IPSI Case Study Booklet

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Contributors and Acknowledgements

This booklet has been compiled by the staff of the United Nations University Institute of Advanced Studies as the Secretariat of the International Partnership for the *Satoyama* Initiative in close consultation with the authors of these studies.

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Foreword

The *Satoyama* Initiative promotes the maintaining and rebuilding of Socio-Ecological Production Landscapes (SEPLs) where sustainable use of land and nature is practiced in accordance with regional characteristics and modern socio-economy, while recognising the value and importance of local traditions and cultures.

The case studies have been collected from IPSI members in line with the Operational Framework, and in accordance with the IPSI case study guidelines. The case studies in this booklet have been selected to showcase the diversity of IPSI member activities and research on (1) useful information on effective approaches for replication that address benefits to biodiversity and human well-being or long-term interactions between humans and nature; and (2) tools that contribute to fostering synergies in the implementation of IPSI member activities.

Sharing case studies can provide the basis for distilling lessons, initiating further research and strengthening collaboration as well as the respective activities of IPSI members. Hence, it is expected that this case study booklet will contribute to securing synergies and complementarities among IPSI members and other interested organisations.

**Themes*
IPSI case studies are categorised according to the following ecosystems.
Forests, agricultural fields, grasslands, inland water systems, coastal systems, urban fringes and others

Contents

National and Local Governmental, other government affiliated organisation

Non-governmental or civil society organisation

Indigenous or local community organisations

Academic, Educational and / or Research Institute

Industry or private sector organisation

United Nations or other Intergovernmental organisation

Title: Management of the palm tree population in Gaya (Niger republic)

Organisation: Executive Secretariat of National Environmental Council for Sustainable Development (SE/CNEDD), Niger
Theme: grasslands, forests

Summary

Gaya palm tree populating is located in south western part of the Niger (Dosso state, Gaya local government, around 350 km from Niamey, the capital city). It is a populating mainly composed of Borassus aethiopum species. This tree is a splendid single trunked species which could reach around 20 m in height. Its life span is between 80 to 100 years. Gaya palm tree plantation covers an area of 32,000 ha and is made up around 2,100,000 trees. This plantation constitutes the most important agro forestry park in West Africa. Since 1974, this populating has undergone many conservation activities and projects in order to sustainably preserve its biodiversity and to promote community based management.

This ecological zone lies between the isohyets 500 and 600 mm of rainfall per year and presents a rich and varied biodiversity favourable for the practices of agro sylvi-cultural activities.

Characteristics of the resource

The palm tree populating is composed of 9 blocks which cover around 32,000 ha. It is 85 km long and between 0,5 to 5 km wide with around 40 trees/ha as mean tree density. This density is relatively good to enable the practice of agriculture by peasants. The farmers derive many products and by products.

Products obtained from palm trees

Population depending mainly on palm tree and the socio-economy of the area
The zone is found in a highly populated area due to the services it offers. The population density is around 42 inhabits/ sq km with a population estimated around 90,000 people spread over 78 villages. The high population growth rate leads to further encroachment by private investors. The space reserved for livestock husbandry is being reduced day in day out forcing cattle keepers to move towards less fertile lands.


Utilisation of palm tree in handicraft

Usages of palm trees

Palm tree (Borassus aethiopum) is the symbol of Dosso state and all interests are focused over this tree. It is considered as food provider by the local communities and its products and by products is exported in Ivory Coast, Tunisia, Morocco and Algeria. In agriculture, palm tree is a provider of organic nutrients to the soils.

- Immature or ripened fruits are used in human feeding. The axial hypocotyl known as «miritchi» is a well appreciated food by the local communities and is used as a powerful sexual arousal ingredient.
- The flowers are excellent feed for the livestock. A study has proven that the flowers contain more nutrients than cowpea leaves or groundnuts leaves (Atta, 1997).
- The roots are used in the production of fishing nets and ropes.
- The leaves are used as fire fuel, roofing materials for traditional houses and bed.

Different phases in the resource management
Traditional management of palm tree

Due to the wide range of products that palm tree offers, the local communities have decided to protect and conserve this tree by using a traditional knowledge to manage the populating.
Management run Government

During colonial era and after independence, government has taken it upon itself to protect natural resources. For the palm tree populating, the protection was carried out by the ministry of forestry. This structure was the sole to issue cutting permit.

The 1st pilot project dedicated for the conservation of palm tree was carried out through the United Nations Development Programme (UNDP). The project management was given by the Tropical Forestry Technical Centre. The local communities were not associated and this lead to the practices disastrous to the conservation of the populating.

Informed about the frustration created, the administration intervened to prohibit illegal palm tree cutting either death or live. The local communities were concerted and associated in the management, even though the forestry administration and the donors did not appreciate the procedure.

From administration run project to a community based management

After the riots organised by the local communities, the government tried to correct by lunching a project in 1978 named "Reconstitution of Dallol Maouri Palm tree populating" funded by Niger government and the Cooperation Funds. This project was followed by another one in 1981 called "Dallol Maouri Palm tree population management Project". This project was run until 1991.
The approach used by these projects did not associate the local communities. Between 1984 and 1987 around 35,000 ha were planted with palm tree and around 300 ha with other tree species.
After more than 10 years of project execution, it began evident that the actions carried out do not take into account the needs and aspirations of the local populations. Notwithstanding the amount of money spent by the projects, it was noticed a loss of tree in farmlands and households.

Through the management of these projects, it is evident that government cannot sustainably manage natural resources without associating local communities, even though the partners are willing to fund the activities. The new approach aims to associate local populations with a broad partnership Government-Local populations-NGOs-private sector.

Towards a more socialised approach:

Many hypotheses have lead to the use of such a solution:

- The usefulness of the tree by all stakeholders as a good reason to preserve it,
- The preservation of natural resources by the local populations could not be achieved if they ignore interests of traditional users who don't believe in the government's strategy,
- A community based management of natural resources could be socially, economically and ecologically sustainable.

The solutions encouraged by the use of this new programme are:
- The creation of a coherent local management framework (Local level management) of the populating.

The representatives of the rural communities have agreed to establish a better plantation management in order to promote palm protection, regeneration and their rational exploitation through Local level management. So the local level structures mainly composed of rural stakeholders have created a consultation and negotiation framework for palm tree management.

A consultation and negotiation framework to discuss all the issues related to local development

The creation of a production line and marketing strategy for palm tree products and by products.
The commercialisation of wood obtained from palm tree which was done by government until 1993, was replaced by a more participative system. This system integrates local population in the marketing process (from the count of death trees to the sale of the wood, sharing the benefits derived from sales and management activities).

Creation of land use committees:
These are tools put in place in order manage conflicts that may arise from the use of these resources. Their mayor role is the reconnaissance, the establishment of land use permits and the fixation of dues.

Effects of the new approach
Owing to the activities run by various projects and all the capacity building, the local communities were able to organise themselves, put in place their own system of seeds collect, germination and plantation without any external intervention. The seeds are planted on the farmlands directly by farmers.
The number of village and participants to the programme since 1994 is constantly increasing. From 1994 to 1998, this number of participants passed from 17 to 52, the number of villages involved passed from 9 to 32. Presently all the village living around the palm tree populating are involved. Many individual farmers' plant palm tree seed without assistance. A study has revealed that around 3,280 ha were planted by farmers in 1997, without a tree density of 100 trees/ha.

Key learning:
- The local management structures and local government created by the projects are functional;
- New forms of collaboration between stakeholders has been developed;
- A good understand of cultural practices is acquired by all the stakeholders;
- Participative planning tools are developed and mastered by all stakeholders;
- The development of community based brigade for the surveillance of the resources (around 312 brigades) and a community based exploitation and marketing of the products;
- Consultation framework in order to plan, decide and execute all the activities;
- Fundraising strategies are developed at local level;
- A communication network is set up.

Conclusion

The experience of palm trees palm has proven that no conservation work could be achieved without the full association and implication of local communities and all stakeholders.

Title: Role and involvement of the commune council in community forestry activities in Domnak Neak Ta Thmor Puan

Organisation: Ministry of Environment, Cambodia
Theme: Forests

Summary

On February 03, 2002, the Royal Government of Cambodia held commune/sangkat council elections nationwide. The goal of locally electing community representatives was to improve the implementation of decentralized local development policy and to transfer power from the central level to the local level with clear roles and responsibility. Among the main roles of the commune/sangkat councils is natural resources management. It is considered as one priority, particularly the focus on the establishment of community forestry.

Within the community forestry management process, it is necessary to have the involvement of all stakeholders. The commune council is a key stakeholder in facilitating the issues and conflicts occurring. In order to reveal the actual roles and support of the commune council on community forestry activities, a case study was conducted in Srer Knung Commune, Chumkiri District, Kampot Province.

The case study emphasized the role and responsibilities of the commune council and village management committee in the process of community forestry development in Domnak Neak Ta Thmor Puan. Moreover, the case study explains the importance of the commune council in legal intervention and describes their responsibility with other competent institutions. The case study describes the direct involvement of commune council members in forest management.

According to results from the case study, it is clear that the commune councils play a crucial role in the preparation and implementation process of community forestry. Community forestry activities have been incorporated into the 5-year development plan of the commune under the coordination of the Seila Program. This plan has also been integrated at the district level. Additionally, the whole commune council actively participates in protecting and supporting community forestry.

The case study also indicated some constraints and problems even though the implementation of community forestry has been satisfactorily supported by the commune council. Despite the above challenges and problems, the commune councils are actively involved in the community forestry process.

Introduction

On February 03, 2002, the Royal Government of Cambodia held commune/sangkat council elections nationwide, as conducted by the National Election Committee (NEC). The goal of locally electing community representatives was to improve the implementation of decentralized local development policy and to transfer power from the central level to the local level with clear roles and responsibility.

Depending on the population, there are between 5 to 11 council members. Their roles and duties are clearly defined by the Ministry of Interior. Among the main roles(1) of the commune/sangkat councils is natural resources management. This is considered as one priority, particularly focusing on the establishment of community forestry.

Within the community forestry management process, it is necessary to have relations and involvement of all stakeholders. The commune council is a key stakeholder in facilitating the issues and conflicts occurring, and is the community level administrative authority.

What support can the commune council provide to community forestry activities?

In order to reveal the actual roles of the commune council in support of community forestry activities, a case study was conducted in Srer Knung Commune, Chumkiri District, Kampot Province. Two days were spent in the field collecting information. The case study emphasized the role and responsibilities of the commune council and village management committee in the process of community forestry development in Domnak Neak Ta Thmor Puan. Moreover, this case study will explain the importance of the commune council in legal intervention and describe their responsibility with other competent institutions. The case study will describe the direct involvement of commune council members in forest management.

Background

Chumkiri is a mountainous area rich in forest products and other natural resources. The forest has provided a range of products to people such as food, water, and wildlife as well as other resources that have long provided sustainable livelihoods to local communities. However, between 1980 and 1998, those forest resources were heavily degraded due to anarchical forest exploitation by both outsiders and insiders. In addition, the cutting, clearance and encroachment on forestland for private titles by a number of individuals has turned the area from a semi-jungle forest to a degraded forest area. The loss of forest cover has caused soil erosion, the loss of wildlife and NTFPs of many species and types as well as made a dramatic impact on the livelihoods of local people.
Being aware of these issues, in 2001, the Community Forestry Research Project (CFRP) and relevant institutions initiated the establish¬ment of community forestry named Domnak Neak Ta Thmor Puan with an area of 992 ha of forestland. CFRP was established jointly by the Forestry Administration of the Ministry of Environment and the Royal University of Agriculture and was funded by the international Development Research Centre and the Regional Community Forestry Training Center (RECOFT). The community forestry area is located in the east along three villages; Prey Yav, Tbeng Pork and Damnak Chnuol in Srer Knung Commune, Chhumkiri District, Kampot Province. There are 596 families with a total population of 2,960 people, of which 1,583 are women.

Linkage of Commune/Sangkat Councils within the Structure of the Community Forestry Committee

Structure of Commune Councils

After the 2002 Commune/Sangkat Council elections all communes within Cambodia set up their own organizational structure to implement their Commune Development Plan. In Srey Knong Commune, Chumkiri District, the organization structure was developed with clear roles and responsibility as below:
The Srer Knung Commune Council has a total of 5 members including:

- One Commune Chief
- One First Deputy Chief
- One Second Deputy Chief;
- Two Members, and
- One Clerk (assistant).

According to the interview, there is a specific division of roles and responsibilities among the members of commune councils as follows:

- Commune Chief is responsible for supervising the overall work in the commune;
- 1st Deputy Chief is responsible for the economic section and natural resources management;

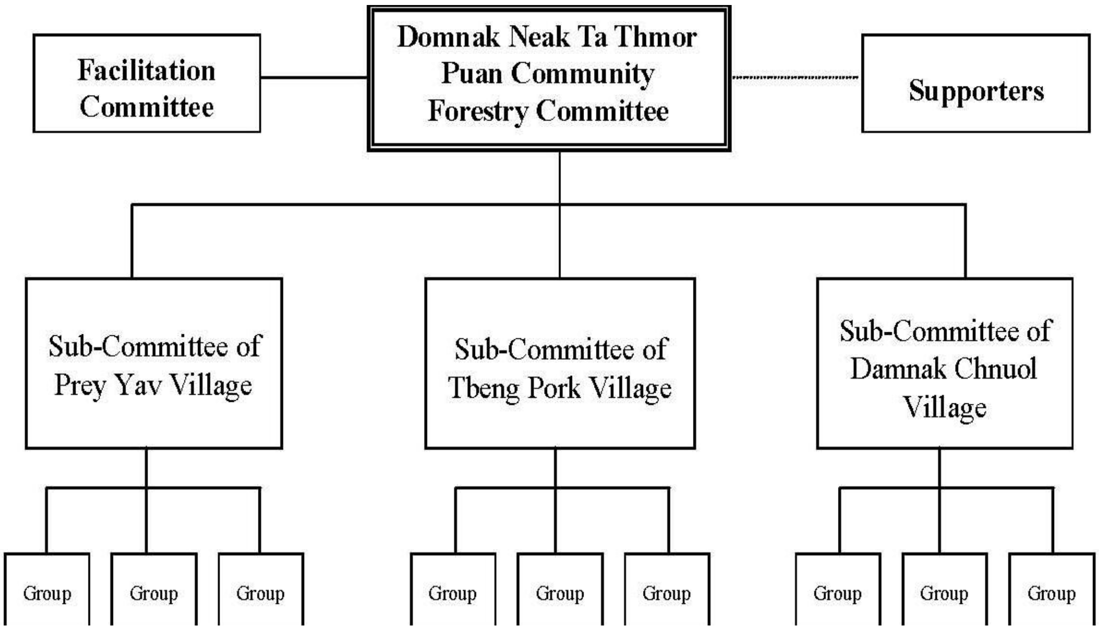
- 2nd Deputy Chief is responsible for security;
- The two Members are in charge of doing a variety of work under the order of the Chief and Deputies; and the
- Clerk assists and does administrative work.

The Structure of Community Forestry Committee

Similarly, Domnak Neak Ta Thmor Puan Community Forestry elected their own village management committee with specific roles and responsibilities amongst committee members and other members within the community as shown below:

- Group is managed by one Leader and one Deputy, of which Prey Yav consists of 19 groups, Tbeng Pork consists of 15 groups and Damnak Chnuol consists of 10 groups.
- Sub-Committee in each village: three committee members per village (one is a woman);
- Community Committee: consists of five people with 2 women;
- Facilitation Committee: consists of four people (three Village Chiefs and one Deputy Chief of Commune.

Community Forestry Structure



Besides the above composition, there is another group called the Support Group providing technical support and facilitating the community forestry implementation process. It is composed of CFRP, CIDSE, and competent institutions.

The table below indicates the general roles of the commune councils as prescribed in the Law on Administration and Management of Commune/Sangkat and Natural Resources Management as well as other actual activities which have been implemented within Domnak Neak Ta Thmor Puan CF. The general structure and roles of commune/Sangkat councils are described below:

Roles of Commune/Sangkat Councils as prescribed in the law	Activities implemented in relation to community forestry work
Protect and conserve environment, natural resources, culture and national heritages. (Point 5 in articles 43 of the Law on Commune/Sangkat Administrative Management).	❖ Legal intervention • Solve conflict; • Suppress and prevent forest crimes; • Demarcate boundary; • Serve as the supporter for Community Forestry; • Sign to recognize; and • Provide advice to the Community Forestry Committee and sub-committee. ❖ Communication with relevant institutions • Incorporate community forestry plan into the 5-year development plan of the commune; • Promote cooperation with other institutions regarding community forestry; and • Disseminate information related to community forestry. ❖ Direct involvement of commune councils as the community forestry members • Involve in community forest protection; • Provide monthly contribution; • Participate in planning; • Participate in statute preparation; • Participate in the monitoring and evaluation of management plan of the community; and • Attend all meetings related to community forestry.

The commune council and Community Forestry Committee has a very close relationship with clear roles and responsibilities to easily implement their work. Practically speaking, the Community Forestry Committee's Facilitation Committee consists of three Village Chiefs and the First Deputy Chief of the Commune.

The role of the Facilitation Committee as prescribed in the Domnak Neak Ta Thmor Puan CF's Statute is to:

- Involve in and facilitate all issues as requested by the Community Forestry Committee;
- Disseminate the activities of the Community Forestry to relevant institutions, local authorities, National and International Organizations;
- Provide advice to the Community Forestry Committee; and
- Involve in the monitoring and evaluation of community activities.

The direct involvement of 1st Deputy Chief of Commune in the community forestry committee is important because he represents the local authority and can be a supporter for the community when there is a problem.

The commune council can play an important role in implementing decentralization of the government which can contribute to good governance. It can be an important institution to carry out commune development work, especially on natural resources management within the commune. However, this process can be successful only if the commune council uses their role to benefit the whole village.

But if they use their power and authority for personal benefit it will cause disbelief among the local population and it will reduce the participation of local people in forest management and even worse, it may cause conflict in the community.

Legal Intervention:

To effectively succeed in the management of the development process, particularly natural resources management, which mainly focuses on community forestry, it is necessarily to have the support of the local authority and competent institutions. There we can consult and discuss in order to ensure that our activity is smoothly implemented and problems or conflicts can be effectively resolved. Logically, the community forestry implementation and operation can be successful if it has the support of local authorities from provincial to commune levels. Particularly, the 1st Deputy Chief of Commune plays an important role as part of the Facilitation Committee in the community forestry organizational structure.

In the Facilitation Committee, he has many important roles including solving land conflicts within his village or commune as well as other community forestry related issues. He is involved in resolving conflicts when demarcating the community forestry boundary and resolving conflicts over boundaries impacted on some villagers' land where they used to cultivate crops. Consequently some villagers are not willing to contribute their land as common property.

After the establishment of community forestry, offences have gradually decreased because the community has become aware of their roles and responsibilities as community members. They became aware through meetings, the dissemination of legislation and laws on forestry and land. In addition, the community forestry statute, management plan, regulation and community forestry concepts have also been disseminated. Although most understand, there are still some offenders, most of them people from outside the village. Due to the facilitation effort of the 1st Commune Deputy Chief and through extension activities the number of offences has been continually reduced.

Apart from the facilitation, the commune councils are also involved in other activities, by acting as advisor to the committee and sub-committee concerning technical issues and management. Regarding the technical support, the commune council normally helps the community committee and sub-committee by additionally explaining any points or issues which they did not clearly understand or when the issues were beyond their capacity to understand. They have assisted when community members were invited by an organization or project for training courses or study tours. One among many activities is signing the approval and recognition of the community legal procedures including the CF by-laws, CF management plan, CF regulation and CF agreement (for future use). It is clear that the smooth and successful implementation of community forestry is the result of strong support by the local authority, particularly the involvement of the commune councils in all activities.

According to the case study interviews, the Community Forestry Committee declared that they are satisfied with the support of the 1st Commune Deputy Chief for all community forestry activities. Most problems or conflicts were resolved at the communal level. Up to now, there is no single problem that cannot be resolved by the commune council.

Linkages with Other Institutions and Extension Activities

Cooperation is an important factor to promote sustainable development, namely in working with the competent institutions and other organizations trying to achieve similar goals. Similarly, community forestry implementation requires support and cooperation by relevant institutions.
In terms of cooperation, the community has worked closely with stakeholders. Mr. Tep An, community committee chief, stated that community forestry activities have been integrated into the 5¬year development plan of the commune under the facilitation of Seila and the plan has been integrated with the district plan. He added that more cooperation is needed when there is conflict or any offence that cannot be resolved by the community (conflict with military over land). Then we have to negotiate or coordinate with leaders of the institution or send the case to the provincial level in order to ensure the process can go smoothly and effectively. Mr. Tep An has widely disseminated information to outsiders about issues related to community forestry, and now, the number of offences has been greatly reduced.

Another significant factor is that the agency CIDSE is working in Chumkiri District of Kampot Province through its development program. It has cooperated and helped to disseminate CF related issues to people, particularly during the community cluster meeting or village planning meeting. In the meeting agenda, they always raise the topic of community forestry activities for discussion. CIDSE staff working in the area echoed the comments of Mr. Yen Oun, "the commune/Sangkat councils have close cooperation with the district level because the district is a strong supporter for conveying information or coordinating issues with the provincial level or relevant competent institutions".

Apart from working as the 1st Commune Deputy Chief and member of the Facilitation Committee, Mr. Sous Neb has actively participated in community forestry activities as a citizen of Prey Yav village. He has mainly been involved in directly building a fire break, meeting to discuss the statutes and management plan, selecting the Community Sub-Committee and Committee, monitoring and evaluating implementation and participated in meetings and discussions related to community forestry.

However, not all members of the community participated to benefit all the people. Some people used their role to protect illegal forest activities (transferring wood from a nearby village) which affected community organizing. Now, some of the community members are less interested in community forestry development.

Conclusions

According to results from the case study, it is clear that the commune councils play a crucial role in the community forestry preparation and implementation process. This is because the commune councils have defined roles and responsibilities for each member. Officially, the Srer Knung Commune Council has specifically assigned Mr. Sous Neb, 1st Deputy, to be responsible for natural resources management, particularly Domnak Neak Ta Thmor Puan community forestry.

More significantly, the involvement of the 1st Deputy Chief in the Community Forestry Committee (Facilitation Committee) is helpful in strengthening the implementation of law. Because he represents the local authority, and is the main supporter of people when they face any problem he is able to resolve other conflicts as well. He always discusses and consults with the commune council or relevant institutions when he wants to make any critical decision.

It should be noted that the whole commune council participates actively in protecting and supporting the community forestry. Additionally, community forestry activities have been incorporated into the 5-year development plan of the commune under the coordination of the Seila Program. This plan has also been integrated at the district level.

The case study indicated some constraints and problems even though the implementation of community forestry has been satisfactorily supported by the commune council. This is because the commune councils are overworked, lack materials and finance and have limited capacity. These are barriers to effectively achieving other activities in the commune.

On the other hand, using their role in an appropriate way helps to accelerate community organizing and gain support from the community members. But if the commune council use their role for personal benefit, it will cause local people to lose their attention and limit their participation in the community development process.

In summary, the commune councils still have some constraints and problems to overcome such as:

- No neutrality;
- Limited capacity;
- Not enough rights and freedom;
- No appropriate working space; and
- Lack of means for travel.

Despite the above challenges and problems, the commune councils are willing to be actively involved in the community forestry process.

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Title: National Action Plan for the Conservation and Sustainable Use of Socio-ecological Production Landscapes (Satochi-satoyama)

Organisation: Ministry of the Environment, Japan (MOEJ)
Theme: forests, agricultural fields, grasslands
Keywords: Satochi-satoyama, Action plan, vision, national measures

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Summary

In the Jomon Era, the Japanese Archipelago was covered with virgin forests and wetlands, where people's lives were integrated with hunting and fishing. With the introduction of agricultural civilization, they converted the wetlands into paddies and built ditches and irrigation ponds.

Harvested for firewood, charcoal and fertilizer, the dark primeval forests were transformed into open, light-filled woodlands. Grasslands and fields were created through grazing and grass harvesting. Over 3,000 years of such human-nature relationships, Satochi-satoyama areas have been formed and maintained, where people have enjoyed the blessings of nature in a sustainable manner, with cyclic use of natural resources around the villages.

However the natural environments of Satochi-satoyama are currently going through a crisis. Owing to changes in socio-economic conditions, Satochi-satoyama areas have been used less and less in farming, forestry and other daily activities, which has caused an increase in abandoned farmlands and forests due to insufficient care. Thickets and bamboo forest have expanded, and ditches and irrigation ponds have been increasingly devastated. As a result, numerous plants and animals inhabiting Satochi-satoyama environments are now disappearing. Thus, it has been a crucial issue to conserve Satochi-satoyama for the conservation of biodiversity in Japan.

Therefore, we formulated the National Action Plan for the Conservation and Sustainable Use of Socio-ecological Production Landscapes (Satochi-satoyama) as the practical action plan for the policies and measures of regional approaches prescribed in the National Biodiversity Strategy of Japan 2010.

The purpose of this plan is to initiate a nationwide movement by presenting the key principles and direction of the national policies and measures for the conservation and sustainable use of Satochi-satoyama, to various stakeholders such as farmers and foresters, local communities, private organizations, enterprises, governments and experts.

Background

(1) Definition and characteristics of Satochi-satoyama

Satochi-satoyama refers to an area consisting of farmlands, irrigation ponds, secondary forest, plantation forest, and grasslands around human settlements. It is located between more natural, deep mountainous areas and urban areas with intensive human activities. The environments of Satochi-satoyama have been formed through various human interventions over a long history. People in Satochi-satoyama areas have practiced both land use in a dynamic mosaic-like pattern and cyclic resource use, developing ecosystems and biota therein unique to the secondary environments as well as creating a rich culture of life in which people live in harmony with the environment while enjoying various ecosystem services.

(2) Current status of Satochi-satoyama

The total Satochi-satoyama area accounts for about 40% of the national land. However, along with modernization of lifestyles and agriculture since the 1950's, some secondary forests have not been managed or utilized, and have been left abandoned. Secondary grasslands have substantially decreased. Since around the 1970's cultivated lands have also been increasingly abandoned. With these changes in human intervention in Satochi-satoyama, various problems are emerging around the country such as, degraded quality of plant and animal habitats; conflicts between humans and wild animals; illegal dumping; and reduced functions in conserving traditional landscapes and national land.

(3) Importance of Satochi-satoyama

Satochi-satoyama areas have been formed as a result of repeated human activities with agriculture, forestry and other practices in a sustainable and stable manner, which were aligned with local natural conditions by using locally developed knowledge and technologies. Satochi-satoyama originally served as places of agricultural and forestry production and community livelihood. Today, in addition to these roles, Satochi-satoyama fulfill various implications and functions, such as biodiversity conservation; sustenance of biomass resources and conservation of indigenous landscapes representing images of hometowns and traditional living culture; provision of opportunities for environmental education and experiences; and prevention of global warming.

Objectives of the National Action Plan and its relation to other policies and measures

The objectives of the National Action Plan for Conservation and Sustainable use of Satochi-satoyama are: to present the importance of Satochi-satoyama areas, the vision, direction, principles and procedures of their conservation and sustainable use to a variety of stakeholders, such as national and regional governments, enterprises, NPOs, and agricultural and forestry sectors; and to specify the national measures for Satochi-satoyama conservation and sustainable use, in order to stimulate public understanding of the significance of Satochi-satoyama and to expand efforts by various entities to develop a nationwide movement.

Though conservation and sustainable use of Satochi-satoyama should be implemented through agriculture, forestry and local daily life activities, the Plan precludes measures with the purpose of stimulating primary industries and revitalizing rural lifestyles. Instead, the Plan focuses on the conservation of biodiversity and better relationships between humans and the natural world.

The Plan is based upon recognition of the second crisis determined in the National Biodiversity Strategy of Japan 2010 and on the matters regarding Satochi-satoyama and countryside areas stated in the Grand Design of the National Land. We positioned the Plan as an implementation plan to put forth concrete actions concerning Satochi-satoyama as called for in the National Biodiversity Strategy of Japan 2010.

When regional governments carry out planning and implementation of Satochi-satoyama conservation and sustainable use, the Plan will play a role as a guideline to stimulate and assist these efforts. We also expect the Plan to be translated into a regional biodiversity strategy that is formulated by individual regional governments in accordance with characteristics of their localities.

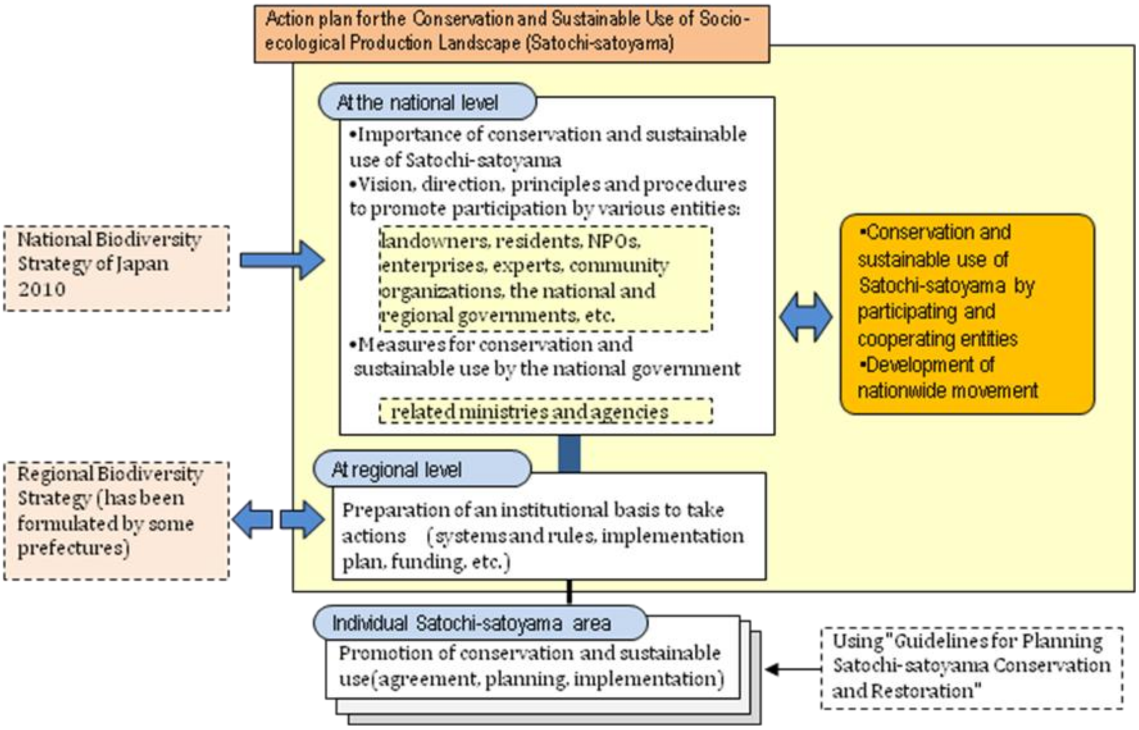

Figure: Objectives of the National Action Plan and its relations with related policies and measures

Vision of Satochi-satoyama conservation and sustainable use
Satochi-satoyama areas are important in conserving the biodiversity of Japan. They also serve as a basis for citizens' livelihood and spiritual culture, providing food, water and natural disaster prevention, and preserving living conditions, landscapes and cultures. At the same time, they are important as a place for learning, experiencing and continuing Japanese lifestyles that have been harmonized with the natural environments.

For the stable sustenance of Satochi-satoyama ecosystems, which offer such varied functions, we will promote management compatible with environmental capacity and resilience, and cyclic use of natural resources. Such efforts should be pursued based on scientific knowledge while learning from traditional wisdom.

Moreover, we strive for Satochi-satoyama, with its multi-dimensional values, to be sustained through participation and cooperation of citizens in all positions as a common natural resource that they share (i.e., new "commons"), to be handed down to future generations.

Direction of Satochi-satoyama conservation and sustainable use
"The Grand Design of the National Land from the perspective of biodiversity", stated in the National Biodiversity Strategy of Japan 2010, illustrates images of the national land to be pursued for the next 100 years in each land category, including natural mountain areas, urban areas, and coastal areas.

In accordance with the long-term goals of the National Biodiversity Strategy of Japan 2010, we hereby set the following three basic directions for the next 10 years that are to be pursued by all measures and implementation activities conducted by various bodies. The period targeted by the Plan is about 10 years, from now until 2020.

(1) Promotion of nationwide movement

While a wide range of the public increasingly understands the values of Satochi-satoyama, we strive for farmers, foresters and local communities as well as various people in different positions to voluntarily participate and cooperate in efforts of Satochi -satoyama conservation and sustainable use, viewing Satochi-satoyama as their common resources. Namely, a large number of people, including urban residents, receive natural benefits from Satochi-satoyama, and at the same time, part of the management costs is supported by public and private funding and volunteer work. Through these collaborative efforts, relationships among the people of the region will be enriched, sustaining efforts towards Satochi-satoyama conservation and sustainable use.

(2) National-level biodiversity conservation through the conservation and sustainable use of locally typical Satochi-satoyama

Considering the large extent of Satochi-satoyama in the national land area (approx. 40%), implementation of Satochi-satoyama conservation and sustainable use should be focused on some areas selected at a regional scale (e.g., prefecture). We aim to ensure that Satochi-satoyama targeted for conservation activities represent socio-ecological features of each region of the country. Regional scale conservation and sustainable use will be undertaken with consideration of a larger-scale ecosystem network, to realize the conservation of Satochi-satoyama biodiversity at the entire country level.

Considering the multi-dimensional values of Satochi-satoyama, aspects and criteria for selecting representative Satochi-satoyama areas of a given region should be determined by the regional governments (e.g., prefecture government). Examples of representative Satochi-satoyama might be areas with particularly rich biodiversity, active engagement with agriculture and forestry in harmony with wild creatures, or of traditional living culture and landscapes symbolizing the image of hometowns. Satochi-satoyama particularly important for biodiversity may be areas with high concentrations of endangered species that depend on Satochi-satoyama environments, or areas providing major habitats for nationally listed or endemic species.

(3) Enhancement of various ecosystem services and revitalization of regional societies

Through diversified utilization of land and resources, we will ensure that a mixture of various types of ecosystems is sustained in Satochi-satoyama in a given region. We then aim for the fulfillment of multi-dimensional benefits of Satochi-satoyama (i.e., ecosystem services), such as provision of water, food, fuel and other various resources needed for living (supplying service); habitat provision for wildlife, soil erosion control, headwater conservation and carbon assimilation (regulatory service); provision of social, cultural, religious and spiritual basis (cultural service); and others.

Through these actions, we strive to contribute to revitalizing the livelihood and economy of the regional society.

Principles of Satochi-satoyama conservation and sustainable use

(1) Role assignment among implementing bodies

Satochi-satoyama have been created and maintained by local communities including farmers, foresters and village people. They are, therefore, an artifact of the natural and social conditions, history and culture of each locality. Therefore, the fundamentals of Satochi-satoyama conservation and sustainable use are voluntary efforts by local communities.

However, Satochi-satoyama management solely by local sectors has been difficult while benefits of the natural resources extend over a wider area of the locality because of the diverse values and functions of Satochi-satoyama.

The conservation and sustainable use of Satochi-satoyama therefore requires support from a broader range of the public or from the entire country. For this purpose, the national government itself needs to conduct initiatives in collaboration with related ministries and agencies, which stimulate regional efforts and then develop these into a nationwide movement.
A role needs to be played by the national and regional governments, enterprises, farmers and foresters, local communities, citizens or NPOs, experts and researchers.

(2) Promotion of collaboration and cooperation among participating entities

While it is becoming difficult to manage Satochi-satoyama solely with traditional workforces, such as local farmers, foresters and village communities, this is required for ensuring sustainable labor and financial resources in order to continue the maintenance and management of Satochi-satoyama. Therefore, it becomes important to promote activities with collaboration and cooperation among diverse entities, from urban residents, NPOs, enterprises, universities, and other new partners, to administrative bodies.

To this end, it is required to develop a platform at the local scale of Satochi-satoyama area for stakeholders to work together on establishing councils, form agreements, and so on. While making the best use of existing systems and frameworks, rules and coordinating organizations will be developed as the basis for collaborative activities, in accordance with socio-ecological characteristics of the locality. When considering the efforts of Satochi-satoyama conservation and sustainable use as larger-scale collaborative work beyond the locality, it is also important to gain support from enterprises and each Japanese citizen.

Thus, we will promote development and take advantage of the use of organizations, funding and other frameworks to gain volunteers and financial support from a wide range of enterprises and the Japanese citizens.

(3) Actions in accordance with regional characteristics

Because Satochi-satoyama areas vary in its socio-ecological conditions for different regions, it is necessary to pay attention to determining a strategy of conservation and sustainable use depending upon the conditions of a given region.

For conservation and sustainable use near urban areas, it is effective to promote collaboration with entities outside of the Satochi-satoyama community. New partners can be found outside of the community, such as NPOs, enterprises and schools, who wish to engage in volunteer work and environmental learning and experience.

In semi-mountainous regions, local farmers and foresters are the main implementing bodies. The stability of their conservation activities may be assured by focusing on local business activities using ecotourism and local products, and on other activities that are linked to the development of the region.

In coastal regions, Satochi-satoyama areas and the ocean are proximate. Considering the regional continuity and integrity of the two areas, cooperation between the two communities on conservation and sustainable use will be effective.

For these types of Satochi-satoyama activities, the national government will implement conservation and sustainable use of typical Satochi-satoyama areas that are selected for each of the ecologically and socially distinctive regions. Building on leading efforts at the scale of a selected area, the conservation practice and sustainable use of Satochi-satoyama will be promoted throughout the region.

Satochi-satoyama areas in semi-mountainous regions contain forests near mountainous areas. In addition, because of declining populations and aging, human resources in the communities are becoming limited. Therefore, while some woodland areas should be managed partly as secondary or artificial forests, others will be properly managed depending on local socio-ecological conditions.

For other woodland areas located close to mountainous areas that are normally transformed into natural forest without human care, the basic approach will be to leave them for natural succession. In these cases, vegetation restoration may be carried out where necessary.

(4) Reflection of biodiversity perspectives on Satochi-satoyama conservation and sustainable use

Activities of Satochi-satoyama conservation and sustainable use may be implemented by diverse entities and for various purposes, reflecting the multi-dimensional values of Satochi-satoyama.

These activities should also be effective in terms of conservation of biodiversity. For this purpose, it is important to create an inventory of basic ecological information, including distribution of wildlife species that depend on the habitats of Satochi-satoyama. Drawing on such basic information, the conservation and sustainable use efforts should be prioritized according to areas of high importance for the conservation of biodiversity. It is also vital to apply adaptive management, in which we can flexibly revise actions and expected outcomes in light of new data obtained from continuous monitoring. To ensure understanding of the biological information, setting proper goals, and implementing management that translates the ecological responses, we will promote participation by experts who have knowledge in the field of biodiversity.

Procedure for Satochi-satoyama conservation and sustainable use

This section, in accordance with sections 4 and 5, describes the procedure of Satochi-satoyama conservation and sustainable use, addressing cross-sectional tasks that are common to all measures and efforts implemented with various purposes by diverse entities, from national and regional governments, private organizations and enterprises, to universities.

(1) Establishing a basis for nationwide activities
(2) Introducing economic instruments for Satochi-satoyama conservation and sustainable use
(3) Preserving traditional technologies for sustainable resource use and developing new technologies to promote cyclic use
(4) Understanding the current status of Satochi-satoyama and promoting monitoring
(5) Characterizing Satochi-satoyama and implementing its conservation and sustainable use based on these characteristics
(6) Preparing a regional-level basis for implementing Satochi-satoyama conservation and sustainable use

National measures for Satochi-satoyama conservation and sustainable use

Sections 3 to 6 described the vision, direction and basic principles for Satochi-satoyama conservation and sustainable use carried out with coordination and collaboration of various bodies, such as the national and local governments, enterprises, agriculture and forestry operators, citizens and private organizations. Based on the vision, direction, principles and upper level strategies and plans, the following categorized measures should be carried out by the national government in an integrated, comprehensive manner.

(1) Raising interest and awareness of citizens in Satochi-satoyama
(2) Developing a scientific basis for understanding and evaluating biodiversity
(3) Preserving wildlife species, protected areas and other designated areas
(4) Conservation and sustainable use through sustaining and stimulating agricultural and forestry activities and rural villages
(5) Revitalizing landscape, tradition and culture through conservation and community exchange
(6) Re-evaluating traditional technologies and sustainable use of Satochi-satoyama as new resources
(7) Utilizing Satochi-satoyama as places for environmental experience and education
(8) Promoting and assisting locally-based efforts through the engagement and cooperation of diverse groups

Website links:
http://www.env.go.jp/nature/satoyama/pamph.html
http://www.env.go.jp/nature/satoyama/En_ActionPlan_All_ver/En_ActionPlan_All_ver.pdf

Title: Community Forestry in Nepal

Organisation: Ministry of Forests and Soil Conservation, Nepal
Theme: Forest
Keywords: Community Forest, Community Forest User Group (CFUG), community development, governance, Handover, Livelihood, Silviculture, Sustainable Forest Management

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Summary

Community Forestry is increasingly recognized as a means for promoting sustainable forest management and restoring degraded forests for enhancing the forest condition as well livelihoods of low income people and forest dependent communities worldwide. It also promotes community rights to forests, enhances forest sector governance and local democracy along with mitigation of adverse environmental and climate change effects.

Nepal has a well-documented history of over 30 years in community forestry and has been regarded as a model demonstrating the sometimes difficult paradigm shift from government-controlled forestry to active people's participation. The Forest Act 1993 provided a clear legal basis for community forestry, enabling the government to 'hand over' identified areas of forest to CFUGs in Nepal.

Some 1.23 million hectare forest out of 5.5 million hectare of total forest area has been managed under community forest with active participation of more than 14000 Community Forest User Groups (CFUGs) in various parts of the country. Patale CF, for example, was almost barren prior to being handed over to a CFUG and now is a fully stocked forest with lots of flora and fauna. CFUGs are managing forests with different silvicultural and management activities.

Benefits accrued from forests are utilized for forest management, livelihood improvement, and social and community development activities. Indeed, community forestry and the Patale CF in particular is now widely perceived as having real capacity for making an effective contribution towards addressing environmental, socioeconomic and political problems in Nepal.

Background

Community forestry has achieved broad global acclaim over the past three decades as a successful model for natural resource management that is innovative, people-centered and effective. It is increasingly recognized as a means for promoting sustainable forest management and restoring degraded forests, for enhancing the livelihoods of low income people, forest dependent communities, for promoting community rights to forests, for enhancing forest sector governance and local democracy, and for mitigating the effects of climate change.

Nepal, as one of the first countries to experiment with community forestry, has now come to be widely recognized as being at the forefront of its development and has perhaps made greater progress than many other countries in establishing it as the cornerstone of its forest sector policy. It has a well-documented history of over 30 years in community forestry internationally, and it is regarded as a model demonstrating the sometimes difficult paradigm shift from government-controlled forestry to active people's participation -one that is observed with keen interest for lessons that can be learnt and applied elsewhere. It is now widely perceived as having real capacity for making an effective contribution towards addressing environmental, socioeconomic and political problems. This case study deals with overview of community forestry in Nepal with an illustration of Patale Community Forest.

Evolution of Community Forestry Policy, Programme and Legislation

The failure of a centrally controlled bureaucratic system of classical forestry, and the existence of informal indigenous forest management provided the impetus for institutional innovation in Nepal's forestry sector. Successive refinement of partnership arrangements between local communities and the state forest agency based on practices in the field, and mutual assessment of the results has led to the growth of community forestry.

The initial phase of community forestry in Nepal was geared towards assigning responsibilities and rights of local forest management to the village level political bodies' i.e Panchayat with the enactment of the Panchayat Forest Rules and the Panchayat Protected Forest Rules, 1978. It was based on protecting and planting
trees to meet the forest product needs of the local people based on the principle of 'gap analysis'.

Three years of rigorous study and consultation in the preparation of the Master Plan for the Forestry Sector (MPFS), in addition to the first national level workshop on community forestry held in 1987 laid the foundation for handing over forests to groups of traditional forest users so that they could meet their basic forest product needs and at the same time conserve these forests. Reorientation of foresters was also considered essential for the sustainable management of these community forests. The MPFS further stressed that participation of local communities in decision-making and benefit sharing was essential for the conservation of forest management.

The endorsement of MPFS in 1988 and the political regime change in 1990 were instrumental in the formulation of new forest act in 1993 and forest regulations in 1995. By the early 1990s, however, continued experiential learning had started to highlight deficiencies in the legislative framework under which the community forestry model was being implemented. In particular, the key role of the Panchayat as a local institution began to be questioned. Panchayat were often large (geographically and in terms of population) and tended to be dominated by the traditional elite in rural society (wealthier, better educated, male and high caste).

It was found that actual management of community forest and day-to-day decision-making on how the forest was to be developed and used would improve if they were undertaken by those people most directly affected by such decisions and prepared to contribute time and inputs into what they considered as their local resource. Thus, the concept of 'forest users' arose, i.e. those local people who traditionally used a particular patch of forest. Subsequently, community forestry became based around the community forest user groups (CFUGs) rather than the panchayat. Much effort during the early 1990s thus became focused on basing community forestry at the community level and seeking ways to bring such disparate groups together into CFUGs.

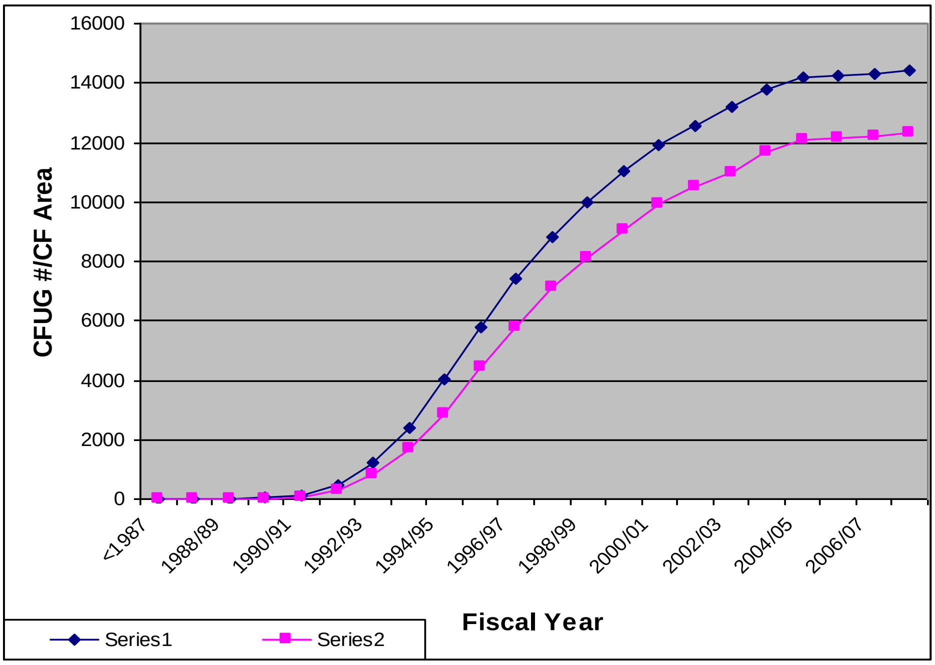
The Forest Act 1993 provided a clear legal basis for community forestry, enabling the government to 'hand over' identified areas of forest to CFUGs. The procedures were later detailed in the 1995 Forest Regulations, backed by the Community Forestry Operational Guidelines 1995. According to the Forest Act and the associated Forest Regulations, CFUGs are legal, autonomous and corporate bodies having full power, authority and responsibility to protect, manage and utilize forest and other resources as per the decisions taken by their assemblies and according to their self prepared constitutions and operational plans (with minimal scope for interference from the state forestry agency). Although all benefits from community forests would go to the CFUGs concerned, the land legally remained part of the state.

Important characteristics of formal CF legislation are:

- All accessible forests can be handed over to users without any limitation on area, geography and time
- Land ownership remains with the state, while the land use rights belong to the CFUGs
- All management decisions (land management and forest management) are made by the CFUGs
- Each member of the CFUG has equal rights over the resources
- Each household is recognized as a unit for the membership
- CFUGs will not be affected by political boundaries
- Outsiders are excluded from access
- There are mutually recognized user-rights
- There will be an equitable distribution of benefits
- The State provides technical assistance and advice.

Status of Community Forestry in Nepal

Figure 1: Handing Over CF over time



Total land area of Nepal	14.7 million ha
Total forest area	5.5 million ha
Potential community forest area	3.5 million ha
Forest area under community forestry	1.23 million ha or 22% of total forest area
Total number of CFUGs	14439
Women-headed CFUGs	805
Total number of households'	1.66 million or 33% of total households

(Source: Gautam 2010)

Patale Community Forest

Introduction

Fig 1: Community Forest with surrounding settlement and forests

Patale Community Forest (CF) is sandwiched between two community forests, namely Kafle CF and Padali CF in Lamatar Village Development Committee (V.D.C) ward number 1, situated in Lalitpur district just 11 km from Kathmandu, capital of Nepal. It is located at 270′ 27′ north, 270′ 37′ east latitude and longitude, respectively.

The community forest consists of 104.6 ha land covering 162 households within a community forest user group (CFUG) with 881 total populations in which 430 are female and 451 are male members. The vegetation type is a mixed one with Chilaune (Schima castanopsis), Katus (Castanopsis indica) and Utis (Alnus nepalensis) as the dominant species. For sustainable management of the forest, it is divided into six blocks, all of which include a fire line to protect from forest fires. From the upper part of this forest scenic view of Kathmandu Valley as well as sunrise view can be observed.

Fig 2: Scenic view of Kathmandu Valley from the community forest area

Historical Background of Patle CF

Prior to 1970, forest conditions were very good with abundant vegetation including trees, shrubs, Non timber forest Products (NTFPs), Medicinal and Aromatic Plants (MAPs), different wildlife species and plenty of water sources.

After 1970, due to an increase in population pressure on the forest and a lack of sufficient source of income for the people to their livelihoods, anthropogenic pressures in this forest rose tremendously, leading to massive deforestation and degradation of the forest. While forest was facing deforestation, in 1985 this forest faced the incident of big forest fire resulting complete loss of vegetation wildlife and converting forest into a denuded hill. Consequently, water sources also disappeared and people faced the problem of having to walk 8-10 hours even to transport a single jar of water. In order to control population pressure and conserve and protect the forest from further deterioration, with the initiation of local communities and the District Forest Office, local people were brought together for conservation and management of that forest and the forest was then handed over to the community forest user group (CFUG) to be managed as a community forest in 1994 after promulgation of the new Forest Act of 1993. Since then, it has been under the control of the community, the condition of the forest has improved, and people are benefitting from forest resources.

Governance

CFUGs have their own constitution, which governs the whole user group as well as the executive committee. Executive committee consists of 13 members with six females and seven males' members. This executive committee looks after the decision making activities within the group. The group has classified households into rich, medium, poor and very poor categories i.e. A, B, C, D. The classification is based on a well - being ranking and the intention of conducting livelihood improvement program especially focusing on the C and D categories. Similarly, the CFUG also focuses its activities on improving governance status and promoting transparency and accountability. Moreover, it has created a separate monitoring and evaluation subcommittee and an account subcommittee.

How is the CFUG conserving and managing the forest?

The CFUG has prepared a five-year Community Forest Operation Plan (CFOP) with technical support from the forest technician of the district forest office. It encompasses overall features of the forest, growing stock, block division, forest management as well as silvicultural operation activities, conservation measures. It also covers provisions for the harvesting, utilization, selling, etc of forest products. CFUGs have to base their activities on this technical document for overall management of the forest. Once approved from district forest officer of district forest office, it becomes officially functional.

Based on the approved operational plan, the following forest conservation and management activities are being carried out by the CFUG:

- Protection of forest from uncontrolled grazing, illegal cutting, and forest fires, etc.
- Regular patrolling by CFUG members to conserve the forest and prevent illegal activities like encroachment, tree cutting, etc.
- Provisioning of forest watchers
- Grazing controls
- Hunting controls
- Rewarding informants informing about the activities of illegal activities within the CF
- Complete control over the collection of stone, sand, as well as all activities causing soil erosion, degradation as well as loss of biodiversity.
- Soil erosion controls
- Forest fire controls
- Punishment of persons conducting any activities against the rules of CF.

Major Silvicultural Activities

- Shrub land improvement: they have prepared a shrub land improvement demonstration plot
- Pruning
- Thinning and singling
- Planting and weeding
- Conversion of Pine Forest into Broadleaved forests.
- NTFP demonstration Plot

Fig 5: Plantation being carried out

Forest Product utilization and distribution:

The CFUG has made provisions within its Community Forest Operational plan regarding the collection procedures for timber, firewood, fodder, forage and leaf litter, as well as a timeframe for carrying out different forest management activities. They consume these products within the CFUG and if they have surpluses of these products, they can sell them outside the CFUG.

Major Vegetation and Wild life within CF

Major vegetation of this forest is as follows:

Nepali Name	Scientific Name	Category(herb/shrub/Tree)	Uses
Bakle	*Myrsine capitellata*	Tree	Fuel wood and timber
Mauwa	*Madhuka indica*	Tree	Fuel wood, fruit and timber
Dhale katus	*Castanopsis indica*	Tree	Fuel wood, fruit and timber
Mansure katus	*Castanospsis tribuloides*	Tree	Fuel wood and timber
Utis	*Alnus nepalensis*	Tree	Fuel wood and timber
Kanphal	*Myrica esculanta*	Tree	Fruit
Chilaune	*Schima wallichi*	Tree	Fuel wood ,timber
Lankuri	*Fraxinus floribunda*	Tree	Fuel wood ,timber
Salla	*Pinus roxburgii*	Tree	Fuel wood, timber, leaf litter
Kaulo	*Persea species*	Tree	Timber and NTFP
Firfire	*Acer oblongum*	Tree	Fuel wood and timber
Chanp	*Michelia champaca*	Tree	Timber
Phalant	*Quercus glauca*	Tree	Timber and fodder
Painu	*Prunus cerasoides*	Tree	Ornamental, timber and fuel wood
Khari	*Celtis tetranda*	Tree	Timber, fuel wood, and pole
Saur	*Saurauria nepaulensis*	Tree	Timber, fuel wood, and pole
Lapsi	*Chaerospondias axillaris*	Tree	Fruit, timber, pole
Bains	*Salix babylonia*	Tree	Fuel wood , timber
Kalikanth	*Myrsine semiserrata*	Tree	Fuel wood , timber, fruit
Gogan	*Sairauia grifthithi*	Tree	Fuel wood , timber
Gurans	*Rhododendron*	Tree	Flower, fuel wood , timber
Mayal	*Pyrus pashia*	Tree	Fruit, fuel wood
Anselu	*Rubus ellipticus*	Shrubs	Fruit, living hedge

Chtro	*Barberis aristata*	Shrubs	Fruit, live fence
Dhasingre	*Gaultheria fragrantissima*	Shrubs	Fruit
Timur	*Zanthoxylum armatum*	Shrubs	Fruit, medicinal value
kimbu	*Morus alba*	Tree	Fruit, fodder
Alainchi	*Amomum subulatum*	Shrubs	Medicinal value
Bhyakur	*Dioscorea deltoides*	Herbs	Vegetable, fruit
Bantarul	*Dioscorea bulbifera*	Herbs	Vegetable
Kukurdaino	*Smalax menispermoides*	Herbs	Vegetable
Anp	*Mangifera indica*	Tree	Fruit, timber, firewood
Koiralo	*Bauhinia variegata*	Tree	Timber, firewood and vegetable
Tanki	*Bauhinia purpurea*	Tree	Timber, firewood
Sisnu	*Urtica dioca*	Herbs	Wild vegetable
Aru	*Prunus persica*	Tree	Fruit
Kainyo	*Gravellis robusta*	Tree	Ornamental value, timber, fuel wood
Amriso	*Thysanolaena maxima*	Grass/herbs	Fodder, soil conservation
Pipla	*Piper longum*	Herbs	Medicinal value
Sugandhawal	*Valeriana jatamansi*	Herbs	Medicinal value
Chiraito	*Swertia chiraita*	Herbs	Medicinal value
Ghodtapre	*Centella asiatica*	Herbs	Medicinal value
Manjitho	*Rubia mahitha*	Herbs	Medicinal value
Charchare	*Parthenocissus semocordata*	Herbs	Medicinal value
Neuro	*Poa polyneuron*	Herbs	Wild vegetable
Nim	*Azadiracta indica*	Tree	Medicinal value, timber, firewood
Ghiukumari	*Aloe verra*	Herbs	Medicinal value
Tejpatta	*Cinnamomum tamala*	Shrubs/Tree	Medicinal, spice value
Pakhanbeda	*Berginia ciliata*	Herbs	Medicinal value
Titepati	*Artemissia indica*	Herbs	Medicinal , antibacterial value
Lokta	*Danphe bholua*	Shrubs	Raw material for paper making
Angeri	*Lyonia ovalifolia*	Shrubs	Firewood
Bhalayo	*Rhus sucedanea*	Shrubs/Tree	Medicinal value
Ansuro	*Justicia adhatoda*	Shrubs	Medicinal and green manuring, mulching
Dhaturo	*Datura stramonium*	Shrubs	Medicinal value
Ganja	*Canabis sativa*	Shrubs	Medicinal value
Akansbeli	*Cuscuta reflexa*	Herbs	Medicinal value
Gurjo	*Tinospora reflexa*	Herbs	Medicinal value

Tarul	*Dioscorea alata*	Herbs	Wild edible fruit/vegetable
Chameli	*Jasminum arborescens*	Herbs	Ornamental value/ essential oil
Sungava	*Dendrobium densiflorum*	Herbs	Ornamental plant
Pipal	*Ficus religiosa*	Tree	Religious value
Bar	*Ficus Bengalensis*	Tree	Religious and timber/firewood value
Kurilo	*Asparagus racemosus*	Herbs	Medicinal value
Dhupi	*Juniperus indica*	Shrubs/Tree	Ornamental use

Wildlife

Bears, different species of deer, leopards, pangolins, rabbits, wolves, snakes and bats are found within this forest. Similarly, various types of birds, reptiles, insects and mammals also occur here.

Sources of Income

- Water selling
- Selling of Forest Products
- Membership fee and membership renewal
- Fee from visitors as well as researchers
- Support from different organizations

The CFUG has been profitably establishing linkages with different grassroots organizations like social clubs, the livestock management committee, the village development committee, the district development committee, media, range posts, NGOs, etc. This has enriched the group and its members across a wide range of issues.
Apart from forest conservation and management, CF has been contributing to different aspects of the community, as well as social development activities, as summarized as follows

- Institutional development of the CFUG
- Investment in community and local development: the CFUG has been supporting different types of development activities like road construction, community building construction, drinking water management, cultural preservation activities, ecotourism promotion, income generating activities, etc.
- Scholarships as well as stationery for low income, diligent and marginalized groups of students.
- Supply of forest products for different types of social development work
- Support for income generating activities like goat and pig raising for women and disadvantaged members of the CFUG, i.e. the previously described C and D categories
- Ecotourism promotion
- Information dissemination

Future strategy

- Conducting different forest conservation and management activities.
- Conversion of pine forests into broadleaf forests for multiple benefits.
- Capacity building for CFUG members, especially those in the C and D categories.

- Planting of Lapsi (Choerospondis axilaris), multipurpose tree/fruit species, on 2 ha of land.
- Maintenance and promotion of NTFP demonstration plot.
- Commercial production of Bio Briquettes.
- As per the new CF guidelines of 2009, appropriate funding will be allocated for forest development, community development as well as poverty reduction programs; these activities will be implemented accordingly.
- In consideration of Tourism Year 2011 in Nepal, a variety of programs related to ecotourism promotion will be carried out.
- Initiative will be taken in implementing Local Payment for Environmental Services (PES) mechanisms.
- All benefits accrued from the forest will be distributed in an equitable way based on the well-being ranking and contributions of users.
- Recognizing the NTFPS (MAPs) within the forest, forest resource based enterprises will be conducted.
- In coordination with forest-related groups/institutions, NGOs, government agencies as well as donor agencies, programs related to forest development, institutional capacity enhancement and poverty reduction will be carried out.

Lessons Learnt

From the community forestry overview in Nepal as well as the Palate CF case study, in particular, the following lessons were learnt:

- First, community forestry is a viable resource management approach for conserving and improving the condition of forest resources if appropriate policy, policymaking processes and compliance mechanisms are maintained.

- Second, CFUGs can become effective and inclusive institutions, bringing together the rich and the poor, men and women, dalits (untouchable caste) and non-dalits, to address poverty and social exclusion by utilizing available resources for both subsistence and commercial purposes.

- Third, CFUGs, if given complete autonomy and devolution of power, can become viable local institutions for sustaining local democracy and delivering rural development services by creating income generating activities, and establishing partnerships with many NGOs and private sector service providers.

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Title: Local livelihood in the Lower Songkhram Basin, Thailand

Organisation: Ministry of Natural and Resources and Environment, Thailand
Theme: Forest, Agricultural land
Keywords: Thai Baan Research, Wetland

Summary

Wetlands play a key role in helping to sustain river systems health. They have important hydrological functions such as recharge of groundwater, improvement of water quality and flood alleviation. The main challenge in the relationship between wetlands and water is to find ways in which to integrate the conservation and wise use of wetlands into the management of river basins. The seasonally flooded forest in the Lower Songkhram Basin is a wetland type in northeastern Thailand. Wetland ecosystems provide the local people with a variety of goods and services upon which they all depend, including food, fuel, clean water and protection from natural hazards. Unfortunately, wetlands are under increasing pressure from unsustainable use and other threats such as pollution and land conversion.

As all cultures gain inspiration from or attach spiritual and religious values to wetland ecosystems or their components – e.g. landscapes, trees, hills, rivers or particular species - biodiversity loss also strongly influences our social relations. The strengthening of local communities' participation in the management of wetlands; allocation and management of water for maintaining the ecological functions of wetlands will support their livelihood. The ecology and history of the seasonally-flooded forest in the lower Songkhram basin research using the Thai Baan research methodology, was undertaken by 240 villages from 4 villages – Baan Tha Bor, Baa Pak Yaam, Baan Uan, and Baan Yang Ngoy in Sri Songkhram District, Nakorn Phanom Province in Northeast Thailand. The research methodology utilizes the situated knowledge of local communities on ecology, management of natural resources, local history, socio-economy and livelihoods

Introduction:

The Lower Songkhram River Basin encompasses a broad range of wetland habitat types associated with a functional floodplain ecosystem, linked to the Mekong River. Annual extensive flooding phenomena are dependent on in-basin precipitation and a backwater effect from the Mekong which in some years shows a marked backflow. The river supports a remarkably productive capture fishery, which peaks each year during the flood recession period, supporting the livelihoods of numerous families locally. The site is notable for holding one of the last extensive areas of seasonally-inundated riverine forests in the Mekong Basin.

The floodplain wetland site supports several rare and threatened fish species, including five species on the IUCN Red List, and is an important resting and feeding site for migratory birds on the East Asian Flyway. The area is generally poorly studied for most major taxa and data is sparse.

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Wetland Livelihoods in the Lower Songkhram River Basin

Communities located on or near the Songkhram floodplain exhibit a high degree of reliance on wetland-derived products for their livelihoods. Villagers generally are engaged in multi-component livelihoods, which vary by season and availability of particular wetland products. Agriculture is of less importance locally than is generally assumed by outside agencies, thus leading to inappropriate development priorities and misallocation of resources. In particular, local people are engaged in a mix of the following wetland dependent activities:

Capture fisheries: Large numbers of families are dependent on fishing for both subsistence and income. Up to 90% of households in some villages have members who are involved in fishing to a greater or lesser extent, with most being part-time or seasonal fishers. At certain times of year, when fish are migrating upstream or downstream off the floodplain following the rainy season, a significant artisanal fishery exists, which generates significant local wealth. Up to 85 different fishing gears were used in the past, many of which were made locally, supporting a secondary industry. High value fish are sold fresh, while lower value fish are processed.

Fish processing: Because of the surplus of fish at certain seasons and the difficulties with transporting fresh fish to market, there is a healthy fish processing industry developed in riverside villages, although not all of the raw material is derived from the Songkhram River these days, with much of the fish being used in pla som (fermented sour fish) being derived from the Central Plains. Some villagers process large amounts of salted fermented fish in clay jars (pla daek) or dried fish (pla haeng), both of which have a reputation for quality from the Songkhram communities.

Harvesting wetland products: A vast range of wetland products, both terrestrial and aquatic, are harvested on a seasonal basis by local villagers and people from outside the basin who travel in to take advantage of the abundance of natural resources. Villagers from as far away as Khon Kaen and Kalasin are reported to come and gather mushrooms and bamboo shoots from the paa boong paa thaam during the early rainy season for sale in their home provinces. Other commonly harvested products include wild vegetables, red ant eggs, tubers, fuel wood, wood or vines for making household implements or fish traps, medicinal herbs and reeds for making mats.

Agriculture: Traditional forms of agriculture are now increasingly scarce, as more intensive forms oriented towards external markets have taken over from subsistence farming. Wet paddy rice is the most commonly grown crop (principally glutinous rice varieties), plus smaller areas of cash crops such as sugar cane, tomato, melon and maize. Rice is mostly grown in the wet season without irrigation, but significant areas may be lost due to flooding when grown on the floodplain or lower terraces. Dry season rice cultivation has long been promoted by the government using centralized irrigation systems, but the majority of these systems has failed and they are now abandoned. However, small scale systems using farmers' own pumps or flood recession trap ponds have proven sustainable over the last 20 years. There are still instances of traditional mixed crop farming systems using terraces on riverbanks or small cleared areas in the paa boong paa thaam, but they are increasingly rare.

Livestock Raising: This is a livelihood activity of great importance to households in the Lower Songkhram Basin, especially raising cattle and buffalo. In the dry season the livestock are driven into the flooded forest or areas of open grassland to graze, while in the rainy season when these areas are inundated, the livestock are taken to higher areas of dipterocarp forest known as "dawn" to feed. The buffalo are superbly adapted to the wetland conditions, having splayed hooves for walking on marshy land and being good swimmers. In the past they were used as draft animals, but nowadays are used as a source of animal manure and sold for ready cash when the family is in need e.g. a member requires medical treatment. In this sense, they are a form of insurance and social security for local villagers, who are less likely to fall into debt than villagers who have sold all their large livestock.

History of the Lower Songkhram River Basin

The ecology and local history of the seasonally flooded forest in the Lower Songkhram Basin research has found that the Lower Songkhram area has been the home of many different ethnic groups for a long time, as a consequence of the rich natural resources and the location, which has long been a transport route between the extensive Sakon Nakhorn Basin and the Mekong River.

The first groups that traveled to the area were the Khmer (called by the local as Khom) and the Laos. The Khmer traveled by Kra Sang boat along the Mekong and its tributaries for trading items of silver ware, gold ware, and swords, while the Lao from Savannaket and Khammuan traded their rice in exchange for salt from the SongKhram valley.

During World War II, Vietnamese people moved to some of the large towns along the Mekong in Thailand. Some of them worked with trading boats traveling along the Mekong and its tributaries, including the Songkhram.

There have been many other ethnic groups from Northeast Thailand and Laos who have relocated to the area such as the So, Lao, Nyaw, and Chinese. These groups moved either to the existing communities or established new communities. They fished, farmed in the flooded forest, traded and worked on commercial boats.

Accordingly, the communities where the research has been conducted are historically linked to the different ethnic groups who moved to the area at various times. The summary of each community is as below:

- Baan Pak Yaam a stop for the Lao from Kammuan who traveled upstream to buy salt to take back to Laos. Later groups that moved to the community, such as the Vietnamese, settled during World War II, Thai from Ubon Ratchathani and Nakorn Phanom. These settlers made Baan Pak Yaam an important trading site on the Songkhram River.

- Baan Tha Bor community was built by merchants and fishers originating from Khammuan and Champasak provinces in Laos. During World War II Vietnamese who worked with the trading boats also moved to the community. Later Thai people from Ubon Ratchathani, Nakhon Phanom, and Yasothorn, together with Chinese merchant settled down, making Baan Tha Bor a large community and a center of trading in the Songkhram Basin. Presently Baan Tha Bor hosts 6 ethnic groups: Thai, Lao, Nyaw, Soe, Chinese, and Vietnamese.

- Baan Yang Ngoy was built by Khmer merchants who sold silverware and swords. They traveled by boat along the Mekong and by foot. It was reported that the villager’s first location was called “Sopamiatra” (locally pronounced as “som pa mid”). However, the old community disintegrated due to war and disease. Later on the Nyaw from Pong and Sa towns in Laos came to the area for trading and fishing, they relocated in the village from the old Khmer graveyard. Presently villagers in Baan Yang Ngoy still speak the Nyaw language.

- Baan Uan was built by people from the confluence of the Nam Songkhram and Mekong rivers at the mouth of Chai Buri river, and Thai people from Ubon Ratchathani who relocated to the area for farming and fishing. Later villagers from parts of Yasothorn and Mukdahan provinces arrived, who came to purchase fermented fish, dried fish, and fermented bamboo shoots also moved to the community.

The economy of communities in the Songkhram basin has been connected to communities in other areas for a long time, through merchants who traveled along the Mekong and its tributaries. Local Songkhram villagers in the seasonally flooded forest have traded their products such as fermented fish and dried fish with rice, salt and chili from upland communities. They also sold dried fish at some festivals and ceremonies such as annual Thay Phanom pagoda festival.

In the early 1940s, there were Chinese sailing ships plying the river selling rice and chili, and purchasing fermented fish from the area to sell in communities along the Mekong in Nong Khai, Mukdahan, Ubon Ratchathani, and on the Lao banks of the river and even as far as Srisaket province on the River Mun.

In 1950 a new road was built connecting Sri Song Khram and Tha Utane districts, minimizing the role of river navigation. More and more merchants started using the road for their trading activities. Later, as roads improved and trucks were introduced, it became possible for buy fresh fish, vegetables, bamboo shoots, and mushrooms from the Nam Songkhram basin for selling in many other areas.

Apart from fish, cattle and buffalo have long been important for the local economy. The seasonally flooded forest and surroundings of the lower Songkhram have served as the largest grazing plains in Sakon Nakhon basin. Villagers in the lower Songkhram basin have traded cattle with Thai people in Central and Eastern Thailand for over a century. Presently, they trade cattle and buffalo in the local livestock markets only, but large livestock remain a vital possession for the villagers.

Ecology of the Lower Song Khram River Basin

The 420 kilometers of Songkhram River is a most fertile river basin. In the lower reaches, stretching up to 200 kilometers from the mouth of the river, there is a seasonal flood forest where annual floods cover an area of approximately 500,000-600,000 rai for three to four mouths during the rainy season. Very similar to the Tonle Sap of Cambodia, in the rainy season the lower Songkhram receives floods derived from upstream runoff and backflow of the Mekong River.

Part of the unique nature of the lower Songkhram river basin is the flood resistant forest (Known in Thai as Pa bung Pa Thaam) comprising many tree and shrub species, including a dominant pioneer bamboo species called Pai Gasa, in the flood area and on the banks.
The complex wetland ecosystem of the lower Songkhram river basin consists of 28 different sub-ecosystems, hosting diverse plants and aquatic organisms. These sub-ecosystems are only revealed in the dry season as the flood waters recede. The sub-ecosystems provide important fish habitats particularly for spawning, such as the flooded forest, creeks (Known in Thai as "Huay"), oxbow lakes (Known in Thai as "Gut") ponds, pools (Known in Thai as "Wang") and rapids (Known in Thai as "Gaeng"). The abundance of fish in the Songkhram depends largely on the complex interacting relationships between annual floods, recession and natural flow patterns, the extent and quality of flooded forest and the variety of local sub ecosystems.

The Thai Baan researchers identify 208 kinds of plants and fungi, 124 fish species, 6 turtle species, 4 shrimp species, 10 mollusk species, 4 crabs, and 6 aquatic insects.

Out of 124 fish species, 115 species are native fish. There are 58 fish species that can be found in the Songkhram River all year round. There are an additional 57 species of migratory fish that migrate from the Mekong River, including the Mekong Giant Catfish. The species migrated to the Songkhram River during the flood season to feed on aquatic weeds, invertebrates and saline clay soil in the flood forest. According to a community note, a number of Mekong Giant Catfish were caught at Kud Takla on the Songkhram River in 1952 and 1953, with a maximum weight of 270 kilograms and have been caught in decreasing numbers ever since. The last Giant Catfish caught was recorded in 2003.

The relationship between the Songkhram and the wider Mekong ecosystem, for example 2 specimens of the White-eared Eel were found during the Tai Baan Research. This is a species of eel that migrates to inland waters along the Mekong from the ocean where it spawns, and has also been found by Tai Baan researchers in the Mun River Basin and Chiang Khong in northern Thailand.

The current situation of the Lower Songkhram Basin

The local economy is still heavily dependent on products originating from the seasonal-flooded forest including fresh and fermented fish, wild plants and cultivated vegetables and large livestock. The number of families who own cattle or buffalo has increased; while the number of animals per household has decreased due to communal grazing plains often being occupied by agribusiness ventures. In the last three decades several large agribusiness ventures have established a presence in the area, buying up large amounts of land at cheap prices and occasionally encroaching on common land, which had led to many instances of conflicts between local communities and the companies, some of which have ended up in the courts.

There are 79 kinds of traditional fishing gears, but eight of them are no longer in use. A number of large scale commercial fishing gears were introduced by the newcomers to the communities and widely adopted over the last 40 years or more.

For agriculture in the seasonal flooded forest and surroundings, there are various kinds of rice cultivation including lowland paddy fields and terraced rice fields. The rice is produced mainly for household consumption. In some years if conditions are right, high yields are possible and villagers can get a reasonably high income from selling rice.

There were once 47 different varieties of rice grown by villagers. Following introduction and promotion of commercial high yielding rice varieties by state agencies the number of varieties has fallen. Currently there are only seven varieties of native rice grown in the area. The villagers also grow various kinds of vegetables for household consumption in upland fields and along the river banks during the dry season.

An important concern coming out of the research is the decline in productivity of the seasonal flood forest as the result of the use of destructive commercial fishing gear, coal making, and commercial farming operations owned by agribusiness companies. They use significant amounts of chemical fertilizers and pesticides in their farming practices leading to reported instances of fish kills around the intensive farming plantations and concerns about human health risks.

At sub-district level there is a fishing auction system run by local administrative organizations to raise funds for community development locally, reflecting insufficient funds provided by the state. This may lead to over-fishing in the area. The productivity of the lower Songkhram River has been further impacted by dam construction upstream. The dam head ponds created have raised water tables that may cause salinization around the surrounding area and kill riparian vegetation.

Importantly for the last 3 years unusual water fluctuation has been observed in the Songkhram basin. Such unusual water fluctuation has only ever been observed within the last 3 years, and has been reported in many parts of the Mekong. While the exact causes may be in some doubt, such unusual water fluctuations are consistent with the development and operation of dams in the upper reaches. When the river ecosystem is affected by unusual water fluctuations, migration patterns of fish may also be affected. There are widespread invasions of aquatic weeds such as Giant Mimosa. The villages complained they could not organize a ceremony on the riverbanks due to the unusual water fluctuations at Baan Pak Yaam.

The degradation of the seasonal flood forest is affirmed by the increasing number of local fish species that are becoming rare, or that might even already be extinct. There are 41 fish species that are nowadays considered to be rare and 11 fish in the Songkhram River for over 50 years. These locally extinct species are migratory fish that migrate between the Songkhram and the Mekong.

Amidst the environmental crisis in the Songkhram basin, the villagers have tried to solve the various problems that have arisen. For instance, they have set up many fish conservation zones, establishing community rules prohibiting destructive fishing gears, and building habitats for fish. Local communities have taken on these management responsibilities themselves. These activities have been supported by district state agencies and temples.

Local community management activities have ensured equity with poorer people being allowed to fish in conservation zones on some occasions. Importantly, it was found that a type of fish conservation by the community has been practices for a long time in the form of “sacred areas” where access to fishing is restricted, but is still respected by villagers.

The research in this area has generated a wealth of information on the ecology and livelihoods in the basin. Local people have led and carried out every step of the research-identifying research issues and questions, gathering and analyzing data, and producing final reports. The research is based on local knowledge and experience, and displays local people’s sophisticated understanding of the area’s ecology, as well as their capacity to manage their natural resources.

Figure1. Working with local communities

Implemented organisations:
IUCN-The World Conservation Union, The Nakhon Phanom Environmental Conservation Club (NECC), Southeast Asia River Network (SEARIN) and Mekong Wetland Biodiversity Programme (MWBP), Office of Natural Resources and Environmental Policy and Planning (ONEP).

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Title: Utilization of natural pastures in the Huascaran National Park by users and rural communities

Organisation: Huascaran National Park, National Service of Protected Natural Areas (SERNANP), Peru
Theme: forest, agricultural land

Introduction

Livestock activity plays a fundamental role in the economy of the users of natural pastures of Huascaran National Park. For these farming communities to harmonize the ecosystems with human activities, it will be required to develop and implement more efficient management practices of the different resources of the productive system (soil, water, fodder, and animal loads).

The natural pastures are found between 3,800 and 4,400 masl. They are composed of low vegetation, whose growth period coincides with the rainy season. The majority are perennial grasses. Their size, without considering the flowering stalks, reaches one meter in height. This is higher than most species such as Festuca dolichophyla and these are associated with other herbs, split equally between annuals and perennials, and bushes that are very widely disseminated. At the end of the rainy season, the dry season comes, during which the more delicate herbs disappear and a vegetation layer composed principally of grasses remains.

On the other side, inside the borders of the natural protected area is composed with predominant vegetal formations of the following types: (1) Monte coastal, (2) Forest of Polylepis sericea, (3) Forests of altitudes higher than 4000 masl, (4) Lithophytic communities, (5) Scrubs, (6) Grasslands, (7) Aquatic and semiaquatic communities (8) Wetlands.

In the majority of the properties, especially in the ravines of the Natural Protected Area, during years in which users are forced to use overgrazed pastures, compounded by the dryness and high temperatures, not only is the production of pasture diminished during the same period of overgrazing, but this also provokes loss of part of the grasslands.

Users of pastures and farming communities

The agrarian reform of 1970 was executed for reasons of popular discontent and the movements of national liberation, which brought destabilization of the system. It included a basic question: secular exploitation, bonded and indirect to the land of the plantations, that has been seen becomes generally, from the usurpation of properties of the indigenous communities, and for the presence of large estates of national capitals and foreigners that at the end of the XIX century and the beginning of the

XX acquired land at ridiculous prices, peripheral to mines or for agricultural extension, sweeping small properties, then the "unexpected biases acquired feudalism: rural and industrial."
The situation of Andean ethnicity was resolved in part with the agrarian reform to liquidate the estates in Peru, and to reclaim the peasant communities (comunidades campesinas) denomination that acquires from this process the calls that until then were indigenous communities.

Family and community profile of the Andean people

In the buffer zone of Huascaran National Park, the cultural patterns of the rural Andean world are dominant, "integrated" in an ethnologic grade that follows at least a major involvement in occidental culture. In great measure, however, it also follows the soul of the peasant communities inherited from the old ayllus as family and territorial units. These have been modified by modern times and competitive of accumulation, competence, success and technology, basically, to demonstrate a particular idiosyncrasy, whose configurations were not properly comprehended made a concerted insertion difficult and participative to a socio-economic system and in the expectations of environmental protection.

Rural Communities are legal persons under national law that the technical criteria for the national census of population and housing not recorded as such in this regard is fragmented into a variety of categories of classification and population management policies. However, their presence is a reality that can not be avoided, there are 41 territorial rural communities involved in that area.
The Peasant Communities are legal persons under national law and the technical criteria for national censuses of population and housing do not record as such, and in this regard are found fragmented in a variety of classifications and of categories of administrative political populations. However, their presence is a reality that cannot circumvent, and there exist 41 peasant communities that are territorially involved in the referred zone.

Andean society and personality

The peasant communities, basically, constitute social, cultural and economic units of associative nature, community or cooperative. They integrate many families, as in the old Ayllus that formed tribes or villages with an authority that represented, organized and directed the common interests. Equally as now, they politically elect an authority that is the president of the community and a representative of all of the families in the matters set forth as "of the community." Also, the community is a political unit, whose reaches comprise the preserved territory since ancient or recuperated by agrarian reform. Legally the property is of the community, participating families of the agricultural lands in quality of landholders lifetime inheritable to the children, ancestral situation that conserves the organizing unit of the community.

Family, community member and role of women

The family in peasant communities, although in the major influence of urban cultural patterns, is the central axis about which turns the life of all of its members, on the basis of blood relationship and political, relations that bring with them an implicit set of obligations of mutual help, of reciprocity, for the solution of problems that require that participation of other members, as in some processes agricultural activity or the construction of their homes.

For their part, the commoner is the anonymous creator of wealth, that once sat ancient bases of large civilizations. In actuality agricultural activities or livestock do not have the same consideration at the time, hence is not a way that promotes economically or culturally, on the contrary, tend to stagnate thus exerting for them, in many, an very strong impulse in the motivations of staggered migrations to urban centers, generally for work as unqualified labor of the construction industry, market services, any eventual agricultural work, etc., and almost always with a return to their lands.

The role of the woman in the family economy is important, of all because in the economy that is generally of subsistence, the procreation of many children constitutes an important necessary component to widen the possibilities that require the same activities of the farm. In addition to provide the wellbeing of the family, they are responsible for bringing up children and managing household affairs. It is effective their direct participation in the productive activities of the field, raising and care for the animals, preparing an element for the construction of the house, at times to commercialize some small excess in the local market, or even become involved in some works of community interest. The woman is the pivot of the family unit, sacrificing in that she feels more directly that the wellbeing of the home depends on the working capacity of all of the members that it spurs.

Communal tradition, rurality and poverty Andean

Specialized research indicates that the situations of extreme poverty in the Republic of Peru have been associated traditionally to the conditions of rural means and to the culture of the indigenous peasant, however, this is a situation that, to contrast, comes from behind. In effect, the community tradition and the rural life of the pre-colonial man, or best from the autonomous period that ended the empire of the Incas, the ethno-history says was not associated to poverty, which is to say that in this period was not known as this situation, with what is required to recognize a particular conditioning that comes from the colony, and continues in the republic without having achieved to solve the problem, possibly because it only has been seen its forms and not a question of background, that essentially underlies the interior nature of the Andean ethnicity, seen anteriorly and that is expressed also in its traditional manifestations.

Protected Natural Area - Huascaran National Park

Huascaran National Park which is also called Core Biosphere Reserve of the same name, was established on July 1, 1975,by Supreme Decree N ° 0622-75-AG.

It is a Natural Area destined for the conservation of animals and plants inside of its natural ecosystems, that are maintained in it the living species seeking their continued evolution and adaptation to the climatic and external agents that affect them, converting in a territory of natural life without external interferences, integrated by the set of unique and varied ecosystems.
It is located in one of the territories of high mountains more surprising of the world (highest tropical mountain range of the world closest than others to the equator), where can be found 712 glaciers, 434 lakes, and 41 rivers. On the other side, it permits the socio-economic development of the surrounding populations.

Regulation of natural pastures in the Natural Protected Area

The usufruct of the natural pastures is regulated through the issuance of the Ministerial Resolution Nº 01200-80-AA-DGFF., which considers the area of natural pastures sufficient for grazing in Huascaran National Park, those that post ecological and physiographic features allow continued temporary use for grazing without deterioration of the productive capacity of the resource or alteration of the hydrological regime of the basin, corresponding to the classification of this area to the park's headquarters.he usufruct of natural pastures is regulated through the issuance of the Ministerial Resolution No. 01200-80-AA-DGFF., which considers the area of natural pastures suitable for grazing in the Huascaran National Park, those that post ecological and physiographic features allow continued temporary use for grazing without deterioration of the productive capacity of the resource or alteration of the hydrological regime of the basin, corresponding to the classification of this area to the park's headquarters.

