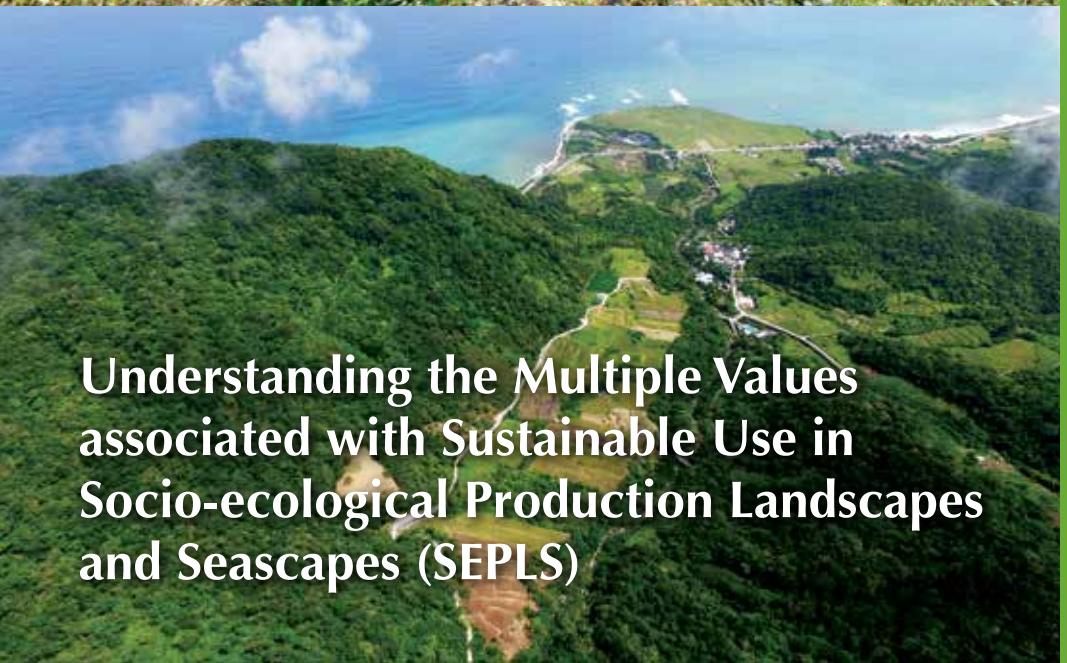
SATOYAMA INITIATIVE

Satoyama Initiative Thematic Review

vol. 5



Understanding the Multiple Values associated with Sustainable Use in Socio-ecological Production Landscapes and Seascapes (SEPLS)

2019

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Satoyama Initiative
The Satoyama Initiative is a global effort, first proposed jointly by the United Nations University and the Ministry of the Environment of Japan (MOEJ), to realize "societies in harmony with nature" and contribute to biodiversity conservation through the revitalization and sustainable management of "socio-ecological production landscapes and seascapes" (SEPLS). The United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS) serves as the Secretariat of the International Partnership for the Satoyama Initiative (IPSI). The activities of the IPSI Secretariat are made possible through the financial contribution of the Ministry of the Environment, Japan.

UNU-IAS
The United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS) is a leading research and teaching institute based in Tokyo, Japan. Its mission is to advance efforts towards a more sustainable future, through policy-relevant research and capacity development focused on sustainability and its social, economic and environmental dimensions. UNU-IAS serves the international community, making valuable and innovative contributions to high-level policymaking and debates within the UN system. The activities of the institute are in three thematic areas: sustainable societies, natural capital and biodiversity, and global change and resilience.

IGES
The Institute for Global Environmental Strategies (IGES) was established in March 1998 under an initiative of the Japanese government and with the support of Kanagawa Prefecture. The aim of the Institute is to achieve a new paradigm for civilization and conduct innovative policy development and strategic research for environmental measures, reflecting the results of research into political decisions for realising sustainable development both in the Asia-Pacific region and globally. The Institute will tackle fundamental challenges to human society, and to redefine the values and value systems of our present societies that have resulted in the global environmental crisis, in order to create new ways of conducting activities and a new paradigm for civilization.

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Foreword

Research led by UNU-IAS has been contributing to the understanding of sustainable use of biodiversity for many years, in particular related to resource-management approaches at the landscape level. In all of our work, we have tried to better understand and communicate the value of biodiversity, both in terms of monetary value and other, less tangible, kinds of value. Our work has consistently shown that these multiple values can be derived from conservation and sustainable use of biodiversity through the concept of "socio-ecological production landscapes and seascapes" (SEPLS), with both social and ecological components contributing to sustainable ecosystems and human livelihoods.

UNU-IAS has worked closely with the Ministry of the Environment of Japan in the development of the Satoyama Initiative, a global effort to realize "societies in harmony with nature," focusing on the revitalization and sustainable management of landscapes and seascapes towards well-managed SEPLS. We have hosted the Secretariat of the International Partnership for the Satoyama Initiative (IPSI) since its establishment at the Tenth Meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD COP 10) in Aichi, Nagoya, Japan in 2010. In this role we coordinate the efforts of partners across the globe toward biodiversity conservation through integrated and holistic landscape and seascape management approaches, with mutual benefits for biodiversity and livelihoods. As IPSI's membership has grown to 258 organizations, it has accumulated a wide range of knowledge and experience, and many members are now working collaboratively for better management of SEPLS in various settings around the world.

The case studies presented in this fifth volume of the Satoyama Initiative Thematic Review highlight how the concept of SEPLS, implemented in different spatial, cultural, and administrative contexts, can contribute to understanding of the multiple values of nature, and thereby improve biodiversity conservation through sustainable use. The objective will allow synthesizing knowledge relevant to a wide set of audiences including the "Methodological assessment regarding the diverse conceptualization of multiple values of nature and its contributions including biodiversity and ecosystem functions and services" currently being prepared by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). I am confident that this volume will provide inspiration and useful knowledge for practitioners, policymakers, and scientists, and that the activities described will make broader contributions to the knowledge base of IPBES, as well as conservation efforts including the Post-2020 Global Biodiversity Framework, the Sustainable Development Goals (SDGs), and other ongoing policy processes.

Prof. Kazuhiko Takemoto

Director, United Nations University Institute for the Advanced Study of Sustainability

Foreword

People value nature in many different ways, and the continued degradation of landscapes and seascapes have negatively impacted many key contributions of nature to people's quality of life. A key challenge for effective and sustainable management of socio-ecological production landscapes and seascapes is how to best account for the multiple values of nature in management decisions. People's values underpin political and economic decisions. However, power relations imply that some values are given prominence in decision, while others remain obscure and even marginalized. This often leads to entrenched power imbalances and social conflicts over the environment. We strongly believe that accounting for the multiple values of nature in decision making is necessary (albeit not sufficient) to achieve a more sustainable and fair use of nature in terrestrial, coastal and marine socio-ecological production systems.

The Satoyama Initiative Thematic Review Volume 5 provides an interesting and unique account of the multiple values of nature associated with Socio-Ecological Production Landscapes and Seascape. The report presents a series of in-depth case studies from across the Global South, including: countries from Latin America (Ecuador, Colombia, and Mexico), Africa (Mauritius, Ghana, and Uganda), Asia (Bangladesh, Taiwan, and the Philippines) and Europe (Spain). All of the case studies highlight the dilemmas between conservation and development, as well as discuss the development and monitoring of community based projects. The case studies also explore how different values of nature influence the decisions and actions of different stakeholders and how this affects the use and distribution of nature's contributions to people. Thus, the report provides an assessment of the role of multiple values of nature in the design, operationalization and impact of the different sustainable use initiatives. The final synthesis chapter also provides important cross-cutting insights and guidelines that link values, decisions and outcomes based on a social-ecological system framing.

The exploration of the role of multiple values of nature towards more sustainable landscapes and seascapes found in this volume is particularly relevant to fill an important knowledge gap by providing high quality evidence on the diversity of values at play in decision making with emphasis on the Global South. This is warmly welcomed. The insights from this Thematic Review will enhance the body of knowledge of relevance to the ongoing IPBES Values Assessment (to be published in 2022), and other assessments and products.

We are sure that this volume will have a broad readership and will become an important source of information for decision makers associated with each of the study cases within the Satoyama Initiative network, and beyond. We also believe this volume is an example of how different types of initiatives across the world can benefit from and nourish the joint scientific and normative endeavour.

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Preface

The Satoyama Initiative is "a global effort to realise societies in harmony with nature", started through a joint collaboration between the United Nations University (UNU) and the Ministry of the Environment of Japan. The initiative focuses on the revitalisation and sustainable management of "socio-ecological production landscapes and seascapes" (SEPLS), areas where production activities help maintain biodiversity and ecosystem services in various forms while sustainably supporting the livelihoods and well-being of local communities. In 2010, the International Partnership for the Satoyama Initiative (IPSI) was established to implement the concept of the Satoyama Initiative and promote various activities by enhancing awareness and creating synergies among those working with SEPLS. IPSI provides a unique platform for organisations to exchange views and experiences and to find partners for collaboration. At the time of writing, 258 members have joined the partnership, including governmental, intergovernmental, nongovernmental, private-sector, academic and indigenous peoples' organisations.

The Satoyama Initiative promotes the concept of SEPLS through a three-fold approach that argues for connection of land- and seascapes holistically for management of SEPLS (see Fig.1). This often means involvement of several sectors at the landscape scale, under which it seeks to: 1. consolidate wisdom in securing diverse ecosystem service and values, 2. integrate traditional ecosystem knowledge and modern science and 3. explore new forms of co-management systems. Furthermore, activities for SEPLS conservation cover multiple dimensions, such as equity, addressing poverty and deforestation, and incorporation of traditional knowledge for sustainable management practices in primary production processes such as agriculture, fisheries and forestry (UNU-IAS & IGES 2015).

