# Indicators for resilience **of socio-ecological** production landscapes

SATOYAMA INITIATIVE

UNITED NATIONS UNIVERSITY

UNU-IAS Institute of Advanced Studies

Bioversity International

**'Socio-ecological production landscapes'** or SEPLs are dynamic mosaic landscapes with habitats and land uses including villages, farmland and adjacent woods, forests, grasslands, wetlands and coastal areas. These landscapes have been shaped over the years by the interactions between people and nature in ways that maintain biodiversity and provide humans with goods and services needed for their wellbeing. They have proven sustainable and can be considered living examples of cultural heritage. A number of studies indicate that the management of these landscapes is compatible with the Ecosystem Approach and the Addis Ababa Principles and Guidelines on the Sustainable Use of Biological Diversity. The Satoyama Initiative, which aims to maintain and, where necessary, revitalize or rebuild SEPLs was recognized as a potentially useful tool to better understand and support these landscapes for the benefit of biodiversity and human wellbeing by the 10th Meeting of the Conference of the Parties to the Convention on Biological Diversity.[1]

**Why a resilience approach?** In order to maintain, revitalize and rebuild SEPLs in times of global change, a resilience perspective on landscapes is essential. In SEPLs, communities create resilience with practices that further their wellbeing, but also support key ecosystem functions and biodiversity. In order to support these processes, a set of indicators[2] is being developed to provide a tool for communities to understand their resilience and encourage the practices that strengthen it. These indicators help measure a community's capacity to build resilience and harness ecosystem services through innovation, adaptation, and through local institutions that regulate the sustainable use of biodiversity..

This project is led by the United Nations University-Institute of Advanced Studies and Bioversity International as a Collaborative Activity under the International Partnership for the Satoyama Initiative (IPSI).

**Who will use the indicators and for what?** The indicators are not conceived as a defined set of measurements but rather as a guide to understanding and strengthening resilience. They are based on case studies that describe communities' strategies to cope with and adapt to change through local innovation and the sustainable use of biodiversity. Further development of the indicators is planned through discussion among IPSI members, other interested parties and local communities, and through their practical application in community development projects in SEPLs. The indicators cover key features of SEPLs that confer resilience. While adapted for agricultural settings the indicators can be made specific to landscapes in which agriculture is not the main livelihood activity. They complement other existing indicator frameworks focused on community wellbeing, traditional knowledge and landscape productivity[3,4,5]. Their practical application in community development projects in SEPLs in more than 10 countries globally are under preparation. Experiences to be gained through the application are envisaged to be compiled and analysed for further improvement of the indicators.

The main purpose of the indicators is to assist communities in developing resilience-strengthening strategies that encourage local innovation, ecosystem protection and beneficial interactions between different landscape components. Unlike many assessment tools, they are defined and measured in terms easily perceived and used by local communities. The main areas in which the indicators can prove useful to the collaborative initiatives between communities, scientists, conservation agencies and development actors are:

- *Understanding the resilience of SEPLs.* The indicators provide an analytical framework with a common set of parameters for the exchange of experience and information across landscapes and communities.
- *Supporting communities in strengthening SEPLs, biodiversity and ecosystem functions*. The indicators can help to identify social processes, institutions, and land use, conservation and innovation practices that need to be encouraged to strengthen resilience.
- *Monitoring and evaluation of project interventions* that

©Frederik van Oudenhoven

***Landscape heterogeneity in the Cuchillas del Toa Biosphere Reserve in Cuba***

aim to strengthen resilience and support biodiversity conservation.

**What do indicators measure?** The indicators measure elements of SEPL resilience that are, almost by definition, strongly interrelated. The practices and institutions that they describe can be grouped into four areas:

- Ecosystems protection and the maintenance of biodiversity,
- Agricultural biodiversity,
- Knowledge, learning and innovation,
- Social equity and infrastructure.