Also, users of natural pastures of the ravines of Huascaran National Park, will be considered of two categories: a) Rural communities and rural enterprises in possession of the area at the time of issuing the Supreme Decree N º 0622-75-AG, establishing the Huascaran National Park, not allowing new revenue. b) Small and medium farmers in possession of the area at the time of issuing the Supreme Decree N º 0622-75-AG., which must be integrated into user committees natural grasses prior qualification of the park's headquarters.

As a contribution to ANP, users agree not to destroy the natural landscape, to prevent hunting or trapping of wild animals, not to cut down tree or shrub plant species, not to burn, avoid overgrazing pastures, as well as no introduction of goats or pigs.

Natural pastures in the valleys of the ANP

The richness in plant diversity is enormous. In the high Andean grasslands is found a diversity of botanical families such as grasses. Within this family, are the genus Festuca, Festuca dolichophylla. Other families such as legumes, Rosaceae, sedges, rushes, etc.. also have this division.

The natural grass surface coverage is 41.5%, and presents a condition that ranges from fair to very poor, indicating that grasslands are overgrazed, and highlights the need to pay attention to in site conservation of plant species in danger of extinction.

Grasses are the largest group of plant species in these grasslands. Among the principal species mentioned are: dolichophylla Festuca, Calamagrostis vicunarum, Stipa ichu, Muhlenbergia fastigiata and Poa infirm. These are key indicator species and key species for management of the gorges of the ANP. Among these are the legumes Trifolium amabile and Astragalus garbancillo, which are considered toxic to livestock, especially sheep. Other species of other genera of plants are: Hipochoeris taraxacoides, Geranium sessiliflorum, corresponding to the family Geraniaceae, Cyperus sp. Belonging to the family Ciperaceae), and Juncus and Scirpus which corresponds to the family Juncaceae.

In highland areas, where moisture from groundwater is abundant, there are the so-called wetlands; areas that have constant underground humidity and develop normally in flat areas and around small lakes. Its botanical diversity varies according to location, depending on the altitude, topography, moisture, exposure, latitude, and so on; being, in most cases, the most notorious muscoides Distichia belongs to the family juncácea.

Native pasture management and ecology

Given the range condition is defined as the health of the plant itself, a native prairie naturally, without being grazed, can grow to its full expression, to what is called a climax to ensure the conservation objectives of the ANP. The description of an excellent condition (climax vegetation), usually is based on moderately grazed pastures, relict areas (ungrazed).

Physical factors, plants, and animals function as a unit and any change in one or more factors, such as fire or grazing, may alter the whole complex. Proper grazing management requires understanding clearly and objectively the needs of both the plant and the animal, and maintains an optimal and stable relationship between them over time.

In this sense, a good grazing management should control the intensity of defoliation and define the method of grazing (days of occupation and rest) most appropriate to the species of grass and the type of animal, in order to increase the production of meadow and maintain its botanical composition. Activity is coordinated with users and rural communities through their directive boards.

Effects of grazing on the prairie

Grazing has direct and indirect effects on the prairie, which tend to be more drastic during the rainy season. Direct effects include physical damage to plants by defoliation and "fraying" in their tissues, as well as by the effect of trampling on stems, leaves and crowns of plants. Indirect effects of grazing are related to soil compaction and puddling, leading to changes in physical properties of soil, and consequently on the growth of plants. Trampling also facilitates the entry of pathogens at sites of the plant with mechanical injuries.

In general, increasing the frequency and intensity of defoliation, dry matter production on the prairie is reduced by the following: a) decrease in light interception by photo synthetically active tissues, b) depletion of nutrients reserve, c) reduction in the absorption of nutrients and water by the plant, and d) removal or damage of apical meristems. The relative importance of these factors relate to environmental factors and the prairie.

It has been shown that intense and frequent defoliation reduced the number of roots of pasture herbage. In addition, defoliation, also reduces the absorption of water and nutrients to the reduced root elongation. The grass growth rate is reduced by increasing the grazing frequency and intensity of defoliation.

Water harvesting in the streams of ANP

The rest of the range increases the availability of water, as the most vigorous plants make roots penetrate to greater depths in the soil.
Most vegetation intercepts rainwater, which reduces the effect of raindrops on bare soil, thus reducing runoff and evaporation of water in the surface layer of soil.

It is observed that keeping active herbaceous vegetation reduces the percolation of rainwater into deeper horizons, likewise, reduces the period of flooding, as sprouts transpire more than older, dryer plants.

Conclusions

The Huascaran National Park Headquarters respects the possession of the rural communities and small and medium farmers at the time of the park's establishment, because it came usucfructing theresource of grasses, such as server and lessee of the landowners or welfare.
In Huascaran National Park and the usufruct natural pastures are 62 user committees, members of the 41 rural communities adjoining the ANP. Benefiting about 3500 families.

User committees and communities currently participating in the management of ANP as an alloy (volunteer rangers) because the streams are sources of their daily activities to sustain the household, for the education of their children, and in cases of emergencies they sell their animals, animals are like a savings.

Finally, it is jointly managed with the board members to local governments to create suitable conditions in the buffer zone to reduce grazing pressure in the Huascaran National Park.

Title: Integrating scientific and traditional knowledge for co-management of socio-ecological landscapes for the well-being of communities in the flood-dependent lower floodplain agroforestry, pastoral and fishery systems of the eastwards flowing rivers of Eastern Africa

Organisation: Kenya Wetlands Biodiversity Research team (KENWEB)
Theme: Inland water

Summary

KENWEB has in the year 2011 been successful in working in all clusters proposed in the area of co-management of wetlands in East Africa. These have comprised multi-disciplinary field excursions to gather data in the case study sites and other high priority sites; dissemination of findings through photographic exhibitions and a documentary; policy research and advocacy for conservation of wetlands; partnerships with like-minded organisations in wetlands management; student and intern mentorships among others. The report gives brief overviews on KENWEB's activities in each cluster proposed in our case study as members of the IPSI.

Cluster 1: Knowledge Facilitation:

Synthesis and normalisation of the existing data at different scales (local, river basin, regional).

Students and researchers of KENWEB have put a database of publications and books on the Tana River Delta together for use. Similarly, articles and information available on hard copy or soft copy have been deposited into a repository for easier access for background studies by members and collaborators.

Cluster 2: Policy Research:

Members of KENWEB have continued to be involved in the following international and national policy to advocate for wetlands conservation and management. This has been possible through the following forums:

- Kenya Ramsar Committee – members have assisted the national node of the Ramsar convention in Kenya in information and processes necessary in designation of the Tana River Delta as a Ramsar Site.
- Prime Minister's Task Force on Deltas of Kenya – Members of KENWEB have been invited to participate in this task force to facilitate knowledge and information for management of the various deltaic wetlands of Kenya.
- Kenya Wetlands Forum – KWF is an advocacy instrument for Kenyan Wetlands under heavy development or degradation. KENWEB is a member of this forum and has continued to provide information supporting conservation in various issues including land-use, community perspectives and justice and water needs for the ecosystem

Cluster 3: Indicators Research: Biodiversity assessments

KENWEB has carried out two multi-disciplinary field trips in 2011 to describe the biodiversity values and services necessary for optimal functioning of two wetlands of Kenya and to assess the threats to their survival.

Tana River Delta, Kenyan Coast (May 2nd to 7th 2011): A team of 14 scientists, interns and students collaborated in a multi-disciplinary field trip to carry out a biodiversity survey of various sites of the

Tana River Delta. The team consisted of the following teams/ groups: mammal; fish; macroinvertebrate and water quality; birds; plants; socio-economic issues; and mapping. The sites visited including ox-bow lakes at Lango la Simba, Onkolde forest, Lake Moa and its village and the Shetani forest. During this visit, filming of scientists at work with communities took place for preparation of a documentary on participatory science.

The presence of 2 of the world's most threatened primate species, the Tana Red Colobus and the Tana Mangabey, was confirmed in the Delta an area from which they were previously unknown. A significant population (about 30% of the world population) of the Madagascar Pratincole was discovered in the Tana Delta. The presence of over a dozen threatened plant species was confirmed, some of them endangered. Two plant species, a Dichapetalum and a Stictocardia found are probably new to science.

Loboi Swamp, Kenyan Rift Valley (August 8th to 14th 2011): For this fieldwork, a team of 18 scientists, interns and students in the following groups worked together to make the first ever biodiversity survey of the swamp: mammal; fish; macroinvertebrate and water quality; birds; plants; socio-economic issues; and mapping.

The results from both surveys are under continuous analyses and preparations for publications. The next field trips will be carried out in 2012 to monitor and carry out recommendations from the studies.

Cluster 4 : Capacity Building

Knowledge sharing:

1. KENWEB Photographic Exhibition entitled "Tana River Delta – A wetland in the Balance"

This exhibition is suitable for students aged 12yrs and above. During its exhibition guided tours by scientists and interns of KENWEB have been organized for Kenyan and International schools.

The photographic exhibition presents the diversity and the richness of the natural and cultural heritage of the Tana Delta and is accompanied by informative text in English presenting the work of the research team, highlighting issues related to its water and land management

It also presents a unique opportunity for students to get a first-hand understanding of the dynamics of multidisciplinary biodiversity research including community participatory assessments and monitoring, stimulating interest in environmental issues and inspiring students to consider careers in the sciences.

The exhibition has so far been shown in three localities:

- Alliance Française de Nairobi (June 7th to 17th July 2011) – where it was launched by the Kenyan Ambassador of France and the Director General of the National Museums of Kenya.
- Alliance Française de Mombasa (July 22nd to August 17th 2011)
- National Museums of Kenya, Ecology Gallery – (August 30th to October 30th 2011).

2. KENWEB Documentary and Panel discussions

During the time of the exhibition of the Tana River Delta photographic exhibition, two panel discussions were organized in Nairobi and in Mombasa on the 27th June and the 16th August 2011 respectively.

The documentary “Participatory Science: Restoration and sustainability of Tana Delta” was viewed during these meetings followed by discussions. The documentary runs for 24 minutes and was produced by Khamis Ramadhan, a renowned Kenyan film maker who specializes on socio-economic and political issues. It features the work of KENWEB scientists and participatory methods of biodiversity and hydrology studies. It brings out important issues regarding land, water, and natural resource use and management. It also features music and songs by a local community youth group on conservation issues of the Tana Delta.

3. Student Training and mentoring:
In 2011 KENWEB scientists have been able to mentor a total of 9 students and assist them in acquiring scholarships, grants and assistance for their studies. These consist of 2 undergraduate students, 1 Master’s and 2 PhDs. These students have been involved in all field activities and laboratory experiments and received training and mentorship in proposal and report writing.

4. KENWEB website: The group’s website has recently been upgraded to allow room for pictures and more information added to enable persons interested in working or partnering with KENWEB to understand what its vision and activities are.

5. Collaborative Activities: KENWEB has recently accepted collaboration with the following national, regional and international partners:

- Tulane University in New Orleans (USA) and the Freshwater section of The Nature Conservancy to present proposals to the US National Science Foundation for funding on the Tana Basin in Kenya.
- The International Water Centre has also recently proposed scholarships for students at the Monach University in Pretoria for training in Water Resource Management. Two interns from KENWEB will be applying for this grant.
- The Laikipia Wildlife Foundation has submitted to IPSI an application for membership in a bid to further work with KENWEB in IPSI’s collaborative projects. This application is now at an advanced level.
- The East African Wildlife Society who are actively lobbying the government and supporting communities in legal issues concerning landuse and developments in the delta has also included KENWEB into their network in order to provide scientific data and knowledge on socio-economic issues concerning land use.
- KENWEB has been accredited to attend the first Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem services (IPBES)

6. Publication

KENWEB members have disseminated their results through scientific papers :

- Hamerlynck O., Luke Q., Nyange T.M., Duvail S. & Leauthaud C. (In Press). Range Extension, Imminent Threats and Conservation Options for Two Endangered Primates: the Tana River Red Colobus Procolobus rufomitratus rufomitratus (Peters, 1879) and the Tana River Mangabey Cercocebus galeritus (Peters, 1879) in the Lower Tana Floodplain and Delta, Kenya. African Primates, accepted for publication on 30/05/2011.
- Hamerlynck O., Duvail S., Vandepitte L., Kindinda K., Nyingi D.W, Paul J.L., Yanda P., Mgaya Y., & Snoeks J. (in press). To connect or not to connect – floods, fisheries and livelihoods in the Lower Rufiji floodplain, Tanzania. Hydrological Sciences Journal - Special Issue on ecosystem services of wetlands, accepted for publication on 23/05/2011.
- Paul J.L. Duvail S. Hamerlynck O. (in press). Appropriation des ressources « naturelles » et criminalisation des communautés paysannes : le cas du Rufiji (Tanzanie). Civilisations, accepted for publication on 10/05/2011.

- Hamerlynck O., Nyunja J., Luke Q., Nyingi D., Lebrun D., Duvail S., 2010. The communal forest wetland, rangeland and agricultural landscape mosaics of the Lower Tana, Kenya: a socio-ecological entity in peril. In "Sustainable use of Biological Diversity in Socio-Ecological Production Landscapes, Background to the Satoyama Initiative for the benefit of biodiversity and human well-being". Convention on Biological Diversity Technical Series n° 52, 184 p. pp. 54-62.
- Duvail S., Valimba P., Nyunja J., Nyingi D., Hamerlynck O., Léauthaud C., Albergel J., 2010. "Floods and Ecosystem Services in Coastal Wetlands". Proceedings of the national workshop on research in the water sector, held at Utalii college, Nairobi, on 5th may, 2010. pp 14-28.
- Hamerlynck, O., Duvail, S., Hoag, H., Yanda, P., Paul, J.-L. 2010. The large-scale irrigation potential of the Lower Rufiji Floodplain (Tanzania): reality or persistent myth? In: Calas, B. & Mumma Martinon C.A. (Eds). Shared water, shared opportunities. Hydropolitics in East Africa. IFRA and Hekima College, Nairobi, Kenya: 219-234.
- Lebrun, D., Hamerlynck, O., Duvail, S. & Nyunja, J. 2010. The importance of flexibility: an analysis of the large-scale Tana Delta irrigation project in Kenya, implemented under an estate system. In: Calas, B. & Mumma Martinon C.A. (Eds). Shared water, shared opportunities. Hydropolitics in East Africa. IFRA and Hekima College, Nairobi, Kenya: 261-282.

Results have been presented at the following conferences

- Duvail S. 2011. Presentation "Land and Water grabbing in East Africa". Australian-French workshop on « water and land » 14 - 17 june 2011. Montpellier France. Abstract
- Duvail S. 2011. Presentation «Natural and Cultural Heritage in East Africa : The Tana delta example », Workshop "Heritage in East Africa" IFRA, Nairobi, Kenya 17-18 January 2011. Abstract
- Duvail S. 2010. Presentation "Environmental and social impacts of dams". Conference at the French School. 18 November 2010.
- Duvail S., Nyunja J., Nyingi W.D. 2010. Presentation "East african coastal wetlands as natural and cultural heritage : the listing of the Rufiji Delta (Tanzania) and the Tana Delta (Kenya) under the Ramsar convention". Conférence Patrimoine, mémoire et politique = Heritage, memory and politics. Mombasa, Kenya 22-26 June 2010.
- Duvail S. 2010. Presentation "Floods and Ecosystem Services in Coastal Wetlands". National workshop on research in the water sector, Utalii college, Nairobi, Kenya, 5 may 2010.

Upcoming conferences or presentations:

- Presentation at the Know Kenya More Workshop on the Tana River Delta. The documentary will be viewed during this workshop from October 31 to November 4th 2011.
- Members of KENWEB have also sent five abstracts on for the Annual Scientific Conference of the National Museums of Kenya to be held from the 9th to 11th November 2011
- KENWEB will be attending the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem services (IPBES) meeting, 3-7th October 2011, Nairobi.

Cluster 5 : On-the-Ground Activities

1. Empowering local communities

KENWEB is supporting a musical youth group from one of the villages of the Tana Delta in recording their music which features conservation issues. Their hit song "Choma ninswi" which translates to ‘let’s go fishing’ has been very successful during the launch of the photographic exhibition and attracted the attention of Kenyan Youth. Their music also features prominently in the movie ‘participatory science: restoration and sustainability of the Tana Delta’.

KENWEB facilitated the travel and participation of a representative of the local communities on the discussion panels on the future of the Tana Delta following the movie showing. For the showing in Nairobi KENWEB facilitated the travel for ten members of the local communities, balanced according to gender and main livelihood (farmers, livestock keepers, fishers)

2. Participatory research approach

KENWEB has continued to work with schools and communities of the Tana Delta through monitoring of rain gauges that have been installed by the project in schools; setting up of water level staff gauges in the Tana River and working with local observers to collect readings; working with local government technical staff from the Water Resource Management Authority to measure the flow of the Tana River.

A participatory mapping exercise of the tidal bore rice irrigation area of Ozi location was conducted using transect walks, focal group discussions and semi-structured interviews. It is clear that the extent of the cultivated area is in decline under the influence of the reduced flood peaks now trapped behind the upstream dams. During one of the transect walks Monochoria Africana a plant species only recorded once in Kenya several decades ago was rediscovered.

Title: Working for the Living in Harmony with Nature, Aichi's Efforts toward Ecosystem Networking

Organisation: Aichi Prefectural Government
Theme: Others
Keywords: Biodiversity, Sustainable Use, Ecosystem Networking, Compensatory Mitigation, Potential Map

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Summary

Aichi has launched a new initiative aiming to create a society where humans and nature can live in harmony. To fulfill these aims, efforts have been in progress to combine "ecosystem networking" and "compensatory mitigation" Ecosystem Networking intends to reconnect divided and isolated natural environments by arranging greenery and aquatic areas to facilitate the movement of living creatures, in order to conserve and restore the unique ecosystem of the region. To promote the establishment of Ecosystem Networking, the Aichi prefectural government has made a map of potential habitats for the first time in Japan. Ecosystem Networks will be established by using this map. Compensatory Mitigation is a system by which the persons/organizations responsible for development activities compensate for any loss in biodiversity in the area. Compensatory measures would be implemented on land meant for public use, such as schools, parks or green spaces of companies, which will help maintain ecosystems. We believe that efforts should focus on the three goals of "seeking harmony with nature", "supporting the clustering of energy-efficient industries," and "making greater use of recycled resources." Industries, academic institutions, government and residents of Aichi would thus work together to develop integrated approaches toward the implementation of a sustainable society.

Introduction

The Aichi Targets of the Strategic Plan for Biodiversity 2011-2020 adopted at the tenth Conference of Parties to the Convention on Biological Diversity (COP10) in 2010, to achieve address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society, the vision of this Strategic Plan is a world of "Living in harmony with nature."
Aichi prefecture decided to host the Conference of the Parties to the Convention on Biological Diversity, and launched specific efforts based on the Aichi Natural Environment Conservation Strategy drawn up in 2009.The Aichi Natural Environment Conservation Strategy was developed to achieve harmony with nature and the sustainable development of this region.

The underlying objective of the Aichi Natural Environment Conservation Strategy is to "seek reconciliation between ecosystem conservation and regional development". To fulfill this objective, new efforts have been made by combining "ecosystem networking" and "compensatory mitigation." If a region-wide natural environment were to become divided and isolated by urban development, the ecosystem specific to the region, which provides habitats for living creatures, would be at risk. Ecosystem networking is intended to reconnect divided and isolated natural environments by properly arranging greenery and aquatic areas to facilitate the movement of living creatures, in order to conserve and restore the unique ecosystems of the region.

Recently, efforts to build biotopes have been gaining momentum at schools, corporations, local communities, and other entities.

The biotopes need to be arranged so that they serve as part of a region-wide network, while taking into consideration the unique ecosystem and the current situation of the surrounding areas.

The objective is not to simply bring back living creatures to the environment. It is necessary to conserve and restore the unique natural environment. We believe that ecosystem networking enables us to rediscover the traditional landscape and culture of the region.

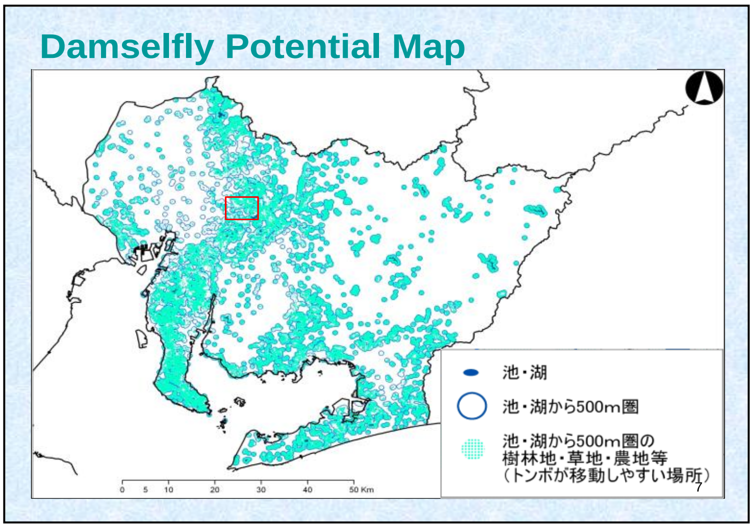
We consider it is necessary to promote collaboration, while holding discussions among various stakeholders in the region to design ecosystem networking and reflect it in community building at the regional level.

Aichi's Efforts toward Ecosystem Networking

(1)The Preparation of Aichi Biodiversity Potential Maps

We prepared Aichi Biodiversity Potential Maps to be used in discussions on ecosystem networking. “Potential maps” refer to maps of potential habitats.
These maps are the first of their kind to be produced in Japan, and indicate not just the actual habitats of living creatures but also the potential habitats where living creatures are likely to live. These maps are based on data encompassing waterside environments and forests that are essential for living creatures to survive, taking into account the characteristics of target living creatures. Potential maps have been prepared based on 16 species of animals and vegetation maps.
The potential maps are intended to raise public awareness. Specifically, residents of Aichi are expected to learn about the potential habitats of living creatures in their communities. Meanwhile, business operators and local government staff should realize that civil engineering works can be adjusted to increase living creatures.

This is a potential map for the damselfly.



Damselflies inhabit still-water bodies such as ponds and lakes. It is known that damselflies can fly up to one kilometer between ponds and lakes. On this map, areas where damselflies can easily reach are marked in light blue.

Potential maps are produced on a scale of 1 to 100,000. The blue patches show ponds and lakes. The blue lines mark a radius of 500 meters around ponds and lakes. Thus, if a circle overlaps another, the distance between ponds is less than one kilometer. The areas in light blue represent green spaces where damselflies can travel.

To promote ecosystem networking for damselflies, the zones that are not in light blue need to be connected. However, buying land is a tough choice, and it is important to consider how to use public land effectively. The patches shown in pink represent public land including schools and parks.
It is assumed that a biotope made up of waterside environments and greenery is built here; a route can be established for damselflies. Public land is not necessarily limited to land for public use. Networking can be promoted by utilizing such spaces as university campuses, green belts on the sites of factories and business establishments, roadside trees, river banks, and household gardens.

(2) Using the Potential Maps for The Formation of Ecosystem Networks

We have a project to promote ecosystem networking by using the Potential Maps. Specifically, these maps of potential habitats for living creatures are used to develop a prefecture-wide biodiversity master plan, and then efforts will be made to carry out the plan.

To do this, we need to develop pilot projects and gain expertise based on results and analyses. Three areas in the prefecture have been chosen for model projects.
The first area is Nagoya's eastern hills, which are characterized by the traditional landscape of typical Tokai hill land elements. This urban area model is intended to restore the ecosystem in the developed area. The second area is Chita Peninsula, which is one of Japan's three major areas with reservoirs and still has more than 1,000 reservoirs. This Satochi model is intended to attain harmony between people and living creatures, as symbolized in "Gongitsune," the name of a fox, the main character of a work written by Nankichi Niimi, who was born in Chita Peninsula and wrote children's stories. The third area is man-made coniferous forest in the Yahagi River Watershed. Man-made coniferous forests will deteriorate if they are abandoned or not properly maintained by thinning and other activities. This Satoyama model is intended to strike a balance between maintenance and neglect.

Efforts are also under way to turn the coniferous forests into broad-leaved forests to help conserve the ecosystem without maintenance. These are some activities in Nagoya's hills, as an example. This area spans about 20 kilometers in the east-west direction, from the Higashiyama Forest located in the eastern end of Nagoya City to the Kaisho Forest located on the edge of Toyota City. The former Expo 2005 venue, now called Moricoro Park in commemoration of the expo, is located here.

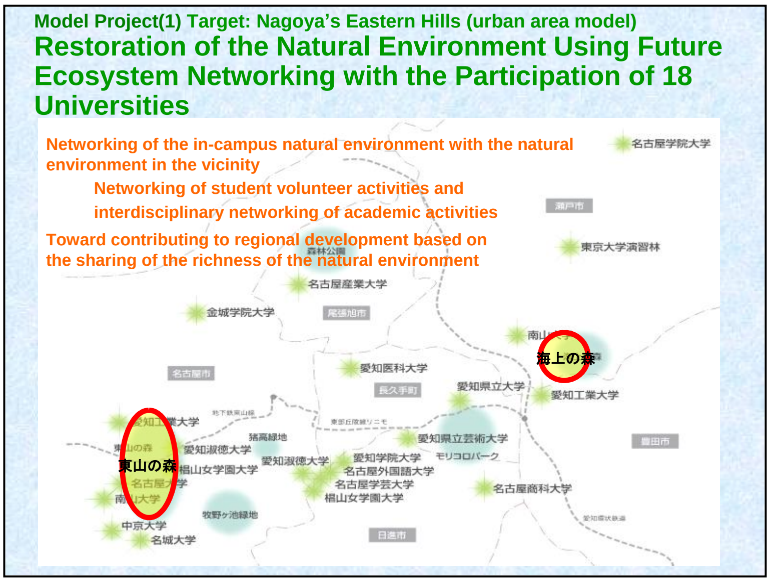


Figure2 shows that the 20 kilometer area in the east-west direction is dotted with 22 campuses of 18 universities.

These campuses serve as "time capsules" to conserve forests, marshlands, and reservoirs retaining the traditional landscape of this region.

The project is intended to promote ecosystem networking by connecting the natural environment remaining on these campuses with the natural environment in the vicinity such as the Higashiyama Forest and the Kaisho Forest, to help restore the traditional landscape comprising Tokai hill land elements. In addition to networking the natural environment, the project aims to encourage networking of volunteer activities by students of the l8 universities, as well as the academic activities of the university faculty involved in research and education. The project is also designed to contribute to regional development by sharing the richness of the natural environment via collaboration among local corporations, residents of Aichi, and regional governments.

The project is an interdisciplinary effort involving the collaboration of experts in biology, eco-business, civil engineering, as well as experts in landscape designing from among the faculty of art universities.

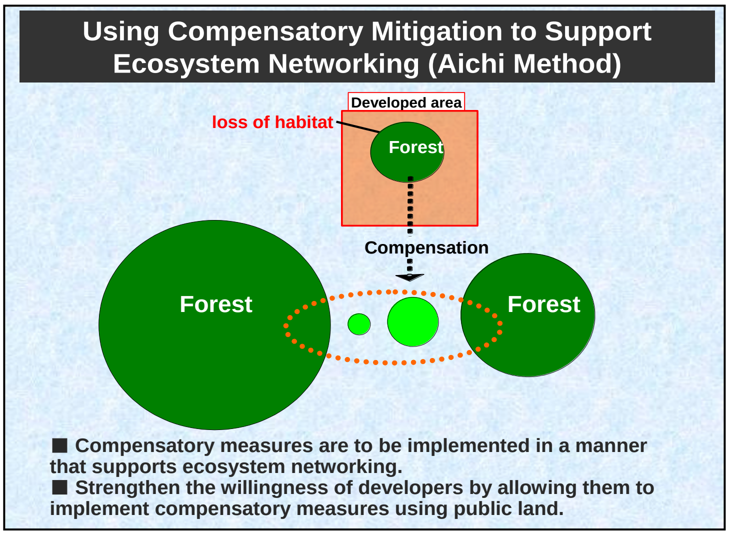
We believe that harmony between people and nature does not simply mean to increase the number of living creatures, but to create a culture that fully values living with, and working and learning with nature.

(3) Using Compensatory Mitigation to Support Ecosystem Networking (Aichi Method)

In this ecosystem networking model project, we plan to demonstrate compensatory mitigation. Basically, during a development project, destruction of the natural environment should be minimized. If destruction cannot be avoided, the impact on the natural environment should be minimized. Any loss of biodiversity due to development activities should be compensated by the developer. Compensation by the developer for any loss of biodiversity due to development activities is referred to as "compensatory mitigation."

This framework was legislated decades ago in Europe and the US, but efforts to build a system have not made headway in Japan. We plan to employ the Aichi Method in which compensatory mitigation is used to support ecosystem networking.

This is a divided ecosystem.



A natural environment, as shown in the red square, is located near the forests. The area shown in the red square is subject to development activities.

Basically, compensation is ensured within the development area. If the compensation is not enough, loss of nature is compensated by using the space that connects the divided ecosystems. This method employs spaces that are available free of charge, including schools, parks, and green spaces on the premises of corporations.

Under this framework, development activities paradoxically promote ecosystem networking, which helps increase the mass of biodiversity. In addition, compensation is facilitated by using spaces that are available free of charge. We believe that a challenging spirit is required to reconcile conservation and sustainable use.

Making guidelines for each sector and developing them to Prefecture-wide

Along with the ecosystem networking model project, Aichi Prefectural Government launched a three-year project in 2010 to develop compensatory mitigation.
This project will establish guidelines for residents of Aichi, corporations, and regional governments based on the results of the model project.

We would like to spread prefecture-wide ecosystem networking and compensatory mitigation, and embody the concept of harmony with nature.

Conclusions

The residents of Aichi, industry, academia, and government started to take action with greater environmental awareness, which encouraged collaboration among these sectors on an equal footing.
We also believe that this manufacturing region can address global biodiversity issues. For example, global warming is a major threat to biodiversity. In the manufacturing industry, energy conservation and commitment to a low-carbon society help to conserve biodiversity.
Another major threat to biodiversity is changes to the natural environment due to the collection of natural resources. In this context, the promotion of recycling and commitment to a recycling society help to conserve biodiversity.
Energy conservation in production processes reduces the input of natural resources, as does recycling. Production in Japan is highly energy- and resource-efficient compared with other major countries.

Aichi is the manufacturing center of Japan, and boasts one of the highest levels of resource productivity in the world.
This means that Aichi’s industries are a model for contributing to harmony with nature by taking advantage of the world’s leading environmental technologies.

We believe that efforts should focus on the three goals of “seeking harmony with nature,” “supporting the clustering of energy-efficient industries,” and “making greater use of recycled resources.”
These efforts will help build a “Sustainable Aichi.”
Aichi will work hard to achieve a sustainable society and set an example for the global community through the collaboration of industry, academia, government, and residents of Aichi.

The approach of Ecosystem Networking establishment restores greenery at schools, parks and business establishments, green belts on the roadsides, and river banks to the local environment used to be there. If Satoyama areas and farmlands which have been conserved by human beings for long time are now left untouched, this gradually leads to ruin in the ecosystem. We aim to restore and maintain these areas and regenerate the ecosystem. In addition, this approach contributes to the achievement of the Aichi Biodiversity Targets which is one of the outcomes of COP10. We will send this to the world as the approach for the co-existence with nature.

Title: Reintroduction Project of the Oriental White Stork for Coexistence with Humans in Satoyama areas, Hyogo, Japan

Organisation: Hyogo Prefectural Government
Theme: Agricultural land, Inland water
Keywords: Ciconia boyciana, Coexistence, Natural resources, Reintroduction, Satoyama

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Summary

The Oriental White Stork (Ciconia boyciana) was a typical species of bird living in Satoyama areas in Japan. The storks inhabited all of Japan about 200 years ago but they began to decrease in number, drawing closer to extinction from over-hunting, agricultural chemicals, and habitat-loss and -deterioration. The Tajima Region of Hyogo prefecture was the last breeding area for storks in Japan. Hyogo prefecture started conservation activities in 1955 and captive breeding in 1965, and succeeded in breeding in 1989.

The reintroduction project was planned according to the IUCN guidelines. We restored rural environments, especially paddy fields and rivers as habitats for the storks. We started to release the storks into the wild in Toyooka City in 2005 for a total of 27 storks by 2010, all of which were monitored by ground and satellite tracking to analyze the ecology and their behavior. The storks started breeding in 2006 and have been successful since 2007 in the wild. The population has been growing, reaching a total of 40 birds in 2010. The young storks that hatched in the wild showed a wide-ranged dispersal all over Japan, several of which stayed outside Toyooka City. For the goal of the reintroduction project, we should change our life style on the recognition that a society in which humans and storks can coexist is safe and secure for humans as well. The storks can be considered a natural resource for tourism, the economy, agriculture, administration, culture, education and research. We should develop such sustainable natural resources for the coexistence of humans and storks.

Introduction

The Oriental White Stork (Ciconia boyciana) is a species of bird that inhabits river valleys, wet meadows, and marshes with scattered clumps of the trees (Hancock et al. 1992). The storks prefer rural environments containing paddy fields, rivers and low hills, namely Satoyama areas of Japan (Sakamoto 1966).
The Tajima Region of Hyogo prefecture was one of the last breeding areas for the storks in Japan, where the last native storks were captured and taken into captivity before they disappeared in the wild in 1971. However, Hyogo prefecture planned the reintroduction project of the storks for coexistence with humans in Satoyama areas (Committee for the Reintroduction of the Oriental White Stork 2003) and started the project in 2005. Such a project with the goal of coexistence between humans and nature is rare case in reintroduction programs of the endangered animals of the world (Soorae 2010).
In this report, I will introduce the history of conservation, the reintroduction project, pilot release, status of breeding and dispersal, and coexistence with humans in Hyogo, Japan.

Location of Toyooka City

Hyogo prefecture extends from the Sea of Japan in the north to the Seto Inland Sea in the south, and further down to the Pacific Ocean through Awaji Island. The 135º east longitude fixes Japan Standard Time and runs through the central part of the prefecture.

Hyogo prefecture contains a rich variety of communities ranging from large cities to rural villages as well as isolated islands, and also has several diversified climatic and natural features. The Prefecture consists of five highly distinctive districts: Settsu (Kobe and Hanshin), Harima, Tajima, Tamba, and Awaji, each of which has its own unique history, climate, and industries.

Toyooka City of the Tajima Region is located in the north-east of Hyogo prefecture (fig. 1). To its north is the Sea of Japan. Toyooka City is positioned about 100km from the Prefectural government (Kobe City).

Fig. 1. Location of Toyooka City (pink area), Tajima Region, Hyogo.

History of conservation in Japan

The storks were observed widely in Japan until the Edo Era (1603 to 1868), when the capture of the storks was prohibited by local domains. The Japanese native population of storks decreased due to hunting in the Meiji Era (1868 to 1912), and became restricted to the Tajima Region (35.5N, 134.8E), northern Hyogo prefecture (fig.2) and the Wakasa Region, western Fukui Prefecture.

Hyogo prefecture prohibited hunting the storks in 1908 and the Japanese government designated the nesting area of the storks as a natural monument in 1921. The Tajima population of storks recovered once but again decreased rapidly after World War Two. The causes of the decline were the deforestation of pine forests used as nesting sites during the war, and the food shortage and health degradation from agricultural pesticides containing organic mercury, and the loss and deterioration of their habitats on land and along rivers after the war. Furthermore, inbreeding depression might have accelerated population decline. The last native storks were placed in captivity and disappeared from the wild in 1971.

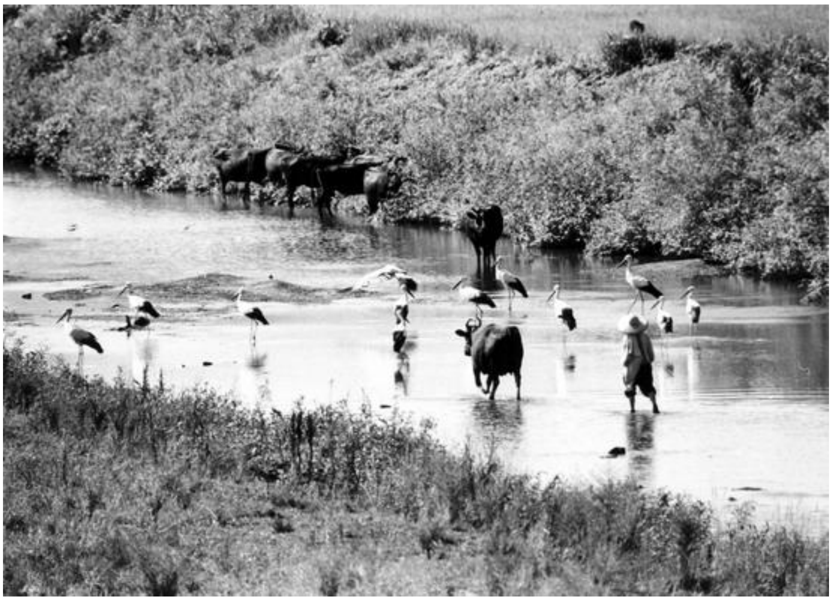

Fig. 2. Coexistence of humans with the storks in the Tajima Region in 1960, Japan (Photo by Fuji Kogeisya, Inc).

Hyogo prefecture launched a project to conserve the storks with local communities in 1955 and started breeding the storks in captivity in 1965. It was difficult to breed the storks in captivity, so the first successful breeding was in 1989, a quarter of a century later. The Prefectural Homeland for the Oriental White Stork was established by Hyogo prefecture as a reintroduction center for the storks in Toyooka City in 1999. Thereafter, the captive population increased, reaching 100 birds in 2002. Acclimation training of the storks began in 2003 and a pilot release of the storks began in 2005.

Reintroduction project

The reintroduction project of the Oriental White Stork was planned based on IUCN Guidelines for Re-introduction (IUCN 1998). The action plan for the reintroduction of the storks was settled on in 2003, based on the idea that an environment where storks live is also safe and secure for humans to live. The plan aims to promote the reintroduction of storks, while creating a region where humans and nature coexist (Committee for the reintroduction of the Oriental White Stork 2003).
The Liaison Committee for the Reintroduction of the Oriental White Stork was organized with the participation of local residents and groups, academics, and governments in 2003. Various efforts were made through discussion and collaboration among the related agencies that promoted environmental improvement, such as nature restoration in paddy fields and rivers, acclimatization of the storks to the wild, as well as popularization and education.
The basic policies of the project were as follows:

- Management of the stork population in a way that maintains its genetic diversity
- Promotion of environmental improvement for habitats of the storks
- Collaboration with related agencies
- Promotion of education programs for coexistence with storks
- Adaptive management

According to these policies, the following points were considered for realizing the project:
Reintroduction methods

- Release plans
- Sites to consider for reintroduction

Environmental improvements

- Stork conservation-oriented agriculture
- Nature restoration in arable land and river systems
- Maintenance of rural forests

Promotion of the project

- Facilitation of a promotion system
- Efforts to raise awareness and promote participation of local people

Furthermore, we referenced the points below according to the guidelines (IUCN 1998) while promoting the project.

- Continuing habitat conservation or restoration where necessary
- Continuing public relations activities, including education and mass media coverage
- Evaluation of cost-effectiveness and success of reintroduction techniques
- Study of processes of long-term adaptation by individuals and populations of the storks
- Demographic, ecological and behavioral studies of the released storks
- Decisions for revision, rescheduling, or discontinuation of program where necessary

Pilot release

We conducted a tentative release of Oriental White Storks between 2005 and 2010 to establish releasing and monitoring methods. We released a total of 27 storks into the wild: seven adult birds (older than one year) in 2005, seven adults and two young birds (less than one year) in 2006, five adult birds in 2007, two young birds in 2008, two adult birds in 2009, and two young birds in 2010, of which three birds died due to a traffic accident, electrocution and starvation respectively, and four were placed back in captivity due to problems with their release, injury, and to avoid inbreeding. Furthermore, one bird is missing. A total of 19 birds were observed in Toyooka City at the end of 2010.

After their release, we tracked the storks to collect data on their movements, habitats and behaviors by direct observation and satellite tracking (fig. 3). We analyzed the phenological stage, ecological parameters, habitat use, and social relationships from such data.

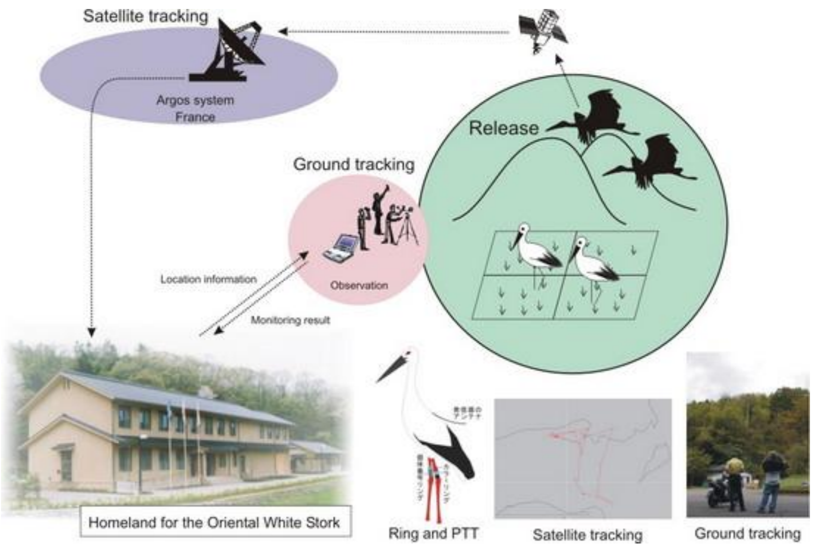

Fig. 3. Monitoring system of the released Oriental White Storks.

Status of the released storks

1) Population Increase in Toyooka

We released a total of 27 birds into the wild between 2005 and 2010, of which three birds died from a traffic accident, electrocution and starvation respectively, and four were placed back in captivity due to problems with their release, injury, and to avoid inbreeding.

There were a total of 19 observed cases of long distance dispersal by 12 storks until 2010. One of them travelled ca. 700 km and another traveled for 49 days. However, every stork returned to Toyooka City, except for the missing birds. A total of 20 birds remain in Toyooka City as of 2010. One pair formed in 2006, and seven pairs had their own home ranges in Toyooka City in 2010. The first pair started breeding in 2006 and reared one chick successfully in 2007, which was 46 years after the last wild fledging in Japan. The average of fledging success and the mortality of the stork population was 5.4 birds/year and 1.8 birds/year respectively, so the population grew, reaching ca. 40 birds in 2010 (fig. 4).

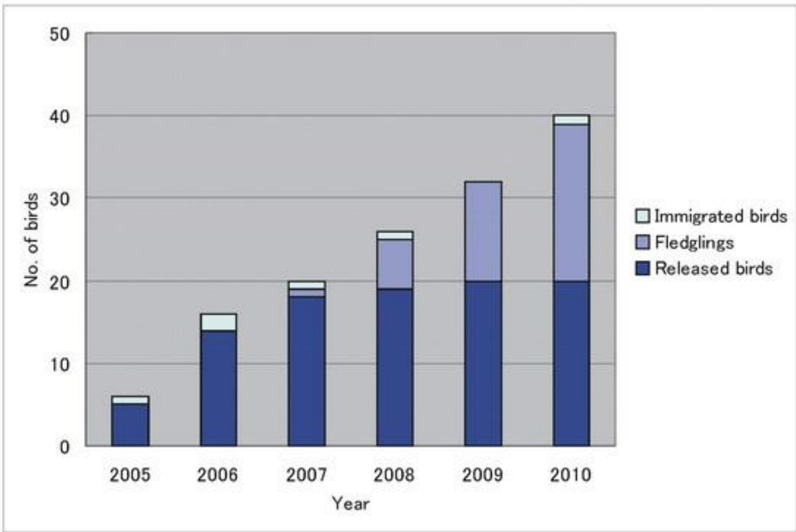

Fig. 4. Yearly change in the number of the Oriental White Storks in the wild.

2) Dispersal of the young storks

A total of 26 young storks that were hatched in the wild in Toyooka City left 50 times to visit the area from Tohoku to Kyushu, Japan (fig. 5). The longest distance of dispersal was more than 700km from Toyooka City. Most of the storks returned to Toyooka City, but several storks remained in other locations.

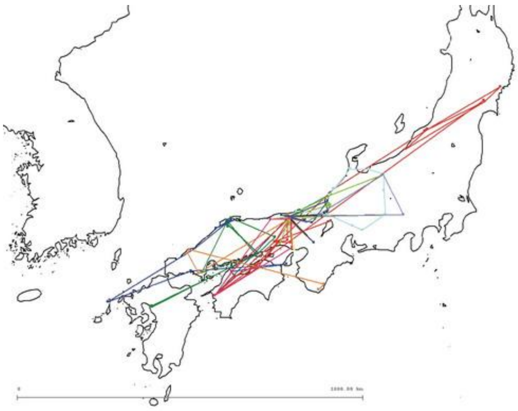

Fig. 5. Examples of long-distance dispersal of the young Oriental White Storks from 2008 to 2010.

For coexistence with humans

The Oriental White Stork can be considered a kind of natural resource, so we can use the storks for regional development and local vitalization. The storks promote developments in tourism, the economy, agriculture, administration, culture and education of the region (Kikuchi 2006, Ohsako et. al. 2008).

1) Tourism
The number of tourists that visited the Prefectural Homeland for the Oriental White Stork was around 140,000 people and increased after the release of storks in 2005. The number reached almost 500,000 people in FY 2006 (fig. 6). A large number of visitors revitalized tourism and accommodations in Toyooka City.

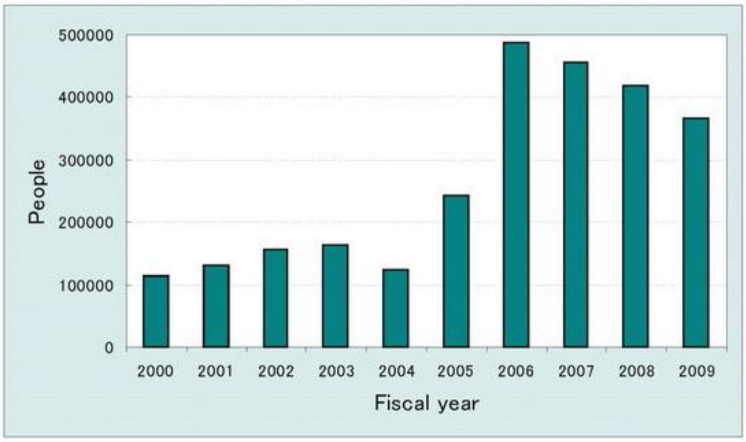

Fig. 6. Annual change in the number of tourists that visited the Eco-museum Center in the Prefectural Homeland for the Oriental White Stork, Hyogo.

2) Economy
Toyooka City settled on the Strategy for Ecology and Economy in 2005 to promote communities where the environment and the economy resonated and generated synergy. The aim was to create a recycling society ecologically and economically with the symbol of storks (Organizing Committee of the Third International Forum on Reintroduction for Oriental White Storks 2006). Several projects were planned according to the subjects below:

- Local production for local consumption
- Promotion of Toyooka-style organic farming
- Promotion of stork tourism
- Enticement of ecological and economical industry
- Utilization of alternative and renewable energy sources

3) Agriculture
Hyogo prefecture and Toyooka City expanded agriculture, while creating habitats for the storks. This method was called the White Stork Friendly Farming method to cultivate tasty rice and to support a diverse wildlife, while creating a rich culture, region, and environment that enabled storks and humans to coexist. The elements for this plan are as follows:

- Reduction of agricultural chemicals such as pesticides and fertilizers
- Organic farming
- Controlling weeds with deep water, rice bran and so on
- Postpone dehydration of the fields

- Brand products
- Settlement of fish ways, refuges
- Water filling in winter

By using this method and adapting to create rice paddies where it was safe for storks to forage, farmers could consequently grow an especially safe and healthy rice for local residents. As such, they intended to build a region with understanding and support between the producers and consumers of rice, which in turn protects and fosters the regional culture and environment to pass on to future generations. Farm products could also be sold at higher price despite the decrease in total production amount.

4) Administration

Toyooka City has a catchphrase with the storks as a symbol for local activation: Toyooka – a hometown where people smile happily and storks soar elegantly. The city settled on the Basic Environment Ordinance for Local Activation and Living Together with Oriental White Storks in 2002 and the action plan according to the ordinance in 2003.

Hyogo prefecture and the Japanese government planned to promote the nature restoration projects in rivers, rural fields and forests in Toyooka City. Artificial marshes, shallows and fish ways were made in rivers and streams. Some paddies were reformed into marshes or filled with water, and fish ways, refuges and slopes were made in ditches along the fields. The aquatic network was recovered for aquatic life among paddy fields, drains and rivers. Pine trees and broad-leaved trees were planted, and cedar treetops were cut and reformed for storks to perch and nest on in rural forests. The goal of these projects was to restore the habitats of the storks.

5) Culture

Japanese people lived in harmony with the storks in agriculture, forestry, tourism, entertainment, local knowledge and so on in the past. The storks were considered as a part of the scenery and customs for the people (Kikuchi 2006). Therefore, the storks were registered as a specially protected animal under the Cultural Properties Protection Law by the Japanese government, that is, the storks were a kind of cultural property.

The Eco-museum Center for Oriental White Stork was established by Toyooka City in 2000. The center promoted the stork reintroduction project and the coexistence of humans and storks. Visitors can learn about the nature and culture of the Tajima region at the center. Furthermore, a field museum and a stork museum are being planned by Toyooka City and Hyogo prefecture.

6) Education

The Oriental White Stork can be a good theme of environmental education because the storks are high on ecological pyramids. People can learn about environmental conservation and the coexistence of humans and nature through the stork reintroduction.
The activities on education were planned as follows:

- Environmental education programs by the Prefectural Homeland for the Oriental White Stork
- International exchange by junior high schools: Russia and Korea
- Total study by elementary schools
- Paddy field school by NPOs
- Civil academy of environmental problems by the city
- Kid’s eco-club by city

7) Research
The Oriental White Stork could be good theme of scientific study because their coexistence with humans had many subjects not only in natural science (biology, agriculture, engineering) but also in social science (politics, economics, sociology). We can approach different subjects through the stork reintroduction. Many students and researchers of universities and institutes have come to study the stork reintroduction project.

Toyooka City encouraged and supported such students and researchers in transportation and accommodation fees through a program called the Scientific Study Support for the Stork Reintroduction.

Promotion of the project

The Liaison Committee for the Reintroduction of the Oriental White Stork consisted of not only administrative bodies and academics but also groups of concerned and local people (fig.7). The committee coordinated collaboration between related projects and measures.

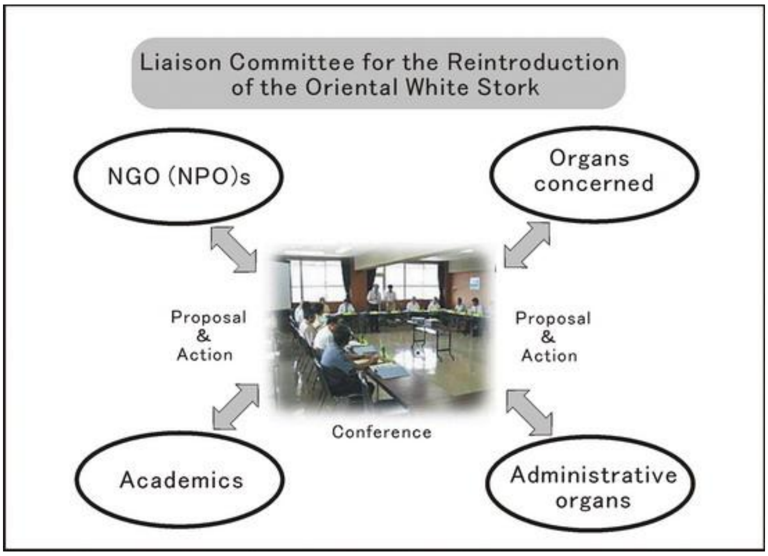

Fig. 7. Promotion system of the reintroduction project of the Oriental White Stork.

Conclusion

The objectives of reintroduction may include enhancing the long-term survival of a species; reestablishing a keystone species (in the ecological or cultural sense) in an ecosystem; maintaining and/or restoring natural biodiversity; providing long-term economic benefits to the local and/or national economy; promoting conservation awareness; or any combination of these (IUCN 1998). Satoyama areas are a hotspot of biodiversity in Japan. The extinction of a keystone species, such as the Oriental White Stork means a decrease in biodiversity in Satoyama areas. We should enhance biodiversity to reestablish the storks. At the same time, we should develop the region using the storks with understanding by local people.

A reintroduction requires a multidisciplinary approach involving a team of persons drawn from a variety of backgrounds. They may include persons from governmental natural resource management agencies, NGOs, funding bodies, universities, veterinary institutions, zoos (and private animal breeders) and/or botanic gardens, as well as government personnel with a full range of suitable expertise (IUCN 1998). We need the cooperation of many people and organizations, and funding by governments to reestablish the wild population of the storks in Japan. At the same time, we should promote the reintroduction project until the storks become a good partner of ours.

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Title: Conserving biodiversity by utilizing wood thinned from forests as biomass fuel for power generation (Sustainable Utilization of Biological Resources)

Organisation: Nobeoka City (and Asahikasei Corporation)
Theme: Others
Keywords: Wood biomass power generation, sustainable utilization of biological resources

Summary

Nobeoka City and Asahi Kasei are planning to sustainably utilize the forest resources of the watershed area of the Gokase River in Miyazaki for biomass power generation, in order to conserve biodiversity and reduce the use of fossil fuels.

The Gokase River watershed area includes both flatlands and mountainous areas, with cedar and cypress trees planted in the mountainous areas for forestry purposes. The cedar and cypress are mature enough for use as timber. The forestry business, however, has declined markedly due to increased imports of cheap lumber since the 1970s. As a result, some forests are left untouched with no thinning work performed. Even where forests are actively managed for timber production, thinnings which are unsuitable for use as construction material are often left discarded on the ground. In both cases, this makes it difficult for natural groundcover to grow due to a lack of sunlight. This has not only altered the socio-ecological production landscape, but is believed to have caused a decrease in biodiversity.

To improve this situation, Asahi Kasei intends to utilize woodchips obtained from the Gokase River watershed area as biomass fuel at a new power plant which will start operation in July 2012. In mixed combustion with coal, the plant will use approximately 100,000 tons of wood biomass per year—in terms of energy content, over 60% of the fuel used.

By utilizing heretofore-discarded forest resources in a sustainable cycle, this project is expected to facilitate a revitalization of the ecosystem, restoring the natural biodiversity as well as the forest's groundwater recharge function. In addition, commerce in woodchips is expected to invigorate the forestry industry as well as the overall economy of the region with increased employment.

This program is the second major effort by Nobeoka City and Asahi Kasei for the conservation of biodiversity in Miyazaki. In 2007, in collaboration with Miyazaki Prefecture and landowners, we began cutting down man-made forests which no longer functioned economically and planting broad-leaf trees native to the area to restore the natural ecosystem.

The major challenge for Nobeoka City and Asahi Kasei is to lower the price of wood biomass fuel obtained from the Gokase River watershed area to the same level as that of coal. In cooperation with forestry associations in neighborhood areas, Nobeoka City and Asahi Kasei began to purvey wood biomass fuel in small scale for one year, to in order to identify the factors that are making the price of wood biomass fuel higher than that of coal, and study what needs to be done to establish an economically feasible system.

Background

- The Nobeoka Power Supply Dept. in the Energy Division of Asahi Kasei Chemicals Corporation currently runs a project for building biomass power generation facilities in Nobeoka City, Miyazaki Prefecture. The facilities are scheduled to go into operation in July 2012.

- According to the plan, waste building materials will be used as wood biomass in the early stage of operation. In search of stable procurement, Nobeoka City and Asahi Kasei are studying a system for procuring wood biomass, including thinned wood from the Gokase River watershed area.

- According to the plan, the biomass power generation facilities will consume 100,000 tons of biomass and other fuel per year. Procurement of thinned wood and forestry remnants from the forests in the Gokase River watershed area will cut CO_2 emissions from fossil fuel by 170,000 tons. It will help advance forestry management to reconstruct the socio-ecological production landscape, enable sustainable utilization of forestry resources and promote the cause of preserving biodiversity.

- Afforestation will be carried out to bring economically nonviable artificial forests back into natural forests.

- There is currently a huge gap between the selling price and purchase price of thinned wood. Sorting this problem out is a challenge.

- Nobeoka City and Asahi Kasei are studying how to meet this challenge in collaboration with the Miyazaki Prefectural Government and local forestry associations.

Introduction

As mentioned in Table 1, the biomass power generation facilities are currently under construction on the premises of the Second Thermal Power Plant operated by the Nobeoka Power Supply Dept. in the Energy Division of Asahi Kasei Chemicals Corporation and are expected to go into operation in July 2012. The facilities will burn a fuel containing at least 60% wood biomass in terms of calories. This means that 100,000 tons of wood biomass will be consumed per year.

The project is considering the use of woodchips derived from forests in the Gokase River watershed area as the wood biomass fuel. Woodchips are produced from thinned wood, branches and leaves that cannot be used as lumber in forest management. The project envisions using these effectively as fuel.

The productive use of woodchips will encourage thinning and help improve the forests. Ecosystems in forests are therefore expected to be restored and biodiversity preserved. This will stimulate the declining forestry industry and contribute to social welfare in the region.

Table 1: Overview of the Biomass Power Generation Facilities

1. Location: 4960 Nakagawara-machi 5-chome, Nobeoka, Miyazaki-ken (on the premises of the Second Thermal Power Plant operated by the Nobeoka Power Supply Dept. in the Energy Division of Asahi Kasei Chemicals Corporation)
2. Output: Steam – 80T/h, Electricity – 14,000 kW
3. Fuel: Wood biomass (generating at least 60% of the calorie when burnt in mixture with coal)
4. Start of construction: February 2010
5. Inauguration: July 2012 (planned)

Characteristics of the research area

a. Location:
Forests in Nobeoka, Miyazaki Prefecture and in the Gokase River watershed area in Japan

b. Characteristics in terms of nature and ecosystems (including topography, climate and ecosystems)
The Gokase River watershed area is located where a line of mountains that stretches southwest to northeast across the southern part of Kyushu meets the flat coastline between the two cities of Miyazaki and Hyuga. The east coast is so close to mountains that it has a sawtooth shape. Part of the Kyushu Mountains, which form a ridge on the island of Kyushu, lies to the west and north of the watershed area.

The Gokase River starts in the Kyushu Mountains and flows eastward, the Hori River originates in Mt. Okue, and the Kita River flows southward from Oita Prefecture. The three rivers merge at the estuary and flow into the Hyuga-nada Sea.

The climate in the area is warm and wet. These characteristics are typically seen in the southern part of Japan. The Kuroshio Current keeps the region warm in winter. The average annual temperature is around 16°C. There is barely any snowfall in the plain throughout the year. The area is pluvial and humid, with annual average precipitation of over 2,300 mm and average humidity of around 70%. Even so, the region enjoys more than 2,100 hours of sunshine a year, as there are long periods of sunshine even in winter.

The Gokase River watershed area has artificially planted cedar and cypress forests as well as deciduous broad-leaved forests composed chiefly of beech on the plain and mountains in the altitude range of 0-1,500 meters. Nearly half the forests are manmade.
Large animals living in these forests include deer and boars. However, there are no carnivorous animals that catch and eat them, and these days they increasingly do damage to agricultural products and forest.

c. Social characteristics (population, land use, land ownership system, governance and lifestyles)
The city of Nobeoka has a population of 130,000. With its strong chemical industry for textiles, food and other products, it has developed into the leading industrial city in Miyazaki Prefecture. The 2008 industrial statistics confirmed that the city had 255 factories with at least four employees, 9,350 workers were under their employment and product shipments amounted to approximately 314.8 billion yen as of 2008.

With respect to industrial sectors, those engaged in a tertiary industry are on the increase while those in a primary industry are declining.

The city's urban district extends 13.4 km north-south and 7.0 km east-west. Its central district has land lots for commercial and industrial use and the residential districts are around it.
The Gokase River system flows through the city of Nobeoka and the surrounding area is used as farmland. However, the farmed area is gradually shrinking and the area of abandoned farmland is growing. Forests cover 84% of the area administered by the Nobeoka City government and a large majority, 78%, is under private ownership.
Since the city is located on the sea, there is also a fishing industry.

d. Characteristics in terms of economy and production relationship (including agriculture, forestry, fisheries and practices)
Artificial private forests of cedar and cypress stretch across the mountainous district of the Gokase River watershed area. These are managed by forestry associations, including the Nobeoka District Forest Owners Association, Nishi Usuki Forest Owners Association and Saiki Wide-Area Forest Owners Association.

However, Japan’s lumber production is sliding after a recent growth of lumber imports, resulting in an inability to implement sufficient forest management. Thinned wood and trimmed branches and leaves are left lying in forests, so that the forests are no longer in as sound condition as in the past. Not under proper human management, they are now in a state of disrepair.

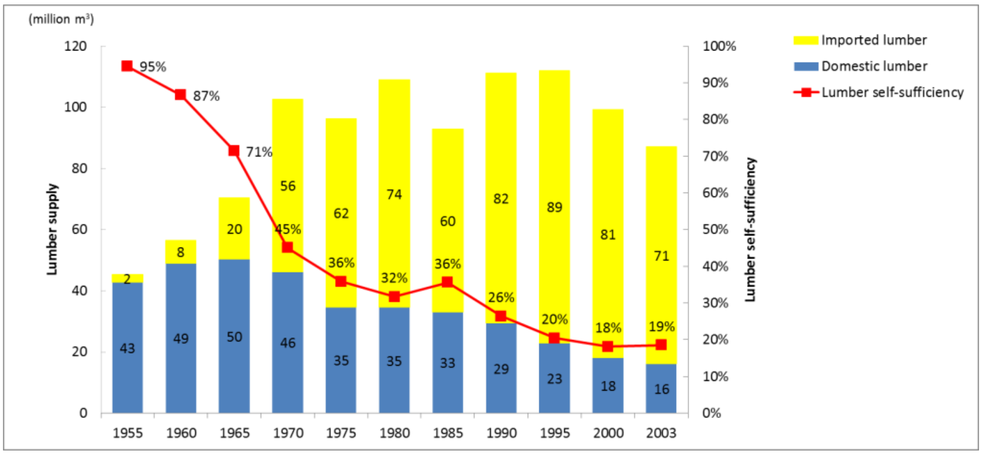

Figure 1: Trend in lumber supply volume

The lumber supply volume fluctuates around 100 million cubic meters, of which Japan-made lumber makes up 20%. (Source: Forestry Agency: Lumber Supply and Demand Chart)

Under these circumstances, those engaged in the forestry industry are declining, as is the industry itself. In the Gokase River watershed area, increasing amounts of forest are left with necessary thinning delayed or without cutting for cultivation.
Even in those forests where thinning and other activities take place, the cut-down wood is often left untransported since it would be costly to carry it out of the forests. There is concern that this may impede shrub growth.

No regular logging takes place in secondary forests of broadleaf trees since firewood and charcoal demand almost vanished. These forests are crowded with trees and the trees are increasingly aged. Tree damage caused by certain insects is beginning to emerge.

e. Other relevant data
Farming is facing harsh circumstances. Agricultural product prices are slumping. Existing farmers are aging and the young farming workforce is in short supply. Amid globalization, competition among domestic and overseas production centers is intensifying. The city of Nobeoka also sees its farmers and agricultural production decreasing.

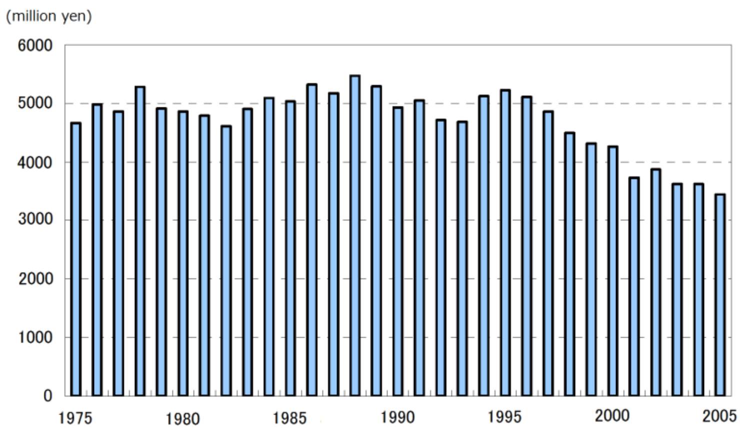

Figure 2: Trend in Agricultural Production in Nobeoka

Characteristics of implementation and the system and their contribution to biodiversity and social welfare

a. Characteristics of implementation and the system of the Satoyama Initiative from five perspectives

If thinned wood generated from forest management is used in the biomass power generation facilities as fuel, the thinned wood, branches and leaves left in forests will be removed and the forests will return to the managed state. This means that rundown forests will again be under human management, incidence of sunlight and growth of underbrush will be restored and biodiversity will be preserved.

The power generation facilities are expected to consume 100,000 tons of biomass fuel per year. The project considers using thinned wood, branches and leaves generated by managing the forests in Nobeoka and neighboring areas as part of the fuel consumed to the extent that does not exceed the environmental limit and retains the natural restoration capability.

By securing an entity that undertakes treating the thinned wood that had to be abandoned in the forests and ensuring that it will be used as fuel for the power generation facilities, it is possible to build a market of wood biomass fuel in the local community and stimulate the forestry industry. This will create jobs and help stabilize and improve livelihoods, and the project will contribute to social welfare.

At the heart of these biomass power generation facilities, the forestry associations in Nobeoka, Hinokage-cho, Takachiho-cho, Gokase-cho and other nearby areas will work together to construct a system for cyclic use of natural resources.

b. Benefits brought to biodiversity and social welfare

Forest thinning as a means of forest management is considered to help preserve biodiversity. This effect will be checked by assessing the ecosystems before and after actual thinning.
The project will also make clear the effect of preserving biodiversity produced by different methods of forest management in order to study what approach is economically efficient and effective for biodiversity preservation.

c. Problems and actions to address them

It is desirable that the price of wood biomass to be utilized as fuel for the power generation facilities is equivalent on calorie basis to that of coal. Lowering the price to attain economic viability poses a big challenge.

Nobeoka City and Asahi Kasei are carrying out a joint study to develop a system for supplying more cost-effective wood biomass and other fuels with the Miyazaki Prefectural Government and local forestry associations.

(1) Biomass power generation facilities

The biomass power generation facilities (see Figure 3) are currently under construction. They are designed to have a power generation capacity of 14,000 kW. According to the plan, their fuel will contain at least 60% wood biomass on a calorie basis. This means that 100,000 tons of woodchips will be consumed per year.


Figure 3: An architect’s conception

(2) Process for use as fuel in the biomass power generation facilities

Wood materials that cannot be used as lumber or pulp for papermaking are used as fuel in power plants. These include thinned wood, wood waste, branches, leaves and bark.

Forest thinning remnants, branches and leaves undergo the process illustrated in Figure 4 before they serve as fuel for power plants.

The costs incurred in the process for using woodchips as fuel consist first of cutting and collecting forestry resources; second, transporting them from mountains to the woodchip factory; third, processing them into woodchips; and fourth, transporting resulting woodchips to the power plant. With the current price of wood biomass, this process is not economically viable. This problem must be addressed.

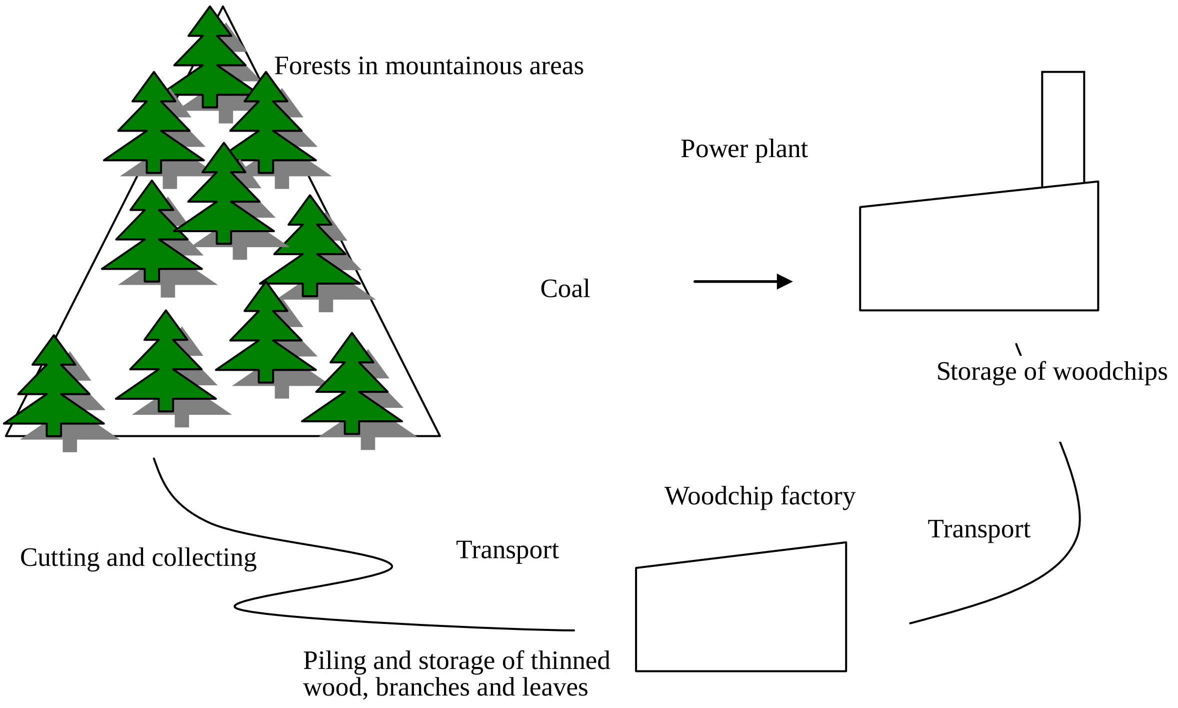

Figure 4: Process for use of forestry resources as power plant fuel

(3) Current practice of cutting

Forests of cedar and cypress trees are found in mountainous areas and cutting work must be done on steep slopes. It is therefore difficult to bring in machinery. Transport of wood that has been cut down is also challenging.

Figure 5 displays clear cutting, showing that the work is done on a steep mountain. Figure 6 suggests that a road needs to be constructed for transport and that cutting is quite difficult without one.

Figure 5: Logging site for cedar and cypress

Figure 6: Lumber transport and a forestry road

(4) Specific action toward cost-cutting

Firstly, the system for processing thinned wood into woodchips and supplying these to the biomass power generation facilities will be put into actual operation in an attempt to identify what problems are involved.

Verification Trial

- This trial is aimed at identifying problems with quality, costs and physical and commercial distribution by procuring wood biomass fuels from the Gokase River watershed area and carrying out trial combustion in existing power generation facilities.

- This trial will be run at a certain scale for a period of one year from September 2011 to August 2012.

- Problems will be identified and organized mainly in the aspects of quality, distribution and cost by actually operating the system.

- A sense of unity will be developed by sharing the awareness of identified problems among Asahi Kasei, Nobeoka City and forestry associations. A foundation will be created for collaboratively working out an idea for reducing the cost to the level of coal.

(5) Contribution to biodiversity

Utilization of thinned wood and other forestry resources in the biomass power generation facilities will push ahead with forest management and help preserve biodiversity in the forests in the Gokase River watershed area.

Without thinning, no light enters into forests and underbrush and shrubs do not grow. This results in an analogous ecosystem and impairs biological diversity. Utilization and thinning of trees disrupts the ecosystems in secondary forests. Groves of trees and grass grow in mosaic forms to allow a wide variety of creatures to live there. On the other hand, absence of utilization creates a homogenous ecosystem. Intrusion of bamboo into woodland also causes a loss of diverse ecosystems.

Utilization of wood biomass fuel in power generation facilities is expected to boost thinning and preserve biodiversity. The project also considers evaluating the ecosystems before and after thinning to confirm whether biodiversity can be maintained by introducing an economically viable thinning approach.

Nobeoka City and Asahi Kasei are also studying a forest managing method in consideration for biodiversity.

Conclusion

A study is currently underway for, in collaboration with Nobeoka City, Asahi Kasei and forestry associations, building a system centered on the biomass power generation facilities that will encourage sustainable utilization of forestry resources to benefit the economy and the preservation of biodiversity.

A verification trial is being carried out to identify what in the processes of thinning, transport and processing into woodchips is responsible for the high cost, with a view to reducing the cost of wood chips. The project is advancing its investigation in an attempt to procure wood biomass fuel derived from forests concurrently with the system inauguration in July 2012.

Title: Natural Resource Management in the Critical Habitat of Western Siem Pang

Organisation: BirdLife International
Theme: Grassland, Inland water
Keywords: Cambodia, critically endangered birds, forest wetlands, rice cultivation, fishing, community natural resource management

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Summary

Cambodia's rural populations are heavily reliant on natural resources to support subsistence-based livelihoods. Small-scale rice production and local fishing sustain a large percentage of the population, and forest products are relied upon to provide food and shelter across the country. As resource-driven markets expand however, the pressures on forests, habitats, biodiversity, and inevitably, livelihoods are also impacted.

Up until the early 1990's, Cambodia remained off-limits to global markets, plagued by almost 3 decades of war and turmoil. Forestry, broad scale agriculture and extraction industries were therefore slower to capitalise on Cambodia's natural wealth, comparative to many of its Southeast Asian neighbours. Formal natural resource protection was also absent until the early 1990s. Today, Cambodia's protected area network covers over 27% of its land area designated under Royal Decrees dating back to 1993 (Hout, Pech, Poole, Tordoff, Davidson, Delattre, 2003). Remaining one of the poorest countries in the region, on-ground management of its protected area network is limited in both financial and technical capacities and laws governing industrial expansion into these areas are weak.

In a rapidly changing economic landscape, Cambodia's biodiversity now faces battles on all fronts: expanding populations continue to encroach into previously uninhabited or very low use areas, opportunistic immigrants from neighbouring nations are also arriving to exploit the wealth of natural resources, and agricultural and extraction industries are being granted sweeping land concessions as the government tries to capitalise on its forests resources. In a number of cases, these economic expansions have diminished available natural resources for subsistence dependent communities.

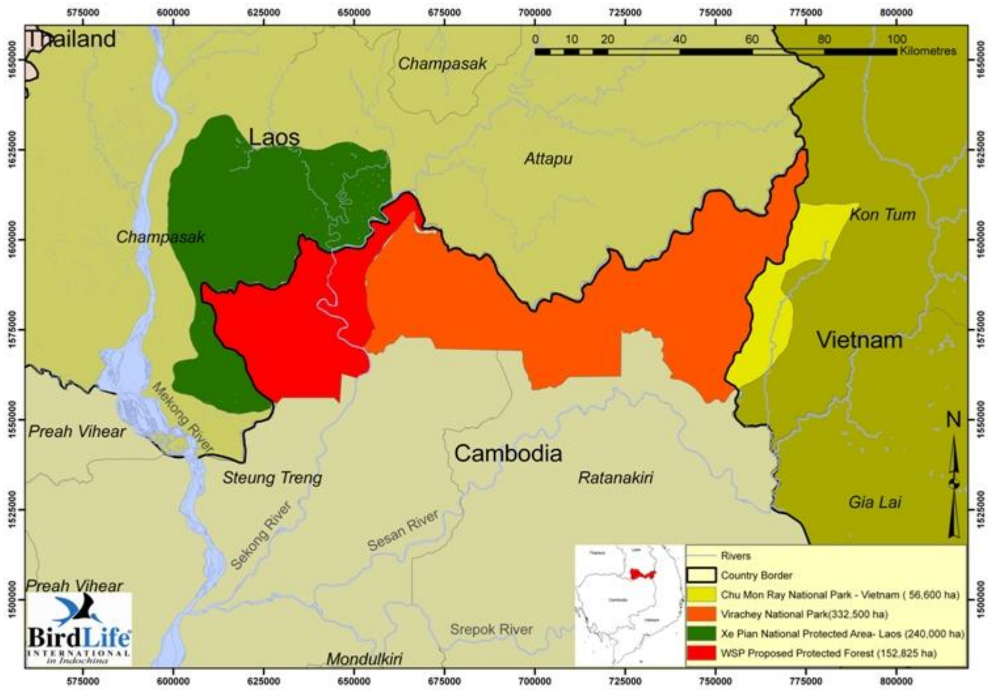
Birdlife International in Indochina - Cambodia Programme (Birdlife Cambodia) has been working with the remote villages of Western Siem Pang (WSP) to improve natural resource management and support basic livelihood activities. Research in collaboration with the University of East Anglia (UEA), is exploring the role of local livelihoods and livelihood activities that impact conservation of the Critically Endangered White-shouldered Ibis. By developing an understanding of the local community's reliance on the forests and wetlands, the project aims to develop livelihood options and alternatives sympathetic to the conservation of the site's critical species.

Preliminary results suggest that there is a strong mutual benefit (biodiversity/community) in the existing grazing system of domestic cattle and buffalo, but these traditional landscape management systems will come under considerable pressure from economic change, especially if the practices valuable to biodiversity become no longer economically optimal. Through community engagement, the threats and stresses to the ecological systems on which livelihoods depend are being addressed, while sustainable management practices are being introduced to help conserve biodiversity and improve local well-being.

General Description and Regional Context

The northern and eastern plains of Cambodia represent the most intact remnant ecosystem of a landscape that is thought to have once dominated southern Indochina and Thailand (Hout et al., 2003). This great expanse of Dry Dipterocarp Forest (DDF), of which WSP is a part, comprises a mosaic of semi-evergreen and evergreen forest patches that harbour some of the most important and unique bird communities in South-east Asia.

The location of WSP is conveniently strategic in conservation value. Nestled in the midst of a protected forest network, the area connects Virachey National Park to the east, and Xe Pian National Protected Area to the west in Laos. Virachey is also linked in the east to Chu Mon Ray National Park in Vietnam. Together, this trans-frontier protected area covers around 757,700 ha of intact forest and represents one of the most significant wilderness areas in Indochina (Lambert, in prep.). In August 2009, the Ministry of Agriculture, Forestry and Fisheries (MAFF) proceeded with a sub-decree to establish the Western Siem Pang Protected Forest for Genetic Conservation of Plants and Animals, covering 152,825 ha. While this provides important scope for conservation prospects of the area, the process is not yet complete; threats are ever-present and increasing and long-term management challenges remain.



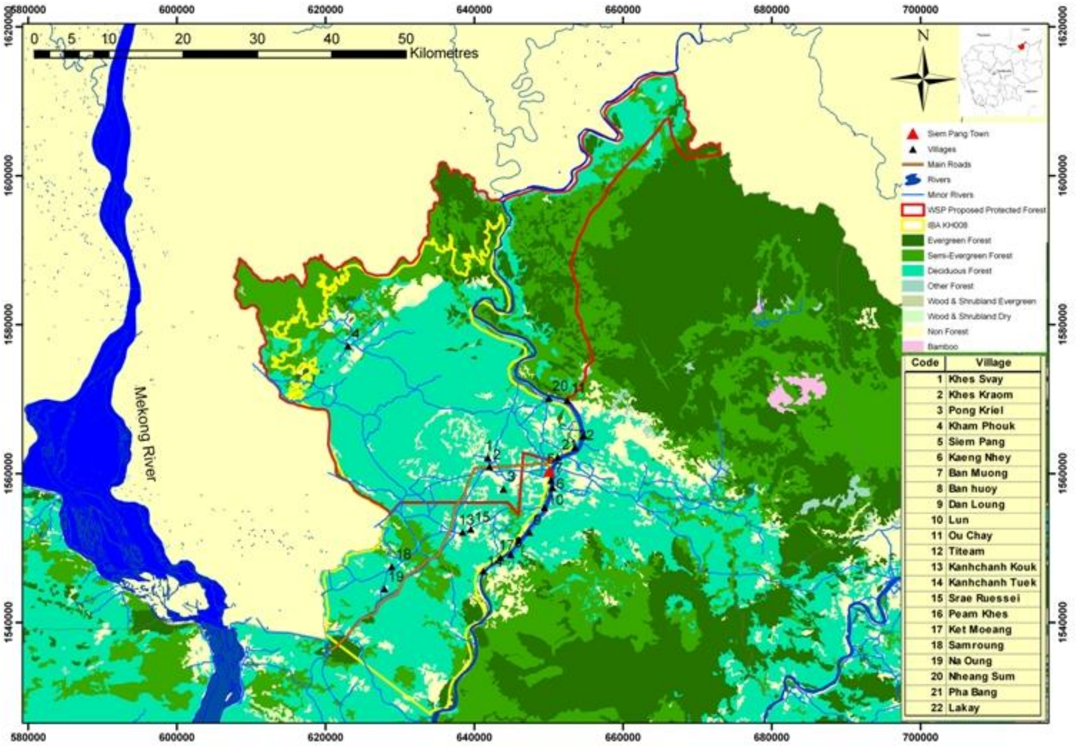
WSP links a vast protected area network across Cambodia, Laos and Vietnam

Biodiversity Values

The biodiversity of the area first attracted international attention when, in 2002, BirdLife International designated the area as an Important Bird Area (IBA) – a key site for globally threatened birds. Indeed, WSP is one of only a handful of sites worldwide that supports populations of an astonishing total of five Critically Endangered bird species (Lambert, in prep.). This includes three species of vulture and two species of ibis. The area has the largest known concentration of White-shouldered Ibis in the world and supports three 'Endangered' and five 'Vulnerable' bird species according to the IUCN Red List of endangered species.

The majority of the site overlaps with the IBA designated in 2002.

Figure 2: The majority of the site overlaps with the IBA designated in 2002.



The conservation significance is not confined to birds as the area supports a significant population of Eld's Deer (Rucervus eldii), a highly localized Indochinese endemic species, as well as a range of primate species and possibly small remaining populations of Siamese Crocodile (Crocodylus siamensis) and even Tiger (Panthera tigris). To date, more than 100 plant species, 301 species of bird, 30 species of non-flying mammal, 12 species of reptile, 10 species of amphibian and 47 species of butterfly have been identified from within the proposed WSP Protected Forest. Lists of other faunal groups for the area are far from complete, but it is likely that future surveys will reveal a wealth of diversity in fish, amphibians, reptiles and butterfly species (Lambert, in prep.).

One of the most important features of the DDF are the trapaengs, or seasonal pools. Trapaengs are a critical habitat for the area's biodiversity and a significant element of traditional livelihood practices. They provide water sources and dry season foraging resources for wildlife, and support numerous Non-Timber Forest Products (NTFP) collected by villagers throughout the year.

Figure 3: Eld's Deer, Giant Ibis (Thaumatibis gigantea) and Woolly-necked Storks (Ciconia episcopus) share a trapaeng to feed and forage in WSP (Photo by J. C. Eames)

Human use and management – how the site and landscape has been shaped

The Dry Dipterocarp Forest (DDF) is the predominant landscape of the WSP protected area. This ecosystem type is thought to have been influenced by generations of human activity and it is widely believed that fire regimes of native people have converted a once denser forest to the present-day open DDF (Lambert in prep.). Dry season burning is still carried out today to generate fresh grass growth and to aid in hunting and collection of natural resources.

Beneficial human impact on habitats is found in fallow, traditionally-cultivated rice fields that are now important for a number of the area's waterbirds. These areas, as well as trapaengs, support complex ecological relationships, from tiny insects and amphibians to large birds and mammals. Local people rely on the pools to fish, collect frogs and other food, as well as rearing livestock, mainly domestic buffalo and cattle. Local people's strong reliance on trapaengs and the processes of their land management are now an integral part in maintaining important biodiversity functions.