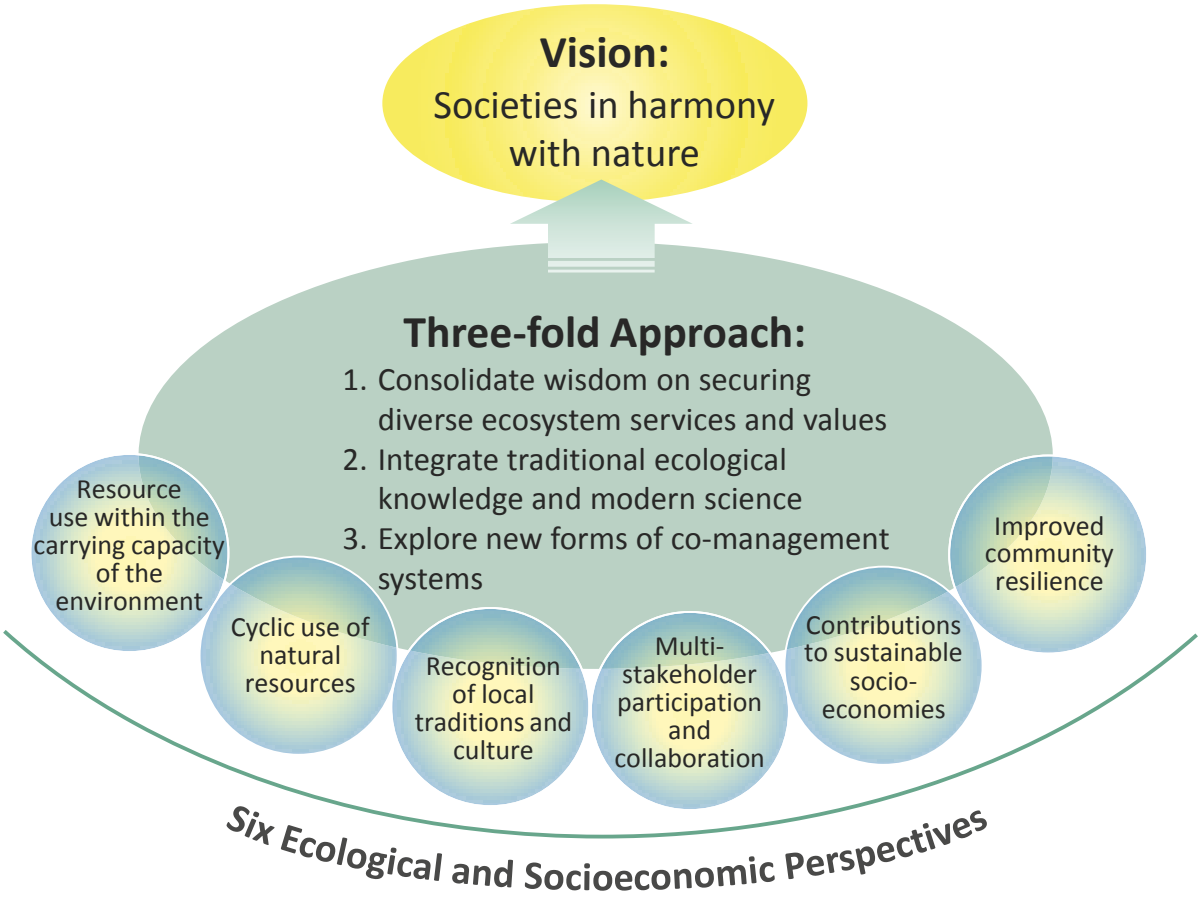

Figure 1. The conceptual framework of the Satoyama Initiative

As one of its core functions, IPSI serves as a knowledge-sharing platform through the collection and sharing of information and experiences on SEPLS, providing a place for discussion among members and beyond. More than 180 case studies have been collected and are shared on the IPSI website, providing a wide range of knowledge covering diverse issues related to SEPLS. Discussions have also been held to further strengthen IPSI's knowledge-facilitation functions, with members suggesting that efforts should be made to produce knowledge on specific issues in SEPLS in order to make more targeted contributions to decision-makers and on-the-ground practitioners.

It is in this context that a project to create a publication series titled the "Satoyama Initiative Thematic Review" was initiated in 2015 as a joint collaboration between UNU's Institute for the Advanced Study of Sustainability (UNU-IAS), which hosts the IPSI Secretariat, and the Institute for Global Environmental Strategies (IGES), an IPSI partner and research institute based in Japan. The Thematic Review was developed as a compilation of case studies providing useful knowledge and lessons focusing on a specific theme that is important for SEPLS. The overall aim of the Thematic Review is to collect experiences and relevant knowledge, especially from practitioners working on the ground, considering their usefulness in providing concrete and practical knowledge and information as well as their potential to contribute to policy recommendations. Each volume is also accompanied by a synthesis chapter which extracts lessons learned through the case studies, presenting them for policy-relevant academic discussions. This series also contributes to efforts being made by researchers to strengthen the evidence base on socio-ecological dynamics and resilience, including those under the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and the Convention on Biological Diversity (CBD).

The first volume of the Satoyama Initiative Thematic Review was published in 2015 with the theme "Enhancing knowledge for better management of SEPLS", focusing on ways to identify, collect, document, maintain, exchange, refine, augment, and make use of information and knowledge for better management of SEPLS. The second volume's theme was "Mainstreaming concepts and approaches of SEPLS into policy and decision-making", covering topics including advocacy, multi-stakeholder engagement, facilitation and coordination of institutions, concrete tools and information useful for policymakers and stakeholders. The third volume, titled "Sustainable livelihoods in SEPLS" identified drivers linked to sustainable livelihoods in SEPLS that are crucial to meet needs for human well-being and to foster sustainable use of natural resources. The fourth volume, "Sustainable use of biodiversity in SEPLS and its contribution to effective area-based conservation" looked at how effective management of SEPLS, which can include areas inside and outside of designated protected areas, can achieve benefits for both biodiversity conservation and human livelihoods through sustainable use of biodiversity.

Purpose of the Satoyama Initiative Thematic Review Volume 5 (SITR-5)

In recent years, the relationship between biodiversity conservation and human livelihoods, survival, and well-being has gained a great deal of attention. However, understanding of the value of biodiversity has tended to focus on tangible benefits that can be measured in monetary terms, while in fact the concept of "value" has interrelated but distinct dimensions and can be interpreted differently by actors with different interests, and thus requires an inter-disciplinary approach including biophysical sciences, social sciences and economics, and indigenous and local knowledge in order to understand and comprehensively capture its diverse meanings and contexts.

In this volume, we seek to contribute to the understanding of how different kinds of values, which have been called "multiple values of nature" (we will use the initialism "MVN" for the purposes of this volume), are provided and maintained through sustainable use of biodiversity in SEPLS management. Included here are case studies that demonstrate how integrated and holistic approaches to SEPLS management can provide intrinsic, instrumental, and relational values to bring about economic, social/cultural and ecological sustainability for both biodiversity and people. The volume contributes to the pool of knowledge that will be relevant for IPBES' ongoing 'Methodological assessment regarding the diverse conceptualization of multiple values of nature and its contributions, including biodiversity and ecosystem functions and services' hereinafter referred to as the 'Values Assessment'. The Values Assessment, based on the decision approved by IPBES plenary in March 2018, is a three-year global critical evaluation of the state of knowledge regarding the multiple values of nature by independent global experts interacting with government representatives and other stakeholders.

Like previous volumes, this publication was developed through a multi-stage process including both peer review and discussion among the authors at a workshop. Authors had several opportunities to get feedback, which helped them to make their manuscripts more useful and easy to understand for readers. First, each manuscript received comments from the editorial team relating primarily to their contributions to the theme of the volume. Peer review was then conducted by the

authors of other chapters, with each author receiving feedback from two other authors who were requested to comment on whether the manuscript was easy to understand and informative, provided useful lessons, and so on. The aforementioned workshop was then held to enable the exchange of feedback between authors. Here, the authors presented their case studies and received comments both from the two designated reviewers and from the other workshop participants. The basic ideas contained in the synthesis chapter were developed from the presentations and discussions during the workshop, and the chapter was made available for review by authors and selected experts before finalisation.

Our experience producing these volumes leads us to believe that the above process offers an opportunity for authors from both academic and non-academic organisations to contribute to generating knowledge in an accessible and interactive way, as well as to provide high-quality papers written in simple language for academics and a broader audience alike. It is our hope that this publication will be useful in providing information and insights to practitioners, researchers, and policymakers on the importance of long-term management of SEPLS for delivering MVN, and on the potential of MVN to mobilize a wide range of stakeholders and integrate disciplines for sustainable use of biodiversity. This, we hope, will prompt policymaking that strengthens such integrated and holistic management approaches.

We would like to thank all of the authors who contributed their case studies and the other participants in the case study workshop. We also greatly appreciate the efforts of IGES for their continued collaboration in the publication process of this volume. Our grateful thanks are also due to the Ministry of the Environment, Japan for supporting the activities of IPSI and its secretariat hosted by UNU-IAS.

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Participating authors, editorial team at the authors' workshop, held from 28 to 30 May 2019 at the United Nations University Headquarters in Tokyo, Japan

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Chapter 1

How multiple values influence decisions on sustainable use in socio-ecological production landscapes and seascapes (SEPLS)

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1. Introduction

Changes in land and sea uses are the major drivers of global biodiversity loss (IPBES 2019). To halt biodiversity loss caused by impacts from unsustainable land/sea use practices, it is first necessary to recognise that there are multiple actors who influence the way landscapes or seascapes are used, managed and governed. The priorities of these multiple actors are often diverse, with interactions between differing priorities leading to varied management outcomes. These could be conflicting when the priorities of certain actors dominate during interactions, or when the priorities of some actors are altogether ignored, but surface due to the impacts of decisions on them. The outcomes could also result in cooperation when trade-offs between priorities are identified, negotiated and solutions based on compromise found.

The outcomes—whether conflicting or cooperative—of socio-ecological interactions between different actors have implications for both the sustainable use of resources and human well-being. Not all cooperative outcomes necessarily result in sustainable use and improved human well-being, as the subscription to a particular vision/principle by all relevant actors may result in decisions with negative consequences. Some stark examples include the promotion of monoculture plantations or widespread high chemical input agricultural practices (Cannell 1999, Shiva 2016).

Therefore, integrating or accounting for multiple values related to nature and its uses while incorporating concepts of well-being, brings to the fore both areas that are contested and those where consensus is possible, and makes the reasons for particular policy and implementation designs visible to larger audiences. The benefits of incorporating multiple values of nature (hereinafter referred as "MVN") are more easily viewed and are relevant in the contexts of socio-ecological production landscapes and seascapes (SEPLS) that are characterized by multiple actors and where management decisions are influenced by the different actions of respective actors.

Through presenting the experiences of selected IPSI partner case studies in this volume, our focus is to highlight the various ways that multiple actors in SEPLS value nature, how contributions from nature are perceived by these actors, and how this translates to governance of SEPLS, in particular to sustainable use of natural resources, sustenance of biodiversity and ensuring the well-being of different stakeholders in the landscape or seascape. Table 1 gives an overview of the case studies, and Figure 1 illustrates the locations of the landscapes and seascapes covered.