**Ecosystem protection and the maintenance of biodiversity.** The health of a landscape and the ecosystems it supports is reflected in part in the diversity of species and their interactions; it also forms the physical, cultural, and often, spiritual bases of a community's wellbeing. Biodiversity contributes to community and landscape resilience by providing ecosystem services, which are sustained (or degraded) by the practices and institutions that regulate the use of natural resources. In the context of climate change, for example, the protection and restoration of watersheds, forest and coastal ecosystems in SEPLs helps regulate hydrology and microclimate, thereby providing a buffer against extreme weather events, floods and droughts.

**Agricultural biodiversity** forms the nexus between the health of an ecosystem and that of a community. It includes species used for food, fodder, fibre, fuel, and the large number of non-harvested species in the wider landscape directly used by or benefiting communities through the services they provide such as pollinators, soil biota and regulators of pests and diseases. Agricultural biodiversity provides material for experimentation, innovation and adaptation. The genetic diversity found in local crop varieties and animal breeds, expressed in important traits such as drought and saline tolerance, and resistance to pests and diseases, helps them adapt to various soil and climate conditions. The loss in diversity of these traits decreases options for risk management and adaptation. Revival of local food systems and landscape diversification, on the other hand, encourages the maintenance of agricultural biodiversity, and contributes to food security and self-sufficiency.

**Knowledge, learning and innovation** are the means of building resilience. Communities strengthen resilience by experimenting, innovating, and learning within and between different knowledge systems, cultures, and age groups. Adaptation strategies may be novel or old, but generally build on bio-cultural or traditional knowledge. This knowledge is specific to the locations and cultures of given social-ecological interactions. It is embodied in resource use customs, agricultural traditions, local languages, cultural values, and social institutions. Many communities are losing their knowledge of local resources, biodiversity and the historical events that have shaped the landscape. The maintenance of this knowledge increasingly depends on the ability of elders, parents and the younger generations in a community to document and share it. The role of young people in valuing traditional knowledge and assimilating it with the new knowledge acquired in urban centres and schools is crucial, but often underestimated.

1 CBD COP10 Decision X/32. Sustainable use of biodiversity.

2 Based on work by Van Oudenhoven, F., Mijatovic, D. and Eyzaguirre, P. (2010) *Social-ecological indicators of resilience in agrarian and natural landscapes*, Management of Environmental Quality: An International Journal 22(2), pp.154-173.

3 Suneetha.M.S and Balakrishna Pisupati (2009) *Learning from the Practitioners: Benefit Sharing Perspectives from Enterprising Communities.* UNU-IAS and UNEP.

4 Tebtebba (2008) *Indicators relevant for Indigenous Peoples: a Resource Book.* Indigenous Peoples International Centre for Policy Research and Education.

5 Buck, L., Shames, S. and Scherr. S. (2007) *Understanding Ecoagriculture: A Framework for Measuring Landscape Performance.* Ecoagriculture Partners.

**Social equity and infrastructure** are key features of SEPL resilience. Gender inequality, social exclusion and marginalization can hinder the ability of women, indigenous and other groups to strengthen resilience. Women, youth and the elderly hold specific knowledge and skills related to biodiversity. For indigenous communities, resilience is intrinsically linked with their efforts to protect traditional ways of subsistence and cultural heritage. The ability to access ancestral lands and engage in traditional land use and agricultural practices are important conditions for communities to maintain biodiversity and associated traditional knowledge. Resilience is also dependent on the availability of efficient and functioning social infrastructure, such as communication, health and education, to meet various needs and aspirations of the communities.

## How to use the indicators?

The indicators, presented in the table, are developed to guide the assessment of resilience in a community. The assessment entails assigning a score and a trend to each indicator by answering the questions listed in the table's first column. A qualitative or quantitative score can be assigned to all indicators using a 5-point scale given in the table's second column. To collect information about changes in trends, the following categories can be used for each indicator separately:

↑ steep upward trend
↗ slow/some increase
→ No change
↘ slow/some decrease
↓ steep downward

The way the indicators are used will differ depending on the user. Communities may seek to monitor the impact of external development, agricultural or conservation interventions on traditional livelihoods; for practitioners and scientists they can help elucidate whether and how the day-to-day interactions between people and the landscape contribute to landscape resilience. Most importantly however, the indicators intend to provide a common language between 'traditional', 'governmental' and 'scientific' communities which values, rather than obscures the complexity of human-environment interactions.