Once abundant, wild herbivores are now rare or no longer present in WSP. For generations, mammals used these pools to feed and wallow. Over time, the effect of trampling and wallowing by large, hoofed mammals across the trapaengs has developed into a highly important ecological function. By reducing vegetation and exposing areas of bare substrate, these disturbed muddy areas become the prime foraging habitats for a number of bird species, including White-shouldered Ibis (Wright, Buckingham, Dolman, 2010). In the absence of naturally occurring herbivores, grazing domestic buffalo now perform this important role, making the traditional livelihoods of local people integral to the conservation of WSP's threatened birds.

Figure 4: Local communities and domestic cattle rely on trapaeng in WSP (Photo by J. C. Eames and Bun Paing)

Characteristics of village livelihoods disappointed

In general, villages rely on wet season rice cultivation and fishing to support their livelihoods. With total family expenditure ranging from 25 cents (1000 riel) to $3 USD dollars per day, natural resource management is an integral part of daily life. Determining when, what and how natural resources are used therefore, can potentially improve management practices and relieve the burden on habitats and species.

To determine local resource use trends, villagers were asked to draw maps to identify community boundaries, infrastructure and major bio-physical landmarks, showing the location of trapaengs and their major uses. Sixty-three trapaengs were identified over the seven villages and are now regularly monitored.

Figure 5: Community consultation and map preparation by local people in WSP. (Photo by Bou Vorsak)

Seasonal changes significantly influence livelihood activities. While the majority of families have land for rice cultivation which takes most of their time during the rainy season (May-December), many suffer food shortages for three months of the year (September to November) when new crops are waiting to be harvested. After the final rice harvests in January, fishing and hunting become the main activities and trapaengs are increasingly utilised for foraging and fishing.

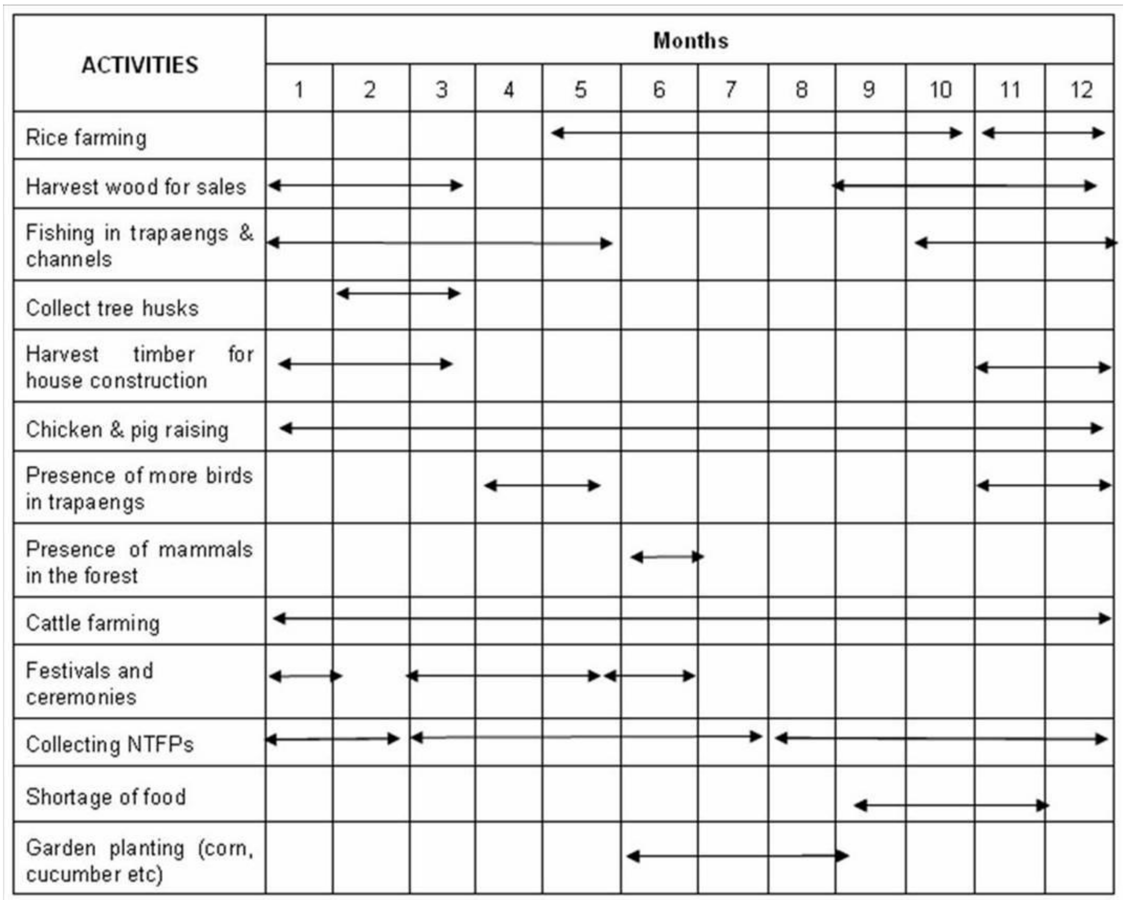


Figure 6: A 'Season Calendar' was produced in consultation with village groups to determine when food shortages may be more prevalent leading to greater pressures on trapaengs.

The economic status was determined for the seven surveyed villages and categorised from A to D. Villages varied in their economic status across a range of criteria, with some far poorer than others. In two of the surveyed villages, 53% and 41% of people were in the lowest economic bracket (category 'D'). Surveys found that all community members use trapaengs for fishing, though wealthier villagers are less likely to rely on fishing catches for their primary source of sustenance.

Criteria	A	B	C	D
Food security	Over 12 months supply with surplus usually sold	12 months	< 5 months	2 months or nothing
Access to land	3 - 5 ha	2 - 3 ha	1 ha - < 2 ha	0 - < 1 ha
Livestock	5 - 20 cow 7 - 15 buffalo	2 - 7 cow 2 - 7 buffalo	1 - 2 cow 1 - 2 buffalo	0
Social standing	Of high social standing and influence	Known and respected within the community	Listened to and respected by others	Less communication with others
Housing	Large wooden house with tile or tin roof	Wooden house with tin roof	Bamboo & palm tree leaf	Bamboo & palm tree leaf
Labour	Able to hire labour	Sometime hire labour	Do not hire labour	Sell labour
Savings and credit	Able to save and provide loans	Able to save	Always have deficit	Always in debt
Tools and materials	Rice mill, tractor, motorbike, TV, mobile phone, truck, generator	Motorbike, TV, recorder, cart	Bicycle, radio	None
TOTAL (7 villages)	***48*** families ***5%***	***363*** families ***37%***	***325*** families ***33%***	***242*** families ***25%***

Figure 7: A survey of the seven villages found only 5% of families lived in the highest economic bracket (category 'A'), while 25% of families were in the poorest category (category 'D').

Villagers were also asked to identify the major threats to their livelihoods. A 25 member panel from a cross-section of the community was established in each village and their primary livelihood concerns were ranked in terms of their potential impact. While results for each community varied, collated data provided the following trends:

- Investment and expansion of economic land concessions
- Transportation (poor roads and bridges)
- Agriculture (lack of technical skills, no irrigation, no agricultural market)

- Unsustainable use of natural resources (illegal forestry, wildlife trade, poisoning at trapaengs and channels)
- Security (domestic animals stolen and hunted)
- Health (lack of medicine and drugs, lack of good quality health centres)
- Poor education (lack of teachers, schools, poor retention rate of students and students regularly missing from school)
- Domestic violence

Threats to natural resources and agriculture are seen as the greatest issues among all villages. Health, education and domestic violence (which was only raised in one village), were seen as secondary issues where food scarcity and impacts affecting subsistence based livelihoods are commonplace. With such a heavy reliance on paddy land for rice cultivation, land grabbing and conversion of local agricultural lands for commercial production of plantation timber and sugar were seen as the greatest threat to livelihoods.

Changing traditions and the future of Trapaeng management

With a population heavily reliant on subsistence from the land and forest products, gradual expansion of human activities into the forest is leading to the decline of the area's natural resources. As previously mentioned, while there is a general concern for the health and retention of natural resources, the lack of alternative food sources stemming from severe poverty leaves many with few alternatives. Minimising the effects of detrimental harvesting methods is a major priority.

The use of poison in both fishing and hunting is presenting a major threat to critically endangered species. In January 2009, a monitoring team discovered a Giant Ibis that had died from poisoning – this being one of the most threatened bird species in the world and now only found in Cambodia where it is the main attraction to visiting eco-tourists. In 2010, one poisoning event killed 10 out of 12 vultures affected, this being the most serious of all documented wildlife poisoning to date (Lambert, in prep.). The risk of chemical bioaccumulation is also a health risk in humans.

One balancing act will involve the area's economic development and the potential of mechanised agriculture to replace traditional techniques. In the absence of buffalo and their important grazing effect at trapaengs, there is a real risk of habitat quality deteriorating at the main foraging sites for wetland-dependant species, and certainly White-shouldered Ibis which depend almost solely on food foraged from trapaengs to feed their chicks (Wright 2008).

By far the greatest threat to the area comes from impending land concessions that currently overlap vast sections of the WSP protected area. Proposed investment includes teak and sugar plantations amongst others. This kind of forestry conversion will cause irreparable landscape changes and undoubtedly destroy resident biodiversity and impact on the lifestyle of local communities

Working with communities to optimise ecosystem contributions to well-being and biodiversity conservation

Since April 2006, BirdLife Cambodia has been implementing projects aimed at "Strengthening Community Natural Resource Management". Initially established for the WSP IBA, the work now extends to the objectives of the Protected Forest. The approach has developed ways in which local communities can protect and harvest forest products sustainably. Engaging the community was the first step in advocating natural resource management improvements.

Community-based Site Support Groups (SSG) were established, comprising local stakeholders with a common interest in conservation. In many cases, their participation is voluntary and members become involved because of the economic, cultural, religious, recreational or livelihood benefits provided by the site. Members come from a variety of backgrounds and in some cases are former hunters, and have since traded their rifles for binoculars. BirdLife has now developed networks of SSGs to promote the exchange of experience and skills in conservation.

As a critical feature of both biodiversity and livelihoods, conservation initiatives have focussed on trapaeng protection – minimising their degradation and maintaining their functionality.

With assistance from SSGs, community meetings were conducted with participants from 7 villages. In 2006, over 200 community members attended meetings aimed at introducing new concepts of sustainable natural resource management. The majority of participants were hunters, fishermen or other forest product collectors.

Participants were concerned about the noticeable reductions in ecosystem services, such as reduced fishing yields, and there was a general consensus that natural resources were being diminished as a result of human activity including agricultural land clearing and general over-exploitation. As a result, there was a willingness to engage with BirdLife in sustainable resource management initiatives.

The mechanism to improve natural resource use is being implemented through the development of a Trapaeng Management Protocol. The outcomes aim to meet the needs of the community while ensuring the essential ecological functions of the trapaengs are maintained. Acts prohibited by the communities include:

- Use of poison at trapaengs
- Pumping of water from trapaengs
- Cutting of trees around trapaengs
- Contamination of trapaengs used for catching fish
- Trapping of animals near trapaengs
- Making noise by using chainsaws near trapaengs

Three species of critically endangered vulture are among the highest priorities for biodiversity conservation in the area. 'Vulture Restaurants' are conducted monthly involving the purchase and slaughter of a cow or buffalo. This provides an opportunity to assess population numbers of the three critically endangered vulture species in WSP while delivering an additional, safe food source to the vultures in the absence of previously abundant carrion (from wild large mammals).

Figure 8: A 'Vulture Restaurant' event. (Photo by J.C. Eames)

Another priority is the Critically Endangered White-shouldered Ibis (WSI). A Nest Reward Scheme was established to discover and protect nesting sites of the Ibis species. Villagers are offered a small financial incentive to provide the location of WSI nests to the Birdlife field staff and local people are employed to guard and reduce disturbance at nest sites during critical stages of incubation and chick-raising. Roost sites are also monitored with assistance from local people.

With a permanent presence in Siem Pang, BirdLife, in collaboration with the Forestry Administration, will continue to work closely with local communities in education and awareness to maintain the ecological functions that support both biodiversity and livelihood activities of the region.

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Title: Waterbird conservation promotes important energy flow between rice paddies and nearby Important Bird Areas in Cuba

Organisation: BirdLife International
Theme: Inland water
Keywords: rice paddies, Cuba, wetlands, waterbirds, Important Bird Areas

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Summary

Rice is the main food of the daily Cuban diet. In order to satisfy the national demand, some of Cuba's wetlands have been converted for agriculture, including into rice paddies. This has resulted in a high loss of natural wetland habitat for biodiversity. Cuba is the biggest island in the Caribbean lying in the middle of important waterbird migration corridors, including the Atlantic and Mississippi Flyways, and is also host to some of the last significant populations of a number of Caribbean wetland dependent bird species, such as the Vulnerable West Indian Whistling-duck (Dendrocygna arborea).

Rice paddies have been considered as a possible emerging alternative habitat for waterbirds. After the 90's (a period of extended economic crisis in Cuba that followed the dissolution of the Soviet Union) food shortages and the lack of fossil fuels transformed agriculture from industrialized and specialized to sustainable and organic agriculture.

Many areas of state land were lent to families in small and medium subsistence units to grow rice and other crops for their own and community consumption, and the remainder was given to the state to guarantee the presence of crops and commodities in the national market. The use of natural fertilizer and few chemicals, fields in varying stages of flooding and drainage, and low impact harvesting methods lead to high levels of vertebrate and invertebrate biodiversity turning the rice paddies into important bird feeding areas while nearby wetlands provide resting and nesting areas for migrant and resident waterbirds.

Nevertheless, only waterfowl (mainly ducks) were perceived as crop pests by the farmers who persecuted and killed them. Since the 1980's, the Bird Ecology Team of the University of La Havana has been doing research on the ecology of the waterbird populations in the rice paddies and nearby wetlands. These studies supported the international recognition of two rice paddies with neighboring coastal areas as Important Bird Areas (IBAs): Humedal Sur de Pinar del Rio and Humedal Sur de Sancti Spiritus.

They have found that waterbirds benefit the crops through weed and pest control and natural fertilization promoting an energy flow through both systems - natural and 'alternative' wetlands provided by rice paddy. The team has been working closely with farmers to convince them not to kill the birds but to regard them as beneficial to their rice crops and to manage them in favour of biodiversity and rice.

Regional Profile and the importance of rice cultivation in the national and local economy

Cuba is the largest and most westerly island of the insular Caribbean, accounting for over 50% of the region's land area. Mainland Cuba is 1,250 km long and averages 150 km wide. Vast plains occupy 79% of the land area but are interrupted by four mountain systems, and the mainland is surrounded by four archipelagos comprising over 4,000 cays. Climate, geography and topography have combined to produce a wide diversity of ecosystems and, as a result, Cuba is the most biologically diverse island in the West Indies. More than 50% of the flora and 30% of the vertebrate fauna are endemic to the island. Cuba is home to 366 species of bird of which 28 are endemic to the island, and 32 are considered globally threatened. Its long shape and low geomorphology holds the most extended wetlands, especially coastal, of the Caribbean region. Wetlands in Cuba provide important foraging, resting and breeding grounds for many waterbirds, from migratory species to residents.

Rice farming is an important part of the Cuban economy (it is the second most important crop after sugar cane). Agriculture contributes less than 10 percent to the gross domestic product (GDP), but it employs roughly one fifth of the working population. About 30 percent of the country's land is used for crop cultivation.

Rice in Cuba is grown throughout all provinces but the main paddies can be found in the south coast on the borders of natural coastal wetlands in Pinar del Río, Matanzas, Sancti Spíritus, Camagüey and Granma. In some cases, the wetlands are a fringe of coastal lagoons and mangroves of about 1 km wide (Pinar del Río, Sancti Spíritus, Camagüey); others constitute extensive areas, with swamps, mangroves, numerous channels and lagoons (Ciénaga de Birama, in Granma and Ciénaga de Zapata, in Matanzas). The close proximity of natural areas and the rice paddies favors the constant movement of waterbirds between them and the consequent interchange of material and energy in both areas.

Figure 1: Large scale rice harvesting in Los Palacios rice paddies, Cuba

Rice has been grown in Cuba since 1750, with a significant increase in the scale of production in 1967. Cubans consume 56 kg per capita which makes it very important in their diets. However, this consumption is highest among the rural and farming population who are the producers of this cereal, and who in the 1960s produced it mainly to satisfy family needs. During the 1980s Cubans developed the specialized production of rice and by that time were able to provide 60% of the national demand, cultivating nearly 130 000 ha. Afterwards in the 1990s, during the economic crisis that followed the dissolution of the Soviet Union, market production dropped significantly. This period transformed Cuban society and the economy due to the severe shortage of fossil fuels. As a result energy dependent systems such as transportation, industry and agriculture were unable to operate. Hunger was experienced with national food shortages. In a response to the lack of food, sustainable and organic agriculture was introduced in low and medium-sized sustainable units. Moreover, the state and communities started to organize the creation of co-operatives to work the land and support each other in production. Much of the state land was lent to farmers to grow rice, with more than 22,814 ha distributed from which 17,446 ha are currently cultivated by farmers and individuals who distribute the crop for self-consumption and to their community. Following the creation of these small and medium-sized subsistence units, the cost of rice dropped by 60 % making it affordable within the national market. However, recently the price has increased due to fluctuations in the international market price. This way of cultivating rice continues, producing crops at small and medium scale for national Cuban consumption. Furthermore, efforts are being made to increase national rice production to decrease dependence on imports from abroad, since the international market price for rice is considered high for the country.

The historical demand for rice in Cuba has led to the conversion of natural wetlands into agricultural fields. Working as alternative wetlands, rice fields are productive feeding grounds for many birds, and also important nesting and resting habitat for other species. They have an elevated carrying capacity that permits the development of high bird populations and invertebrates that exceed those of natural areas. In Cuba, about 10% of the endemic plants and 50% of Cubans birds are associated with them.

The Use and Management of Natural Resources in the Region

(1) The Use and Management of Natural Resources in the Past and Present

Rice cultivation has been practiced in Cuba from around 200 years, shortly after colonization by the Spanish. At that time farming was done by hand and with the use of animals. Agricultural machinery pulled by animals was first used by the end of that period and the crop system employed was of dry land and in others surface-irrigated land. A rice development program started in 1967 with the objective of achieving self-sufficiency in rice production. In Latin America, Cubans come second in terms of their consumption of rice, with an average per capita consumption of 56 kg per year, which creates a national demand for 450,000 tons.

Cuba's tropical climate favors rice cultivation almost year round. Seeds can be sown all year with the exception of the period from the end of August through to the middle of November (for about 3 months) because seeds sown at that time form panicles at the coldest time of year (December and February) causing flower sterility and empty grains. Rice paddies occupy extensive areas with varieties yielding on average 4.9 tons/ha and an annual production nationally of more than half a million tons. However, the yield per hectare remains lower than the average in Central American and Caribbean countries. Cultivation goes through a wet and dry cycle, and since rice is grown constantly over large areas, there are always fields in varying stages of flooding and draining, leading to high levels of vertebrate and invertebrate biodiversity. This characteristic makes possible the management of high bird diversity, which moves from one field to another as birds move to maintain their specific requirements. Harvesting is done twice a year, limited in part to shortage of water, lack of fertilizers and modern agricultural technology. This activity generates more than 20,000 jobs on public (state owned) farms.

(2) The Problems Associated with the Use and Management of Natural Resources and its Impact on Biodiversity

There are growing, conflicting concerns regarding the bird community associated with rice cultivation. Rice farmers were concerned about crop losses presumed to be caused by birds, whereas conservationists are concerned about the value of the paddies as bird habitat and thus about the implications of the agricultural management techniques for the bird community. Consumption of rice seeds is the major negative impact that birds may have on the rice yield. However, rice is an important source of food for many waterfowl species and they could benefit from the rice not collected during the harvest.

In the last 15 years chemical use has been reduced by c. 50%, which has turned the rice paddies into important bird feeding areas, while neighbouring wetlands are resting and nesting areas. The reduction in the use of pesticides and herbicides in Cuba presumably is a main factor in the dramatic increase in the population of various waterbirds (e.g. Glossy Ibis *Plegadis falcinellus* and Black-necked Stilt *Himantopus mexicanus*).

Figure 2: Waterfowl in Sur del Jibaro rice paddies just before spring migration

Regional Plans and Other Measures toward Resolution of the Above Problems

An integrated approach is being proposed as a solution to these problems: the rice Agro-ecosystem. Birds are clearly an important biotic component of the rice agro-ecosystem. A better understanding of the role birds play in the energy flow and nutrient cycle will be essential if an ecological approach to improving agriculture and wildlife is to take a hold. Research aims to determine the role of rice paddies in bird conservation, and the threat posed by the indiscriminate use of chemicals that pollute the natural environment.

Understanding the relationship between rice cultivation and birds

(1) Research and outreach

The Grupo de Ecología de la Universidad de la Havana has carried out research since 1978 to gain knowledge about the ecology of waterbirds in natural and alternative wetlands. The group's findings have helped change the attitudes of farmers towards birds on their rice paddies – an important development, given that the two most important wetlands in the country, the Zapata Swamp and the Birama Swamp, both have rice plantations in nearby areas which are heavily used by birds.

Figure 3: Researchers from the Grupo de Ecología de la Universidad de la Havana

Combining research with an active environmental education program, wetland training workshops and the development of local groups called ‘Wetland Friends’ to involve local people in conservation, the team is slowly changing attitudes. Rice growers previously believed that birds were eating their crops and were killing the birds. As a result of an improved understanding of the ecological relationships, and effective communication by the University which has successfully demonstrated that rice cultivation is compatible with avian conservation, the attitude of rice growers and the wider community has changed positively in relation to birds. Instead they recognize the benefits birds bring to their crops. Farmers have also stopped the cutting of mangroves and are pursuing the declaration of the coastal zone as a protected area, whilst community members are engaged in wetland research at the University.

During their research the University team identified two rice paddies with neighboring coastal areas which were proposed as candidates among the Important Bird Areas (IBAs) for Cuba. IBAs are normally located in natural areas, and single-crop cultivation is not what typically comes to mind when one thinks of bird conservation.

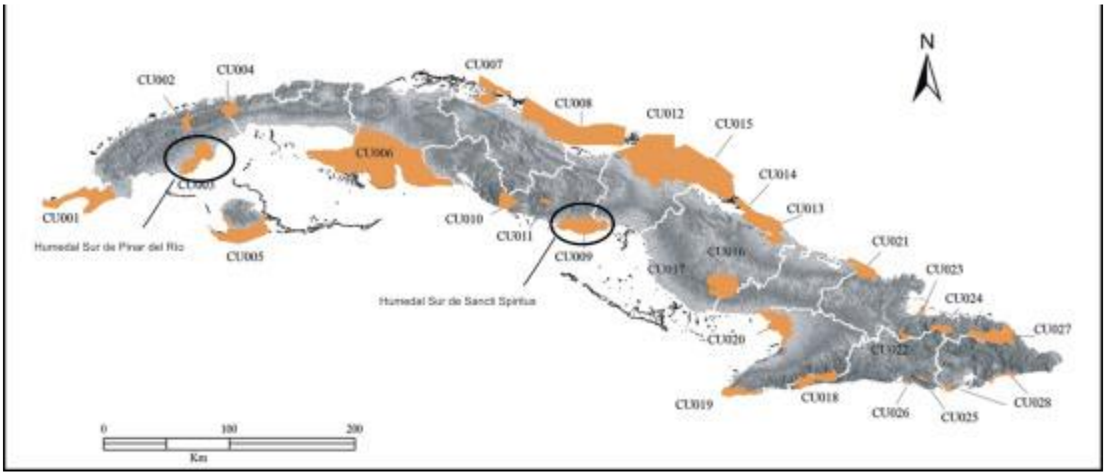

Figure 4: Important Bird Areas of Cuba

The first of these proposed IBAs is the Costa Sur de Sancti Spiritus. It encompasses the Sur del Jíbaro, one of the country’s most important rice paddies and a place widely held to host large concentrations of aquatic birds. To the south, it includes a coastal strip of wetlands composed of several important lagoons, such as El Basto and La Limeta, and a strip of mangroves that is several kilometres wide at some points. The area covers about 60,593 ha and 107 species of birds have been recorded there. Numerous migratory species also gather here, especially wading birds and ducks.

The second IBA (Humedal Sur de Pinar del Rio) has a similar environment and is located in the south of Pinar del Río province. It includes a group of natural coastal wetlands and the adjacent rice paddies between Los Palacios and Consolación del Sur. The area has more than 101 species of birds, with a notable abundance of aquatic birds, particularly herons and an estimated 20,000 Glossy Ibis (*Plegadis falcinellus*). There are thought to be more than one hundred of the globally threatened West Indian Whistling-duck (Dendrocygna arborea) in the area.

Main Content of conservation efforts

The possibility that birds may have a positive effect on the rice fields has previously received little attention. The research findings of the team from Ecología de la Universidad de la Havana show that birds are an important biotic component of the rice agroecosystem, especially concerning the energy flow between the paddies and the nearby wetlands. There is a need for farmers and wildlife biologists to work together towards the goal of minimizing rice loss while enhancing the quality of wildlife habitat. Some of the positive effects of birds are:

1. The majority of birds in the paddies feed mainly on animal pests and weed seeds rather than rice seeds, and doing so in flooded stubble fields reduces the subsequent crop weeds;
2. Waterbirds' droppings add nutrients to the rice paddies' soil;

Among the agricultural practices that benefit waterbirds are the avoidance of intermittent flooding or dry cultivation, stubble maintenance during winter, allowing persistence of some weed patches inside fields, and conservation of natural vegetation in rice field areas.

About the study

This study was carried out by the group Ecología de Aves from the Faculty of Biology of the Havana University and financed by the Whitley Fund for Nature under the conservation project titled Rice Paddies and Natural Wetlands as Conservation Sites for Aquatic Birds. We would like to give our special thanks to Susana Aguilar from the National Centre of Protected Areas.

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Title: Ankeniheny-Zahamena Corridor, a field demonstration model

Organisation: Conservation International (CI)
Theme: Forest
Keywords: Madagascar, integrated natural resource management, protected area governance

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Summary

The Ankeniheny-Zahamena Corridor (CAZ) is a new protected area that encompasses one of the largest remaining blocks of rainforest in Madagascar. The vision for CAZ is a landscape-level conservation area that includes multiple zones and land designations. Conservation International's (CI) aim at CAZ is to conserve the existing, intact natural capital (i.e. the principle) so that the delivery of ecosystem services such as carbon sequestration, water provision, and pollination (i.e. the interest) continues to flow for the benefit of people. We refer to this as a landscape-scale green economy approach. The central idea of a green economy is that natural capital is managed in a way to sustain flows of ecosystem services to benefit people, furthering economic development and, at the same time, conserving nature. This concept presents an opportunity for action as it provides information, arguments, and decision making tools that can be put into place, tested, and refined.

CI/Madagascar's work at CAZ is already demonstrating the success of a green economy approach to conservation and development. By focusing on conserving healthy ecosystems that provide the ecosystem services upon which people depend, we are safeguarding the natural capital that is needed for economic activity. CI works with societies to secure ecosystem services that flow from natural systems to meet both current and future needs. The key to securing ecosystem services for the benefit of people is to demonstrate success in specific places and then scale-up those successes for broad-level impact.

Background

The Ankeniheny-Zahamena Corridor (CAZ) has long been regarded as one of Madagascar's top conservation priorities and numerous studies have catalogued its rich biodiversity. To date over 2,043 species of plants have been identified (85% are endemic), with representatives from 5 endemic families. Fifteen species of lemurs and 30 other species of mammals are known from CAZ as well as 129 species of amphibians and 89 bird species. CAZ's flagship species include several species of threatened lemur such as Indri indri, Varecia Variegata variegata, and Propithecus diadema.

CAZ covers 381,000 hectares of pristine rainforest and provides important ecosystem services for the surrounding area (Figure 1). Water provision and erosion control are particularly important for the agricultural plains on both the east and west sides of the corridor and for the two hydroelectric plants that supply electricity for Madagascar's two largest cities. Local culture is also deeply rooted in the forest, where residents gather medicinal plants and have sacred sites such as tombs. The local culture has contributed to the preservation of these essential ecosystems through sustainable practices and utilizing traditional knowledge. The culture has become intertwined with nature, and their codependent relationship is vital to both humans and the rich biodiversity that exits.

The corridor is under threat, however. Major pressures include slash-and-burn agriculture and mining. If these pressures are not alleviated, CAZ will soon disappear, taking with it not only the incredible biodiversity it houses, but also the essential ecosystem services it provides to countless rural families in the area.

Thanks to the Government of Madagascar's commitment to triple the surface area of protected areas throughout Madagascar, CAZ is well on its way to becoming one of the largest protected areas in the country. Having received temporary protected status on December 31, 2005, CAZ partners (CI/Madagascar, regional government authorities, local NGOs, community associations, and other stakeholders) are working to finalize the protected area creation process and to ensure that CAZ is conserved in perpetuity.

The CAZ protected area includes three pre-existing parks and reserves run by Madagascar National Parks: Zahamena National Park, Mantadia National Park and the Mangerivola Reserve (Table 1). Before the creation of CAZ, efforts to conserve the corridor's natural resources were localized and lacked a clear overall strategy. The new protected area has provided a framework to develop a clear vision for the conservation of the whole corridor and to scale up successful pilot initiatives.

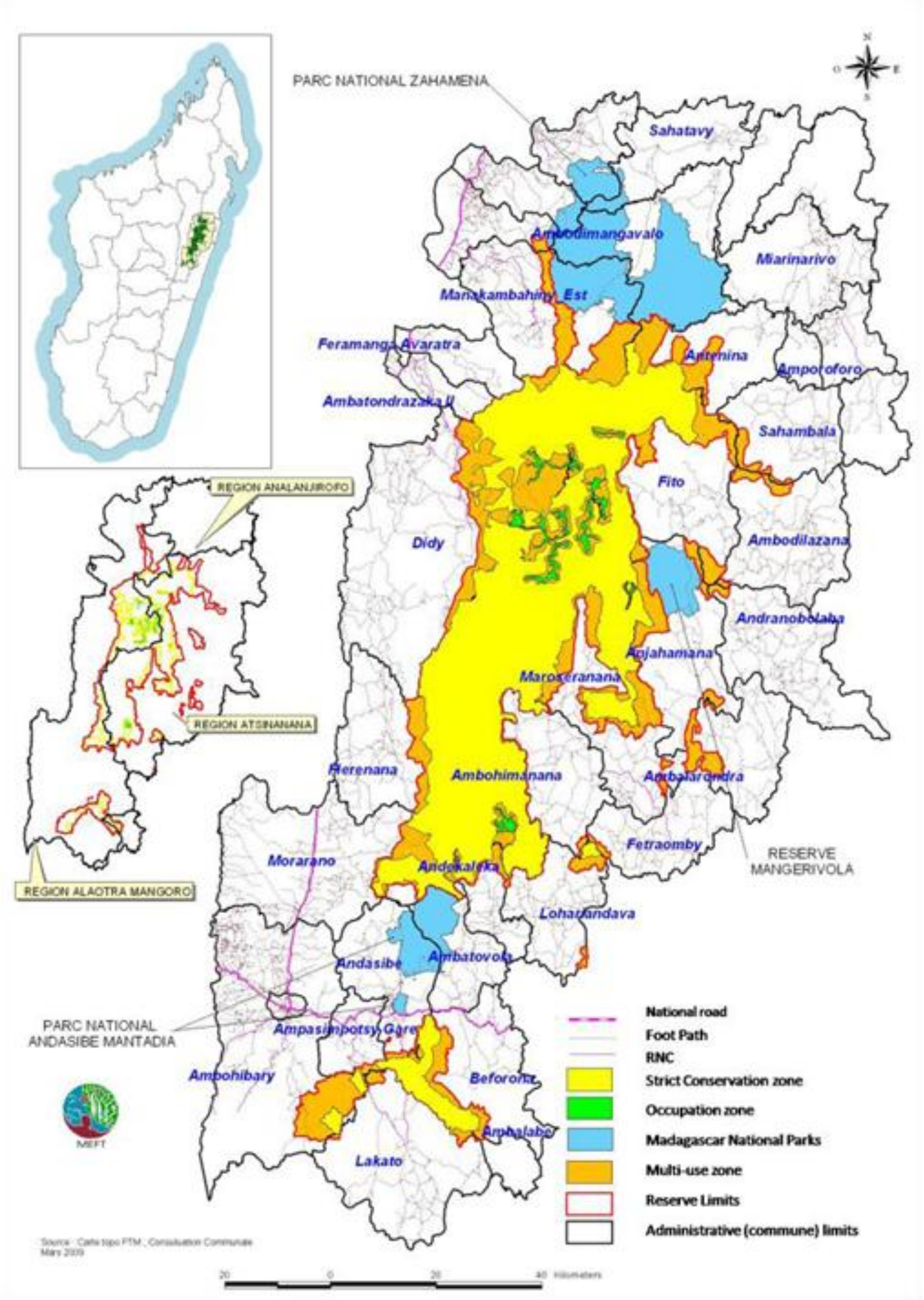


Figure 1. Map of the Ankeniheny-Zahamena Protected Area

Table 1. Ankeniheny-Zahamena Forest Corridor At-a-Glance

Protected Area	Date	Surface Area	Ecosystem	Management Regime	Zoning
Ankeniheny–Zahamena Protected Area	2005	381,000	Native humid forest, with clearing for hillside rice, eucalyptus plantations, mining, logging and fuel-wood gathering	Co-management governance regime	IUCN category IV with strict protection zones and areas under community sustainable management
Zahamena National Park	1997	41,402	Native humid forest	Managed by Madagascar National Parks	IUCN category II; allowed activities include research, tourism
Mantadia National Park	1989	10,000	Native humid forest	Managed by Madagascar National Parks	IUCN category II; allowed activities include research, tourism
Mangerivola Reserve	1958	11,900	Native humid forest	Managed by Madagascar National Parks	IUCN category IV; allowed activities include research, tourism

Science

From the outset, science has been at the foundation of establishing the CAZ protected area. CI/Madagascar has conducted, supported, and compiled research at CAZ for over a decade in an effort to inform good policy and management decisions. This research has included species-level work to understand specific needs of restricted-range or threatened species, landscape-level work using remote sensing to monitor forest cover change and land-use change, and modeling to predict future carbon dioxide emissions from deforestation.

The result of this research is a picture of CAZ's incredible richness in terms of biodiversity, its importance for providing ecosystem services, and its vulnerability if unsustainable practices continue unabated. One of the more compelling pieces of research we have generated is the map of deforestation over time at CAZ.

More recently, we have been working to understand the ecosystem services CAZ provides. For instance, we estimate the forests at CAZ stock important amounts of carbon. One hectare deforestation in the CAZ results in an average of 270 tons of $CO2$ released into the atmosphere. In addition, CAZ protects the headwaters of eight large rivers and regulates water systems for local agriculture. These rivers supply approximately 325,000 residents with water directly. Through dams and aquifers, they also provide water to the residents of the the provincial capital, Toamasina.

Working with a robust set of partners at multiple levels, an important body of knowledge has been generated that underpins the overall approach CI/Madagascar is promoting in CAZ. It is through these important partnerships that CI/Madagascar has amassed widespread support for conservation in this area.

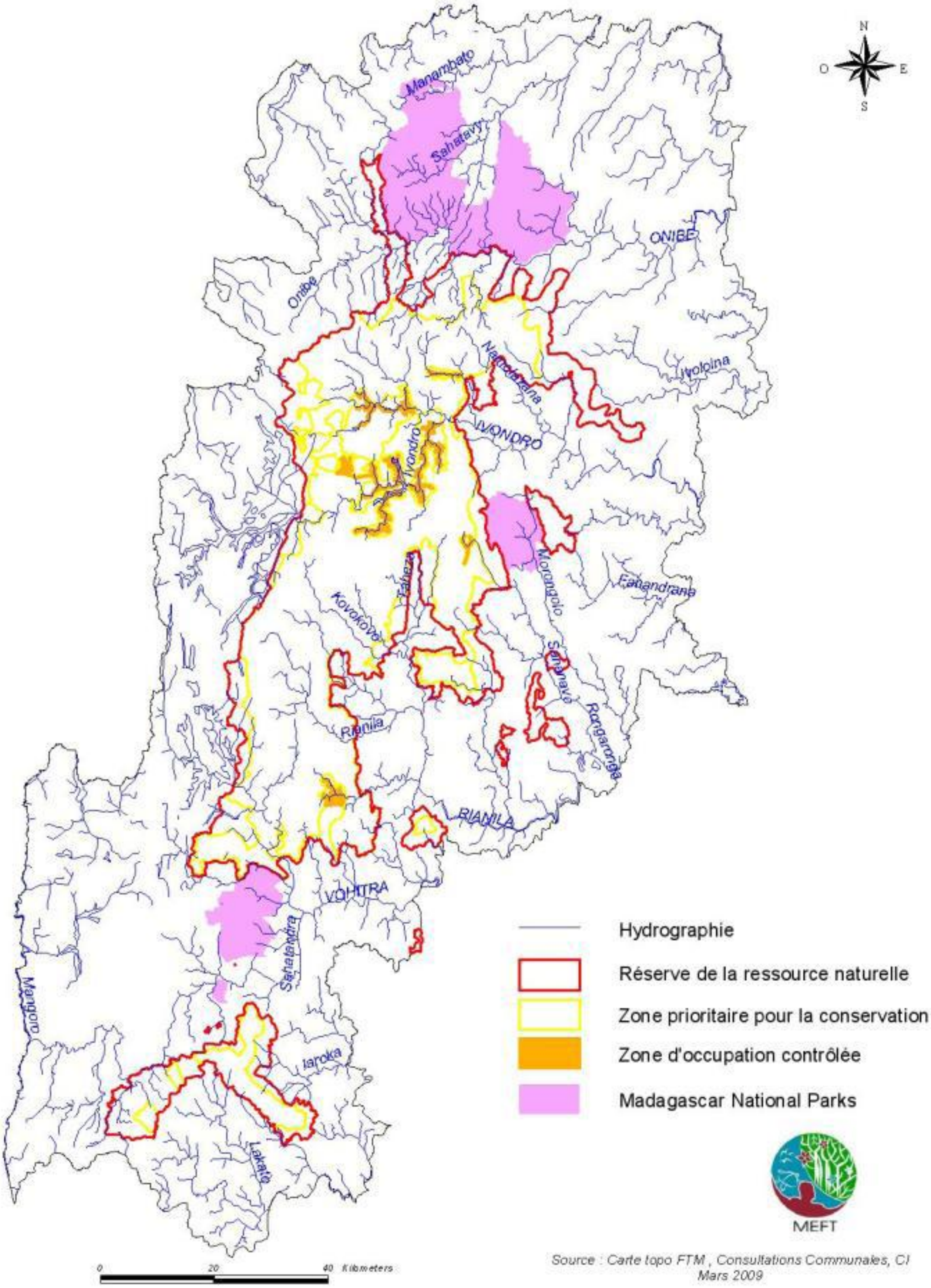


Figure 2. Hydrological regime at CAZ.

Developing a green economy

Conserving CAZ requires an innovative approach that involves developing mechanisms to capture the economic value of the forest and then distributing those benefits equitably. The area is just too large and complex for any other strategy to deliver conservation and development outcomes effectively and sustainably. CI has dubbed this the green economy approach. This means understanding and planning for the forest's future in the context of the many other land uses that surround it. It also means incorporating the various values the forest holds into its future management regime – timber products, non-timber products, aesthetic values, hydrological services, carbon sequestration, cultural and spiritual sites, etc. Finally, it means understanding the dynamics throughout the corridor and planning activities in the most strategic manner possible. With limited resources, we must target our interventions in those areas that are most highly threatened.

Building successful partnerships is a cornerstone of the approach. To work effectively in three regions, over 20 communes, and countless villages, CI/Madagascar has partnered with local NGOs, other donor-funded projects, the private sector, and community associations. This tactic, which is the foundation of the model CI has adopted for Madagascar, has allowed us to expand our reach to the entire CAZ corridor.

The approach prioritizes human well-being and includes many targeted interventions to ensure that CAZ produces real benefits for those people who rely most directly on its resources. These interventions are grounded in the CAZ governance structure, which serves as the overarching mechanism for sharing management responsibilities and distributing benefits.

Governance

CI/Madagascar supported a series of meetings and discussions to determine the final governance structure of CAZ. Stakeholders at multiple levels participated, including local communities, the Ministry of Environment and Forests (MEF), and various other partners. The decision was made to adopt a co-management governance type, with an emphasis on community-level participation and empowerment. Roles and responsibilities were defined, paying particular attention to the lowest levels of the structure.

CAZ's co-management structure is divided into two main parts, a strategic orientation component and a management component (Figure 4). The MEF delegates responsibility to the Protected Area Manager, which, along with the Orientation and Monitoring Committee, serves to define strategic priorities for management. The CAZ Manager and its staff including six sector managers, and the Local Management Unit managers ensure daily management functions and implementation. Specific roles and responsibilities of each of these entities are described in Table 2.

The decision making body is the Ministry of Environment and Forests. It has the final decision making power for all questions related to the management of CAZ and approves the management plan for the protected area. Although the Ministry has final decision making power, decisions are informed by extensive consultation and negotiation with the other stakeholders involved. The Ministry can also act at any level of the protected area through its decentralized representatives at the regional/ local levels.

The Orientation and Monitoring Committee (OMC) serves as a deliberating and consultative body and is made up of 19 members. It provides guidance on the implementation of the management plan and the protected area policies.

The Protected Area Manager ensures the executive function of the entire protected area. Until a definitive Manager is identified, CI/Madagascar is serving in this role. The Manager is responsible for implementing management, compiling reports from the Sector and Local Management Unit (LMU) levels, and reporting to the MEF and OMC.

A total of six Sectors have been defined for CAZ (Figure 5). Each Sector supervises the management within the LMUs in its zone. The Sectors also liaise with authorities and partners within the zone. Activities within the Sector are coordinated by a Sector Coordinator employed by the Manager.

The Local Management Units are at the most local level within the management structure. Their role is to manage each LMU, including ensuring the implementation of the local management plans, establishing and enforcing local use rules (Dina), and submitting activity reports to their Sector Coordinator.

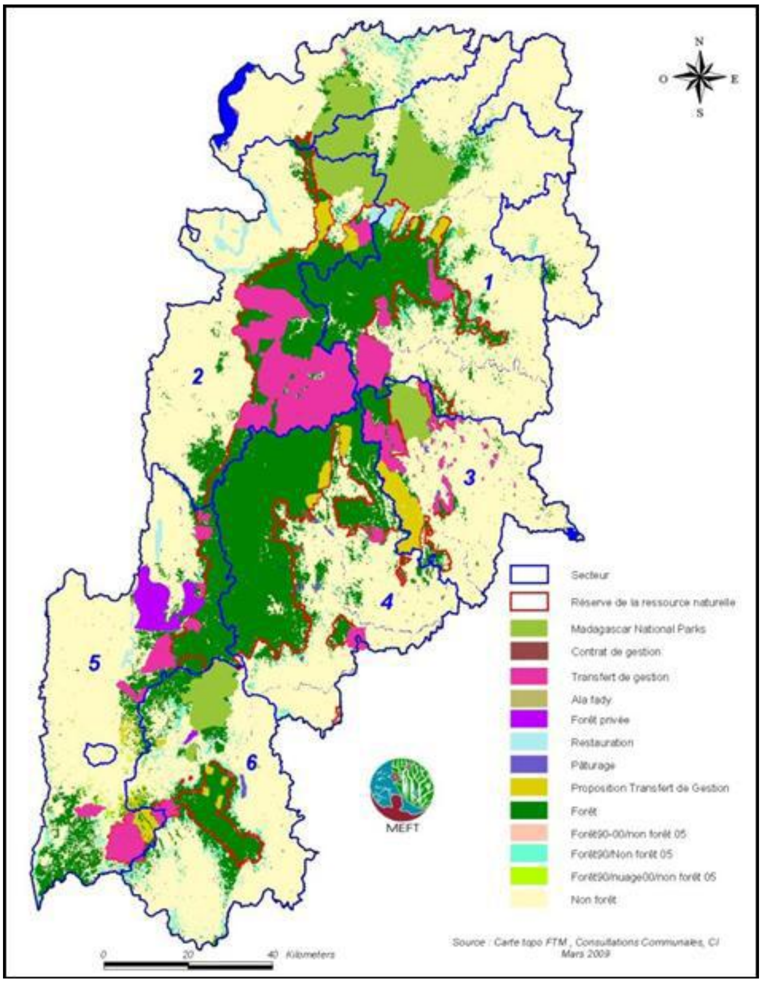


Figure 4. The six Sectors of the CAZ governance structure.

Forest carbon projects

In an effort to mitigate the effects of climate change, CI/Madagascar has been supporting the government in Madagascar to develop two forest carbon projects at CAZ. The Tetik'Asa Mampody Savoka ("Return the Fallows to Forest" in Malagasy) reforestation initiative, or TAMS, is reforesting degraded agricultural land to restore a natural corridor between existing protected areas. In the past, natural forests have been cleared and lands degraded through unsustainable agricultural practices, including reduced fallow times between crop cycles, charcoal production from native and exotic tree species and legal and illegal forestry and mining activities. The initiative is designed to be certified under the Clean Development Mechanism (CDM) to generate emissions reductions through the reforestation of both public and private lands. The government of Madagascar leads the initiative and is supported by CI/Madagascar, which has led the field work in identifying eligible lands for reforestation. The World Bank BioCarbon Fund included the project in its portfolio, while the government of Madagascar and CI are providing funds for implementation. Several nurseries have been created to reforest at least 600 hectares of degraded land; these nurseries are growing more than 120 native species, most of which have never before been propagated, adding to the science of restoration in the country. In addition over 200 jobs have been created by this initiative, providing direct stimulation of the local economy.

CAZ is also the site of a pilot REDD+ initiative (Reducing Emissions from Deforestation and Degradation 'plus' biodiversity conservation) that is supported by CI. The initiative has involved the creation of CAZ as a protected area with the intention of using sustainable financing, including carbon markets, to support its design and management. The goals of the forest carbon initiative are to reduce deforestation and enhance the capacity of the communities to manage natural resources, while protecting biodiversity and water resources important for downstream production. Revenues from the marketing of emissions reductions will help finance long-term protection and management of the CAZ. Portions of the protected area are placed under strict protection, while other areas are zoned for community resource management with support and oversight by the government. The initiative has received technical support from CI in the design of the activities aimed at reducing deforestation, calculation of the emissions baseline and the design of the management plan for the protected area. CAZ was the first REDD+ activity to receive the support of the World Bank's BioCarbon Fund, which has also provided technical support, notably by creating a mosaic deforestation methodology designed to be acceptable under the Voluntary Carbon Standards guidelines.

Table 2. Roles and responsibilities of the various actors in the CAZ governance structure

Structure	Composition	Roles and Responsibilities	Decision making process	Observations
Ministry of Environment	Ministry represented by the *Direction du Système des Aires Protégées* (DSAP)	Interface with other ministries and technical and financial partners Approve management plan Support the Manager on legal and administrative issues	Is the ultimate decision maker for issues related to CAZ management	
Orientation and Monitoring Committee (OMC)	3 DREF 2 Regional Heads 1 Manager representative Designated representatives: 4 other regional ministerial representatives 2 sector representatives 2 mayors (1 per region) 3 civil society 2 technical and financial partners 1 PlaCAZ	Approve orientations and strategies for implementing management Monitor and evaluate technical, administrative, and financial management of PA Monitor management implementation by the Manager Analyze policy implementation and suggest new orientations Advocacy	Advise/ orient the Manager Serve as deliberating and consultative body Deliberating -> management plan implementation Consultative -> policy, general strategy and orientation	Meet twice a year Approve work plans and reports Meeting costs covered by the Manager
Protected Area Manager	Director of CAZ protected area and associated staff	Propose strategies and orientations for management implementation Update management plan Implement management plan and develop annual work plans Monitor and evaluate achievements vis-à-vis management plan Interface with stakeholders Orient and support activity implementation at the Sector level Develop business plan and fundraise Approve the management plans of the Local Management Units	Receive reports from Sectors Submit reports to OMC and GOM Communicate action plans for management with other sectors Accountable to Ministry	Note: Develop Operational Plan
Sector	Sector Coordinator employed by Manager	Collect and analyze Local Management Unit reports Supervise management by Local Management Units (LMU) Submit reports to regional ministry representatives Liaise with local authorities	Reports to Manager Compiles reports from LMUs	Platforme: 1 commune rep 1 partner rep 1 rep per LMU
Local Management Unit (LMU)	Stakeholders inlcuding local community associations, partners	Devleop and implement LMU management plan Conduct patrols of core protected zone near LMU Represent the community within the PA governance structure Manage LMU (Dina, reporting)	Report to Sector Decision making within the General Assembly	

Small grants

Another vehicle CI/Madagascar has used to create economic opportunities for people conserving CAZ is by providing small grants to jump start income-generating projects. Known as the Node Small Grants Program, this initiative provides small grants to community-level associations to undertake activities that directly contribute to conservation outcomes. The Node Program is innovative in that it achieves two major objectives simultaneously: (1) supporting local conservation action, and (2) contributing to increased capacity of national NGOs to administer and manage grants at the local scale. The first objective is achieved through the small grants themselves, and the important local-level conservation activities that are completed with these resources. The grants are awarded to local associations. As CAZ's governance structure becomes more robust, CI/Madagascar is prioritizing LMUs to receive this funding.

The second objective is achieved through the innovative mechanism CI/Madagascar is using to disburse funds. Rather than having a centralized system of grant-making controlled by CI/Madagascar employees, we have partnered with Malagasy NGOs – the "Nodes" – working in district-level towns in CAZ to receive and review proposals, issue grants, and monitor activities. This mechanism provides these Malagasy NGOs with an opportunity to hone their grant management skills as well as build their expertise in supporting conservation. To date, CI/Madagascar has supported over 70 micro-projects around CAZ through this small grants program.

Tourism

Tourism serves as a response to slash-and-burn agriculture, hunting, logging, and other threats. CI/Madagascar's tourism program complements the other initiatives being implemented at CAZ insofar as it is a vehicle for stimulating economic activity contributing to a green economy. We aim to use tourism development to finance conservation through tourism concessions, by creating jobs linked to tourism activities, and developing constituencies through strong partnerships among protected area managers, the private sector, communities, the National Tourism Board, and the Tourism Department.

CI's tourism program focuses on developing sustainable tourism that provides economic opportunities without resulting in negative environmental or social impacts. The approach includes tourism planning for CAZ. This involves collaborating with stakeholders at multiple levels, including tourism industry actors, to support the development of the tourism management and monitoring plan for CAZ.

The approach also involves increasing competitiveness of the tourism industry at CAZ. This effort uses a value chain approach to develop strong and competitive partnerships to better position CAZ as a destination, especially to those who adopt an ethic of responsible tourism. The value chain approach involves identifying constraints and opportunities, and defining parameters from which to improve the tourism industry. The result of this analysis is a strategy for tourism industry development that ensures community-based involvement and benefits within the nature-based tourism sector. The strategic plan is shared and implemented in a participatory manner with actors including tour operators, hotels, transportation service providers, protected area managers, and local communities. Activities include training for local guides, building relationships between local service providers (e.g., hotels, restaurants, guides) and tour operators, and encouraging local tourism businesses to adopt good practices such as sourcing their foodstuffs locally.

Conservation agreements

Another component of CI/Madagascar's approach to developing a green economy at CAZ is conservation agreements. These are agreements established between CI/Madagascar and local communities at CAZ with the support of governmental authorities. The purpose is to engage in a commitment to achieve conservation results while offsetting the foregone benefits from unsustainably using the forest.

The mechanism for establishing conservation agreements with local communities involves targeting the Local Management Units of CAZ's governance structure so that there is a direct link between the conservation management tasks communities perform and the benefits they receive. CI works with ASOS (a local development organization) and VALBIO (a research institute supported by Stony Brook University) to train and empower communities to assume responsibility for ecological monitoring. Indicators regarding natural resource management behavior and the status of key resources such as economically beneficial trees or water sources are tracked. The information generated will guide land-use planning at the community level and provide quantitative information on biodiversity and land-cover changes. Communities are then compensated with micro-development projects. Key to the success of this project is that communities choose incentives that best meet their development needs but priority is given to activities related to sustainable livelihoods.

Integrated health, population, and environment

Many people living in and around CAZ do not have access to basic health services. They live in extremely remote areas that are far from health clinics, doctors, and medications. Their health is closely linked to the state of the ecosystems in which they live insofar as they may contract water-borne parasites from streams or ponds, or other diseases or infections from bushmeat.

CI is working to address these ecosystem-related human health issues by improving access to health care services and products, and building capacity to deliver those services. These activities have been implemented with local NGOs and communities participating in CAZ's governance structure. CI's approach involves training community-based agents who are able to provide technical assistance on a variety of topics including improved nutrition, hygiene, and family planning. They are also certified to issue vaccinations.

Amplification

CI's efforts in CAZ are proving successful but these positive results must be amplified if we are going to affect a larger scale. Our approach to scaling-up our impact includes applying lessons learned in CAZ to other areas of Madagascar, influencing policy, engaging markets, building capacity, and improving communications.

The approach in CAZ is already being recognized as a model that should be replicated to other areas of Madagascar. CI/Madagascar is working with regional authorities, NGOs, and communities in nine other important landscapes to use a similar strategy for developing a green economy. Learning from the CAZ experience, CI/Madagascar has been able to provide critical expertise and insight into making this approach applicable to various ecosystems and contexts.

Policy

CI/Madagascar is amplifying the impact of the work at CAZ by influencing national policy. The lessons generated at CAZ have been used to inform Madagascar's national protected area law and policy framework. CAZ is also pioneering in developing a management plan for a multi-use protected area in Madagascar and a robust co-management governance regime. These efforts have been used to develop national-level policies and resource use in multi-use protected areas and governance structures. Before the work at CAZ and other new protected areas began, the policies were primarily being conceived from a theoretical standpoint. CAZ provides the field experience and ground-truthing needed to refine these polices and ensure they are achieving their intended goals.

Markets

A key component of developing a green economy is scaling it up is the extent to which markets are transformed and businesses become more sustainable in their practices. CI/Madagascar is using the work at CAZ to influence markets and businesses. For instance, through the forest carbon projects at CAZ, CI is providing valuable lessons about how the carbon market should be developed and how carbon revenue can be distributed. This is providing potential buyers with the reassurance they need that their carbon emissions will truly be offset through forest carbon projects. In addition, CI/Madagascar has engaged the tourism industry, specifically those firms focused on responsible tourism. Facilitating linkages between them and Malagasy-based businesses is beginning to affect the extent to which tourism in Madagascar is developed and marketed in an environmentally-friendly and socially-conscious way.

Capacity building

CI/Madagascar's effort to scale-up its impact includes building capacity for scientific research, conservation, and policy making. CI believes that science should be used to inform appropriate action and that scientific capacity needs to be cultivated to ensure this function in the future. As such, CI/Madagascar supports research through grants. This research is conducted by national associations, researchers, and students. The aim is support the generation of scientific knowledge by Malagasy researchers as input to decision making. Since 2004, CI/Madagascar has supported over 150 Malagasy research projects.

CI/Madagascar also supports university programs, student groups and community associations that want to increase their general understanding of Malagasy conservation issues. Through activities such as educational field trips, exchanges and lectures, CI/Madagascar is increasing the constituency of Malagasy citizens that understand and support conservation work. Since 2003, CI/Madagascar has provided over $11.5 million in grants to civil society groups working to conserve the country's biodiversity.

In addition, CI/Madagascar works closely with Malagasy authorities on issues related to conservation such as protected areas, land-use planning, and climate change adaptation. These issues can be complex and technical and many Malagasy officials do not have formal training in these areas. CI/Madagascar therefore provides training, materials and tools to support these decision makers in their governance work. We engage them as true partners, providing data that can inform analysis and decision making.

Communications

The work at CAZ is being amplified through communications efforts. CI/Madagascar works closely with national and international media, providing incentives for them to report on activities at CAZ. These efforts raise awareness among the public about the importance of conservation issues and how conservation can contribute to Madagascar's overall development.

CI/Madagascar also supports other communications activities such as participating in the organization of national celebrations of awareness-raising events like World Environment Day, Biodiversity Day, Wetlands Day, Forests Day and Climate Change events. Updates of conservation activities are shared with the general public and partner organizations through the news media, regular newsletters, websites and rural radio. One of the most successful approaches for increasing the coverage of conservation in the news media has been by providing regular trainings and information to journalists and using competitions to encourage high-quality reporting on environmental issues.

Key lessons

Although the context at CAZ is unique, many of the circumstances, challenges, and issues are similar to those faced elsewhere. The tension between conservation and development, the pressure exerted by outside interests, and the multiple actors implicated are issues that exist in many places. We feel our efforts are proving successful and that a few key factors have contributed greatly to this:

Although time-consuming and expensive, the effort put into developing partnerships has ensured that the protected area now benefits from a broad alliance of diverse stakeholders that share a common vision for creating and managing this large new protected area.

The emphasis on building the capacity of organizations in the corridor and the development of good, effective governance at a landscape scale.

The provision of incentives to local people for conservation, whether through conservation agreements, grants linked to natural resource stewardship, or nature-based enterprise such as ecotourism.

CI's sustained presence and investment in the corridor combined with a recognition that long term financial sustainability is a key element to success.

Looking ahead

CI works with societies to secure ecosystem services that flow from natural systems to meet both current and future needs. The key to securing ecosystem services for the benefit of people is to demonstrate success in specific places and then scale-up those successes for broad-level impact.

CI/Madagascar is demonstrating that economic development in the Ankeniheny-Zahamena corridor is possible with effective stewardship of the forest. This model, the green economy model, is a way to bring economic opportunity to people today while safeguarding this same opportunity for future generations.

CI/Madagascar is supporting the management of CAZ's natural capital in a way that sustains flows of ecosystem services, people will benefit, economic development will be furthered, and nature will be conserved. This model reinforces the imperative codependent relationship between humans and nature. The lessons learned at CAZ are helping to refine the model and apply it to other landscapes in Madagascar. They are also influencing decision makers and policies.

By focusing on conserving healthy ecosystems that provide the ecosystem services upon which people depend, we are safeguarding the natural capital that is needed for economic activity.

Title: Abrolhos seascape, a field demonstration model

Organisation: Conservation International (CI)
Theme: Coastal
Keywords: Brazil, Abrolhos, marine conservation

Summary

The Abrolhos Region off of Brazil's southeast coast is a natural paradise for biodiversity and people. The waters are the most biodiverse in all the South Atlantic, full of an incredible array of marine life. Once a year over 7,000 humpback whales come to Abrolhos to reproduce. Residents depend on the sea for their livelihoods, working as fishermen, collecting crabs in the mangroves, and developing tourism. Over the last 13 years, Conservation International (CI) has been working in the Abrolhos bank to design and implement a network of multiple-use and no-take marine protected areas (MPAs). CI-Brazil's model combines institutional commitment, good science, and strong partnerships to develop an effective ecosystem-based management system for the region. Local-level results are amplified through a series of concrete activities that influence regional and national policy, build local capacity, and increase awareness. This model is already proving successful in shaping an economic development pathway that is built on the central and fundamentally essential role of nature. The road toward sustainability is being paved in Abrolhos.

CI works with societies to secure ecosystem services that flow from natural systems to meet both current and future needs. The key to securing ecosystem services for the benefit of people is to demonstrate success in specific places and then scale-up those successes for broad-level impact.

Background

The Abrolhos Region is located off the southern coast of the State of Bahia, Brazil (Figure 1). It is an area of 95,000 km2 where the continental shelf extends far into the ocean leaving an area of relatively shallow water (~20-70 meters). Abrolhos is a mosaic of important ecosystems including coral reefs, mangrove estuaries, calcareous algae-covered substrate, and beaches.

As the most biodiverse area in the South Atlantic, the Abrolhos Region houses numerous endemic species such as the brain coral (Mussismilia braziliensis) and various threatened species such as sea turtles, sea birds, marine mammals and fishes. In a rapid assessment conducted in 2003 a total of 1,300 species were documented, 45 of which are listed as threatened on the IUCN Red List.

Approximately 230,000 people reside in the coastal area adjacent to Abrolhos. Many people engage in traditional livelihood activities and it is estimated that 20,000 residents are employed as fishermen. The region experiences an influx of national tourists during holidays and also receives hundreds of international tourists during the whale watching season from June to September. Approximately 80,000 residents are employed in the tourism sector, which is a growing activity in the region.

To conserve the area's unique biodiversity and ensure long-term livelihood opportunities for local people, several marine protected areas (MPAs) have been established. Currently, the core MPA network includes four Federal protected areas: the Abrolhos Marine National Park, Corumbau Marine Extractive Reserve, Canavieiras Extractive Reserve, and Cassurubá Extractive Reserve (Table 1).

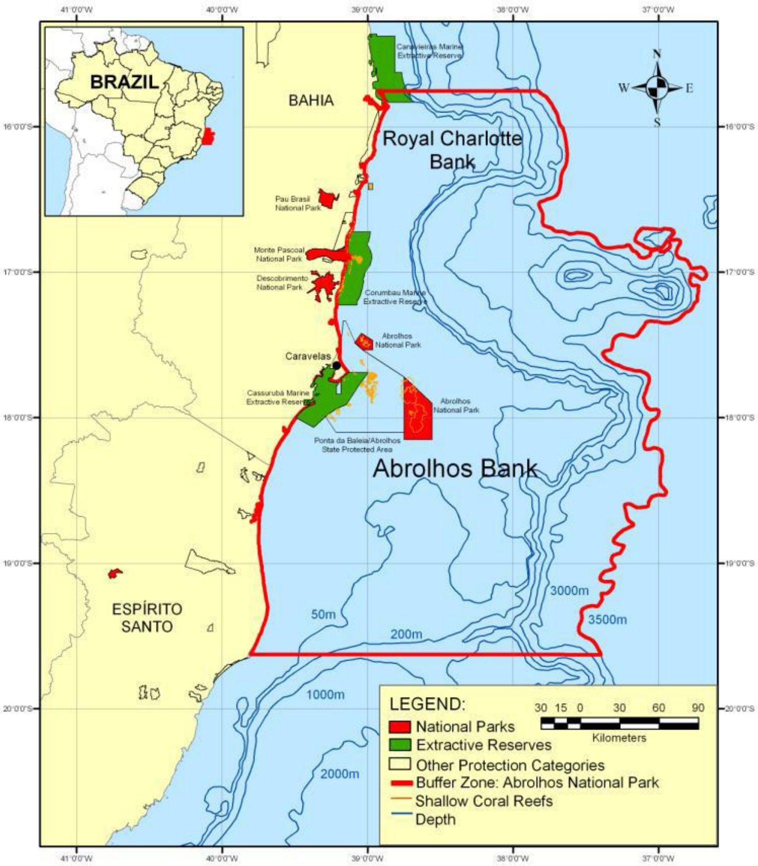


Figure 1. Location of the Abrolhos Region and its protected areas.

Table 1. Marine protected areas of the Abrolhos Region

Protected Area	Date	Surface Area	Ecosystem	Management Regime	Zoning
Abrolhos Marine National Park	1983	88,250 hectares	Islands and coral reefs located 45 miles off the coast	Administered by the Chico Mendes Institute for Biodiversity Conservation (ICMBio)	No-take protected area; allowed activities include tourism and research
Corumbau Marine Extractive Reserve	2000	89,500 hectares	Coral Reefs, shrimp banks that are a coastal marine area adjacent to two national parks protecting remaining blocs of the Atlantic Forest	Co-managed by ICMBio, local communities, and several nongovernmental organizations including CI	Multiple-use area including some no-take zones
Canavieiras Extractive Reserve	2006	100,000 hectares	Coastal marine and mangrove areas	Co-managed by ICMBio, local communities, and several nongovernmental organizations including CI	Multiple-use area including fisheries management regulations
Cassurubá Extractive Reserve	2009	100,000 hectares	Coastal marine and mangrove areas	Co-management; management structure under development	Zoning under development

Science

CI's work on the Abrolhos Region is driven by science. For over a decade, CI-Brazil and its partners have been conducting both ecological and socio-economic research to improve priority-setting and inform management decisions. Most recently, much of CI-Brazil's research has been conducted as part of the Marine Managed Areas Science (MMAS) program, a CI-led initiative to conduct research in several important marine areas worldwide. The objectives of this program are threefold:

1. Create local capacity for marine conservation
2. Evaluate the effects of MPAs on ecosystems and people
3. Conduct science to improve MPAs design and implementation

In Abrolhos, MMAS has enabled cutting-edge inquiry into the connectivity among habitats, namely mangrove estuaries, near shelf reefs and outer shelf reefs. Results of this research indicate that these habitats are connected and that various species of fish may use these multiple habitats throughout their life cycles. The implication is that protected areas are needed in these multiple habitats to ensure ecosystem functionality.

Habitat mapping has resulted in the identification of new reefs further offshore that may multiply the total reef area of the Abrolhos bank by two to seven times. Through MMAS, CI-Brazil has also been involved in the identification of new, hole-like formations in the substrate. Although still not well understood, these formations may serve as refuges for fish seeking protected water or hiding from predators. Even further, beyond these newly-identified structures, are large calcareous algae banks, which may play a role in reducing CO_2 concentrations in the atmosphere but which require further study.

In addition to habitat and connectivity research, CI-Brazil and its partners have conducted a number of studies to understand the effects of MPAs. For instance, a recent study looked at fish biomass of commercially-important fish species in a no-take zone inside the Corumbau Marine Extractive Reserve as well as at increasing intervals from the borders of the no-take zone. Results indicate that fish biomass is increasing inside the Reserve boundaries and that there is a positive spill-over effect outside as well. This is important information for managing multiple use MPAs and including no-take zones within them. Still other studies have focused on identifying spawning aggregation sites and understanding population dynamics.

Biological and ecological data has been coupled with socio-economic information. In 18 communities along the Abrolhos coastline, CI-Brazil and its partners are conducting research to understand the socio-economic impacts of MPAs as well as the cultural dimensions associated with MPA management.

CI-Brazil and its partners also undertake regular monitoring activities to track trends in biodiversity and fisheries. This information has demonstrated the impact of MPAs in improving fisheries and biodiversity conservation. It has also identified problems such as coral bleaching and disease. These are symptoms of threats such as overfishing and perhaps climate change. Research on the impacts of climate change may provide insight into ecosystem vulnerability and adaptation measures that should be put in place.

The aim of this research is to inform the development of a holistic management plan for the entire Abrolhos Seascape, targeting the maintenance of the most critical ecosystem services and sustainability of fisheries.

Ecosystem-based management

CI-Brazil is influencing the development of a sustainable, ecosystem-based management model for the Abrolhos Seascape by conducting rigorous scientific research and working with a network of strong, committed partners. To conserve ecosystem services and ensure the functionality of the Abrolhos ecosystem, MPAs must be established in a network that promotes connectivity. This vision is well on its way to becoming a reality through multiple MPAs with various conservation objectives.

The key to CI-Brazil's model for achieving results at Abrolhos is developing a robust approach that demonstrates how conserving the natural ecosystem ensures the delivery of important ecosystem services that are needed by people.

Success of the Abrolhos model is contingent upon its ability to deliver sustainability – ecological, political and financial.

Ecological sustainability – CI-Brazil is working toward ecological sustainability by establishing protected areas and implementing appropriate use rules. Research indicates that Abrolhos MPAs have had important successes to be replicated. Fish populations are stable inside multiple-use reserves such as Corumbau while they continue to decrease outside the reserves. This clearly demonstrates a strong potential for achieving food security for over 15,000 people relying on the MPAs. Also, reef fish species abundance has increased not only inside MPAs, but also close to their borders, demonstrating the positive spill-over effects of conservation.

The Abrolhos model is incorporating measures to address new threats such as climate change. Research on coral bleaching, disease and susceptibility will inform the identification of areas that must be protected to facilitate adaptation and make the system more resilient to climate change. At the same time, scientific knowledge of calcareous algae banks is elucidating the role of these marine habitats in reducing CO2 concentrations in the atmosphere.

The marine extractive reserves are strong instruments for securing traditional territories and ways of life. By relying on both traditional and scientific knowledge to inform the management of Abrolhos, local cultural practices that contribute to the maintenance of healthy natural ecosystems are recognized for their contribution to the provision of ecosystem services. Traditional Knowledge, which refers to the "innovations and practices of indigenous and local communities around the world", has made a significant contribution to sustainable development. This knowledge and practice of using biological diversity at the local level in a sustainable way, even promoting biodiversity, helped the management of vital ecosystems in Abrolhos. This interdependent relationship between humans and nature has been mutually beneficial, specifically in the Abrolhos model.

Political sustainability – The governance structures of the individual MPAs in the Abrolhos MPA network are essential building blocks of creating and maintaining political will for conservation. They bring together multiple stakeholders including government, nongovernmental organizations, universities, research institutes, labor unions, fishermen's associations, and the private sector. The coalition of these groups has resulted in a critical mass of support for conservation robust enough to withstand powerful external interests that favor destructive economic development alternatives. A key component of developing a strong governance regime is ensuring adequate capacity for making decisions, implementing actions, conducting evaluation and adapting strategy. We are working with our partners to address these needs and are already witnessing impressive advances in local capacity for marine and coastal area governance.

Financial sustainability – The Abrolhos model will not persist without financial sustainability, both to cover the costs of management and to ensure sustainable livelihood options are lucrative for local people. CI-Brazil's work in this area is ongoing, but progress has already been made. To secure funding to cover management costs, we are working with our partners to establish the Abrolhos Trust

Fund. This fund would be endowed and then used for complementary management costs such as monitoring, awareness building and patrolling, when government funds are scarce.

Efforts are also underway to develop and improve sustainable livelihood options and to shape the local economy into one that conserves Abrolhos' natural resources. A specific initiative includes working to increase fishermen's income through sustainably improving commercialization of local fish products in Corumbau and Canavieiras Extractive Reserves. To improve incomes from local fisheries, we are working to strengthen local fishing associations, engage the market and establish incentives for buyers to procure directly from associated fishermen who can provide higher quality product.
Abrolhos delivers ecosystem services for the benefit of peopleCI focuses on six initiatives to ensure human well-being: climate, water, food security, health security, cultural services and species contributions. In Abrolhos, we are addressing four of these directly.

Conserving the species of Abrolhos is important because they are the building blocks upon which human activity depends.

By protecting Abrolhos, CI-Brazil is working to ensure food security for local people who depend on fish, crab, and other seafood for their sustenance and their livelihood.

In our ecosystem-based conservation model, we build upon existing cultural links with nature, protecting the cultural services that Abrolhos provides.

CI-Brazil is helping to achieve climate security by conserving the coastal and marine ecosystems at Abrolhos that regulate climatic conditions.

Amplification

CI's efforts in Abrolhos are proving successful but these positive results must be amplified if we are going to affect a larger scale. Our approach to scaling-up our impact includes applying lessons learned in Abrolhos to other areas in Brazil, influencing national policy, building capacity, and improving communications.

The approach in Abrolhos is already being recognized as a model that should be replicated to other areas of Brazil. Recently, CI-Brazil was asked to provide technical support to marine conservation efforts ongoing off the coast of the State of São Paulo. Stakeholders in São Paulo acknowledge the expertise and experience CI-Brazil can bring to this process and have requested assistance. This is a clear indication of CI's growing role in developing field models, testing them, and amplifying results through sharing the lessons with others.

The Brazilian government has been impressed with the quality of CI-Brazil's work and the compelling scientific information we are able to produce. As a result, the Brazilian Ministry of Fisheries invited CI-Brazil and partners to develop an innovative methodology for monitoring small-scale fisheries in the region to improve the national protocol used all along the Brazilian coast.

Policy

CI-Brazil has been providing information to decision makers and influencing national policy since the early days of our engagement in the Abrolhos Region. In 2003, the government of Brazil proposed selling permits to explore for oil and gas in the area. This prospect was of immediate concern to CI and our partners in the region because this type of exploration could have devastating effects on Abrolhos' marine biodiversity, ecosystem services, and local livelihoods, regardless of whether oil or gas were actually exploited as a result of exploration. The potential negative impact was exacerbated by the fact that 243 blocks would be offered in the region, covering near 75% of the Abrolhos bank.

To reverse this decision, CI-Brazil and close partners took the lead in creating a group of like-minded stakeholders including environmental organizations, universities, and local associations. The purpose of this group, which came to be known as the SOS Abrolhos Coalition, was to advocate for the long-term conservation and sustainable use of Abrolhos' resources. After months of organizing, developing policy briefs, communicating scientific research to policy makers, and garnering support from a wide constituency, the SOS Abrolhos Coalition was successful in persuading the government not to issue exploration permits in the area. It was a victory in governance and sent a strong message that zoning is a critical component of sound economic development policy and trade-offs must be considered carefully.

More recently, the SOS Abrolhos Coalition played an important role again when the Cassurubá mangrove estuary was nearly transformed into the largest shrimp farm in Brazil. Shrimp farming would be extremely destructive in this area. Creation of shrimp ponds would require clearing vast areas of mangroves and other vegetation, and the estuary would become contaminated by the waste generated by the farmed shrimp. Because the estuary is the nursery for many reef species, this could negatively impact the numbers of larger fish found in deeper waters. The result would thus be devastating to local people who live off the resources, both in the estuary itself and further offshore.

In an unprecedented effort, the SOS Abrolhos Coalition launched an advocacy campaign that touched all sectors and reached the highest levels of government. The end result was a monumental visit by President Luiz Inácio Lula da Silva to Caravelas to sign the decree creating the Cassurubá Extractive Reserve in 2007. CI-Brazil, its partners, and local people were vindicated by this event, which was a clear demonstration of the power of sound science, good management models, and persistent advocacy.

Capacity building

CI-Brazil's effort to scale-up its impact includes building capacity for scientific research and conservation. CI believes that science should be used to inform appropriate action and that scientific capacity needs to be cultivated to ensure this function in the future. As such, CI has developed a Science-to-Action program, which aims to generate scientific knowledge and expertise as input to decision making. As part of its Science-to-Action program, CI-Brazil is working to prepare the next generation of decision makers, scientists, and resource users. Two programs are currently underway to build local capacity in marine science:

Marine Protected Areas Monitoring Course – This is the only such course in Brazil focused on the adaptive management of MPAs. It involves students and MPA professionals and managers from all over the country and is offered annually by Alliance for Marine Conservation, a partnership between CI-Brazil and the SOS Mata Atlântica Foundation. The course provides participants with knowledge and skills to design, implement, and assess the results of marine monitoring programs. It includes both classroom and field components. To date 55 people have completed the course from institutions of more than 10 different states in Brazil.

Open Your Eyes to Science – This program, developed by the State University of Maringá (UEM) and CI-Brazil, is an innovative capacity building initiative targeting high school students. Supported by the National Council for Science and Technology and the Bahia State Foundation for Science Support, this program stimulates students to engage in scientific and environmental projects carried out in Abrolhos by CI-Brazil and partners. It teaches students about the scientific method, the ecology of Abrolhos' marine species, and the importance of this ecosystem for providing ecosystem services and livelihoods. Students are then paired with researchers and contribute directly with real research projects. They participate in all phases of the research process – question formulation, data gathering, analysis, and reporting. Participating students are already demonstrating increased interest in scientific professions. The project is now led by the Caravelas Polivalente High School, with support from CI-Brazil, UEM and the Humpback Whale Institute.

Communications

The Science-to-Action program includes a communications component to translate scientific information in to awareness-building tools that target the public, decision makers, and other stakeholders. The aim is to build informational bridges among groups and make technical information accessible to lay audiences. We use various communication and information sharing tools to accomplish this. For instance, CI-Brazil organizes exchange programs among fishermen to stimulate face-to-face interaction and dialogue. This is extremely effective, especially for sharing lessons and experiences among the extractive reserves in the Abrolhos Region.

CI-Brazil also supports the development of communication support materials such as banners, posters, presentations, radio spots and videos. For instance, a poster and t-shirts have been developed in collaboration with the local artist's association – Arte Manha – that depict the connectivity among habitats and the importance of a functional MPA network in conserving fish species. A video, "Mokussuy: The importance of the Abrolhos MPAs" was developed in collaboration with the same association and the local cinematic club – Cine Clube Caravelas – to illustrate the central role MPAs play in the regional economy, culture and identity. These efforts are extremely effective in generating interest, raising awareness, building a conservation constituency and influencing behavior.

Key lessons

Although the context at Abrolhos is unique, many of the circumstances, challenges, and issues are similar to those faced elsewhere. The tension between conservation and development, the pressure exerted by outside interests, and the multiple actors implicated are issues that exist in many places. We feel our efforts are proving successful and that a few key factors have contributed greatly to this:

Long-term, sustained presence – CI-Brazil's ability to be effective is strongly linked to its long-term commitment to and presence in the Abrolhos Region. We have cultivated lasting relationships with local and regional actors. Because of this we are seen as credible, legitimate, and trustworthy. Our programmatic approach with a long time horizon has been critical to our success.

Scientific research and monitoring – Our strength in generating scientific information and making it accessible to various audiences is now well known in the region. CI-Brazil is regarded as highly skilled and capable of conducting rigorous research to inform decision making, management, and policy. Keeping a scientific foundation upon which to design and adapt programs is essential for maintaining credibility among partners, as well as for informing decisions.

Strong partnerships – Our effectiveness in the Abrolhos Region is inextricably linked to the extent and quality of our partnerships. We see ourselves as a key actor in the region, but one among many. Influencing an economic development pathway requires political momentum, which can only be built with strong partners.

CI acknowledges the following partners for their support of the Abrolhos Seascape work: Marcos de Moraes, International Conservation Fund of Canada, Waitt Family Foundation, Gordon and Betty Moore Foundation, Alpargatas, InvestTur, Daniel Cohen, Claudia and Francisco Oliveira, and The Graces.

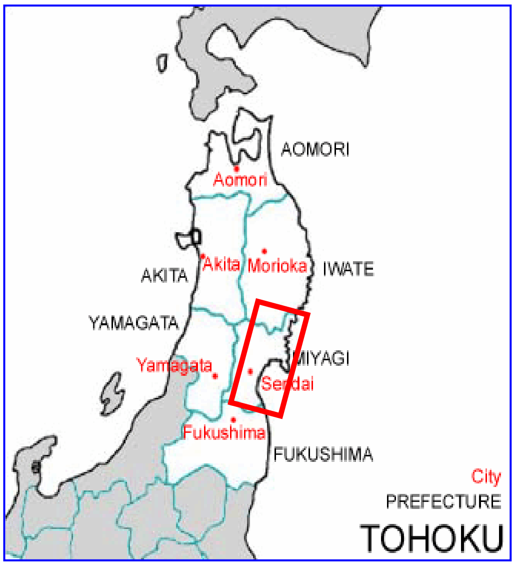
Title: Monitoring the Biodiversity of Tsunami Affected Areas in Tohoku

Organisation: Earthwatch Institute-Japan
Theme: Others
Keywords: Ecosystem, biodiversity, monitoring, engaging public

Summary

The rich ecosystems of the Tohoku Pacific Ocean coastline suffered immense damage from the tsunami of 11th March 2011. Reviving of rich aquatic ecosystems is essential for renaissance of Tohoku. The Green Renaissance Project led by Tohoku University and local NPOs is in line with Earthwatch Japan's activities. We are determined to help the recovery of ecosystems that will surely lead to richness and strength of the local areas and support rebuilding of Tohoku where nature and society live harmoniously.

We are engaging the public in monitoring research led by scientists in brackish tidal flat, rice paddies and islets alongside the tsunami affected coast line. The result obtained from this research will be utilized for the reconstruction plan of Tohoku.



Introduction

On 22nd May 2011,"The Tohoku Green Renaissance Project" has been declared by Tohoku University and local NPOs as follows:

"The massive earthquake and tsunamis of 11th March 2011 caused catastrophic damage to the coast line of Tohoku region. Rebuilding society and the economy of this region is the priority for the whole of Japan and of pressing interest to the international community. The area devastated was a harmonious natural mixture of riparian land, forest and ocean, and historically the population of the area has optimized its ecosystem services for their livelihoods.

Rapid re-development of this area, without conducting an environmental impact assessment and giving adequate thought to the biodiversity of its rivers, rice paddies and ocean, may not only fail to repair the natural damage, but compound the losses already suffered. For this reason we believe a renaissance, or rebirth, of the area is necessary via "Green Rebuilding" to enrich the ecosystems and nurture biodiversity.

We affirm as citizens of the region that green rebuilding is necessary to regain and secure regional well-being and to strengthen our harmonious relationship with nature. ”

The Green Renaissance Project is in line with Earthwatch Japan’s activities, besides it is determined to help the recovery of the ecosystem that will surely lead to richness and strength of the local areas and support rebuilding of Tohoku where nature and society live harmoniously.
We propose ecosystem monitoring projects in brackish tidal flats, rice paddies and islets alongside the affected coast line. The result obtained from this research will be utilized for the reconstruction plan of Tohoku.

Objective of program

- Understand the size of disturbance caused by 11th March tsunami and its impact on the local ecosystems.
- Detect the facilitation factors and human disturbance factors for ecosystem recovery.
- Offer the information about suitable land use for renaissance and also about mechanism of ecosystem and biodiversity, which is critical for business promotion to local population and county.
- Through the above, Earthwatch Japan will help to create a system that enable the locals to use ecosystem functions and services.

* Tohoku University has data on the ecosystems in these brackish tidal flats, rice paddies and islets before the tsunami hit that allow the comparison of condition of ecosystems before and after the tsunami.

Outline of the projects

Monitoring the influence of earthquake and tsunami on brackish tidal flat ecosystem

<FIELDING>

- Search the surface ground of fieldwork site for 15 minutes and collect living organisms into plastic bags.
- Dig into the ground 15 times and collect living organisms into plastic bags
- Identify species of the collected-organisms and record them.
- Evaluate biodiversity condition of the tidal flat
- The ratio of species on the recording sheet to found species shows their usefulness as habitats for organisms

<Use of the results>

fig1

fig2

→ Identify the undamaged habitats by comparing the before and after results of the tsunami; the collected data is applied for evaluation of level of disaster damage.
→Identify the level of recovery and disturbance factors by observing the growth of benthos.
→ Identify invasive non-indigenous species at early stages and apply to restoration of brackish tidal flat ecosystem
→ Encourage the development of symbiotic relationships between nature and local population and environmental literacy of local people

Monitoring of ecosystem in Matsushima Islet

<FIELDING>

Fig3

fig4

- Monitoring the environment of the beach, marsh and rice paddies
- Investigate the beach, marsh and rice paddies that are thought to have had the biggest damage from the tsunami. In this research, check whether the change in vegetation is related to recovery of the ecosystems or not.
- The investigation is carried out with quadrat survey on island plots.
- Study on undamaged nature
- Create a nature map of Urato Islands based on the data obtained from this investigation and record the change of natural environment. The investigation of flora and fauna is carried out around hiking course by using line census method.
- Monitoring diversity of butterflies
- Observe the changes of vegetation caused by the earthquake and tsunami and monitor the impact on the change in diversity of butterflies. Record name of species and number of butterflies taken at research plots.

<Use of the result>

→To identify the recovery process of biodiversity in the islet.
→To support revival of the local communities by discovering and conserving tourist attractions such as nature and biodiversity of the islet.

Monitoring the rice paddies hit by the earthquake and the tsunami
<Purpose>
Understand the impact of the earthquake and tsunami on rice paddies and identify the facilitation and hindrance factors for environmental recovery by tracing process of natural recovery of the environment.
<Fielding>

fig5

fig6

Carry out seasonal monitoring survey on plants, aquatic insects, fish and amphibians in 10-25 different rice paddies, which are at different stages of recovery work from tsunami damage. From this survey, identify changes of biota in different rice paddies.

<Use of the results>

→ Identify factors that caused differences in size of impacts caused by tsunami, on ecosystems and influence of biota from comparison of the survey results.
→ Identify the facilitation and hindrance factors of recovery of rice paddies ecosystems
→ Share the outcome obtained from this research between the parties involved and raise environmental literacy of citizens that will lead to promotion of healthy, sustainable rice paddies over the long-term.