Table 1. Overview of the case studies

Chapter (country)	Title (author)	SEPLS and related values	Decision-making context
Chapter 2 (Mauritius)	Recognising the local values of coastal wetland biodiversity for sustainable economic and livelihood development at Résidences La Chaux '*Barachois*', Mauritius (Déja et al.)	Coastal wetlands with traditional *barachois* coastal lagoons established for fish rearing and segregated from the ocean by permeable stone walls. Highly valued for food and feed, mitigation of natural hazards, medicinal value of coastal vegetation, source of ornament crafts, and recreation purposes.	Abandonment of *barachois* and increase of waste dumping in lagoons, wetland restoration vis-à-vis natural feed aquaculture enterprise, fragmented governance across ministries and limited government support to on-site management.
Chapter 3 (Ecuador)	Framing cultural ecosystem services in the Andes: *Utawallu* as sentinels of values for biocultural heritage conservation (Sarmiento and Cotacachi)	The Imbakucha Basin and its watershed include the largest Andean lake in Ecuador and mountain landscapes maintained by ancestral practices of indigenous communities whose livelihoods are associated with their spiritual beliefs and cultural perceptions of nature.	Constructing the narrative for a biocultural approach to conservation of protected areas around the Imbakucha Basin indigenous territory in response to the indigenous people's plea to conserve their sacred sites.
Chapter 4 (Ghana)	Empowering communities for natural resource management: the case of Community Resource Management Areas (CREMA) in Western Ghana (Osei-Owusu and Frimpong)	Community resource management Areas (CREMA) established in high forest zones with mosaics of diverse forest types and agriculture land of mainly cocoa. A Community Biodiversity Value Typology (CBVT) is used to measure multiple values of CREMA relating to consumption, production, naturalistic, aesthetic symbolic, moralistic, educational and training, and ecosystem services.	Understanding the communities' perception of the socio-ecological value of CREMA to better communicate these associated values within the communities and for designing a more robust management system.

Chapter (country)	Title (author)	SEPLS and related values	Decision-making context
Chapter 5 (Colombia)	The San Antonio Forest Key Biodiversity Area Governance Scheme: collective construction based on differences (Quintero-Ángel et al.)	A productive and biodiverse forest landscape with a mosaic of ecosystems and land uses, including villages, crops, forests, pastures and private properties containing luxury country houses and small farms. Stakeholder surveys found nature is perceived as governed spaces for ecological conservation; or as sources of ecosystem services, income sources, life, refuge from city life and well-being.	Protected area corridor, issues in law enforcement, land-use conflicts, habitat loss and water pollution, yet lack of useful information on threats. Thus, need to construct a participatory governance scheme that represents the different visions of nature.
Chapter 6 (Mexico)	Landrace maize diversity in *milpa*: a socio-ecological production landscape in Soteapan, Santa Marta Mountains, Veracruz, Mexico (San Vicente Tello and Jönsson)	Conserving landrace native maize diversity through cultivation by indigenous people in *milpa,* a polyculture system practiced on mountainous tropical zones with high humidity, which is representative of Mexican indigenous people's worldviews of nature being important landscapes that encapsulate MVN.	Expansion of hybrid maize cultivation replacing native varieties, adaptation of native varieties to changing climatic conditions and the need for understanding of MVN perceived by the farmers of the *milpa* production.
Chapter 7 (Spain)	Enhancing communication and co-learning in socio-ecological landscape management through elicitation of local communities' visions and values (Díaz-Varela et al.)	Mid-range mountainous area with priority habitats including raised bogs, blanket bogs and Atlantic wet heathlands, which are developed for traditional use as livestock grazing pastures, resulting in cultural landscapes rich in habitats and endemic species. A difference in perceptions of MVN found conservation agencies more for intrinsic value of ecosystems and local people for instrumental and relational values related to their livelihoods.	European Nature 2000 Network site, communal forest land (MVMC) governed by the MVMC Community Assemblies. Conversational approach needed to resolve conflicts from differing visions, restore common trust and provide a common language.
Chapter 8 (Bangladesh)	"The Sundarbans is our mind": An exploration into multiple values of nature in conversation with traditional resource users (Titumir, Paran and Pasha)	The world's largest single-tract mangrove ecosystem combined with forest, coastal and wetland, enriched with high biodiversity of uniquely adapted aquatic and terrestrial flora and fauna. Direct and indirect use values drawn from indigenous knowledge of traditional resource users (TRUs) whose livelihoods are mainly fishing or collecting wood, honey, shells and crabs.	Sundarbans mangroves declared as an Ecologically Critical Area (ECA), which neglects the rights of inhabitants and is not effectively enforced.
Chapter 9 (Chinese Taipei)	Towards an integrated multi-stakeholder landscape approach to reconciling values and enhancing synergies: a case study in Taiwan (Lee, Karimova and Yan)	Two indigenous settlements located on the east coast of Taiwan along a tropical forest watershed, with the terrestrial Amis community cultivating farmlands in the middle reaches of the watershed, and the rice-cultivating coastal Kavalan community located in the lower reaches of the watershed down to the Pacific Ocean. Both communities shared the same priority for the relational value of nature but lacked a cross-border communication, while supporting local authorities prioritized either intrinsic, instrumental or relational values of nature mainly based on their sectoral goals and lacked a cross-sectoral coherence.	Reconciling socio-ecological value perceptions of multi-interest stakeholders to develop a new cross-border and cross-sector institutional capacity.

Chapter (country)	Title (author)	SEPLS and related values	Decision-making context
Chapter 10 (Uganda)	Direct use values and nutritional potential of selected wild edible plants from Teso-Karamoja Region, Uganda (Ojelel et al.)	Dryland landscape comprised of mainly woodlands, grasslands and shrublands in eight forest reserves and home to 99 wild edible plants. The direct use values of these plants and the nutritional potential of five commonly used species is presented.	Need to conserve wild edible plants which are disappearing from landscapes and for documentation of their associated indigenous traditional knowledge.
Chapter 11 (Philippines)	Re(Connecting) with the Ifugao Rice Terraces as a socio-ecological production landscape through youth capacity building and exchange programs: A conservation and sustainable development approach (Serrano et al.)	A UNESCO World Cultural Heritage site and FAO Globally Important Agricultural Heritage System (GIAHS), the Ifugao Rice Terraces are located on landlocked and generally mountainous landscape characterized by thick forests, creeks and streams that are tributaries to major rivers. Transferring of associated economic, cultural and ecological values derived from rice terraces to youth is priority to ensure sustainable management.	Although designated as a UNESCO World Heritage site and FAO GIAHS, the rice terraces are facing pressures of insufficient management due to abandonment, unregulated tourism activities and out-migration of youth. Thus, there is an urgent need to document, educate and disseminate the landscape's associated values so as to build human capacity for management and create sustainable livelihoods.
Chapter 12 (India)	Mainstreaming Community-Conserved Areas (CCAs) for biodiversity conservation in SEPLS - A case study from Nagaland, India (Edake, Sethi and Lele)	Located at the heart of Nagaland at an altitude of 1,900 m, the area is characterized by the Tizu River and sub-tropical wet hill forest primarily overlapping with the sub-tropical pine forest that harbors many endangered and threatened species of the Indo-Burma hotspot. Villages of the Sema tribe, whose livelihoods are mainly shifting cultivation of timber, medicinal plants and non-timber forests products, also practice farming for subsistence and wildlife hunting. Traditional intimate relationship with nature exists based on spiritual foundation of the interconnectedness of God, people and nature.	The Nagaland state, where the majority of natural habitats are placed under private or communal lands overseen by village councils, is facing challenges of unregulated resource overexploitation including excessive wildlife hunting. Need to link the CCAs, revive traditional conservation practices, develop community-based ecotourism initiatives and formalize and mainstream a network of CCAs.

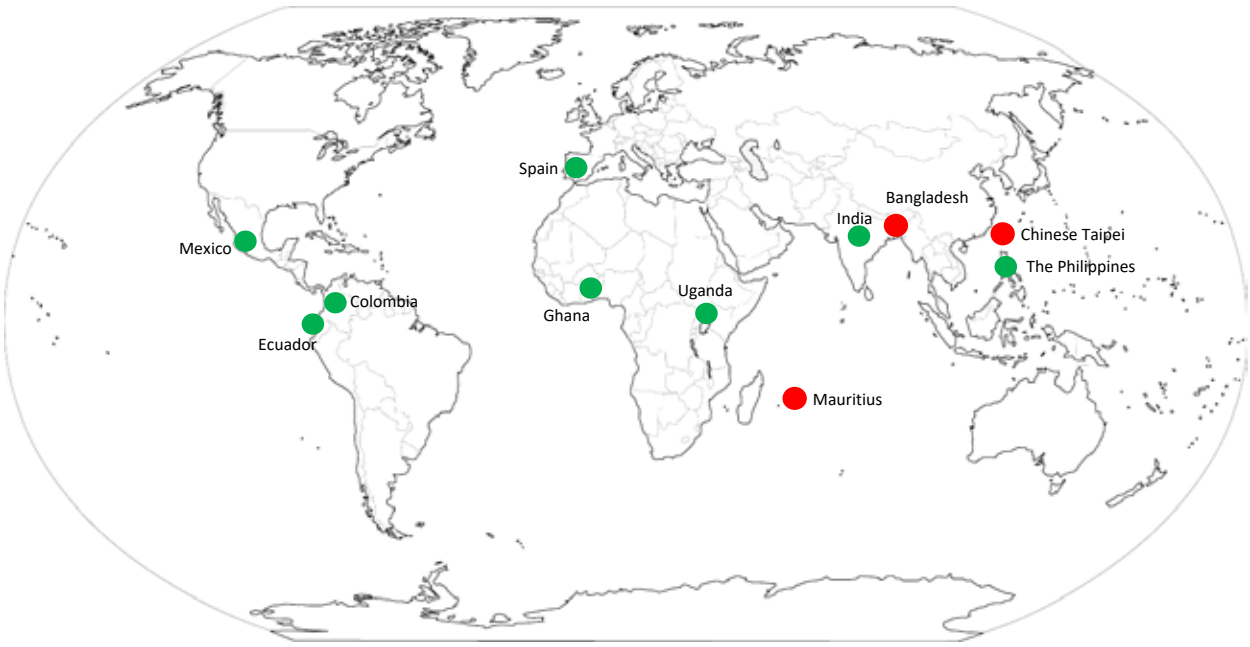

Figure 1. Locations of the case studies presented in the Satoyama Initiative Thematic Review Volume 5 (green: landscape; red: mixture of landscape and seascape) – 4 in Asia, 3 in Africa, 1 in Europe, 3 in Central and South America.

1.1 Multiple Values of Nature (MVN)

Recently, there has been a growing acknowledgment of the need to bring in the perspectives of all possible stakeholders and actors who impact (and conversely are impacted by) socio-ecological systems, resulting in different outcomes (IPBES 2016; Pascual et al. 2017). The Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services (IPBES) is currently undertaking an assessment ("Methodological assessment regarding the diverse conceptualization of multiple values of nature and its contributions, including biodiversity and ecosystem functions and services") to explore ways to incorporate multiple values in valuation methods and approaches for decision-making vis-à-vis nature and nature's contributions to people (NCP). The NCP concept is an extension of the ecosystem services concept whereby nature is seen as not just commodified services for human consumption, whether provisioning, regulating or others, but also as providing benefits that could overlap or fall between these categories. Therefore, a pluralistic valuation and assessment of these benefits is called for (Pascual et al. 2017). Such a nuanced approach to integrating multiple conceptualizations of nature requires a new narrative accounting for the diverse benefits that humans derive from nature. Towards this, the IPBES has clarified a few basic concepts that are highlighted below:

1.1.1 Dimensions of 'values'

The word "value" has interrelated but distinct dimensions and is understood and analyzed differently in the biophysical sciences, social sciences, economics, and from indigenous and local knowledge perspectives. Moreover, the word "value" has different meanings. It could be a *principle or core belief* associated with a general worldview or local cultural context (e.g. living in harmony with nature vis-à-vis nature as a provider of inputs required for a good quality of life) or a *preference*, which is a choice of a particular state over others (e.g. monocrop plantations to mosaic landscape use). It could be considered the *importance* of something for itself or others, now or in the future, regardless of proximity (e.g. sacred value of a species in a landscape), or be understood as a *measure* where nature's contributions to people (NCP) can be directly quantified and monitored in biophysical or economic terms (e.g. economic value of timber) (Pascual et al. 2017, see Fig. 2).). Often there is a policy tendency for this measurement to be translated to monetary terms, and the economic value manifested by the market dynamics of global trade or payments for ecosystem services (PES).