# INDICATORS FOR RESILIENCE IN SOCIO-ECOLOGICAL PRODUCTION LANDSCAPES

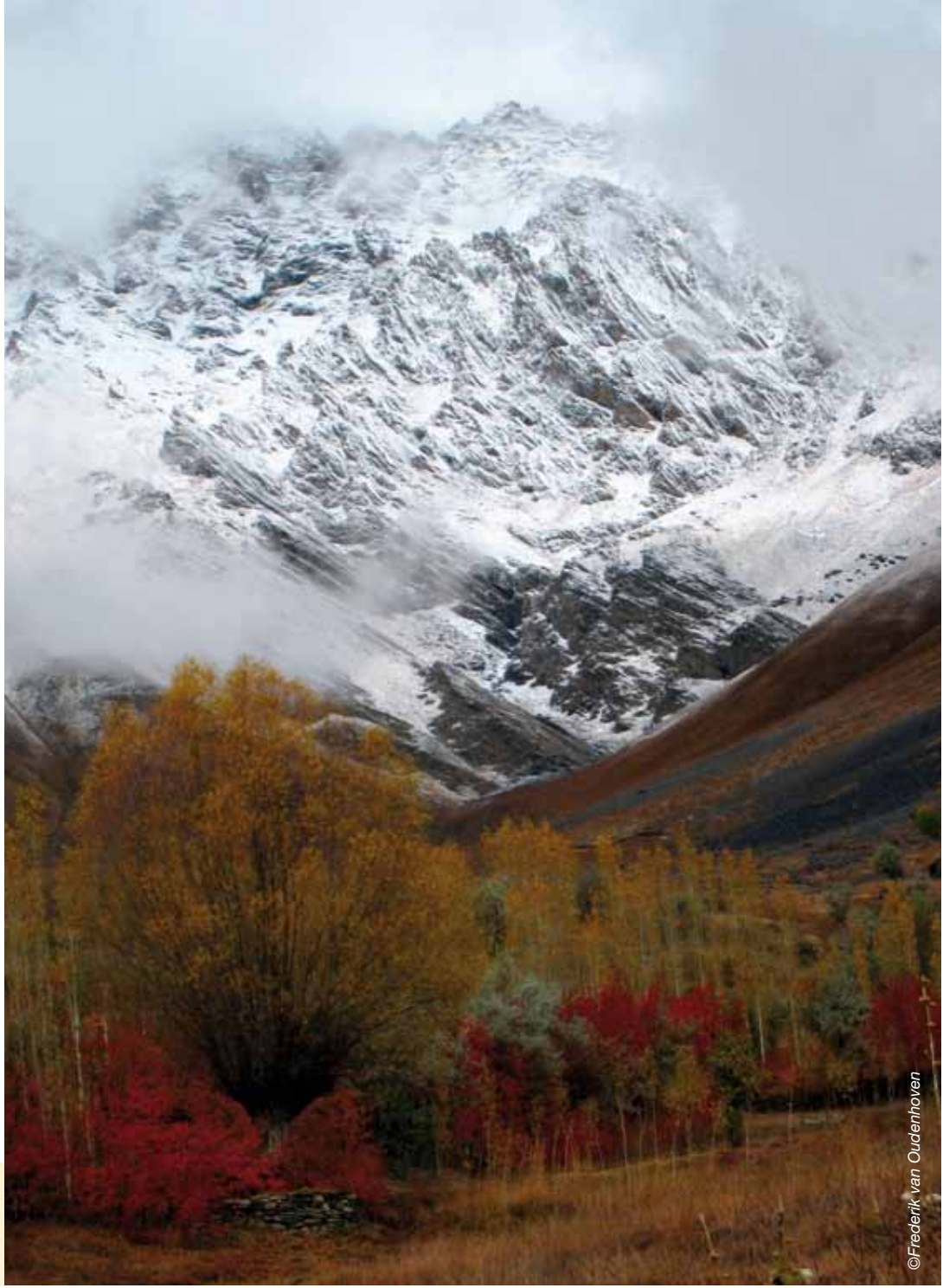
| *WHAT TO ASSESS?* | *SCORES* |
|---|---|
| ***ECOSYSTEMS PROTECTION AND THE MAINTENANCE OF BIODIVERSITY*** | |
| **Heterogeneity and multi-functionality of the landscape**<br>• Do land management practices maintain a heterogeneous landscape mosaic composed of different land-use types and ecosystem patches e.g. forest patches, home gardens, cultivated fields and orchards? | (5) Heterogeneous landscape consists of diverse land-use types and well-connected ecosystem patches.<br>(4) Landscape mosaic consists of several land-use types and some ecosystem patches.<br>(3) Landscape consists of several land-use types and fragmented ecosystem patches.<br>(2) Landscape consists of two or three land-use types and few ecosystem patches.<br>(1) No heterogeneity, i.e. one type of land-use predominates in the landscape. |
| **Areas protected for their ecological and cultural importance**<br>• How many landscape components that maintain ecosystem functions and services are protected? Protection may be formal or informal and include traditional forms of protection such as sacred groves. | (5) Protected and low-use areas cover key resources and are well-connected with ecological corridors.<br>(4) Protected and low-use areas cover key resources in the landscape.<br>(3) Protected and low-use areas small.<br>(2) Protected and low-use areas very small.<br>(1) Landscape intensively used, leading to resource depletion and accelerating loss of biodiversity. |
| **Ecological links between landscape components for sustainable production**<br>• Are ecological links between different landscape components maintained and harnessed for sustainable production e.g. ecosystem patches kept for pollinators, pest control, nutrient cycling, groundwater recharge and soil erosion control? | (5) Beneficial links between landscape components are maintained and harnessed.<br>(4) Some beneficial links between landscape components are maintained.<br>(3) Production systems partly depend on external inputs.<br>(2) Production systems largely depend on external inputs.<br>(1) Production systems heavily depend on external resources (e.g. high pesticide use). |
| **Rate of recovery from extreme environmental and climate change-related stresses and shocks**<br>• Does the landscape have the capacity to cope with and recover from extreme environmental and climate change-related stresses and shocks e.g. pests and diseases, extreme weather events, floods and droughts? | (5) No significant damage to landscape functioning.<br>(4) High rate of recovery.<br>(3) Medium rate of recovery.<br>(2) Low rate of recovery.<br>(1) Irreversible damage to landscape functioning. |