First trial research at Urato Island(August 12 to 14,2011)

Trial Monitoring Survey of Ecosystem in Katsura-jima Island & Sabusawa-jima Island (the Urato Islands)

The Urato Islands, which consist of four inhabited islands and a number of uninhabited islands, are located around the entrance of Matsushima Bay. It is said that these islands weakened the 3.11 tsunami entering the bay, and thus Matsushima, one of the "Three Prominent Views of Japan," and Shiogama, which is one of the major fishing ports in Japan suffered less from the tsunami compared to other coastal areas. Instead, many of the Urato Islands were severely damaged, and rebuilding work is delayed partly because they are not accessible by land transportation.

On Aug. 12-14th, 2011, following the aims of the Declaration of the Green Rebuilding from the Sea and Rice Paddy, Tohoku University conducted a trial monitoring survey of ecosystems in the Urato Islands, in association with Earthwatch Japan. Because the university was monitoring the ecosystems in the islands before March 11, it is possible to compare the data before and after the earthquake and tsunami. Nearly 30 people, including 15 volunteers, corporate workers, NPO/NGO staff, and researchers, participated in this research.

Tohoku University and Earthwatch Japan will start a full monitoring survey next year, based upon the experience and result of this trial. The results of this trial survey will be announced as the compilation and analyses of the collected data are completed.

References: Tohoku University (http://gema.biology.tohoku.ac.jp/green_reconst/TOP.html)

Title: A review of policy actions for more resilient land management in the upper watersheds of Davao

Organisation: Hydrology for the Environment, Life and Policy (HELP) Davao Network
Theme: Agricultural land, Inland water
Keywords: Policy, partnerships, IWRM, socio-ecological production landscapes, indigenous knowledge

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Summary

In the Davao Region of Southern Mindanao, Philippines, Integrated Water Resource Management (IWRM) has been a key framework for promoting sustainable land use in local ecosystems. However deteriorating trends continue across the watersheds and there is an absence of critical reviews to validate whether the current set of policies are providing a supportive environment for sustainable socio-ecological production landscapes . The predominant socio-ecological production systems in Davao are identified and a focus on 'opposite end of the spectrum' production systems (agri-business sector and the customary production systems) provides a context for the range of pressures and drivers of change.

The progress of recent watershed policy towards achieving intended policy outcomes such as 'control of harmful agriculture practices' are reviewed with selected field level partnerships highlighted as having greater success in changing minds and actions of communities when compared with the top down formal watershed policies. It is concluded that in order to achieve the goal of 'sustainable and resilient socio-ecological production landscapes,' the communities of Davao would be best served if the two production systems (traditional and agri business) will have to find ways of co-existing. It is also concluded that IWRM can provide an appropriate framework for moving towards this goal, but only if greater commitment, leadership and resources are delivered through government, corporate and society partnerships.

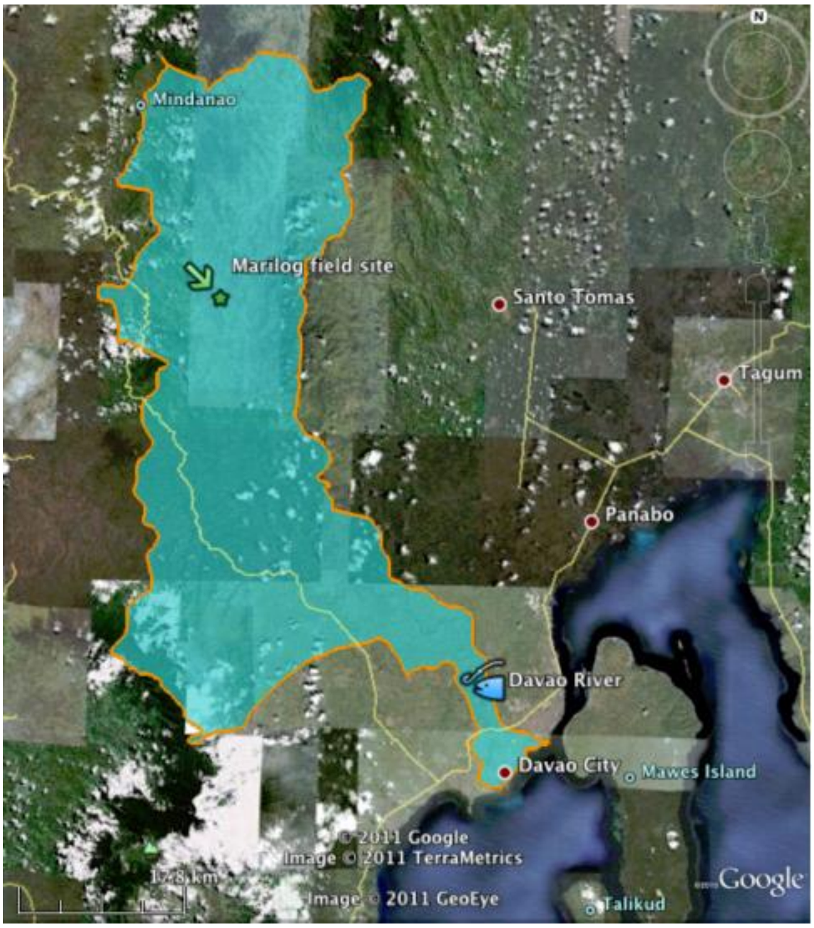
Description of the Problem/ Challenge

The challenge today in the Marilog area is the serious degradation of the ecosystems, including loss of forest cover, soil erosion and deteriorating water quality.

The degradation of the upland ecosystem is noted to be impacting on the ability of Indigenous People (IP) communities to sustain traditional livelihoods and negatively affecting the health and wellbeing of local communities. This degradation highlights lost opportunity for potential economic benefits from standing forests and agro-forestry production systems.

The degradation of steep slopes in the area has also increased vulnerability of local communities to landslide and the economic burden on downstream communities is escalating due to increased severity and frequency of flash floods.

The recent growth of the banana sector in the Marilog area and the wider region of Davao presents threats and opportunities for the IP communities. The challenge for policy makers will be how to guide the evolution of landscape management practices to reap some of the economic rewards seen in agri-business production models and still retain cultural and ecological integrity across the region.



Applying new models for conservation

In 2010 Davao HELP Network was accepted in to the International Partnership for the Satoyama Initiative (IPSI)". Member organisations of IPSI share a common commitment to uphold the vision of the Satoyama Initiative to realise societies in harmony with nature. The initiative outlines a three-fold approach to:

- Consolidate wisdom on securing diverse ecosystem services and values;
- Integrate traditional ecological knowledge and modern science to promote innovations;
- Explore new forms of co-management systems or evolving frameworks of "commons" respecting traditional communal land tenure.

This case study looks at how to apply the Satoyama approach to guide better policy actions at the field level. To contextualise our understanding we look to explore two local land use groups, agroforestry subsistence landscapes of the Indigenous Peoples and the agri-business production landscapes of the Banana sector.
Five Keys for Change are identified as appropriate steps for coordination structures and policy that can build better bridges for inter-sectoral collaboration between current land use, traditional ecological knowledge and modern science. It is concluded that in order to achieve a goal of 'sustainable and resilient socio-ecological production landscapes ,' the communities of Davao would be best served if the two production systems (traditional and banana) can find ways of co-existing in Davao.

The Keys for change

Four key lessons are extracted that are considered valuable tools for policy makers and water and land use managers to help over come the described challenges

(1) Constructive engagement and joint social learning processes.

Constructive engagement and joint social learning processes with the land user groups (cluster by sector or socio ecological production landscapes) can help managers and policy makers better understand existing practices and this can allow for more appropriate programs and policies to protect critical areas, avoid conflicts and assist the marginalised groups to have a deeper economic appreciation of their lands. The KFI partnership with the Marilog Communities is a good working example of how constructive engagement and joint social learning process can result in field level practices with positive economic and ecological benefits for local and downstream communities.

(2) Adoption of an Agro-ecological landscape approach.

Philippine law sets out land classification and agriculture department maps agriculture use but these formal classifications often do not accurately reflect the local mosaic of the actual land uses and land cover. At a local level the Davao City watershed code call for the delineation of Prime Agricultural Areas for use and utilization for human and economic activities. The Watershed Code in Prime Agricultural Areas directs agricultural activities towards ensuring 'food security shall be pursued through sustainable and environment-friendly agriculture in a harmonious balance between economic development and environmental protection.'
Adoption of an Agro-Ecological landscape approach can aid the development of appropriate policies for different production systems (e.g. subsistence Agro forestry, Agri Business, etc). These landscapes can be identified at as sub watershed units defined by real ground uses including the predominant social, ecological and production systems. However it is important to be aware of the interrelated nature of the sub units. For example in Davao efforts need to be focused on ensuring the economic opportunities and benefits of banana can be retained without further erosion of desirable cultural practices. It also must be recognised that the watershed unit remains an appropriate strategic level for planning and monitoring of overall ecosystem health.
The defining of Socio Ecological Production Landscapes is not intended to replace formal land classification but to support the Watershed Code and enable more responsive policy decisions. A very basic division of the type of socio ecological production landscapes in Davao could be defined as

- Agro Forestry Non-Tillage Landscapes.
- Mixed Use Agriculture Landscapes
- Prime Agricultural Production Landscapes.

Figures 2 and 3 below highlight some of the socio ecological aspects of two landscape systems; a traditional and a developed system, the former represented in the Agro Forestry Subsistence Landscapes and the later represented by an Agri-Business landscapes.

The current land use systems of the Indigenous Peoples (IP's) communities are perceived by both themselves and by down stream urban communities as being unproductive. This perception is collaborated by the income levels in Barangay Marilog where 84% of household were living on less than 172 php (4$) a day . Considering there is on average 5 person per household this means that the majority of persons in Marilog are living on less than 1$/day. This can be considered as extreme poverty when bench marked with poverty statistics in the Philippines.

The culture of banana production is the far end of the spectrum of agricultural production systems when compared with the IP socio-ecological systems. Banana is a major land user and employer in the region. Its production system is dominated by mono cropping and high input systems. Understandably banana and its associated economic opportunities is a strong driver of change in both cultural and land use practices across the region.

Figure 1: Visual assessment of Agro Forestry Non-Tillage Landscape in Davao, Philippines.

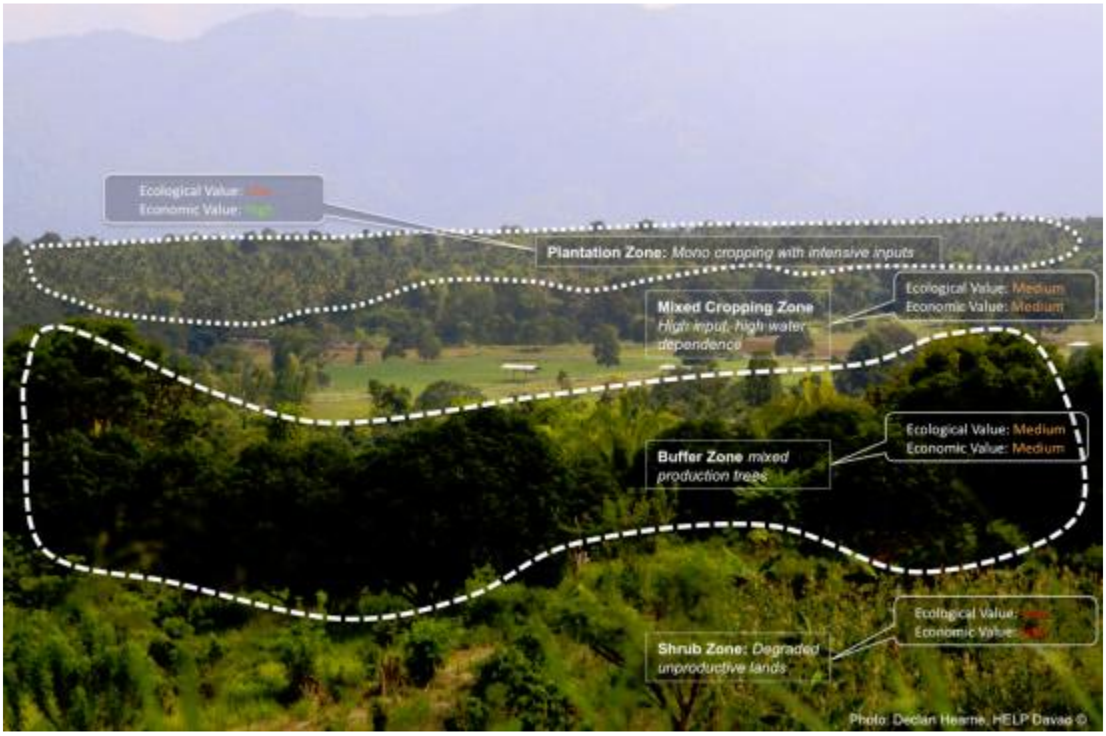


Figure 2: Visual assessment of a Prime Agricultural Production Landscape in Davao, Philippines

Rights based approaches must be considered

It is critical that policy makers and end user alike recognise the existence of the multi-layered systems and the need for plural societal systems. Plural societal systems look to ensure that formal law recognises and reinforces other power structures outside the formal state. The IPRA law in the Philippines establishes a formal framework for such a Plural Societal System. However all land and water use laws need to recognise and understand the potential cross cutting factors (influencing and barriers) depending on how informal or traditional authority systems are considered.

The challenges in negotiation and identifying pathways towards understanding of the customary arrangement are considered to be procedural and an ongoing evolving process. Such processes will require active field extension officers (e.g. CA, CENRO, DA, DENR) who facilitate knowledge awareness and new practices and critically must provide effective feedback to policy makers. Such feedback loops are traditionally not well established in the Philippines and this may be an area where academic, corporate and civil society partnerships (such as the Davao Water Partnership) may be able to play effective roles.

It is projected that time invested in aligning customary and formal law in the upland ecosystems of the Philippines, can result in higher adoption rates, increasing the likelihood of achieving intended benefits and is more likely to be sustained over time than costly enforcement programs of formal law.

Customary knowledge is not static, but adaptive

It is believed that efforts to ignite a renaissance in customary knowledge can positively serve the local and downstream communities. The selection of the word renaissance implies the need to cast out existing perceptions and embrace new ways of viewing and employing customary knowledge. A renaissance must seek to distil the best practices and innovate for appropriate new cultural pathways that are socially acceptable and economically sustainable.

Scaling up through effective partnerships

Integrated Water Resource Management (IWRM), which seeks to consider all users, can be used to enable equitable decision-making framework for allocation of water resources and land use policies at the watershed or basin level. Using the IWRM Spiral can help policy makers and local communities understand long term changes in their landscapes (See figure 3) While full implementation of IWRM is recommended as an effective framework to build social, economic and environmental capital for the benefit of all Davaoñenous. Local government and national level government agencies must be ready and open to recognise limitations of ongoing efforts and must be prepared to recognise what has worked and what has not. To date efforts in Watershed management have built social capital but have not done enough to reverse deteriorating ecosystems or direct green growth.

New partnerships must be open and inclusive of government, academics, corporations and society. These partnerships need to be formalized with clear directions and roles. They must be resources to better engage commitment and guide leadership towards more responsive environmental and sustainable economic outcomes. The Watershed Management Council must be operationalised to lead coordination of efforts. Existing informal coordination efforts (e.g. Davao Water Partnership, WMCC, PCEEM) should be unitized by the government to engage a full range of stakeholders. Local government should seek to identify sectoral champions to lead new responsive approaches that can result in better socio ecological production systems on the ground.

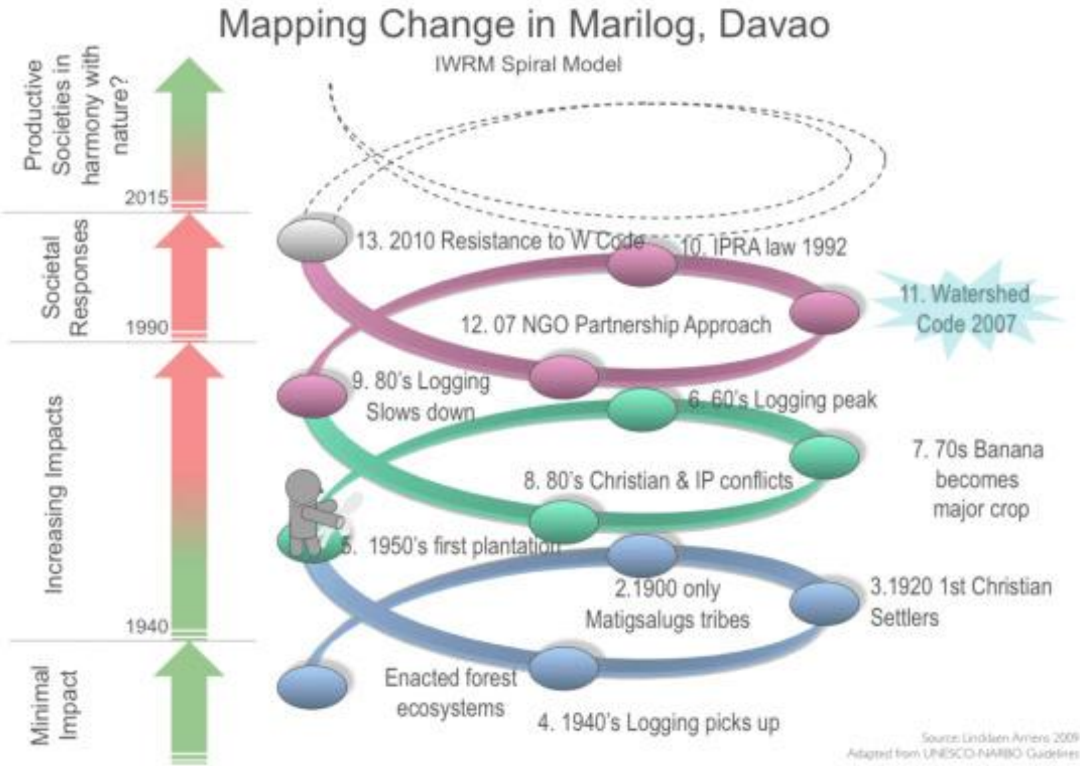


Figure 3: Major land use milestones in Marilog Davao

The Change

The keys for change have been identified through a review of real experiences from IP communities working with NGOs and government agencies and by applying the Satoyama frameworks to attempt to improve understanding and appreciation of the need to adapt customary policies in ways that sustain core elements of culture yet adapt to pressures for change. By working in real partnership with end users, such as the IPs, decision makers can become more aware of field realities and real sustainable opportunity for change. Existing partnerships at the field level are demonstrating that this process can lead to more sustainable actions on the ground. The challenge now is to find methods to scale up this lesson to watershed levels.

Title: Passerano Marmorito's bio-cultural landscape

Organisation: International Agency for the Protection of Biocultural Landscapes and for a New Rurality (AGER)
Theme: Agricultural land
Keywords: bio-cultural landscape, traditional agricultural practises, biodiversity and cultural heritage, new rurality, extensive exploitation model, crop diversity

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Summary

Passerano Marmorito (hereafter referred to as "Passerano") is a little village located in Piedmont, North-West Italy, in a hilly wooded region in the Asti province. The peculiarity of this landscape is of being a residual testimony of a traditional historical rurality that took complete form between the eighteenth and nineteenth centuries, and that has survived mostly intact until today. We can consider this landscape as a real bio-cultural landscape, a landscape where rural culture is still sometimes hardly legible in the manifestations of agro-ecosystems' natural components, in the architectural typologies, in the landscape shapes, in people's memories and in the biogenetic heritage of native breeds and cultivars.

The farmer's natural substrate shaping action in this land was based for centuries on a weak and extensive land exploitation model, subsistence-oriented, distributed on small properties. This model has left an important mark on biodiversity, and on people's culture, Among the several critical factors that seriously endanger the survival of Passerano's bio-cultural landscape, the major and most dangerous ones are people leaving the countryside to move to the cities, the mechanization and the use of chemicals in agriculture, the pressure exerted by food market; the urban sprawl. Survival of bio cultural residual landscapes allows us to take many lessons from the past, in order to build up a new sustainable development model. In the present text we show how in the case of Passerano some steps toward this direction have already been taken and we point out the medium/long term solutions that could be taken in the future to keep counteracting forces that tend to banalize and erase forever landscape's memory and values.

Passerano Marmorito's bio-cultural Landscape

Passerano Marmorito (hereafter referred to as "Passerano") is a little village located in Piedmont, North-West Italy, in a hilly wooded region in the Asti province. Here you can still feel the old political-administrative identity of the Radicati and Cocconato noble families that held the power nearly up to the 15th century.

The peculiarity of this landscape is of being a residual testimony of a traditional historical rurality. Among the factors that have greatly helped building the Asti-region's territory deep character, in its specific natural context, the most important role is played by the peasant culture that for millennia has permeated and shaped rural landscapes, that now in few cases are miraculously resisting a powerful push for more intensive and market oriented global economy.

We can consider this landscape as a real bio-cultural landscape, a landscape where rural culture is still sometimes hardly legible in the manifestations of agro-ecosystems' natural components, in the architectural typologies, in the landscape shapes, in people's memories and in the biogenetic heritage of native breeds and cultivars. (Malvasia of Schierano, Capriglio peppers, Asti onions, Piedmonts' Tonda-Gentile nut, Piedmont cow).

Photo 1,2 Views of Passerano Marmorito's rural landscape

Regarding the general landscape structure, there still are cultivated mosaics of fields, vineyards, hedges, small and large forested areas, rows of reeds, punctuated by the discrete presence of votive pillars, country churches, isolated crosses, all evidence of rural and religious life. The settlements with red roofs, towers, castles and palaces overlooking the hills, seem unmoved witnesses of the evolution of these "landscapes of the time" (Photo #1, 2).

Driving forces that have shaped Passerano's landscape

Farmer's natural substrate shaping action in Asti's region has been based for centuries on a weak and extensive land exploitation model, subsistence-oriented, distributed on small properties. This model has allowed for the establishment of a natural community in balance with the agro-ecosystem, leaving an important mark on biodiversity, and on people's culture.
Few mechanized crops with very low chemical inputs, woods managed with the primary objective of a regeneration of annual and long-term wood availability, therefore, with light cuts, aimed at extracting, from time to time just what was strictly needed, a careful and economical use of water, have allowed for the survival of natural forest fragments, lentic and lotic wetlands, xerothermic paranatural grasslands, riparian wooded strips, dry-type gullies, grassy cenosis, hedges, etc. These habitats are still refuges for flowers, insects, birds and mammals of high naturalistic value and they determine all the conservation interest of these areas.

Another key element that led to and partly still results in the formation and survival of the bio-cultural landscape in this region, is crops diversification. Once diversification was vital for the population to offset drops in the production of single crops, due to weather adverse conditions, diseases, market fluctuations.
Traditionally these areas were living in a dynamic and self-sufficient economy; in fact, diversification was a source of pride, a compendium of knowledge and competencies. Each farm was a point of contact for many soft skills.
Fields were cultivated with a specific crops rotation; there were orchards and large gardens. Even breeding was diversified, although the main gain was from cattle, with an average of 5-10 cows per farmhouse. Today, for different reasons, a small part of this diversity remains and maybe that is one of the things we appreciate the most about Passerano's landscape

Passerano's landscape bio-cultural approach

If you explore Passerano's territory and you encounter an element of its bio cultural landscape, you can acknowledge its dense and complicated network of relationships with other elements, material or immaterial, belonging to different thematic fields. This brings you to reflect on its importance and its value today, as evidence of an ancient balance and wisdom, and you feel the need to reactivate this wealth of knowledge. This way of “reading” landscape, starting from single visible details and then extending to all the connections created by them with other elements, is the essence of the bio-cultural landscape approach. Here below we report three examples, among the many existing, of Passerano’s countryside traditional elements, and their network of connection with other elements.

The case of Heather (*Calluna vulgarism*)
A traditional and non-intensive forest management allows better conservation of heather, an evergreen shrub of the Ericaceae family, which grows on hilltop forest clearings.
With their pink flowers, heather stretches used to “paint” forest clearings, thus, they used to leave a strong visual imprint on the forest landscape, plus, heather was used in sericulture to provide support for the silkworm to weave its cocoon, so it was linked to the cultivation, now disappeared, of mulberry trees and silkworm. In addition, heather meadows are tied to a specific insect fauna, today of a considerable conservation interest.

The case of the Cornelian Cherry (*Cornus mas*):
Cornelian cherry is an autochthonous shrub that has become rare in Asti’s regional countryside because it’s typical of an ecotonal habitat. Traditional farming included the use of hedges to separate properties, in these hedges Cornelian Cherry used to thrive. Some specimen of Cornelian Cherry still survive today in Passerano; some of them are very old (Photo #3).

Photo 3 old Cornelian Cherry shrub

Local artisans and carpenters used the very hard cornelian cherry wood to make handles, or other wooden tools that could bear heavy loads. Women used to collect Cornelian Cherry fruits to make jams because Cornelian has a great concentration of vitamin C.
The Cornelian Cherry is a medicinal (astringent) plant; it is a great melliferous plant because it blooms early in March when leaves are not yet born. For the same reason Cornelian Cherry hedges used to give a really attractive mark on early spring’s landscape, with huge yellow flowerings along a network of country hedgerows, while all around there still were winter brown and yellow dominant colours

The case of votive pillars
This case regards a typical element of the rural architecture, not monumental but very characteristic of Piedmont’s rural landscapes. From the beginning of the seventeenth century until the middle of the twentieth century, popular belief said that those who had received a pardon had to build a pillar to thank God.

Pillars are small buildings, very aesthetically pleasing, made entirely from local materials (stones, bricks). Their architectural style was an expression of popular culture and they still have a great significance as an expression of popular religiosity (Photo#4).

Photo 4 Votive Pillar in Passerano

Pillars were also historical documents, as they used to represent the memory of the persons who had built them and the historical events in which they had been involved.

Pillars were milestones of ancient religious penitential and propitiatory processions (called "rogazoni"). Pillars had to be visible, so they have been positioned at strategic locations on roads (Photo#5), on hilltops or near crosses; actually pillars were very useful as markers. Pillars also used to create shelters for farmers during storms. Even insects and lizards often choose dry environments created around the pillars.

Photo 5 Votive Pillar positioned on a road

The network of relationships between different elements of a landscape, as mentioned above, is the very essence of bio cultural landscapes and determines their high and valuable information content, which we now have a duty to protect.

Risk factors in Passerano's bio-cultural landscape

Among many critical factors that presently endanger bio-cultural landscape survival in Passerano, the most dangerous ones, which tend to undermine the very landscape, are the following.
First, the Italian economic boom after the Second World War and the exodus from the countryside into the cities, which began with the great social and economic changes and still continues today. This flight resulted in landscape abandonment and degradation of its forms.
The second factor has been the hard mechanization and the use of chemicals (pesticides and chemical fertilizers), associated with crops industrialization: it has saved enormous fatigue to farmer's work, but at the same time, it has caused the disappearance or the banalization of many agro ecosystems, fundamental in characterizing the landscape.

The third factor is the global market pressure; today's farmer no longer produces for their family consumption but according to an international food market demand, so the amount and type of productions and consequently space requirements in agricultural land have changed dramatically: farms tend to decrease in number and grow in size, to specialize their production and to reduce crops diversity.

The fourth factor is urban spread, which dangerously recreates town suburbs settelment patterns into the countryside, with houses, warehouses, shopping centres, etc., which greatly downgrade landscape and its harmony and introduce pollution and soil sealing.

What allowed Passerano's bio-cultural landscape survival?

Passerano's landscape today is partially maintained thanks to a number of factors that we try to describe succinctly.

First of all, this hilly land, with very steep slopes, makes agricultural intensification very difficult and the same applies to its urban transformation.
Second, rural depopulation has meant that today inhabitants are, on average, older, and still tied to agricultural practices of which they have memory. Actually, it's thanks to these seniors that we can recall traditional rural life memory.

Thirdly, it still exist a type of "part time" agriculture in Passerano. Already in ancient times, many farmers in these regions were working for half of the season in huge farms in plain areas not far away from home. In these regions, there was a kind of capitalist agriculture driven by large landowners who were taking seasonal workers from other regions of Piedmont and Italy.
Today there still are part-time farmers that work for most of the year in industry or in the services sector in the city or in the province's major towns, and come back home to work their land over the weekend.

Moreover, in some cases, ancient practices, having disappeared with the advent of modern agriculture, have been re-discovered more recently. For instance, fertilizers, that before were completely self-produced (with farm waste processing, manure, etc.): with the arrival of cheap chemical fertilizers, farmers had brilliant yields at first, but accompanied with water pollution, soil fertility loss for nitrates leaching, and dependence from chemical companies for products. With more recent chemical prices increases, farmers have found themselves in great difficulty, so today many of them have returned to organic matter recycling systems enhanced by modern agronomic knowledge. Now many farmers usually make by themselves and regularly use highly effective free of charge recycled products such as compost.

Another example of a virtuous phenomenon is the recent re-diffusion of traditional cultivars previously grown by old rural families: with the global food market, agro-biodiversity experienced a great decline. Very few dominant varieties are cultivated in any soil, either suitable or not, thanks to agro-industrial methods (with pesticides and fertilizers). Today, there's a recovering demand of ancient crop varieties by consumers, promoting healthier and tastier food, and the producers also verify that they have lower costs and better yields.

Considerations on existing/feasible connections between Passerano's bio-cultural landscape model and a new sustainable economy

Traditional agricultural landscape was created by farmers in an era in which agriculture was the population's basic means of subsistence, so peasants were just involuntary biodiversity managers and caretakers; on the contrary, now the whole community must participate in this effort, because agriculture is no longer an activity practiced by everybody.

In a substantive sense, there's a need for public intervention in order to protect what remains of the current bio-cultural landscapes evidence, and, at the same time, to direct production and farming toward less impacting models encouraging landscape preservation.

Examples of public interventions that are currently working this way in Piedmont are:

- European Community Rural Development Program which provides funds for farmers who maintain landscapes and are willing to convert their farming into environmentally friendly productions (organic, integrated);
- regional funds for Landscape Projects (pursuant to 14/2008 Regional Law), with which Piedmont Region provides financial support to buildings' architectural renovation or landscape restoration or other projects made up in respect of project areas' landscape identity and history.
- Conservation and protection measures. Protection and security are now imperative to prevent landscape values from the risk of disappearance, whilst we are working to conceive a new development model. For instance, recently Passerano's town was designated as "area of remarkable landscape interest" according to Cultural Heritage National law (Law 42/2004)
- Training activities: In recent years public awareness of Passerano's landscape value increased, the municipality has invested heavily on farmers and citizens training, e.g. organizing courses to teach what is biodiversity and why it is important.

Passerano's bio-cultural landscape survival is essential to maintain a knowledge, biodiversity and sustainability "reserve tank"; it's a further chance for a different world, where man is living in harmony with other living beings.
Actually, Italian and European bio-cultural landscapes are maybe not so significant in relation to food security for their inhabitants, in comparison with socio production landscapes in poorer countries, but they represent a guarantee and a point of reference for the further elaboration of sustainable lifestyles and for a high level of quality of life.

Passerano's bio-cultural landscape future

If government intervention is essential to promote and support bio-cultural landscape rebirth, in the future a fundamental role will be played by producers, stakeholders and citizens' private initiatives on the territory.

Today, landscape-friendly business activities are those linked to farm holidays, food and wine tourism, organic farming, or those related to local products marketing, in opposition to the supermarkets concept.

These activities are now slowly recovering in Passerano and, for being strongly linked to the territory and depending on its integrity, they are candidates to play a key role in the economic and social revival in the region and in promoting people's return to the countryside.

Furthermore, under the current economic crisis conditions, a certain return to the countryside and to a small scale real economy, with low initial investment that focuses on the quality of the product is likely conceivable.

However, it's unthinkable to reconstruct a peasant culture similar to the past; it is more likely that today's world draws lessons from the old rural knowledge and instils them into other non-agricultural sectors including: tourism, energy production, services, etc.

For example, in these territories it would be desirable to set up small-scale productive activities' districts, based on matter recycling (which was a peasant culture conceptual foundation), or new activities that use raw materials obtained locally, or a village's program for energy independence through renewable sources, to make the sun and wind main actors again in the production of energy, or even a program for buildings recovery, finalized to match high energy efficiency standards, in order to mimic peasant good practices, like money saving and resources waste containment, and finally an investment program on low impact and high-tech soft technologies.

This is a bet that some local communities, in some respects, have already begun to place, Passerano first and foremost among them. However, there is a fundamental condition to be met for succeeding: that this territory bases itself on ancient knowledge while simultaneously interfacing and making systems with external realities that are pursuing the same goals.

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Title: Assessment of Lentic-Lotic Basin Biodiversity Improvement through a Cyclic Platform Process of Management

Organisation: International Lake Environment Committee Foundation (ILEC)
Theme: Inland water
Keywords: Integrated Lake Basin Management (ILBM), biodiversity-based platform process, knowledgebase and knowledge mining,

Summary

In spite of their global significance, many lakes and other inland waters around the world are in a critical condition and will be most severely affected by the global warming and various human interventions because of their lentic (static) nature as water systems. In coping with such situations, the International Lake Environment Committee Foundation (ILEC: c.f. Attachment 1) has developed a methodological framework called ILBM (Integrated Lake Basin Management) and the ILBM Platform Process.

This paper focuses mainly on two subject areas; one being the presentation of the methodological framework itself, and another being five ILBM case studies from various parts of the world on biodiversity conservation and enhancement. All of the case study topics pertain to the challenges faced by the typical lentic-lotic (e.g., lake-river, pond-stream, wetland-feeder river) systems in developing countries faced with a rapid decline in ecosystem integrity, particularly with regard to biodiversity. Lastly, the paper analyzes the scope of application of ILBM Platform Process, the knowledgebase cum knowledge mining system called LAKES (Learning Acceleration and Knowledge Enhancement System) and the networking of the biodiversity case study projects within the lentic-lotic environments. The proposed methodology may have a wide application possibility to the lateral analysis as well as to the governance improvement process of other biodiversity cases than those related to ILBM.

Introduction

The riparian and watershed basins of lentic-lotic (e.g., lake-river, pond-stream, wetland-feeder river) systems are among the most bio-diverse ecosystems on the globe, and they have been facing serious threats of degradation. The lack of methodological framework for application to practical management is one of the major reasons why such degradation threats have been ubiquitously persisting across the globe. To address this challenge, ILEC has been promoting the concept of ILBM over the past decade or so. With the growing body of knowledge in the application of ILBM concept, ILEC is now configuring a methodological framework called the ILBM Platform Process. The framework aims to serve as a guide in attaining a suitable level of resource sustainability through gradual, continuous and holistic improvement of basin governance as necessary. With the associated knowledgebase system, LAKES, the ILBM Platform Process has so far proven to play an instrumental role in the pursuit of sustainability in lake basin management including those pertaining specifically to the lake-basin biodiversity issues.

The proposed approach, i.e., the combined use of the ILBM Platform Process and the LAKES knowledgebase system would be applicable to thematic cases beyond lake basin management, such as river basin and forest resource management. Further, the cyclic nature of the Platform Process and the knowledgebase development focused on key issue domains of governance (as related to institutions, policies, participation, technology, information and finance) has good potential to serve well in dealing with such broad-scoped subjects as biodiversity enhancement.

Integrated Lake Basin Management (ILBM)

Integrated Lake Basin Management (ILBM) is a conceptual framework designed for assisting managers and stakeholders in achieving sustainable management of lakes and their basins, with its six fundamental pillars for governance improvement as shown in Table 1. The primary characteristic of ILBM is that it is not a prescriptive planning procedure. Rather, it is a compilation of lessons learned from the global experiences of lake basin management in the past, synthesized to address complex planning issues with a basin governance framework that reflects the unique features of lentic waters such as lakes and reservoirs (i.e., long retention time, complex response dynamics, and integrating the surrounding environment and human activities).

For a successful lake basin management, it is essential to fill the gaps between what has already been done, and what remains to be achieved in its application process with long-term and strong political commitment. Continuous efforts will be necessary to further expand and refine the concept of ILBM for a better future of lakes and other water bodies that are now under serious threat of degradation, particularly caused from human activities and climate change.

Table 1: The Six Pillars of ILBM

Institutions: A management system with an appropriate organizational setup helps ensure sustainable benefits to lake basin resource users.

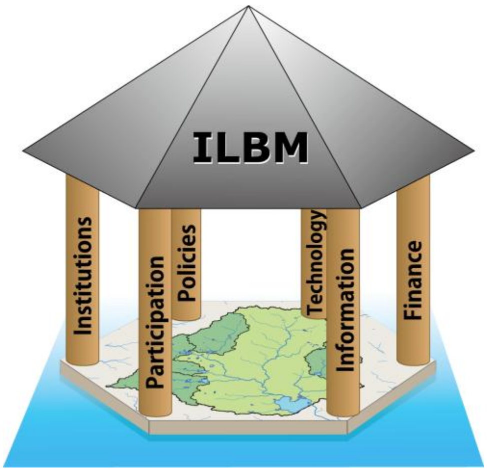
Policies: Policy tools must be better developed to facilitate concerted societal actions for sustainable lake basin management.

Participation: All lake basin stakeholders should participate in decision-making process for sustainable management.

Technologies: Although their effect often tend to be limited in certain areas and short period of time, physical interventions, such as shoreline and wetland restoration, provision of sewerage and industrial waste-water treatment systems, afforestation, mitigation measures for siltation control can play a significant role in improving lake environment.

Information: Scientific and public perceptions on lake basin management can differ from case to case. Without knowledge generation and sharing, human and financial resources mobilized in lake basin management effort may management efforts may prove futile.

Finance: Financial resources should come from all basin stakeholders benefiting from both direct and indirect use of lake resources. Efforts must be made in order to develop innovative approaches for generating locally-usable funds.



ILBM Cases on Biodiversity

Global implementation of ILBM is still in its early stages, yet it has been gaining attention and participation in each project focal point shown in Figure 1, bearing a number of successful cases (http://www.ilec.or.jp/eg/lbmi/pdf/LBMI_Main_Report_22February2006.pdf). Among other things, ILEC is now focusing on further promoting ILBM for conservation of biodiversity and Socio-Ecological Production Landscapes (SEPL), particularly with regard to inland water basins where complex combinations of lentic and lotic water systems exist.

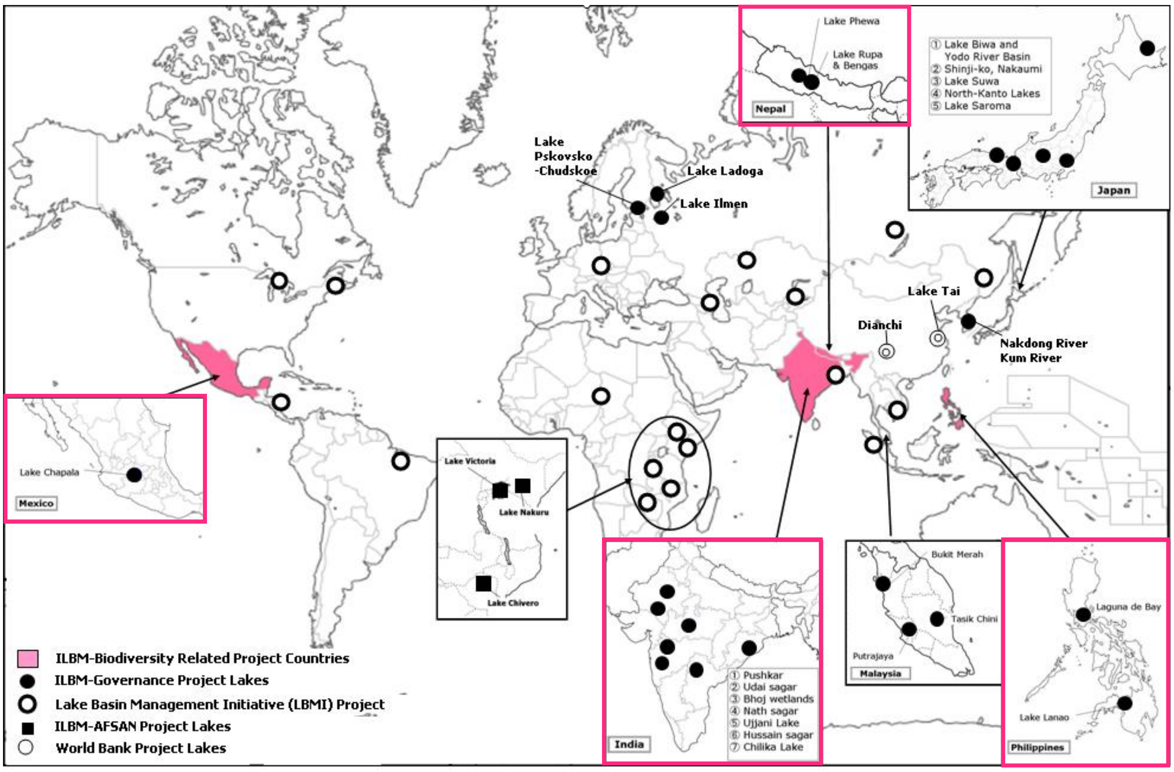


Figure 1: ILBM-related Case Study Lake Locations

The five case studies from the pink highlighted countries in Figure 1 are listed as related case studies in the end of this paper, each comprehensively illustrating how closely a sustainable management of inland water basins is related to their sound ecosystem and healthy human livelihood in coexistence with biodiversity. The project tasks and deliverables seen in these South / Southeast Asian and South American inland water basins are as follows.

In Nepal, the degradation of biodiversity in the Himalayan Lakes is an immediate concern, affecting not only human livelihood and agriculture, but also the entire ecosystem of fauna and flora in its catchment area. Under such circumstances, a promotion of ILBM initiated in Rupa, one of many Himalayan Lakes, has strengthened governance in the local municipalities which in turn restored their abundant ecosystem and boosted economy.

Mexico, where deterioration of the forest ecosystem in the Lake Chapala basin once caused a decline in agricultural production and an increase of the poverty level, is now presenting successful project outcomes from the ILBM approach. The formation of better organization and regulations helped mitigate deforestation, improve agricultural productivity, develop herbal medicinal technology and expedite cost effective eco-technologies, now all generating profits to local livelihood.

In the Philippines, a remarkable restoration of SEPL has been achieved through an implementation of sustainable management in Tadlac Lake. Triggered by the lake turnover and fish mortality from intensified aquaculture proliferation in the late 90s, stakeholders from the local authorities to residents all played important roles in the conservation movement which eventually lead to fundamental consideration for a successful ecotourism program.

India presents two cases from different approaches. The one in the Western Indian tribal belt promotes ILBM as a solution to child malnutrition, which is a challenge imposed by the loss of biodiversity in the regional forest area under the persistent threat of climate change. Now the pilot project conducted shows that all the existing water bodies can be exploited to obtain sustainable food security for the local tribes to eradicate child malnutrition without any external support.

On the other hand, the case in Ujjani Reservoir, where severe river pollution is putting the lives of marginalized people at risk, proves that ILBM is also applicable to river (lotic) basin management. One of the remarkable approaches in their ILBM promotion is utilization of an inventive eco-technology called green bridge, a grafting ecosystem filter to improve self-purification capacity of stream availing bacteria in the local ecosystem.

Despite the background difference, we can observe several measures and effects common in all cases. First of all, strengthening the governance as symbolized in the six pillars of ILBM is a primary step in implementing sustainable basin management. This means their basin management plans and programs for resource development, use and conservation would not be sustainable without a support of appropriate governance framework gearing together as characterized in Figure 2.

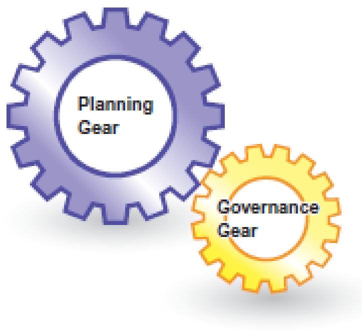


Figure 2: Planning and Governance Must be Properly Geared Together for Sustainable Basin Management

In addition, participation of stakeholders plays an essential part in realization of sustainable lake or river basin management. A lack of awareness of the impacts (of their actions on the aggravated water resources can deter the conservation process. Therefore it is important to continuously work on the wider dissemination of information through educational programs, systems and institutions that can not only help stakeholders learn the proper use of their water resources and understand regulatory interventions, but also encourage them to participate in related grass-root activities.

Eventually, extensive participation under strong governance evolved over time would duly lead to biodiversity enhancement and socio-ecological production landscapes back into the region, which could also bring about better livelihoods. It would also lead to enhancement in local economy, not only through sanitation improvement, but also creating more jobs in such areas as ecotourism, environmental education, and eco-technology applications.

Development of the ILBM Platform Process

The ILBM concept, having evolved from the past lake basin management experiences globally, is continuing to evolve. With such developments in recent years, ILEC has launched a new guideline book entitled “Development of the ILBM Platform Process: Evolving Guidelines through Participatory Improvement” (now available on ILEC official website: http://www.ilec.or.jp/eg/index.html). The guideline book presents the ILBM Platform, or a virtual stage for improving basin governance through ILBM.

General Steps of the ILBM Platform Process

The ILBM Platform Process takes the following steps for all platform members: The first step is to acknowledge the state of their lake basin management by making a lake brief, or a collective action report. Table 2 is a general outline of the report which helps systematically raise appropriate questions for corrective actions. The second step is to identify and analyze the issues, needs and challenges regarding the six pillars of ILBM, and the third step is to integrate the ways and means to meet the governance challenges and implement actions.

Table 2: General Outline a Lake Brief

1. Introduction
2. Description of the Lake (supplemented by Annex A below)
3. Management of the Lake and Its Basin
4. Major “Impact Stories” of the Lake
5. Major Lake Basin Governance Issues (supplemented by Annex B below)
6. Key Challenges to Lake Governance (supplemented by Annex B below)
7. References

Annex A: Lake Questionnaire, or a checklist of data and information on biophysical and managerial issues facing the lake basin
Annex B: Six Pillars of Governance, or a check list flowchart of the governance issues facing the lake basin)

Once the Platform is formed, the existing lake basin management information can be compiled and analyzed as necessary and as possible, by a small expert group formed to undertake the platform supporting activities. If feasible, the collected and analyzed data and information can be transformed into inventories of data and information and made available through a database and a knowledge base. The team may then be able to share the results with a much broader circle of stakeholder organizations, as a means of deciding on their respective roles and responsibilities for pursuing concerted actions.

ILBM Platform May Grow to Become a Cyclic Process

How each of the case study lake basins will be able to improve its governance toward sustainability depends on a number of factors. For some, the conventional approach in planning, without explicit reference to the concept of ILBM, may be adequate for addressing their sustainable management. But the experience and lessons learned from the ILBM cases compiled over the years imply two things quite clearly. Firstly, since lake basin management is not a project but a long-term governance improvement process, it has to evolve over many years and decades toward sustainable resource development, use and conservation. Secondly, even without calling it ILBM, the process adopted in successful lake basin management cases entail gradual but continuous improvement of lake basin governance. This idea is presented as a Cyclic ILBM Platform Process in Figure 3.

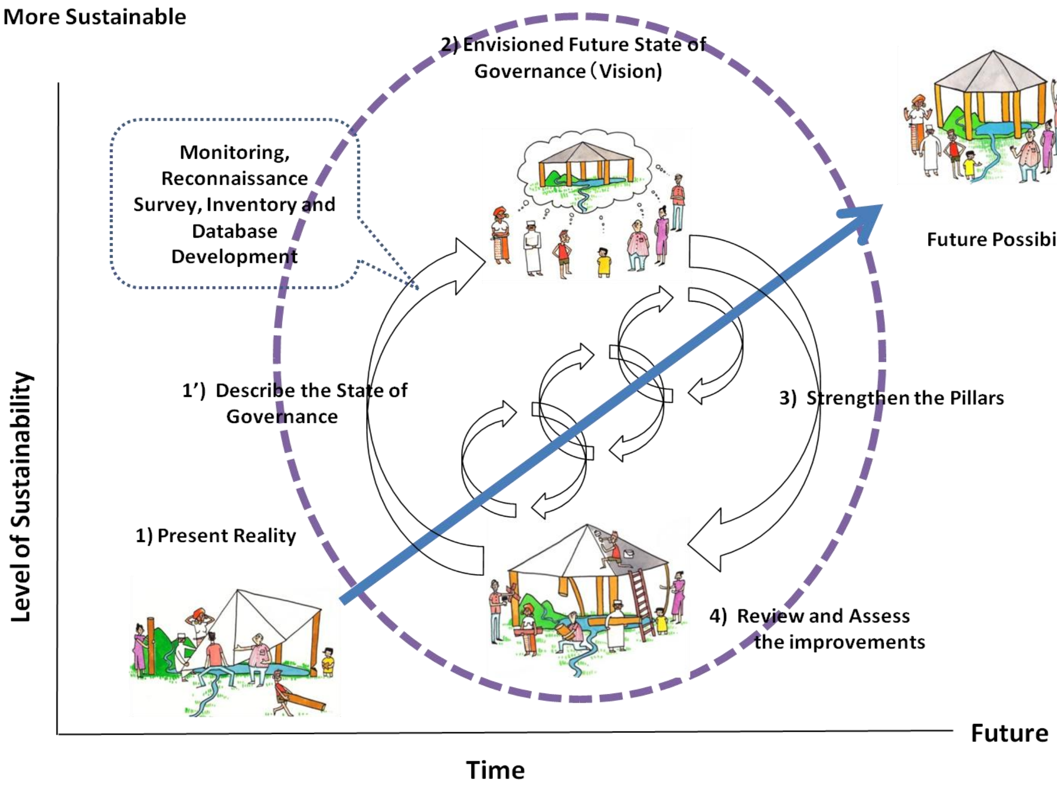


Figure 3: Schematic Illustration of a Cyclic ILBM Platform Process

The gradual envisioning step in the cyclic process of governance improvement has important implications for many of the emerging issues facing us, not only within the context of lake basin management, but also within the broader issues of sustainable livelihoods in the face of a growing need to deal with such complex issues as climate change impacts, diminishing biodiversity, health threats associated with both acute and chronic problems stemming from degraded lentic water environments, as well as the catastrophes associated with hydrologic extreme events such as floods and droughts, which often defy our capability to predict. Surprisingly, in fact, the number of ILBM applications is increasing in these areas, which go beyond the realm of the conventional concept of lake basin management.

Challenges and Prospects of the ILBM Platform Process

The challenges facing ILBM are obviously enormous. The process presented in the ILBM Platform is still in its infancy, as far as its recognition to deal with the mainstream water issues debated in the international community is concerned. Nevertheless, as the majority of the accessible freshwater resources on our planet are interlinked lentic-lotic systems of various levels of complexity, and their requirement for special care in management that has not been well understood, with most of the international fora having overlooked this aspect, it is time that ILBM emerges and plays an important complementary role in managing not only lakes and reservoirs, but the range of other water systems within their basins and beyond. ILEC will continue collaborative work with its worldwide counterparts for further development and proliferation of the methodology, whose process has the following merits described in Table 3.

Table 3: Identified Merits of the ILBM Platform Process

1. Non-prescriptive design: The non-prescriptive and flexible narratives of the lake brief allow the basin community's values, in terms of socio-cultural and historic backgrounds, to be properly reflected in the ILBM Platform process.
2. Updating of information: The periodic revision of lake briefs also helps update the issues and prepares the stakeholders to meet new challenges.
3. Joint preparation: The joint preparation of a lake brief helps clarify specific needs, challenges and approaches for productively addressing important lake basin governance issues.
4. Wide range of issues without prejudice: The lake brief design and The ILBM Platform concepts accommodate a wide range of views from stakeholder groups and individuals without undue prejudice or prerogatives.
5. Fostering of common vision: The ILBM Platform provides a basis for sharing a common vision and for resolving differences in ideals.

Knowledge Base and Database for Sharing and Learning from the Global Experience

"LAKES": Knowledge Base cum Knowledge Mining System

An enormous quantity of information has been generated so far, and will continue to be generated, on a wide range of subjects pertaining to lake basin management, both on a national and international basis. Much of it pertains to natural science topics, including physical, chemical and biological aspects (limnology, hydrology, climatology, ecology, biochemistry, etc.), all of which contribute to understanding the state of lakes, reservoirs and other lentic water bodies, both individually and collectively. There also is a growing number of studies on the managerial aspects of aquatic, terrestrial and riparian ecotone systems, including water quality, sediment, and riparian environment improvements as well as those of inflowing and out-flowing water systems extending out to the upper watershed tributaries.

Given this situation, developing and sharing the knowledge being continually generated and accumulated is ever more important, particularly with regard to the ILBM Platform approach or any other approaches adopted in different parts of the world. For the purpose of addressing this goal, an interactive knowledge base with knowledge mining system, called LAKES (the Learning Acceleration and Knowledge Enhancement System) has been developed at the Research Center for Sustainability and Environment, Shiga University, Japan (RCSE-SU), in collaboration with the National Research Institute for Humanity and Nature (RIHN), Kyoto, Japan). A screenshot of "LAKES" is shown in Figure 4. LAKES currently has the capacity to process several hundred documents for 'mining' the imbedded knowledge with the use of free keywords, as well as the use of a prepared thesaurus, ranging from the level of the whole documents, pages, paragraphs, or even individual sentences. LAKES also is linked to the World Lake Database described below, and will soon be linked to Geographic Information Systems (GIS) resources and other important websites providing for complementary sources of data and information.

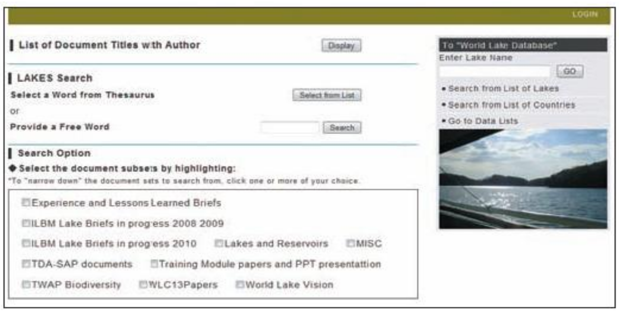


Figure 4: A Screenshot of "LAKES"

"World Lake Database"

As a repository of the output of Survey of the State of World Lakes (1986- 1988), a database system called the World Lake Database was developed and made accessible through the ILEC official website for those interested in reviewing and downloading information and data for individual lakes, as well as for cross-cutting analysis among the lakes of water quality parameters. This system can also serve as a depository of lake basin management data that may already have been generated and made public only in the form of hard-copy reports and technical papers, but not in an electronic database because of an inability to develop and maintain such a system. As the number of ILBM-related efforts increases, such a need will increase as data and information compiled in the form of Lake Briefs is also expected to grow. A screenshot of the World Lake Database is shown in Figure 5.

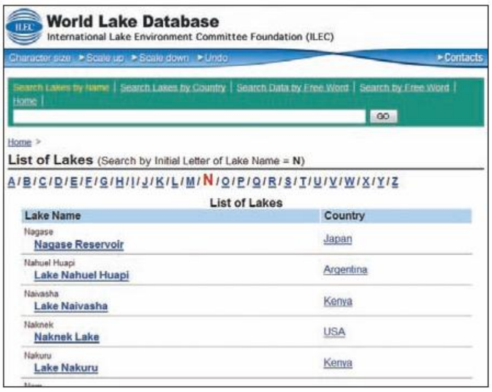


Figure 5: A Screenshot of "World Lake Database"

Therefore, "LAKES" and "World Lake Database" are both intended to be meaningfully linked for prospective ILBM activities in order to make the best use of the already-existing information facilities and data sources that have been available for public access. The web links to these two knowledge base and database systems are listed in the end of this paper, together with other related global database systems on inland water management.

Expanding the Scope of ILBM Application to Other SEPL Cases

With the aforementioned merits of the ILBM Platform Process and together with the associated knowledge base and database mining systems, ILEC will continue collaborative work with its worldwide counterparts for further development and promotion of sustainable inland water basins and biodiversity management. Figure 6 illustrates how ILEC's major proposal with the platform process and knowledge mining systems could work in an enhanced global network, including its future partners under IPSI.

As examples of the figure above, Table 4 shows how the other five case studies in Nepal, Mexico, the Philippines and India could further extend their ILBM project by using the assessment methodology of ILBM Platform Process, and also analyze the linkage with other related project focal points by using knowledge mining systems like LAKES and WLDB.

ILEC – IPSI Project Perspectives

ILEC-IPSI

Methodology for the Benefit of Biodiversity / Human Well-being Governance & Management

"ILBM-SEPL Platform"

Knowledge Base & Database Mining System

"ILBM-SEPL Knowledge Base"

Worldwide Network with ILBM-SEPL Project Focal Point

		Examples
Platform Process	1.Collective action report (as an alternative to "Lake Brief")	Lake / River / Forestry/ Micro-watershed Brief
	2. Criteria for a cydic assessment process	Monitoring, reconnaissance, survey, inventory & database, participation, organization
	3. Indicators for review	Biodiversity, water quality, economic growth, poverty level, employment rate, agricultural / fishery crops, education, health / sanitation improvement
Knowledge Mining	1. Existing thematic field	Water quality control, sewage treatment, agroforestry, eco-tourism, eco-technology, medicinal & nutritional science
	2. Prospective thematic field	Green-approach (i.e. ,eco-tourism / eco-technology), agroforestry, fishery, medicinal plant technology, sewage treatment, healthcare
	3. Supplemental information & sources for enhancement	Securing finance, stakeholders' participation, technological development, education, job training
Networking	1. Spatial linkage among fields	Subtropical / tropical woods & water bodies, urbanization, industrialization, monsoon, deforestation, high latitude,
	2. Horizontal linkage among regions	Lake / river / micro-watershed basin communities
	3. Vertical linkage among people and collectives	National / municipal governments & authorities, local NGOs, fishers, farmers, indigenous people, tribals, researchers, engineers, doctors

	Nepal: Lake Basin Livelihood	Mexico: Forest restoration	Philippines: SEPL of Lake	India: Child Malnutrition	India: River Water Quality
Platform Process:					
1.Collective action report	Micro-watershed Brief	Micro-watershed Brief	Lake Brief	Lake and River Brief	River Brief
2. Assessment in a cyclic process	Monitoring, reconnaissance, survey, inventory & database, participation, organization	Monitoring, reconnaissance survey, inventory & database, participation, organization	Monitoring, reconnaissance, survey, inventory & database, participation, organization	Monitoring, reconnaissance survey, inventory & database, participation, organization	Monitoring, reconnaissance, survey, inventory & database, participation, organization
3. Review with indicators	Biodiversity, water quality, economic growth, poverty level, employment rate, agricultural crops, education	Biodiversity, water quality, economic growth, poverty level, employment rate, agricultural crops. education	Water quality, fish crops, economic growth, poverty level, employment rate education	Biodiversity, water quality, economic growth, poverty level, employment rate, health & sanitation improvement, education	Biodiversity, water quality, economic growth, poverty level, employment rate, health & sanitation improvement, education
Knowledge Mining :					
1. Existing thematic field	Water quality control, sewage treatment, eco-tourism, agroforestry	Water quality control, eco-technology, sewage treatment, eco-tourism, agroforestry	Water quality control, fishery technology	Water quality control, medicinal & nutritional science	Water quality control, eco-technology
2. Prospective thematic field	Eco-tourism, agroforestry, medicinal plant technology	Eco-tourism, agroforestry, medicinal plant technology, eco-technology	Eco-tourism, fishery	Primal & maternal healthcare	Sewage treatment, eco-tourism , eco-technology
3. Supplemental information & sources for enhancement	Securing finance, stakeholders' participation, technological development education, job training	Securing finance, stakeholders' participation, technological development, education, job training	Securing finance, stakeholders' participation technological development education, job training	Securing finance, stakeholders' participation, technological development	Securing finance, stakeholders' participation, technological development, education, job training
Networking:					
1. Spatial linkage among fields	Subtropical woods & water bodies, urbanization, industrialization, monsoon deforestation, high latitude	Tropical woods & water bodies, urbanization, industrialization, deforestation	Tropical water bodies, monsoon	Tropical woods & water bodies, monsoon, urbanization, industrialization	Tropical water bodies, monsoon urbanization, industrialization
2. Horizontal linkage among regions	Lake basin community	Micro-watershed basin community,	Lake basin community	Lake and river basin tribals	River basin community
3. Vertical linkage among people and collectives	National / municipal government &authority, local NGOs, fishers, farmers, researchers	National / municipal government &authority, local NGOs, farmers, fishers, researchers, indigenous people	National / municipal government & authority, local NGOs, fishery groups, fishers, researchers	National / municipal government &authority, local NGOs, tribals, doctors, researchers	National / municipal government &authority, local NGOs, engineers, researchers

Conclusion

Although ILBM was initially developed for the field of lake basin management, its methodology can be applied to a wide range of environmental issues with governance improvement challenges. Thus, the six pillars of governance for ILBM may well be the six pillars of governance for SEPL. The ILBM Platform Process can be adapted as a SEPL methodology, as a SEPL Platform Process. As shown in Figure 7, the conceptual framework and strategic program may serve as an efficient approach for managing various universal ecosystems and environmental resources for sustainable co-existence and mutual use, through a gradual, continuous and holistic, global improvement of their governance over a long period of time.

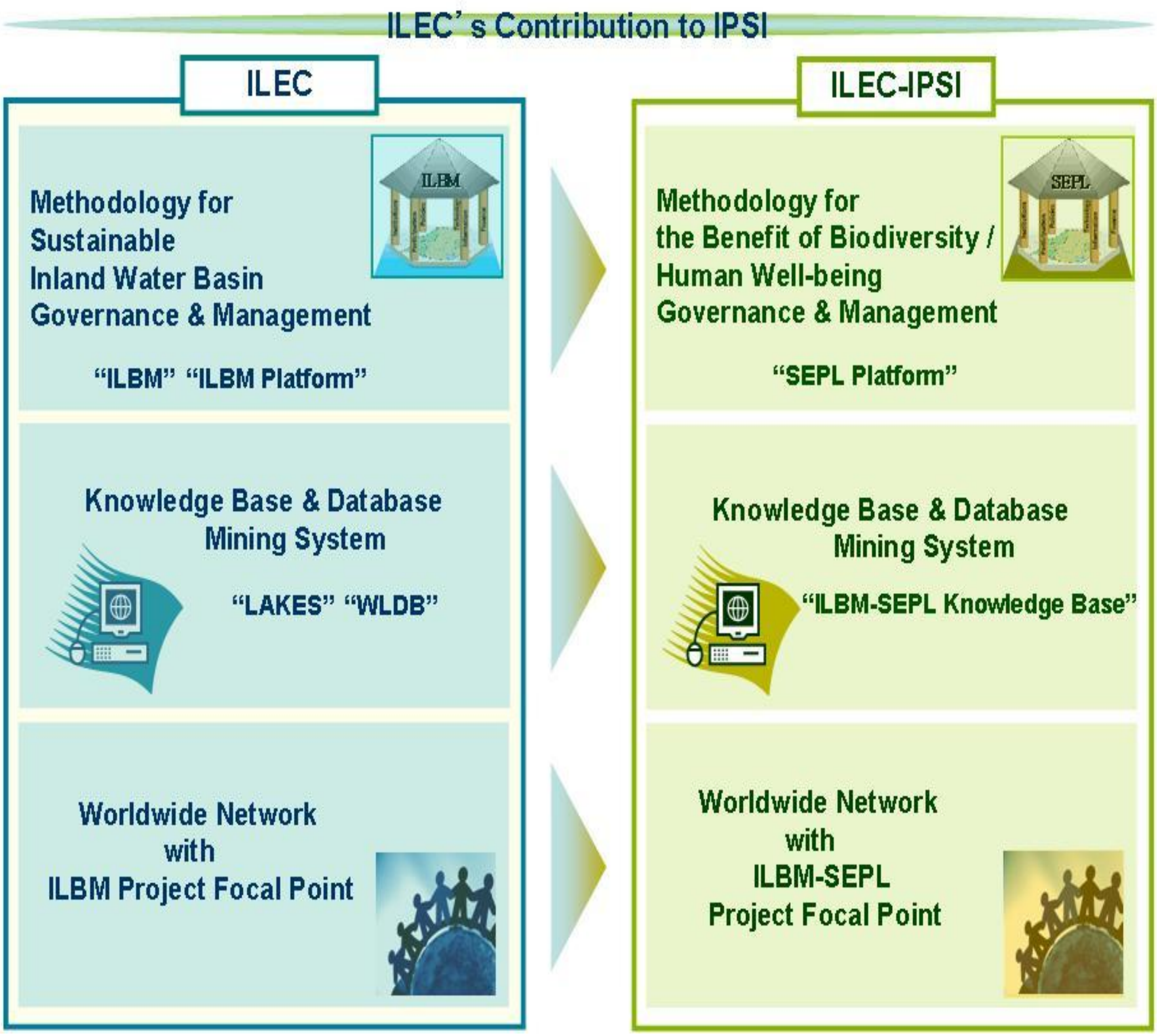


Figure 7: Proposal Diagram, "ILEC's Contribution to IPSI"

Title: On-Farm Conservation of Plant Genetic Resources: A Case Study from Wayanad District of Kerala, India

Organisation: M S Swaminathan Research Foundation (MSSRF), Community Agrobiodiversity Centre
Theme: Agricultural land
Keywords: on farm conservation, agro-biodiversity, wild foods, traditional knowledge and biodiversity hot spot

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Summary

This paper describes the plant genetic resources of food and agricultural value that occur in Wayanad district - a hot-speck in the world biodiversity hotspot of Western Ghats. About 75 rice varieties were once grown in the district, suited to the land classification and geo-climatic peculiarities, but this has now narrowed to around 15-20 rice varieties. The genetic diversity of the rice in the district is known for its specialty varieties, which have aromatic and medicinal properties. Roots and tuber crops occupy a prominent place in edible crop diversity.

Traditionally, a wide range of landscapes, mostly outside forests, have been accessed by tribal communities for a wide range of food and edible products. Wild food collection varies from trapping small animals or digging root tubers to cultivating greens in agricultural fields and catching fish and crab - major sources of animal protein. The Kattunaikka community possesses knowledge of 177 wild food species, while Kuruma, an agricultural group, knows some 88 species/varieties. The study reveals that traditional land use is a sustainable pathway for protecting genetic diversity of crop plants and the diversity of available wild food plants. Enhancing on-farm diversity is important in view of not only improving food security, but also for reducing greenhouse gas emissions from agricultural landscapes.

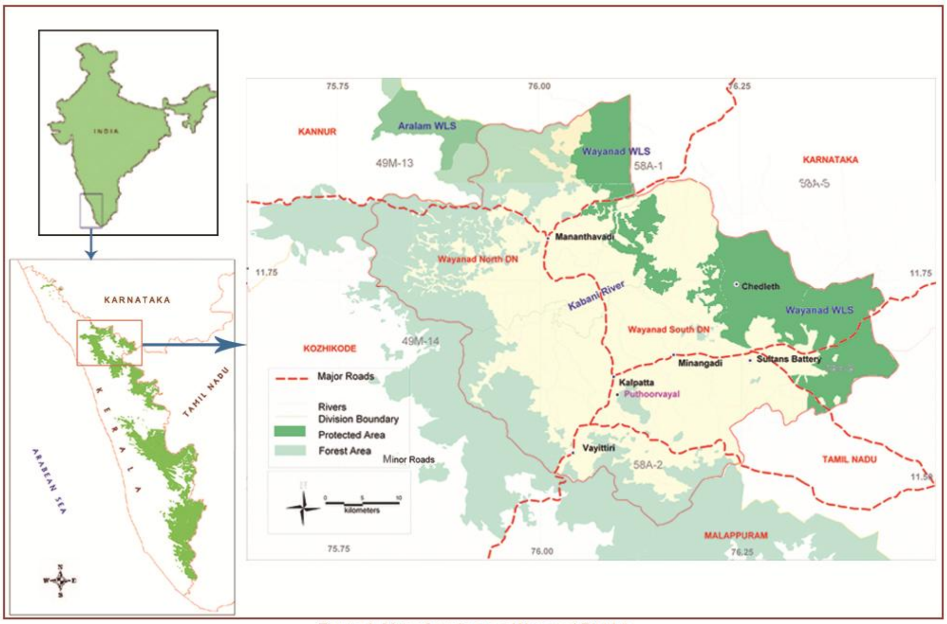

Figure 1. Map of study area: Wayanad District

Introduction

India is a Centre of Origin and Centre of Diversity for crops like rice, Indian dwarf wheat, kodo millet, legumes like black gram, green gram; spices such as black pepper, turmeric, cardamom and ginger; and fruits like jackfruit and mango. This important food and nutritional resource is a major component of agrobiodiversity in India and is viewed as a link with the ethnic and cultural diversity that encompasses over 550 tribal communities living in diverse agro-ecological regions across the country. Since the 1970's the change in land use practices and land cover of agro-ecosystems has been rapid and rampant across the country, and has resulted in heavy losses of genetic diversity in all the indigenous crops and breeds, in addition to drastic degradation of major ecosystem services like soil building, water purification, seed dispersal, pollination, etc. To cite one example, Kerala, which covers hardly 2% of the land area of India, has recorded nearly 25% of the country's biodiversity. But various reports show that in Kerala there is a high degree of degradation along different biodiversity levels, most importantly in terms of agrobiodiversity, and in most ecosystem services categories. For example, almost all of the narrow endemic species of plants or animals have degraded populations. The fresh water recharging capacity and soil formation in most of the mountain regions has been drastically reduced, and in the case of agrobiodiversity, near depletion has been reported in traditional crop and breed diversity and services of marine and fresh water ecosystems.

Threats ranging from habitat destruction to biological invasion, commercial exploitation and pollution continue to pressure such services in the state. In regards to the example above, it is almost certain that climate change can cause further degradation to all these goods and services, in particular those of forests, fisheries and the agricultural sector, as Kerala is one of the most vulnerable states in India in terms of climate change impacts. Many biologically diverse regions like the Wayanad-Silent Valley region, Cardamom Hill region, etc. continuously experience unprecedented and irreversible changes to the structure and functions of their ecosystems, including the associated bio-geo chemical cyclic functions.

This paper examines the case of the Wayanad district of Kerala with reference to how much diversity is present there in terms of plant genetic resources of food and agricultural value, and what is happening to this diversity and the landscapes where it is located. MSSRF efforts to conserve such diversity on-farm are also highlighted in the paper.

Agrobiodiversity of Wayanad

Wayanad is located from 110 26' 28'' - 110 58' 22'' N latitude and 750 46'38'' - 760 26'11' E longitude. It is a hilly terrain at the southern tip of the Deccan plateau covering an area of 2136 sq. km with an average altitude of around 750 m. The district is unique for its rich wealth of flora and the diversity of its ethnic cultures. The low altitude hills are filled with plantations of tea, coffee, pepper and cardamom, while the valleys are dominated by paddy fields. From the highest altitude of the Western Ghats on the western border of the district, the plateau of Wayanad gradually slopes down towards the east. Further from Mananthavady, it becomes a common plain of paddy fields with the swift flowing Kabani coursing through it.

The district is a natural habitat and one of the state's biggest producers of spices, beverages, fruits, vegetables, medicinal and aromatic plants, and NWFPs. The district (ca. 2136 sq.km in size) contributes significantly to the state's foreign exchange earnings through most of its spice crops. The district's traditionally managed landscapes used to be habitats for endless genetic diversity in cultivated food crops and plantation crops.

The Case of Traditional Cultivars of Rice

Records reveal that in the past, approximately 75 traditional rice varieties were in cultivation in Wayanad district, and were suited to various land types and agro-climatic peculiarities of the region. Most of these varieties were marked by distinct functional traits that assured stability of the population and by better suited mechanisms for dealing with various biotic and abiotic stresses. The traditional rice genetic diversity of the district has now been narrowed down to less than 20 varieties (Photo 1). Many of these varieties provide several kinds of insurance against crop failure to the farmers. Cooking quality, grain colour, aroma, calorie content, feeling of stomach fullness, medicinal qualities, high fodder and grain yield are some of the main attributes that influence the choice of a variety from among the traditional rice cultivars of the district. There are also varieties with fine aroma and medicinal qualities. One of the varieties of rice with special significance is Navara, a variety known for its medicinal value and extensive use in Ayurveda for treating problems related to rheumatic complaints. These varieties become extremely important as an adaptation option for farmers facing imminent climate change impacts. (Photo 8,9).

The following twenty varieties are now in cultivation in the district, largely in the tribal areas.

Veliyan (Mannu Veliyan): Drought and flood tolerant, source of high calorie energy, used in the brewing of home liquor, the burned husk is highly regarded for making homemade tooth powder; Chettuveliyan: Flood resistant, comparatively high yield, bold and red coloured grain, nutritious and tasty rice, it gives a feeling of fullness when consumed, resistant to various biotic and abiotic stresses, high fodder yield as well as grain yield; Palveliyan: Highly preferred for rice gruel ('Kanji'), white kernel; Thondi: Tasty rice, red kernel; Palthondi: Highly preferred for rice gruel, white kernel; Marathondi: Red and stiff rice; Chennellu: Holy and medicinal rice, used as a cure for stomach ulcers, vomiting etc; considered as the king among traditional rices; Kaima: Scented rice, preferred for preparing breakfast dishes and ghee rice; Urunikaima: Scented, preferred for preparing breakfast dishes; Mullankaima: Scented, used for special family occasions; Poothadikaima: Scented with strong aroma, preferred for preparing beaten rice; Gandhakasala: Scented, preferred for Biriyani and Payasam on special family occasions; Jeerakasala: Scented, preferred for Biriyani and Payasam on special family occasions; Mullanpuncha: Drought resistant; Thonnuran Thondi: Short duration, traditionally treated as famine crop, harvested under emergency circumstances during scarce periods; Kalladiyaryan: Highly drought resistant, suitable for valleys and terrains; Onavattan: Tasty rice, introduced variety; Chempathi: Scented rice; Chomala: Highly tasty rice, white kernel, preferred for the preparation of breakfast dishes during special occasions; Chenthadi: flood tolerant, tasty grains.

The Case of Traditional Cultivars of Legumes

Local communities in this district have been using different wild and traditional legume cultivars for food and medicinal purposes for a long period of time. Looking at the importance of such biological resources, efforts have been made to identify and conserve such species and cultivars on the basis of their relative importance to the food and nutritional security of low-income forest communities. The tribal communities of the district have been conserving over 20 different legume cultivars. These genetic variations are of prime importance for successfully breeding improved cultivars with added value and desirable resistance to disease and pests. These varieties need to be continuously cultivated by providing proper recognition and rewards to the individuals conserving them (Photo 4).

The Case of Traditional Cultivars of Yams

Yam root has been cultivated as an agricultural crop and eaten for centuries in many cultures. The importance of yam diversity in Wayanad has been historically recognised by the native inhabitants, and this diversity has been used in various ways to meet their food requirements and other cultural/ spiritual needs. However, many of the cultivars of edible Dioscorea have now been discarded mainly due to the advent of potatoes in the food table and also due to cultural erosion. In order to address this situation, MSSRF has intervened with the objective of establishing community seed banks integrated with in situ on-farm conservation that allows for long-term conservation of cultivated yam varieties. Most yam varieties and species do not produce seeds and therefore cannot be conserved in conventional gene banks. Twelve varieties of yams were collected from the district, and all these varieties are maintained at the Community Agrobiodiversity Centre's Field Gene Bank (Photo 2).

The Case of Wild Foods

The consumption of wild plants seems more common and widespread in food insecure areas, where a diverse range of species is consumed. Many tribal and rural families of Wayanad still conserve a wide range of plants for their food needs. For some of these communities, the consumption of wild-food plants seems to be one of the important local survival strategies, and many of these species are not just consumed during periods of drought, food scarcity and other hardships, but also form part of their regular dietary intake. Narayanan et al., (2003) reported the food use of about 343 taxa by 3 different tribal communities from this district (Photo 5). The study sought to focus its attention on the wild food management practices of three prominent tribal communities of Wayanad, namely the Paniya, Kattunaikka and Kuruma. The Paniya are predominantly a landless group working as wage labourers and living close to agricultural landscapes, particularly the paddy fields. The Kattunaikka are traditionally a food-gathering tribe and live close to the forests. The Kuruma are a settled community, living together in joint families and engaged in agriculture.

There is remarkable variance in how different communities access different landscapes and their consumption patterns of wild food. The Paniyas provide a fine example of a community that depends heavily on the semi-wild environment for their food and other needs. Historically, they were bonded labourers, who were involved in strenuous labour in their masters' fields from dawn to dusk. In the past, the wages were paid in kind (a fixed measure of paddy, most often), and along with the food gathered from the wild, contributed to their diet. They continue to live neither as a purely forest-dependent community nor as full-time agricultural producers. They are efficient in managing the disturbed semi-wild environment that traverses paddy field-margins and bunds, irrigation canals, thickets, road-sides and home gardens, containing a substantial number of species and varieties. The men and women of this community have acquired knowledge on 222 wild edible species, most of which are accessed and utilised from this disturbed environment. Traditionally, they accessed the forest ecosystem to trap small animals or dig root tubers, and the agricultural fields to gather greens or to catch fish and crab, which constituted a major source of their animal protein. The Kattunaikka who live in the forest environment are on the same level with the Paniya in terms of their knowledge and dependence on wild food for sustenance. They possess knowledge of 177 wild food species, while the Kuruma, an agricultural group, know only 88 species/varieties (Photo 3).

An examination of the patterns of accessing wild food from various landscapes by different communities indicates the following: It is evident that the Paniya access almost all types of landscapes for wild food, and the Kattunaikka have greater access to forests and rivers for wild food collection. Except in the case of the Kattunaikka, the landscapes accessed by women are closer to their homes, while the ones farther away are accessed by men.

An attempt was made at Muthanga of Wayanad Wildlife Sanctuary, in the dry zone of the district, to study the social hierarchy among the four socio-cultural groups- Kattunaikka, Kuruma, Paniya (the tribal communities) and Wayanadan Chetty (a non-tribal community) - in their consumption of different wild foods. The study shows that different communities have varied preferences towards different wild food species and attach values to them based on their social status. Kuruma and Kattunaikka know that Noonji (a kind of snail) is a safe and edible delicacy and is available in large numbers in wet areas like paddy fields and shallow streams, but they do not include this in their diet. When asked about this, they replied that 'only the Paniya consume Noonji'. It is considered a matter affecting social prestige to consume it as food, but when prescribed as medicine for certain ailments, other communities show no hesitation in consuming it. Such differences were also observed in the case of some leafy vegetables, mushrooms, tubers and crabs. Maracheera (Embelia tsjerium-cottom) is a kind of green widely consumed by the Kattunaikka, but no other community in this area eats this species, despite its availability in their vicinity. Likewise, the Kattunaikka only consume tubers such as Dioscorea pubera and Dioscorea hamiltoni. These are instances that reflect how a landscape is accessed and managed in different ways by different communities during different seasons (Photo 7).

However it has been observed that Wayanadan Chetty families consume many species that are also consumed by the Paniya. The fact that both of the communities use the same nomenclature to describe many wild food species is, in a way, indicative of the common knowledge that they share about the use of these species. But the Chetty avoid certain species consumed by the Paniya, which require strenuous processing to be rendered edible. It has been observed that the Wayanadan Chetty encourage the Paniya to catch crabs from their paddy fields as a crop protection mechanism, because the crabs damage the paddy seedlings. It was not very evident from the survey, whether the Paniya have been privy to any knowledge that was the preserve of the Chetty. The Chetty women, however, whom the study records to have knowledge of about 19 leafy greens, acknowledged that they came to know of the uses of several herbs from the Paniya women. But in the case of mushrooms, the Chetty do not rely entirely on the Paniya's knowledge, and many varieties of mushrooms that the Paniya women render edible through processing are considered deadly poisonous by the Chetty women. Similarly, the Chetty are indebted to their Kattunaikka labourers for much of their knowledge about edible tubers, and they identify most wild tubers by the names that the Kattunaikka use for various Dioscorea species (Photo 6).

There is insufficient sharing of knowledge among various forage communities regarding wild food. The reasons for this are not yet clearly understood. It may be an indication of cultural and social identity of each community, and group rivalries may also play a role. This was more evident among powerful and autonomous clans belonging to the same socio-cultural group, like the Kuruma. It is also possible to view this as some kind of a management approach for the allocating and accessing of different resources by different communities. No doubt, social hierarchies among tribal communities and between tribal and non-tribal communities do play a role in traditional knowledge remaining, by and large, the preserve of each community.

What is happening to the Agrobiodiversity of Wayanad?

Changing Land Use

Today, the agrobiodiversity of the district is experiencing tremendous transformation due mainly to changes in land use practices and the preference for high yielding varieties. The neck-deep marshy lands, which were cultivated with rice in the past once or twice a year, have now been transformed into fields that can be ploughed by a tractor. As a consequence, swift surface water depletion and draining takes place, particularly when banana or betel nut palm cultivation is replaced with rice crops. Conversion of land for non-farm use and erroneous land management practices have negatively impacted natural resources. The intensive cultivation practices and manuring patterns adopted in the plains were copied as such, without consideration for the fragility of the soil or the topography of the district's highland. The heavy land tilling on the slope resulted in serious soil erosion, and the absence of soil conservation measures heightened the pace of soil erosion. During the monsoon season, runoff rates increase and soil erosion rates reach their highest point. The result is that the fertile topsoil is washed off every year causing nutrients to leach and wash away from the agricultural fields.

The indiscriminate use of chemical fertilisers and pesticides poses a number of problems. The replacement of paddy cultivation by banana plantations, accompanied by the liberal use of chemical inputs, has annihilated the soil's micro flora and fauna, and has posed serious threats to the typical wetland ecosystem and biodiversity. The toxic residues reach kenis (shallow, unprotected wells for drinking water dug near paddy fields) and contaminate these sources of drinking water depended on by small and marginal land holding communities, especially tribal communities. The careless handling of pesticides and chemicals can open the door for many diseases. Used pesticide bottles also get thrown into water bodies like streams and canals, which causes water pollution and harms innumerable aquatic organisms. The chemicals used in the upland areas reach the low-lying areas through run off and leaching processes, and contaminate the streams and rivulets in valleys. It magnifies the spread of toxic residues to all those who depend these water sources and causes health hazards.

Changing Perceptions in Wild Food Consumption

Until about two decades ago, wild food made up the greatest portion of the Kattunaikka community's food intake. Men and women played a near equal role in every dimension of wild food collection and management. The income earned from the marketing of wild foods like honey, garcinia, gooseberry, etc. was spent to benefit the family as a whole. The Kattunaikka were once a group solely dependent on foraging in which men and women contributed equally to the collection of greens, digging of tubers, hunting, fishing and other jobs.

The trend has changed steadily since the 1980's though. Changes in land use patterns, restrictions on forest access, developmental interventions, etc. have been cited as the causes. It has been observed that gender roles shift in relation to changing socio-economic contexts. Gathering greens is now generally women's work, as in the case of the Paniya, Kuruma and other settled communities. However, in certain study sites, for example in Muthanga and Aranamala, the Kattunaikka women are now engaged in food production. They tend small home gardens where wild food species collected from the forests have been introduced. They are aided by the men, who collect various wild species from interior forests. In Aranamala, the food basket of the Kattunaikka settlement has been considerably reduced as a result of the people devoting their entire land holdings to the cultivation of cash crops. In terms of wild food management, this trend has ultimately resulted in various plants and animals being discarded, although they were once relished portions of their diet. The cash crop economy has also resulted in mainstream patriarchal society seeping into all the associated structures of property owning in the community.

The tubers that the Kattunaikka women have sought to introduce in their fields also bear out the truism: what is conserved is related to who collects it. The preference is for varieties fit for making side dishes and not for those varieties that are good for roasting or steaming, which constitute full meals in themselves. Women also place emphasis on species that are not commonly found in the vicinity of their habitats. It has been noted that the Kattunaikka women take a special interest in collecting Cheruthen, a highly nutritious and medicinal honey that is ideal for infants. It was never a practice to sell this rare variety of honey, which entailed great pain and intense labour by the Kattunaikka women during the collection process. Women's perceptions about the value and usefulness of a product play a significant role in the effort they make towards its sourcing, preservation and management.