1.1.2 Types of 'values'

Values are of different types:

- Values can be non-anthropocentric, such as **intrinsic values**, which are independent of any human experience and evaluation. An intrinsic value is viewed as an inherent property of the entity (e.g. an organism) and not ascribed or generated by external valuing agents, such as human beings.
- They can also be anthropocentric, such as **instrumental values**, which often relate to nature's contributions to people and refer to the value attributed to something as a means to achieve a particular end.
- Another type of anthropocentric value can be **relational values**, which reflect symbolic relationships with natural entities. They reveal elements of cultural identity, social cohesion, social responsibility and moral responsibility towards nature.

It should be noted, however, that one same entity can be the object of different values. For instance, maize that is grown for human consumption can have an intrinsic value, because it contributes to genetic biodiversity. It also has an instrumental value to those consuming it, as it provides them nutrition. Consuming and producing maize may also be the source of a relational value for people, due to the crucial role of maize in some cultures (Chapter 6). Furthermore, maize could also become part of the agrobiodiversity related with ritual and spiritual observance (Chapter 3).

1.1.3 Types of valuation methods

Taking into account the plurality of worldviews and the diversity of values, valuation methods should be multidimensional and multifaceted, integrating methodologies where necessary, drawing from multiple data sources over time to provide more comprehensive assessments and contextual explanations for how and why

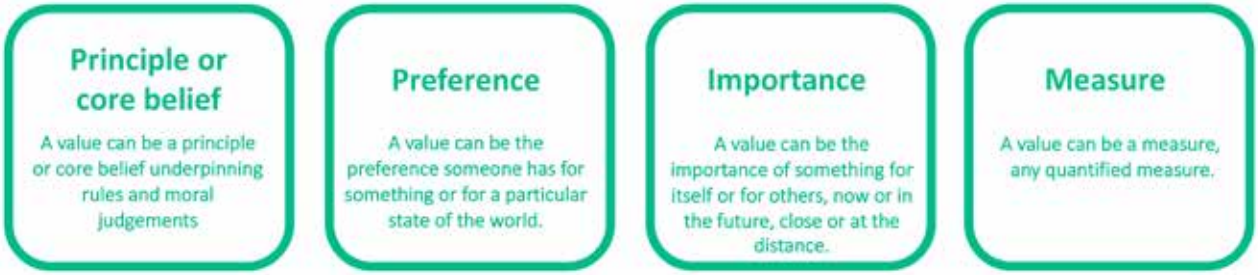

Figure 2: Dimensions of 'values' (IPBES) (Pascual et al. 2017)

values are perceived, formed and changed. A comprehensive valuation could include a combination of unidimensional methods of valuation and/or adopt integrated approaches in capturing plural values. Unidimensional methods of valuation have specific foci and elicit specific values such as:

- **Socio-cultural** – eliciting values of nature held by social groups and focusing on the role of nature in culture and social reproduction
- **Economic** – eliciting values held by individuals through evaluating the price of given aspects of NCP
- **Health** – valuation focusing on the effects of NCP on human health
- **Indigenous and local knowledge/Holistic valuation systems** – emphasising relationships and dynamics established among people and nature regarding the regeneration or reproduction of the systems of life of Mother Earth for living well; these include indigenous valuation approaches
- **Biophysical** – usually a numerical amount denoted by a magnitude, quantity, or number determining allegedly objective measurements of the ecological value of NCP

Plural valuation methods, on the other hand, an integrate various foci, through identifying the different types of values present in a given context. This is the task that has been achieved in the empirical chapters presented in this review.

2. SEPLS and Multiple Values

SEPLS are areas with "dynamic mosaics of habitats and land and sea uses where the harmonious interaction between people and nature maintains biodiversity while providing humans with the goods and services needed for their livelihoods, survival and well-being in a sustainable manner" (IPSI Secretariat 2015). Six key perspectives have been identified as necessary to the promotion of SEPLS: (1) resource capacity within the carrying capacity of the environment; (2) cyclic use of natural resources; (3) recognition of the value and importance of local traditions and cultures; (4) multi-stakeholder participation and collaboration; (5) contributions to socio-economies; and (6) enhancing community resilience. Based on these characteristics, SEPLS' vision of multiple functions of a landscape or seascape and its use is determined in alignment with these functions through promoting an integrated approach of multi-stakeholder co-management and benefit-sharing arrangements. Even while equity is not guaranteed across SEPLS, they certainly provide the opportunity for different stakeholders to pursue and sustain fulfilling livelihoods that are pegged to the sustained availability of resources and various ecosystem functions. This then translates into improved well-being outcomes, such as access to food security, health and energy security and cultural needs. It therefore follows that in order to better understand the integrity of a socio-ecological system with multi-functional uses such as a SEPLS, a more plural and inclusive approach that accounts for the well-being priorities of different constituents of the system is needed.

2.1 Multiple values in SEPLS

To highlight the diversity of values that may be contained and further prioritized in a SEPLS, we mapped the prominent values identified across the 11 different case studies in this volume (SITR vol. 5). During the case study workshop, authors of the respective chapters were requested to identify three types of core values from their respective SEPLS, i.e. *intrinsic, instrumental and relational values*. These values were further segregated into (1) Principles (e.g. core beliefs), (2) Importance (3) Preferences and (4) Measures, broadly outlining the dichotomy between use and non-use values. To recognize these multiple, plural values–though there is overlapping to certain extent—we adopted the above approach where authors provided case-specific examples and narratives under each column, classifying most commonly identified values under 12 segments. Thereafter, an attempt was made to quantify the diversity of values from SEPLS, simply by counting the frequencies of narratives identified under each component (see Fig. 3).

As such, and quite expectedly, instrumental values, especially in the categories of *importance* and *measures*, were found to be strongly recognized within the SEPLS. These were enriched by diverse stakeholders' perceptions and multiple uses of production landscapes, where landscape productivity and functions (e.g. fish production, rice cultivation, water retention) are directly linked with human well-being and sustenance. Moreover, instrumental values within NCP are often quantified through monetary indicators of consumption, which contribute to local livelihood and support income generation, and thereby, are easily recognized. The appreciation of relational values, in particular, *principles*, or core beliefs that underline the traditional and customary relationship between humans and nature, followed as the next most recognized. A number of case studies reported sacred sites, religious beliefs, customary rituals, indigenous/local knowledge and practices which contributed to the sustainable management of SEPLS (Chapters 3, 6, 12) with non-consumptive uses. While these values cannot be quantified in economic terms, their recognition is vital. As argued by Christie et al. (2019), both instrumental and relational values directly contribute to quality of life, which possibly explains the overwhelming recognition of these values. Contrarily, intrinsic values, which are inherent in nature and independent of human

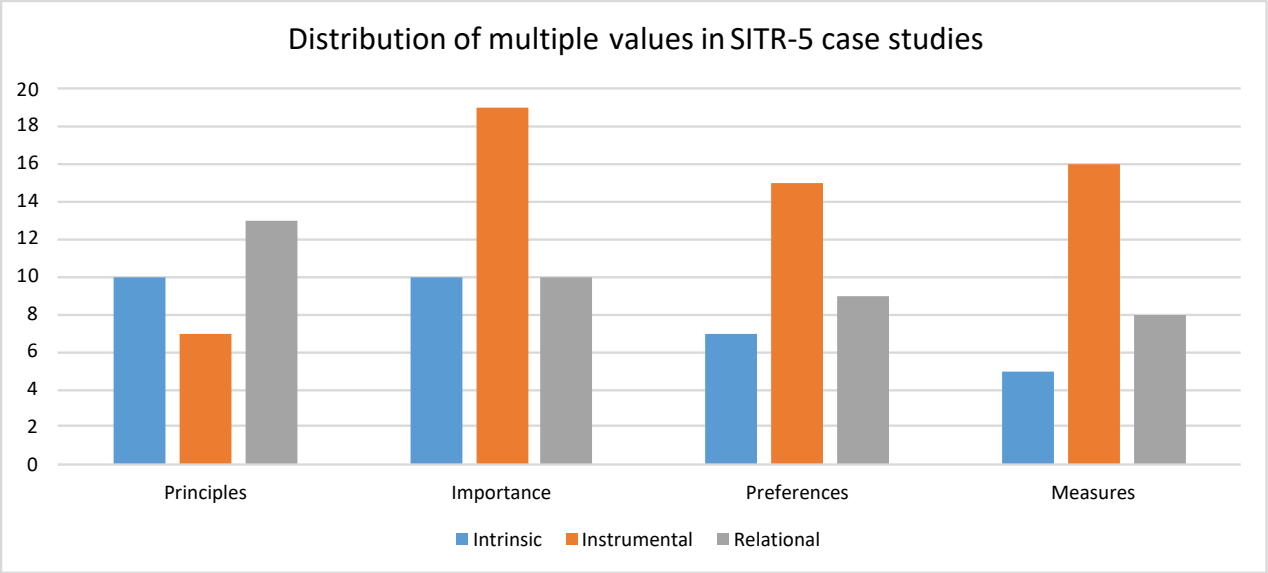

Figure 3: Tentative distribution of different values identified during the case study workshop

experience and evaluation, found lesser mention. One possible reason is the broadness of the concept, which, at times, is difficult to conceive at the scale of a SEPLS. Nevertheless, authors provided several important narratives about intrinsic values of SEPLS, including perspectives on dimensions of planetary awareness and related worldviews (e.g. perceiving conservation in terms of global carbon storage or biodiversity conservation) and cultural context (iconic values, heritage areas which are inherent values of SEPLS and not necessarily dependent upon local community experiences and uses). Furthermore, since SEPLS are primarily utilitarian spaces, relational and instrumental values tend to have primacy over inherent values.

As argued by Pascual et al. (2017), NCP are associated with a wide range of values. Some of these values, nonetheless, depend on individual and/or collective experiences and the way people interpret nature and its contributions. Within the case studies, the representation of MVN are captured through analyzing different narratives provided by the authors during the case study workshop. In brief, these narratives range from general appreciation for nature and nature's biophysical and economic contributions, to symbolic associations, traditional practices and dependence on nature for goods and services. To understand the diversity of values, we summarize the key narratives from different case studies in Figure 4 and in the following paragraphs.