*Rice terraces, The Philippines*

| ***AGRICULTURAL BIODIVERSITY*** | |
|---|---|
| **Maintenance, documentation and conservation of agricultural biodiversity in a community**<br>• Are local crops, varieties and animal breeds used in a community?<br>• Is agricultural biodiversity documented and conserved in community classification systems and community seed banks? | (5) Local crops, varieties and breeds (#) widely used, documented and conserved.<br>(4) Local crops, varieties and breeds are used by some community members; documentation and conservation practices are weak.<br>(3) Local crops, varieties and breeds are used by few community members; documentation and conservation practices do not exist.<br>(2) Local crops, varieties and breeds are rare and used only by very few community members; documentation and conservation practices do not exist.<br>(1) Local crops, varieties and breeds no longer found. |
| **Diversity of local food system**<br>• Do communities use a diversity of traditional and locally-produced foods, e.g. cereals, vegetables, fruits, nuts, wild plants, mushrooms, berries, fish and animals? | (5) Locally-sourced foods abundant and widely used.<br>(4) Locally-sourced foods available and used by some community members.<br>(3) Locally-sourced foods available and occasionally used.<br>(2) Variable availability and use of locally-sourced foods.<br>(1) Scarcity of locally-sourced foods. |

| ***KNOWLEDGE, LEARNING AND INNOVATION*** | |
|---|---|
| **Innovation in agricultural biodiversity management for improved resilience and sustainability**<br>• Do community members improve, develop and adopt new agricultural biodiversity management practices to adapt to changing conditions, e.g. climate change, population pressure, resource scarcity?<br>• Examples of innovative practices are the adoption of water conservation measures (drip irrigation), diversification of farming systems and switch to drought- or saline-tolerant crops/varieties. | (5) Community members are receptive to change and adjust their practices through local innovation.<br>(4) Community members are receptive to change; local innovation takes place but can be strengthened.<br>(3) Community members are receptive to change but the rate of innovation is low.<br>(2) Community members are moderately receptive to change, no innovation.<br>(1) Community members are not receptive to change, no innovation. |
| **Access and exchange of agricultural biodiversity**<br>• Are individuals within and between communities connected through institutions and networks for the exchange of agricultural biodiversity, e.g. seed exchange networks, local markets and animal and seed fairs? | (5) Multiple systems of exchange regularly operating within and between communities across different cultures and landscapes.<br>(4) Exchange within and across communities takes places but can be strengthened.<br>(3) Exchange takes place occasionally.<br>(2) Exchange takes place rarely.<br>(1) Systems of exchange do not exist. |
| **Transmission of traditional knowledge from elders, parents and peers to the young people in a community**<br>• Is the knowledge of key concepts and practices about land, water, biological resources and cosmology transmitted between different age groups? | (5) Key concepts and practices known to all community members, including youth.<br>(4) Key concepts and practices known to community members, but not to those considered youth.<br>(3) Key concepts and practices known only to adults and elders.<br>(2) Key concepts and practices known only to elders.<br>(1) Traditional knowledge lost. |
| **Cultural traditions related to biodiversity**<br>• Are cultural traditions related to biodiversity maintenance and use continued by young people, e.g. festivals, rituals, songs, etc? | (5) Cultural traditions practiced by all community members including youth.<br>(4) Cultural traditions practiced by community members, but not by those considered youth.<br>(3) Cultural traditions practiced only by adults and elders.<br>(2) Cultural traditions practiced only by elders.<br>(1) Not practiced. |

| | |
|---|---|
| **Number of generations interacting with the landscape**<br>• How many generations interact with the landscape for subsistence and income? | (5) Three or more generations interact with the landscape.<br>(4) Two or three generations interact with the landscape.<br>(3) Two generations interact with the landscape.<br>(2) One or two generations interact with the landscape.<br>(1) One generation interacts with the landscape. |
| **Practices of documentation and exchange of local knowledge**<br>• Are community-based institutions and systems for documentation, exchange and acquisition of externally-sourced knowledge in place? E.g. existence of traditional knowledge registers, resource classification systems, and community biodiversity registers, farmer field schools. | (5) Institutions and systems for knowledge documentation and exchange are present and well-functioning.<br>(4) Institutions and systems for knowledge documentation and exchange present but can be strengthened.<br>(3) Some knowledge documentations and exchange taking place but need to be strengthened.<br>(2) Only a small fraction of knowledge documented.<br>(1) Documentation of knowledge does not take place. |
| **Use of local terminology or indigenous languages**<br>• Do community members use local terminology related to land and (the use of) biodiversity, and, if applicable, do they speak the local dialect or language? | (5) Local terminology (and local dialect or language) widely used in the community.<br>(4) Local terminology used by the majority of community members.<br>(3) Local terminology used by a part of the community.<br>(2) Local terminology used by a small part of the community.<br>(1) Local terminology not used. |
| **Women's knowledge about biodiversity and its use**<br>• Are women's knowledge, experiences and skills recognized as central to practices that strengthen resilience? | (5) Women's knowledge, experiences and skills recognized, respected and used.<br>(4) Women's knowledge, experiences and skills mostly recognized and respected and used.<br>(3) Women's knowledge, experiences and skills partially recognized, respected and used.<br>(2) Women's knowledge, experiences and skills receive little recognition.<br>(1) Women's knowledge, experiences and skills not recognized. |