The Kattunaikka are prominently involved in wild food marketing. Nellikka (Emblica officinalis), Poopal (lichen species), Kodampuli (Garcinia gummigutta) and honey are the most widely collected non-wood forest products, and are important sources of income for families. Both women and men are engaged in the collection of all these products, with men taking a leading role in their collection and sale. While competition for accessing these products has increased, it has not pushed the Kattunaikka men and women to resort to unsustainable harvesting practices habitually engaged in by the mainstream communities. They would not, for instance, cut down the entire fruit-laden branch of a gooseberry tree, just because it is convenient to collect the fruits from the grounded branch.

Declining Knowledge of Wild Foods

The decline in knowledge related to wild foods across successive tribal generations is a reality amongst all the communities, including forest dwelling communities like the Kattunaikka. An exercise carried out with three generations of the Kattunaikka community revealed a trend not very different from what was obtained in a similar exercise with the Paniya. Ten attributes were tested among the respondents by asking direct questions about their knowledge related to identifying, accessing, processing and management of wild food. The sample included a total of 120 individuals. The knowledge providers were divided into three age groups: 5 to 18, 18 to 40, and above 40. The results show a sharp decline in knowledge transfer between the 2nd and 3rd generations. More than seventy percent of the children pleaded ignorance for every single attribute tested. The girls showed marginally better knowledge compared with the boys, and were better informed about mushroom collection and processing. The sharpest decline in transfer of traditional knowledge was in the identification of edible yams, processing of root tubers like colocasia, extraction of palm powder and the art and technique of tree climbing. It was surprising to note that the majority of the boys could not even climb short trees, in light of the fact that they belong to a community in which the men climb dizzying heights to access honey. It was also noted that children who attend school are barely aware of most wild food species, except for fish and crabs. The limiting role of school in the transfer of traditional knowledge in this community was similar to that for the Paniya children. A relatively high percentage of the second generation (age group 18 to 40) of Kattunaikkas were knowledgeable about most of the attributes and continue to prefer wild foods to those available at the market. More than 80% of men and women of this age group were equally knowledgeable about attributes of honey collection and yam management. They were also quite conscious of the reasons for depletion of wild food resources. But many of the men and women in this age group did not know how to extract sago (palm powder) from Arenga and Caryota palm, or how to identify epiphytic edible mushrooms. Women in this category were better informed than men on techniques like the catching of crabs and processing of colocasia and mushrooms. The respondents in the over 40 age group did relatively well in all ten attributes, except for tree climbing. As expected, women across all age groups did not report any expertise in this area.

Conclusions

The study shows that traditional land use is a sustainable pathway for the protection of genetic diversity of crop plants and the diversity of wildly available food plants. Enhancing on-farm diversity is important for reducing greenhouse gas emissions from agricultural landscapes. In addition, such practices also increase habitat value by maintaining ecosystem heterogeneity and restoring wild vegetation for carbon sequestration. Reduction of chemical fertilizer use through traditional cultivation practices and use of alternate methods like INM and IPM result in a minimization of pollution and thereby contribute to the overall health and well-being of the dependent communities. Promoting ecologically sound agricultural practices that concurrently ensure both crop productivity and biodiversity conservation therefore take on greater importance. MSSRF has worked with this rationale since 1997 in the Wayanad district to promote integrated management of agrobiodiversity, particularly the conservation of plant genetic resources. Activities have been concentrated primarily in the area of agricultural landscapes and wilderness areas accessed by tribal communities for wild foods. For the past 14 years, CAbC has been committed to working towards conservation and sustainable use of landscapes outside forests in the Wayanad district, which are vital for protecting conservation sites like the Western Ghats.

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Title: Benin's experience in the management of sacred forests for biodiversity conservation

Organisation: NGO Circle for Conservation of Natural Resources (ONG CeSaReN)
Theme: Forests
Keywords: Biodiversity, sacred forests, sustainable management

Summary

Considered as birthplace of vodoun, Benin contains many scattered patches of forest and tree groves of primary religious, ethno-botanical and conservation significance known as sacred forests. These forests have an important socio-ecological and cultural function. But under growing demographic pressures many of these sacred forests are disappearing; others maintain a fragile status as sites for religious practices and as natural gardens for the collection of plant material for traditional medicine. Conserving these forests is currently a challenge to take up. The main challenges for the sustainable management of these forests are related to (i) Weakening of traditional leadership and religious practices associated with the conservation of sacred forests affect biodiversity resources while there is little experience in community managed forest and participatory processes; (ii) no legal framework for Sacred forests under which their resources and biodiversity can be protected (iii) over exploitation of forest products (iv) Increasing poverty and food insecurity in surrounding villages increase pressure on sacred forests resources. To safeguard these forests, the Government is implementing some strategies for integration of sacred forests in the protected area system through a new form of co-management that integrates traditional knowledge and practices and modern science. This survey is undertaken to share Benin experience in taking up the complex challenge of attaining a wide range of sustainable land use objectives and integrating biological resource management into the everyday lives of local people.

Context

Benin is a country located in Western Africa with an area of 122 600 km2. Considered as the "birthplace of voodoo" (or Vodoun, as spelled in the local language meaning "god"), the county contains approximately 2940 sacred forests according to an inventory undertaken by researchers (Sokpon and Agbo, 1999). These forests cover an area of 18,360 hectares which represents about 0.2% of the total area of Benin. 70% of the 'forests' are small sacred groves of less than 1 ha (Photo1), 18% extend to an area of between 1 ha and 5 ha and 12% are larger than 5 ha. These forests have not received legal protection status from the State like the official protected forests (modern protected areas) but were able to maintain the integrity of their resources until the recent past. They represent a successful model of sustainable traditional management and conservation of biodiversity. Based on strong cultural and religious beliefs, this traditional forest management system has proven to be highly effective against forest clearance and forest degradation. The principle of this method of conservation is based on fear and respect for traditional local beliefs, the strength of traditional authorities, the power of dignitaries and religious leaders. Currently as the power of traditional authorities within the community is weakening, taboos are no longer respected. Most sacred forests are affected by an abused and uncontrolled exploitation and are subject to an alarming deterioration. Under growing demographic pressures many of these sacred forests are disappearing.

The Government of Benin through the General Directorate of Forests and Natural Resources is engaged in a strategy for integration of sacred forests in the protected area system through a new form of co-management that integrates traditional knowledge and practices and modern science. This survey is undertaken to share the experience of attaining a wide range of sustainable land use objectives and integrating biological resource management into the everyday lives of local people through the adoption of a strategic and holistic framework in order to achieve a whole landscape system management approach.


Photo1: Small size sacred forest (of less than 1ha)

Socio-ecological functions of the sacred forest in the landscape

Socio-cultural and religious function
Sacred forests have strong socio-cultural and religious functions. They represent shelters for deities, places of worship, rituals or other ceremonies. As economical functions, they represent a place where the local population can collect deadwood, medicinal plants, and NTFPs). Generally, there are strong links between a sacred forest and the history of the village to which it belongs. Villages very often bear the names of sacred forests. Access to sacred forests belonging to secret societies is completely forbidden to the non-initiated, while access to cemetery forests, fetish forests and community forests is subject to the authorization of traditional chiefs. In addition to traditional customs that protect sacred forests, persons found guilty of improper activities (including ecological degradation) within sacred forests are subject to penalties, which may range from simple warnings to fines (usually paid in livestock) to bewitchment.
Different types of Sacred Forests can be grouped (Kokou and Sokpon, 2006) according to their religious function into:

- Sacred hunting forest reserves. In this type of forest, the local populations have the right to hunt, to extract the honey and cut certain trees species for timber. Some ceremonies are performed at the beginning of each hunting season
- Forests of the ancestors. These forests are said to house the spirits of the ancestors. It is usually where the first occupant of the village is buried. Some of these forests have become cemeteries for village dignitaries. These are forests where the rituals are performed to benefit the community.

- Forests of the dead. These forests serve as burial sites for people who die in a bizarre or violent event (following a road accident, in a fire, during child birth, struck by lightning or drowned). For fear of suffering the same fate as the dead they are buried in special forest and groves.

- Forests of the gods and spirits. They are most numerous and can accommodate several deities or forest spirits in one site. Common vodoun deities include: Danzoun Dan (forest of snake god), Nyiglinvé (rainbow god), Xèbiossozoun Xèbiosso (god of lightning), Sakpatazoun Sakpata (god of the earth) and Lissazoun (symbolized by the chameleon). There are also forests that local people call "principal sacred forest" whose deities are consulted only in case of serious problems and when the sacred forests called "secondary" are unable to find solutions to their problems (deadly epidemic, persistent drought, etc.).

- Forests of secret societies. They serve as places of secret society initiations. They include the Orozoun or forests of Oro, the Kouvitozoun Kouvito forests and the Zangbétozoun or forest of Zangbeto (these vodoun deity embody the dead and the ghosts).

Ecological Functions of sacred forests
Despite their small size, sacred forests represent a significant tool for conservation and the sustainable use of biodiversity. First, they are highly important as refugia within the productive landscape for numerous species, some of which provide important benefits to the surrounding productive lands, such as pollinating insects and birds, and plant species used for live fences and hedges. Secondly, sacred forests also function as in-situ seed-banks and genetic reservoirs (Photo2). Some of the flora and fauna species found within sites or in their vicinity include threatened and endangered species. For example, both the hippopotamus and the crocodile are considered sacred animals. These sacred species are protected by local communities within, but also outside sacred forests. Thirdly, as landscapes that have been carefully managed over tens and even hundreds of years, sacred forests' ecosystems and species assemblage are somewhat different from any of the areas currently included in Benin's system of PAs, and also different from the cultivated landscapes by which they are surrounded. The diversity of forest species within the sacred forests (DBH equal or greater than 10 cm) varies from one forest type to another and between 3 and 55 species (Sokpon and Kokou 2006).

Some sacred forests are connected with other natural ecosystems and/or protected area through ecological corridors, gallery forests, rivers and water bodies creating biological connectivity and a spatial/ecological network (Lokossou 2010)
Moreover, sacred forests generate other ecological benefits, some of which go beyond the area immediately covered by the sites. These include the protection of water sources (Photo3), barriers against soil erosion, safeguarding of soil fertility and carbon sequestration.

Biodiversity conservation in Sacred Forests
In Benin, some species of trees or animals are sacred and therefore protected. A sacred tree is tied to a practitioner for his entire life (Sokpon and Kokou, 2006). The believer identifies with the qualities of the sacred tree: for example strength and greatness of the baobab, the splendor of iroko (Milicia excelsa, etc). The sacred species vary from one region to another. For example, some species of python are sacred in certain parts of the south but not in the north. Sacred forests are rich in biodiversity. These resources are used by local populations for many purposes (Table 1).

Photo2: A century year old tree in a sacred forest producer of seeds.

Photo3: A water source protected by a sacred forest

Table 1 Sample of some important biodiversity found in Sacred Forests

Medicinal plant species	**Known uses in Benin**
lchornea cordifolia (Schum. & Thonn.) Müll. Arg.	insomnia and jaundice
Anthocleista nobilis G. Don	rheumatism
Bombax brevicus *	muscular strains and broken bones

Cochlospermum planchonii Hook. f. ex Planch.	gynecological maladies
Combretum micranthum G. Don	anti-malaria
Crateva adansonii DC.	antiseptic effects, among other uses
Morinda lucida Benth.	malaria and hypertension
Newbouldia laevis (P. Beauv.) Seemann ex Bureau	cough, toothache, conjunctivitis and dysmenorrheal
Holarrhena floribunda (G. Don) Dur. & Schinz	genital infections
Pavetta crassipes K. Schum.	anti-malarial and diuretic
Pavetta corymbosa (DC) F.N. Williams	weight gain
Rauvolfia caffra Sond.	neurological sedative also used against mental diseases
Spondias mombin L.	gynecological, obstetrical and zootechnical medicinal features
Voacanga africana Stapf	hypertension
Xylopia aethiopica (Dunal) A. Rich.	aromatic tree with several uses including insecticide
Milicia excelsa	Fecundity control
Khaya senegalensis	anti-malaria
Sacred Animal	**Known uses in Benin**
Colobus vellerosus	It is believed that the Black-and-white colobus can forewarn villagers of upcoming unfortunate events, such as drought, disease or death, and are therefore not hunted. (primate, threatened by habitat loss)
Osteolaemus tetraspis and *Crocodylus cataphractus*	The West African dwarf crocodile and the African sharp-nosed crocodile are sacred animals within traditional beliefs. They are worshiped by villagers and never hunted. The crocodile's presence in wetlands and streams imposes a temporary ban on fishing
Python	Many species of pythons are worshipped in southern of Benin
Hippopotamus amphibus	Also a sacred, worshipped animal, believed to provide villagers with abundant fish catch.

Although detailed and systematic surveys of biological resources found in sacred forests are still lacking, there is sufficient evidence in existing studies that sacred forests have higher concentrations of useful, rare and threatened plants (e.g. Garcinia kola) and animal species (e.g. Psittacus erithacus and Colobus vellerosus) per unit area than what would be usually found outside sacred forests and their area of influence. Among the identified biodiversity in sacred forests are also numerous medicinal plants, large trees considered sacred and several fruit trees, which attract avifauna and other wildlife.

Threats, pressures on sacred forests

In the last decades, traditional slash-and-burn farming practices have been replaced by more intensive agricultural methods and by commercial crops, especially, cotton, cashew nuts and palm oil. As it usually happens, such changes affect peasants, increase the pressure on the remaining natural resources, reduce the size of forest remnants, affect their structure and composition, deplete game animals and create ever smaller forest fragments. When gallery forests connecting these patches are destroyed as well, these forests start an inevitable slide towards ecosystem degradation and biodiversity loss. Although many of the sacred forest of central and southern Benin have been preserved because of their cultural and religious significance their present condition as remnant samples of the original forest cover is precarious. In the northern part of the country the conditions are better because sacred forests are larger, connectivity with other natural areas functional and the forest stewardship function of traditional authorities relatively strong. The following are the major factors affecting the viability of sacred forests and the survival of biodiversity within them.

- Legal status within the PA system. Presently sacred forests as communal lands are not part of the official public forest domain. As the power of traditional authorities within the community is weakening, sacred forests are threatened and biodiversity lost. Providing a legal framework within the protected area system of Benin will go a long way towards legitimizing conservation and forest management efforts, strengthen the social position of traditional authorities and reverse resource degradation and biodiversity loss.

- Weakening of the power of traditional authorities. Traditional authorities in charge of sacred forests -and especially those whose authority derives from the practice of voodoo rituals and the enforcement of ancient taboos, are increasingly being challenged by the social and economic status conferred by modern religions, the loss of followers, the questioning of secret societies and rituals. In such cases, taboos are difficult to enforce, the social status of voodoo priests is eroded and the power of local kings diminished. As a result of the public decentralization law, municipal authorities are to assume responsibility for the management of forest resource (including sacred forests) located within their jurisdiction. Communes do not have in most cases, the technical capacity and financial resources to assume the role of forest managers. Moreover, for political reasons municipal governments also tend to avoid confronting traditional authorities on the use and conservation of sacred forests.

- High demand of forest products: Fuel wood is the most important household energy used by the rural populations. Charcoal is used extensively in urban centers of Benin. Access to forest and wood resources has become a conflicting land use issue, while the increased economic importance of fuel wood charcoal and timber, has escalated pressures on remaining forest stands, woodlots and sacred forest. Some tree species previously protected in sacred forest or as sacred species are currently logged (Photo4)

- Land pressures: As commercial crops expand and the rural population grows, the demand for farmland and human settlement continues to increase putting pressure on remaining forest areas. Whilst in some areas land is generally available, the soils within forests are considered richer than on the outside, thus conversion of this land to crops is seen as advantageous. Where controls are weak, sacred forests are logged, and the land is converted for other uses such as agricultural, house construction, etc.

- Bushfires are a constant menace to forest resources in the savannah region of Benin. These fires are usually set by people for a variety of reasons for example: (a) hunters burning grass to drive small animals into the open, (b) herders setting fires to encourage a new flush of grass for their stock, (c) farmers engaging in pre-emptive burning to protect fields, groves etc. and (d) farmers creating ash to fertilize low-yielding soils. Whatever the reasons for bushfires, they are a threat to savannah forests affecting the herb, shrub and understory trees, decimating wildlife, destroying the microbiology of soils and ultimately destroying the forest completely. As sacred forests become smaller in size and the forest structure more open they become easy victims of out-of-control bushfires thus affecting their long-term ecological viability and reducing ecosystem functions.

- Threats to the local biodiversity: In some sacred forests the local tree species are replaced by exotic fast growing species (Tectona grandis, Eucalyptus, Acacia auriculoformis). In other cases, sacred forests are invaded by invasive species such as Azadirachta indica or water jacinth (Photo6).

Institutional, Policy and Regulatory Context

According to the national forestry law, the sacred forests belong to the non-public domain which includes collective or community properties.
The law on decentralization extends the authority of the municipal governments onto all lands - including collective property, community lands and sacred forests, located within the municipal limits. Most municipal governments however, recognize the special status of sacred forests and tend to respect the traditional authorities' ancestral rights on the use and conservation of these forests. The institutional-political context of most sacred forests is further complicated by the fact that many mayors derive their political power from informal alliances with traditional authorities, local kings and voodoo priests. In addition, most municipal governments are unprepared to take on sacred forest management and prefer to share this responsibility with traditional authorities, especially when local kings and village chiefs are still active. In this project, municipal governments will play a coordinating role and work side by side with traditional authorities in the management and conservation of sacred forests.

Challenges and strategies to achieve sustainable management of sacred forests

Facing the increasing degradation of sacred forests, strategies to achieve sustainable management are undergoing implementation. The main challenges are identified and appropriate solutions are defined.

Challenge 1) Sacred forests have no legal framework under which their resources and biodiversity can be protected.
The failure to clarify property or usufruct rights may create disincentives for the good stewardship of resources that provide the basis for sustainable livelihoods and the sustainable use of biodiversity within sacred forests and the surrounding areas. A legal framework on the sacred forest as part of Benin's protected areas system is being elaborated. Such status will make sacred forests the object of attention by the country's forestry authorities and the subject of public intervention and financing. This will help all the stakeholders to implement conservation actions and protect forest resources within the institutional and legal framework of the country's protected area system.

Challenge 2) Capacity building of sacred forests owners and managers and other stakeholders
Faced with the weakening of traditional leadership and the religious practices associated with the conservation of sacred forests, reversing current religious and cultural trends is not achievable. But implementing forest conservation mechanisms which strengthen the forest manager role of traditional authorities, and other stakeholders is doable. This support will in turn, lead to stronger stewardship of forest resources resulting in biodiversity conservation. Allowing the National Forest Administration (NFA) to work closely with traditional authorities and engage them directly in forest conservation will reinforce the legitimacy of their authority vis-à-vis the community. This objective is be achieved according to: (a) the degree of erosion of traditional authority, (b) the amount of perceived benefits the community derives from sacred forest conservation and sustainable use, and (c) the level of collaboration among the NFA, the municipal authorities, community groups, and the NGO. The challenging aspect of this process will be to design and carry out implementing

arrangements that will enable traditional authorities, municipal governments and national forestry entities to work together towards the effective stewardship of sacred forests.

Challenge 3) Over exploitation of sacred forest resources
In order to counteract the threats derived from uncontrolled harvesting of plant material for medicinal purposes and for firewood and charcoal, a set of actions aims at producing such products in the buffer zone of sacred forests with community participation. The National Association of traditional healers has embarked with support from the Ministry of Public Health of Benin, in the establishment of “botanical gardens” specifically devoted to the production of plant material used in traditional medicine. In addition the legal framework for sacred forests will help to define a consensus on resource exploitation.

Challenge 4) Increased poverty and food insecurity in the local population increases pressure on the sacred forests resources.
To reduce poverty and food insecurity in the local population, appropriate income generating activities will be developed such as private plantation, promotion of non timber forest product etc. The threats on forest resources will be addressed through a community-based strategy of communication and environmental education led by traditional authorities in collaboration with forestry agents and municipal authorities. The contribution that sacred forests in Benin can make to the sustainable use of biodiversity will be capitalized.

Conclusion

Through the project Incorporation of Sacred Forests into the Protected Areas System of Benin some actions are implemented in 10 clusters of sacred forests in Benin. The project objective is to promote the sustainable use of Benin’s Sacred Forests as a network of community-managed conservation areas incorporated into the national system of protected areas.
The project is supposed to help to avoid further loss of biodiversity contained within the sacred forests of Benin by establishing an institutional framework for sacred forests, including the clear definition of roles and responsibilities for their management. Similar actions are needed for the numerous remains sacred forests in the country.

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Title: Facilitating stakeholders and community involvement in a Satoyama landscape

Organisation: Nomi Satoyama Conservation Society
Theme: Others
Keywords: community, natural resources, neglected field, partnership

Summary

The Satoyama region in Nomi includes planted forest, secondary forest and paddy fields, which include many rare and endangered species, and which have been relatively unaffected by development in recent decades. Basic management of planted forests has been maintained, but with the aging population, maintenance of woods and many agricultural fields has been neglected.

The Nomi Satoyama Conservation Society(NSCS), works to promote the protection, support and managed use of the Satoyama area resources. It has organized tree planting and forest management projects, conducted natural farming methods research, opened the Satoyama Nature School, and is working to preserve such traditional local crafts as charcoal-making. The NSCS has also helped to promote pesticide free agriculture, and partnerships between people in the Satoyama areas and people from the urban areas who are encouraged to rent and cultivate abandoned agricultural land at low cost.

Creating regular opportunities for exchanges between the NSCS members and local residents has helped bring community support to the Satoyama area promotion activities, despite initial resistance from local communities to land cultivation by outsiders or activities that invite many people to the area. The NSCS has established strong partnerships with three Satoyama communities, and wishes to continue to expand its support for projects and activities that suit the local communities.

Outline of the Region

Nomi City's Satoyama area is located in the center of Kaga plains which is situated in the south of Ishikawa Prefecture. The area to the east of Nomi is an alluvial fan sandwiched between the Tedori River flowing from the Hakusan mountain range and the Kakehashi River; the gentle sloped hilly areas of Nomi stretch out to the Hakusan mountain range. The City of Nomi is located 20 km south-west of Kanazawa which is the capital city of Ishikawa. To the north of Nomi lies the river Tedori (Hakusan City/Kawakita Town), while to the south lie hilly areas; the Nomi Hills (50 ~ 400m Satoyama) lie in the east and the urban areas of Nomi lie in the west, all of which are a part of Nomi's Satoyama region. Komatsu Airport is the aerial gateway of Ishikawa and is only 15 km from Nomi; Kanazawa city is also just about 20 km from Nomi. Since Nomi is situated so conveniently close to the neighbouring towns, out of the total number of salaried persons, the percentage of people employed in secondary industries is 42.1 %, while the percentage of those employed in tertiary industries is 55.9%.

In 1995, before the multiple town merger and creation of Nomi City, the combined population of three towns (Neagari, Terai, Tastunokuchi) was 42,033. At the time of the merger in 2005, the population was 47,689 and in 2009 the population stood at 48,634. It is estimated that the population will rise to 52,000 by 2026 (Nomi City Urban Planning Master Plan, 2009). Out of the population of 48,634, the population in the Satoyama areas amounted to 3,763 (as of April 2005); thus, the Satoyama population only amounts to 8% of the total population which is quite small when one considers the size of the Satoyama area in proportion to the total area of the City. The total area of Nomi City is 83.85 km^2 and Satoyama area is 45 km^2, thus amounting to 53% of the total area. The breakdown is as follows: Cultivated Land – 19.20 km^2; Forests – 35.64 km^2; Residential Area – 10.39 % km^2; Other: 18.62 km^2 (1st Nomi Comprehensive Plan). Manufacturing industry is

Nomi’s key industry and there are a number of electronic parts and textile manufacturing plants located in Neagari district which faces the Japanese Sea; these manufacturing plants make use of the underground water of the Tedori River.

The breakdown of Nomi’s total production amount of the value added products is as follows: agricultural production: 2,160,000,000 Yen (Agriculture, Forestry and Fisheries Department Statistics, Hokuriku Agricultural Administration Bureau 2007); industrial goods shipment: 252,960,000,000 Yen (Ishikawa Prefecture‘s Industry, Industrial Statistics Survey Report 2008); retail/wholesale product sales : 51,710,000,000 Yen (Ishikawa Prefecture’s Commerce (Wholesale/Retail) Commerce Statistics Survey Report 2007).

Natural Environment of the Region

The average annual temperature of Nomi City is 14.1 C°and the city gets an average annual rainfall of 2,135. 4 mm. The summer in Nomi is hot and winter brings a lot of snow, which is typical for areas situated by the Japanese Sea.
The Satoyama region in Nomi has a number of secondary nature areas such as planted forest, secondary forest as well as paddy fields and it is possible to see some rare animal and plant life in this area. So far 1036 types of plant have been identified in Nomi, consisting of 295 trees and 741 herbaceous plants (Nomi City Plant Survey Report 2008), out of which 96 are endangered species.

The northern and southern habitat limits of many animals found on the Japanese Archipelago overlap in the area of Nomi and consequently the vegetation is also rich in the area. Some of the unique animals identified in the Satoyama areas include the umbrella species of Asiatic black bear, serow or raptor species such as osprey, owl, Japanese which is designated as Natural Monument, or the wild boar which has been the cause of damage to human communities in recent years and so on. The reason behind such rich natural environment is the fact that there have not been any major development projects in the Satoyama area after the high economic growth period and the volume of secondary natural area has not changed in last 30 years. However, the lack of management has been conspicuous at the same time and it is evident in the abandonment of paddies, vegetation transition, and death of pine trees, oak trees as well as in the rising phenomenon of increasing size of miscellaneous trees.

Local Resources of Satoyama Region

Utilization of Satoyama Resources after WW II

Nomi’s Satoyama area lies mostly along the A-Class river of Tedori and mountain streams of the Kakehashi river system and the Satoyama resources are used mostly by the satochi area (residential areas and paddy fields). In the hilly areas sandwiched between the mountain streams and SATOCHI, there are planted cedar trees in the lower grounds, and coppice along theridge of the higher area.. Rice paddy cultivation in the Satochi area situated alongside mountain streams has a long history; however, due to shortage of people, in recent years, the cultivation work is carried out by agricultural corporations with the help of large machinery. In spite of this, there are certain communities in this area where the entire cultivation land is found abandoned owing to reasons such as lack of sun light, wildlife nuisance, shortage of successors, etc.

Until about half a century ago, people used to make charcoal as they moved from one place to another in the forest and those traces can be found even today; however, in recent years the traditional mobile charcoal kiln style has been replaced by a fixed charcoal kiln. Today, there is only 1 professional charcoal maker left in the city and there is only 1 kiln left in the city. Today there are very few old houses left with traditional irori (sunken hearth cut in the middle of the floor) or that use kitchen stoves and as a result of this, there has been a sharp decrease in the use of forest resources required to produce heat energy and people rarely use fallen leaves as a compost; this has led to a lack of circulation of forest resources and the forest management.

Use of Satoyama Resources and Its Effects on the Ecosystem

Nomi's Satoyama areas have seen a sharp increase in the aging population. In the short span of a quarter of a century, the general aging rate for this area has jumped to 26.9% from 13.3 %. In 5 out of 17 Satoyama communities, the rate of the aging population has exceeded 30 %, while according to statistics the rate has crossed 46% for one community, making it practically a "marginal community". Due to an increase in the aging population, there has been a significant lack of maintenance of woods and many of the satochi fields or paddies located in the valley also lie abandoned.

Due to the derelict fields and mountain streams, there has been a decrease in human traffic as well as a sharp reduction in agricultural pesticides; however, it has been found that as a result of this, the numbers of critically endangered Abe's Salamander have increased.

Based on the national and city policies, the management of planted forests (cutting certain portion of trees) is being carried out actively and the condition of planted forests in Nomi is quite good as compared to similar forests in other cities or towns (40% of planted forest was thinned out in 2009). However, the use of heavy machinery in managing such planted forests can pose a threat to the habitat of animals, some of which are designated as rare and therefore it is necessary to have a minute assessment of the environment. Although the management conditions of the planted forests are better in comparison as mentioned earlier, such management is limited to simple care or looking after. The environment cannot be said to be ideal for the ecosystem since there are a number of problems such as decrease in the amount of snowfall, aging and decrease in professional hunters' population, multiple incidents of crop damage by wild boars, appearance of black bears in the Satochi or residential areas and so on.

Utilization of Regional Resources of Satoyama Area / Ecosystem Conservation Activities

In 2010, Nomi city drew up a plan called "Nomi City Basic Environment Plan" which aims at carrying out measures related to conservation and creation of environment; the sub-theme of this plan was "protection and nurturing of the rich nature of Satoyama, Satoumi & Satochi and its beautiful landscape". The city administration has been playing its part through a number of Satochi and Satoyama preservation activities such as: 1) Protection of rare species and conservation of ecosystem, 2) Promotion of development of forest and Satoyama, 3) Supporting forest/Satoyama conservation activities carried out by NPO, 4) Supporting volunteer efforts to restore abandoned cultivation land or use such land as citizens' farm development project, 5) Promote and support use of forest resources as natural energy, and so on.

Nomi Satoyama Conservation Society (Nomi's Satoyama Fan Club)

Background behind the Establishment of the Society

The two trends of depopulation in secluded places in mountains and aging population have not changed in Japan and the issues such as rising cases of abandonment of arable land and destruction of mountain forests have become serious social problems; these problems exist in the secluded mountain areas of Nomi as well and they have become important topics of debate for last 25 years. In February 2006, Nomi City proposed the establishment of a Satoyama Promotion Association with the purpose of revitalizing Satoyama areas and held a meeting with 19 Satoyama communities concerning the issue.

Upon this proposal by Nomi, 6 officials including the first chairman of the Association (2006 ~) took the lead in formulating the outline of the association's activities and its organizational structure. In March 2006, the association organized a Satoyama Promotion Forum aimed at local residents and this forum helped people understand the gravity of the situation in Nomi's Satoyama areas as well as made them realize the need for the revitalization activities for the region. This forum also established a solid foundation for the Satoyama Promotion Association, which later came to be called as Nomi’s Satoyama Fan Club（Nomi Satoyama Conservation Society）.

Outline of the Organization and Its Activities

(June 2006, at the time of its establishment)
Members: Executive officials: 4; Directors: 18; Part-time staff: 5
Activities: Charcoal kiln making, Nature Walks (4 times), Development of a nature trail route; Mushroom inoculation, Satoyama craft (making of kanjiki : Japanese traditional style snow shoes), publication of information journal

(Year 2007)
Members: Association members: 96; 3 organizations, 4 industries, 4 executive officials, 21 directors, 1 permanent staff and 7 part-time staff
Activities: Charcoal making (3 times); Tree planting & forest management project for planting mushrooms (twice); Fallow field regeneration (grow edible wild plants); Creation of 3 nature trail routes; Production and sale of firewood; Citrus fruit fields revitalization work; Hokkori Festival; Nature walk meet-up; Construction of a website; Information magazine publication

(Year 2008)
Members: 145 Association members; 5 organizations; 4 industries; 4 executive officials; 19 directors; 3 permanent staff and 8 part-time staff
Activities: Charcoal making (10 times); Tree planting & forest management project (13 times); Fallow field regeneration (3 times); Nature walks meet-up (4 times); Satoyama Nature School (6 times); Citrus fruit fields revitalization work (3 times)

(Year 2009)
Members: 137 Association members; 5 organizations; 7 industries; 4 executive officials; 16 directors; 3 permanent staff and 8 part-time staff
Activities: Charcoal making (10 times); Tree planting & forest management project (18times); Fallow field regeneration (4 times); Experimental cultivation based on natural farming method (11 times); Citrus fruit field revitalization work (3 times)
Satoyama seasonal vegetable market (9 times); Nature walks meet-up (4 times); Satoyama Nature School (6 times); Satoyama Nature Classroom (12 times)

Outline of the Activities
Nomi Satoyama Conservation Society (hereinafter NSCS) aims at the regional revitalization of Satoyama areas. The Society's activities have 3 main mottos:
1) "Protect: Traditions, Culture, Nature", 2) Utilize: Environmental Industry and Technology", 3) "Deepen: Nature Experience and Environmental Education"
The main Society activities can be categorized into 4 types as follows:
1) Conservation and regeneration of Satoyama; 2) Cooperation and support of Satoyama community activities; 3) Creation of industry using Satoyama resources; and 4) Environmental education and human resource development using Satoyama resources

NSCS carries out a variety of activities. The Activity Report of 2009 mentions a total of 82 activities and if one takes into consideration the preparation, preliminary inspection, post-event work, etc., then it would be clear that sometimes the Society conducts a number of activities in the same week. These various activities are supported by an amoeba-like organizational structure which enables a single member to be a part of multiple organizations and contribute to the growth of multiple organizations (an organization does not necessarily grow and there are organizations that decline or perish naturally). As a result, a number of activities, ranging from recreation to semi-professional levels that are planned by groups under our umbrella organization have been increasing.

Principal Activities
There are 5 main activities that our Society has been continuing since its inception.
These activities are: “Charcoal Making”, “Fallow field regeneration”, “Forest management by Local residents”, “Hands-on Experience & Exchange Activities”, and “Environmental Education”.

Ever since its inception, the principal goal of NSCS’ activities has been the effective utilization of Nomi’s Satoyama resources (especially deciduous broad−leaved forest).
The Society started its activities with making of a charcoal kiln. The idea behind this was to “make a start from a point that would be the point of destination in the end”. In the last 3 years, our Society has conducted Professional Charcoal Maker Training Classes; students who graduated from this class set up a charcoal making group called
O-sumi-kai (Charcoal Association) and this group has carried out charcoal making 20 times in 2010.

Although Nomi has many Satoyama areas which are rich in nature, if one takes a closer look, one will find that the area from halfway up the mountain has been left neglected for almost half a century and it has turned into an unmanaged deciduous broad-leaved forest; one can also find many large-sized beech and red pine trees that stand decayed or have fallen to the ground. In order to regenerate such a Satoyama environment, a number of forest management activities are carried out by local residents. Since its establishment, the Society has also been involved in activities such as managing (by removing weed and thinning) the walking trail, encouraging mushroom planting, producing firewood, etc. In 2010, these activities were carried out on the 1st Sunday and 2nd/3rd Wednesday of every month.

There are a number of abandoned cultivation lands, many of which are in the valleys of Satoyama area where there is a rapid rise in aging population. NSCS considers such abandoned cultivation land as a Satoyama resource and one example of utilization of such land is Tsubono-machi where local residents and other volunteer citizens practise “farm ownership”, especially for the farms that cultivate edible wild plants such as udo (Aralia cordata) and tarano-me (Aralia spinosa) since such products find it difficult to reach the markets. One of the goals of such an ownership cultivation system is to encourage land owners from outside the town to come to these communities and have exchanges with the local people (increase people to people exchanges); since the goal is to increase people to people exchanges, this ownership system expects the owners to manage their lands by themselves and in exchange of their time and efforts, ownership charges are not high.

In 2009, a group called Food-Agri School, with a focus on research in natural cultivation was established. This group rented abandoned cultivation land from the local people and started growing vegetables.

In 2010, as a part of its CSR activities, an agricultural implements and machine maker started its regeneration project on a 1.4 ha abandoned cultivation land in Tsubono-machi; in 2011, this land will be cultivated as a citizens’ farm. Since this land was lying abandoned for almost 25 years, it is believed that the soil will not have any agricultural pesticides residue and future cultivation does not foresee the use of any pesticides.

There are a number of hands-on activities that are expected to promote exchanges between people in the Satoyama areas and from the urban areas. It is hoped that such increased exchanges will help preserve and pass on natural environment, history, culture and traditions of Satoyama area. For instance, some of the main hands-on activities that NSCS has been conducting from its year of inception are as follows:

Snow Hiking in kanjiki (Japanese traditional style snowshoes) which involves making one's own kanjiki and walking on snow; Satoyama Guide Hiking which is held 5 times every year on a regular basis;

Nomi Hokkori Festival was started in 2007 with the aim of revitalizing Butsutaiji-machi which has the smallest population (9 households with 30 people) in the city.

In 2010, which was the 4th year of Hokkori Festival, we organized this festival in collaboration with Tokaido Hokkori Matsuri of Ritto City in Shiga Prefecture. Nomi's Hokkori Festival is growing steadily every year and the number of visitors to this festival has risen to 2500 from 1000 in its first year, with the number of stalls also going up considerably to 40 from 11 stalls.

The Nomi Satoyama Nature School began in the 2nd year after the establishment of NSCS, with the purpose of giving a first-hand experience of environmental education to young children through play and games in Satoyama surroundings. Day-long activities are held 4-5 times a year and overnight camp programs are organized once a year, while keeping in mind seasonal suitability of Satoyama. Thanks to the improved recognition of Nomi Satoyama Nature School, the number of applications received for the camp program was almost double the capacity number, as a result of which the 2-day camp was organized twice in 2010.

The environmental education activities conducted in 2010 were as follows:
June: Walking trail maintenance work, planting of sweet potato;
July: Exploring animal life in fallow fields;
August: Camp, Aquatic life survey of rivers in Satoyama, Woodwork;
November: Exploring animal tracks in Satoyama; Sweet potato baking with fallen leaves;
February: Snow-Hiking in the snow covered Satoyama;
March: Making pizza using edible wild life plants with children and their parents

Other Activities
Satoyama Nature Classes: A personnel training program aimed at cultivating local leaders from among the local citizens. NSCS hopes that through this program people will be able discover a number of regional resources by themselves as they learn about Satoyama's nature and culture and also put into practice resource planning and management in order to use these resources more effectively.

Citrus Fruit Field Revitalization: Citrus fruit fields which are not cultivated any more, are rented free of compensation under the Self-Managed Ownership Farm Scheme; the scheme mainly involves activities such as removing weeds twice a year, pruning once and exchange meetings (local residents and the owners).

Nursery in Woods: Satoyama-related activities are organized thrice a year (summer, autumn, winter) for participants in collaboration with a private nursery school.
"Health-up Hike": Satoyama-Hiking is organized to promote health and health management as a part of the collaboration with a general hospital in Nomi. We also carry out blood pressure and blood oxygen level monitoring before and after the hike, as well as counselling concerning one's health and warming-up exercises under the supervision of a sports trainer as part of this activity in order to differentiate our hike program from other similar programs.

Regional Revitalization through the Use of Natural Resources

Industrialization of Society Activities

Our Society believes that in order to preserve a favourable condition of secondary natural environment of Nomi's Satoyama which is a social and ecological landscape, it is necessary to continue activities focusing on Satoyama conservation and regeneration, as well as regeneration of abandoned cultivation land or other activities focusing on
Satoyama awareness programs through projects such as Satoyama Guide Hike or Satoyama Nature School.

In order to continue activities mentioned above, it is necessary to improve present activities even further and try to make them unique while trying to increase income through a participation fee at the same time; moreover, it is also possible to regenerate a fertile cultivation land and sell its harvest by using regional resources of Satoyama forest as a source of bio energy and by effective utilization of abandoned cultivation land; the income gained in this way can be returned to the region in some form or the other.

The biggest goals of NSCS is to create a system which is beneficial to people who contributed through their physical labour or through their regional resources and also to commercialize Society activities; we feel that our goal will be realized when it will become possible to sustain such industrialized activities.

From an increase in people to people exchanges to an increase in residential population

A variety of activities organized by NSCS have helped increase people to people exchanges in the Satoyama area as compared to 2006 and earlier. For instance, the number of visitors to the Hokkori Festival has risen to 2500 from 1000 at the start and out of these 2500 visitors, 40 participants came from outside the Ishikawa Prefecture.

However, the awareness towards such activities among local residents is not very high and there are people who are opposed to activists' entry into mountain forest, opinions to refuse outsiders and sale of vacant houses or land lots.. One of the reasons for this is that although there are regular exchanges between the NSCS members and other participants, there are not enough exchange opportunities for local residents to interact with outsiders. The other reason is that because of the aging population, younger population is usually preoccupied with community events (group work or traditional events) and even when NSCS asks community members to participate it is difficult to get their cooperation.

There have been inquiries from participants coming from outside the Satoyama area about vacant houses and the possibility of relocating to Satoyama areas.

Reforming Local Residents' Awareness

NSCS has managed to establish strong bonds with 3 out of 19 Satoyama communities through the Society's regular events and activities. These 3 communities are, 1) Tsubono machi which has the highest aging population rate in Nomi, 2) Butsudaiji-machi which is the smallest village community and 3) Nagataki-machi which is an important center of Takinami Field.

Tsubono is located at the meeting point of two valleys and the main portion of cultivation land was situated along the river side in the valley, however due to factors such as lack of sunshine, damage by wild animals and aging population almost all the land has become derelict. Since 2006 we began considering the possibility of using such land to grow edible wild plants which only have minor circulation volumes in the markets.

There were both Yeas and Nays in the local community but fortunately a voluntary association called Tsubono Sugina-kai was formed which mediated between the local residents and NSCS and it was decided that a part of derelict cultivation land will be used to grow edible wild plants through an ownership system. Since then a Sansai (edible wild plants) Festival is celebrated every year in early spring where land owners and local residents mingle with each other.

As mentioned above, when a plan was proposed in 2010 to regenerate 1.4 ha cultivation land that was lying derelict, some people welcomed the idea of having outsiders in their community since they believed that their village community would not change unless people from outside the town came to their community, which proved that local people were becoming more receptive to outsiders. Moreover, there are some outsiders participating in Mizu-no-Kai group which is responsible for managing a breeding program of loach on the site of regenerated abandoned land.

Butsudaiji-machi is Nomi's smallest community with 9 households and a population of 30. In 1889, 6 smaller villages (aza) were reorganized to form Satokawa village in (presently) Komatsu City and in 1907 Kokuzo village (located in the south of Satoyama area) and Yoshikawa village (located in the north of Komatsu City) merged to make
Kokufu-aza Butsudaiji. In September of 1934, Mukuroji Tunnel was opened which linked the Satoyama area (north side), thus leading to a shift from Kakehashi river-side community life to present day Nomi Kokuzo district-side community life. Due to these changes, the village children also had to transfer to Wake-Jinjo Elementary School from Kakehashi-Jinjo Elementary School, thus weakening the bonds with 6 aza of present day Komatsu City.

In 1956, 3 villages, namely Kokuzo, Yamagami and Hisatsune merged together to form Tatsunokuchi Town and in year 2005, towns of Tatsunokuchi, Terai and Neagari merged to form Nomi City, thus making Butsudaiji-machi the southernmost village of Nomi, with the tunnel connecting it to the urban areas of Nomi. In 1991, spring-water was discovered near Kannon Temple situated at Mt. Yarimizu-Kannon which is located close to Butsudaiji; afterwards, in September 1996, Nomi City built Yarimizu-Kannon
Reisui-do (Sacred water basin). Moreover, in August of 1998, the New Mukuroji Tunnel was opened, making it convenient for vehicular traffic. At present, every day 300 cars on an average come to Butsudaiji to draw the sweet, fresh water from the Kannon water basin.

In order to make use of such resources, NSCS came up with an idea to organize the Nomi Hokkori Festival. At first, local people were not very enthusiastic about this idea and they did not want to hold this festival for more than 1 year, but since then this Festival has already been held for 4 years! In fact, at the last review meeting, local people had some very enthusiastic inquiries about the festival such as "what will be the main theme for the next year's Festival" or "what can we do to make the festival even more original and unique" or "what can be done to improve the hospitality standards" and so on. Besides such positive feedback, we have a few people who would like to open a café in the village after they have retired; thus, it has become clear that increased people-to-people exchanges is helping the revitalization of the region and this has changed the attitudes and level of awareness of local people.

NSCS plans to propose and support projects or activities that suit the respective village communities, after consulting them with the local residents; NSCS hopes that such efforts will not only help change local residents' attitudes, but also raise the region's profile.

Title: The use of Agrobiodiversity by indigenous and traditional agricultural communities in: Adapting to climate change

Organisation: Platform for Agrobiodiversity Research
Theme: Agricultural land
Keywords: Agro-biodiversity, climate change, Agroforestry, Home gardens and other diversity-rich approaches, Crop, soil and water management, Organic agriculture, Traditional food systems, Pastoralism, Pollinator

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Summary

Agrobiodiversity, or agricultural biodiversity, includes all the components of biological diversity of relevance to food and agriculture, as well as the components of biological diversity that constitute the agro ecosystem: the variety and variability of animals, plants and micro organisms, at the genetic, species and ecosystem levels, which sustain the functions, structure and processes of the agro ecosystem. Indigenous and traditional agricultural communities throughout the world depend on, and are custodians of, agrobiodiversity maintained within agricultural landscapes through various forms of traditional resource management. These communities are coping with an increasing number of interlocking stresses that result from different aspects of global change, including the problems related to population increase, insecure and changing land ownership, environmental degradation, market failures and market globalization, and protectionist and inappropriate policy regimes and climate change (Morton, 2007).

Climate change presents a major concern, often interacting with or exacerbating existing problems. It makes new demands for adaptation and coping strategies, and presents new challenges for the management of the environment and agro ecosystems. Discussions on global policies related to climate change have largely disregarded the potentially negative effects of many of the proposed policies on indigenous and traditional agricultural communities and their livelihoods and rights. Agrobiodiversity has also been largely overlooked in discussions on climate change, despite its importance for the livelihoods of rural communities throughout the world and for the development of adequate adaptation and mitigation strategies for agriculture.The Intergovernmental Panel on Climate Change (IPCC) report (Adger et al., 2007) ignores the role of diversity in production systems and the central role that agrobiodiversity will have to play in both adaptation and mitigation at the country, landscape, community and farmer levels. Indigenous and traditional agricultural communities are adapting to change and are developing ways of strengthening the resilience of agricultural landscapes through various local strategies based on the protection of traditional knowledge and agrobiodiversity. The approaches being adopted include the use of centuries old traditional practices (e.g. the forest management of indigenous Hani people of Yunnan province in China, and 3000 year old Cajete terraces and the associated agricultural system in Mexico) and their adaptation to changing conditions, as well as the development and adoption of new approaches.

Over the past two years the Platform for Agrobiodiversity Research has been collecting information on the ways in which indigenous peoples and rural communities have been using agrobiodiversity to help cope with climate change. The information comes from over 200 different stories, reports and articles from many different sources . Here we present an analysis of the information and identify the most important adaptation strategies adopted. We also set out some of the ways in which agrobiodiversity can be used to help improve the adaptability and resilience of the farming systems managed by rural communities and indigenous peoples around the world. A conceptual framework was designed to enable the review of a wide range of community devised strategies employed in agricultural ecosystems and landscapes in different environments (mountains, drylands, forests, wetlands and coastal regions). The results of the review elucidate the intrinsic link between adaptation and the protection of ecosystem, agrobiodiversity and traditional knowledge.

Understanding adaptation

Together with increasing temperatures, climate change also leads to increasingly unpredictable and variable rainfall (both in amount and timing), changing seasonal patterns and an increasing frequency of extreme weather events, floods, droughts and .re. These can result in decreasing productivity, changing agro-ecological conditions, increasing or altered patterns of pest activity and accelerating rates of water depletion and soil erosion. The changes, and the responses of communities to them, are many and varied in both nature and extent, depending on situation, culture, environment (mountains, drylands, forests, wetlands, coastal), agro-ecosystem, environment and opportunities. In order to understand and analyse the information an appropriate conceptual framework was needed.

The impacts of climate change are felt at the level of the natural resource base upon which rural communities depend, at the farming system level, and at the level of individual species (Vershot et al., 2005). At each level, communities employ a different set of actions to enhance the resilience of local food systems. This grouping of activities into the ecosystem or landscape level, the farm level, and the species level provides a basis for the development of a conceptual framework for helping to understand how communities use agrobiodiversity and ecosystem services to adapt to climate change. Indigenous and traditional agricultural communities develop their local food systems at the ecosystem or landscape level (or the system level) by managing ecological and biological processes within the system. In this way, they construct niches, shape microclimates, encourage landscape regeneration and influence gene flow. These management activities are often regulated by social institutions, customary laws and cultural values, which encompass traditional agro-ecological knowledge. Based on the feedback from the environment, the management practices are adjusted in a way that supports the maintenance of the ecosystem, helps maintain agrobiodiversity and enhances resilience to climate change (Salick and Byg, 2007). This type of adaptive management is perhaps best understood by using a whole system approach, in which the adaptability and resilience of the system and its components are determined by actions at different levels and interactions within the system, as illustrated in Fig. 1. The system can be an ecosystem, for example a watershed, or an agricultural landscape spreading across ecosystems, for example an agricultural landscape consisting of terrestrial and aquatic components.

Some studies refer to the whole ‘socio-ecological’ system as a way of including the concept of adaptation in environments in which humans are involved. Socio-ecological systems behave as complex adaptive systems, in which the humans are integral components of the system seeking to decrease vulnerability and increase resilience of the system through different management strategies (Walker et al., 2004). The vulnerability of such systems relates to the exposure and sensitivity to perturbation and external stresses, and the capacity to adapt (Adger, 2006). In these systems, resilience can be described as the capacity of a system to absorb recurrent disturbance and reorganize while undergoing change without losing its function, structure, identity and feedback (Walker et al., 2004). The ability of the humans to influence the resilience of the system is referred to as their adaptive capacity (or adaptability). The material within the agro-ecosystem, including species complexes, soil biota and traditional varieties, can also possess greater or lesser adaptability and capacity to evolve and change in the face of changes in temperature, rainfall or other environmental changes.

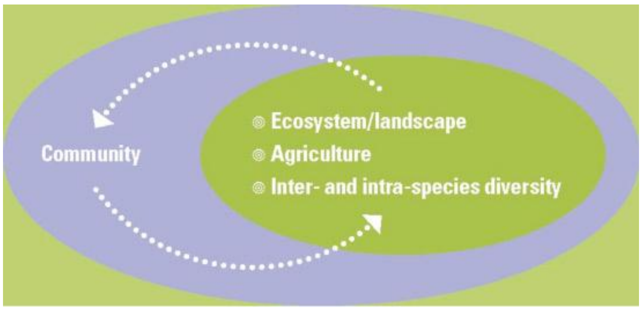

Figure 1 -Resilience is enhanced through the activities at and between different levels within a system.

Here we use this system-based approach to identify (i) the main adaptation strategies at the levels of the ecosystem, the agricultural system, and inter- and intra-species diversity, and (ii) interactions between the levels that contribute to the resilience of a system. A special focus is put on the social and community dimensions of adaptation discussed in the sections following the results of the analysis. The main patterns and approaches that emerge are illustrated with specific examples taken from the cases studied.

Adaptation strategies ecosystem- or landscape-based approaches

At the ecosystem or landscape level, adaptation activities can reduce the impacts of climate change and buffer their effects, reducing the negative impacts on humans and the environment. A variety of projects have been undertaken to protect and restore ecosystems, rehabilitate degraded landscapes and sustainably manage natural resources. These strategies appear to reduce vulnerability and strengthen resilience of local food systems to floods, droughts, rising sea level and extreme weather events. Examples from forest and mountain ecosystems, coastal areas, drylands and wetlands are given in the following paragraphs.

In Nicaragua, Honduras and El Salvador, where climate change has exacerbated soil erosion and watershed degradation, a forest landscape restoration project has been undertaken. This aimed to increase the resilience of tropical hillside communities by halting deforestation, restoring watersheds, diversifying production systems and encouraging sustainable landscape management (IISD, 2003a). In the Philippines, the Camalandaan Agroforest Farmers Association, a community-based land and resource management organization, have undertaken tree planting and forest protection to reduce sudden onrushes of water (during the rainy season) and depletion of water reserves (during the dry season) (Equator Initiative, 2008b).

In the coastal regions of Asia and Africa, community-based mangrove restoration has been undertaken in Indonesia, Thailand, Cambodia, Kenya, Senegal and Zanzibar. Mangroves function as a protection against storms and can help to mitigate salt water intrusion, coastal erosion and floods. Restoration of watersheds is helping to reduce vulnerability to climate change-associated stresses in a number of regions. In the drought-prone regions of Maharashtra in India, rehabilitation of a watershed ecosystem conducted on a micro-catchment basis helped to improve soil conditions, increase water availability, regenerate landscape and diversify agricultural production through a number of activities, including water harvesting and the encouragement of natural regeneration (IISD, 2003b).

In many cases, sustainable management practices have been revived and implemented to reduce vulnerability and enhance resilience. In Sudan, a community-based rangeland rehabilitation project aimed at increasing resilience to drought by improving soil productivity through sustainable land management, diversification of production systems, agroforestry and sand dune fixation (IISD, 2003b). In Tibet, pastoralists have engaged in the restoration of peatlands (Wetlands International, 2009). Thousands of hectares have been restored by regulating grazing pressure and erosion. It is believed that this will regulate the .ow of the Yellow and Yangtze rivers, thereby reducing flooding and drought risks for the communities downstream.

Improving the resilience of agricultural systems

At the level of the agricultural system, adaptation strategies include integration of trees and livestock into production systems; cultivation of a higher diversity of crops (diversification); and improved crop, water and soil management. These are not usually carried out singly but are combined in different ways depending on the ecology, needs of communities, availability of different materials and the challenges faced. Most adaptation initiatives include the use of approaches based on agroforestry and crop diversification, which are often combined with improved crop, soil (including soil biota and nutrients) and water management. Adaptation activities include both the revival of traditional production practices and the adoption and development of new techniques (e.g. a switch to low input agriculture and the use of alternative ways of livestock management). Some examples follow.

Agroforestry

Agroforestry is an increasingly important adaptation strategy for enhancing resilience to adverse impacts of rainfall variability, shifting weather patterns, reduced water availability and soil erosion. In Burkina Faso, to fight desertification and rehabilitate degraded land, trees are planted in the fields and around villages with a traditional water harvesting and soil improvement technique known as zaï. This technique, in combination with crop diversification and other techniques, through innovation and experimentation, has resulted in the development of an integrated agro-sylvo-pastoral system with higher resilience to droughts (Taonda et al., 2001).

Home gardens and other diversity-rich approaches

A number of adaptation case studies emphasize the importance of diverse home gardens in ensuring the family food supply in areas significantly affected by climate change. Examples from Bangladesh describe two types of adaptation strategies for enhancing the resilience of home gardens. In drought-prone regions, the resilience of traditional homestead gardens is strengthened through intercropping of fruit trees with vegetables, small-scale irrigation and organic fertilizers (FAO, 2010a). In the flood-affected regions, floating gardens have been created for cultivation of a mix of traditional crops, including saline-tolerant vegetables such as bitter gourd, red amaranth and kohlrabi. The floating gardens, in combination with alternative farming methods such as duck rearing and fishing, are important source of food during floods (Haq et al., 2009).

Crop, soil and water management

In arid and semi-arid regions, and increasingly in the sub-tropics and the tropics, soil productivity and water availability have decreased due to a combination of climatic and non-climatic factors such as ecosystem degradation and over-exploitation. Improved management of soil and water within cropping systems has helped communities to cope with these problems. In a number of adaptation projects, traditional soil and water management practices involving diversified cropping have been revived. Traditional knowledge is often combined with innovation resulting in better crop, soil, and water management practices. The most common methods for the improvement of soil productivity and water availability are a combination of: minimum soil disturbance, direct seeding or planting, live or residue mulching, cover crops with deeper rooting crops including annual and perennial legumes, micro-catchment water harvesting (e.g. infiltration pits and planting basins) and re-vegetation. These are key elements of practices that have become known as Conservation Agriculture in which ecosystem services are enhanced within the production systems at the farm and landscape level.

In Burkina Faso, to rehabilitate the soil, farmers apply mulch to degraded land, which attracts termites. The termites open burrows through the sealed surface of the soil and slowly improve soil structure and water infiltration and drainage (Ouédrago et al., 2008). In Sri Lanka, saline lands are brought back into production with green manure. Green manures are grown in situ (sunn hemp, green gram, black gram and grasses) or green leaf manure is obtained from trees and bushes around the fields (Vakeesan et al., 2008). In Jamaica, guinea grass mulching is a local strategy adopted in the low-rainfall areas to control soil erosion, increase the water retention capacity of the soil and improve soil structure (FAO, 2010b).

Traditional rainwater harvesting and irrigation systems have been revived and play an important role in augmenting the water supply in water stress-prone environments. In Tunisia, there is an increasing interest in jessour, a traditional system of dams and terraces for collecting run-off water, which enables cultivation of olives, fruit trees, grains and legumes (Reij et al., 2002). In the Andes, the Quechua have revived the waru waru, an ancient cultivation, irrigation and drainage system for increasing the productivity of land with high salinity levels and poor drainage in areas with frequent droughts and frost (Ho, 2002). The waru waru regulate microclimate, soil moisture and pest activity.

Organic agriculture

Farmers' experiences show that organic agricultural practices, both traditional and innovative, can strengthen the resilience of local food systems. Reports on the importance of organic agriculture come from India, Ethiopia, Bangladesh, Nepal, Honduras, Sri Lanka, Thailand, Nicaragua, Cuba and the Philippines. In Rajasthan, India, an increasing number of small-farmers are adopting vermicomposting – a non-traditional method of improving the nutrient content and water-holding capacity of the soil. This method is combined with cultivation of stress-tolerant crops, crop diversification, green manuring and mulching (Shah and Ameta, 2008). In Nepal, farmers use traditional and non-traditional organic agricultural practices to improve water use efficiency, prevent erosion and improve the productivity of cropping systems (Ulsrud et al., 2008).

Traditional food systems

In traditional food systems a number of methods are used to maintain soil productivity (e.g. intercropping, crop rotation, fallowing). These practices continue to ensure food and livelihood security under increasing climate change and variability. The United Nations Framework Convention on Climate Change database of local coping strategies includes the following examples of traditional agricultural practices (UNFCCC, 2010).

- In Tanzania, the Matengo living in the highlands have cultivated steep slope fields for more than a century using a grass-fallow-tied ridge system to grow maize, beans, wheat and sweetpotatoes, all on a rotational basis with a fallow period.

- In Indonesia, the Kasepuhan of West Java optimally utilise their natural resources through an integrated fish-rice system. Fish-rice farming systems are also used in a number of other Asian countries such as Bangladesh.

- In Goa, India, the Khazans' agriculture-aquaculture system, based on the principle of a tidal clock and salinity regulation, ensure sustainable management of resources. On the Indian Andaman and Nicobar Islands farmers cope with the extreme heat and dryness of summer through a number of techniques, including mulching and intercropping of coconut and betel nut seedlings with banana plants.

- In Bhutan, in periods of food scarcity due to extended dry seasons and infestation by pests and diseases, subsistence farmers rely on wild foods. The farmers cultivate crops, rear livestock, and manage common pool resources such as communal grazing land and communal forests for leaf litter and forest-based food products (wild tubers, fruits, vegetables, medicines etc). In times of crop failure due to delayed or weak monsoon and pests, livestock and wild foods meet the household nutritional requirements.

Pastoralism

Pastoralists in the Sahel, by breeding their herds over many generations in often harsh and variable environmental conditions, developed many different breeds with valuable traits. Traditional pasture and herd management systems include the conservation of natural ecosystems through extensive ranching and rotational grazing, and keeping a mixture of cattle, goats and sheep (Morton, 2007). Due to the effects of climate change, mainly the more frequent occurrence of drought; species and breeds with adaptive traits are becoming increasingly important. In the Ethiopian Borana rangelands, pastoralists have retained their nomadic ways but are replacing their cattle herds with camels, which feed on trees as well as grasses and can survive longer periods without water (New Agriculturalist, 2009a).

Pollinators

During the past few years apple production in Himachal Pradesh, India has been continually declining. A study has shown that this decline in productivity is due to pollination failure (Pratap, 2008). The reasons are lack of trees that can provide fertile compatible pollen and lack of pollinators (bees, butter.ies and moths). To overcome the lack of insect pollinators farmers are renting honeybees, decreasing the numbers of pesticide sprays and carrying out hand pollination (Pratap, 2008).

The use of inter-and intra-species diversity

Maintenance of high levels of inter- and intra-species diversity is a strategy to decrease vulnerability and enhance resilience to climate change and associated stresses. Adaptation activities include the maintenance and reintroduction of traditional varieties, the adoption of new species and varieties to meet newly developed production niches, and the development of ways of ensuring that materials remain available (e.g. community seed banks) and adapted (e.g. participatory plant breeding). Linked to the developed of adapted and adaptable materials have been adjustments in cropping patterns and crop cycle.

As a result of climate change, indigenous and local crops and varieties, particularly drought-, salt- and flood-tolerant, fast-maturing and early- or late-sowing crops and varieties, are increasingly cultivated. Their availability is improved though the establishment of community seed banks. Reports from drought-prone regions of Zimbabwe, India, Nicaragua, Kenya, Vietnam, the Philippines, Mali, the Timor Islands and other countries show an increasing importance of drought-tolerant crop varieties of millet, sorghum and rice. The reports also mention other drought-tolerant species and varieties of cereals, fruit and vegetables as well as wild species. In Botswana and Namibia, drought-tolerant wild fruit tree species (e.g. Sclerocarya birrea, local name: morula; Azanza garckeana, local name morojwa) are planted around the villages with the aim of domesticating them (Bonifacio and Zanini, 1999). In the areas experiencing an increased level of flooding and salinization of freshwater and agricultural land; salt- and flood-tolerant crops and varieties have been introduced. In India, community seed banks with a focus on rice have been established to strengthen the community seed supply of flood-resistant varieties in Bihar and Bengal and saline-resistant varieties in Orissa (Navdanya, 2009).

Several reports indicate a switch to short-duration varieties and adjustments in planting and harvesting dates as a response to a decreasing length of growing season and changes in seasonal patterns of precipitation and temperature. In India, in areas where crops had failed due to heavy rainfall during the pod formation stage, farmers have switched to short-duration varieties and adjusted sowing depth and date (unpublished data). In Cambodia, there is a shift in the planting date of rice; rice seedlings are planted in November instead of in September (Mitin, 2009). In Ghana, farmers are planting early maturing crops and sowing the seeds earlier than in previous years (Mapfumo et al., 2008).

In Uttar Pradesh, in the foothills of the Himalayas, communities are experiencing an increasing frequency of flash floods; dry spells during floods; changes in flood timing (longer, delayed or early); increased duration and area of waterlogging; and changes in time, volume, and pattern of rainfall. Adaptation to climate change required the development of a new crop calendar as illustrated below (Wajih, 2008). Crops that are fast-maturing, flood-tolerant and with soil-rehabilitating characteristics are planted according to the calendar.

Adapted from Wajih, 2008

The selection of new varieties by farmers and participatory plant breeding (PPB) are supporting adaptation to changing production environments. Often, adaptation and selection of traditional varieties is associated with on-farm conservation activities. In Bangladesh, the development of short-duration rice varieties formed part of the adaptation strategies of people living in the Gaibandha district of the Char islands, where there has been an increase in the land area affected by major floods from 35% in 1974 to 68% in 1998. On Timor Island, to strengthen the resilience of agriculture to erratic rainfall, farmers have developed their own varieties of maize, sorghum, foxtail millet, dryland rice and cassava (Kieft, 2001).

In Nepal, changes in the monsoon pattern have caused a disruption to rain-fed agricultural systems and exacerbated genetic erosion of local landraces with drought-resistant and lodging-tolerant characteristics. Farmers have responded by establishing a seed bank and engaging in a PPB programme. A total of 69 rice varieties have been revived and stored at the seed bank (Ulsrud et al., 2008).

In Honduras, farmers organized community-based agricultural research teams, to diversify their plant genetic resources and develop hardier plant varieties that grow well on their soils. Responding to the higher occurrence of hurricanes, farmers were able to produce improved maize varieties through a participatory breeding process that are shorter and capable of withstanding the physical trauma brought by the hurricanes, with a higher yield and yet are still adapted to high-altitude conditions. The selection process was accompanied by a conservation effort, as the seeds of the selected species are stored in a community seed bank, assuring availability of healthy and resistant plants (USC Canada, 2008).

In several countries the System of Rice Intensification (SRI), a different rice agronomy that also works well with traditional varieties, is spreading and already raising productivity and income of more than 1 million small indigenous and traditional farmers around the world on over 1 million hectares. SRI benefits derive from changes in the ways that their existing resources are used through a set of modified agronomic practices for managing rice plants and the soil, water and nutrients that support their growth.

Some of the main adaptation strategies at different levels

Ecosystem or landscape

Activities at the ecosystem and landscape level aim to mitigate and buffer the effects of climate change through ecosystem protection and restoration, landscape rehabilitation and the sustainable use of natural resources. Examples are:

- Reforestation of tropical hillsides, riparian forests and mangroves.
- Rangeland rehabilitation and improved pasture management.
- Restoration of wetlands, peatlands, watersheds and coral reefs.
- Re-vegetation in drylands.

Agricultural systems

At the agricultural system level, the resilience of local food systems is enhanced through the diversification and sustainable management of water and soil. Commonly employed strategies are:

- Diversification of agricultural landscapes (agroforestry).
- Diversification of production systems (cultivation of a higher diversity of crops and varieties and crop-livestock-trees integration.

- Low-input agriculture, soil conservation and improved water management and use efficiency (mulching, cover crops, rainwater harvesting, re-vegetation, fallow, intercropping, crop rotation).
- Adjustments in crop and herd management (changes in crop cycle).

Intra- and inter-species diversity

Intra- and inter-species diversity is protected, used and redistributed to strengthen the resilience of agricultural systems and maintain production in stress-prone environments. The main adaptation measures are:

- Use of stress-tolerant and fast-maturing crop species and varieties; and stress-tolerant species and breeds of cattle.
- Protection, reintroduction and distribution of traditional crops through community seed banks and on-farm conservation.
- Stress tolerance improvement through farmers' selection and participatory plant breeding.

A whole system approach

The main types of responses to climate change identified in the previous section illuminate the cross-scale processes, providing an insight into the adaptation dynamics (Fig. 2). The interplay between adaptation strategies at different levels contributes to the resilience of the whole system through (i) the links between natural and cultivated landscapes; (ii) the supportive role of agriculture in the protection and restoration of ecosystems; and (iii) the maintenance of species and genetic diversity.

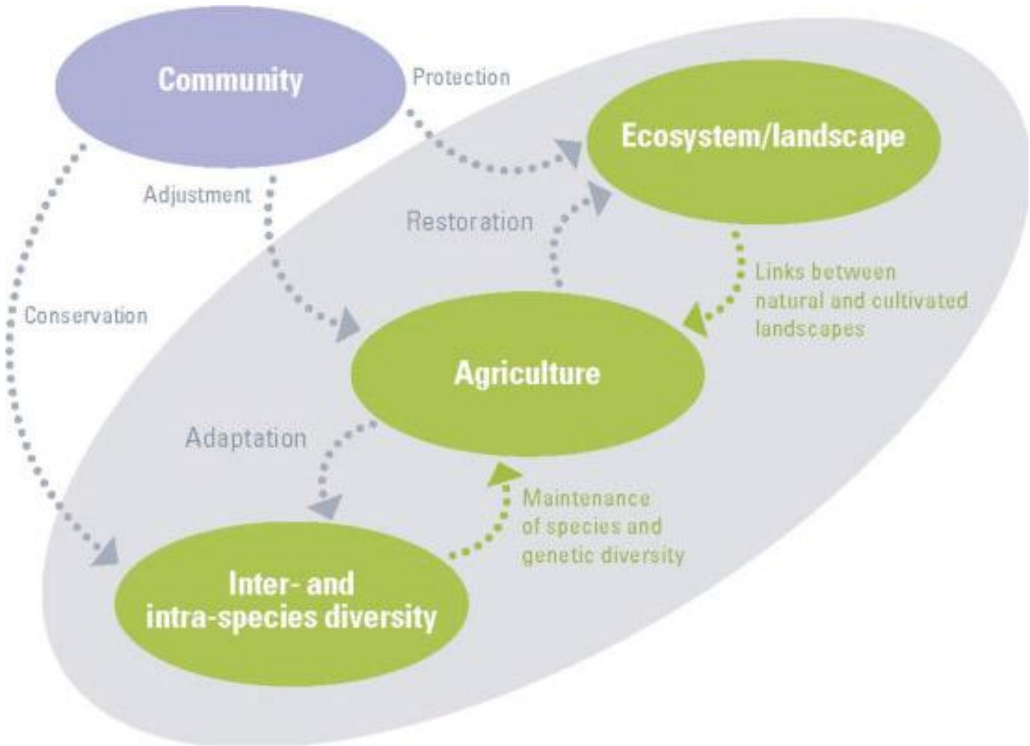

Figure 2 – Adaptation dynamics

The links between natural and cultural and cultivated landscapes

In many traditional agricultural landscapes, the wild and cultivated areas are integrated under a management system to complement each other. For instance, the common practice of rotational farming (shifting cultivation) exemplifies a situation in which it is often difficult to distinguish between cultivated and wild or natural landscapes. Within cultivated fields, where crops are planted, wild species are also recruited and tended. Various forms of forests and individual trees, though not planted, are cared for, managed and used for food, fuel, medicine, timber and various other necessities (Rerkasem et al., 2009).

The wild areas provide services essential for the resilience of the cultivated regions including erosion control, microclimate regulation, pest regulation and pollination. Wild species provide alternative sources of food and income during the periods of bad harvest or herd loss due to unfavourable weather conditions. Many communities harvest wild vegetables, fruits, tubers and other edibles from the forest during the year, especially during the season of greatest food scarcity.

Wild species with traits such as tolerance of extreme temperatures and salinity are becoming increasingly important resources for communities. In Bangladesh flood-affected communities cultivate saline-tolerant varieties of reeds and saline-tolerant and drought-resistant fruit and timber trees, to reduce vulnerability to floods and sea-level rise and ensure longer-term income generation. This involved the establishment of community tree nurseries and distribution of indigenous varieties of coconut, mango and other fruit species as well as mangrove-associated species (Selvaraju et. al., 2006).

The role of agriculture in ecosystem protection and restration

Sustainable types of agriculture can reduce the adverse impacts of climate change on fragile ecosystems and encourage rehabilitation of degraded landscapes, as illustrated by the following examples. In Rajasthan, India, where drought and environmental degradation severely impaired the livelihood security of local communities; a community-led, watershed-restoration programme reinstated johads, a traditional rainwater-harvesting system. Johads are simple concave mud barriers, built across small, uphill river tributaries to collect water and encourage groundwater recharge and improve forest growth, while providing water for irrigation, domestic use, livestock and wildlife (McNeely and Scherr, 2001). Restoration of over 5000 johads in 1000 villages has resulted in the restoration of the Avari River and the return of native bird populations (Narain et al., 2005). In Honduras and Nicaragua, an increasing number of farmers are abandoning the slash-and-burn technique and adopting the Quezungal slash-and-mulch agroforestry system, which draws on traditional practices of tree management and reduces crop damage caused by natural disasters (Bergkamp et al., 2003). In Honduras, the result has been the natural regeneration of around 60 000 ha of secondary forest, restoration of soil quality, and consequently better crop yields (New Agriculturalist, 2009b).

The maintenance of spacies and genetic diversity

Cultivation of a high level of diversity in an agricultural system strengthens the system’s resilience. In turn, agricultural systems with diverse species and varieties of crops and livestock provide for the maintenance (in situ conservation) of diversity and the evolution of continually adapted populations. In many cases, introgression of genes from wild relatives or cross pollination results in new genotypes or helps to maintain the broad genetic base within crops In situ conservation of the agricultural diversity of genes and species often occurs within a mosaic of agricultural landscapes consisting of home gardens, fields, groves and orchards, and boundaries and niches that create diverse selection and adaptation factors through exposure to the environmental change. An example of the importance of genetic diversity has been the maintenance of traditional pearl millet and sorghum varieties in Niger and Mali over the past 20-30 years. While varietal identity has often altered over this period, total diversity and average yields have remained broadly unchanged, despite periods of significant drought and the occurrence of other environmental and social stresses. It appears these materials show sufficient adaptability to enable farmers to cope, at least partially, with periods of significant rainfall shortage and that farming practices and local institutions have favoured the maintenance of diversity (Kouressy et al., 2003; Bezançon et al., 2009). Interestingly, in both countries, there was some loss of long-duration types with an apparent increasing preference for rapidly maturing varieties.

Community dimension of adaptation

Adaptive management of agrobiodiversity involves activities at both the individual and community levels. At the individual farmer level, agricultural systems are diversified and various management practices adjusted. However, the adaptive management of water, soil and agrobiodiversity takes place at the ecosystem or landscape level and requires communal efforts, often regulated through social institutions. Local institutions that endorse the sustainable management of agrobiodiversity and landscapes have been re-established in several adaptation projects. In Niger, the Tuareg nomads have protected and improved their pastureland through pasture-management associations; thereby strengthening the resilience to both climatic and non-climatic pressures (New Agriculturist, 2009a). In a mountainous region of Ecuador, a community-based initiative has promoted sustainable use of resources to prevent ecosystem degradation resulting from inappropriate agricultural practices and overgrazing (Equator Initiative, 2004). The Turkana pastoralists in northern Kenya, and Sukuma agro pastoralists in Shinyanga, Tanzania, have restored degraded woodlands through the revival of local institutions for natural resource management (Barrow and Mlenge, 2003). The Turkana restored over 30 000 ha and the Sukuma 250 000 ha of woodland; which has resulted in a mitigation of risks associated with droughts (ibid).

The need to replenish diversity in agricultural systems has encouraged the community management of genetic resources. This has resulted in the establishment of community seed banks to facilitate the revival and distribution of traditional and stress-tolerant crops and varieties. In Uttar Pradesh, India, the establishment of seed banks to facilitate the diversification of local food systems is one of the flood coping mechanisms (Wajih, 2008).

Just as local crops and varieties needed to be reintroduced or new crops introduced, in some cases, traditional practices have also had to be adjusted. Indigenous forecasting techniques have become less reliable due to the increasing variability and irregularity of rainfall. Many Javanese farmers base their planting schedule on the Javanese lunar cyclical calendar, as well as observations of the environment, yet both are becoming unreliable. Instead of relying on observations that used to indicate the start of the rainy season such as falling leaves, singing birds or noisy insects, the farmer began using climate forecasts and other agro-meteorological information (Winarto et al., 2008). In other places farmers have begun documenting climate change impacts at local level (Ulsrud et al., 2008).

Women’s role in adaptation

Many projects concerned with the protection of agrobiodiversity are initiated and managed by local women’s groups. In India, women have initiated and engaged in a number of adaptation projects, which involve the revival of traditional seeds and the establishment of community seed banks. In Sri Lanka, a women-led project has been promoting the cultivation of indigenous roots and tuber crops, organic agriculture and integrated pest management, and seed bank establishment (Equator Initiative, 2008c). Women’s groups are also involved in ecosystem protection and restoration projects. An example comes from Senegal, where a collective of women’s groups in nine villages manages mangrove nurseries and reforestation. The group has made significant contributions towards restoring the mangroves and protection of biodiversity, which has encouraged the return of wildlife (Equator Initiative, 2008d).

Integrating adaptation and livelihoods with the protectionof indigenous people’s rights

Adaptation projects are closely linked to the initiatives aiming to protect traditional knowledge and indigenous people's rights. Many adaptation projects are initiated, supported and carried out by indigenous communities trying to protect their rights to ancestral lands and culture. In the Philippines, an organization of the Kalinga indigenous peoples, working on, among other issues, the protection of biodiversity and indigenous rights, is engaged in a number of activities of critical importance to the resilience of local food systems such as watershed rehabilitation, reforestation, and rice terrace rehabilitation. The organization aims to achieve sustainable livelihoods through the indigenous forest, watershed, irrigation and ecoagriculture management systems; and protect the rights of Kalinga indigenous peoples and their ownership over ancestral lands (Equator Initiative, 2004a).

In Colombia, Panama, Peru, Bolivia, Ecuador, Thailand, India and other countries, indigenous organisations are actively involved in the protection of traditional knowledge and reintroduction of indigenous crop varieties of vegetables, tubers, grains, beans and fruit. The Potato Park in Cusco, Peru was created in 2005 to protect the genetic diversity of local potato varieties and associated indigenous knowledge. The project demonstrates the link between the protection of agrobiodiversity and the protection of indigenous people's rights, livelihoods and culture. Indigenous Quechua communities involved in the project have brought back from a gene bank into their fields over 400 potato varieties to ensure the adaptation to changing climatic conditions (Argumedo, 2008). The park has organised indigenous technical experts to monitor changes and identify responses and innovations that are consistent with the cultural imperatives and livelihood needs of Andean communities (ibid).

Conclusions

Three general conclusions can be drawn from this analysis of the different ways in which indigenous and traditional agricultural communities are coping with climate change. Firstly, adapting to climate change has usually involved a range of different actions at all three levels; ecosystem or landscape, farm or agricultural system, and involving both inter- and intra-specific diversity. Secondly, innovation based on both traditional knowledge and new information has been important, and social (e.g. community) cultural and political dimensions have played a key role. Thirdly, use of traditional crop and livestock species and varieties, with new materials where necessary, has been a common feature. From these follow a number of specific conclusions that can provide a basis for action to support adaptation by indigenous and traditional agricultural communities.

- The resilience of local food systems and their adaptation to change can be enhanced through a strategy of diversification within landscape and agricultural system or farm. This may be achieved using a range of different approaches including agroforestry, maintenance of a diversity of crop species and varieties, and increased use of agro-ecosystem-associated biodiversity and is equally appropriate in dryland, mountain, humid tropic and coastal environments.
- Ecosystem protection and restoration, landscape rehabilitation and reforestation can reduce the adverse effects of climate change on local food systems. They reduce the vulnerability to extreme weather events, drought, excessive rainfall and seawater intrusion, and help ensure ecosystem services such as pollination, pest regulation and erosion control.
- Resilience and adaptability seem to be enhanced by the use of sustainable agricultural practices (e.g. low-input agriculture). High-input agricultural practices and the ecosystem degradation often associated with their use accelerate the loss of agrobiodiversity, soil erosion and water depletion, and thereby aggravate the vulnerability of traditional agricultural communities to climate change.
- Adaptation involves the continuing maintenance in production systems of intra- and inter-species diversity using traditional crop and livestock species and varieties and access to new diversity. Maintenance of sufficient diversity allows farmers to improve stress tolerance through selection and breeding techniques, and enables the natural process of adaptation to

operate under the changing agro-ecological conditions. Access to new crop and livestock materials can also be an important part of coping strategies.

- Adaptation solutions are local. Protection and restoration of ecosystems, diversification of agricultural landscapes and the protection and use of agrobiodiversity de.ne an adaptation framework that can be applied in different environments. However, the choice and design of specific strategies are based on local experiences of climate change, needs, resources, knowledge and agricultural traditions.
- Adaptation activities are undertaken at the community level. Many of the challenges cannot be met at the level of the individual or farm and require community involvement. Community institutions play an important part in adaptation. Women as custodians of agrobiodiversity often play a key role in adaptation activities.
- The need to adapt to climate change has often led to the revival of traditional practices and agricultural systems. Traditional agricultural practices and land-management techniques, especially in stress-prone environments, can help ensure productivity under adverse conditions through the management of microclimate and soil and water resources.
- The continuous process of innovation required to cope with climate change involves the use of traditional knowledge combined with access to new knowledge. Local management systems of ecosystems, landscapes, agricultural systems and genetic material are often harmonised with and adjusted to changing agro-climatic conditions. At the same time new knowledge is also needed to cope with changing circumstances and the introduction of new materials.
- Local agrobiodiversity-based solutions create opportunities for integration of adaptation and protection of indigenous peoples' rights. Many adaptation initiatives mentioned in this paper are initiated, supported or managed by indigenous communities. Their adaptive capacity often depends on their ability to access their ancestral lands and protect their cultural heritage.

There remain a number of areas where we urgently need further work. One particular area is the social, cultural and political dimensions of adaptation. In a number of cases it is clear that an innovation based on traditional knowledge can lead to development of local adaptation measures that protect ecosystems and agrobiodiversity, and empower indigenous and traditional agricultural communities. This link between empowerment of communities and adaptation needs to be better understood. There is also a need to develop indicators of adaptation, adaptability and resilience that are useful at different levels and some communities and groups have already embarked on this. These indicators will help to identify what contribution agrobiodiversity can make and where it is likely to be most useful.

From the conclusions listed above it is possible to identify the kinds of activities that are likely to support the use of agrobiodiversity by traditional rural communities and indigenous peoples as part of their coping strategies. The support for, and maintenance of, local social and cultural institutions can obviously play an important part. Empowering communities so as to enable them to carry out interventions at ecosystem or landscape level can also be important. The need to ensure continuing access to a range of diverse crop varieties, agroforestry species and livestock types and their maintenance, is essential. This may best be combined with the further development of such materials through locally based selection or breeding activities. Way of supporting the maintenance of traditional knowledge combined with access to new information will be important as part of adaptation, as will the development and adoption of locally appropriate improved agronomic practices.

The results and conclusions show that agrobiodiversity has a key role to play in adaptation to climate change and to improving adaptability and resilience in agro ecosystems. It is essential that international and national policy debates on adaptation to climate change begin to take account of the rich experience and the actions already undertaken by traditional communities and indigenous peoples and to ensure their full involvement in debates on policies and actions required.

Title: Planting seeds for rooted change towards community rights in flourishing forests - A Case from Huulung District

Organisation: Culture Identity and Resources Use Management (CIRUM)
Theme: Forest
Keywords: Advocacy, community rights to forests, land reclaiming

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Summary

The necessity of regenerating forests and making the forestry sector more beneficial to Vietnamese people is widely agreed upon. Yet the prevailing reality is that vast amounts forests that should long belong to people are still under control of often ineffectively functioning State Forest Enterprises (SFE's). Conflicts over the access, control and use of forests are daily realities, like in the Huulung case where CIRUM has been active since 2007.

At the time of writing significant international and national trends are affecting forest development in Viet Nam, such as the commercialisation and the international climate change agenda. In this context large numbers of development organisations are currently engaged in the forestry sector under the flag of 'community based forest management'. For some of these efforts however their alleged community based nature can be doubted. Moreover, one can even question what their effects will be on communities and people's rights in forests over the longer run? In our context working on forest land rights is usually considered to be 'a sensitive issue'. We claim instead that it is a stressing issue, but one that we can address with the right attitude, adaptability and dedication.

In this case study, CIRUM share the experience in Ho Muoi village of Minh Son commune, Huulung district where we broke through the layer of sensitivity to work towards forests that are truly managed and used by villagers. The need to protect people's and community rights in forests is continually increasing and through this case CIRUM hopes to inspire others to work on these issues in a meaningful way.