2.1.1 Instrumental values of SEPLS

The SITR case studies identified a large number of instrumental values of SEPLS, which can be roughly characterized as consumptive and non-consumptive uses of nature and nature's contributions. This, in other words, refers to the human use of natural resources – including flora, fauna, water, and soil, to the benefit of the communities within the SEPLS. Almost all the case studies recognized the values of different productive landscapes, including forests, agricultural and coastal areas, either under *importance* or *preferences*. Examples include provisioning of food (Chapters 6, 7, 10, 11, 12), fuelwood, water (Chapters 3, 5, 7), fisheries (Chapters 2, 9), wild food and medicines, education and tourism (Chapters 9, 12). In general, there is strong overlap between *importance* and *preferences;* however, authors argue that some of these NCP, e.g. locally grown organic food (Chapter 3) and locally produced honey (Chapter 7), are favored over market or farm-based supplies. Similarly, some studies further mention the *preference* of particular production landscapes, e.g. rice terraces (which produce food and tourism revenue) over forests (Chapter 11). Importantly, most of these values are easily quantifiable, either in economic or biophysical terms, and therefore also find mention under *measures*. Examples include quantity of fish catch, food production, water quality and quantity, and species richness, which also determine the productive functions of SEPLS.

2.1.2 Relational values of SEPLS

Relational values with nature are dependent on cultural, community, or personal identities. Therefore, these values are unique and place-specific, unlike instrumental values. Authors identified a number of relational values across the case studies, often citing different community experiences, customary practices and symbolic/iconic values of nature. Within the identified relational values, those related to

principles account for a large portion, including forest rights and the right to self-determination of indigenous communities (Chapters 3, 12), sense of place/place-attachment (e.g. ancestral land, heritage, Chapters 3, 5, 7, 11), and sacred landscapes and religious significance (Chapters 11, 12). At the same time, authors reported on the *importance* of relational values in spiritual well-being (Chapters 3, 11), quality-of-life and way of life (Chapters 2, 3), place-attachment (or place rootedness) and traditional knowledge (Chapters 5, 6), all of which are highly valued by local communities. With regards to *preferences*, studies mentioned the aesthetic qualities of SEPLS, including opportunities for recreation (e.g. Chapters 2, 7), spiritual satisfaction (Chapters 11, 12) and sense of heritage (Chapter 3), as important values that are preferred by the communities, in contrast to an altered state. It is, however, difficult to quantify relational values through an appropriate non-economic measure. Authors, nonetheless, identified some indirect ways (proxy) to measure relational values. These include, but are not limited to, transfer of traditional knowledge (Chapter 11), number of tourists visiting SEPLS (Chapter 3), and number of young people returning to the SEPLS (Chapter 9).

2.1.3 Intrinsic values of SEPLS

Intrinsic values of SEPLS are values that are inherent to a particular landscape, or a combination of mosaic landscapes, that are not related to any human values involved in the landscape. These values are often articulated by people however to accommodate several planetary concerns, worldviews and general perceptions. For example, healthy forests have a inherent value, but are considered by stakeholders to contribute to biodiversity conservation and maintain the global climate. Within the case studies, we observed a general and homogeneous mention of intrinsic values. For instance, biodiversity conservation was referred to by several authors as an intrinsic value of their respective

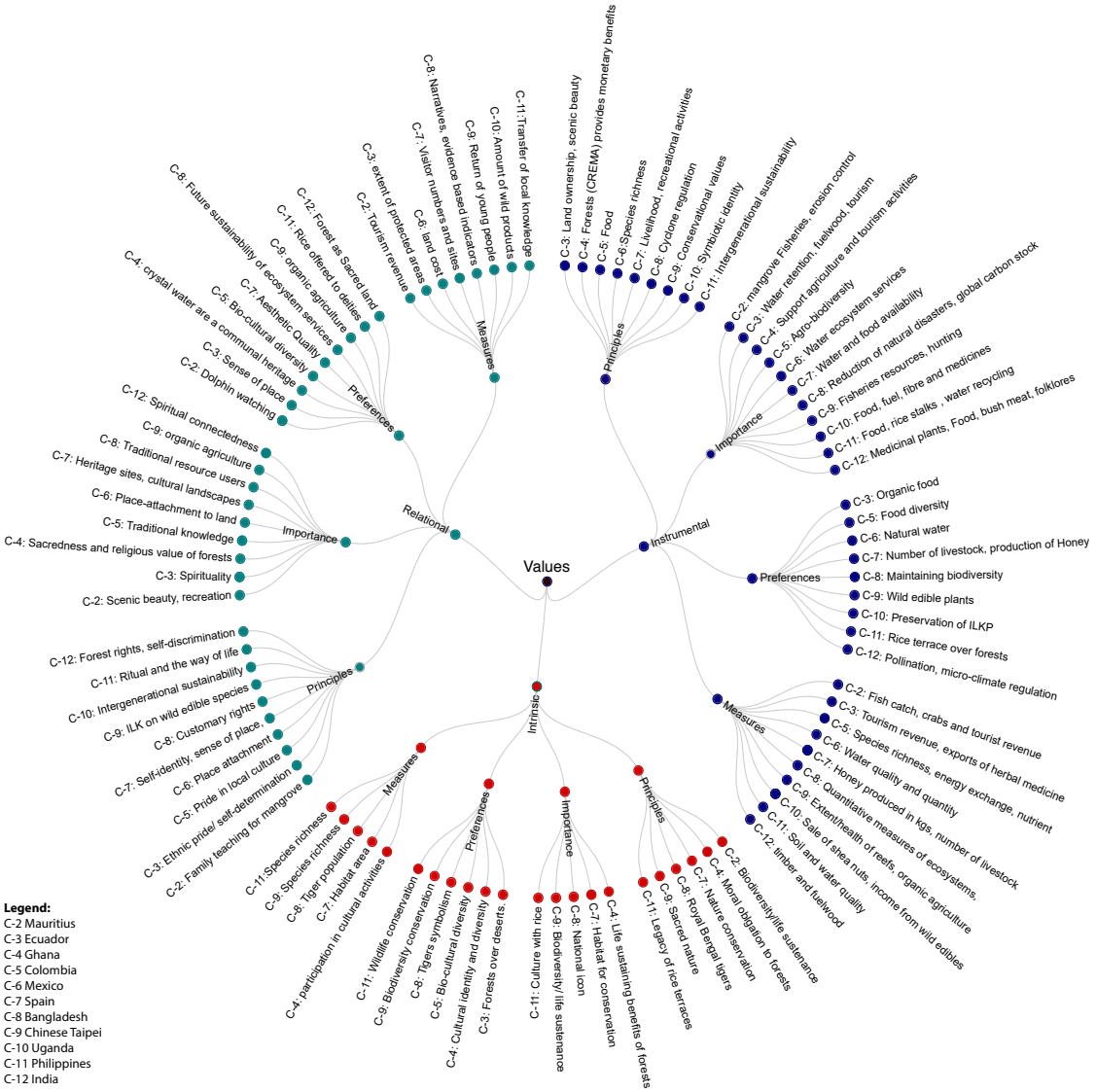

Figure 4: Diversity of Values in SEPLS captured through case studies of SITR Volume 5

SEPLS, which falls under *principles, measures* as well as *importance* (Chapters 3, 6, 8, 9, 11). An example provided in Chapter 8, identifies the protection of Sundarban mangroves in Bangladesh as facilitating conservation of the tiger, which is both a national icon and globally threatened species. Similarly, in Chapter 11, authors mention the legacy of rice terraces and their positive impacts on culture and life, which are certainly not limited to the SEPLS, but also contribute to the larger bio-cultural diversity of the region and the country. The identified intrinsic values, however, tend to be instrumental and relational values of SEPLS. Nevertheless, this value identification exercise shed light on how the understanding of multiple values of nature can directly contribute to decision-making and sustainable management of SEPLS.

2.2 Sustainable use and multiple values in SEPLS

Sustainable use of resources in SEPLS is typically influenced by the actions of different stakeholder groups that operate or exert influence in the area; the types of decisions that are made on use and management of the landscape or seascape; the presence of formal and informal institutions that enable inclusive governance and bridging between divergent perspectives and identify least harmful trade-offs; and the socio-political contexts wherein the stakeholders operate, including legal frameworks and power dynamics of political ecology at various levels of governance. A schematic representation of this interplay of factors is illustrated below in Figure 5.

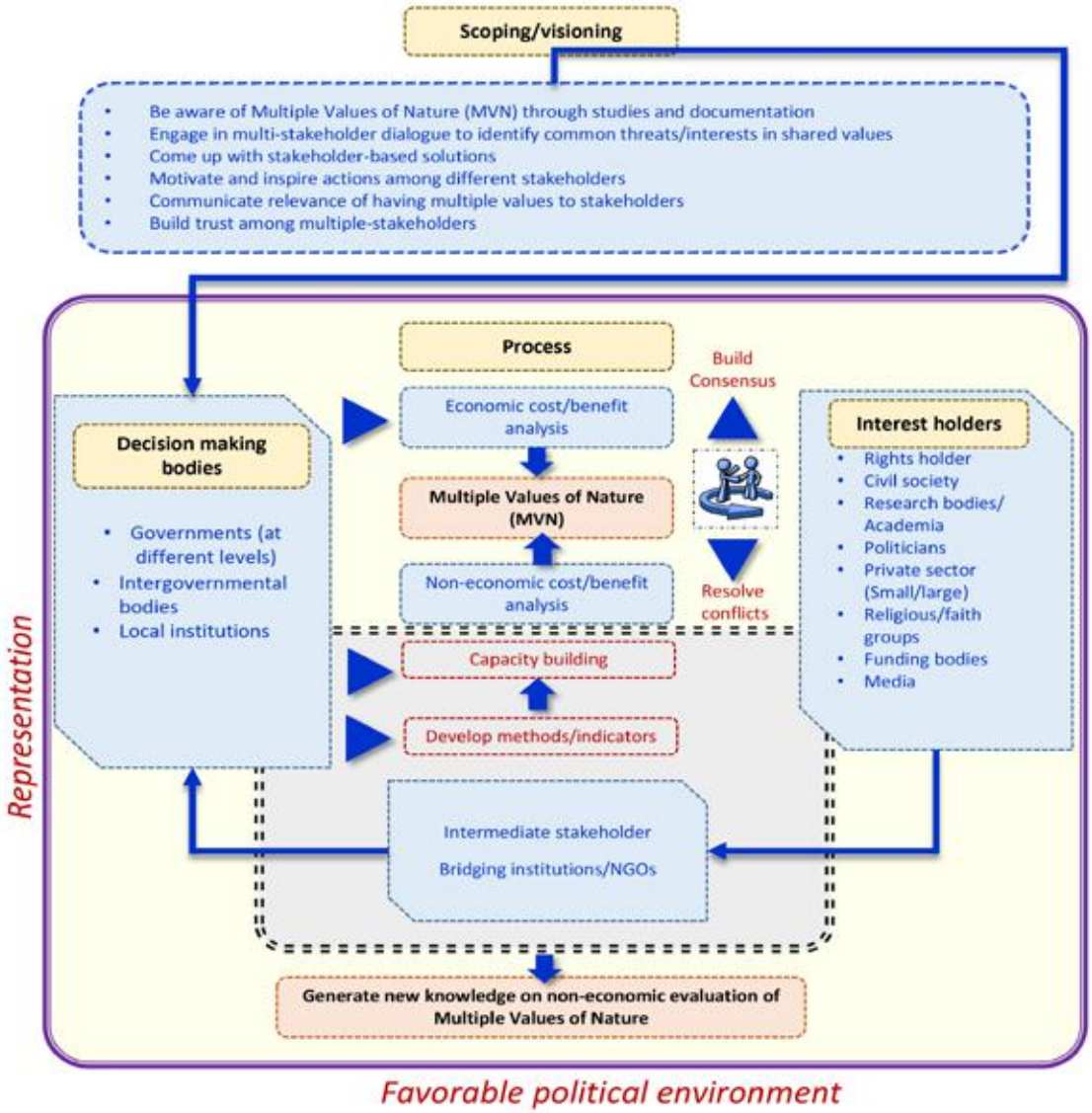

Figure 5: Schematic representation of process that could be adapted to ensure the integration of multiple of values in decision-making related to SEPLS