©Frederik van Oudenhoven

***Winter descending on a fruit orchard in the Pamirs. Fruit trees are grown around settlements, creating a little vegetation in an otherwise barren landscape. Fruits are a mainstay of the diet of these mountains, providing energy, vitamins, and medicine.***

| ***SOCIAL EQUITY AND INFRASTRUCTURE*** | |
|---|---|
| **Local resource governance**<br><br>• Are land, water and other resources effectively managed by community-based institutions? I.e. existence of traditional institutions (customary laws) and non-traditional local initiatives (governmental and non-governmental) for the sustainable use of resources. | (5) Institutions in place and resources effectively managed.<br>(4) Institutions in place and some resources effectively managed.<br>(3) Institutions in place but need to be strengthened.<br>(2) Institutions not effective.<br>(1) Institutions not present. |
| **Autonomy in relation to land and resource management**<br><br>• Does the community have autonomous access to indigenous lands, territories, natural resources, and sacred and ceremonial sites, e.g.clarity of tenure rights?<br>• Is that autonomy recognized by outside groups and institutions, e.g. governments and development agencies? | (5) Community has access to its traditional lands and resources and autonomy in their management.<br>(4) Community has access to its traditional lands and resources and partial autonomy in their management, but its autonomy needs to be strengthened and recognized by outside groups.<br>(3) Community has limited access to its traditional lands and resources and limited decision power over their management.<br>(2) Community has limited access to its traditional lands and resources and no decision power over their management.<br>(1) Community has neither access to nor decision power over traditional lands and resources. |
| **Gender**<br><br>• Are women involved in decision-making and communication with outsiders?<br>• Do women have access to resources, education, information and opportunities for innovation? | (5) Women are involved in decision-making and communication with outsiders, and have the same access to resources and opportunities as men.<br>(4) Women are involved in decision-making and communication with outsiders, and have access to resources and opportunities, but less so than men.<br>(3) Women are partially or occasionally involved in decision-making and have limited access to resources and opportunities.<br>(2) Women are rarely involved in decision-making and have limited access to resources and opportunities.<br>(1) Women are not involved in in decision-making and have no access to resources and opportunities. |
| **Social infrastructure**<br><br>• Is social infrastructure, including roads, schools, telecommunications, energy, and electricity in place? | (5) Social infrastructure exists and meets all community needs.<br>(4) Basic social infrastructure exists.<br>(3) Not all necessary infrastructure exists or functions satisfactory.<br>(2) Some major social infrastructure is missing and opportunities for its improvement are limited.<br>(1) No infrastructure in place. |
| **Health care**<br><br>• Do community members have access to health care?<br>• Are traditional healing methods and modern medicine present? | (5) Health care accessible for all community members and functions to the satisfaction of the community.<br>(4) Basic health care accessible.<br>(3) Health care facilities exist but do not function satisfactory or not easily accessible.<br>(2) Health care facilities not satisfactory and not easily accessible.<br>(1) Health care not accessible. |
| **Health risk**<br><br>• Is there a health risk from epidemics, water contamination, air pollution or other threats, e.g. malnutrition? | (5) Low risk.<br>(4) Average risk.<br>(3) Moderate risk.<br>(2) High risk.<br>(1) Very high risk. |


***Sacred Forest, Yunnan, China***


*The Inca 'agricultural research station' of Moray, near Cusco, Peru, where crops were adapted for use in the different parts of the Inca empire. The depressions in the landscape were probably constructed to simulate different growing conditions. Cover photo: The human-made islands, called Uros, of lake Titicaca in Peru.*

**For more information contact the**
**Secretariat of IPSI, UNU-IAS**
**E-Mail: isi@ias.unu.edu**

**http://satoyama-initiative.org/en/**