Background

In the past few decades SFE's played a major role in Viet Nam's forestry sector. Starting in the 1970's when forests were collectively brought under management authority of SFE's to be fully subsidized and regulated to achieve state set production targets. Although the focus on excessive timber logging was understandable in the light of national rehabilitation, it also became clear that this approach could not be sustained long as at the end of 1980's devastation of forests, biodiversity and the environment had visibly adverse effects on local people and economies. Several years after launching most SFE's still lacked the capacity to implement regeneration programmes and to manage large amounts of forests under their authority. Government's recognition of SFE's weak organisational performance and the continuing environmental damage set the ground for the adoption of the Prime Minister Decision 187 in 1999 geared to assess and reorganise SFEs into more viable entities and to make the forestry sector more beneficial to the poorest local people. This policy was expected to facilitate a major release of forest land to district people's committees (PCs) to re-allocate households, but a World Bank evaluation after five years implementation concluded 'most SFE continue to use land inefficiently and locking it under their control'; in 2002 SFEs were still controlling about 40% of all forest lands with a remarkably low profit-investment rate (as low as 1.09%). Therefore to revalidate Decision 187 the government adopted the Decree 200 in 2004 with essentially the same principles and goals but with more legislative power and clearer formulated provisions. But various (official) studies conclude that the implementation of this policy did not bring the expected results of greater efficiency, effectiveness and the release of forests for reallocation to households. Ineffective SFE's still have authority over large amounts of lands

So why are well intended policies not translated into reality? It seems that the biggest struggle for district authorities relates to the demarcation, classification and allocation of forests. In many localities, re-allocation is complicated by unclear boundaries, overlapping land claims and conflicts, while many local authorities are obstructed by the lack of administrative and human capacity and a clear mandate to address these issues systematically. Moreover the vested interest of influential stakeholders is a force to maintain the status quo. As a recent study concludes:

'There still appears, to be inertia in some provinces at both PPC and DARD level to move slowly and carefully when it comes to the reallocation of SFE land. Implementation requires both the encouragement of households and individuals to accept land and forests, and the motivation of districts and communes to organize the implementation (Evaluation Study World Bank, 2005)

Eucalyptus & Environmental Degradation in Huulung

When CIRUM entered Minh Son commune in 2007 the situation in Huulung was a schoolbook example reflecting the situation previously described. After many years of SFE control the environmental damage in Huulung was and still is tremendous, particularly because since the 1990's Huulung is appointed as a strategic area for timber production. Consequently the plantation of eucalyptus has been promoted for many years with initially positive reception from local authorities and the people because the short term benefits are appealing. Large scale plantation of eucalyptus has however resulted in severe soil degradation, depletion of water resources and a loss of many valuable indigenous plant species. Even a short visit to the district is enough to convince one that the short term benefits of eucalyptus are largely outweighed by the social, economic and environmental costs and the threat for local people's long term livelihood.

Although over the past decades the amount of land controlled by SFE's in Huulung decreased significantly, they still control large amount of forests. Disputes between SFE and the people have long persisted due to overlapping forest claims or disagreement over the benefits. A common feature in the locality is that local people who have a need, cultivate (or as the rhetoric goes 'encroach') forests that have long been neglected by SFE. However in some cases as soon as local people's investments and efforts materialize, SFE's claim rights over benefits. Such claims from SFE are often rooted in the fact there are gaps in policy or the lack of clear guidelines and control which leads to arbitrary and incomplete contract arrangements between SFE and local people. Sometimes it is simply the misuse of gaps in policy to deprive local people from benefits. Paradoxically local people's need of forest that belongs to the SFE creates a dependence on the enterprise, and the vicious circle of re-entering relations and occurring of conflicts. Over the years local people had continuously been making claims and protests but the district authorities had never made serious attempts to enter into dialogue to listen to people's story or to search for solutions for their never ending disputes with the SFE. For their part, local people witnessed for many years that individual scattered complaints did not help any, but they made no attempts to innovate their approach, or to create a common voice to solve their problems.

Four years have passed and the current picture is a totally different one: in the past three years local people created a common voice and found their way to be heard by decision makers. Decision makers no longer neglect local people's concerns and are conscious of their own role and responsibilities. After a process of dialogue, local people, commune and district authorities all have the same aspirations and the commitment to regenerate the forests and recover the environment. Moreover, through close coordination they successfully reclaimed 60ha from the SFE and agreed upon the reallocation of the forest to the community and households and carry out a plan for regeneration. Particularly because they made a joint effort to reclaim the land, all stakeholders now feel the desire and responsibility to prove that they will work better on the reclaimed forests.

What happened that changed local people into aware citizens and decision makers into conscious and committed leaders? In the coming sections we try to explain why by first giving a short summary to conceptualise our approach in Ho Muoi village of Minh Son commune. In the second part we shall describe some selected details in the process and the lessons we learnt while we were on the path.

Conceptualising CIRUM's approach

If we would summarize CIRUM's approach to work on forest land rights, we could typify it as the *'combination of a community based bottom up force with lobby at decision making levels, to make the force of two directions meet towards consorted action'*. The cornerstones in this process are the guarding of meaningful participation from all levels and narrow attention for social and psychological aspects that are essential for change in people's attitudes and behaviours. Taken from psychological theories we use different ingredients at various stages for behaviour change at multiple levels with the following formula;

(A)wareness raising that a situation is problematic and there is need to change
(C)onfidence building on the ability to achieve the change
\+ (D)esire is triggered to realise the change

(A)+(C)+(D) lead to = ADC (A)ction,(C)ooperation,(D)edication to work on the change

ML= Multiple Levels and stakeholders are involved in the process
RC= Rooted Change is realised
ADC x ML = RC

Working with multiple levels to create Awareness + Confidence and Desire for change are the elements where CIRUM's role is most prominent. This process is however far from straightforward and requires an approach with different angles and a focus for each stakeholder. Once the psychological elements (A+C+D) are combined in multiple level stakeholders, the people become 'Dedicated' to take leadership to 'Act' and to 'Cooperate' towards desired change. At this point CIRUM's role as an NGO becomes less prominent and turns into one of supporting and encouraging the dynamics that evolve.

Village level (A)wareness + (C)onfidence + (D)esire

Ho Muoi villagers constitute the level where we worked to create increased awareness on the environmental damage created by eucalyptus and existing policies that secure community rights in forests. For this purpose we established a nursery group with key farmers, a traditional herbal healers group and undertook actions towards the building of two models to regenerate the forests. Members of these groups acquired knowledge, organisational and technical skills and moreover confidence through conducting action studies, environmental assessments and designing plans. In our encounters Cirum was always looking for opportunities to bring in the information we had acquired through policy analysis and research. Another angle for capacity building was the organising of study tours to the HEPA (an ecological preservation area in Ha Tinh province) and Cirum project area to put the key farmers and herbal healers in touch with other areas. These encounters prompted further discussions on the problems local people are facing like the loss of indigenous species, knowledge and culture; moreover it gave the key farmers and the healers the opportunity to learn about other groups' processes to establish and run a community based organisation and to reclaim forest land for protection and regenerating indigenous species. These models showed the people a real life example what the result of their plans like nursery development and herbal gardens could be in a few years. Exchange with strong persons elsewhere was significant because it made key farmers and the healers conclude that change will only occur if local people desire the change and take action. This brought the healers to a point where they took action to convince the commune party secretary to visit the same study areas as they did before so he could witness with his own eyes how Huulung's future might look like; provided that they have the right conditions. After convincing the party secretary the healers and key farmers from six households started to discuss and design their ideas into concrete plans. After a needs assessment and mapping the forest use situation, the healers identified 14ha forest areas with important ecological functions, for which they drew up a basic plan for regeneration.

Commune Level (A + C + D)

After hearing healers' stories, the commune party secretary's curiosity was awakened and together with the healers CIRUM organised a study tour to HEPA for commune level leaders to lay the first seeds for the idea to reclaim forest land for regeneration. Inspired by the visit on the one hand, and witnessing the eager attitude of healers on the other hand triggered the party secretary to join the villagers in their cause. From that moment on local people could count on his support and involvement in activities like local assessments, further designing of the model for regeneration and community mobilisation. While the involvement of such an influential person reinforced local people's confidence, the party secretary's insight in the environmental damage and policies increased and soon the commune party secretary turned into a key figure in advocating for the reclaiming of land from SFE and to regenerate Ho Muoi forests. As we will see later on, the party secretary would play a pivotal role as bridge between local people, commune and district authorities.

District and Province Level (A + C + D)

Parallel to the above mentioned process of community mobilisation, CIRUM also worked on awareness raising among higher level decision makers. This was strategic because at later stages these actors would be needed for final approval of the plans for reclaiming and regeneration. Their awareness and commitment would also help us to influence and mobilise lower level decision makers. Therefore aside from informal contacts to build relations, CIRUM informed and involved Huulung District and Lang Son provincial officials at crucial points in the process and organised study visits to demonstrate regeneration models in other areas.

Action Cooperation Dedication x ML = RC

At this point the awareness, confidence and desire to reclaim land for establishing a model for forest regeneration had become strong among villagers and commune leaders and to some degree provincial officials. From this point onwards there was a highly dynamic situation of action, cooperation and spontaneous attempts among stakeholders to influence and persuade each other.

After the healers and key farmers designed a model for community based forest regeneration and management, they needed to present and discuss with villagers. After all, the desired situation could only be realised with dedication from a broad range of people and the model would become the villagers'. Hence in a meeting facilitated by the commune party secretary the model was presented to villagers in order to collect ideas on its appropriateness and necessary adaptations. During the meeting all households in the village were represented and 42 households (of the total 140 households in the village) principally agreed to participate in the model, even though the details of forest allocation and regeneration had to be discussed and negotiated further. After the meeting the party secretary took responsibility for the formalities to reclaim 14ha forest from the SFE and sent on behalf of all villagers the first letter to commune officials, and attached the design of the model, the minutes of the village meeting and signatures of all households that would participate in the model.

Shortly after submitting the first letter villagers organised an onsite meeting for commune officials to make them understand the background of the reclaiming project. Through letting them witness the environmental problems and by explaining the model the villagers anticipated convincing the leaders about their capacity to use the reclaimed forest more effectively. Then on the request of commune leaders another study visit was organised to Cirum project areas and HEPA to learn more about the practical implementation and outcomes.

Once commune leaders were convinced, they took formalities to forward the people's request to district authorities. Here we had come to the most crucial point: our efforts for community mobilisation from the bottom up and the lobby at higher level now met at a central and most decisive level. On request of the commune leaders the whole cycle of organising onsite meeting and study tour was repeated for district level officials. After these visits the district leaders did not merely approve of people's request but the district party secretary even requested local people to reclaim more than 14ha forest. Subsequently the villagers revised their plan and expanded the model to 60ha and 40 households and re-sent the reclaim letter to the district. It was just a matter of days before the district gave formal approval and forwarded the reclaim request to the final decision makers: Vinafor and informed SFE officially about the request. Previous involvement of Vinafor in the process meant that approval was just a matter of formality. The only dialogue left was with the SFE and the district officials took leadership in this process. As the enterprise needed to understand what is happening and they were asking about Cirum, district authorities organised meetings and a tour to Cirum study area. Although still having questions, SFE realised they had no other choice than to accept the reclamation as they saw how the confidence of the villagers and how they were backed by leaders at all levels. Nevertheless they were also interested to cooperate in and learn from the regeneration model as also the SFE itself was in search of solutions for the situation. From now onwards the villagers, commune and district leaders and Cirum had a responsibility to make the model a success.

Zooming in the process and lessons

To anyone familiar with development work, the activities outlined may seem trivial, considering that community mobilisation, establishing Community Based Organisations and study visits are nowadays part of essentially any development intervention in Vietnam. Nevertheless we assert that not every community mobilisation or study visit is the same. In the coming sections we try to pinpoint what we encountered as key factors that make a development intervention truly community based, locally rooted and effective beyond the borders of a project.

Never stop learning about the locality

To work with local people meaningfully, especially on a topic that is generally perceived as sensitive, it is crucial for an NGO to gain insight on the history, culture and present social and power structures and continuously keep an eye on local dynamics and changes in power. When we first entered the commune after a small investigation, we obviously thought to be of added value in solving forest land conflicts and supporting forest reallocation, but we underestimated the sensitivity of the issue and were initially blocked by the commune chairman. Confronted with the fact we needed much more time to grasp the local situation; we started actively on building relations and trust.

Furthermore, particularly in the beginning levels. Field staff members were continuously interacting with local actors and were able to formulate questions suitable to the person and situation. Finally also the fact that field staff originated from the commune was an enabling factor to establish relations and to access to information.

Civil society should touch upon the 'Pain-points' and find says to face the challenge

CIRUM's strategic and long term goal in Huulung has been and still is to facilitate the forest reallocation from SFE's to local people and to promote their sustainable use and management by the community. We want to generate evidence that community based management of forest benefits both people and nature. As briefly pointed out before, in initial phases we were blocked by the commune chairman. The situation characterised by multiple conflicts and varying interests was clearly too precarious to touch upon. At this point we could have decided to re-shift our attention; but we believe that the fundamental role of an NGO is to face challenging issues; this is what gives us our legitimacy and raison d'être. Therefore being blocked merely meant that we had to revisit our strategy and to think creatively of other paths that could lead to our goals. We started to work directly with villagers on small pilot projects that are fitted with government policies and local concerns, such as 'natural resources management' and used generally accepted terms to explain our goals.

On the surface our work was acceptable but in our activities, formal and informal encounters we were always aiming to create understanding on the damaging effects of eucalyptus, the ineffective use of forests and policies. By directly working with the people we guided them in assessing alternatives and learn about ways to claim their rights for a better future. Paradoxically the sensitivity of forest land issues made it challenging to work on it but it was at the same time also the reason why Cirum received much cooperation over time: the pain was felt by all, from local to the district levels. One of the paths to open up the discussion on land conflicts and ineffective SFEs, was through making it impersonal. In this sense the numerous study visits to Truong Son forestry cooperatives, Ha Tinh province and Cirum project in Bac Lang, about which you can read in the next box, have been a determinant factor. These are two areas where Cirum has cordial relations and where comparable problems as in Minh Son and Ho Muoi village had already been solved.

The different study tours showed people from Minh Son they are not the only ones dealing with certain problems and this would open the way to start to discuss SFE and the environmental situation in Ho Muoi. It was clear to see that each and every time the participants of the visits were impressed by the sight of the flourishing forests that were locally managed and this triggered discussion of this as a potential model in their own situation. While the potential to establish a similar model in Huulung or Min Son was discussed, this naturally led to opening the discussion on challenges that needed to be overcome first: conflicts between SFE and the people. Then the leaders in Huong Son and Bac Lang would use this opportunity to share about their experience of reclaiming forest from SFE and reallocating it for local regeneration and management. There was a clear pattern that before study visits participants were often silent and reluctant to open up about the problems with SFE, whereas during and after the visits the dialogue would be open and lively. A very clear indication in change of attitude was when the district leaders admitted having difficulties in solving the complex land conflicts and admitted they do not know where to start. Just as important was the fact that the study visits served as a mirror that change is only possible if local people and authorities join forces and take action. Therefore the importance of carefully selected areas for study visit can not be overstressed. These should be suitable for the visitors to identify themselves with and should provide prospects for change that are in reach of the visitors.

Another positive side effect of visiting Bac Lang was that it allowed us as an NGO to prove our contributions elsewhere and gain trust. The more we worked with local actors the more they understood our intentions and let go of the perception that NGO's are anti-government. There where we had been blocked to work on forest land issues two years before, we were now openly welcomed to provide support to become another HEPA or Bac Lang.

Lobby: Nurture and use relations at different levels strategically

Establish relations at different levels
The use of our existing relations has been very helpful throughout the whole process. To start with our existing relations with the Provincial Farmer Association and the provincial department of international relations enabled us easy access to the district and community in the start up period. In order to introduce ourselves we first organised a workshop in cooperation with the Provincial FA. And during the initial study visits we could count on participation from influential actors at province and district levels because they were invited through our relations at provincial departments. While gaining trust from local people had been relatively easy, it was initially a struggle to gain trust among commune and district authorities because of the common perception that NGOs are antigovernment. However step by step we have been able to build trust and relations with key actors through a humble attitude and through sharing about the progress to show our contributions to local people and our plans. To guide and monitor our project Cirum established a so called 'Task Force Group' with representatives from district and commune authorities, mass organisations and local people and this Task Group was informed and involved at important moments in the process. We especially tried to recognize and ally with influential actors who appeared to be captive to our messages and who seemed to share the concerns of local villagers. One clear example is the commune's party secretary. He first showed hesitation towards Cirum but as we encouraged the healers and key farmers to link up with him the party secretary got increasingly involved and eventually played such an important role.

Stakeholders influence other stakeholders at the same level
Another strategy that worked well was facilitating stakeholders at a particular level and position to influence other stakeholders at the same level. Throughout the process we witnessed many examples where the enthusiasm of a key person fuelled enthusiasm of other persons at the same level. To this end we especially made use of the study visits which entailed that we supported local actors in preparing the study visits carefully, to make sure the agenda and the contents would suit the visiting delegation. Therefore every time we would mobilise our well established relations with strong leaders in Huong Son and facilitate that the agenda would involve same level actors as the visitors. If it were for instance Huulung district leaders visiting, then the district leaders from Huong Son would be invited for the discussions and if the visitors were healers, then the healers from the locality would be invited. The contact between the same level stakeholders would also go beyond the study visits. The same leaders from Huong Son would also participate in the study visits to Bac Lang, local workshops in Minh Son and onsite meetings in Ho Muoi in order to act as key speakers and share their experience. The discussions and information shared by strong leaders from Huong Son had a much larger effect than when an NGO like us would share the same information and ideas.

Exchange and communication with same level persons proved effective because there was a certain level of understanding of each others position and situation. Moreover seeing that people in the same position had been able to solve problems increased the curiosity and confidence of visits to landmarks and tourist attractions. This was partly to create a lively impression on the fieldtrip that would make them remember, but most importantly a social agenda created the space for informal contacts and exchange of valuable information.

Facilitate dialogue between different levels
Supporting local people to formulate plans and getting approval from authorities is not an uncommon development approach. However a more important matter is the quality of the process and the question whether the local ties have been strengthened to ensure long term effectiveness. Therefore both before and after submitting local plans we created occasions of sharing and dialogue between local people and authorities:

Especially the onsite meetings were an effective way to establish understanding and goodwill among authorities and local people. Actually these were the first time occasions where commune and district authorities and local people listened to each other's problems, dilemmas and entered into constructive dialogue. Being in touch with local people and listening to their stories, problems and aspirations gave all the complaint letters and the problems they knew flesh and blood; they could no longer ignore. During the onsite forum for commune leaders, the chairman who had initially blocked us by saying that land problems do not exist, showed a total shift in attitude. He openly discussed problems and revealed his disagreement on the way SFE is managing the forests. In a speech he shared with all villagers the beautiful memories from his childhood in Huulung…when the forests were flourishing and spread so much life!

Ensure local leadership and ownership

Whichever level and whoever we work with, as an NGO we are constantly aware of our position and role. In our cooperation and encounters with local people and authorities we try to be humble about our position at the same time. We are confident and show our willingness to support whenever necessary, but more often we need to take a step back and let local actors take the leadership. This implies that as an NGO you must sometimes accept the loss of control and reinforce the ideas and dynamics that evolve spontaneously. Local ownership is the only way to guard quality of the process because local actors know best how to deal with political and social dynamics in their own context. Moreover it is the only way to ensure local actors feel ownership over decisions and will feel responsible afterwards, also in case Cirum would leave the commune.

The activities directly in the community have often been led and carried out by the healers or key farmers. Also with regard to decisions for the future Cirum never imposed a solution. It was rather that through local studies, meetings and study visits local actors learnt about alternatives and assessed their feasibility. Eventually the healers themselves spoke out the wish to establish a community based regeneration model and they requested Cirum for assistance. Only from that point onwards we gave the support in the design of a regeneration model. The same goes for the community mobilisation which was fully carried out by the healers, key farmers and commune's party secretary and when they felt it was the right time.

In fact many of the study visits and onsite forums we organised were not our idea but have often been initiated by local actors who asked Cirum to support. For instance, after the first study visit to HEPA the provincial officials requested Cirum to bring them to our project areas to learn more about our activities. Another case was after submitting the first letter of forest reclaim the commune leaders suggested to organise study tours for the district authorities. This could be seen as indication that they really cared about the understanding and agreement among district leaders for the reclaim. Indeed these study tours convinced the district leaders who did not only agree on the reclaim but even requested local people to revise their plan to ask for more land. It was also the wish of district leaders to talk to local people about their plans that made them request an onsite meeting in the village with district authorities alone first and another onsite meeting between villagers and SFE as second.

There were also instances at which we were explicitly asked to step back as an NGO because it was pointed out that 'local problems should be solved by local actors'. This was the case with the commune's party secretary who took lead in the procedures to reclaim land and the district authorities who took responsibility to negotiate with the SFE and to mediate in the process of forest reallocation and establishing the model. However a loss of control does not imply a loss of responsibility because the role of an NGO remains to follow closely what is happening and guard that the process is participatory, equal and outcomes are just. Furthermore an NGO must always be alert to possible unintended effects of its presence. We exist to support people in solving their problems, not to create them.

Title:Building and Supporting Resilient Biocultural Territories in the Face of Climate Change

Organisation: Indigenous Peoples' Biocultural Climate Change Assessment (IPCCA)
Theme: forests, agricultural fields, grasslands, inland water systems, coastal systems
Keywords: indigenous biocultural territories, climate change, traditional knowledge, livelihoods, well-being

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Summary

The IPCCA is an indigenous initiative which brings together indigenous communities and organizations from a diversity of fragile and biodiverse ecosystems and socio-ecological production landscapes to assess the impacts of climate change and build responses that enable continued resilience and strengthen a harmonious relationship between people and nature. This case study explores the IPCCA approach of indigenous biocultural territories and a methodology based on combining traditional knowledge, local inquiry and science through a mutli-stakeholder participatory process to understand climatic change as it is experienced locally, assess climatic and ecosystem conditions and trends and build adaptive responses for well-being. The IPCCA approach is offered as a vehicle for accomplishing the Satoyama Initiative goals.

Introduction

Socio-ecological production landscapes, or Satoyama-like landscapes are the product of historical co-evolutionary relationships between communities and ecosystems. Most indigenous peoples have historically maintained harmonious relationships within their territories, nurturing the rich biological and cultural diversity found in the world. Today, indigenous peoples are among the most impacted by climate change (UNPFII, 2007). Their landscapes and territories are facing severe impacts of extreme weather events such as droughts or hurricanes, and melting of the permafrost and glaciers and sea level rise as a result of rising temperatures, leading in some cases to relocation of entire communities and in most cases to a weakened ability to sustain livelihoods and well-being and maintain the co-evolutionary relationship with the ecosystems that have enabled their historical resilience. The Indigenous Peoples' Biocultural Climate Change Assessment (IPCCA) initiative is a response to this challenge, empowering indigenous communities to undertake local analysis of the changes and their impacts in order to build appropriate adaptation and mitigation responses that strengthen their socio-ecological systems and enable well-being within their territories.

Based on the experience of indigenous communities, the IPCCA uses a biocultural response, empowering communities in their indigenous models of territoriality. Since its inception in 2009, nine local biocultural assessments of climate change impacts are being implemented, as seen in Table 1 the local assessments were selected to provide diverse experiences of the impacts of changing climates on ecosystems and livelihoods.

Region/Country	Indigenous Peoples/Communities	Ecosystems
Pisac, Cusco, Peru	Potato Park, Quechua	High mountain agroecosystem
Amazonia, Ecuador	Sápara Nationality	Tropical rainforest
Kuna Yala, Panama	Comarca Kuna Yala, Kuna peoples	Tropical forest, coastal and marine

North Western USA	PNW Tribes in California, Oregon, Washington, Nevada in USA and British Colombia in Canada	Pacific coastal, interior mountain and continental semi-arid shrub-steppe, Great Basin biomes
Lapland, Finland	Skolt Sámi Nation, Village of Sevettijärvi	Sub-arctic river and terrestrial
Kenya	Maasai peoples	Evergreen bushland
Andra Pradesh, India	14 Adivasi communities	Forest and agroecosystem
Chiang Mai, Thailand	Huay Manao village, Karen indigenous peoples	Tropical rainforest
Ifugao, Philippines	3 major linguistic groups in Ifugao province	Mountain, forest and agroecosystem

Table 1. IPCCA Local Assessments

The local assessments use local frameworks and perceptions of climate and its changes to build understanding of the changes induced on the ecosystem-community relationships and their impacts on livelihoods and well-being. Through building epistemological bridges between traditional knowledge and science, new innovative approaches to maintaining livelihoods are empowering communities to strengthen and reclaim their territorial approaches within the current challenging context of global change. This case study illustrates how the IPCCA approach and methodology are appropriate vehicles for addressing the goals embraced by the Satoyama Initiative to maintain harmonious relationships between nature and people for resilient socio-ecological production landscapes.

Indigenous Biocultural Territories

Indigenous biocultural territories is a proposal for territorial management modeled on traditional indigenous territoriality (Argumedo & Pimbert, 2008). The term biocultural is used to emphasize the interlinked nature of the social and environmental systems, as well as providing a platform for recognition of the biocultural heritage contained within the territory (Swiderska, 2006). Elements of territoriality include land tenure and use, ritual practices relating to the land, systems of production and exchange, political claims and cultural identity (Liffman, 1998). Examples of traditional models include the Comarca system in Panama, ejidos in Mexico and the ayllu system in the Andes. A common element of these systems is the resilient and agrobiodiverse landscapes that are found within them. While each model developed within a particular local context of ecosystems and culture, they all share a common holistic approach to managing the relationships between people and living spaces. The resulting territories and their landscapes are therefore the product of historical engagement in a particular way with the world and the process of adapting to their environmental conditions and climate (Ford et. al 2006; Posey, 2001; Stevens & De Lacy, 1997).

Besides being grounded in territory and indigenous governance, processes used by indigenous people to manage land and life are also rooted in an indigenous understanding of the cosmos, in which people and all other beings in the world are interconnected, creating social relations and obligations between all beings (Berkes 1999, International Council for Science 2002, Allen et al. 2009). The resources and biodiversity found in indigenous territories are managed through a reciprocal relationship between all beings. Indigenous resource management practices are therefore the result of a way of being in the world, the consequence of which, in many cases, has been to nurture resilient social and ecological systems and landscapes.

Photo 1. The Potato Park landscape, Pisaq, Cusco, Peru. (Photo by ANDES)

This territorial approach to understanding development and maintenance of socio-ecological production landscapes provides a wide base for strengthening resilience. Processes that have maintained resilience in these particular socio-ecological production landscapes include social organisation, spiritual engagement, economic relations, knowledge production and sharing, and collective governance. In many cases these underlying processes and the associated knowledge have been degraded through colonization and continued discrimination as well as new threats such as climate change. The indigenous biocultural territories approach used by the IPCCA provides an opportunity to creatively build upon traditional territorial models in order to create systems that can respond to the current political, environmental and social contexts and challenges. Through assessing where impacts are impairing the ability of communities to maintain or strengthen their resilience, new innovative models are built. Socio-ecological production landscapes in this context are both a vehicle for resilience and the product of historical resilience.

The IPCCA Methodology

In undertaking biocultural climate change assessments, the IPCCA has built upon the experiences of local partners working in diverse and fragile ecosystems across the world, to develop a common methodology. The methodological framework used is based on intercultural dialogue, bringing together participatory, emancipatory and indigenous methods adapted to the local context in a multi-stakeholder collaborative process.

Political, economic, and ecological processes are at play in creating climate change and solutions must therefore address all of these aspects. The processes that are drivers of climate change occur across physical parts of the globe and its cultural spheres, such as global production and consumption patterns that are responsible for greenhouse gas emissions; hence it is understood not just as climate change but as global change (Karl & Trenberth, 2003). It follows, therefore, that adaptive strategies for responding to global change must create links between the scales and cultural contexts that create the changes and those that are being impacted. Intercultural practice is a way of doing this, which allows awareness and analysis of the inequalities embedded in interactions between indigenous societies and their knowledge systems and dominant cultures. This is particularly important in the IPCCA process, as indigenous peoples are the most vulnerable due to historic process of discrimination and their direct dependence on the ecosystems they inhabit.

The first step in the process involves developing the structures that will be used to undertake the analysis – a local steering committee is established, and study and focus groups identified for undertaking analysis of climate change and its impacts in the communities. Once the structures are in place, a baseline is developed. Information is gathered to build a picture of the current state of the biocultural territory (ecosystems, communities etc.) and climatic conditions in the area. Strong emphasis is placed on recovering traditional knowledge on ecosystems and climate. Ecosystems services are described from a local perspective, valuing the rich knowledge of biodiversity and climate that is the product of their co-evolutionary past. In some cases this requires recovery of knowledge from elders, and intergenerational exchange is a key element in this process of empowerment.

Once a clear picture of the current state of the biocultural territory and climatic conditions is achieved, an assessment of conditions and trends and their impact on the identified elements of resilience in socio-ecological production landscapes is undertaken. Through use of cutting edge tools such as global climate models brought together with maps of traditional landscape management practices, bridging of epistemologies enables analysis of potential future scenarios for a resilient landscape that can provide well-being. The carrying capacity and resource use within the landscape is based on historical use and knowledge for landscape regeneration taking into consideration the changing conditions. The resulting information is used to undertake futuring activities and scenario building exercises within collective decision making processes for future planning.

Throughout all stages of the assessment, maximum participation of community groups and members is ensured through a collaborative process. As the assessment is driven by the community, local authorities and decision making spaces provide participatory platforms, ensuring that all relevant knowledge and expertise of aspects of landscape management, livelihoods practices as well as spiritual connections are contributing to building a picture of the challenges and finding avenues for responding appropriately.

Building Resilient Biocultural Territories

The strategic goal of the IPCCA local assessments is the development of evidence-based and locally appropriate responses that enable resilience of the biocultural territory in the face of climate change. To this end, each indigenous biocultural territory undertaking a local assessment develops life plans. Life plans are strategies for cultural, social, political and economic affirmation of a territorial approach to development – they are, in essence, development plans that focus on building resilience and ensuring well-being. They are built from within, creating strategies to use local knowledge, values and objectives to build resilient production landscapes to face climate change and other political, economic and social challenges.

The life plans developed through the IPCCA assessment process are vehicles for reaching the Satoyama Initiative vision of realizing societies in harmony with nature. Developed from a holistic biocultural understanding of territory, landscape, ecosystems, knowledge and collective life, the IPCCA assessments can: consolidate wisdom on securing diverse ecosystem services and values; integrate traditional ecological knowledge and modern science to promote innovations; and explore new forms of co-management systems while respecting traditional communal land tenure.
An example of how this may be accomplished comes from the Sápara territory in the Ecuadorian Amazon. In the Amazon, climate change is impacting on hunting and gathering practices, which are the basis of Sápara livelihoods. The communities are responding through analyzing climatic conditions and trends and their impacts on forest ecosystems that provide services ranging from provisioning (food, fuel, water etc.) to cultural (spiritual connection to the forest). An understanding

of climate change as a global process through scientific models provides opportunity to link local to global concerns. The vast knowledge of the forest ecosystems, which is based on a historical co-evolutionary relationship, is combined with GIS maps to identify areas of vulnerability from various threats, including those posed by oil exploration in their territory. Their life plan, which is in development, will address the need to adjust livelihoods practices while needing to secure their communal land tenure to ensure their ecosystem services and resilience in their territory. The territorial approach enables a wide view of the local needs, without separating environmental and social realities.

A different example comes from the subarctic tundra ecosystems in Lapland, Finland. The Skolt Sámi practice their traditional reindeer herding and subsistence fishing activities in a biocultural territory that is experiencing severe impacts of climate change. The changes being experienced illustrate that climatic change combines with other social and economic processes and is threatening their reindeer herding livelihoods. The relationship of people and reindeer is a deep and spiritual connection and the impacts on culture and spirituality cannot be underestimated. Through forced relocation Sámi knowledge has been significantly degraded and livelihood adaptations were made from nomadic to settled life. Today, through the IPCCA local assessment the Skolt Sámi are recovering much of their lost traditional knowledge and practices, to strengthen their own understanding of historical resilience and to renew their practices of subsistence fishing and reindeer herding. Use of video techniques and GIS are assisting in the assessment and development of adaptation plans that can maintain the harmonious relationship between people and nature, which is the basis for resilience.

The two examples illustrate that each biocultural territory is different, and each must be understood through local frameworks and processes. The International Partnership for the Satoyama Initiative is a network of initiatives, organizations and communities all contributing into the complex task of maintaining resilient socio-ecological production landscapes. The IPCCA territorial and methodological approach provides opportunity for empowering communities to recreate their futures based on what has worked in the past and what is needed to face new challenges.

Title: Role of Traditional Knowledge in Strengthening Socio-ecological Production Landscapes

Organisation: Indigenous Peoples' International Centre for Policy Research and Education (TEBTEBBA)
Theme: Others

Summary

Traditional knowledge of maintaining the balance of the different parts of the land is a primary consideration in territorial management among indigenous peoples. Presently, much of these are in varying stages of persistence and dis-integration due to various socio economic and political pressures. Recognizing the importance of traditional knowledge including customary sustainable use and equitable sharing of resources, the United Nations Convention on Biological Diversity (CBD) , has not only adopted their promotion in its Article 8j and Article 10c respectively, but also adopted the ecosystems approach as its main framework in its program of work. It was along this line that the Tebtebba Foundation, Inc. forged a partnership with the Montañosa Research and Development Center (MRDC) in June 2008 and engaged the Kalanguya's of Tinoc, Ifugao of the Cordillera Administrative Region, Philippines to implement the project "Support for Community Development within the Framework of Indigenous

Peoples Rights and Ecosystems Approach"

The work brings together five communities of Tinoc, Ifugao, Philippines and two IP organizations; the MRDC who works directly with indigenous peoples' organizations on sustainable production food systems for 30 years and Tebtebba, who works and has gained recognition in promoting indigenous peoples' rights in the international arena. It is a collaborative work with the following objectives:

- To enable communities to identify and characterize the land use and management of their territories, i.e. composition, structure and function with respect to a) human interaction, needs and values including cultural aspects; b) conservation and management of biodiversity; and c) environmental quality and assess changes on the mentioned subject matter;
- To facilitate information exchange and learning sessions among and between community holders of traditional knowledge, authorities of customary law and service providers/duty bearers towards formulating and adopting development plans within the principles of ecosystems approach consistent with the rights and customary resource management and sustainable use practices of indigenous peoples;
- To promote the adoption of the ecosystems-based approach at different levels of development planning and implementation and to draw lessons at appropriate times from the piloting experience and transmit these to policy makers and strengthen implementation of the ecosystems-based approach; and,
- To support initiatives on socio-economic work pertinent to revival, innovations of traditional livelihoods linked to biodiversity and ecosystems.

Project implementation

To implement the project, four development strategies were drawn up, but at different stages of the work, the partnership had to find the correct balance or combination of two or three of these and at other times, to focus on just one. These strategies include (1) research and documentation, (2) organizing and capacity building, (3) advocacy and networking, and (4) socio economic projects implementation.

Site Selection and Getting off the ground

The Cordillera Region, Philippines which forms a contiguous land mass peopled mainly by indigenous peoples (comprising more than 85% of total population) who more than once have come together in region wide unity to defend their lands, rights and resources was chosen as the implementation site. The Partnership zeroed in on the area that forms the watershed of the 360- mw Magat Dam, a geographical scale that would enable the Partnership to 1) focus yet 2) be able to show interrelations and 3) be able to target an inter-provincial cooperation. The site is in the Province of Ifugao, a UN-declared heritage site for its impressive rice terraces.

Since the project was a pro-active initiative of the Partnership, it took time to introduce and explain the project and get the informed consent of the chosen communities; namely: Ahin, Wangwang, Tulludan, Tukucan and Binablayan, five of the 12 barangays of the municipality of Tinoc, Ifugao.

The developmental phase of the project proved to be much harder than anticipated due to (1) the prevailing "research fatigue" due to numerous researches conducted, (2) the widespread discrimination against traditional lifeways and practice of rituals which some Christian fundamentalist groups have portrayed as works of Satan and (3) commercial chemical-based farming and the attendant culture that measures success in terms of cash generation have relegated traditional subsistence production systems as "backward."

These difficulties prompted a strategy shift from a more focused research to more awareness raising through formal and informal sharing sessions to discuss the distinct features of indigenous knowledge on sustainable use and resource conservation and the cultural practices that strengthen community cohesion and solidarity. These also served as a venue to learn and generate data on traditional resource management practices, production systems and changes through time in the target communities. Data gathered from these sessions were substantiated with key informant interviews.

The work hastened as more people became interested in the research process that incorporates awareness raising. By September 2009, the project was able to gather substantial data showing the contrasting situations of Ahin, a subsistence village, and Tukucan, which has adopted production for the market through the commercial monocrop chemical-based vegetable production. The data presented a sophisticated knowledge system of sustainable land use management and resource sharing in Ahin, most of which are still practiced by the present generation. On the other, Tukucan which since 1996 has gradually converted most of its agricultural land to vegetable farm manifested a degraded environment, decreased ecosystems services, increased food insecurity and a growing incidence of indebtedness among the farmers.

Up-scaling in the municipal level

Such findings made possible the advancement of work in networking and advocacy which pushed for the holding of the First I-Tinek Land Summit in January 2010. While the Summit highlighted the Kalanguya's profound knowledge in managing territories and sustaining and improving biodiversity, it also sounded the alarm on its state of erosion. In some areas, indigenous knowledge is eroding as people succumb to "modernity" in response to discrimination even as the international community is increasingly promoting it to remedy global ecological ills. The summit underscored the present challenges of a degraded environment resulting from chemical monocrop farming, decreased land security due to privatization of communal lands, and waning authority on customary law especially on resource use. From their collective learning the participants came to some conclusions:

We may not be able to convert privatized bel-ew (watershed) back to 'communal' land but 'owners' must agree to convert and maintain it as part of the watershed and community protected area. We need to strengthen our customary laws and further develop our indigenous knowledge systems on sustainable use.

The covenant, signed by 63 leader representatives of all 12 barangays of Tinoc, called for action to "arrest environmental degradation and promote people's wellbeing." To carry this out they identified some actions to take; namely: (1) halt environmental deterioration and address such phenomenon (e.g. stop farmland encroachment into the forest land, reforestation and delineation of community protected areas) and (2) increase food security through sustainable food production systems, renewable energy development and, where feasible, reviving and promoting innovations/development of traditional occupations (e.g., permaculture in rotational agricultural areas). Further unification process was done through the holding of the Man-ili Leaders' Forum, a gathering of elders, authorities of customary laws and more community leaders. They re-affirmed the potential of their traditional knowledge and culture to solve environmental ills, weakening unity of communities, and cultural erosion due to religion. They also raised the need for the entire Tinoc municipality to unify on current land and resource issues. Finally the Man-ili forum committed to incorporate the covenant in the plans of all farmers' associations in Lower Tinoc.

Comprehensive Land Use Planning

Among concrete actions identified as early as January during the Land Summit was for all the 12 barangays to do a comprehensive land use planning (CLUP) in their respective communities. Tukucan led the first implementation by starting the delineation community protected areas and actively campaigned for the reclamation of degraded watershed areas in November 2010 and started its reforestation program in February 2011. Since only Ahin was following the example set by Tukucan, a steering committee composed of the Municipal Development and Planning Office, the Municipal Agricultural Office, 2 elders (1 male and 1 female) and the Partnership to facilitated the CLUP processes in the different barangays. Barangay CLUP started in May and continued up to the first week of August amidst preparation of swidden farms and rice harvest.

Summary of research findings

As defined, ecosystems approach is a strategy to manage land, water and living resources that promotes conservation and sustainable use of the different parts of the environment, thereby ensuring continued ecosystems services and functioning for people's well being. The Project concluded that ecosystems approach is a traditional holistic view of the Kalanguya of Tinoc in the management of their territories. The Kalanguya manage their territories through a land use patter creating different nested ecosystems within their mountain homeland. Starting from the highest elevation is the 'bel-ew' (watershed).

The bel-ew or watersheds are collectively owned by villages. It serves as boundaries between villages and source of clean air, water, fuel, food and medicines. Neighbor villages are also allowed to hunt, gather food and medicines. Unwritten law on the use of this include no cutting of trees and non- burning of the bel-ew. Within the bel-ew are the pehyew or sacred sites which also serves as sanctuary for animals and plants; the dowengan (hunting grounds), linnengan (areas for bird hunting) and the along-ni-hebheb (natural springs).

Scattered just below the watershed are the kiyewan (woodlots), source of the many other needs of the community such as timber, firewood, food, medicinal and pesticidal/ botanical plants. Below the kiyewan are the inum-an, areas for swidden farming . The kiyewan is a communal woodlot and muyung are clan-owned woodlots where people source their fuel and materials for building their houses whereby selective and regulated cutting is practice. Inum-an are communal swidden areas and kinabba is a privatized swidden farm. If not used by the owner, the kinabba can be tilled by others with the permission from the owner.

Adjacent to the swidden farms are the pahtu, the pastureland or grassland where large ruminant animals such as horses, cows, carabaos and goats are left to graze. Next is the papayaw or ricefield which are privately-owned. Aside from producing rice, onions, garlic, leafy vegetables and legumes are rotated in the same paddy field. After harvest, rice stalks are mixed with mud to form mounds where vegetables are planted. This practise makes it possible for soil to have good aeration to improve both physical and chemical properties. Ricefields are also a source of fish (tilapia, dalag and mudfish), snails and mudfish collected by any member of the community.

Pan-abungan are the homesites. A typical Ifugao house is a perfect picture of an agro-forestry system surrounded by tree gardens of various species and bamboos integrated with herbs, vegetables and animals which manifest deep understanding of diversity and integration. Part of the home but a distinct land use is the dayahan, an area specifically designated for pigs at the farthest edge of the homesite in a forested area. Pigs after being fed their morning meals are left to roam the dayahan.

At lower elevations are the wangwang or outflowing river from streams and creeks which serve as the source of irrigation water and habitat of aquatic resources. These are held in common by the villagers and are sources of fish snails, and insect larvae gathered for food.
From the different parts of the land emerged a biodiversity of flora and fauna distinct to each of the nested ecosystems- the fish, frogs, edible snails, weeds, insects, varieties of rice, more than 20 cultivated food crops, several naturally occurring plants in the rotational agricultural areas, and various kinds of grasses and trees in the pastureland. People learned to develop livelihood and 25 traditional occupations were recorded including hunting, food gathering, food processing, farming, fishing, pottery, bamboo weaving, barter, salt making, sugar cane processing, stonewall construction and broom making. Except for blacksmithing and weaving, raw materials required for these occupations are found in the community.

The pattern of Ifugao agriculture is complex. It depends on many ecological, social, and cultural factors including the knowledge of how these elements are interrelated and effectively utilized . And so with the Kalanguya of Tinoc. The complex and integrated use of distinct land forms in their territory creates a balanced ecosystem that protects the web of life of the different parts of the ili (village/community). These are strengthened by their traditional knowledge on resource management, custom laws, belief systems, spirituality, community solidarity, and social values transmitted from one generation to the other. Their respect for nature as manifested by many rituals that they have to perform for the use of resources, their strong belief that land is life is to be nurtured for future generation and their activities determined by the coming of certain birds, flowering of certain plants, the direction of the wind, the formation of the clouds illustrates their strong hold on sustainable use and land-man-nature relationship.

Up to the 80’s, people generally live from the land and produce most of their needs but the interplay of various factors brought in changes. Formal education was introduced in the area in the 1940’s and by the 80’s, the norm is to pursue higher level education. The proliferation of wants became evident and increasing need for cash was felt. Seasonal outmigration of able-bodied household members became regular annual activity leading to scarcity of labor in the village weakening the traditional farming system of soil fertility enhancement, pest management and seed selection. Fundamentalist religions increased and downgraded the traditional belief system. This was worsened by the adoption of the chemical-based cash crop production. Virgin forests were bulldozed to pave the way for the production of commercial vegetables. By the time the Partnership entered the area, people‘s confidence on their knowledge and lifeways was much eroded that they wouldn’t like to talk about it.

Significant achievement

Increasing appreciation of indigenous knowledge systems and practices on natural resource management

For the project, the most significant impact came from the awareness raising incorporated in the process of research work have questioned which debunked misperception and clarified matters pertinent to traditional knowledge. The project was able to show, principally to the pilot communities themselves, the profound wisdom of the territorial and natural resource management passed on by their forebears especially at a time when traditional knowledge is beginning to break down and disparaging views against indigenous lifeways are causing some youth to feel shame or disinterest in learning their culture. Group discussions and formal educational sessions on sustainable use of resources led them to recognize the sound ecological basis of their traditional practices and to assert these in the face of discrimination.

Translating these into actions, members of communities have started initiatives that resulted in a) the increase of six to eight traditional rice varieties through seed exchange among women in two of the five target barangays; b) community campaigns to strengthen traditional labor exchange groups (ubbo), synchronized agricultural activities, (c) active protest against bulldozing of forestlands; and (d) recognition of the superiority of custom law over state law on land and resource management.

Moreover, deliberations on research findings questioned the widespread notion (prior to the project) that commercial chemical based vegetable production have significantly uplifted the quality of life of the people involved and forwarded observations on inability of some farmers shift to organic farming as they are now trapped into the vicious cycle of indebtedness, the prevalence of food insecurity, the decreasing water supply (2 water spring in Tukucan dried up) and marked decline in community biodiversity. A high level of unity was achieved when there was a call for action to arrest environmental degradation in January 2010 and promote people's well being by community leaders and affirmed by authorities of customary laws in .

Enabling communities to advocate and influence policies of concerned government bodies and development agencies towards supporting the general objective of the project on the municipal and provincial level

The first breakthrough in networking and advocacy was when the project captured the interest of the different line agencies after the research output was presented to them a year after the pilot communities granted their permission to the Partnership. As an offshoot of this presentation, the Legislative Council granted an allocation for an up scaling of the project on the municipal level.

While it was only the Municipal Development and Planning and the Municipal Agricultural offices who persisted, the municipal 3-dimensional mapping of the whole municipality was undertaken. The present day land use was documented and subsequent village level comprehensive land use planning were undertaken led by the barangay councils. Notable in the land use planning are the common goals of (1) enhanced quality ecosystems services through the protection and conservation of watershed, rivers, springs, irrigation canals and (2) increased food security by increasing productivity of production areas paddy fields and rotational agricultural areas and production of cash crops through revitalization and innovations on traditional knowledge.

The strengthening of custom laws of community protected areas was another breakthrough. It took more than a year for communities to deliberate and convince each other on the need to revive custom laws in protected areas. Yet upon deciding on the matter it was not only the delineation of protected areas (nine of twelve barangays) but also reclaiming degraded forest land by reforestation was started in Tukucan, barangay with the widest degraded forest.

Promoting development/innovations of traditional occupations for increased food security and poverty alleviation

To date, the partnership has implemented three projects. The first was the construction of the Wangwang Footbridge in July-December 2009 to facilitate access to farmlands. This project is the first of its kind in the community on four counts: best in quality and durability in the municipality, designed through collective discussion, implemented through an ubbo group and done through a collaborative effort of the people's organization and the barangay council.

The second project set up a blacksmith training center through the newly formed Tinoc Panday Group in collaboration with the local government unit. Blacksmithing is one of the traditional occupations in the area, but in the entire central Tinoc only one living blacksmith continues to practice it. As 53-year-old Daniel Binay-an declared,

It gives me great pleasure to be a trainer in blacksmithing. I thought I would not be able to transmit the skills I have. The project now gives me the opportunity to lead a more meaningful life, I can transfer my skills to others. As such, I will die a happy man.

Monitoring the project revealed that people have continuously streamed into the blacksmith training center to have their tools repaired since it opened in August 2010. This also manifests the tradition of kailala in which people are wont not to waste but to optimize the use of every resource.
A third project was the establishment of the Inum-an Development Project launched on November 23. The inum-an is the rotational agricultural area or where shifting cultivation is practiced. Since time immemorial, the inum-an has contributed much of the people's sustenance. Before rice terraces were built, these areas supplied rice, camote (sweet potato), legumes and vegetables. Up to this time, these continue to supplement rice farming, contributing more than 50 percent of the food needs of the village. However, inum-an management has to contend with 1) shorter fallow periods, thus decreased soil fertility and reduced productivity; 2) need for better soil erosion control as the environment becomes more fragile; 3) growing population and limited land; 4) decreasing labor force and 5) the need for cash. With the Inum-an Development Project, innovations for sustainable food systems can be showcased and food security enhanced. Specifically, the project aims to:

1. Support interested ubbo groups, with members of organized groups as a priority, willing to integrate innovations in their inum-an;
2. Provide learning venues for other members of communities for innovative technologies;
3. Increase productivity of the inum-an;
4. Contribute to increasing food security of project beneficiaries;and
5. Contribute to organizational funds to promote and develop sustainable food systems.

Some barangays have also started reclamation of degraded watershed areas through reforestation. The promotion of self help initiatives for the establishment of communal and household tree nurseries has also taken off the ground.

The bigger challenge still is how to strengthen collective action to enhance watersheds and wood lots, intensify swidden cultivation, revitalize food and honey gathering, hunting and other traditional occupations to answer the growing need for cash.

Forming or strengthening appropriate groups in the community to spearhead planning, resource generation and implementation of community development plans
Strengthening the farmers' organizations was initially not considered a priority by barangay councils, but this problem was overcome as the need for strong peoples' organizations was reaffirmed. Community leaders and elders at the Man-ili Convention discussed and agreed on a more systematic and comprehensive plan for community organizing as they gained a better appreciation of the role of indigenous peoples' organizations in ensuring self determined development. To date four farmers' organizations have been revived and organizing of elders is ongoing.

Maximizing project outcomes for national and international policy advocacy
Linking the project to national and global policy advocacy has just started. The project experience has been presented in fora organized by Tebtebba in the Philippines with the aim to promote revitalization of indigenous peoples' natural resource management systems, using as an example the

profound knowledge of the Kalanguya. It has also been shared with community mappers in different countries supported by the Forest Peoples Programme (a UK-based NGO) working on customary sustainable use through community mapping. A broader perspective was provided to these groups including traditional occupations and traditional knowledge on the development of nested ecosystems.

Continuinf work

The MRDC-Tebtebba Partnership continues to work towards the objective of unifying different stakeholders in Tinoc to formulate a road map for the adoption of the ecosystems approach on a higher and wider level taking into account current realities. This requires the formation of a body that will spearhead and ensure adoption and implementation of the Land Summit Covenant on the municipal level through the municipal comprehensive land use plan. To attain this, the following work has to be done:

- Capacity building among different peoples' organizations formed on the barangay level and envisioned to be part of the project's sustaining mechanism; and
- Convening an inter-agency roundtable discussion to define roles of each in the implementation of land use and development plans.

Conclusion

The project to pilot the CBD ecosystems approach in Ifugao is a work in progress. But as it moves to the next phase, it is guided by the insights drawn from the first phase of work.

- To introduce the ecosystems-based approach as something new is historically inaccurate and an inappropriate starting point for indigenous peoples because it fails to appreciate and build on indigenous and customary land use and management systems These systems are anchored on maintaining ecological balance, which is of utmost consideration in their economic system and part of the socio-cultural and political fabric of their community life. These must be supported.

- Development strategies that require the effective and full participation of local people have long been formulated but implementation has yet to take off in the project site.

- The conceptual framework linking ecosystems services to people's wellbeing holds true among the Kalanguya of Tinoc. This and other materials will facilitate the formulation of development indicators themselves.

- The notion that traditional occupations are directly linked to land use pattern and biodiversity is also affirmed in the study areas.

- Against an external threat, people can easily unite themselves to resist and fight. However, the democratic processes to resolve conflicts and threats created from within and by members of a community may take a longer process.

- Land use and sustainable development planning needs to be pursued to ensure the people of Tinoc of the enjoyment of their rights. These are the rights to own and develop their lands, territories and resources; to have legal recognition and protection for these as well as for their customs, traditions and land tenure systems; and to have their free, prior and informed consent obtained in any project that affects them as provided for in the UN Declaration on the Rights of Indigenous Peoples linking the project to national and global policy advocacy has just started.

Title: Integrating community development with the management of grasslands at Ke'erqin Nature Reserve, Inner Mongolia, China

Organisation: Centre for Resource and Forestry Policy Study (CFNRPS), Renmin University of China
Theme: Inland water
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Summary

Since 2007, with the support of the UNEP/GEF funded Siberian Crane Wetland Project, various community development activities in the Beizifu community have been carried out at Ke'erqin National Nature Reserve in the Inner Mongolia Autonomous Region. These community activities covered a wide range of elements for an environmentally-oriented integrated development approach: restoration of traditional cultures, empowerment of local communities, self-organization, rural bio-energy, establishment of community revolving funds, promotion of micro-enterprises, participatory pasture management planning and monitoring, environmental education, and establishment of the community-initiated Beizifu Ke'erqin Pasture Protection and Management Association. Based on this intervention, this paper documents the reflections on key points for identifying interventions and projects in the Beizifu community supporting community-based natural resource management.

These points are: translating the conceptual strategy for intervention into an operational strategy, targeting model and orientation, identifying actions supporting community-based resource management, developing trust between outsiders and the community, changing the behaviour and attitudes of local officials, and monitoring and evaluation of community actions. Finally, this paper reviews some critical issues for development interventions at the community level supporting sustainable natural resource management and biodiversity conservation, including development intervention, unification of community, culture - in particular traditional culture, and centralization and decentralization.

Background

Within the past thirty years, the total area of nature reserves in China has rapidly expanded to 14% of the country's total land area, providing protection for endangered species and representative ecosystems in a qualified sense. Traditionally, natural resources allocated for conservation would be used by local communities, and these conservation areas are often located in economically underdeveloped regions with poor transportation facilities and far from city centres. Therefore, the livelihood of local people should depend on natural resources which are 'allocated' for conservation.

For a long time, executive orders, laws and regulations have been the main measures for resolving conflicts between natural reserve protection and peripheral communities. However, because objective requirements for the survival and development of local communities were ignored, conflicts between conservation areas and communities became increasingly intensified.

On the other hand, the nature conservation sector in China has gradually assimilated new ideas from international natural conservation practices, including the important approach of community co-management. In China, community co-management has transformed from a concept into a practical action for nature conservation. With the initiative of the Beizifu community of the Ke'erqin National Nature Reserve (NNR) in the Inner Mongolia Autonomous Region, starting from 2007, the UNEP/GEF Siberian Crane Wetland Project (SCWP) has supported some pilot community development activities. Over the past 3 years, the project facilitators, the local community and the nature reserve staff jointly achieved progress in the direction of community-based resource management and biodiversity-friendly economic livelihood alternatives. At the same time, questions arose concerning some intervention actions. This paper focuses on development intervention supported by SCWP in the Beizifu community, and documents our experiences in the process of community intervention towards developing a co-management scheme for natural resource management and biodiversity-friendly alternative livelihoods. Based on this intervention, the authors wish to share their reflections from the perspective of development sociology.

Materials and methods

Basic Information on Beizifu Gacha (Village)

The Beizifu Gacha (hereinafter referred to as the Beizifu community) is located at the center of the Ke'erqin Sandy Land Region, with four natural villages, 233 households and a population of 890, 95% of which are ethnic Mongolians. Ke'erqin Sandy Land Region, the largest such sandy soil area, is a typical semi-arid region lying between farming areas and deserts in Northeast China. This is one of the most fragile regions, sensitive to human disturbance and natural calamities such as rainfall shortages and increased temperatures associated with climate change. Historically, the Mongolian people created their own culture associated with grazing the vast pastures of this region. "Beizifu" means "mansion of the nephew of the king (from the Qing Dynasty of China)", where an area with about 20,000 ha of land was presented to this nephew. With population growth, farming has been introduced in recent decades. The prolonged drought has threatened farming and grazing activities, people's daily lives and traditional culture. Yields of maize fluctuated greatly from year to year, and the natural pasture and savannah ecosystem was seriously degraded. During a baseline survey in the Beizifu community before starting the community development project, the local people ranked degradation of nature resources including pastures and wetlands, and lack of rainfall, as the primary threats to their livelihoods, and the future of the community.

Due to resource degradation, the Beizifu community, as one of the representative communities of the Ke'erqin Sandy Land Region, was marginalized during the process of rapid economic progress in China. In 2007, the average net income per capita in the community was about 900 yuan (about 132 US$), far below the national average of rural farmers, at 4,140 yuan (about 608 US$). Farming (maize and mung beans) and livestock raising (sheep and cattle) are the main income sources. In recent years, revenue from off-farm income has sharply increased, and more and more young people are seeking migrant jobs.

In recent years, many initiatives have been taken by local governments to offset resource degradation and to alleviate poverty in the Ke'erqin region, including the introduction of a grazing ban, genetically modified livestock, and eco-energy initiatives. These measures have achieved some positive impacts; however it is necessary to assess how the communities interpret these interventions in their production practices. These initiatives intended to safeguard natural grassland, wetland and savannah ecosystem with joint efforts from individual households, collectives and the state.
Beizifu community, the majority of whose territory is located in the core zone of Ke'erqin NNR, and it is unique in some aspects of its ecosystem complex including rare cranes and wildlife. However, it is a typical representative of communities in the nature reserve with rich resources, poor community, rich traditional culture, poor governance, and social and ecological fragility to outside intervention.

Ke'erqin National Nature Reserve

The Ke'erqin Wetland and Rare Bird National Nature Reserve is located within the borders of Xinjiamu Sumu (Township), in the northeast part of Ke'erqin Zuoyi Zhongqi (county) of Xing'an League (Prefecture). The geographic coordinates are 44° 51′ 42″ - 45° 17′ 36″ N, 121° 40′ 13″ - 122° 14′ 07″ E. The northern boundary of the conservation area is close to Tuquan County of Xing'an League, the eastern boundary side is contiguous with Xianghai NNR in Jilin Province, the southern boundary is the Huolin River, and the western boundary is 27 km from Bayanhushu

Township, the capital of Ke'erqin Zuoyi Zhongqi; the north-south length is approximately 46 km, the west-east width is approximately 44 km, and the total land area is 126,987 ha.

Ke’erqin is a comprehensive National Nature Reserve protecting the basic structure of the Ke’erqin Grassland ecosystem to a relatively complete degree, including three representative landscapes: wetlands supporting rare birds, native elm (Ulmus macrocarpa var. mongolica) forest and Ke’erqin Grassland. There are 175 species of birds within the conservation area, including seven bird species with first-grade state protection: Oriental Stork Ciconia boyciana, Black Stork C. nigra, Red-crowned Crane Grus japonensis, Siberian Crane G. leucogeranus, Hooded Crane G. monacha, Great Bustard Otis tarda and Golden Eagle Aquila chrysaetus. Also, there are 29 bird species with second-grade state protection. The globally threatened bird species occurring in the reserve are the Oriental Stork, Red-crowned Crane, Siberian Crane, White-naped Crane G. vipio, Hooded Crane, Swan Goose Anser cygnoides, Baer’s Pochard Aythya baeri and Great Bustard. The species resources of cranes and storks are a key conservation value of the reserve. China has nine of the world’s 15 crane species, the largest number of any country. There are six crane species in the conservation area: Hooded, Eurasian G. grus, Red-crowned, White-naped and Demoiselle Cranes Anthropoides virgo. Demoiselle Cranes also breed in the local area.

In addition, there are 452 species of angiosperms within the conservation area. There are 3,000 ha of Siberian Apricot Prunus sibirica secondary forest, which occurs in different densities, and is an element of the original landscape of Ke’erqin Grassland together with grassland and open elm forest. As one of the three largest grasslands in Inner Mongolia, there is not much remaining of the Ke’erqin Grassland outside Ke’erqin NNR due to continuous drought and the rapid development of livestock breeding.

In 1985, the Ke’erqin Nature Reserve was established at the prefecture level, and in 1995, it was upgraded to a National Nature Reserve. Ke’erqin NNR has struggled in recent years to safeguard its natural grassland, wetland and savanna ecosystems with rare cranes and wildlife in the face of growing pressure from Beizifu and the residents of other villages for grazing and other resource uses. Prolonged drought has threatened biodiversity and the welfare of local communities at Ke’erqin, and has increased conflict between conservation and development needs. Through many years of management practices, the reserve leadership and technical staff have realized the need and potential for community-based development to enhance resource protection and sustainable use while enabling the reserve to meet its conservation objectives in partnership with local communities.

Research methodology

An action research methodology was used as the fundamental data gathering approach. Action research is “learning by doing”, contributing to the practical concerns of the local people in an immediate problematic situation and simultaneously furthering the goals of social science (Gilmore et al., 1986). This approach requires collaboration between researchers and local people through shared learning and reflection. We provided trainings to the local community and nature reserve staff and assisted them in designing, implementing, monitoring and evaluating the community development intervention. They learned and then applied what they had learned to implement the work themselves. As researchers, we were able to conduct research in a real-world situation, aiming to solve real practical problems.

We followed five phases as developed by Susman (1983) (see Fig. 1). Initially, problems were identified and data collected for more detailed analysis. This was followed by the collective proposal of several possible solutions, from which a single plan of action emerged and was implemented. Data on the results of the intervention were collected and analyzed, and the findings were interpreted in the light of the action’s success. At this point, the problem was re-assessed and the process began another cycle. This process continued until the identified problems were resolved.

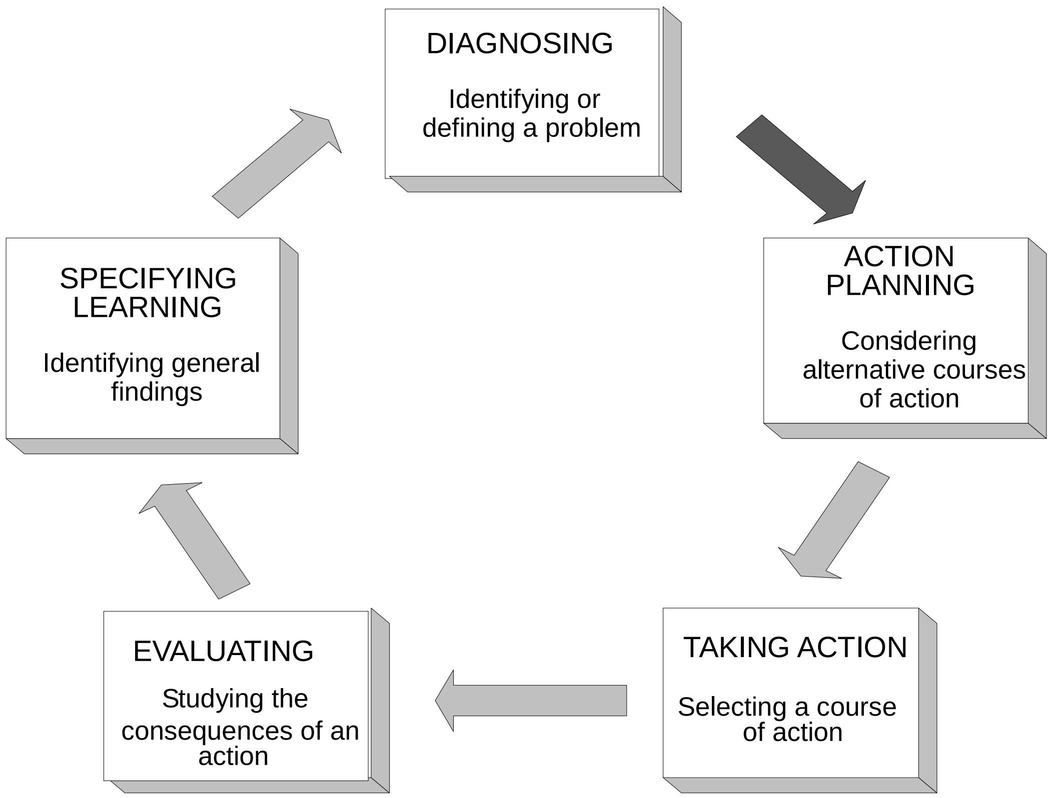

Figure 1. Detailed Action Research Model (adapted from Susman 1983)

Over the past three years (2007-2009), the authors worked with the local community to manage the community's natural resources, and developed a good rapport with the villagers, adopting time-efficient, participatory primary data collection approaches in addition to the accumulated secondary data. Strong emphasis was given to participatory techniques and ethnographic modes of data collection. We lived in the Beizifu community to understand the people's daily livelihood activities in relation to fengshui forests (forests with symbolic spiritual meanings, and being strictly managed by local communities, and usually serving ecological functions), using a participatory observation method. This approach along with semi-structured interview and group discussions were our first hand data collection methods.

Semi-structured interviews were carried out with key informants. These included Nature Reserve officials, community heads and villagers, and officials from the county and township governments. These key informants were involved in the process of community intervention together with the researchers. Group discussions including elders, men, and women in the villages were organized to discuss three main topics. The first topic was related to cross-checking the data collected and provided by key informants. The second topic concerned influential, big events (including national and local policy adjustments) in the history of natural resource management and utilization, and their impact on specific locations. Finally, these discussions considered the functions, management, utilization methods, activities and benefits relating to natural resources. During group discussions, visual tools, including participatory mapping and ranking, were used for analysis.

Analysis of data from interviews, combined with information derived from situational analysis and case studies, was used to explore the research questions and to arrive at specific conclusions. Hence different bodies of original yet sometimes fragmentary data were organized into a format relevant to the investigation. Such data treatment measures covered comparison, analogy, induction, deduction, reasoning, and summarization – each designed to identify existing processes and problems for further inquiry.

This research was a reiterative process. We analyzed data during the fieldwork period and adjusted our research plan according to activities taking place in the field. We tried to do research together with local people and based on the villagers' perspectives. This is a good way to do research from within, according to Struthers (2001). Besides soliciting data to meet our research objectives, we also developed friendships with the participants through our frequent interactions with them.

Introduction of the development intervention in the Beizifu Community

Prior to initiating the community development activities in the Beizifu community in Ke'erqin NNR in 2007, a series of trainings were provided to reserve staff and officials from local governments, including: in-class training on participatory rural appraisal (PRA), co-management planning, and sharing-learning among Nature Reserve staff under the project, and domestic and overseas study tours on co-management and integrated rural development. After the community project was initiated in the Beizifu community, these trainings were continued and expanded to more participants including village heads and progressive farmers. These trainings provided a fundamental base for them to acquire and apply new knowledge in the community development processes.

In 2007, the Beizifu community-based resource management action started with a week-long training workshop on participatory appraisal and planning. The primary goals of this training were: to develop multi-stakeholders partnership mechanisms; to expand the social network for people in the community; and finally and most importantly to conduct integrated community development planning for the Beizifu community. This training was facilitated by the researchers, and Participants included individuals from the Nature Reserve, technicians from county forestry and livestock bureaus, representatives of the township government, and village heads and farmer representatives. As a result, a multidisciplinary team was established to analyze the problems and challenges they faced, the advantages and disadvantages they have, the opportunities and potentials they hold, and thus to develop an integrated community development plan to guide the three year intervention. The plan aimed to develop an integrated biodiversity-friendly community development model. In other words, through the implementation of a series of developmental subprojects, assisting with ecological culture instruction activities, giving full play to community members' initiative in participating in natural resources management, especially grassland management, and gradually adopting sustainable community-based grassland management; adopting and testing the idea of participatory planning, establishing a framework for community development within the next two years, making adaptive adjustments to the implementation process based on new situations and popular will, developing farmer organizations and enhancing capacity building through study tours, training and learning.

The villagers were initially interested in converting their goat herds from a local variety to a new (more expensive) breed that can yield greater profits through cashmere (goat wool). By reducing the size of the goat herds in this way, the herders expected to increase revenues while reducing pressure on the grassland. As project discussions began, different opinions emerged on priorities for the use of project funds, and attention began to shift towards the process for the community members to work together. Up to September 2009, the following activities were conducted in the Beizifu community and by line agencies:

- Various stakeholders related to pasture management consulted
- Biogas piloting and extension conducted
- Shed feeding facility improved
- Trainings and study tour conducted

Beizifu Ke’erqin Pasture Protection and Management Association (community initiative) established in September 2008

- Participatory pasture management planning
- Water saving facility installed at farming land
- Mongolian cultural activities became an important part of the Association’s program
- Householder-based enterprises promotion
- Environmental education for children and schools
- Seasonal grazing planning and pasture restoration action
- Community-owned Pasture Guards Team established in partnership with Ke’erqin NNR
- Participatory monitoring of pasture restoration
- Farmer’s cooperative (on pig raising, biogas, farming, pasture, sheep raising, etc.)
- Community-based revolving fund (under the Association) established in 2008 and expanded at the beginning of 2009

At the time the Association was established, the action generated much interest and support from the county and township government and various agencies at both governmental levels. An empty classroom in a village school (the children are now educated at the town or county levels) was converted into a community center and association office with various awareness-raising materials about protecting the grassland on the walls, and a rather imposing list of Association regulations. Yet during this time, the community members gained actual experience with the economic activities supported by the project (the Association, for example, became the entity that could manage the revolving loan funds, and maximize benefits for their use – perhaps also to help with initiation of community enterprises such as processing of local dairy products or soya bean curd production).

The Association has not provided any project money for converting family herds to cashmere goats, but has successfully encouraged some families to do so with their own resources; this activity was set aside as only marginally suited to developing collective activity and a cooperative spirit within the community. They came to regard maintaining their culture as an important aspect of community development, and started a women’s dancing group and an instrumental/singing group. They also started to understand the potential for cooperative action on such essential issues as grassland management and livestock management. For example, they established a team to investigate the problem of over-grazing and pasture degradation, and saw the complexity of the problem as well as the great benefits involved if they could reduce the number of intruders and external grazers on the lands of the community.

The Association was joined voluntarily by 67 households out of 223 in the Beizifu community, and grew to 134 households by August 2009. The Association’s leadership and members, as they gain a clearer understanding of the potential benefits of the Association, need opportunities to learn more about successfully managing and developing their Association, through outside expert advice and also by visiting other successful cooperatives within the grassland region.
These initiatives have been facilitated by Ke’erqin NNR with their best efforts. The reserve considered that resolving the conflict between conservation and development needs to be a substantial issue. Through project activities during the past three years, however, the reserve leadership and technical staff have realized the strong potential for community-based development to enhance resource protection and use while enabling the reserve to meet its conservation objectives in partnership with local communities.

Reflections from identifying interventions

Objective Strategy and operational strategy
We aimed to interpret the livelihoods of local people and management of sustainable wetland resources in theoretical terms; and to strive to seek one method and approach for achieving a

harmonious balance between the sustainable management of wetland resources and the subsistence activities of local people on the basis of an established wetland resources management regime.

However, when it comes to the real world, this is not an easy task. We do not consider the arrangement of activities for community involvement programs based on livelihoods as the starting point, but rather wetland management activities as the starting point. This is an either-or choice, in which it is difficult to achieve the best of both worlds, and the choice has to be made.

Researchers and reserve staff engaged in natural resources management would automatically design the project framework from the perspective of the sustainable management of wetland resources, as shown in Fig. 2. However, since the community participates in wetland management, it cannot become a simple community development or poverty alleviation programme, and Fig. 2 can be used as a basic conceptual framework for the sustainable management of wetland resources and conservation of biological diversity.

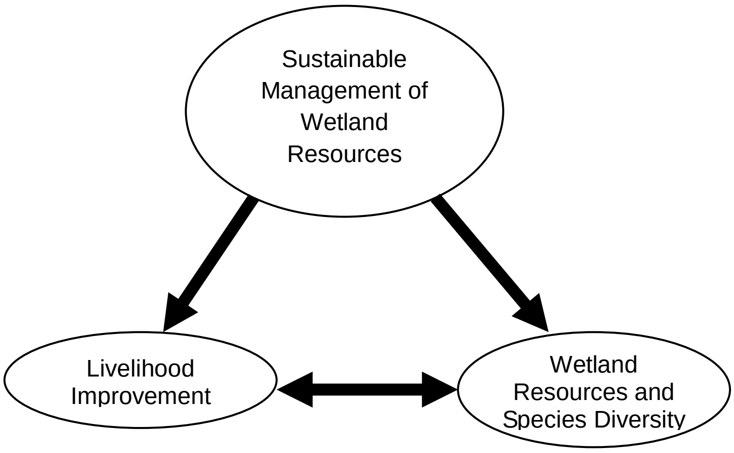

Figure 2 Conceptual Framework for Community Participation in Wetland Resource Management Programmes

The above-mentioned conceptual framework needs to be transformed into a practical operational framework. It needs to establish preferred starting points for problem consideration in relation to the livelihood improvement of local people, as shown in Fig. 3. In other words, it needs to discuss how to resolve the problem of sustainable management of wetland resources and conservation of biological diversity based on the livelihood improvement of local people.

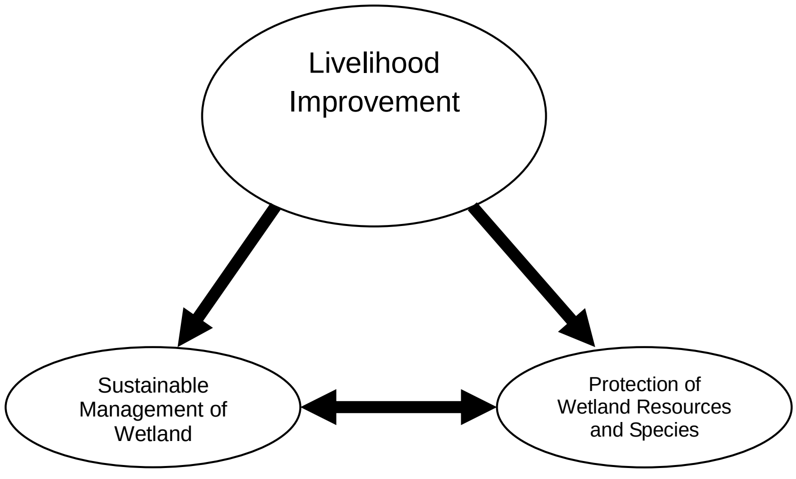

Figure 3 Operational Framework for Community Participation in Wetland Resource Management Programmes

As for the practical experience in Ke'erqin NNR, if the local communities could get more space to maneuver from government agencies, sustainable wetland resources management and biodiversity conservation would be better integrated into the proposed development programs that are currently putting most energy into livelihood improvement activities such as livestock raising, etc. After 2007, the researchers and reserve staff spent much time communicating and living together with the local people in the Beizifu community, jointly analyzed problems relating to the management of wetland resources with them, and gaining an understanding of the complicated relationship between their livelihoods and the wetland resources. This provided the basis for developing community livelihood programmes related to wetland resource management and the conservation of biological diversity, such as seasonal grazing planning and pasture restoration action, establishment of a community-owned pasture guard team in partnership with Ke'erqin NNR, and participatory monitoring of pasture restoration.

The above experiences were informative in regards to two issues. First, sustainable resource management needs to exceed its currently recognized scope, beyond simply maintaining the relative stability of ecosystem structure and functions and the continuity of natural ecological processes, to a more holistic concept of also protecting the related economy, society and culture. Specifically, sustainable resource management supports ecological sustainability; economics, social justice, multiculturalism, acceptability and well-behaved social construction are its life-force (Qian et al. 2008). Secondly, it cannot endorse rapid and flexible PRA as an adequate approach. This method only provides a tool for establishing mutual understanding between the researchers and the community. Thus, time must be invested to authentically develop programmes which are of intrinsic value. It was possible to generate valuable community development intervention programmes by improving understanding and consensus through interdependent learning between the villagers and reserve staff.

Orientation and objective model

In early 2009, we defined the Beizifu community as an "Integrated Environment-friendly Development Model". After 2.5 years of work, we proposed that the GEF project should intervene to move towards a vision of the kind of village Beizifu should become. It is usually expected that when developing such a program, we must inform governors before receiving funds, so as to obtain resources for development intervention. We often got bogged down in the management conflicts. Based on the development intervention concept, we could only inform the project examining and approving body that the intervention direction of the Beizifu community project is correct, but were asked to provide detailed information on the "what, why, how and when" of project implementation. At the same time, community cadres and staff of the Protected Area Authority were already very accustomed to this way of thinking, even though they understood that the project was out of the control of project managers after its approval.

Rural development conducts social capacity building through the negotiations and efforts of different social actors. These social actors include: government organizations, farmers and farmer organizations, protected areas, universities and research institutes, etc. Different social actors hold different types and levels of resources, follow different principles of interest and value, and have different abilities. Different interpretations of development intervention by these actors and the interactions between them lead to diversification of development interventions (Long 2001; Liu 2006). Our approach aimed to promote diversity. We should not conclude the project failed simply because the realized community intervention was not the goal we expected to achieve. During the Beizifu community intervention, as the main decision-makers, we constantly reminded decision-makers involved in community project design that the most important thing is to find the direction of intervention, and that the specific development interventions can be left to grassroots actors. In the last three years, the decision-makers participating in the Beizifu community development intervention gradually understood this concept, which was an important success factor.

Identifying project activities towards community-based resource management

Figure 4 shows an ideal basis for development interventions on wetland management (Qian et al., 2008). First, we need to seek the common points of the development strategy of local government, the development strategy of rural households, and the acceptable utilization strategy for wetland resources.

As the model in Figure 3 suggests, a viable strategy for the sustainable management of wetland resources consists of the overlapping sectors of local government, protected areas and local community households, as long as the technology employed has economic feasibility. In reality, local governments have long dominated local development; at least they have indisputably dominant rights in economic development. For more than 20 years, farmers could only avoid or resist if they did not like the Government's development strategy, while the management bodies of protected areas made little contribution to development strategies and specific measures. Now it is necessary to promote the participation of protected area staff in development strategies and specific measures in order to achieve the conservation of biological diversity and sustainable use of wetlands.

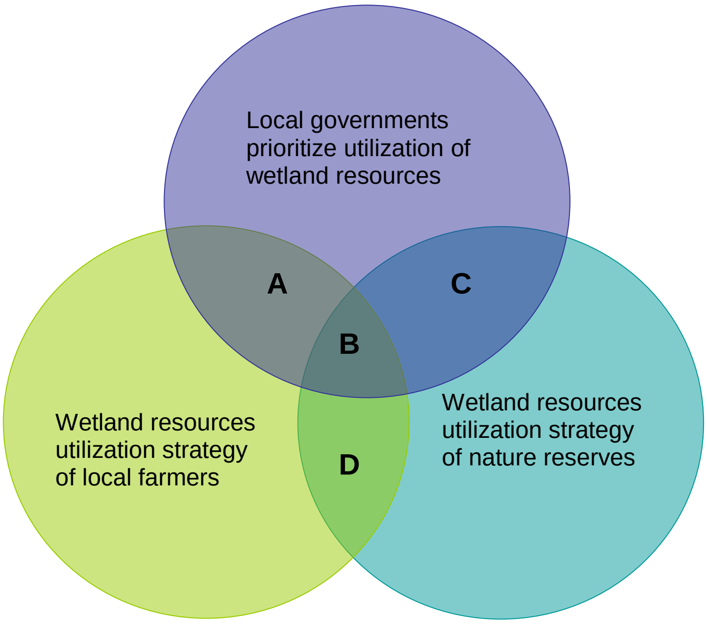

Figure 4 Analysis of Community Development Project in Wetland Reservation

Secondly, considering feasible technology, the available area will be more limited, as shown in Table 1, which required us to conduct a more careful investigation and study, a more comprehensive analysis and multiple arguments. It should be noted that to design a suitable intervention and to promote the sustainable management of wetlands within the protected area and its surrounding villages is more difficult than an average development project, requiring a more meticulous feasibility study. The general practice is to first carry out a comprehensive analysis of the development strategy of local government and the interest of related protected areas, then to conduct deep assessments of families in the community to understand their problems, challenges and strategies in development, and to determine a possible strategy which can cover the development strategies of local governments and acceptable management techniques and measures for protected areas.

Table 1 Consideration of feasibility for development projects

	A	B	C	D
Feasible Technology	The local government and local farmers accept, but the protected area authority does not accept, technically feasible	Three parties accept - goal of wetland utilization project, technically feasible	Government and protected area authority accept, technically feasible, but farmers do not support	Protected area authority and local farmers accept, technically feasible, but local government does not support
Unfeasible technology	The local government and local farmers accept, but the protected area authority does not accept, technically unfeasible	Three parties accept, but technically unfeasible	The government and protected area authority accept, local farmers do not support, technically unfeasible	Protected area authority and local farmers accept, but the government does not support, technically unfeasible

Thirdly, the complicated social factors increase the complexity of project selection. Farmers in rural communities are not homogeneous: there are all kinds of families in a village. Residents of the Beizifu community emigrated from other places one after another over the last 300 years, with some families having more than three hundred years of history, while others have only thirty years. Some families divide up, and are in heavy debt due to weddings and the buildings of new houses; some have a sick main labor force; some have to spend large sums of money for children to go to university; some have disabled or mentally retarded members. Every family wants to do different things and faces different practical difficulties. It is difficult for grassroots governments to find a development measure and action which can easily satisfy all families. Coupled with the long-term impact of a planned economy, it is difficult for grassroots governments to adapt to such a huge change in rural communities, lacking the work experience in rural communities under a market economy. Another constraint is that the capacity of some rural cadres is questionable; they usually do not have the time or the patience for field investigation and study. Protected area staff members are generally committed to their work, often involving some self-sacrifice. But they have their own families, clans, and other social networks. They also have personal plans for family development, so their behaviours are promoted and restricted by the social networks. All these factors influence their views on wetland management to various degrees. These views objectively reflect the interest of individual members, families, clans and other social networks of protected area staff members, as well as their knowledge and life experience. In real life, to promote community co-management work, it is necessary to empower the authority of the community in managing its natural resources.

Even if the leadership of protected areas recognizes this trend, the average employees do not necessarily agree. The loss of power means loss of face, and loss of access to benefit. It also goes against their need to protect their own social networks.

Entering the community

In an era when China's social economy is changing rapidly, the farmers in the Beizifu community are being marginalized. There are various contradictions and conflicts between farmers and other farmers, farmers and the community committee and Party branch, villages and other villages, villages and grassroots governments, and villages and protected areas. These are the biggest problems facing Chinese farmers in developing their communities. Villagers view people from outside with wariness and hostility. The biggest problem the project faced was how to remodel the community's understanding of protected area staff, local government staff and project experts.

We introduced a concept of an entry project to cope with the above situation. Usually long processes are involved to reach project approval, from project identification, proposal formulation, application and approval by many levels of authorities, fund transfer processing, which usually requires one more year, in particular for the first project for the Beizifu community. Meanwhile in the real world, the nature of the community and participating households may change, and the farmers' interests may also shift. These usually create additional conflicts between the local government and the local community.

Thus, during the first visit for developing integrated community development planning, we clearly stated that the first project proposed by the Beizifu community would be approved with only two conditions, agreed to by the majority of community, and less than 50,000 yuan in total budget. This project would be considered as a gift to the community for developing trust between the project staff, the community and the local government. A community-based revolving fund was selected by the community as an entry project.

Implementation

Local officials and community heads are used to implementing projects through top-down processes. Thus a critical issue was how to change the attitudes and behaviours of all actors, including local officials, community heads, and officials from the Ke'erqin Nature Reserve involved in the implementation process.

China does not lack the idea of participatory processes and practices either in ancient or contemporary history (Liu, 1999). Based on the experiences in the Beizifu community, change of individual behaviour and attitude is the most difficult part of promulgating community-based natural resource management practices. Outsiders need to recognize 'the knowledge and skills of the community people', and to collaborate with the local people, to be 'learners' rather than 'leaders' or 'alms givers'. Many local officials still doubt the capability of the local people (Liu et al., 2004).
In the past three years, the community has demonstrated its capacity to implement its project towards the sustainable use of natural resources. Some officials have learned from this process and their attitudes and behaviours have gradually changed. However it is still one of the major barriers to project implementation.

Monitoring and evaluation

Although it is an important stage in the project cycle, very little knowledge has been gained on how to evaluate the intervention. However, we can summarize the achievements according to the opinions gathered from all the actors in the process. During the three-year intervention, the Beizifu community has been unified, the goat herds have been downsized to about two-thirds of former numbers, and the herders expected to increase their revenues while reducing pressure on the grassland. The Association has not provided any project money for converting family herds to cashmere goats, but has successfully encouraged some families to do so using their own resources.

This activity was set aside as only marginally suited to developing collective activity and a cooperative spirit within the community. The villagers came to regard maintaining their culture as an important aspect of community development, and started a women's dancing group and a musical instruments/singing group. They started to understand the potential for cooperative action on such essential issues as grassland management and livestock management. For example, they established a team to investigate the problem of over-grazing and pasture degradation, and saw the complexity of the problem as well as the great benefits that could be realized if they could reduce the number of intruders and external grazers on the lands of the community. In short, the progress made in the community has testified to the possibility of harmonization of rural development and environmental protection (or biodiversity conversation).