The figure highlights that within a socio-ecological context, and within particular socio-political environments, several interest holders are present, some being direct stakeholders, while others have an influence on decisions made within the system. These actors interact in various ways and express their priorities to use and manage resources and the landscape, leading to consensus-based outcomes or conflicts. In either case, resolution towards a cooperative outcome is desired and requires active involvement of dominant decision-making bodies (from customary bodies to local governments to higher levels of governance). The case study experiences point out that in order to ensure desirable outcomes for both biodiversity and people, it is essential that these decision-making bodies represent multiple interests and ensure the full and effective participation of all relevant interest holders in the consensus-building process. Acknowledging that this is not common practice, it is clear that appropriate methodologies to capture multiple values of nature are required, and the capacities of those involved in negotiations and decision-making processes need to be built to undertake such plural approaches to decision-making on use of SEPLS. Affinities and congruences are needed also with the decision-taking bodies at the local level, who have to strongly back the making of decisions in faraway legislative contexts and adapt them to situated actions.

3 Stakeholders and Decision-Making Contexts In SEPLS

Decisions relating to use and management of SEPLS are made as a result of different interactions between stakeholders – either hierarchical when dominant actors prevail, or deliberative where more inclusive interactions result in decisions reflecting the concerns from several actors. In the SEPLS context, decisions are made across different levels – administrative, geographical and cultural – by stakeholders who share interests and concerns on either governance, biophysical or social issues (see Fig. 6).

3.1 Decision making process

The process of decision-making, however, is not a neatly boxed process and is often iterative and influenced by several dynamic factors that change over time. Decisions may be made for different time scales that reflect visions for well-being and occur within particular social, political and legal contexts – this implies that if the law decrees a particular form of cultivation, or if there is a situation of political unrest, the choice of production methods would be in line with these contexts, rather than aligned to ecological principles or social preferences of the local community. Unlike climate factors that are changing at planetary scale, the political, religious or economic climates are changing sporadically or ephemerally (Sarmiento 2017) which affects the micro-economic dynamics on the local markets. This reaffirms the need to ensure context specific planning (whether economic or landscape planning) with sufficient focus on bio-cultural specificities. On the positive side, social preferences have resulted in diversity and specialization in produce and products from SEPLS (Gu & Subramanian, 2012; SITR Vol. 3, UNU-IAS & IGES 2017; SITR Vol. 5 case studies). At the local level, decision-making is influenced by cultural factors and by concerns of income and various development needs (SITR Vol. 4, UNU-IAS & IGES 2018; SITR Vol. 5 case studies). When government policies, social preferences and the priorities of local populations are in accordance, evidence shows that the likelihood of achieving sustainability-related goals of economic prosperity, social equity and conservation of natural resources is higher.

3.1.1 Decision-making contexts

The decision-making contexts identified from the case studies include:

1. Formal or informal decision-making processes
   Decisions are often made through formal or informal institutional processes, involving local/ traditional

Administrative	Geographical	Cultural
• Global (every country) • International (combination of some countries) • Regional (countries located in same geographical region) • National • Sub-national /Provincial / Prefectural • Local – household, clan/tribes	• Watershed • Landscape • Seascape	• Ethnicity • Tribal • Historical

Figure 6. Levels of decision-making in SEPLS management: Decision-making contexts and stakeholder typology

Table 2: Stakeholders and interest holders in management of SEPLS

Governance	Economic Actors	Ownership and rights holders	Thought leaders	Influencers
• Regional governments (e.g. EU) • National governments • Sub-national / Local governments • Politicians	• Producers / Farmers, Forestry, Fishers • Consumers • Urban residents • Business sector/ Corporations • Tourism sector	• Local communities • Indigenous peoples • Landowners • Local schools/ Children	• Chiefs and elders (traditional leaders) • Religious and spiritual groups • NGOs • Research institutions/ Universities • International Organizations	• Media • Women's groups • Youth • Culinary chefs (Food culture) • Cultural Sector – Artists, Musicians, Fashion Designers, Dancers

leadership and/ or governments. Depending on the strength of institutions and the spatial scale in which they operate, the process may be top-down (led by national or sub-national policy bodies) or bottom-up (led by local institutions), and sometimes involve a mix of legal and customary measures to ensure compliance (Chapters 4, 7, 9, 12).

2. Long-term or short-term focused
Decisions are being made to meet short term objectives, that often focuses on economic interests but less on socio-ecological resilience. Decisions are also being made with a view to ensure long term sustainability of activities and resources. The latter is usually the case where both human wellbeing and natural resource use and management are considered together in planning and management with outcomes that target both conservation and development priorities. It focuses on proactive engagement of the communities and various actors in the upkeep of the landscape. As a consequence, there is considerable reflection and investment on capacity development for youth and various actors in appropriate contexts that are sensitive to stakeholder realities (Chapters 3, 8, 11).

3. Identifying leverage points to promote action
In some cases, monitoring of the outcomes of decisions as a continuous process is considered an important aspect of ensuring a dynamic and flexible approach to landscape management. Some approaches include identifying key performance indicators/ goals; ensuring constantly that the interests of various actors are balanced; that local priorities and international goals are coherent and further, investing in advocacy activities to garner support to implement decisions (Chapters 2, 5, 6, 10).

3.1.2 Stakeholders and interest holders in SEPLS

Stakeholders and interest holders in the SEPLS from the case studies of this volume are identified and summarized as follows (not in any order of importance, nor exhaustive, Table 2):

3.2 How to bring multiple values to decision-making: Reconciling mismatches in values

We identified guiding principles in six mutually-reinforcing tiers that could help bring MVN to decision-making concerning SEPLS, drawing on an analysis of the contents of the eleven case studies, as well as the discussions among the authors and experts during the case study workshop (see Fig. 8). Firstly, it is vital to identify the values of nature that stakeholders share as a common principle (tier 1), which provides the foundation for subsequent actions. Concurrently, and especially when knowledge on MVN is limited, MVN need to be comprehensively documented (tier 2) and shared with key stakeholders (tier 3). Then, stakeholders are able to strengthen collaboration, building on a collective understanding of their common or conflicting interests pertaining to MVN (tier 4). Decision-makers could better understand MVN (tier 5) if they have information on MVN (tier 3) that is specifically and effectively targeted at them, or if they are involved in a collaborative mechanism (tier 4). Landscape institutions (tier 6) that embrace the first five tiers can encourage decision-making that takes fuller account of MVN. Below we describe how these principles and corresponding tools and measures were reportedly useful to address mismatches in the recognition of MVN in decision-making under different contexts (see Fig. 7 and Table 3).

Tier 1. Center on nature's values as a common principle: Communications centering on the values of nature that indigenous peoples and local communities (IPLCs), decision-makers and other stakeholders share as a common principle reinforce the subsequent five tiers. The rights of 'Mother Nature' codified in constitution in Ecuador and Bolivia enabled policy coordination across ministries. Likewise, the recognition of the notion of 'Mother Earth' embedded in the worldview of IPLCs enables conservation actions that resonate with their own values. In a more practical sense, formal institutions that recognize IPLCs' traditional norms,

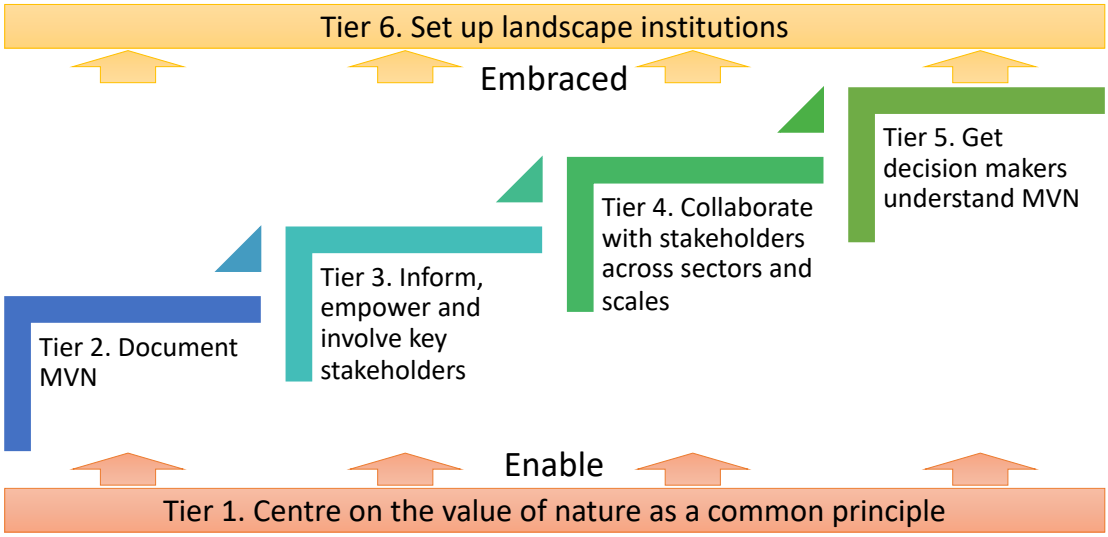

Figure 7. Guiding principles for bringing MVN to decision-making

taboos and customary practices contributing to sustainable land and resource management can encourage IPLCs to become leading actors.

Tier 2. Document MVN: Where information on MVN is not readily available, or the values of one or a few stakeholder groups disproportionally dominate over others in decision-making on SEPLS, it is vital to document MVN as perceived by multiple stakeholders as the basis for informed actions. Often cultural values are vital for IPLCs, but also are implicit and thus tend to be overlooked by decision-makers. Ethnographic or social surveys, as well as 'people's biodiversity registers' (Chapters 4, 10) that record traditional knowledge concerning biodiversity are effective and powerful tools to better understand cultural values. Science and technologies, including economic valuation and laboratory analysis of food nutrition, or multiple evidence-based approaches, can help make such implicit values more explicit and transmissible across stakeholders. The SEPLS Indicators of Resilience are employed to identify multiple values of different landscape components that underpin landscape resilience (Chapter 5).