Reflection and conclusions

Development Intervention

Planned development interventions do not always achieve their expected direct outcomes. Reviewing the two decades of experience on planned interventions towards co-management schemes for biodiversity conservation, a rather mechanical model of the relationship between projects, implementation and outcomes has been mostly espoused. It is necessary to re-conceptualize the notion of an intervention as “an ongoing socially constructed and negotiated process, not simply as the execution of an already-specified plan of action with expected outcomes” (Long, 2001). Intervention is made up of a complicated set of processes, which involve the reinterpretation or transformation of intervention action during the implementation process. Therefore, there is no straight line from action to outcomes. In fact, outcomes may be the result of factors not directly linked to the particular implementation program. Local governments and communities always find sufficient space for formulating and pursuing their own ‘development projects’, that often clash with the interests of upper level government institutions; in particular, those at the highest level and most socially distant. Implementation should, then, be viewed as a transaction process involving negotiation over goals and means between actors with conflicting or diverging interests, and not simply as the execution of a particular policy (Warwick, 1982).

We must also take account of the diverse ways in which individuals and their households organize themselves, individually and collectively, in the face of planned interventions promoted by ‘higher’ authorities, such as governments and international development organizations. The strategies they devise and the types of interaction that evolve between them and the various intervening parties shape the nature and outcomes of the interventions. In this way, ‘external’ factors become ‘internalized’ and come to mean different things to the different interest groups or to the different individual actors involved, whether they be implementers, clients or bystanders.

Unification of the Community

Since collectivization was introduced in rural areas, public services have disappeared. In production, villagers must face the market by themselves. They have been totally dominated in terms of agricultural production technology, agricultural supplies, and marketing. In Ke’erqin, there is continual pressure from three different sides on the villagers' land-use decision-making space:

1) Market. The role of the market is giving villagers increasing impact. Villagers have to rely on the market to make production decisions, and commercial rates of these agricultural productions are increasing. Villagers also depend more and more on the market. Green revolution technology has also had a growing influence on the production behavior of villagers. It has led farmers to be more dependent on agencies which provide credit, seeds and fertilizers, and farmers have to sell their agricultural products to repay these debts. And these service agencies usually retain a high margin of profitability. Diesel supply serves as a good example of this as villagers need irrigation to achieve agricultural production, and the associated costs are an important part of overall production costs and fertilizer, one of which is that farmers buy fertilizer on credit from private agricultural enterprises before production. When the farmers harvest their crops, they have to pay 140% of the amount received on credit before production. Villagers can get loans from credit associations, but they need a mortgage to receive a loan, and even if there is a mortgage, they cannot get a loan when they are most in need of money. The interest rates on loans to farmers are high, equivalent to an annual interest rate of about 20%.

2) Policy. In recent years, the government has been enacting various policies, such as a prohibition on grazing, enclosures, etc. The use of natural resources by villagers has been limited to a certain extent by the establishment of Ke’erqin NNR in the Inner Mongolia, a natural forest protection project and other such activities.

3) The government's development interventions. For example, in Ke’erqin Youyi Zhongqi, the local government developed the silkworm industry in 2008, including a village in the Ke’erqin protected area. The Beizifu Community opened grasslands and planted mulberry trees under the leadership of the local government. While this policy was supported by the people, they were in fact supporting the opportunity to open up new farmland instead of planting mulberry trees, for there are prohibitions on creating new farmland on grassland areas. From the people’s point of view, it does not matter if the mulberry survives; what they care about is the fact that the grassland has already been opened up for farming. When the plan for mulberry cultivation fails, switching to the cultivation of other crops will become a matter of course.

The living space of the community is also being compressed. Community leaders are under increased pressure from higher authorities to improve management practices, but usually without the concrete support required to do so. To make things worse, the higher authorities and staff of protected areas have to take over some of the power of the community leadership, because their own utilization and distribution power is declining due to the policies and interventions introduced by governments at higher levels. Some even participate in the business of ‘selling’ (contracting out) natural resources, a practice carried out by some community leaders to accommodate social pressures or create financial impetus.

Another aspect is that, exposed to the rapidly changing outside world and the widening of employment opportunities and channels, communities are faced with more and more choices. The big contrast between the local communities and the outside world encourages increasing numbers of young people to leave their communities in order to seek new livelihoods and ways of life. This, to a certain extent, promotes the disintegration of communities.

The disintegration of communities has generated many problems. As a result of a weakening of the community’s collective consciousness, there has been a lack of public awareness and a weakened sense of community by progressively more people, because social networks tend to be established with the neighbourhood, family and external society. Everyone focuses on their own matters and there is a serious lack of community production and living services. Individual farmers face the market alone, and purchase their own agricultural resources. It is not possible to organize water facilities, and there is a lack of public cultural activities. he direction of intervention within China's rural development is to rebuild the consciousness of the community and develop a sense of ownership. It is also the key to rebuilding communities like Beizifu. In 2007, China estimated the difficulty and long-term characteristics of re-modelling communities. By promoting communities to build an “invisible” and “visible (physical) space” to establish a common platform, it has made it possible for villagers to participate in the management of natural resources, as well as decision-making for community development. The “invisible space” includes a recreational team, security team, grassland Protection Association, and various other types of groups.

The ‘visible space’ includes a community center and a community-based revolving fund group. An important indication of progress in the community's remodelling process was the 2009 Women's Day. The village organized a reunion for women, which involved the voluntary participation of almost all the village women in the activities. The village cadres had not expected that so many would be willing to participate. During the implementation of the community project, the village cadres gradually established the role of village elite, and villagers demonstrated their enthusiasm for the 2009 village election. The main participants of community project were chosen for the newly elected village leadership. Our three-year experience with the Beizifu community proved that if outsiders treat the members of a community with sincerity, listen to their concerns, and respect their decisions, they will gradually grow to trust outsiders, and will also become organized.

Power of traditional culture

Culture plays an inherently strong role in community development. The majority of community projects focus solely on activities that lead farmers to become wealthier, or facilitate the production and livelihoods of the people through the building of bridges, roads, gas supply, etc., while ignoring the potential of culture. In this project, we deliberately emphasized projects which can unite and mobilize communities, attempted to work with local natural resource management of wetlands, and combined these with local biodiversity conservation. In Beizifu, we saw the potential influence of culture on development.

Culture remodeling is a long-term dynamic process. In some protected areas, or Forestry Bureaus, a bureaucratic culture has been created, which consists of avoiding trouble whenever possible and bullying the weak and small. This goes against the precepts that: "nature and men are one", or "men and birds under the same blue sky". There is a long and difficult path towards encouraging communities to love birds and respect nature, while resisting the bad behavior of a few internal and external individuals.

China is faced with fierce conflicts between traditional and modern civilization, agricultural and nomadic lifestyles, and shifting modes of cultivation. We must realize that China is undergoing social change and may not return to a traditional form of civilization. The social conflicts, environmental degradation, public confusion and social disorder brought by cultural fragmentation will become increasingly obvious. Therefore, China badly needs new concepts for connecting modern and traditional ways of life, and for building a new Chinese culture based on traditional values and China's rich and varied natural environment, thereby achieving a new harmony between nature and culture.

Centralization or decentralization

Policy on pasture and wetland resources has shifted frequently since the founding of the People’s Republic of China in 1949. Each shift has always placed local communities on the losing side in terms of access to resources. During its first 30 years, China was in a period of centralization and collectivization, followed by 30 years of decentralization and de-collectivization. Somewhat paradoxically, however, regardless of whether collectivization or de-collectivization prevailed, the outcome has always been the same: resource degradation. This at least part of the reason why China finally ended up undertaking massive and largely centralized interventions in terms of pasture protection, grazing prohibitions, and caged raising of cattle and sheep. This suggests that the best policy for the restoration of natural resources would be through rebuilding the strong link between local people and their resources.

There have been dramatic changes over the last 60 years in the interrelations between people, communities, and resources as reflected in changes within the macro-political, economic and social contexts, as well as changes at the micro level in terms of power relations, knowledge, and livelihood struggles. Frequent mutations in the macro and micro contexts have resulted in concomitant shifts in resource management and land use. This has brought at least one negative consequence, namely that short-term planning has caused the loss of local communities' endogenous resource management practices and possibly undermined the relatively harmonious power relationships that existed between the different actors in the villages (Liu, 2006).

Since 2003, the local government has applied a policy of zero grazing to offset the trends in degradation of pasture resources. Garrett Hardin’s “The Tragedy of the Commons” has stimulated China’s policy makers to try to put a stop to de-collectivization and privatization, and to prevent selfish individuals from overusing common resources. However, there is much more to the issue than that. Resource use and management is a critical arena for struggle and conflict between stakeholders (Liu, 2006). Access to trees and their products galvanizes the interests of both outside groups the government and authoritative non-government actors and inside groups – community people. The fundamental question we should ask is whether local knowledge systems, power structures, and cultures will be able to coexist and integrate in the face of external capital invasion and privatization (Baumann, 1998).

Title: Identification of potential benefits of urbanization for degraded grasslands in central Hunshandak Sandland, China

Organisation: College of Life and Environmental Science, Minzu University of China
Theme: Grassland
Keywords: Degraded grassland; Urbanization; ecosystem management; Sustainable development; Hunshandak Sandland

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Summary

Urbanization is often regarded as a pressure on rural and agricultural land use. But in this article, using a case study in central Hunshandak Sandland in Inner Mongolia, China, it was demonstrated that urbanization has potential benefits for the restoration of degraded grassland. The degradation of Hunshandak Sandland could only be reversed if the intensity of overuse is also reduced. Through the urbanization of three small towns in a small area (accounting for 0.1% of the total area), the local inhabitants in severely degraded grassland could be reduced. Thus, severely degraded grassland (accounting for 44% of the total area) would be released from livestock pressure and restored. With increases in the size of the urban area, the area of restored grassland has also increases. Urbanization provides socioeconomic benefits to the grassland area in terms of the economy, education, science, entertainment and social welfare. Also, the restored grassland can provide a healthy environment for the three small cities and towns. Thus, a reciprocal relationship could be formed between urban and grassland areas.

Introduction

Urbanization is the process of concentrating population within a city, which usually serves as the local center of politics, economy, commerce, transportation, education, information and culture (World Resources Institute, 1996). The degree of urbanization is normally regarded as an indicator of the level of development (Simpson, 1993). There have been some studies on the relationship between natural ecosystems and urban areas (Folke, 1997), but urbanization is often regarded as a pressure – even a constant pressure - on rural and agricultural land use (Gerrit and Van der Knaap, 2002; Wessels et al., 2003). For example, the total agricultural area of ten nations in Europe decreased by 6×106 ha over the period from 1968–1988, largely due to urban development (Bouma et al., 1998). However, in this paper, we describe an alternate view. In combating grassland degradation in Hunshandak Sandland in Inner Mongolia, China, we found that urbanization has potential benefited degraded grassland.

Land degradation is a worldwide problem, with over 250 million people and a third of the earth's land surface directly threatened by desertification (Diallo, 2003). Desertification comes from land degradation in arid, semiarid and sub-humid areas as the result of various factors, including climatic variations and human activities (UN, 1992; Fernández, 2002). Interactions and conflicts between natural processes and human activities may lead to desertification (Sansom, 1999, Zhang et al., 2003a). In fact, many researchers in the world believe that population pressure and overgrazing are the main reasons for desertification in sandy grasslands. i.e., desertification in Kuwait (Al-Awadhi, 2003), India (Ram et al., 1999) and China (Wu and Ci, 2002, Jiang et al., 2003a, Zhang et al., 2003b). Desertification can therefore be reversed by removing these pressures (overgrazing, over-cultivation due to human activities (Dobson et al., 1997; Bradshaw, 2000; Okin et al., 2001).

Hunshandak Sandland is one of China’s four major sandy grasslands, with an area of 53,000 km2. The area covered by moving sand dunes was 2.3% of the total area in 1950, 8.2% in the mid-1970s, 13% in the 1980s, 50% in 1996, and 70% in 2002. The number of grazing animals (mainly cattle and sheep) has increased 3.3-fold since 1949, accompanied by a rapid increase in population (over 6-fold during the past fifty years); these factors are believed to be the primary reasons for the rapid desertification (Li et al., 2001). These two pressures have exceeded the threshold carrying capacity of the grassland (Jiang, 2002) in the severely degraded areas.

In this article, we explore the potential benefits of urbanization to degraded grassland. The inhabitants and their domestic livestock in severely desertified grasslands in Zhenglan Banner, located in the center of Hunshandak Sandland, are to be moved to eco-towns, and degraded grasslands are being left alone so that the degraded ecosystem can be restored through concomitant conservation of biodiversity under natural processes. By enlarging the size of the eco-towns, local inhabitants will be able to raise livestock, develop industry and increase ecotourism. The resulting improvement to their standard of living is designed to be an example of sustainable development combining the environment, society and economy. There is also a full discussion of the potential of this urbanization approach to combat desertification in the Hunshandak Sandland.

Methods

Study Area

Hunshandak Sandland is situated in Inner Mongolia within Northern China (Fig. 1), and has an average altitude of 1201m above sea level. Zhenglan Banner (N41°46¢-43º69´; E114º55´-116°38¢), in the hinterland of Hunshandak, has an area of 10,182 km2 (all background data are from Statistics Bureau of Zhenglan Banner, 2001, if not otherwise indicated), and a population of 78,400. 32% of the population lives in three towns, Shangduyin Gol, Sanggandalai and Habiriga, and 68% is scattered throughout the rural areas. The towns only comprise 0.1% of the total Banner area, while the grasslands make up the rest. Of this area, 81.8% was once considered useable rangeland. However, most of the land has been seriously degraded due to over-grazing. There is a prevailing temperate semiarid climate, with an annual mean temperature of 1.7℃, annual precipitation of 250-350 mm (80-90% falls between May and September), and annual transpiration of 2000-2700 mm. Around 801 higher plant species, more than 402 vertebrate species, 174 birds and 526 insects have been recorded, with the total number of species exceeding 1500 (Zhenglan Banner Government, 2001).

Zhenglan Banner is inhabited by persons of Mongolian descent and includes six other minority groups, accounting for 42% of the total population. Han descendents make up the remaining 58% of the population. Zhenglan Banner has 11 stock-raising Sumus (townships) under its jurisdiction as well as three agricultural townships and three industrial towns. Shangduyin Gol Town, the capital of Zhenglan Banner, is the political, economic and cultural center of the whole area. Both the Mongolian language and Chinese language are spoken within Zhenglan Banner. Livestock production is the main source of income in the rural areas, although there is steady growth in the dairy, meat, textiles, fur and leather processing, carpet manufacturing and wine making sectors. The financial income of Zhenglan Banner was 21 million USD in 2002 (1 USD is approximately equal to 8.3 RMB). The average income of one herdsman over the period from 1960-2002 in Zhenglan Banner is shown in Fig. 2 C.

In the past four years, the rapid desertification has attracted a great deal of attention from both the central government and Zhenglan Banner. Desertification is now identified as an important ecological challenge in formulating developmental policies. Since 2000, a special fund containing 14.5 million USD has been invested by the central government to combat desertification in Zhenglan Banner. Technical, institutional and legal consultative committees were established by Zhenglan Banner's Government, so that environmental management strategies integrate development policies with resource management programs and industrial projects.

Data Collection and Analysis

A wide range of policy and statistical documents related to our study were collected at four different administrative levels: county, league, provincial and national. Historical data in Zhenglan Banner from 1950 onwards includes population figures, livestock numbers, land area, and other comprehensive socioeconomic. The collected data were analyzed and synthesized to formulate the actions programs discussed here. The expected population levels within the towns as well as economic trends for the next 10 years were forecasted and incorporated into “The Long-term Developmental Plan of Zhenglan Banner” (Zhenglan Banner Government, 2000). The assessment of resources that could support tourism maintenance of cultural diversity was based on local governmental reports (Zhenglan Banner Government, 2001) and reviewed by experienced experts.

Determining the Degree of Desertification

Land desertification was estimated by combining remote sensing data (Landsat TM image) with GIS and statistical data from the Grassland Administration of Zhenglan Banner, and was confirmed through field surveys. Rangeland was classified into four different landforms: sparse-elm-forest, low grassland, hills and wetland. The method of Chen et al. (2002) was used for determining the degree of desertification. The desertified grassland was classified into three categories, integrating both ecosystem and herbage quality for animals. The ratios of plant community height to the potential plant height (without grazing) of <20%, 21-50% and >50% corresponded to 'severe', 'intermediately' and 'least' desertification pasture, respectively. The degree of decrease in reproductive branch (categories <50%, 51-90%, >90%) and edible grass production (categories <30%, 31-65%, >65%) were both determinants for the three categories of desertification. We based our calculations on a 1:250,000 scale topographic map. The data for plant community height and the degree of decrease in reproductive branch and edible grass production were obtained from the Zhenglan Banner Grassland Bureau (2001), which developed the information by working at the local village level (Gacha). The work was done by technicians under the guidance of experts from the Institute of Botany of the Chinese Academy of Sciences in 2001. In each Gacha, 50 sample areas (1m×1m each), were investigated at a distance of 300m from each area. The data were classified into four different landforms (sparse-elm-forest, low grassland, hills and wetland), then the respective average values for plant height and reproductive branch and edible grass production were calculated to determine the degree of desertification in each Gacha. Finally, the degree of desertification for Zhenglan Banner as a whole was determined.

Experiment measuring Natural Restoration

In order to assess the effect of natural processes on restoring degraded grassland in severely desertified areas, some 2668 hm2 of severely desertified grassland in Bayin Hushu Gacha of Zhenglan Banner were fenced in 2001. Plant biomass (fresh weight) and coverage were measured on July 2001 and July 2003 in each of the four habitats: fixed sandy dunes, semi-fixed sandy dunes, shifting sandy dunes and lowland; for five treatments: degraded area, severely degraded area, protected area, interval protected (with rotational grazing), unprotected area and forage base. In each habitat for the five treatments, the average biomass and coverage were calculated based on 10 randomly selected samples (1m×1m).

Results

Natural Restoration Experiment

For the restoration of desertified grassland, the experiment has provided positive results related to the restoration of desertified grassland. The comparison of biomass and gross vegetative coverage between protected, intervally protected and unprotected areas demonstrated that protected area yields and coverage increased significantly over a two year period compared with the unprotected or interval protected areas (Fig. 4). Shifting sand dunes did not have any vegetation before this field trial, but afterwards the biomass was measured to be 1560 g m-2 in protected areas compared with 220 g m-2 in interval protected areas. Plant community coverage also reached 60% and 32%, respectively, for the two area types. The nature of vegetation also changed after the area was protected; the vegetation in fixed sandy dunes was dominated by Artemisia frigid, Cleistogens squarrosa and Carex duriuscula prior to the study, and after protection the landscape became dominated by Agropyron michnoi, and Kochia prostrate. The dominant vegetative species in lowland areas changed from Chenopodium glaucum and Chenopodium acuminatum to Leymus chinensis and Elymus dahuricus. Still, the number of plant species in sample areas increased after being protected for two years, with an average of 121% in protected and 74% in interval protected areas in all habitats, respectively.

Degree and Location of Degradation

Of the 10182 km2 of land in Zhenglan Banner, almost all the grasslands are affected by varying degrees of desertification (Table 1); the ratio of severely, moderately and least-desertified areas was 22: 13: 15. Biodiversity levels can be restored once human population pressures are removed. The population in severely degraded grasslands is 10507 individuals, or 13% of the total population of Zhenglan Banner.

Urbanization Provides Ecological Benefits to Grasslands

In order to restore degraded grasslands and to protect their biodiversity, the residents and their livestock are to be transferred to three towns (funds to be supplied by both the central and local governments). In fact, some 5778 people and their livestock have been moved into three towns matching their preferences and with regard to the priorities of Zhenglan Banner. The balance of the rural populations is now scheduled to be moved over the next five years.

Rural residents have expressed a willingness to move to three small towns (Fig.1) distributed in the moderately and least-desertified grassland, e.g., Shangduyin Gol, Sanggandalai and Habiriga. These three towns cover an area of 10.2 km2 (0.1% of Zhenglan Banner's total area), but now contain 32% of Zhenglan Banner's total population, and still have large potential for holding more people.

The feasibility of moving people currently living in severely desertified grasslands into three eco-towns is based on the following reasons. Firstly, the population in towns has been increasing at a rate of 1-1.9% per year since the 1950s (Fig. 3). Most of these people came from pasture areas.

Transmigrating would increase the population in towns by 40-50% (Fig. 3). Secondly, moving the population from pastures into towns would satisfy human resource needs required by the future economic development of towns and cities. Presently, there are more than 10 major projects under construction or in the planning stages in Shangduyin Gol (Table 2). These include tourism, livestock processing, real estate and other industrial development projects with the total investment projected to equal 21,000 million RMB, requiring a population of 20.7 thousand in 2002 and 51.2 thousand in 2010. Thirdly, the formation of financial income has changed over the past 50 years (Fig. 2B). The ratio of income from stock production to GDP (gross domestic product) has shrunk whilst income generated by industry and other activities has increased. This indicates that some parts of traditional stock production will be gradually replaced by modern stock production methods (restricted grazing, breed selection, etc.), related agribusiness and other industry. Still, with urban areas expanding, more grassland could be restored; i.e. more urban areas equals more restored grassland. It is expected that if 92% of grasslands are restored, the rate of urbanization will increase to 72%, and only 0.18% of the land will be occupied (Table 3).

Socioeconomic Benefits of Urbanization for Grasslands

Among the various economic components of GDP in Zhenglan Banner, the past 20 years have seen a decrease in the contribution from micro-agriculture, including agriculture, forestry, pastoral production, home-based processes (such as milk and meat production, wool cutting and milk-wine making) and fishing. However, there is growth in the contribution from urban industries, such as transportation, commerce, construction and services (Fig. 2B). In recent years, there has likewise been an increase from township industries, including home-based commerce and fishing. This indicates that the increased economic income of local people was mainly based on increases in industrial production, benefitting from urbanization. This also indicates the general trend of Zhenglan Banner towards urbanization. In addition to the economic benefits to the rural area, urbanization has also generated social benefits including personal training and education, social welfare and services, and both direct and indirect improvements in science and technology.

Discussion and Conclusion

It certainly seems clear that restoration and sustainable development of desertified ecosystems must take into account the living patterns and economic well-being of local residents, due to the complexity of economic and ecological factors that must be integrated into the local social system. In short, the cultural behavior of local people has to be harmonized with the natural traits and potential of the local ecosystem (Dyson, 1996; Holling, 2001; Jiang et al., 2003a).

Removing human disturbances from severely desertified grasslands could help to restore degraded ecosystems and protect biodiversity. Enlarging the size of towns and cities could accommodate people being relocated from severely desertified grasslands. Their involvement in developing animal production and processing activities as well as ecotourism and other industries will raise the standard of living.

From a local, regional and policy point of view, Jiang et al. (2003b) have pointed out that urbanization provides several functions in terms of supporting the relocated residents, e.g.:

1. personal training and education,
2. science and technology transfer,
3. information and awareness of local, regional, national and international issues
4. entertainment,
5. sanitation and medical care,
6. cultural activities (folk music and ceremonies, gymnastics, etc.)
7. social welfare and services.

All of the above are attractive to people who will need to be moved from the desertified grasslands. In the case of Zhenglan Banner, after moving people into three eco-towns, there would be an increase in the degree of urbanization, an indicator of the developmental level of a region, with the quality of life of the relocated persons being markedly improved. With the growth of urban areas, restored grasslands will also increase (Table 3). On the other hand, the inhabitants in severely desertified grasslands must be relocated, as there is no way to live on these grasslands and feed livestock.

Once settled in the towns, the relocated people could engage in ecotourism, commerce and transportation activities. In the case of Zhenglan Banner, there seem to be special tourism features that are unique: sparse-elm-forests, sandy lands with many lakes, and low grasslands, as well as special types of biodiversity. There is also cultural diversity including Mongolian styles, famous historical sites, the Chahar culture (Chahar are descendants of one tribe of Mongolian People) and historic figures. Shangduyin Gol Town was once the summer capital (1256-1369) of the Yuan Dynasty, which had a territory traversing Europe and Asia. Thanks to Marco Polo's travelogue, Shangduyin Gol was known to the world as early as the thirteenth century and these sites have been well preserved. Rough estimates by the Tourism Program of Zhenglan Banner (Zhenglan Banner Tourism Bureau, 2001), indicate that the percentage of GDP generated by income from tourism would increase to 8% in 2005 and 15% in 2010; By 2007, up to 20.000of the herdsmen active today would be engaged in tourism and benefit from these activities. Furthermore, ecotourism, commerce, services, and transportation in potential buffer zones and transition zones exert far less pressure on the grasslands than the intensive livestock grazing practiced in the past. Of course there is a need to prevent fragmentation of urban area development, since this may reduce the productivity of agricultural lands and lead to degradation of wildlife habitats (Platt, 2004)

In order to relocate the people from severely desertified grasslands, a special fund of 45 million RMB, averaging 30,000 RMB per family, was invested in 2000-2001 by the Central Government of China. The funds were meant to be invested in the entire range of activities discussed here, including ecological migration, town construction, establishment of milk, beef and mutton factories, training for people to succeed in the new environment, and creation of ecotourism facilities. The goal is to attain gross revenues of $14.5 million USD within the next five years. These funds are meant to motivate provincial and county governments as well as private enterprises to invest their funds towards the ultimate goal of combating desertification in Zhenglan Banner, thus providing a substantial financial basis for undertaking much larger restoration activities in the surrounding degraded grasslands.

In conclusion, the potential benefit of urbanization for degraded grasslands is that severely desertified grasslands would be left in a natural state, therefore stimulating the re-establishment of biodiversity, wildlife and vegetation. The people now living on severely degraded lands (population 10507) will be relocated into three towns. How about "This in turn would satisfy the development requirements of these three towns to increase urbanization rates by 40-50%.

The town of Shangduyin Gol would be enlarged into a central city in Hunshandak Sandland - a tourism city, a Mongolian cultural city and an eco-city. Overall, there is an estimated 67,000 hm2 of lowlands in Zhenglan Banner, which have a higher production potential. If all the lowland areas are reasonably managed, the grass yield potential should reach 300 million RMB (calculated for 2250 kg/ha). The direct income can reach 60 million RMB according to 2002 market prices. Furthermore, ecotourism and culture-tourism are estimated to produce an income equal to 50 million RMB (Zhenglan Banner Tourism Bureau, 2001), stock production and further processing, and related agribusiness would produce an income of 950 million RMB, income from commerce and other industry would equal 50 million RMB (Zhenglan Banner Government 2000), and the total income would be 335 million RMB. This would correspond to 18 times the income of Zhenglan Banner in 2002, thus realizing the objective of achieving sustainable development in Zhenglan Banner of Hunshandak Sandland.

A third of the earth's land surface is also located in arid and semiarid areas like Hunshandak Sandland, and is directly threatened by desertification (Diallo, 2003). If we are able to combat desertification in a third of the earth's land surface, as well as meet other human needs, such as economic development and life improvement, by urbanization, this will be an accepted accessible weapon through the world.

Acknowledgements

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Title: The scattered fruit tree meadows of the Swabian Alb

Organisation: Ecosystem Services Research Group, Berlin-Brandenburg Academy of Sciences and Humanities (BBAW)
Theme: Agricultural land, Grassland, Forest
Keywords: Ecosystem services, policy instruments, conservation

Summary

The Swabian Alb, in the South-Western part of Germany, is one of the country's most small-scale and diverse cultural landscapes with rich biodiversity and ecosystem services. It is home to one of the largest scattered fruit tree habitats of Europe. The term scattered fruit tree meadows refers to orchards which are composed of open stands of standard fruit trees, undersown with crops or managed grasslands. Recently, this traditional land-use type has come under threat. The case represented in this study presents the high value and multitude of ecosystem services which are provided. It looks back on the driving forces of the orchards' historical development and refers to reasons behind recent gains and losses. Measures are presented to conserve this human-influenced natural environment; these aim not alone for nature conservancy, but especially for a contribution to human well-being. The case of the scattered fruit tree meadows illustrates very well that in cultural landscapes natural processes align with socio-economic activities and quality of life.

Background

In European landscapes, people and nature have co-evolved over centuries. How these cultural landscapes look like, is the result of persistent landscape change following from of a highly diverse variety of land uses. A typical traditional landscape stretches like a belt through Western, Central and Eastern Europe: scattered fruit tree meadows. This agroforestry system is a historical form of commercial orcharding which is composed of open stands of standard fruit trees, undersown with crops or managed grasslands. The study focuses on the Swabian Alb (Schwäbische Alb), in South-West Germany, where one of the largest contiguous landscapes of this type in Europe can be found.

The characteristics of scattered fruit tree meadows
Scattered fruit trees (German: Streuobst) can be defined as "tall trees of different types and varieties of fruit, belonging to different age groups, which are dispersed on cropland, meadows and pastures in a rather irregular pattern" (Herzog, 1998).


Figure 1: Scattered fruit tree meadow in the Swabian Alb.

The most common species are apple, pear, plum, sweet cherry, and also walnut. Planted at an average density of 20-100 stems per ha, the minimum stem height of 160 cm allows utilization of the ground where fodder grasses, cereals, root crops, or vegetables are grown (Herzog, 1998; Plieninger, 2012). Typical scattered fruit tree arrangements take on the shape of whole valley slopes or greenbelts around villages, but also of alleys along streets and of individual trees or tree groups. Scattered fruit trees are delimited from home-gardens or intensively managed orchards through their open and scattered character.

Figure 2: Example of scattered fruit trees that form a green belt around the village, in this case the village of Owen (Swabian Alb).

The scattered fruit tree habitats of Germany are a traditional agroforestry system resulting from an interaction of different drivers tied to the development of techniques and markets as well as political events. Although being often received as a typical pristine agricultural landscape, it is a relatively new one. Until the 17th century fruits were mostly produced for mere subsistence, and fruit trees were confined to home-gardens. The development of these habitats of highly scenic value which constituted whole new landscapes was triggered not by aesthetic reasons, but by economic ones (Weller, 1996). The early beginnings of market development were interrupted by the European Thirty Years' War (1618-1648), leaving devastated landscapes, and other catastrophic events and epidemics (Herzog, 1998). Several laws and public regulations later implemented allude to the importance of enhancing fruticulture for a revitalization of the landscape: the linking of the permission for citizenship or marriage to the obligation to plant fruit trees may be cited as an example as well as the damage of fruit trees being a punishable offence (Herzog, 1998; Weller, 1996). The 18th century is a period of wide-spread extension activities. Both scattered fruit trees and orchards became a prominent element of German landscapes, especially in the cultural landscapes of the Southwest. Another indicator for the economic significance of fruit tree meadows especially in South-West Germany is the condition of the sites on which the planting started. These were sites with particularly favourably conditions (river valleys, South facing slopes), including arable farm land. Many trees were planted in former vineyards which had been in decline due to changing climate conditions, pest invasions and arising competition with wine production from the Rhine area (Herzog, 1998). Later on, technical progress made the production of fruits even more cost-effective; the implementation of railways, for example, brought the products of scattered fruit trees to markets on a much larger scale. In Germany, the plantation and expansion of scattered fruit trees reached its peak in the 1930s. From the 1950s onwards, markets for cheap imported fruits emerged in Germany, which necessitated efforts to produce fruits at competitive prices and led to "a shift of market-oriented fruit production from Streuobst to intensively managed orchards" (Herzog, 1998). These intensive fruit tree systems are of a completely different shape in their horizontal and vertical vegetation structure (dwarf trees, bushes or espaliers planted in row; Weller, 2006). The economic conditions had changed. While in Baden-Württemberg nearly 18 Million scattered fruit trees had been counted in 1965, only 9.3 Million trees (ca. 116,000) remained in 2008 (MLR, 2008).

The case of the Swabian Alb

In the Swabian Alb, situated in the South-West federal state of Baden-Württemberg, this development needs to be examined more precisely. The area is situated around 50 km South-East of Stuttgart and covers both foothills and the Swabian Alb low mountain range.

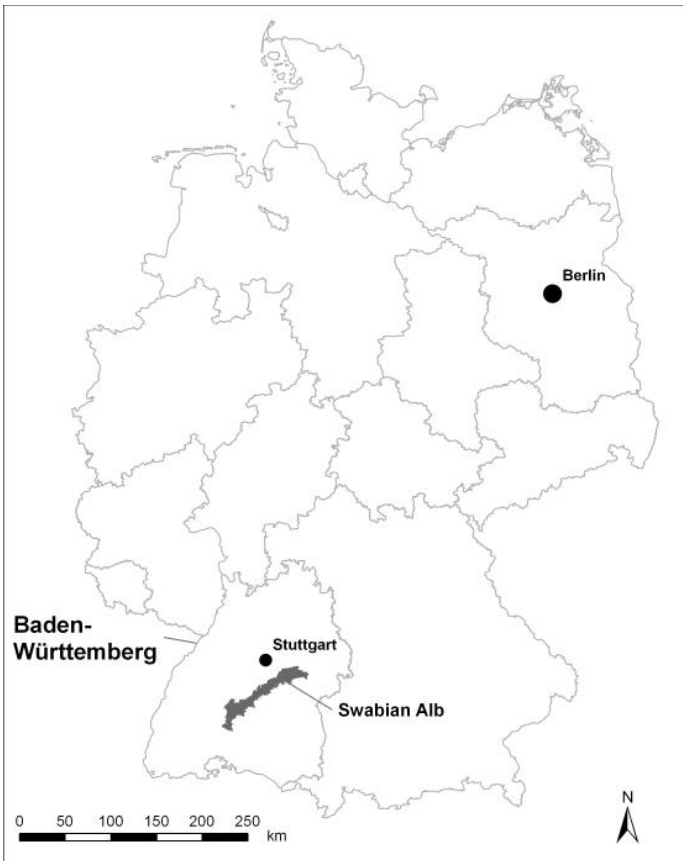

Figure 3: The location of the Swabian Alb in the German federal state of Baden-Württemberg.

While nowadays intensively managed orchards dominate the favourable sites of the region allowing for profitability, sites with more difficult growing conditions still harbour scattered fruit tree meadows to a great extent (Weller, 1996). One of the largest contiguous landscapes of this type in Europe with about 6,000 ha of grassland and 600,000 scattered fruit trees can be found in the forelands of the Swabian Alb Mountain Ranges (Thiel et al., submitted). The region is characterized by small-scale and diverse cultural landscapes with rich biodiversity and ecosystem services. This site as a part of the UNESCO Biosphere Reserve Swabian Alb is of high biological and cultural value.

Use and management of natural resources in the scattered fruit tree meadows

Scattered fruit tree meadows in the Swabian Alb are low-intensity systems that need to be maintained through regular, but extensive and moderately frequent human uses. The grass understorey is mown once or twice a year if not grazed extensively by sheep or other livestock. They are primarily in private ownership. The high value of this landscape results from the human-influenced shape of the natural environment as a mosaic of extensively used manifold small-scale habitats.

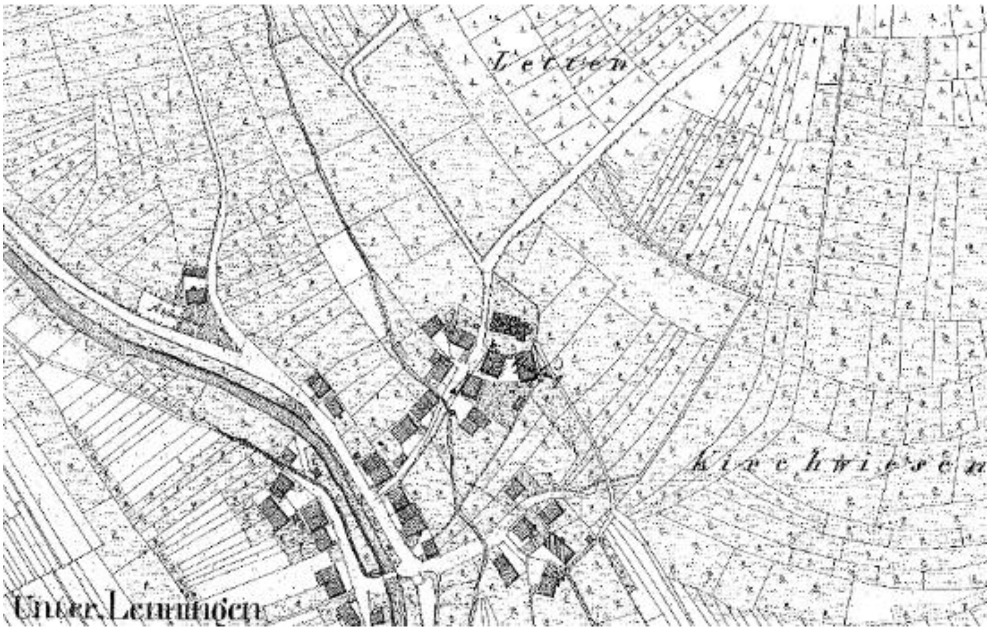

Figure 4: The small-scale structure of land tenure shown in this historical map of 1828 of the Swabian Alb (Village of Unterlenningen) indicates the highly diverse structure of the scattered fruit tree meadows (LGL, 2012 [1828]).

The largest amount of the products is processed for juice production, especially apple juice; further products are used for direct consumption, liquors, must or vinegar. Along with the fruits the agro-forestry system allows the production of hay and fruit as animal feeds, firewood or timber (Kizos et al., 2012). In the understanding of the Satoyama Initiative the scattered fruit tree meadows of the Swabian Alb may be assumed as a typical Socio-Ecological Production Landscape (SEPL).

Biodiversity and ecosystem services

Provisioning services may be the most obvious services that scattered fruit tree meadows provide. Farming is mostly done on sideline basis or as spare-time activity, whereas commercial fruit cultivation concentrates on intensively managed half-standard plantations. However, the fruit production of scattered fruit trees affects the European market and the economic value is underrated, although the net profit for the individual farmer is rather low (Herzog, 1998, 2000). Emerging from economic reasons in the previous days, scattered fruit trees are appreciated and enhanced mostly due to their biodiversity and ecosystem services today. The habitats' combination of trees and low-intensity understorey layers results in small-scale and highly diverse structures and ecological gradients (site conditions, microstructures, ecological niches). In addition, typically fruit tree meadow elements like hedges, ditches, embankments, stone walls or dead wood accumulation are enhancing structural diversity (Kizos et al., 2012). The genetic diversity and local varieties are very high. In Germany alone, more than 3,000 fruit varieties were found in 2008 (MLR, 2008). The biodiversity that scattered fruit trees host is outstanding, among them many threatened plant and animal species. The orchards host five times more bird species than intensive fruit tree systems whose horizontal and vertical vegetation structure (dwarf trees, bushes or espaliers planted in row) are of a completely different shape (Weller, 2006). Of crucial importance to sustaining metapopulations of wildlife is the ability to provide connectivity between forest, woodlands, and other semi-natural habitats (Plieninger, 2012). In addition, scattered fruit tree meadows provide critical regulation services by improving the locate climate, buffering groundwater pollution, or controlling surface-runoff and soil erosion (Thiel et al, submitted). Also the cultural services provided by the orchards are manifold. The recreational service contributes al lot to local well-being and attracts day tourists. Concerning the landscape aesthetics, this kind of cultural landscape is characterized by its high diversity, not only spatially, but also temporal in the course of the seasons (Herzog, 1998).

Figure 5: The scattered fruit tree meadows are a constitutive part of the Swabian Alb cultural landscape and closely linked to regional identity.

The scattered fruit tree meadows today

Due to the variety of valuable ecosystem services perceived by the inhabitants, deep societal concerns are caused by the decline of scattered fruit trees which could have been witnessed in parts of the Swabian Alb during the last decades. Losses were caused both by intensified and extensified land-uses. On the one hand, especially green belts around villages suffer from increasing urbanisation. On the other hand, many orchards have been abandoned as a result of a lack of profitability and have been converted into forests. Many remaining fruit trees are overaged, lack regeneration, and suffer from neglect.

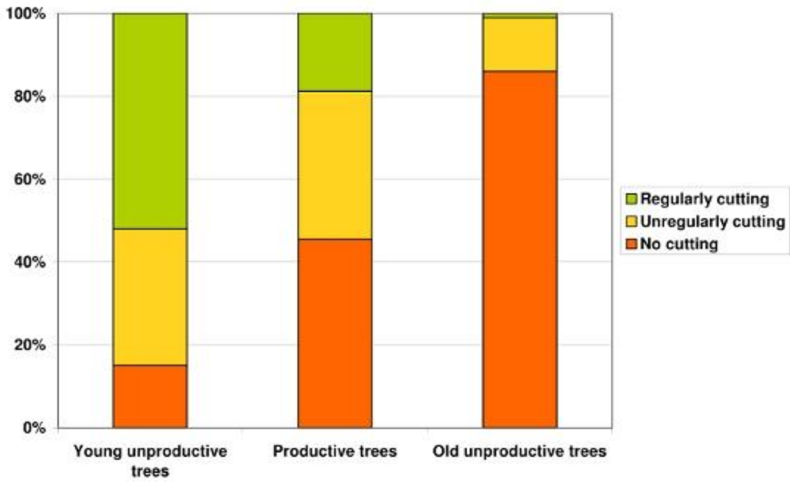

Figure 6: Maintenance condition in relation to the productiveness of scattered fruit trees (results for the federal state of Baden-Württemberg). Maintenance efforts are substantial for the conservation of the orchards, however, the data collected shows great deficits (based on: MLR, 2008).

However, surveys show that changes in the spatial arrangements of orchards were much stronger than their overall area changes. Thus, the landscapes structure is threatened by large-scale simplification and agricultural upscaling (Plieninger, 2012). Large-scale clearances have affected the inhabitants' minds and have brought the importance of landscape scenery and its role for regional identity into the public focus. The look back on the history of this type of land-use system reveals the fundamental role of economical driving forces for its development. Today, however, the ecological and cultural value of the scattered fruit trees and orchards predominate and evokes strong public support.

Maintenance of scattered fruit tree meadows

In the case presented, a number of different policy measures for preservation, maintenance and revitalizing of orchards are provided. Most of the measures acknowledge the crucial role of those stakeholders who are in fact the land-users: the owner of the orchards. On the state level, the agri-environment programme of Baden-Württemberg (MEKA III) asks farmers to undertake environmental activities and pays income losses and costs (more than 4 Million Euro in 2008). Another scheme, the EU co-financed Life+-Project, has started in 2009 and aims at protecting birds in scattered fruit tree habitats and maintaining the habitats at the same time by promoting bird-friendly cutting of trees and revitalising trees on communal land. Other supporting schemes entail the processing and marketing of fruits given that the profitability of this land-use type is an important factor in the farmers' perspective. In many areas, juice from scattered fruit trees is commercialized with an additional charge for maintenance efforts. The strong support of project work in the field is partly due to the structure of private, small-scale ownership of the orchards. Building of networks, information and education campaigns as well as market research are promoted. One of the most prominent schemes is the PLENUM-project which aims to preserve and develop nature and environment. Under its umbrella, e.g., juice and liquor brands have been established combined with an additional premium for producers for adhering to specific production practices (MLR, 2008).

Conclusion

The case of the Swabian Alb scattered fruit tree meadows illustrates the locally persistence of traditional land-use systems. Then again, it points out that the linkage of agricultural use and economic incentives to nature conservancy is of critical importance. These findings underpin the Satoyama approach that a harmonization between development of human activities, especially agriculture, and conservation of biodiversity is necessary in order to preserve cultural landscapes. However, further research is needed in order to understand processes of landscape change. Although there are manifold counter measures, the extent of well maintained scattered fruit tree meadows still decreases. Neither a sound survey of the spatial extent of changes nor a sufficiently explanation of the reasons behind efforts to either maintain or clear orchards does exist so far. The reasons for strong public support and local efforts to maintain the traditional surroundings remain vague.

Main efforts of the Ecosystem Services Research Group

The drivers, impacts and policy options regarding Central European cultural landscapes are firmly in focus of the Ecosystem Services Research Group. The project is jointly managed by the Berlin-Brandenburg Academy of Sciences and Humanities; the Ecologic Institute, Berlin; the Öko-Institut e.V.; and the Institute for Landscape Management at the University of Freiburg. It aims at analysing the relations between ecosystem services, market-based policy instruments and quality of life in Central European cultural landscapes. Three questions are central in this context: (A) How do market-based instruments affect land-use practices and the provision of ecosystem services? (B) What effects do changes in land-use have on selected ecosystem services, and what connections and interactions exist between ecosystem services? (C) How can the relationship between ecosystem services and quality of life as well as economic welfare be conceptualized? These relations are examined, amongst others, using the example of the biosphere reserve Swabian Alb.

Local actors are closely incorporated into the analyses. The research group assumes that complex resource use problems, like the case of the scattered fruit trees, are connected with heterogeneous interests and knowledge-intensive ecosystem relations which may be tackled more efficiently and sustainable by integrating scientific expertise, regional (resource use) knowledge, and stakeholder interests. Therefore, the group initiated a scenario process in two Swabian Alb municipalities. Moreover, uncertainty, or merely a lack of data, about the value of different ecosystem services may be stated. In particular aesthetic and spiritual services provided by cultural landscapes and their crucial role for identity, social networks, and lifestyles of the local population are usually under-represented in both research and land use policies. Here, the research group aims at contributing to overcome these deficits. A key aim of this collaborative investigation of different disciplines is to point out opportunities for sustainable design of incentive instruments concerned with ecosystem services. In the case of the scattered fruit tree meadows these could be opportunities to adapt this kind of land use to the current demands of land-users and their personal interests.

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Title: Mainstreaming satoyama in research, education and regional collaboration towards the revitalization of Noto Peninsula

Organisation: Kanazawa University
Theme: Others
Keywords: Satoyama satoumi, regional revitalization, capacity building

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Summary

Kanazawa University is a regional academic institute located in Ishikawa Prefecture, Japan where 70 percent of the land can be classified as satoyama (Nakamura 2006). The area's biodiversity-rich landscapes and seascapes have been formed through longstanding human-nature interaction that had fueled the area's once vibrant rural economy. Changes in our lifestyle and industrial structure, however, have resulted in the depopulation and aging of the rural communities, which in turn led to the deterioration of the landscape due to underuse. The state of our satoyama thus signifies the "inconvenient truth" behind Japan's rapid industrialization and economic growth. As such, it urges us to rethink our development trajectory and the role of academia in society as well.

The case study presents our challenge as a regional university in bringing together local, regional and global actors in order to mainstream the satoyama approach as a means towards endogenous development through sustainable nature use. It highlights the inception, expansion and partnership formation of the Satoyama Satoumi Project—a meta-project that would develop to encompass all three pillars of the university's action goals: to become "a research university dedicated to education, while opening up its doors to both local and global society (Kanazawa University 2010: 4)." Although the process has been site-specific and may allow for little generalization, we hope the case serves as an example for mainstreaming a locally-grounded concept for sustainable development in both the academia and policy-making at various levels from the local to the global.

The Satoyama Satoumi Project

Kanazawa University

Kanazawa University is located in Kakuma Hills of Kanazawa City, Ishikawa Prefecture. As a central university of the Hokuriku Region, Japan, it boasts 3 colleges and 16 schools with 1,012 teaching staff, enrolls over 8,000 undergraduates and nearly 2,300 graduate students.

The Inception of the Satoyama Satoumi Project

The university's satoyama-related activities developed alongside the institute's major transition in its history of over 150 years: our conversion into an independent corporate entity and campus relocation. Founded as a national university in 1949 under the Ministry of Education in accordance with the National School Establishment Law, the institute consolidated various medical, technical and educational facilities in Kanazawa City, the Prefectural Capital, some of which had been in service since the mid 19th century. Within 25 years, however, our operation had outgrown its historically unique campus in Kanazawa Castle. Moreover, the upcoming incorporation of Japanese national universities (2004) obliged us to clarify our social responsibilities. The Satoyama Satoumi Project was launched at this timing of the institute's rebirth.

The Satoyama of the New Kakuma Campus

The relocation of our campus gradually took place between 1989 and 2010. The acquired 200 hectares in Kakuma Hills, formerly the agricultural and forestry land of Kakuma Town about 5 kilometers from the center of Kanazawa City, had largely retained its satoyama characteristics. Deciduous broad-leaved trees such as Chinese cork oak and konara oak are among the rich biota of 700 plant species; 15 mammals including fox, raccoon dog, Japanese serow, Japanese black bear; 47 avians including three rare Falconiformes; and over 1,000 insects. At a time when abandoned satoyama continue to deteriorate nationwide, the condition of Kakuma Hills in a periurban setting was found to be a huge asset to the university. Our plan was to conserve and restore this natural environment and to create a campus open to the local communities as part of our mission to expand our social contribution sector.

Fig 1: Kanazawa University's Kakuma Main Campus and its “Satoyama Zone”

Kakuma Satoyama Nature School (Kakuma Shizengakkou) and the Launch of the Satoyama Satoumi Project

In 1997 we assigned a third (74ha) of the new Kakuma Campus to Nature Conservation Forest (62ha) and Nature Park (12ha)（Fig 1）. The area corresponds to our current “Satoyama Zone,” which serves site to our education and research in secondary nature processes. In 1999 we launched the “Kakuma Satoyama Nature School (Kakuma Satoyama Shizen Gakko)” to make this area available to the public for a lifelong learning project in the experience and study of wise nature use. This marked the beginning of “Kanazawa University Satoyama Satoumi Project,” a metaproject promoting the conservation and revitalization of secondary nature.

The activities at Kakuma Satoyama Nature School include: 1) developing and implementing nature experience and lifelong learning programs, 2) voluntary activities by locally organized “Satoyama Mates” (about 400 members) in bamboo forest and terraced rice paddy restoration (Fig 2) etc., 3) convening regional collaboration events such as “Satoyama Forum” in partnership with Ishikawa Prefecture, Kanazawa City and the private sector, and “Town Meetings” with municipalities (Wajima, Kaga, Kanazawa, Hakusan, Suzu, Hakui and Nanao) and townships (Noto, Anamizu, Uchinada). At the heart of such activities is “Kakuma-no-Sato,” a 280 year old wooden farmhouse dismantled from former Shiramine Village, Ishikawa Prefecture, and reconstructed on campus to commemorate the university’s 50th founding anniversary in 2005 (Fig 3). Over 10,000 users have benefited from the facility every year. We have also appointed 41 community revitalization leaders of Hokuriku Region as “Satoyama Satoumi Resident Researchers” to act as brains and instructors for our activities. To further our mission by strengthening our footing within the university, we have established “Kakuma Satoyama Headquarters (Kakuma Satoyama Honbu)” in August 2010.

“Kakuma Satoyama Headquarters” plans for the management and operation for the wise and contemporary use of our Satoyama Zone. The General Manager is appointed from the university’s Board of Executives, and the Steering Committee assumes the policy-making role. Under the General Director, the Board of Trustees is composed three sections: Management, Research and Education, Collaboration. To solicit a wide range of cooperation, we invite local governments, enterprises, organizations and citizens to form a “Satoyama Cheering Squad”, while assigning an advisory panel “Kakuma Satoyama Liaison Committee” to facilitate collaboration between the university and its partners. We implement advanced and original education and research using the Satoyama zone to train people to become the foundation of sustainable society in alliance with the region.

The Satoyama Satoumi Project thus began at the time of the university’s rebirth when our incentives towards an environmentally conscious campus matched our emerging institutional needs. Various activities of socially contributive content were brought together under the theme of satoyama to encourage public engagement towards the co-creation of an arena of life-long learning. Noteworthy is how the satoyama setting predicated the learning process to be mutual and multidirectional. While research staff and students studied the Satoyama Zone to elucidate the processes of secondary nature and its restoration, for the place to retain its satoyama characteristics it first had to be restored, then constantly maintained. The expertise for satoyama restoration and maintenance had to be sought from former farmers and foresters who knew how the land had been worked. We owe much to former landowners who joined the Satoyama Mates to volunteer to return to their abandoned paddies, to impart fellow Mates and satoyama researchers of their skills and knowledge in paddy reconstruction. The Satoyama Mates, mostly retired urbanites, found the restoration and farming activity educational as well as recreational, as they brought along their young with minimal previous exposure to practices in traditional land use. To sum, the study of satoyama involved the creation of a new system of knowledge and practice where scientists and farmers-foresters learned from each other while educating their young. In the face of agricultural decline, the campus site’s detachment from mundane economic concerns enabled all actors to pursue their ideals, whether in farming or research, in a nostalgic utopian atmosphere evocative of communal rural life. However, as we began to increase our extramural activities in Town Meetings and strengthened our contacts with Resident Researchers, we were awakened to the aforementioned “inconvenient truth” of rural life. The real satoyama issue lay well beyond our campus walls, inseparable from economic reality. It is thus we thought to expand our mission to the Noto area.

Expansion to Noto

Noto’s Satoyama and Satoumi

Noto Peninsula comprises the northern half of Ishikawa Prefecture, protruding 80km northwards into the Japan Sea. The entire terrain lacks large rivers and plains, and is covered with hills broken by small ponds and rivers that irrigate valley bottom paddies. This mosaic landscape of human-maintained forests and farmland creates a biodiversity-rich green corridor 20-30km wide. The seascape along the coastline varies dramatically, as the north and west coast faces rough waters of the Japan Sea while the rest of the shoreline forms part of Toyama Bay. Off the northern shore where ocean currents Liman and Tsushima meet is where fish from both warm and cold waters are found. This diverse seascape has nurtured the development of various forms of fishery and its social institutions for sustainable use. Such landscapes and seascapes as products of longstanding human-nature interaction have collectively received international acclaim as Noto Peninsula’s Satoyama and Satoumi, which would be selected GIAHS (Globally Important Agricultural Heritage System) in 2011.

Noto’s Satoyama and Satoumi, however, face deterioration due to underuse as the very human population who have worked the landscapes and seascapes is in steep decline. The vast area comparable to Tokyo is inhabited by a mere sixtieth (230,000) of the metropolis, and the figure is projected to more than halve by 2030. The situation is worse in the Oku-Noto (deep Noto) area, or the distal half of the Noto Peninsula. Unless urgent measures are taken to reverse the trend, depopulation and devastation of the environment would accelerate in a negative spiral. The ideal would be to revitalize the area through the promotion of sustainable use of its satoyama and satoumi.

The Noto Gakusha (Noto Branch of Kanazawa University)

With the above in mind we set out to seek collaboration with the Oku-Noto area to “do what only universities can do, in ways universities usually won’t.” The first step was to establish a university satellite in the area. At the very tip of Noto Peninsula, more than 150 km from Kakuma Campus, we found an elementary school which had been shut down in 2005. Suzu City, the owner of the facility, agreed to let us use the building for free after renovating it for adult use at a cost of 46 million yen. This is how Kanazawa University Noto Gakusha (Noto Branch, Fig 4), the hub of our activities in Noto, came into being in 2006 (Uno 2010). Below are our projects based in Noto Gakusha:

Noto Peninsula Satoyama Satoumi Nature School (Noto Hantou Satoyama Satoumi Shizengakkou)
The first in our series of projects in Noto was the launch of another nature school at Noto Gakusha, as a "new knowledge platform" for study on the local environment in collaboration with local residents. The Noto Peninsula Satoyama Satoumi Nature School (Noto Hantou Satoyama Satoumi Shizengakko) began in 2006 under a three-year funding scheme from Mitsui & Co. Ltd.

Environment Fund. We sent in a fresh doctorate to live and work in the area as resident researcher for the Nature School. The main activities of the Nature School include: researching biodiversity of satoyama and satoumi; organizing voluntary conservation activities of satoyama and satoumi by local communities, the universities and urbanites (Fig 5); environmental education targeted for local elementary and middle schools, universities and residents (Akaishi 2010). In order to promote the institute's collaboration with local residents, Suzu Support Group was formed among city employees, community leaders and pioneers in agribusiness, which would develop into a non-profit organization "Oraccha-no Satoyama Satoumi (Our Satoyama Satoumi)" in 2008. After the expiration of the initial fund in 2009, the Nature School is run by the NPO whose steering committee includes both local leaders and university staff.

The NPO serves the basis of our regional collaboration with various local stakeholders centered upon the Noto Gakusha (see also Fig 9). In order to revitalize the Noto as a whole, however, a broadening of area and approach was necessary. This has been sought through a series of projects and organizations subsequently implemented in Noto Gakusha.

"Noto Satoyama Meister" Training Program
The most fundamental and enduring effect in regional revitalization should result from the empowerment of its protagonists, the people. The "Noto Satoyama Meister" Training Program is our capacity building division, or education in the context of regional collaboration. We train young professionals up to 45 years of age with the aim of preparing these individuals to start up environmentally-conscious agriculture, forestry, fishery and related businesses, or to take on leadership-roles within the Noto area. The two-year course of weekend lectures and hands-on training includes various topics such as environmental studies (Fig 6), development, local culture (Fig 7), agricultural technique (Fig 8) and agribusiness (Fig 9). Our biweekly public seminars are broadcast on the local cable television network and serves to disseminate our vision in the Noto area (Kawabata 2010).

While most of the students are from the Noto area, employed in civil service, forestry and agricultural cooperatives or private enterprises, some have moved in from the urban areas to participate in the program and to enter agriculture.

Apart from coursework, students engage in their thesis study on original means to revitalize Noto's satoyama and satoumi. The range of topics so far have varied from non-timber forest product marketing, carbon-minus charcoal production, natural dye using local satoyama material, refurbishing abandoned houses to let, creating community spaces to promote intergenerational communication, tours encouraging returned overseas volunteers to move into the Noto area, etc. We encourage students to choose topics that are grounded on their very local context that which they could pursue after completion of the program. The freedom of range of thesis topics is our way of ensuring the revitalization process to be endogenous and sustainable. At the end of their course students will submit a thesis, which is subject to oral defense in front of a committee including local authorities in the relevant field. Graduation from our program, in other words, is a handover process of the revitalization initiative to the newly born Meister's local context. Our goal is to train a total of sixty Meisters—each with his/her own project to revitalize Noto—over five years of funding by Ministry of Education, Culture, Sports, Science & Technology (MEXT) from 2007 through 2012. In order to carry out a program of such scale and nature, we had to consolidate our implementation structure whilst expanding our partnership framework. We staffed five young researchers in ecology, agronomy, public policy and anthropology to reside in Suzu to run our program full time. Senior staffs based in Kanazawa would commute nearly every weekend to supervise the operation, thereby connecting the Noto Gakusha to the Kakuma main campus. Of special note are our technical assistants who are experts in local agriculture, fishery and forestry and have excellent communication with the local stakeholders. Their presence is particularly important given Kanazawa University's lack of faculty in agronomy and related disciplines. To bridge this gap we also sought collaboration with Ishikawa Prefectural University whose former body was an agricultural junior college. Having young students and staff move into the rural areas of Noto, and encouraging leadership personalities to join our program have meant that collaboration with local governments at various levels would be ideal. Thus we concluded a series of partnership agreements, firstly the "Chiikidzukuri Renkei Kyotei (Regional Development Partnership Agreement, 13 July 2007)" with the two municipalities (Suzu, Wajima), two townships (Noto, Anamizu) and Ishikawa Prefectural University (formerly Ishikawa Prefecture Junior Agricultural College). The process stimulated our communication with the Ishikawa Prefectural Government. A trans-sectoral organization "Satoyama Meister Renrakukai (Satoyama Meister Liaison Committee, 31 August 2007)" was formed within the Prefectural Government, which would develop into another pact, the "Houkatsu Renkei Kyotei (Comprehensive Partnership Agreement 23 April 2008)" between the prefecture and the university (Uno 2010).

Apart from our expanded staffing, partnership with the government and educational sector, we enhanced our collaboration with local farmers, foresters, the fishery sector and private enterprises etc. "The Satoyama Meister Support Network" was formed in addition to our preexisting network of Satoyama Resident Researchers to provide local assistance in the implementation of our program. Its members have opened their fields as sites for our hands-on coursework (Ito et al 2010) as well as provided on-the-job training for students and graduates aspiring to start up on their own (Kawabata 2010).

Several graduates have already become forerunners in the promotion of environmentally-friendly agriculture, and a network of eco-conscious farmers and agribusiness is beginning to emerge. Synergies are also beginning to develop between our other ongoing projects, its staff and its participants (see below).

Noto Peninsula Satoyama Satoumi Activity

This is another program funded by Mitsui & Co. Ltd. Environment Fund (2009-2012) which focuses specifically on promoting urban-rural exchange in the Noto area. Through this program, students and youth from urban areas are encouraged to engage in various research, educational, and satoyama / satoumi related conservation activities with residents of Noto. Our aim is to bring one thousand participants through this exchange program over the course of three years, with the hope of creating new possibilities for enrichment of the Noto area. We have organized various short term courses for the study and experience of Noto's satoyama and satoumi mainly for universities and the University Consortium Ishikawa as well as companies interested in corporate social responsibility. In direct promotion of the Satoyama Initiative, we have coordinated JICA (Japan International Cooperation Agency)'s training program in Noto for participants from Asia, Africa and Latin America (Fig 10). The light-footed project has been able to catalyze various synergies straddling the Noto and the urban areas. A recent example of such coordination is the value-added sales of terrace-paddy rice produced by smallscale Oku-Noto farmers to enterprises and markets in Kanazawa.

"Noto Ikimono Meister" Training Program

“Ikimono” is a comprehensive term in the Japanese language applied to all “living things.” This is a Nippon Foundation-funded program (2010-2013) that aims to train five “meisters” a year to become proponents communicating the importance of human-nature symbiotic relationships to future generations. School teachers and local citizens develop skills in teaching children about satoyama, satoumi and their biodiversity. Farmers, fishers, foresters and eco-tour guides will learn how to conserve and utilize biodiversity in their respective fields (Fig 12). The one-year course provided by this program was ideal also for Satoyama Meister Students who aspires to become interpreters and coordinators for learning opportunities of Noto’s satoyama and satoumi. Some of the inaugural Ikimono Meisters are attending Satoyama Meister as well—we are about to witness the birth of “double Meisters” equipped for Noto’s revitalization.

Noto Operating Unit

Our efforts in Noto thus far had been a mere aggregate of projects each delimited by its own funding period. In order to seek continuity of our collective undertaking, we established a formal organization within the university. Thus in October 2010, as we have founded “Kakuma Satoyama Headquarters” we have also founded the “Noto Operating Unit” the office for which is installed in the Noto Gakusha.

As we expanded our mission to the Noto Peninsula, we have consolidated our partnership with various local and regional actors while formalizing our organizational structure. One of the most important lessons learnt through this process has been that in order to mainstream the satoyama approach, capacity building had to occur both at the personal and institutional levels, not only at the field of relevance but also within our main campus. For our non-tenured staff in Noto who had to face the lived-in realities of the rural setting, learning from Noto’s residents and its satoyama and satoumi was a prerequisite to project implementation. In order for us to integrate our Satoyama Satoumi Project into the university structure, however, our challenge has been to educate our main campus academic & administrative staff towards the importance of regional revitalization and biodiversity conservation. This is an ongoing process which is related to yet another strand in our effort: our various research activities and increasing commitment to the international biodiversity conservation regime.

Research and global outreach

The university has conducted research in socio-ecological production landscape areas in Ishikawa and other parts of the world. We are currently consolidating the knowledge produced through various disciplines including ecology, meteorology, health sciences, economy, sociology, anthropology, etc., to serve as a basis for our further activities in research, education and regional collaboration.
The most relevant synthesis to date comes from Japan Satoyama Satoumi Assessment as a sub-global assessment of the millennium ecosystem assessment, co-chaired by Koji Nakamura for the Hokushinetsu Cluster (Kikuzawa et al 2010). The compiled knowledge serves as a basis for our ongoing research projects such as the Satoyama Satoumi Revitalization Study and the Satoumi Study. Our focuses include the creation of GIS databases for an ecological history approach, biodiversity assessment in rice paddy systems and material circulation in satoyama/satoumi systems, and assessing continuity of cultural practices in depopulating areas, etc.

The Hokushinetsu process has been unique compared to other JSSA clusters in its bottom-up approach involving not only scientists but a variety of local and regional stakeholders, connecting them to national and international regimes for biodiversity conservation. The partnership framework formed during the assessment has proven useful to our ongoing activities mediating local, regional and global processes in the transmission of satoyama and satoumi values, as in our involvement in CBD related events and organizations such as COP9 and 10 and the Satoyama Initiative, in alliance with UNU-IAS and Ishikawa Prefecture. We are currently working with local governments towards the planning of biodiversity strategies in line with Japan’s implementation of the CBD. Following the selection of Noto’s satoyama and satoumi as a GIAHS site, we are also consulting with the relevant four municipalities and four townships in order to assist local policy formation.

Our commitment towards the promotion of these international regimes has had the effect of enhancing the visibility of our project within and outside the university. The attained recognition has helped us to formalize our organizational structure within the university in order to seek continuity in our efforts in the revitalization of our satoyama and satoumi.

Towards a "Noto Model" for regional revitalization

Over the years, the university's efforts towards maintaining, revitalizing/restoring socio-ecological production landscapes and seascapes in the region have developed to encompass all three colleges and various facilities within the university structure (Kanazawa University Satoyama Satoumi Project 2011), such that between 2010 and 2011, we have implemented over fifty independent programs in the Noto Peninsula alone. As our University Action Goal has come to state, we now seek to promote Noto Peninsula with a focus on integrated area studies at the highest domestic level (Kanazawa University 2011).

As we near the termination of our "Noto Satoyama Meister" Training Program (March 2012), we are in the course of planning our next phase in capacity building towards satoyama and satoumi revitalization. Among our plans is to create a "Noto Campus", in which the whole area can be envisioned as a common arena for multidirectional education and research in alliance with the prefecture, townships and municipalities, local communities and various stakeholders of the Oku-Noto, including universities with a shared interest in the area. We are seeking a "Noto Model" of regional revitalization, in which young aspiring individuals shall find the door to our satoyama and satoumi the very door that opens them up to both global and local society, replete with opportunities for generations to follow.

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Title: Biodiversity Conservation through Domestication of High Value Medicinal and Aromatic Plants in Mountain Ecological Landscapes of Nepal

Organisation: Kathmandu Forestry College (KAFCOL)
Theme: Grassland

Summary

This report is part of the case studies “Biodiversity Conservation through Domestication of High Value Medicinal Plants in Mountain Ecological Landscapes of Nepal” conducted in Rasuwa District of Nepal during the second half of 2011. This study was conducted in four resource poor Village Development Committees (VDCs), namely Shyaphru, Ramche, Dhunche and Bhorle of Rasuwa district. The project on domestication of medicinal plants for livelihood improvement and biodiversity conservation was implemented by the Nepal Agroforestry Foundation (NAF), the partner institution of the Kathmandu Forestry College in the beginning of 2008.

Main objective (Goal) of this project was to conserve Medicinal and Aromatic Plants and improve livelihood of the local people. The project purpose was to get food sufficiency through MAPs integration into existing farming system and thereby increase productivity. The major activities of the project included home nursery of medicinal plants, technical skills transfer, exposure visits, cultivation of medicinal plants in both private and public lands, cooperative formation and linkage with big companies and booklets publication. Through this project, farmers received technical training on MAP cultivation and management. The publication of package of practices of three MAP species (Swertia chirayita, Veleriana jatamansii and Rheum austral) is another important deliverable conducted during the project period. Almost half of the households (260) directly benefited from this project. The analysis revealed that the project beneficiary households produced 1.3 million MAP seedlings in home nursery and enough seeds from the cultivated MAPs in 2011, which contributed to reduced pressure on wild medicinal plant resources and thereby increased bio-diversity conservation. Total annual average income of the direct beneficiary households increased from Rs 31,084 in 2008 to 34,450 (1 USD = 71 NPR) in 2011. Overall cash income of the direct project beneficiary households increased by 11 percent during this period as a result of project intervention, while increasing medicinal plant cultivation area by almost 10 percent and maintaining MAP population in the wild. Income from MAPs was almost doubled from Rs 3,604 in 2008 to Rs 6,500 in 2011. Recommendations are made to improve the existing biodiversity situation and livelihoods of local communities.

Introduction

In recent years, bio-diversity conservation and poverty reduction through effective use and management of Medicinal and Aromatic Plants (MAPs) has become a fervent agenda of many scientists and development practitioners in the mountain region (De Beer, 1996; Larsen, 2000; Pandit and Kumar, 2010). MAPs have an important role to play in rural communities for people’s livelihoods (Arnold, 1995; Pandit et al. 2009). MAPs are also inextricably linked to regional natural bio-diversity. Medicinal and aromatic plants (MAPs) have long been a source of income of resource poor farmers of mid-hills and mountain region of Nepal. Despite these benefits, Medicinal and Aromatic Plants (MAPs) are increasingly faced with major threats from various environmental, socio-economic and institutional factors and also due to expansion of unregulated trade and commercial use (over harvesting, inadequate processing and storage). Swertia chirayita (Chiraitta), Veleriana jatamansii (Sugandhawal) and Rheum austral (Padamchal) are examples of some high value MAPs under threat in study district, Rasuwa due to their market value (Pandit and Kumar, 2010). The existing agro-based farming system in the hills is constrained by lack of new technology and infertile and limited land availability and thus resulting in possible food deficits with an increase in population in the foreseeable future. To address these problems, integration of MAPs domestication into existing farming systems was thought to be one of the viable options for the resource poor farmers for their sustainable livelihood and bio-diversity conservation in mountain ecological landscapes.

Out of about 7000 species of plants recorded in Nepal, approximately 700 species have medicinal properties (Edwards1996; Subedi, 2003). Some of them are better suited to fragile mountain conditions and more profitable than cereal crops (Pandit, 2003). In Nepal, many rural poor have been involved in harvesting of wild MAPs for survival (Olsen, 1998; Pandit et al, 2009). This activity has supplemented their meager income from subsistence agriculture although they have not been able to receive their due share because of the manipulation and exploitation by traders and middlemen. Besides, after the initiation of World Trade Organization (WTO) in Nepal, direct subsidy on the production of tradable MAP goods and agricultural crops have been removed or reduced. This has created global competition in the production of tradable agricultural commodities. Due to a lack of advanced infrastructure, technology and manpower, it is very difficult for countries of hill regions, for example, because of cheap rice imported by Nepal from India. Thus the countries like Nepal have to identify commodities for which the country is at a comparative advantage. Due to the presence of different micro-climates, Nepal has strength to produce special MAP crops, which are grown in its climate niches. Many MAP species need such climate niches, which do not exist in other regions.

In order to address the above problems, the project was implemented by the Nepal Agroforestry Foundation (NAF), the founding member of the Kathmandu Forestry College in 4 VDCs (Shyaphru, Ramche, Dhunche and Bhorle) of Rasuwa district from July 2008 to June 2011. The project aimed at decreasing pressure on medicinal plants in the wild, enhancing bio-diversity conservation and increasing production of farmland through MAPs integration.

Implementation strategies adopted by the project

The project was targeted to Tamang and Sherpa of four VDCs (Ramche, Dhunche, Shyaphru and Bhorle) of Rasuwa district. As the project was demand driven, it was therefore implemented through grass roots level farmer groups- mostly mixed. Twelve groups were formed. Beneficiary selection was made through Participatory poverty analysis (PPA). NAF worked in collaboration with the concerned government body i.e. Langtang National Park (LNP) and District Forest Office (DFO) especially in legal issues associated with MAP domestication and capacity building of the local groups for biodiversity conservation. For technical support NAF established a working relationship with the District Agriculture Development Office (DADO) and other green sector line agencies such as District Soil Conservation Office (DSCO) and District Veterinary and Livestock Offices. Grass roots level organizations were mobilized for strengthening the local groups. Demo plots were established in private land for encouragement to the farmers. The project considered the gender issue. It also involved marginalized communities i.e. Tamang and Sherpa in most project activities.

Both men and women farmers were provided with trainings required for domestication and they were encouraged to participate in various sharing meetings at village as well as district level. Women were involved at every level of the project from design to implementation. Female farmers were encouraged to take the leadership in domestication of MAPs and utilize the income generated from its sale for household expenditure and education of the children. Male members of the group assisted females in MAP promotion activities and the possible work load added to women by this project was minimal.

Methodology

This study has adopted a multipronged approach to collect relevant information. Following methods were applied to gather first hand information from project beneficiaries, stakeholders and project staff.

Household survey

Out of 265 farm households organized in 12 farmers groups for project intervention, 139 farm households organized in 10 groups were surveyed in 2008 for baseline information. A survey form developed in 2008 was used to collect basic information in 2008 (Annex I). The same form was used to collect farm household information in 2011 and the same 139 households were surveyed in 2011 for comparison.

A survey was carried out in the last week of June 2011 by deputing field staff. An orientation was given to the interviewers on how to carry out the household level survey. The quality of survey conducted in the field was supervised and monitored on a regular basis. The surveyed forms were collected and brought to Kathmandu and were processed in an excel sheet. The information obtained in 2011 through fresh surveys was than compared with the information collected in 2008 to trace out the changes contributed by the project.

Focus group discussion

A focus group discussion was organized in each of the target villages during the latter part of June 2011. This discussion was held in a public school compound and all farmers were requested to express their ideas and opinions in an open and fair manner. The group was facilitated based on a checklist from the Assistant Forest Conservation Officer of the Lamtang National Park. The data collection was supervised by NAF and KAFCOL.

Qualitative information particularly motivation of farmers towards medicinal plants, its future prospect for expansion in farmland, biodiversity conservation, profitability, problems in MAPs cultivation, market price, trading system of MAPs, contribution of NAF through this project in propagation and domestication of MAPs, and contribution and assistance to farmers from line agencies of the government were collected through focus group discussion.

Key Informant Survey

Key informants from various district line agencies such as the Assistant Forest Officer of District Agriculture Development Office and Assistant Conservation Officer of Lamtang National Park were interviewed by the evaluation team in their offices. Information on coordination of the project during its implementation with line agencies of the government and stakeholders, cooperation and support from line agencies to the project, feeling of the stakeholders towards the project and integration of this project learning in public programs were collected through key informant interviews.

Meeting with project staff

A joint meeting between the M&E team from NAF central office and field project staff who were involved directly or indirectly in project implementation, was organized and opinions of the staff on problems and prospects on MAP domestication in farmland and factors affecting project implementation and lesson learned from this project were collected in this meeting.

Review of project documents and literature

A thorough review of project documents including approved project proposal, trimester reports, annual compiled report, base line information and other project documents pertaining to medicinal plant domestication and use was done.

Major outputs of the project

Output 1: Increased sufficiency and availability of MAPs seeds and seedlings

The project has made significant production and distribution of seeds and seedlings of MAPs particularly Swertia chirayita in the project VDCs and beyond the project VDCs as a spillover effect. Farmers produced sufficient amount of seed and seedlings of MAPs in their farmland and the district has self sufficiency in this species. A total of 260 households were trained in medicinal plants nursery development, cultivation and harvesting, of which 182 (70%) farm households developed home nurseries in the project area. In an average 70 percent of the farm households 7,300 seedlings were produced per household per annum (Table 1) which is a significant contribution of the project in MAP domestication. Before the start of the project, farmers used to collect small amounts of medicinal plant species from forests for their domestic use, which had degraded the MAP population in the wild. Now the framers produce MAP species in their own land.

Table 1: MAP seedling production by trained farmers in project VDCs in 2011

VDCs	HH number	Trained families	Average size (M^2) of home nursery	Seedling production per household	Annual seedling production in home nursery
Shypru	106	74	(10x20) = 200	10,000	740,000
Ramche	95	67	(8x15) = 120	6,000	402,000
Dhunche	41	29	(6X12) = 72	3,600	104,400
Bhorle	18	12	(10x15) = 150	7,500	90,000
Total	260	182	146	7,300	1,336,400

Source: Estimate of project staff and leader farmers during FGD and joint evaluation in June, 2011

Annually the project farmers produce 1.3 million seedlings in 4 project VDCs. Besides, the trained farmers and other individual farmers have also learned from the project and established home nurseries.

Output 2: Technical capacity of farmers increased in MAPs cultivation

The project has made a significant contribution to enhancing technical capacity of farmers in domestication and cultivation of MAPs in four project VDCs. To encourage farmers towards domestication of MAPs and to enhance their skills and knowledge, an exposure visit was organized in the first year of the project in Dolkha district for 22 leader farmers. Leader farmers observed domestication of MAPs in private land and community forestry and imparted knowledge on domestication, cultivation, harvesting and marketing processes. Skills and knowledge gained by these farmers through this exposure was shared with their colleagues in their respective group. This type of exposure visit helped to broaden their knowledge and skill on domestication of MAPs.

According to project staff and available reports during assessment, eight slots of MAP nursery management, cultivation and harvesting trainings were organized for 131 male and 129 female (total 260) famers during the project period (Table 2). On average there were 20 participants in each slot. However, the number of participants in each group varied by location due to travel distance from their home to the training venue. The number of participants in one event ranged from 13 to 25.

Table 2: Training for farmers on medicinal plant nursery management, cultivation and harvesting

VDCs	Number of groups	Male	Female	Total households
Shypru	5	56	50	106
Ramche	4	52	43	95
Dhunche	2	15	26	41
Bhorle	1	8	10	18
Total	12	131	129	260

Source: Project records, 2011

Discussion with farmers revealed that the transfer of MAPs nursery management, cultivation and harvesting skills and knowledge from those farmers trained by the project has a multiplier effect. Every farmer in the focus group discussion reported that they had educated their neighbors, relatives and colleagues on MAPs domestication. A team of seven project staff members deputed in the field supported the farmers groups to enhance their technical knowledge on domestication and cultivation. The team supported woman leader farmers in organizing and facilitating trainings at local level and visited every nursery and cultivation site during the entire project period. Timely follow up by staff as well as from the collaborating organizations was done so that farmers were updated with new information and technical knowhow.

Seeds of some medicinal plants along with nursery materials like water cane, plastic sheets, and small pipes for irrigation, sprinklers etc. were provided to the farming households. The farmers who could not grow seedling in their farm due to failure were provided with seedlings produced by project nursery for direct cultivation. The project has made an equitable distribution of support materials to all trained farmers. Equal amounts of support materials including seeds were distributed among the group members. Discussion with farmers revealed that the need for these support materials was different among the farmers based on their interest and the size of cultivation of MAPs in private land.

Output 3: Farmers groups institutionalized

Farmer’s group formation and their institutionalization is one of the important activities of the project. Altogether 12 farmer groups were formed during the entire project period. About half of the members in farmer groups were female. An authorized executive committee comprising 7-11 members with chairperson, secretary, treasurer and members was formed in each group with active participation and consensus of all stakeholder farmers. Altogether, 265 households were organized in MAP groups for domestication of medicinal plants in project VDCs (Table 3). The majority of farmers organized in the group were from marginalized ethnic groups including Tamang and Sherpa. On average 22 households were organized in a group with a good mix of male and female headed households. The group members were trained on group dynamic, group functioning, coordination and domestication of MAP in their farmland.

Table 3: MAP farmers groups by VDC and sex

VDCs	Number of groups	Male	Female	Total households
Shypru	5	57	52	109
Ramche	4	53	43	96
Dhunche	2	15	27	42
Bhorle	1	8	10	18
Total	12	133	132	265

Source: Project records, 2011

MAPs domesticator farmers of four VDCs have formed a network of their own, which has been registered as a cooperative recently. They are running saving credit programs and marketing of

MAPs. A better sense of coordination and institutionalization is observed among the users forming a good network in order to market MAPs fetching more profit. Every group is strictly functional based on their group's mandates and operational guidelines. Every decision was well recorded and endorsed in presence of members and formal structures identified. The existing cooperative had established linkage with major stakeholders for sustainable marketing of the products. All the farmers were equally benefitted because they had an equal share in the group. This is how farmer groups were found institutionalized.

Output 4: Pressure on natural resource base of the three MAPs decreased
It was observed that the project has made a tremendous contribution to domestication and cultivation of medicinal plants within and outside the project beneficiaries and it is imperative to conclude that the project has significantly contributed to the reduction of pressure on natural resource base in the district, particularly on three MAP species (Swertia chirayita, valeriana jatamansi and Rheum australe). On average direct project beneficiary households of the project have cultivated medicinal plants in 1.15 Ropani of land (Ropani = 500 M2) (Table 4).

Table 4: MAP cultivation in private land in 2011

VDCs	Number of households trained in MAPs cultivation	Number of households practicing MAP cultivation	Seedlings in home nursery	Cultivated land size (M2)	Number of seedlings transplanted /HH	Number of plants survived, matured and harvested	Yield (in Kg) in one harvest
Shypru	106	74	10,000	750	7,500	6,375	225
Ramche	95	67	6,000	500	5,000	4,200	140
Dhunche	41	29	3,600	400	4,000	3,400	97
Bhorle	18	12	7,500	350	3,500	2,975	106
Total	260	182	7,300	576	5,758	4,894	165

Source: Estimate of project staff and leader farmers through farmers field visit, 2011

The majority of farmers have cultivated Medicinal plants as a single crop for better benefit. The income from MAPs is almost three times higher than cereal crops (maize, wheat and millet) and potato. While the marginal farmers who have small patch of land and cannot wait for long gestation period of MAP species have practiced mixed cropping.

Sustainable production of Swertia chirayita seed has been ensured by the project. On average a trained farmer cultivating this species produced 4kg of seed in one harvest (Table 5). However, every farming household had no practice to produce seed after harvest. They only sorted out small amounts of seed required for their home nursery, and the rest is left carelessly. Some farmers got the seeds after harvest for their domestic use and sale outside the village. Two farmers reported that they sold 4 kg of seed in Kathmandu in 2010.

Table 5: Swertia chirayita cultivation in private land and estimated seed production in 2011

VDCs	Total number of households trained in MAP cultivation	Total number of trained farm households cultivating *Swertia chirayita* in private land	Mean production of seed (in Kg) in one harvest	Potential per household to produce seed
Shypru	106	74	225	5.00
Ramche	95	67	140	3.50
Dhunche	41	29	97	2.25
Bhorle	18	12	106	2.65
Total	260	182	165	4.12

Source: Estimate of project staff and leader farmers through farmers field visit, 2011

On average, 40 kg of harvested dry Swertia plant contains one kg of seed. The project beneficiaries can produce 30 tons of plants and 7 quintals of seed in one harvest. The price of one kg seed is Rs 9,000 (1 USD = 71 NPR) in local market but the local traders pay only Rs 4000-6000 per kg. Besides the project farmers supplied/sold required amount of seed in local market for nursery to other conservation projects and individual farmers willing to develop home nursery.

Outcomes

Change in land use pattern among the project beneficiaries

Out of 139 household heads surveyed for information (60 HH heads), 43 percent were literate and (69 HH heads) 57 percent were illiterate. Average household size of the project beneficiaries was 5.9 persons which is relatively higher compared with the national average of 5.4 persons (NLSS, 2004). There was no substantial change in occupation of people in the project area. However, the people are gradually motivated towards MAP cultivation in private land as an impact of the project and growing attraction towards tourism and seasonal hotel business as a result of growing numbers of visitors in Gosahikunda, a Hindu religious place and Lamtang National Park. Small change in land use pattern has been observed among the project beneficiaries. Average land holding size of the project beneficiaries including all types of land was 9.9 Ropani before the project which increased marginally to 10 Ropani after the project. This increase was contributed by purchase of 10 Ropani of Khet (lowland) by project beneficiaries from others and extension of 9 Ropani of Pakho (upland) in marginal area (Table 6).

Table 6: Change in land use pattern among the project beneficiaries

VDCs	Total number of households trained in MAP cultivation	Total number of trained farm households cultivating *Swertia chirayita* in private land	Mean production of seed (in Kg) in one harvest	Potential per household to produce seed
Shypru	106	74	225	5.00
Ramche	95	67	140	3.50
Dhunche	41	29	97	2.25
Bhorle	18	12	106	2.65
Total	260	182	165	4.12

Source: Baseline survey 2008 and line survey 2011
Note: Figures in the parentheses indicate total land area of the surveyed project beneficiaries

The project constantly educated project beneficiaries on cultivating MAPs in marginal land and in their upland terraces for better income. As a result the 33 Ropani of land left barren before the project due to insufficient rain for crop cultivation, lack of labor at household, high investment compared to its return and destruction by wild life was brought under cultivation, particularly for MAP and other crops (Table 6).

Change in livestock herd size among the project beneficiaries

Small change in livestock herd size was observed among the project beneficiaries. Overall the livestock herd size was 9 per household before the project which increased to 10 after the project. (Table 7) Livestock herd size of buffalo was increased for milk production and sale along the Kathmandu-Dhunche transportation route and sheep and goat in northern part of the district for income generation. However, the herd size of ox declined slightly and the size of cow remained constant. Number of chicken raised at household level also increased remarkably as the demand for poultry products increased along the transportation corridors (Table 7).