Tier 3. Inform, empower and involve key stakeholders: Participatory and iterative processes to document MVN (tier 2) can effectively inform, empower and involve key stakeholders. Such a process starts with knowing relevant stakeholders, e.g. through stakeholder mapping or institutional capacity assessment. On that basis, multi-stakeholder value elicitation exercises that involve key stakeholders in documenting MVN help them build collective understanding on their common and conflicting interests in nature's values (Chapter 3). Participatory biodiversity assessment involving local communities is a useful tool to document traditional knowledge on species or lands, and thereby to provide communities with an opportunity to rediscover the intangible values of nature. Community-based ecotourism enterprises turn intangible values of nature into tangible ones for local communities through tourists' payments. Often youth involvement is a key issue for the sustainability of SEPLS, as youth are increasingly leaving SEPLS, mostly in rural settings, for higher education and income in cities (Chapter 11). Tablet-based virtual modules on indigenous people's life and knowledge, combined with real exchange visits between indigenous and urban youths, are effective to transfer indigenous knowledge and values of nature across generations and spaces.

Tier 4. Collaborate with stakeholders across sectors and levels: Focused efforts to inform, empower and involve stakeholders (tier 3) can lead to their mutually reinforcing relationships. Strategic interventions, such as participatory project appraisals and communication strategies to build mutual trust, are likely to yield enhanced collaboration among stakeholders across sectors and scales (Chapters 2, 4, 5, 9).

Tier 5. Get decision-makers to understand MVN: One way to convince decision-makers on MVN is to involve them in a collaborative scheme (tier 4). It also was found effective to target specific policies or decision-making bodies to influence. Such approaches include continuous dialogue with the government authority that holds the highest stake, e.g. fisheries department for seascape management, and providing an evidence base for formulating a results payment policy. Comprehensive reports on MVN, such as the case studies provided in this volume, can also be useful to make decision-makers understand MVN.

Table 3. Tools and measures that were found helpful to follow the six tiers and the key mismatches addressed, drawing on the cases reported in this volume

TOOLS AND MEASURES	KEY MISMATCHES ADDRESSED
Tier 1. Center on nature's values as a common principle	
• Rights of 'Mother Nature' codified in constitution (C-3) • The notion of 'Mother Earth' embedded in indigenous people's world view (C-3, 5, 6) • Reinvigorate traditional norms, taboos and customary practices (C-4, 8, 12)	• Encourage policy coordination across ministries • Connect the principles held by local actors with conservation efforts
Tier 2. Document MVN	
• Ethnographic/ethnobotanical/social surveys (C-3, 6, 7, 11); people's biodiversity register (C-12) • Laboratory analysis of wild edible plants (C-10) • Multiple evidence-based approach (C-8) • Resilience assessment (C-5, 12)	• Understand different value perceptions and priorities among stakeholders; increase understanding of cultural values that encompass traditional knowledge and indigenous people's worldview • Provide scientific evidence on the nutritional value of traditional food from the wild • Integrate scientific and traditional knowledge to demonstrate value plurality • Understand the functions and values of different landscape components that underpin landscape resilience
Tier 3. Inform, empower and involve key stakeholders	
• Stakeholder mapping (C-7); institutional capacity assessment (C-9) • Multi-stakeholder value elicitation exercise (C-3, 4, 9); participatory biodiversity assessment (C-4) • Community-based ecotourism enterprise (C-12) • Contextualized tablet-based module (C-11) • Indigenous and urban youth exchange programme (C-11)	• Identify relevant stakeholders and their capacities and relationships • Build collective understanding on common and conflicting value perception that provides the basis for collective action; document and revive traditional knowledge • Provide an alternative livelihood and raise awareness of instrumental value of nature • Make indigenous youth better aware of the value of their traditional knowledge and distinctive culture; familiarize urban youth with indigenous culture
Tier 4. Collaborate with stakeholders across sectors and scales	
• Participatory project appraisal and governance (C-2, 4, 5) • Build mutual trust and communication strategy (C-7)	• Reconcile conflicting interests and draw on capacities of various stakeholders • Address communication gaps among stakeholders
Tier 5. Get decision-makers to understand MVN	
• Involve decision-makers in collaborative scheme (C-4) • Targeted lobbying (C-2) • Identify policy to influence, e.g. results payment (C-7) • Present case study paper to the government authorities and other stakeholders	• Encourage decision-making backed by better knowledge on MVN • Provide evidence base for a financial mechanism • Enhance understanding on different value priorities and interests among stakeholders
Tier 6. Setup landscape institutions	
• Multipurpose cooperative (C-2), CREMA (C-4), participatory governance scheme (C-5); CCA (C-12) • Category V protection complying with IUCN guidelines (C-3) • Multi-stakeholder platform that engage stakeholders across borders and sectors, landscape action plan (C-9)	• Effective landscape management–encourage autonomous action and complement government's limited capacity • Integrate cultural aspects into conservation efforts • Encourage coherent policies and actions across sectors and borders

Tier 6. Set up landscape institutions: Institutional arrangements for sustainably managing SEPLS are found across the world. These can take various forms, such as the community resource management areas (CREMA) in Ghana (Chapter 4), the community conservation areas (CCAs) in India (Chapter 12) and the participatory governance scheme proposed in Colombia (Chapter 5). Such landscape-level institutions that embrace the first five tiers can ensure decision-making that takes fuller account of MVN. Along this line, some practical tools were identified such as the IUCN Category V protected areas proposed in Colombia and the multi-stakeholder platform that engages stakeholders across sectors and community borders in Taiwan.

4 Challenges and Gaps in Incorporation and Conclusions

The major challenges identified in the case study experiences that continue to impede efforts in taking up pluralistic approaches to managing SEPLS include :

1. Insufficient attention to capture MVN
   Efforts and methodologies to capture and build on MVN for the management of SEPLS are still not widely deployed. The case studies presented in this volume illustrate a wide variety of means to capture MVN. However, they mostly are still progressing to involve a more comprehensive set of stakeholders and to embed MVN in policies and actions. The frameworks and process need continuous improvement to encourage the participation of a wider range of stakeholders, to accommodate their diverse perspectives, and to present such information to decision makers in a concise manner. More participatory and inclusive approaches that involves co-learning methods need to be encouraged to ensure more effective and equitable management of SEPLS.

2. Asymmetric capacities of different stakeholders
   This relates to differences in the knowledge and understanding of MVN and further indicating a need to develop appropriate communication strategies and awareness among stakeholders on the benefit of inclusive planning and management, methods to negotiate between conflicting values and importantly, identify expertise and resources to undertake such comprehensive approaches to capacity building.

3. Incoherence in policy and governance framework
   Policies are often sector oriented and governance framework is diverse and fragmented resulting in loss of opportunities to synergize and achieve inter-related objectives. This calls for urgent policy action to ensure policy coherence across multiple levels of governance.

Experiences from the cases show that the efforts for recognising and incorporating multiple values in decision-making build vital enabling conditions for the sustainable management of SEPLS. This is because such efforts engage and compel multiple stakeholders, at and/or across local, national, and global levels, to promote better understanding of and take into consideration each other's perspectives and interests towards use and management of resources in the landscape and towards well-being priorities. This increases the likelihood of obtaining more equitable outcomes. It also helps to identify what resources are required to achieve different parameters of a good quality of life for the population, especially if those are indigenous peoples rooted in ancient ritualized traditions of landscape stewardship.

At the policy level, such approaches help harness local perspectives and inform high level policy-making that is sensitive and better aligned to local contexts. They help refocus benefits of production and conservation activities from merely economic gains to economic-plus benefits, including intangible ones such as sense of place and livelihood security. Such plural approaches to capturing benefits from landscapes also bring to attention the multifunctional nature of SEPLS that have nurtured human-nature co-existence over time. These approaches enhance synergistic planning and implementation by various policy agencies, enabling policy coherence and inter-sectoral cooperation, forming the basis of the move towards transformative change that is being envisaged globally (IPBES 2019).

Transformative changes are seen as a necessity to shift away from the *status quo* and proactively adopt at multiple levels, measures and approaches that embrace integrated planning and implementation and are respectful of the rights, responsibilities and equity of all stakeholders. Applying SEPLS approaches for integrated and holistic management could provide the opportunity and platform for different stakeholders and interest holders to understand MVN, thereby spurring them to bring about transformative change for biodiversity conservation, thus improving resilience of their landscapes and seascapes, and ultimately progress towards the global target of a society in harmony with nature.

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Chapter 2

Recognising the local values of coastal wetland biodiversity for sustainable economic and livelihood development at Résidences La Chaux *'Barachois'*, Mauritius

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Abstract

Barachois features Mauritian historical seascape, which is composed of brackish water lagoons enclosed by stone walls traditionally used for fish raring under French rule before 1800, as well as patches of mangroves and coastal woodlands surrounding the lagoons. They, however, are now mostly abandoned and turned into waste dumping ground. The Environmental Protection & Conservation Organisation (EPCO) initiated a community-based project to pilot the restoration of the *barachois* seascape that enhances its socio-economic, cultural, aesthetic and environmental values and thus to improve local people's livelihoods and promote biodiversity conservation. As a part of the project appraisal and implementation process, the project investigated multiple values that stakeholders in the target community associate with the *barachois* seascape by household surveys and focus-group discussions. All stakeholder groups that we investigated, i.e., fishers, tourist boat skippers, women, youth and elders unanimously noted the importance of the two major functions of the *barachois* seascape. These were shelter against coastal hazards such as cyclones and storms; and fish reproduction. *Barachois* also produces crabs, which were mainly harvested by youth for household consumption. Some value aspects were perceived differently among stakeholder groups. Tourist boat skippers appreciated the value of the *barachois* waterbody and endemic birds as tourist attractions. Women and elders tended to appreciate the beauty of the seascape and animals. Women emphasized the importance of *barachois* for children to learn swimming and to understand natural environment. The recognition of the values that *barachois* seascape entails for the local community enabled the project to draw stronger commitment of a wide range of stakeholders to the restoration of *barachois* and sustainable resource management in it, resulting in the establishment of a local cooperative. This process has improved local decision-making capacity and will contribute to the harmonization of legislation in the future.