Table 7: Change in livestock herd size before and after the project

No	Type of livestock	Before	After	Change (in No)
1	Buffalo	0.9	1.2	0.3
2	Ox	0.9	0.8	-0.1
3	Cow	4.0	4.0	0.0
4	Sheep/goat	3.0	4.0	1.0
5	Mull/horse	0.2	0.2	0.0
6	Average herd size	9.0	10.2	1.2
7	Poultry	4.0	6.0	2.0

Source: Baseline survey 2008 and end line survey, 2011

Change in level of food sufficiency at household level

Food sufficiency is measured counting the support from own farm produce and buying by other cash income generated from sale of household level farm produce. Before the project 16 percent of farm households could support food only for three months from own produce whereas it declined to 10 percent after the project (Table 8)

Table 8: Change in food sufficiency level

No	Food sufficiency by moths	Before project		After project	
		No of HH	Percent	No of HH	Percent
1	Sufficient for three months	22	16.0	15	10.0
2	Sufficient for six months	104	75.0	90	65.0
3	Sufficient for nine months	13	9.0	34	24.0
	Total	139	100.0	139	100.0

Source: Baseline survey 2008 and end line survey 2011

Similarly, 75 percent of farm households had food sufficiency for six months before the project which declined to 65 percent. Importantly 9 percent of farm households before the project had food sufficiency for six months before the project which increased to 24 percent after the project (Table 8). Similarly, slight change was observed in sources of income to complement the food deficit among the project beneficiaries. Farmers reported that the contribution of wage labor, sale of livestock and sale of livestock products declined marginally and the loan from relatives declined significantly compared with before the project (Table 8).

Table 9: Change in sources to complement the food deficit at household level (N=139)

No	Source to cover the food deficit	Before (No HH)	At the end (No HH)	Change in No	Change in %
1	Wage labor	11	6	-5	45.0
2	Seasonal employment during tourist season	44	48	3	7.0
3	Loan from relatives/neighbor	25	5	-20	80.0
4	Sale of livestock	8	7	-1	12.0
5	Sale of cash crop (Potato & veg.)	62	65	3	5.0
6	Sale of livestock products	97	90	-7	7.0
7	Sale of agricultural products	9	6	-3	33.0
8	Sale of NTFP/MAPs (Chairato)	-	131	131	94.0

Source: Baseline survey 2008 and end line survey 2011

Sale of NTFP including MAPs was not reported before the project whereas 94 percent of surveyed farmers reported that this was one of the important sources of income to complement the food deficit (Table 9). Thus, it can be concluded that the project has contributed significantly to reducing food deficiency in the district through increased source of income by selling MAPs produced in farm plots.

Change in cash income among the project beneficiaries

One of the most important impacts of the project was observed in household income. Average household income among the target beneficiaries increased from Rs 31,084 in 2008 (before start the project) to Rs 34,450 (at the end of project) in June 2011 (Table 10). An absolute increase of income by Rs 3,366 per household was contributed mainly by medicinal plant cultivation in private land and its sale in Kathmandu. Mean income generated by project households from NTFP including MAPs was only Rs 3,604 before the project whereas it increased to Rs 6,500 in 2011. Income to project beneficiaries from this activity was 80 percent higher in 2011 compared with 2008. The project beneficiaries have cultivated medicinal plants (S. chirayita) in 1.15 Ropani of land in 2011. It means on average each beneficiary household is expected to produce 165kg of S. chirayita in his/her farmland which would yield Rs 66,000 per household. The project could not record this income because of its short duration.

Table 10: Change in mean household cash income before and after the project

No	Source of income	Before	After	Change	Change in %
1	Seasonal employment	2050	2150	100	5.0
2	Sale of livestock	1892	1500	-392	21.0
3	Sale of livestock products	4547	5000	453	10.0
4	Sale of NTFP including MAPs	3604	6500	2896	80.0
5	Sale of cash crops (Potato.veg)	1294	1100	-194	15.0
6	Wage labor including portering during tourist season	7935	8200	265	3.0
7	Hotel business	6072	6500	428	7.0
	Total mean	31084	34,450	3366	11.0

Source: Baseline survey 2008 and end line survey July 2011

Income from seasonal employment during tourist season, sale of livestock products and wage labor including portering during the tourist season increased positively (Table 10). While there were slight declines in sale of livestock, cash crops and other non-specified sources of income. Decline in sale of cash crops particularly potato and vegetable was contributed by allocation of 1.15 Ropani of land for medicinal plants cultivation as it reduced total area under cash crops. Decrease in sale of livestock has compensated by increased sale of livestock products among the project beneficiaries.

Reduced pressure on wild MAP and increased biodiversity

Before the project was implemented, the three medicinal plants promoted by projects were locally threatened and were in danger of extinction in forests. There were very few farmers who cultivated these species. The discussion with project beneficiaries and district stakeholders revealed that the pressure on these species has been significantly reduced. Of the 139 farmers interviewed, almost two thirds (90 farmers) expressed the number of plants of these species increased in forests and substantially increased in farmlands. Seeds produced from these plants have contributed to expansion of these species in both forests and farms. The domestication has not decreased bio-diversity in both forests and farms since most farmers have introduced medicinal plants as mixed cropping into the existing farming system. No species have been removed. Only intensity of cropping of cereal crops and potato was reduced. The number of cultivated farm crops remained unchanged.

Lessons Learned and Recommendations

Lessons Learned- constraining factors

High expectation of farmers from the project: The farmers organized in groups by the project had expressed high expectation from the project at the initial phase of the project. Besides the technical and materials support for domestication of MAPs in their farmland, they also demanded other income generating programs, food support and other community development which were beyond the scope of the project. To tackle this problem, the project had developed strong synergy with poverty alleviation project funded by the Poverty Alleviation fund for cash support and income generating program. Besides, the project staff clearly informed the farmers on limitation of this project stating that it will focus more on transfer of technology for domestication and bio-diversity conservation of MAPs through demonstration plots, help to establish home nursery, educate and train them on MAPs cultivation and domestication techniques and exploring market for appropriate price of the products.

Limited patience among the farmers: Farmers have a tendency to seek immediate return because they are confronted with day to day problems. This type of attitude was problematic to cultivate MAPs like Padamchal in farmland which has relatively long gestation period to get return. Two farmers who participated in demonstration plot development in their private land ploughed their trail plots as the germination of Padamchal was relatively long. Farmers were educated on total production cycle of MAPs and time required to get reasonable return. Since then the farmers who have enough patience participated in MAPs cultivation in private land.

Invasion of wild animals: Grazing and invasion in MAP cultivation area near the forest by wild animals like deer, wild pig and boar from Lamtang National Park was another problem to cultivate these MAPs in private farmland. However, the Chairato has been identified best MAPs which is not destroyed or grazed by wild animals because of its extremely bitter taste. The project was unable to address this problem because it does not fall under the project jurisdiction.

Low technical knowhow on pest management: There was hardly any expertise in the district either in the project or in the line agencies of the government to identify nature and type of pest invasion in MAPs. Farmers estimated that about 15-20 percent of Chairato plants died due to pest invasion. Chairato plants were invaded by one type of insect white grub living below the ground locally known as Khumrekira. Project staff could not identify the pest and thereby recommend the appropriate treatment process instantly during field visit. However, the project managed to send a technician from Kathmandu to solve the problems.

Lessons learned **-***Contributing factors: Various factors contributed individually and collectively to the success of this project which are described briefly in the following sections.*

Pool of expertise within the NAF/KAFCOL: NAF has been working in agro-forestry and NTFP sector since long ago and has a huge pool of expertise required for projects in this sector. It has pooled trainers, technicians and other expertise required for the project from its roster of members and volunteers. Besides, NAF also has 51% share in Kathmandu Forestry College which is attached with NAF. It easily got other expertise from the college as and when required. Overall it helped to provide appropriate skills to the farmers in MAPs cultivation and domestication in private land.

Synergy of this project with other projects: Local farmers demanded other community development and income generating programs to address their household needs which were beyond the scope of the bio-diversity conservation project. Therefore, the project has developed excellent coordination with other projects like Poverty Alleviation project supported by Poverty Alleviation Fund and conservation project supported by WWF Nepal to provide further support to farmers.

Reasonable market price of the products: The project established a direct link between the producers and big traders abolishing the role of the middle men in the district in collection and sale of medicinal plants. As a result, the farmers began to get a reasonable price for their products and were motivated towards the project.

High profitability of MAPs cultivation in private land: Cultivation of MAPs, particularly S. chirayita, is found profitable to the farmers compared with cereal crops cultivation. It was estimated that 143 kg of S. chirayita can be produced in one Ropani of land (500 m2), if it is cultivated with proper manuring and extended other care like weeding and pest management. Total income from this MAP yields Rs 57,200 in one Ropani of land. While the income from cereal crops like buck wheat, wheat and potato yields only an average of Rs 10,000 in one year. Farmers said that the return from MAP can be obtained in 18 months because one year is required for preparing the sapling for plantation and six months for growth and harvest in the farm. Therefore they suggested to compare one crop of MAP with two year cereal crops grown in one unit of land. Income from cereal crop in one Ropani of land to the farmers is just Rs 20,000 while it is Rs 57200 from MAP in the same land management unit.

High spillover effects: As the indirect project beneficiaries knew from the direct project beneficiaries about the profitability of the MAP cultivation, they were motivated towards its cultivation and project. The indirect project beneficiaries purchased MAP plants from the direct project beneficiaries produced in their home nursery and began to cultivate in small patch of land. The home nursery owners sold S. chirayita seedlings to other farmers. This project was successful in demonstrating a high level of spillover effects over a short time period.

Environmental and Biodiversity conservation benefits: Overall the project activities had no harmful environmental impacts. Adequate and balanced application of inputs especially organic manure was applied to keep the soil fertile and prevent soil degradation. The introduction and promotion of MAPs species increased the diversity of the area and farmers began to get benefits from using this diversity through selection of the desired MAPs species. As explained earlier, the species such as S. chiraita, V. jatamansi and R. austral were almost at the verge of extinction due to their high market value followed by unsustainable harvesting in natural habitats. The domestication of these species by this project enhanced the natural resource base in the forest as it helped to reduce the haphazard collection and bring a balance to natural ecosystems.

Most farmlands are located on steep slopes in the mountains of Nepal where farmers were practicing a cereal-based land use system that requires intensive soil tillage, particularly frequent ploughing and hoeing. As a result, farmlands in the hills had been losing top soil at rates of 8 to 12 tons/hectare per year (Pandit 2001). Due to the combined effect of soil erosion and farmers' limited affordability to apply adequate amounts of manure and fertilizer, soil fertility has steadily deteriorated (Neupane and Thapa 2001). As the MAP cultivation required less tillage (earth work) than cereal crops; it obviously reduced the soil loss and helped to decrease soil erosion and hence increased soil fertility.

Recommendations

Based on analysis of major outputs and outcomes of the project and experience gained during its implementation following recommendations are made.

- Analysis of attitude and behavior of target farmers towards MAP species and their domestication in farmland prior to implementation of such project helps to prioritize the inputs and resources on their preferred species. Baseline survey did not cover this aspect, as a result the project simultaneously promoted three species i.e. Padamchal, Sugandhawal and Chairato. Among these species, Chairato was preferred for domestication by farmers.

- Pest management emerged as one of the major problems in cultivation and domestication of MAP species in project area. The project was not prepared sufficiently to address this problem. Therefore, it would be better if adequacy of technical expertise required in the ground before implementation of such project is assessed and necessary arrangement is made accordingly.

- The formation of cooperative for post project activities was relatively late in this project. Therefore, it is recommend to form such cooperative in time so that it can be matured during the project period and can take over the post project activities for sustainability.

- Duration of the project was too short for changing farming behavior of the farmers and biodiversity conservation. Changing farming behavior of the farmers from traditional cereal crop to MAP type cash crops required relatively longer time. Therefore, it is recommended to design such project at least of 5 years duration.

- The farmers groups formed by the project still need technical back up and support to become full phased leader farmers in MAP cultivation. Therefore, it is recommended to develop post project mechanisms to support these farmer groups. A pro-poor community based forest enterprise model is recommended for future implementation, which not only increases income from MAP resources but also helps conserve resources in both farms and forests.

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Title: The Agras field system as a cultural landscape in Galicia (Spain)

Organisation: University of VIGO (UVIGO)
Theme: Others
Keywords: field systems, agras, cultural landscapes, spatio-temporal evolution, dynamics

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Summary

The aim of this research is the analysis of the dynamics of traditional agrarian landscapes with agras field system in Galicia, so as to provide new insights into their historical-cultural value and on their spatio-temporal distribution. On the one hand, the agras field system was very dynamic as in the past agras occupied larger areas in the region. On the other hand, we observed that despite agricultural evolution, agras showed strong inertia, as they have preserved their functionality for several centuries until the second half of the twentieth century. From this period onwards, the destructuring and loss of functionality of agras has been observed. Decline was favoured by demographic retreat and changes in the agricultural productive system. Nevertheless, we have observed a significant persistence of the agras structure, of its traditional knowledge and toponymy.

Introduction

The main objective of this research is the analysis of the dynamics of traditional agrarian landscape of agras in the Galician community in order to provide data regarding its historic-cultural value, spatio-temporal distribution, as well as its recent evolution dynamics, which allows us to reflect on its persistence and its conservation perspectives.

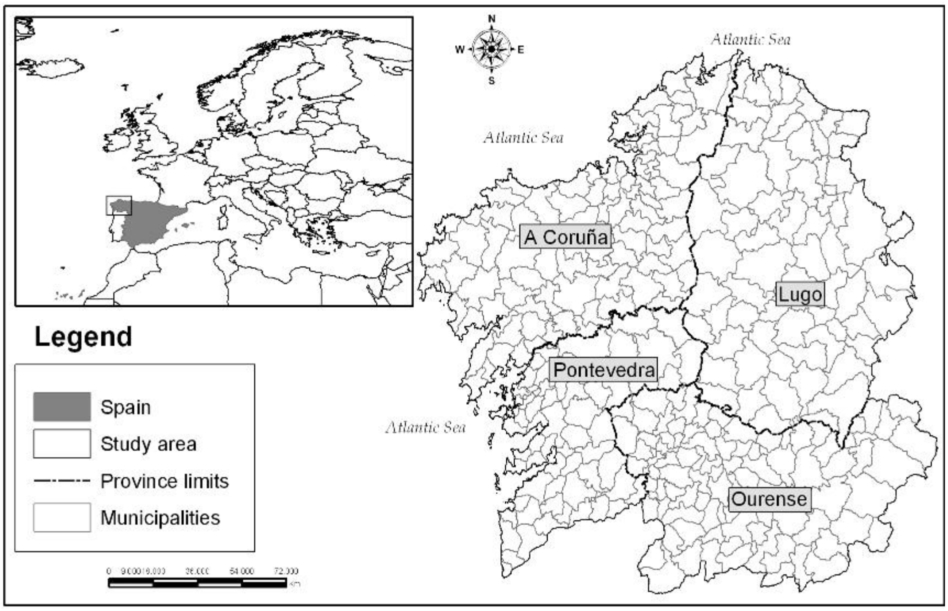

Figure 1. Study area

Methodology and sources

Firstly, we have carried out a review of the state of the art, presenting the agras field system in the context of the cultural landscapes of Galicia (Northwest of Spain, Figure 1), providing data of its main characteristics and its similarity with other agrarian field systems of Atlantic Spain. Following, with the support of historical cartography (Méndez Martínez, 1994) and a recent work (Calvo Iglesias et al., 2012), in which the utility of the micro-toponymy is shown as an indicator of the presence of agras, we have analyzed the recent dynamics of the agras, specifically the permanence or the loss of the agricultural nature of the agras, through sampling of toponyms relative to these within their distribution area using the cartography of the present rural cadastre database. For this, we have randomly digitized a total of 1,490 sampling points corresponding to the toponyms of agras and analyzing the type of recent land cover according to usage data of SITGA (2003), in order to determine an estimate of the possible directions of land use change in the agras. On the other hand, we have used the records from the rural cadastre at the end of the 1950s (twentieth century) as a source to locate agra toponym records, their use and determine their morphology and area. The overlay of this information in a geographic information system with the photo interpretation of the orthophotographs of the National Plan for Aerial Orthophotography (PNOA) of 2003 has allowed us to study their recent evolution.

Cultural landscape of Galicia

The cultural landscape of Galicia presents a broad diversity manifested on a local scale, the result of the adaptation of the agrarian system to different environmental contexts and social, economic and historic-cultural imperatives, to which are added the richness and heterogeneity of ethnographic elements, such as fences, raised granaries and other similar constructions. Within the framework of this diversity there have been certain common features in the use of space, a reflection of the most widespread land use system in the region: multiple cropping (García Fernández, 1975; Bouhier, 1979; Mata Olmo, 1997). This traditional land use system, based on an integral utilization of the resources of the territory, assumed an organization which made a distinction between the areas dedicated to land with permanent crops or Ager, the forests or Silva and the Saltus or "monte" in which scrubland predominated (García Fernández, 1975).

The Ager was organized in different areas according to the property, type of crop and utilization management, basically distinguishing the cultivated land (with different characteristics according to the field system), from the cortiñas or enclosed plots subject to intensive cultivation, from the orchards known as eixidos or circundados, basically used for the supply of vegetable and fruit crops, as well as the non-irrigated and irrigated meadows. Forests were mostly used for firewood and wood, although also as a source for fodder, litter and charcoal. In the case of soutos, the utilization of chestnuts had a high importance in most of Galicia and, in particular, in the mountainous areas, in the food supply for human consumption as well as a complement in animal feeding (Díaz Varela et al., 2009). The multiple use of the scrubland should also be pointed out, of vital importance for the feasibility of the traditional system, as a source for litter or estrume for producing dung, firewood and charcoal, as well as for shifting cultivation through slash-and-burning practices or estivadas, and pasture for grazing animals (García Fernández, 1975; Bouhier, 1979; Balboa, 1990).

Bouhier (1979) distinguished five basic types of agrarian field systems still existing in Galicia in the 1950-60 period (Figure 2): bocage or landscape of enclosed fields surrounded by the Montañas Septentrionales, the dominating crop on terraces and banks in the coastal sectors, the vineyards on terraces in the gorges of the Miño and Sil rivers, the openfields or crops in open fields of the southeastern mountains and agras field systems which mainly extend through the valleys and flatlands of the interior of Galicia. In between, he identified several transition areas in the contact areas of the agras and the remaining agrarian field systems, with mixed characteristics. Spatial configuration, functionality and management of the agras

The name agra or agro refers to a block or collection of cultivated plots of land with a perimeter fence and which was divided into parcels within or open leiras. In certain areas of Galicia, they also have other local names such as "veiga", "praza", "vilar", "chousa" and "barbeito".

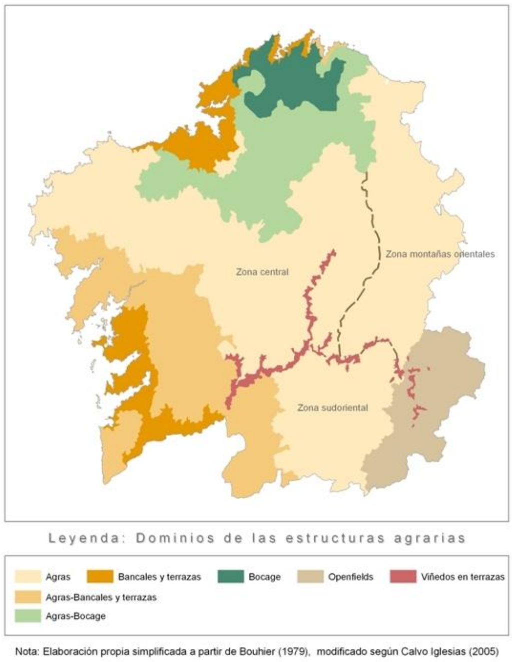

Figure 2. Extent of field systems identified by Bouhier

In respect to the spatial configuration, these were characterized by the presence of a temporary or permanent outside perimeter fence, and the existence of one or several access roads to serve the parcels. In general, agras were closed after planting and opened to harvest the main crop on a fixed date and the subsequent utilization of the stubble. As a consequence, the entry of livestock was blocked while the land was cultivated and thus prevented any damage to the crops. The interior of the agra was accessed by a wooden or wrought iron gate and the right of way to the parcels usually through a road which was closed as the parcels were sown following an established order. In the interior of the agras, the parcels were narrow, elongated and open, with only boundary stones known as “marcos” demarking the property. The closing of the agras might be temporary, through the accumulation of lumps of earth, shrubs or a tall fence of interwoven thin flexible branches, or, permanently, with stone or earthen walls known as valados with a fence of trees.

Figure 3 shows a fragment of the map produced in 1794 for the purpose of litigation by the Agra or Insua de Balay located in the parish of Santa María de Loureda (presently in the municipality of Arteixo, A Coruña), disputed by the Marquis of Camarasa and Parga and Mr. Pedro Ramón Pardo Osorio, in order to resolve whether or not it was included in the forum awarded to Juan Cancelo and his wife. The legend of this map indicates that the Agra de Balay or Insua of the same name was enclosed within, and that within the agra there had been a little-used pathway which crossed it. The legend also shows the ownership of the leiras or parcels within the agra and indicates that some of these were used as fields instead of cultivated land. The cartographic representation shows the agra as a collection of parcels open on the inside and surrounded by an exterior shrub enclosure, a perimeter trail and a path which crossed the agra. It also distinguishes between cultivated parcels and the meadows or fields. In general, the agra presents a geometry with rounded edges while the interior parcels are generally elongated rectangles.

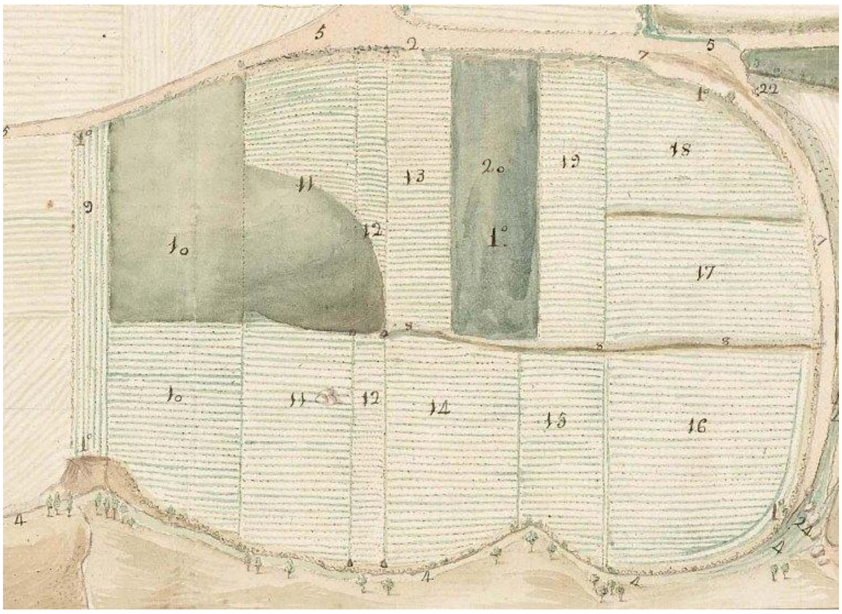

Figure 3. Details of Agra de Balay in the "Map of areas of the parish of Santa María de Loureda, A Coruña" (Archive of Royal Chancery of Valladolid, PyD, 223)

Agras initially had a double function, on the one part, its main use consisted in providing cereal crops, although there was also livestock utilization of stubble, which permitted the recovery of fertility with the resting of the crop and thanks to livestock contributions of faeces. This duality was reflected in the crop systems, with initally two-year rotations and subsequently three years in agras with better land characteristics or better fertilized; and combinations of a more extensive nature with fields remaining fallow for two years which the farmer reserved for the poorer or less fertilized agras. With the progressive incorporation of new crops to the rotations, in particular maize and potatoes, the crop alternatives were made more complex and the continuity of associated regulations became more difficult. Maize was introduced very quickly throughout the eighteenth century in the coastal regions, with its penetration in the interior being much slower. This fact resulted in the neat differentiation of two agrarian utilization models: one more intensive and more productive on the Atlantic front and the other of an extensive nature and low yield on the interior flatlands (Bouhier, 1979; Villares, 1984).

Due to this organization of the crop in the agra and the rate of rotations, for practical purposes, the inhabitants tended to have their properties or own land in several agras in order to obtain fruit every year. This is corroborated by the verbal sources consulted and other prior research (Cardesín, 1992; Calvo, 2005).

In regard to its management, although the parcels of the agras belonged to different owners, the regulations were determined by certain standards of a collective nature. In this manner, the use of the agras was subject to the followup of certain standards established by the rural community and which regulated the type of crop in the agra, the cultural work schedule (planting, harvesting), the maintenance of crop rotation within the agra and livestock access to this for stubble utilization. An illustrative example of these regulations is constituted by the Mondoñedo ordinances of 1503, in which the division and closing of the space to be cultivated in the new agras was established, with the exception of vineyards and orchards, which could be closed on an individual basis. These ordinances decided that the closures would not be modified and that each owner would work on its maintenance on a proportional basis to the amount of property in the agra, as well as prohibiting livestock access while they were cultivated (Saavedra, 1985). These customary standards common to other regions of Spain, of oral transmission (most frequently in Galicia) or obtained in medieval charters, municipal ordinances and royal provisions, tend to receive the name of the derrota de mieses an expression which alludes to the permission for livestock access to the cropland once the fruit had been picked so as to graze on the stubble fields. Derrota de mieses responded to the need to complement and compatibilize agricultural use with livestock. In this manner, the grazing practice thus allowed to recover the fertility of the worked land through the fallowing and fertilizing produced by the animal feces. On the other hand, the common pastureland without any demarcation of boundaries between different estates facilitated this activity and permitted to economize the salary of shepherds (Sánchez Salazar, 2002).

On the similarity of agras to the erías and mieses of Asturias and Cantabria

Bouhier found significant similarities between the agras and the structures historically present in the Atlantic area generally known as ería en Asturias, and mies or mier in Cantabria. In Cantabria, they also had the name of ería in the areas bordering the Asturian community, and in Valle del Liébana the name cuérano was used (Fernández Benítez et al., 1994). Sánchez Gómez (1987) describes this as cultivated land formed of numerous individually worked parcels, but enclosed by a single fence common to all, which demarked and separated the space for agriculture and livestock. This fence symbolized the common responsibility to protect the fruit and collective nature of livestock utilization of this space once the crop had been harvested. This description, as well as those described in other works consulted (García Fernández, 1988; Fernández Conde, 1993; Fernández Benítez et al., 2002) corroborates the close similarity between agras and erías determined by their characteristic elements: the existence of a common external enclosure, the internal arrangement in open plots and the collective regulations which controlled these.

Thus, entry to the erías was gained by a gate (portiella in Asturias and portilla in Cantabria) for common use and there was also at least one access path which served the different parcels (Fernández Conde, 1993). As in the case of the agras, the erías and mieses were enclosed by walls (murias en Asturias) or by different types of shrubs or tall wattle fences along the entire perimeter to prevent the entry of livestock while the land was under cultivation. Inside, the fields were kept opened, the property was demarcated with boundary stone markers known as finxos in Asturias (Fernández Benítez et al., 2002). The construction and maintenance of the erías and mieses enclosure was also carried out on collectively, such that all inhabitants had to contribute in proportion to the area of land they held within this (García Fernández, 1988).

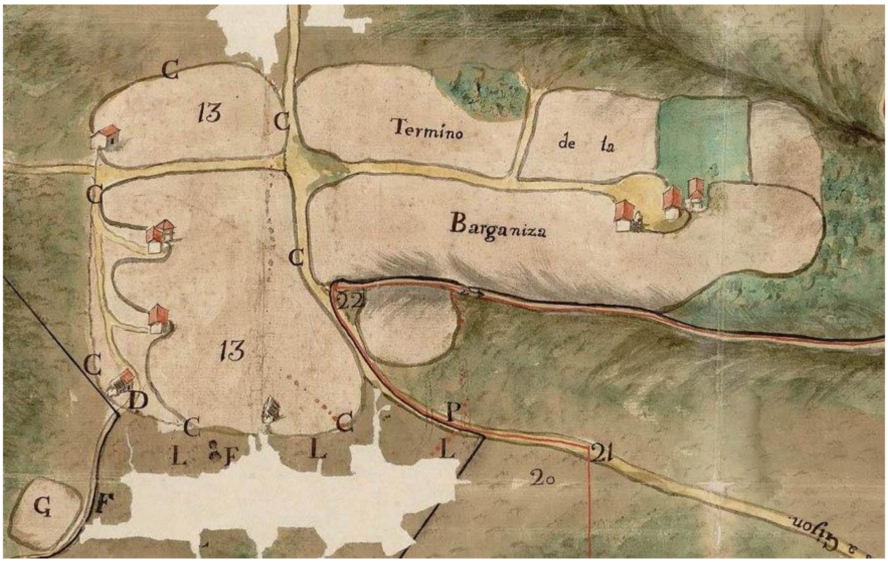

Figure 4. Detail of the ería of Cabueres, showing the boundaries with the letter C (Archive of the Royal Chancery of Valladolid, PyD 540)

An example of the presence of toponyms related to the erías and their graphic representation is that of the "Map of the Anes district", prepared in 1782 as result of a dispute between José Omaña y Oviedo and José García and consorts, regarding the occupancy of a plot of land. This map indicates, among others, the toponyms Hería de la Peña, Hería del Medio or del Charcón and la Hería de Cabueres, together with the area of Barganiza in the municipality of Siero in Asturias, as well as schematically representing the boundaries of the Ería de Cabueres and its access paths (Figure 4).

Initially, the use of the erías and mieses, as in the case of the agras, was to alternate the cereal crop with fallowing. The diffusion of the maize crop, throughout the seventeenth and eighteenth centuries, resulted in a reorganization of these and a stricter regulation to make the intensification of crop rotation compatible with livestock. In effect, maize was introduced in fallow land, considerably reducing the grazing period and, in addition, favored the simultaneous incorporation of leguminous crops (kidney beans). The reorganization involved the joint organization of erías and mieses to materialize the separation of parcels with wheat or rye from the parcels intended for maize (Sánchez Gómez, 1987; García Fernández, 1988). Throughout the nineteenth century, crop rotation reached its maximum complexity with the incorporation of the potato in alternation with the winter cereals and the gradual introduction of forage crops following the maize harvest (García Fernández, 1988). The decline and loss of function of these agrarian structures occurred between the last third of the nineteenth century and the beginning of the twentieth century, due to changes produced in the agrarian system. The degree of intensification reached made the continuity of grazing unfeasible, and thus eliminated an elementary function of the erías and mieses. This loss of function was also propitiated by the restrictions imposed on this customary use by the Royal Order of 1853 abolishing the grazing system, as well as the individualization of agrarian space through fences, and productive reorientation toward stock raising (García Fernández, 1988).

Recent evolution of agras landscape

The dynamic nature intrinsic to the landscape notion, involves its evolution and transformation over time, as a result of the interaction between environmental and anthropic factors (Holl and Nilsson, 1999). Until relatively recent times, this evolution and transformation was, in general, slow and progressive, of local impact, the result of a process of adaptation to environmental conditions, for which these landscapes have been perceived as relatively stable. From the beginning of industrialization, the population growth and the growth of urban areas beginning in the eighteenth century and, specifically, from the technological revolution throughout the twentieth century, the speed and magnitude of the changes increased considerably in many places of Europe (Antrop, 2005).

In the case of the Galician landscape, important transformations are being produced from the second half of the twentieth century, linked to deep socioeconomic changes. In the last decade, we have observed an aging and depopulation of the rural environment, particularly in the interior of Galicia, and at the same time a significant increase of urban pressure on the coast. The evolution of the population in Galicia from 1960 to 2008 shows how the provinces of Lugo and Ourense totaled a population of 927,807 inhabitants in 1960 (INE, 2009, IGE, 2009), as a result of which approximately 25% of its assets have been lost, while the provinces of A Coruña and Pontevedra with total populations in 1960 of 989,551 and 679,445 inhabitants having increased their assets by 15% and 40%, respectively (INE, 2009, IGE, 2009). On the other hand, a deep transformation of the agrarian sector is being produced, which has gone from a traditional system characterized by multiple subsistence cropping, non- remunerative small land holding and certain singular agrarian structures, to a market system, to a reorientation of agricultural activity marked by the intensification and specialization toward livestock. Under the framework of this transformation of the sector, a significant drop in the number of operations has been produced (78.77 percent during the 1962-2005 period), of the agrarian population (79.3 percent in the 1955-2000 period), an increase in the average size of operations as well as a continued decline of the cultivated area (65.13 percent between 1962 and 2005). The existence of significant changes in land use should also be pointed out, given that the decline of cultivated land has resulted in an increase of area of meadows, rangeland and of afforested areas (Fernández Martínez, 2002; Loureiro and Barrio, 2009). Livestock specialization with the consequential impoverishment of crop alternatives, as well as the modernization of operation systems and of infrastructure through parcel concentration has also resulted in a homogenization and simplification of the landscape.

Bouhier (1979) saw the unequal and gradual abandonment of the rules regarding closing and crop rotation of agras and, consequently, the loss of function of these. Thus, in certain locations such as the lower valleys of Tambre and lower Ulla, it is indicated that from 1930 the infractions of the customary standards had begun, although in other areas of Galicia this rupture did not become general until the middle or after the 50s.

In other Galician municipalities, as occurred in Touro and Boqueixón, these standards continued in effect until the end of the 1960s. In a recent study in the north of Galicia, loss of function of the agras occurred between 1960 and 1970, although in a majority of the cases analyzed, the continuity of the associated toponymy, the agricultural nature, of the traditional skills, as well as of the spatial structure and morphology characteristic was observed, with the exception of the areas subject to land consolidation or afforestation (Calvo et al., 2009).

In the present study, toponyms have been used to evaluate the persistence of agrarian field systems. The random consultation of present cadastral data of the entire region has allowed us to corroborate the continuity and high frequency of the toponyms associated with the agras. In addition, these frequently maintain an agricultural nature, as can be seen from the results (Figure 5). Precisely, in 84 percent of the cases, the toponyms related to agras continue associated with land of agricultural crops, in spite of having lost the original function of these and though its morphology has been blurred. Thus, in the majority of cases analyzed, the old rotations with cereal have been replaced with permanent uses as meadows and forage crops. The morphology has in certain cases also been altered due to the individualization of the use of agrarian space through enclosure in certain cases and the simplification of the morphology of the parcels during land consolidation. In 3% of cases, the agras parcels have been abandoned and have brushwood, while in the rest of the cases they have been replaced by afforestation (11%) or urban land use (2%). This information offers significant data regarding the possible directions of change experienced in agras: loss of cerealistic nature due to the production reorientation toward livestock production, abandonment of agrarian land, structural changes deriving from parceling concentration and the development of infrastructures and disappearance of structures in the afforestation and urban development processes. In a prior study (Calvo Iglesias et al., 2006), in the north of Galicia, similar directions of change have been identified and quantified, with the occurrence of several of these directions being frequently observed in the same area.

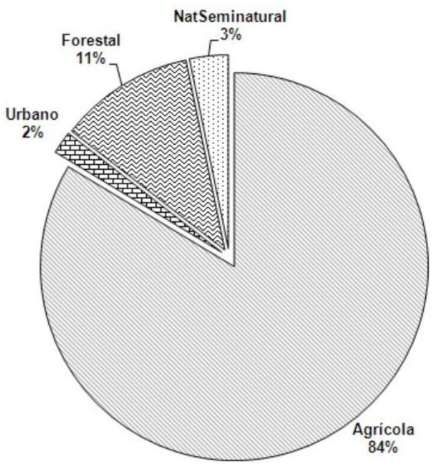

Figure 5.Directions of change in agras according to sampling

Conclusions

In this study we have analyzed the agras as agrarian structures and their reflection in the cultural landscape of the traditional agrarian society in Galicia. Agras maintain a close similarity with old erías and mieses structures in Asturias and Cantabria, as is reflected by the descriptions regarding their morphology and function, as well as the examples found in the historic cartographic documentation.

The analysis of their historic evolution has allowed us to observe their dynamism, inasmuch as in the past these structures occupied more extensive areas in the region and, their inertia on the other, given that in spite of the evolution of the agrarian society, they have remained functional over several centuries, up to the second half of the twentieth century. The study of their recent evolution reflects the destructing and loss of function of the agras, favored by the demographic regression of the rural areas and as a result of the changes in the production system which has resulted in a reorientation and specialization toward milk production. Thus, the rural depopulation, abandonment of agricultural activity and reforestation of agrarian land, parceling concentration and urban development are factors which significantly contribute to erasing what is left of the traditional agrarian landscape. In spite of this, we have established a significant persistence of the agricultural nature in the areas where these structures are located within the Galician territory.

The decline of the agras has taken place in a more recent period in respect to the erías and mieses, frequently allowing to conserve the associated local knowledge, its toponymy and even, in numerous cases, its morphology and/or its structural elements, which is relevant for the Galician landscape study and may also be of interest for further knowledge of the evolution of erías and mieses. However, it is necessary to underline the unequal evolution of the agras landscape which, as we have illustrated previously, in certain cases persisted until very recently, while in others it has been completely transformed or is undergoing transformation. The loss of function and the present lack of recognition regarding its value constitute serious threats to the conservation of its structure and, in particular, of the associated local awareness and significance of its toponymy, whose transmission to new generations is not guaranteed.

In spite of these threats, its persistence in Galician memory and territory, as well as the recent approval of the Galician landscape law constitute an opportunity to identify, conserve and value the traditional agrarian landscape elements which have transcended to the present, as testimony of the history of rural societies, an expression of the continued interaction of human beings and the environment over time, and ultimately as part of our cultural heritage, following the inspirational principles of the World Cultural Heritage Convention and of the European Landscape Convention.

Title: Productive bamboo landscapes of Western Zhejiang

Organisation: International Network for Bamboo and Rattan (INBAR)
Theme: forests, agricultural landscapes
Keywords: Bamboo, production forests, sustainable forest management, non-timber-forestry products

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Summary

The sustainable harvesting of bamboo from natural and managed forests is an important livelihood activity for communities from much of China, Asia and the global South in general. The ability of bamboo to meet the economic needs of people without exceeding the carrying capacity of the environment has been best exemplified by its use in the mountainous areas of Zhejiang, China, notably in Anji and Lin'an counties which are two of the major areas in China for the production of bamboo timber (Phyllostachys pubescens) and bamboo shoots (Phyllostachys praecox and Phyllostachys pubescens). Whilst extraction of bamboo from forests for household and agricultural purposes is commonly practiced by people around the world, the development of specific silvicultural and processing technologies by Zhejiangese farmers and artisans over at least the last 800 years represents a unique understanding of both bamboo's properties for human utilization and its environmental benefits within an agricultural system.

Bamboo's distribution and characteristics in Anji and Lin'an

Anji and Lin'an are situated in the northwestern corner of Zhejiang province in the Tianmushan mountain range. Both counties have large farming populations, with 87% of inhabitants classified as rural, and approximately 230 inhabitants/km2. Both counties are hilly with little land suitable for agriculture, which previously made access difficult and poverty prevalent; at the end of the 1970's Anji County was below the national poverty line with annual per capita income at less than USD 50/year (Zhu 2008). Due to the hilly topography of the two counties and limited area for the cultivation of food crops, there is a high forest coverage (60%) of which approximately half is bamboo (Mertens 2008). Land use studies have shown a pattern of higher elevation areas retaining natural forest, whilst mid-elevation slopes are planted with bamboo, and the plain and valley floors are used for agriculture, consisting of rice, vegetables, sweet potato, corn and green bean and other crops which are consumed by households or sold. This land usage pattern is optimal for productivity from available land resources, whilst retaining perennial cover on mountain slopes, which helps by both minimizing soil erosion from hillsides as well as regulating water flow into the crop growing areas. Recent research (Lou et al. 2010) has highlighted the potential benefits of bamboo forestry management for carbon sequestration; continual extraction and storage of bamboo carbon in products is likely to be more effective than fast growing tree species.

Figure 1: Bamboo planted on slopes is important for controlling water regulation and soil erosion

The planting and management of bamboo on the mid elevation slopes is a key component of the production system. Like elsewhere in China, there is high pressure on land resources and the cultivation of bamboo, which can provide both a source of direct nutrition (through bamboo shoots) and income through the sale of shoots and timber, has allowed farmers to become richer without resorting to deforestation or slash-and-burn farming of hillsides. Equitable distribution of forestland ensures that each household owns at least small area of bamboo forest (typically 1 hectare) which provides both income and security. Most farmers derive between 20-40% of their incomes from sales of bamboo products to timber mills and agribusinesses (for shoots). (Ruiz Perez et al. 2004) The relative high value of bamboo farming means that it is often more profitable to other crop production (including rice), and its resilience as a crop means that it is often a more dependable and favored source of income amongst farmers. (Zhu 2008)

Historical development of bamboo farming techniques

Bamboo harvesting in Zhejiang has a long history, and techniques of bamboo farming have been improved over time to raise productivity, whilst retaining sustainable use of resources. The reference to farming techniques for bamboo in Zhejiang and its valued use in products dates back to at least the Han period (206 BCE-220 CE) appearing in ancient texts such as the ErYa (Jiang 2007). Specific techniques for cultivating bamboos have been developed in order to improve and smooth productivity over years, and tailored based upon whether bamboo production is aimed at timber, shoot or dual purpose production. Techniques include: Selective harvesting based upon age markings, planting areas on ‘on and off’ years to coincide with productive cycle of bamboo, density control, soil tillage and fertilizing, pest and disease control, removing top branches to preventing snow damage etc.

In recent years, the importance of biodiversity and sustainable forestry management practices to the long term health of bamboo forests has become better recognized. The application of SFM to bamboo forests in Anji and Lin’an is being tried in different ways, such as the development of mixed chestnut-bamboo forests in Lin’an, and group certification under the Forest Stewardship Council (FSC) for Anji’s bamboo forests. (Anji Bamboo Industry Association, pers. comm.)

The development of multiple uses of bamboo to enrich growers

As well as traditional uses such as a source of food and material for construction and weaving, a use has been found for every part of the bamboo plant for creating both utilitarian and artistic products. The potential of productive uses of bamboo is illustrated in Figure 2 below, which highlights the multiple uses from each part of the plant. Much of the growth of the bamboo industry has occurred in the local areas around Anji and Lin’an, forming close linkages between farmers and processors. As well as traditional uses of bamboo, which complement other agricultural activities (such as winnowing baskets, rakes, fishing traps and nets; stakes and panels for building structures), ongoing innovation has led to numerous new products to meet large markets traditionally dominated by wood, as well as new markets specifically for bamboo goods. Through advances in processing technology and by moving up the product value chain, prices and bamboo farmer revenues have kept pace with the rest of China’s economy driving the sustainability of the local economy. Together the bamboo processing industry in Anji provides around 30,000 jobs to local inhabitants, providing an important source of off-farm income (Zhu, 2008).

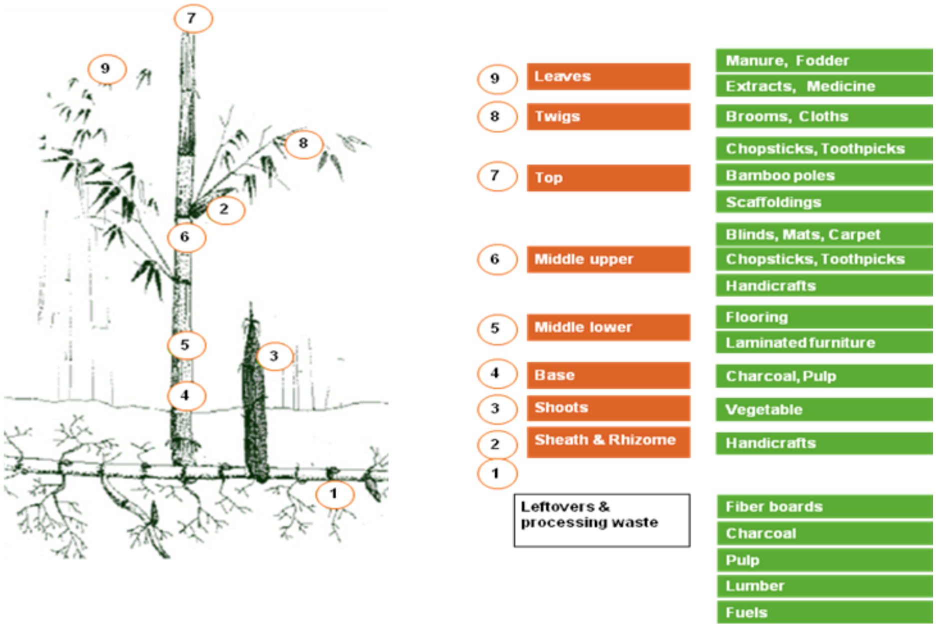

Figure 2: The multiple uses which have been found from the different parts of the bamboo plant (Zhu 2008)

Lessons of the sites for other areas

Anji and Lin'an represent models of highly successful and sustainable exploitation of local bamboo forest resources in mountainous areas. At the local level, the land use patterns of bamboo farming on hillsides has allowed farmers to meet their development needs by providing incomes, a food source from bamboo farming, protecting their environment and preserving their traditional culture around bamboo. This has occurred without the significant degradation of soils or water resources, which are features of other hilly areas around the world. Additionally, the development of successful silvicultural practices and uses for bamboo in traditional and modern uses has had the triple benefit of raising farmer incomes, sequestering carbon and avoiding deforestation. The experiences of these counties highlight the potential of bamboo, an often under-recognized Non-Timber-Forestry Product which has great potential for meeting economic and environmental challenges of the 21st Century.

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Title: Tropical forests for local people

Organisation: International Tropical Timber Organization (ITTO)
Theme: forest
Keywords: Community/local forest management, tropical forests, ITTO

Summary

The International Tropical Timber Organization (ITTO) has funded over 1,000 projects and activities contributing to its mandate to promote sustainable forest management. These projects span a range of themes and topics relevant to SFM. One of the most important areas of ITTO's work, and one of the most relevant to the International Year of Forests, 2011 theme of Forests for People, is its efforts to involve local communities in SFM.

Forests are particularly important resources for the rural poor in tropical countries, with over 800 million people living in forests and woodlands in the tropics.1 Forest communities include indig-enous peoples and other local groups which have been living in forest areas for significant periods, as well as more recent settlers or immigrants. Many of the very poor are hunting or gathering tribes, landless people living around forests and landless forest workers.

In addition to improving livelihoods by providing a subsistence safety net, including food, shelter and fuelwood, the tropical forests also provide communities and smallholders with a source of cash income, a capital asset, a source of employment and an alternative health-care system based on forest plants. More needs to be done to improve the livelihood of forest-dependent people when they are interested in moving from subsistence livelihoods towards market-based activities. In many tropical zones, most local community cash income from forests comes from collection and commercialization of non-timber forest products such as bamboo, rattan, bushmeat, wild medicinal and aromatic plants and forest fruits. The employ-ment impact of these activities in the tropical rural areas is measured in millions in both the informal and formal sectors, but reliable estimates are lacking. However, due to poverty and difficult access, many forest communities are living in conditions in which even the most minimum standards for education, health, sanitation, potable water, infrastructure and employment cannot be met.

Indigenous groups and communities own or are entitled to the use of about 25 per cent of the forests in developing countries.2 According to a recent assessment,3 the forest area owned by commu-nities and indigenous peoples in the ITTO developing member countries4 in 2008 was about 332 million hectares. This was about 51 million hectares (18 per cent) more than six years earlier, demonstrating a strong trend to transfer formal ownership to forest communities. However, there are various countries where commu-nity forestry is not yet practised at all, or is still in the initial stages.

Community forests have existed for centuries and represent one of the main forms of forest ownership. For instance, in Guatemala, Mexico and Papua New Guinea, community ownership of forest land has been the dominant tenure form for decades. More recently, the Governments of Bolivia, Brazil, Cameroon, China, Colombia, Ecuador, Ghana, Guyana, Honduras, India, Peru, Thailand and Venezuela have revised their policies and legislation for this purpose, some of them with ITTO assistance. In addition to transferring or recognizing ownership rights, various other arrangements are being applied in the devolution of management or use rights to local communities and their members.

The process is not, however, as simple as granting communities title over forest areas, since this is usually not sufficient to ensure SFM and the development of community forest enterprises (CFEs). In general, forest communities are poorly equipped to manage their forests sustainably and to generate value through timber produc-tion and various other benefits. One reason for this is that the forest areas transferred to communities have often been degraded lands with limited development potential and a lack of investment in rehabilitation, which seriously limits their role as a livelihood source for local people who are in need of immediate tangible benefits.

In spite of the difficulties, community forest manage-ment and enterprises represent a huge opportunity for contributing to national development goals through poverty reduction, sustainable socio-economic devel-opment and environmental conservation in rural areas. It has become clear that, given the right conditions and incentives, communities can govern and manage forests sustainably for a variety of objectives, and restore degraded landscapes and ecosystems.5 However, improvement is generally needed in managing natural, human, financial, physical and social assets by communities.

In order to address continued high poverty levels in tropical countries due partly to the inadequate capacity of indigenous peoples and forest communi-ties to manage their forests and develop community forest enterprises on a sustainable basis, in 2009 ITTO established a Community Forest Management and Enterprises (CFME) Thematic Programme.6 Some of the prominent causes of poverty and unsustainable management of community forest resources are:

- Lack of clear land tenure and resource rights and inappropriate legal and policy frameworks
- Poor organization of forest communities and limited capacity among CFEs due lack of technical, business and managerial skills
- Weak competitiveness in CFEs.

Land tenure is often insecure and resource rights have not been clarified which is a major constraint for engag-ing communities in such long-term endeavours as SFM. Insecurity discourages sustainable practices in forest utilization and community investment. This is partly explained by inappropriate legal and policy frameworks which have often been designed for large-scale private operators and tend to be biased against small-scale operators like CFEs.

Family in community forest nursery, Peru

Ashaninka family in community forestry plantation, Peru

In various ITTO producing member countries there is a lack of clear government policies on community forest management, which is reflected in the absence of targeted public support to this activ-ity. National policies tend to overlook the economic potential of community forestry and the important social, cultural and other benefits of CFEs. Even where policies exist, forest authorities do not tend to have confidence in the capacity of indigenous peoples and communities to sustainably manage their forest resources.

Consultations with ITTO producing member country focal points have revealed that, in countries with no or weak community forests, government institutions do not fully understand commu-nity priorities. In most countries, even where legal reforms have been carried out, the regulatory frameworks reflect outmoded tenure arrangements and can make it impossible for small-scale actors and communities to benefit from the reforms. Discriminatory rules and regulations can represent fundamental challenges for forest communities and the rural poor.7 Regulations often prevent legal access to forests and markets, unduly raise the transaction costs for community enterprises and promote unfair sharing of benefits and corruption. In addition, arbitrary changes of rules and obligations can have dire consequences for local people.8

Regarding social assets, weak internal organization is often found in forest communities, particularly those which have a heterogene-ous ethnic population structure. This is often associated with differing priorities and conflicting interests among community members, some-times resulting in inequitable sharing of benefits. Basic organizational capacity and effective participation of all members of the community, including women and marginalized groups, are preconditions for success in such targeted joint efforts as sustainable forest management.

Being small and isolated, forest communities do not represent the necessary critical mass as a stakeholder group to promote common
interests in policy development, forest product markets and the development of appropriate support services. The underlying reason is inadequate cooperation among forest communities and their enterprises. Forest users' organi-zations, networks and alliances are essential to advance community forestry and CFEs. There has been extensive reliance on external intermediaries such as non-govern-mental organizations and government agencies, with a focus on short-term project approaches to providing support. Building up community capacity is, however, a long-term endeavour. Capacity-building is also needed in forest agencies to create new attitudes and skills to enhance their facilitation role.

Dayak villagers with harvested forest incense, providing a source of A community forest nursery in Peru income to the East Kalimantan economy, Indonesia

In spite of its importance, traditional knowledge is not usually enough when forests are managed for market-based production purposes. Indigenous peoples and forest communities typically lack essential managerial and tech-nical skills, knowledge and experience in running CFEs and accessing markets. This is a key constraint which also makes communities vulnerable to external pressures and illicit activities. Building up community capacity to plan, utilize, monitor and control their forest resources is therefore critical to reduce illegal logging and associ-ated trade. However, in most ITTO-producing member countries a shortage of targeted capacity-building and training facilities, weak local intermediaries and inad-equate support to community-based organizations are retarding progress. Valuable lessons learned have been accumulated in many countries but this knowledge has not been sufficiently used to replicate and upscale success-ful experiences. Traditional knowledge should not be lost as it can provide invaluable support to sustainable forest management if systematized, improved and disseminated together with modern tools to increase competitiveness and market-based approaches.

Community-based enterprises are typically insufficiently competitive as there are major shortcomings in their human, financial and physical assets. Even in the leading countries only a few CFEs have developed into medium-sized industrial enterprises, and their capacity to get a fair price for their products and to invest in value-added activities is low. Apart from niche markets, buyers generally tend to prefer suppliers who can provide reliable deliveries in sufficient quantities. As CFEs typically lack commercial cooperation and other networks, they cannot enjoy the economic benefits of scale and specialization, keeping their profit-ability low. This is coupled with isolation from the market, limitations in market access due to increasing requirements for verifiable legal and sustainable product supply and general ignorance of market character-istics and pricing potential. Trade intermediaries tend to unduly exploit such situations to reap windfall profits, resulting in an inappropriate sharing of benefits for CFEs. Support programmes have often failed due to problems with providing the required economic feasibility assess-ments for community forest enterprises.9

Another set of constraints to the development of forest communities, smallholders and their enterprises can be their limited access to capital and appropriate technologies. Most rural funding schemes have been designed for agriculture and only a few countries have targeted financing schemes for community forestry. This is particularly problematic in fairly common situations in which the forest areas transferred to community management are degraded and require significant investment in restora-tion. Existing credit schemes are not tailored to the need of community forests for relatively long pay-back periods which are not compatible with the conditions of regular commercial credit. Financing institutions have little understanding of the business potential of community forest opera-tions. Forest growing stock could be used as collateral for financing of CFEs but this is rarely possible due to lack of relevant regulation and engagement of the banking sector.

ITTO’s contribution

Since 1992, ITTO has accumulated a significant body of knowl-edge and experience in the development of community forestry in its producing member countries. Prior to establish-ment of the CFME programme, a total of 85 projects were implemented with an investment of about US$40 million. These projects have had a significant impact on country and community capacity as revealed by thematic evaluations.10 It has been clearly demonstrated that community forest management and enterprises can lead to sustained improvements in livelihoods but they have to be economically feasible, which is one of the key issues of the CFME Programme.

ITTO has implemented successful community forestry projects in Bolivia, Ghana, Panama, Peru, the Philippines and Togo, among others. In addition, many ITTO projects in the field of reforestation and forest management have included a focus on creating economic and other benefits for the local communities through their participation in project interventions. ITTO recently completed a series of forest tenure conferences in the three tropical regions, raising the profile of this important topic globally. And the CFME programme (which commenced operations in 2010) is already funding important country activities in Ghana, Indonesia, Papua New Guinea and Thailand.

A considerable body of this work has been under-taken in partnership with other multilateral and bilateral organizations such as the Food and Agriculture Organization's Forestry Department and the Center for People and Forests (RECOFTC) and in consulta-tion with the Rights and Resources Initiative (RRI), the Global Alliance of Community Forestry (GACF) and the Forest Peoples Program (FPP) of the World Rainforest Movement. ITTO will continue to work with its global partners to ensure that communities and local people achieve their potential to contribute to the sustainable management of the forests they depend on.

Title: Training for Capacity Development on Biodiversity conservation and rural development

Organisation: Japan International Cooperation Agency (JICA)
Theme: Forest, Grassland, Agricultural land, Inland water
Keywords: Capacity Development, SATOYAMA Initiative, Training in Japan, Sustainable management of natural resources

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Summary

JICA implemented training on biodiversity conservation and rural development for capacity development for developing countries and promotion of SATOYAMA Initiative in 2010. 14 persons from 13 countries participated in the training, and they understood the importance of harmonization between biodiversity conservation and rural development. Training provided opportunities to understand situation of SATOYAMA management in Japan through field observation and intensive lectures, and uniquely contributed to realizing different concepts of SATOYAMA in different countries. Recognizing that Japan's experience and knowledge on SATOYAMA could not be directly applied to each developing country in practice, JICA needs to further analyze Japanese experience, and extract knowledge and lessons for improvement of future training and cooperation projects in the world.

Concept

Background of the Training
The Japan International Cooperation Agency (JICA) is an independent administrative institution responsible for the implementation of bilateral components of Japan's Official Development Assistance (ODA). With a view to achieving human security, JICA contributes to socioeconomic development, recovery, and economic stability of developing countries. Recognizing biodiversity conservation serves to protect the life of vulnerable people in developing countries, and ensures stable and sustainable growth of the international society, as a member of the international community, JICA assists biodiversity conservation efforts in developing countries as a priority of its cooperation.

At the Tenth Meeting of the Convention on Biological Diversity in October 2010, Japanese government proposed the SATOYAMA Initiative as an international model of natural resources management in human-influenced natural environments. These human-influenced natural areas called Satoyama in Japan are located in all parts of the world. Recently sustainable use of natural resources is tending to be lost in Satoyama, which causes negative impact to biodiversity. To prevent biodiversity loss, it is important to use natural resources in sustainable way, not only to conserve primeval nature environments by setting protected area.

Environmental degradation is progressing through excessive use of natural resources by a population explosion in developing countries where many people depend on natural resources for their livelihood. A vicious cycle of poverty and environmental degradation disrupts the ecosystem services necessary for their livelihoods.

In Japan, Satoyama is threatened due to urbanization, industrialization and rural population decrease. And so many approaches for nature conservation and rural development are conducted in various places.

This course was conducted so as to contribute to rural development from the viewpoint of the reconciliation between nature conservation and livelihood promotion by sharing experience and knowledge gained from Japanese approaches and present state of Satoyama in developing countries.

For what?
Participants learned the cases of natural resource management of Satoyama in Japan and other parts of the world to make the plan for the rural development in their own countries from the viewpoint of the reconciliation between nature conservation and livelihood promotion.

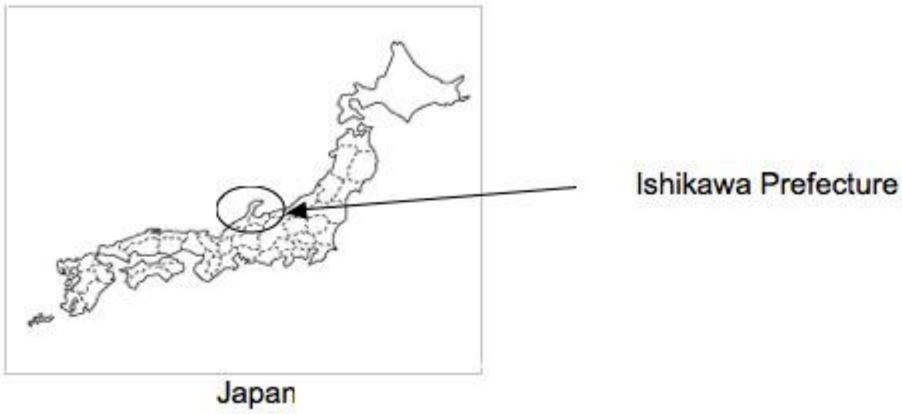
For whom?
1) Central or local governmental officers or management staffs of public organizations who are in charge of planning and implementing the rural development and nature conservation
2) Staffs or researchers from NGO or other institutions related to rural development and nature conservation

How?
1) Lectures for basic understanding of Satoyama, SATOYAMA Initiative and related policies
2) Learning the cases of natural resource management through inspection and practice
3) Preparation and presentation of action plan for the rural development in their own countries from the viewpoint of the reconciliation between nature conservation and livelihood promotion

Description of the Training

Title
Promotion of SATOYAMA Initiative: Biodiversity conservation and rural development through the sustainable management of natural resources

Place
Ishikawa Prefecture



Partner Organizations
Ministry of the Environment, Japan, UNU-IAS Operating Unit Ishikawa/Kanazawa (UNU-IAS OUIK), Kanazawa University and Ishikawa Prefecture

Period of program
November 2010 to December 2010

Target Country
14 participants from 13 countries
（Indonesia, Malaysia, Viet Nam, Cambodia, India, Nepal, Costa Rica, Panama, Ethiopia, Malawi, Mali, Burkina Faso, Kyrgyzstan, Colombia)

Overall Goal

The concept and case examples for the reconciliation between biodiversity conservation and sustainable use of natural resources would be shared among the people concerned in each participant's country, and rural development plan harmonizing nature conservation and livelihood promotion would be implemented accordingly.

Objective and Outcome

Learning from case examples of biodiversity conservation and sustainable use of natural resources with broad participation of stakeholders in Satoyama in Japan, training participants would understand the concept of SATOYAMA Initiative, related policy and case study of sustainable use of natural resources deep-rooted indigenous traditional culture in Japan.

Participants made action plan which described what participants would do for the rural development in their own countries from the viewpoint of the reconciliation between nature conservation and livelihood promotion based on the knowledge and experience gained from the Course.

Contents

Expected Module Outputs	Program	Method
(1)Basic understanding of Satoyama, SATOYAMA Initiative and related policy	SATOYAMA Initiative National Biodiversity Strategy Ishikawa Prefectural Biodiversity Strategy Policy of Satoyama and Satoumi conservation use in Ishikawa Pref.	Lecture
(2) Understanding of concept and information sharing related conservation and use of biodiversity in Satoyama	Sub-global Assessment of Satoyama and Satoumi Natural resources management in Satoyama and Satoumi Satoyama nature school Satoyama Satoumi project of Kanazawa university Nanao Bay Satoumi Revitalization Project	Lecture/ Inspection
(3) Understanding of rural development through the sustainable use of natural resources	Natural resource management in Satoyama and Satoumi Rural development project in Harmony with nature Satoyama Meister Model landscape of Kanakura, Wajima City Town promotion by cycle of local resources in Ikeda	Lecture/ Inspection
(4) Mastery of the method of use of natural resources in business	Business development based on resources in Satoyama Agro-forestry/Ecotourism	Lecture/ Case study
(5) Understanding of conservation and sustainable use of natural resources deep-rooted indigenous traditional culture	Wise use in Katano-Kamo-Ike (traditional hunting of duck) Conservation and use of traditional culture in Shiramine Shirayama city	Case study/ Inspection
(6) Understanding concept of policy related to the tax burden for ecosystem services from satoyama in urban area	Development of forestry activities by use of forest environment tax Forestry activity of the upper area of Tedori river	Lecture/ Inspection
(7) Presentation at the symposium, sharing of knowledge and experience in Japan and other countries, presentation of action plan *)	Presentation of country report Attendance at the symposium Preparation and presentation of action plan	Practice

*) Action Plan: The Plan which describes what participants do for the rural development in their own countries from the viewpoint of the reconciliation between nature conservation and livelihood promotion based on the knowledge and experience gained from the Course.
Action Plan should be worked out in the manner that it should be actually implemented back home as the training results. It is recommended that participants bring some relevant information in electronic form, such as figures, data, pictures and maps to prepare the action plan.

Analysis of Action Plan

14 action plans were prepared and presented. In terms of themes, these action plans can be categorized as follows.

No.	Theme
5	biodiversity and rural development around protected areas
3	natural resources management including land use management
3	eco-tourism promotion
2	community-based forest restoration plan
1	Others

Questionnaire Survey

Questionnaire survey was conducted at the end of the training, and a few results are shown below.
Q1. Did you find the design of the program appropriate for you (your organization) to achieve the Program Objective?
(※design of program: structure of modules in the program)

←← Yes, appropriate				No, inappropriate →→
□4	□3	□2	□1	n/a
10	4			

Q2. Were you able to learn from the experiences of other participants in the program?

←← Yes, very much				No, not at all →→
□4	□3	□2	□1	n/a
7	7			

Q3. Was the quality of lectures good enough for you to understand clearly?

←← Yes, very good				No, poor →→
□4	□3	□2	□1	n/a
8	6			

Q4. Were you satisfied with the textbooks and materials used in the program?

←← Yes, very much				No, not at all →→
□4	□3	□2	□1	n/a
8	5	1		

Q5. Do you think the knowledge and experience you acquired through the program in Japan is useful?

□A	4	Yes, it can be directly applied to work.
□B	9	It cannot be directly applied, but it can be adaptable to work.
□C	1	It cannot be directly applied or adapted, but it can be of reference to me.
□D		No, it was not useful at all.

Q6. After you return to your country, do you think it will be easy to apply what you acquired to your organization or country?

←← Yes, very easy				No, very difficult →→
□4	□3	□2	□1	n/a
	8	6		

Findings/Observations

According to questionnaire survey, most of participants thought knowledge and experiences obtained through the training were useful. Around half of participants felt it easy to apply what they acquired through the training to their own country because training concept and contents were consistent with policy of their organizations. However, they recognized such knowledge and experiences could not be introduced and applied to their own countries without modification and translation into the local context due to differences of nature environment and economic condition.
It is concluded that objective of the training was achieved and that the training helped not only training participants but Japanese concerned for the training to deepen understandings on concept of SATOYAMA Initiative promoted by Japanese Government and identify different concepts of SATOYAMA in different countries.

Lessons

As mentioned above, Japan's experience and knowledge on SATOYAMA could not be directly applied to each developing country. Participants and Japanese who were engaged in the training understood different concept and context of Satoyama and/or Satoyama-like landscape in different countries by exchanging and sharing views and experiences in the training. Frankly speaking, at the beginning of the training, even in Japan, the commonly-recognized concept of SATOYAMA Initiative was not found. Thus, it is expected that action plan developed in the training would be modified and tailored to the local context of each country to be implemented.
Recognizing different concept of SATOYAMA in different countries, designing the training should be carefully made to respond to different needs from each different country.

Future Challenges and Perspective

JICA plans to continue Satoyama training for three years (2011-2013). Based on the lessons derived from the training, JICA should carefully design and implement the training for contributing to expanding Satoyama Initiative-related activities and capacity development in developing countries.
It is our recognition that we need to analyze Japanese experience, and extract knowledge and lessons for improvement of the training in close cooperation with our partners.
As knowledge-based organization, JICA refines knowledge and lessons through the interaction with training participants including analysis of action plan developed in the training to apply them to the local context of developing countries, and utilize them for JICA's relevant projects in the world, and share them with our partners.

Title: Community-based adapatation in Namibi, a tool to enhance conservation tillage practices

Organisation: United Nations Development Programme (UNDP)
Theme: Agricultural land
Keywords: adapting farming systems, conservation tillage, dry land crops, in-field water harvesting, community- based adaptation

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Summary

The UNDP-GEF Community-Based Adaptation (CBA) project in Namibia addresses serious issues brought about by extreme climate events resulting from climate change. The project 's both long-term and short-term objectives combine community skills and involvement with innovative agriculture practices; the project aims to increase community participation and awareness and build relevant capacity and skills to manage the uncertainties of climate change.

The twelve villages participating in the project are comprised of a diverse audience of community members, including vulnerable children and their communities.1 The target groups consist of subsistence farmers (most of whom are women and youth) who are most likely to depend on the affected and impacted environments for subsistence and cash incomes.

The project is piloting six coping strategies that have the potential to become longer-term adaptation methods for communities. These coping strategies include (1) ensuring greater water security in the region in the face of increasing climate change pressures, (2) production of vegetables irrigated by flood waters, (3) improvement of dryland crop production, (4) increased use of new and drought-resistant crops, (5) introduction of energy efficient stoves and (6) increased awareness about adaptation and mitigating strategies. At present, the methods are being piloted at different sites. A comparative analysis of the pilots' results will be undertaken to assess the effectiveness and applicability of each strategy (or combination thereof) at different sites and in various countries.

This information will help inform community decisions on the selection of coping strategies, including whether more than one strategy can be implemented at a time. Given the complexity of climate change impacts, this multi-strategy risk-transfer approach will be necessary in the future. The programme employs a holistic approach that addresses climate change adaptation threats and improves community livelihood. In Namibia, conservation agriculture (CA) is being applied at sites in the pilot regions as part of the CBA approach. Benefits of this approach range from social empowerment to increased crop yields. These impacts are real and are having a positive impact on the community-at-large. For example, community members are organizing into self-help groups (SHGs) to share knowledge and build capacity; families with HIV/AIDS are being supported through improved nutritional status as a result of increased food security; farm land quality is improving through composting, biochar, crop rotation and CA; fish and livestock farming are being supported through the provision of ponds and watering pans; and communities are growing other foods, such as rice, fodder and mushrooms.

These diversified activities and actions from the CBA projects have provided an enabling environment for communities to improve their nutrition, gain extra income, and be better prepared for the difficulties associated with the ever-changing climates in their villages. These actions and resultant benefits have increased the resilience of communities as they continuously adapt to impacts of climate change.

Introduction

Local climate change and its variability pose greater risks for vulnerable, poor, and marginalized communities due to the physical impact it makes there. Since 2009, the UNDP-GEF CBA project in Namibia has been working with 12 villages that are facing a number of key problems that stem from extreme local climate events *(e.g. pronounced droughts and floods, rising and variable temperatures, increasingly unpredictable rainfall patterns and amounts, severe land degradation leading to loss of productive arable land and range, loss of livestock, as well as high levels of deforestation and over utilization of natural resources).*

The agricultural sector in Namibia is particularly affected by climate change. Droughts and erratic rains, interspersed with floods that originate in Angola, plague the northern side of the country and leave brittle, nutrient-poor soil, which renders farm lands unproductive. This negatively affects food, water security and general livelihoods due to failed harvests, and decreases livestock numbers and products. The UNDP-GEF CBA project is working to safeguard livelihoods by encouraging target communities to improve farm gate incomes, diversify the sources of other farm-based incomes, and properly utilize farmlands.

The CBA project is also working with communities to build resilience and adaptive capacity to climate change in agro-pastoral communities and to foster community participation in the identification of climate drivers, risks and adaptive solutions. The target group is comprised of the most vulnerable community members, including women and children, that depend on rain-fed agriculture (*e.g. planting pearl millet, maize, sorghum, ground nuts and cowpeas*), natural resources *(e.g. collecting fruit and oil from the wild),* and livestock rearing for both subsistence and cash incomes in the semi-arid areas of northern Namibia.

The first step, and short-term objective of the project, is to enlist community participation in the vulnerability assessment and solutions-generation stage by bringing members together to identify the climate change drivers, risks and adaptive solutions. The project uses a vulnerability reduction assessment method to assist communities, through a participatory process, in determining an appropriate plan of action. This is done through cohesive social groups and trainings before piloting projects.

After the community has a solid understanding of the issues and options, the community can begin to implement effective solutions generated in a participatory way. This is the second step, and long-term objective of the CBA project. During this phase, the project targets the communities' needs to build resilience and adaptive capacities. Communities apply a suite of actions to improve and strengthen their soil management practices, including the application of conservation agriculture in combination with appropriate crop rotation and crop residue retention and incorporation practices that, for example, add coping levels of staple food crops (Mahangu)2 and legumes (cow peas and ground nuts) when grown together in a single farm.

Conservation tillage as a tool for community-based adaptation

The CBA approach in Namibia is driven by national strategies on adaptation and aims to make a significant impact on community development, reduce poverty, and encourage capacity building to help identify climate change related factors and drivers.

A main focus of the project in Namibia is the promotion and application of conservation agriculture (see Box 1). The applied CA method via the Conservation Tillage Project (CONTILL) is specific to the Namibian agriculture circumstances. CONTILL, developed in 2005 through research and on-farm trials, encourages farmers to produce and apply compost-based fertilizer (manure), to practice minimal soil disturbance using ripping and furrowing, to create in-field water harvesting, and to apply crop rotations, which enable farmers to secure their own food supply and to market surpluses. As a result, farmers are leaving their age-old ineffective practices and quickly adapting to conservation tillage practices. Furthermore, CONTILL allows farmers to diversify production (for instance, of sunflower oil and chicken feed, simultaneously) to boost food security, income and nutrients. CONTILL is helping to reduce the negative effects of floods, drought and irregular rainfall patterns, rising temperatures, and soil degradation. In fact, this process is already showing great results with an increase in agricultural yields of up to 500%.

Conservation agriculture

Conservation agriculture aims to achieve sustainable, profitable agriculture and improve the livelihoods of farmers by combining profitable agricultural production with environmental concerns and sustainability. It has been proven to work in a variety of agro-ecological zones and farming systems. Practitioners perceive CA as a valid tool for Sustainable Land Management.

In Namibia, the CONTILL conservation agriculture method is achieved through the application of the following strategies:

- Minimal soil disturbance through ripping and furrowing soils
- Crop residue retention and incorporation
- Crop rotations

Organizing community-based adaptation in Namibia

The project is bringing together community members to create a participatory process to engage stake-holders and build awareness and skills. This process brings together groups to discuss and develop adaptation strategies and carry out related exercises, such as vulnerability reduction assessments. Although, participation in these groups is voluntary, every effort is made to balance community representation. Support for local groups, and in some cases, the formation of the local groups, is being guided by the local non-governmental orginization (NGO) Creative Entrepreneurs Solutions (CES).

Creative Entrepreneurs Solutions

Creative Entrepreneurs Solutions is a local NGO that is working with communities to support the implementation of adaptation activities to optimize sustainable impact and empowerment of the target communities. CES applies a holistic and practical bottom-up implementation approach. It creates an enabling environment by collaborating with strategic partners and stakeholders (e.g. line ministries, local authorities, national and international institutions of higher learning, traditional authorities, farmer’s organizations, vocational training centers, NGOs, and community-based organizations [CBOs]) to form task teams to support communities.

Support systems

Creative Entrepreneurs Solutions and its partners are establishing support systems for communities that are in dire need of assistance to cope with and adapt to changes in the local climate. Support systems provide assistance that ranges from advisory functions, informational provisioning, procurement of necessary tools, implements, and relevant seeds, production of compost fertilizers and services, to the fabrication and introduction of renewable energy technologies. This support system ensures a very high level of community participation and motivation. The support system, created and currently managed by CES, provides an enabling environment for targeted, sustained community development. It promotes sustainable livelihoods as a means to adapt to climate change. It emphasizes sustainable development founded on social mobilization and empowerment at group and/or community levels. It also encourages the formation of self-help groups (SHGs), and the utilization of the advantages of their cohesiveness, skills training, mentorship, and on site farmer-to-farmer learning through on-farm demonstrations. The support system is well organized and provides a mechanism in which other partners can channel support to communities for various developmental activities.

Self-help groups

Self-help groups help to implement CBA strategies identified by community members and are buttressed by support systems, which help and cushion vulnerable communities to cope with and adapt to changes in the local climate. Community members are encouraged to form SHGs where one member of each community functions as that community’s coordinator, and is appropriately trained for this responsibility by CES’ partner organisation, Hand-in-Hand, Republic of South Africa (RSA).

The SHGs are a platform for knowledge sharing, duplication of successful CBA strategies, savings and enterprise creation. The formation of SHG's in Namibia is based on existing models in Africa and Asia that are founded on education, socialization and empowerment. These provide the necessary prerequisite to keep communities together and to pursue issues of common concerns, such as being involved in communitybased adaptation initiative in their localities.

Project Results

The UNDP-GEF CBA Programme in Namibia comprises a cluster of 6 projects and became operational in December 2009. Since its inception, the programme has experienced robust levels of participation. Currently, there are 40 community members practicing the CONTILL CA method on their smallholding farms, and approximately 73 community members practicing and test-validating the practices on community-owned plots. A group of women, along with a few male partners from Onakapya, Ongungulume, Onkani, Onkaankaa and surrounding villages, formed OIKE, a women-led CBO that is testing CONTILL on several plots within their region in northern Namibia. The participating communities faced problems with flooding and or drought on their individual or community farms prior to working with UNDP. These issues led to crop failures and increased food insecurity. Through the application of CONTILL3 as a result of the UNDP GEF CBA project, these problems were successfully mitigated in late 2009.
The project has seen positive results to date due to three main factors: (1) use of effective equipment; (2) use of crop rotation and (3) use of an integrated approach.

Use of effective equipment

The use of effective equipment has been critical to the success of CONTILL in Namibia. A tractor-mounted ripper-furrower equipped with wings is being used to break up the soil; it breaks up the hard pan underneath the light-sandy topsoil at a depth of 30 cm, which allows for water retention and deep root penetration below the hard alkaline (salty) layer. This allows the feeder roots to reach the nutrients located below the 30 cm depth in the soil. At the same time, the wings make a furrow that collects rainwater and channels it to the base of the furrow and into the ripped area where the plants will grow. Research and on-farm trials show that this method is solving problems associated with limited moisture in the soil (i.e. drought), as well as flooding (by allowing and increasing infiltration). The in-field water harvesting channels rainwater to the plants basal area. During flooding, the abundant, excess water finds its way through the ripped compaction layer, infiltrating deep into the soil and preventing water logging. Ripping and furrowing can be adapted to traditional cultivation methods and can still be cost effective. The technology can accommodate pulling by both oxen and tractors with similar increases in harvest yields.

The farmland that was ripped and furrowed in January/February 2010, following CONTILL best practices, has done exceptionally well (see Photo 2). Although all of the project participants faced drought or flooding, their crops (pearl millet, beans, sorghum and maize) grew to maturity with higher yields than expected in fields that were conventionally farmed and only used traditional methods4. The project farmers received a bumper harvest from their CONTILL farmlands, particularly from pearl millet (Mahangu) – the national staple food crop in the region.

Use of crop rotation
Mirroring the adaptable community-based cultivation methods in the expansive Namibian semi-arid lands, crop rotation of legumes with pearl millet, maize sorghum, coupled with composting of plant residues, is a no-cost fertilization method that has worked well in combination with ripping and furrowing. Similarly, the introduction of improved but locally tested wild seeds is another important adaptation factor under trial in Namibia. This approach takes advantage of and utilizes existing indigenous knowledge to adapt to climate change.

Use of an integrated approach
Creative Entrepreneurs Solutions, OIKE, local CBA project implementing partners, and community members are aiming to not only pilot the climate change adaptive characteristics of CONTILL as a technique, but also to undertake applied research and document the drivers of adaptation. This approach should provide real-time, on-farm instructional information, which can be used by other farmers to learn about how to apply new dry-land farming technologies while maintaining the use of traditional fertilizer application practices (e.g. using plant residues, manure and crop rotation) and rain-fed crops within a changing planting patterns.

Summary of Key Areas of Success
The UNDP-GEF CBA programme in Namibia is successful on many levels. It is raising awareness and bringing communities together to participate in the development and implementation of adaptation strategies. The main adaptation tool being utilized in Namibia within the CBA project is the CONTILL, Namibia-specific CA method. This method of farming is well suited to the conditions in Namibia and, as shown through this report, is yielding excellent results. It is also gaining wider acceptability regionally and nationally. The following summarizes how the project has been successful.

Creation of awareness and strategic mobilization in communities
Community members have witnessed the process and success of CONTILL through their involvement in all of its steps. This began with community mobilization and land preparations and has continued through the germination of crops, the growing period, and into the harvest period that resulted in a bumper harvest. These communities have benefited from NGOs, farmers' associations, Agriculture Extension Officers, and volunteers who have worked with farmers, on local and remote levels, and have accompanied them during the process.

Application of appropriate technological support
The in-field water harvesting resulting from ripping and furrowing practices has contributed to continuous growth even with inadequate rains during the farming season. Moreover, in torrential downpours (resulting from variable rainfall attributed to regional climate change), the fields where CONTILL was applied have not been waterlogged, have been less alkaline and have retained less moisture for a longer period of time. This result can be attributed to the effectiveness of the CONTILL approach, which increases the amount of water captured from rainfall per square meter of row spacing from 300 mm to 520 mm.[5] This methodology and associated technology has also ensured that plants are stronger and provide a higher pearl millet yield. Supporting this result, past regional scientific trials have shown an average yield of 209 kg/ha from conventionally ploughed fields (see Photo 4 & Photo 5), compared to a realizable 1,176 kg/ha from CONTILL fields. This significant increase in yield will contribute to food security in the area (see Photo 6).

Use of knowns (seeds source) and unknowns (new technologies)
Part of the success of CONTILL CA in Namibia has been the combined approach to implementation. CONTILL represents a new and improved farming system within the communities, but integrates the new approach with the use of traditional crops (although some seed varieties went through an improvement programme locally). The CA technique and improved traditional seeds are the vehicles through which adaptation strategies are being realized. These strategies have allowed the farmers to carry on with their preferred method of traditional rain-fed crops with a better farming system. This

seems to be a major factor contributing to the success of CONTILL as an adaptation strategy at the pilot sites. The project is showing that mixing unknowns with knowns can reduce cultural shock and risks associated with adoption of a new technique, such as CONTILL in this case, while enhancing acceptability and the adaptability of the farmers involved.

Experimentation with new crops and technology and diversification of risks of failure
The CONTILL projects allowed farmers to experiment with new crops and technology. This year, project farmers introduced yet another crop, the sunflower, used to produce cooking oil and chicken feed, to diversify incomes (see Photo 1). Results showed that the plants were strong, benefited from the in-field water harvesting in the CONTILL furrows, and required less attention. This gave farmers more time to focus on their primary crops. For example, one of the groups was able to start their white maize harvest early from their CONTILL community plot and had impressive yields of two to three cobs per plant. This surplus enabled the community to market green maize daily at open-air markets (see Photo 7) during the harvesting season.

Identification of the need for continuous community-based support systems
A vital factor in successfully adapting to climate change is a reliable support system. The support system must be community-based and fully present in the target community; preferably it should offer the needed services and goods. In this case of CONTILL in Namibia, the following deliverables have been part of the assembly of goods and services provided to the communities: service provision (ripping and furrowing), subsidised fertilizer, technology inputs and advisory services. The support systems have been sourced from NGOs, CBOs, faith-based organizations (FBOs), civil society, and government extension services. These groups have helped to facilitate tailor-made, continual community-based research on relevant best practices, lessons, improvement of inputs (e.g. seeds), and infrastructure (private sector based support is the best way to guarantee continual supply). The support system has also helped to ensure adaptability and provision of the reliable support required for successful implementation of adaptation measures.

The Future of Conservation Tillage

A Model for Community-Based Adaptation

The possibility of transferring and duplicating CONTILL CA in and outside of Namibia has great potential. As an adaptation measure, CA is ideal for countries that experience unpredictable rainfall events and patterns, as well as arid areas with light, alkaline soils such as those of northern Namibia. The CONTILL process outlined in this report, and the associated technology described, may also work well in similar areas such as those of Kwa Zulu Natal province of South Africa, most parts of Australia, Ethiopia and Zambia.

By applying CONTILL, soil quality is improved, which leads to greater crop yield for small farms at the household level. CONTILL contributes to community food security and adaptability to climate change events, both of which are exacerbated by drought and flooding in Namibia.

Next Steps: the Implementation of a New Conservation Agriculture Model

The next step for UNDP-GEF CBA CONTILL projects is to implement what is arguably the best model for CA in Namibia. This model will be applied at the community level, starting with 30 CONTILL CA method test strips on a small-holder farming level. Neighbours will be invited to a CONTILL demonstration (“farmer’s day,” which is similar and modelled after “a farmer’s field schools approach”) where they will see, hear, and learn from farmers with experience in conservation tillage. As part of this model, local ploughing service providers will be encouraged to purchase CONTILL implements at the “Farmer’s Day” and to offer ripping and furrowing services to local farmers at affordable rates. This action will bring on board micro-finance institutions, run by CONTILL farmers, that would subsidize farmer’s fees as well as offer trainings, advisory and marketing support systems.

The Namibian case is currently at this stage of development. Communities’ adoption of CONTILL CA technology (use of ripping and furrowing) in Namibia has been successful; the next step will be to sustain and put in place self-regulating mechanisms to ensure its effective repetition nationally.