Keywords: Barachois; Local Values; Wetland Biodiversity; Restoration; Mauritius

Country	Republic of Mauritius
District	Grand Port
Size of geographical area[1]	Approximately 70 hectares
Number of indirect beneficiaries[2]	2,140 persons (Local community)
Dominant ethnicity	Creole
Size of case study/project area[1]	70 hectares
Number of direct beneficiaries[2]	115 persons (number of residents who gain additional income by conducting on-the-ground project activities)
Geographic coordinates (longitude and latitude)	20°25'01.6"S 57°42'52.7"E
Dominant ethnicity	Creole

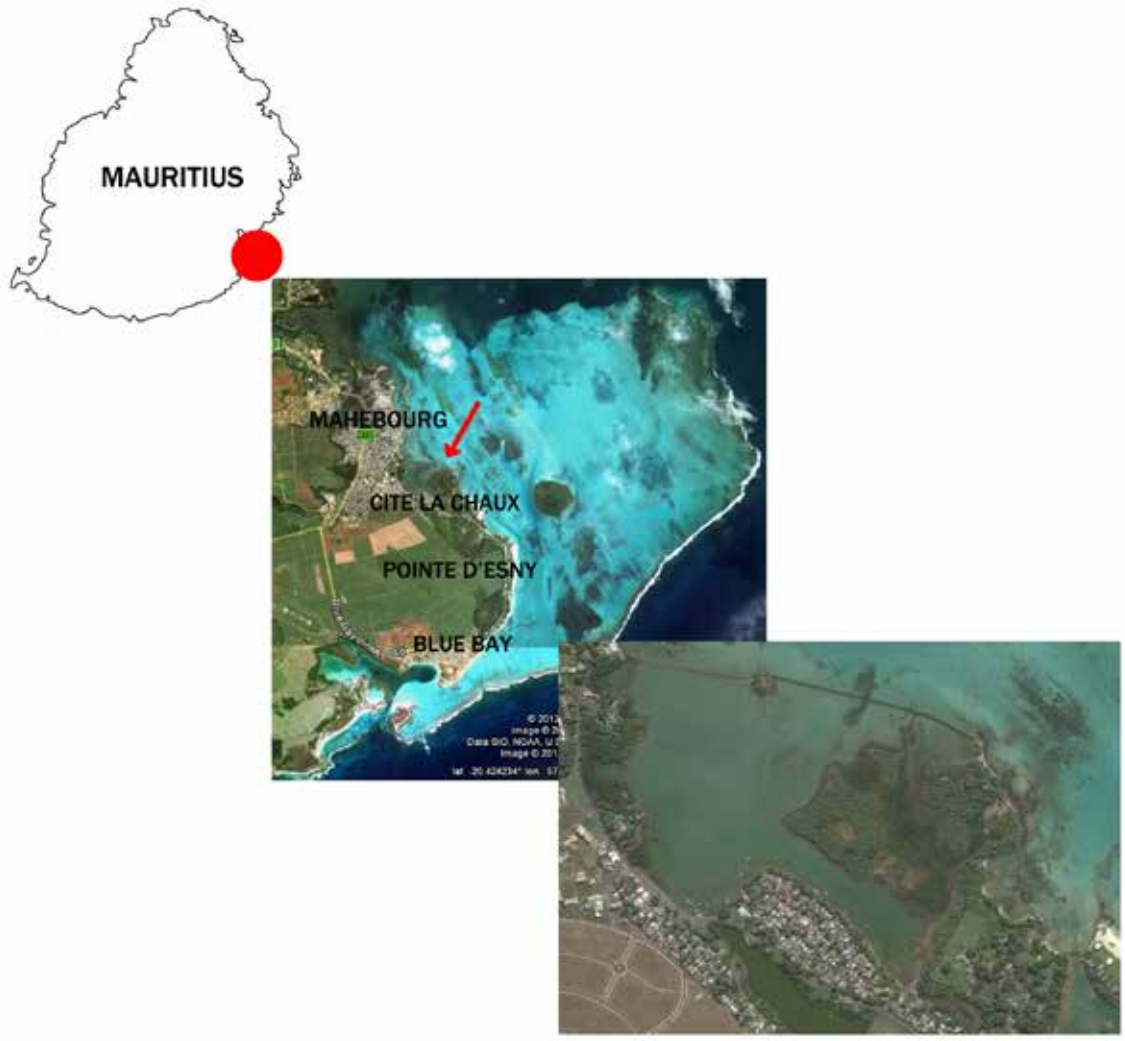

Figure 1. Map of the country and case study region

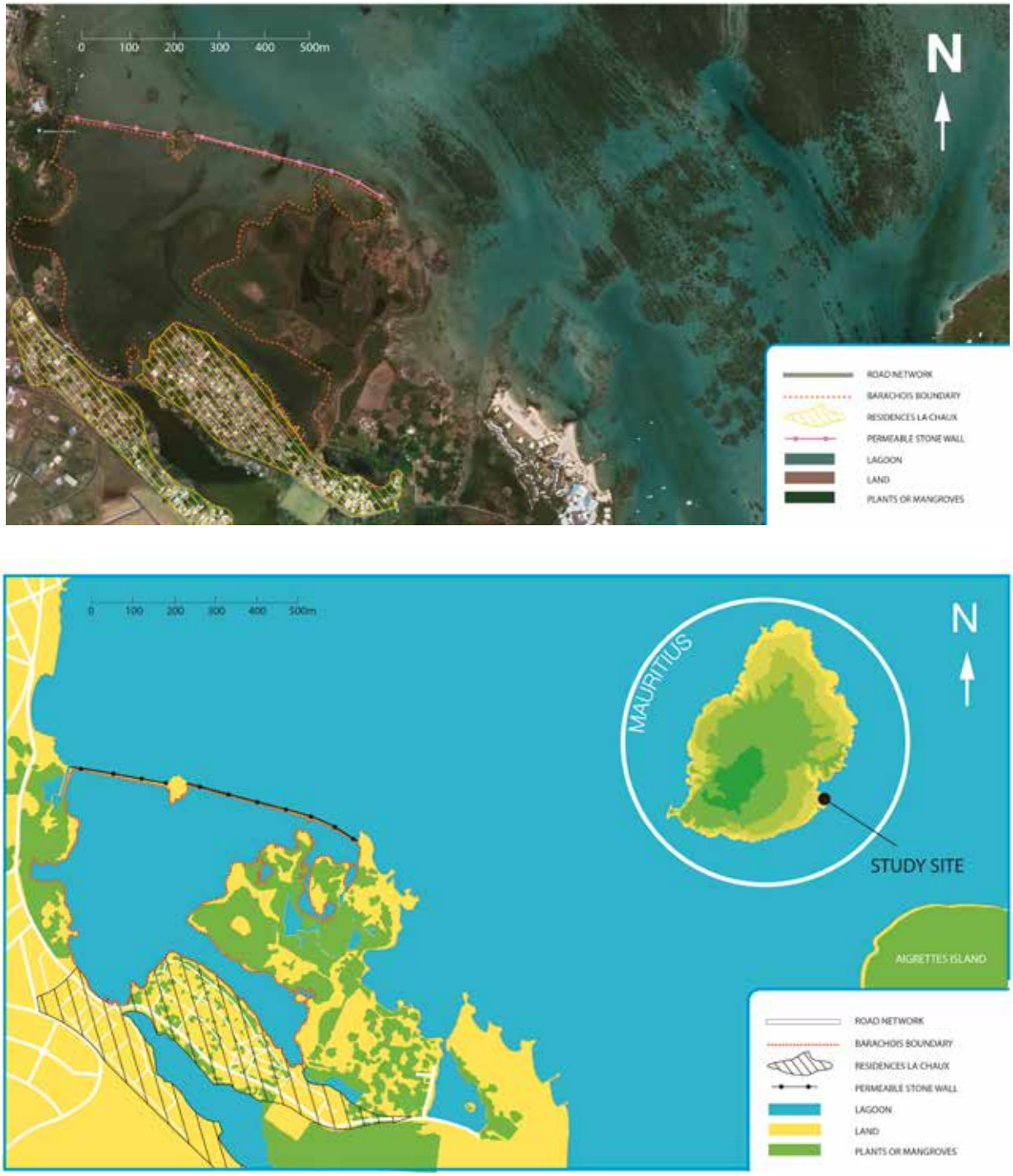

Figure 2. Land/sea use and cover map of case study site

1. Introduction

Although threatened, wetlands constitute some of the most important ecosystems on earth for biological, hydrological, socio-economic, cultural and aesthetic reasons (Terer, Ndiritu & Gichuki 2004). Fish, clay, fibre, water supply and purification, nutrient retention, coastal protection, climate and flood regulation, recreational opportunities and tourism attractions are wetland ecosystem services that enhance human well-being and livelihoods (Gayatri 2000; Oglethorpe & Miliadou 2000). Wetland ecosystem goods and services are essential for sustaining livelihoods (Costanza et al. 1997), particularly in developing countries where local communities are highly dependent on natural resources.

However, it is estimated that more than 50 percent of wetlands worldwide have been degraded or lost in the past 150 years (O'Connell 2003) due to anthropogenic factors primarily resulting from a lack of awareness of their ecological and socio-economic value (De Groot, Wilson & Boumans 2002; Terer, Gichuki & Ndiritu 2005). Environmental degradation occurs worldwide and tends to create severe economic and social impacts resulting in ecological conflicts (Armiero & Sedrez 2014; Martinez-Alier, Temper & Demaria 2016). Conflicts are the consequences of differing perceptions of value by different groups of stakeholders. Reaching consensus among all stakeholders on multiple values is often neglected in the decision-making process (Iniesta-Arandia et al. 2014; Phelan & Jacobs 2016; Villegas-Palacio et al. 2016). It is thus critical for decision-makers to recognize and integrate the values perceived differently by all stakeholders to ensure effective and sustainable wetland conservation and management planning.

In Mauritius, *barachois* are marine coastal wetlands and refer to parts of coastal lagoons established for fish rearing and segregated from the ocean by permeable stone walls, mostly constructed before 1800 under French rule (Paul & Balkema 1987). *Barachois* are Mauritian coastal socio-ecological systems, with rich biodiversity and productivity characterized by complex brackish water ecosystems. They have become increasingly abandoned mainly due to management difficulties and have been turned into waste dumping sites. In 1965, the Ministry of Fisheries took the *barachois* of Mahebourg and started aquaculture experiments using fish, crabs, prawns and oysters (see Fig. 3). Only for experimental purposes, the effort did not provide any benefits to adjacent communities. Subsequently, there were frequent incidents of poaching by local people, regardless of fences and patrols by security guards and dogs. The experiment was terminated in 1985 when someone poisoned the *barachois* waters. This case clearly revealed that the decision-making process of the *barachois* restoration planning, which was carried out by governmental agencies and experts without community participation, had led to ineffectiveness and unsustainability.

Figure 3. Aerial view of Mahebourg barachois (Photo by John Olsen)

There are 33 *barachois* along the coastline of Mauritius, located in estuaries or nearby groundwater outlets where complex brackish water ecosystems are formed (Coche 1982). To halt the degradation of these critical ecosystems, and in response to depleting inshore fish stocks, attention is increasing being paid to the rehabilitation and enrichment of *barachois* for boosting aquaculture production and diversifying the livelihoods of local fishing communities (Rawson 1988).

2. The *barachois* project

The Environmental Protection & Conservation Organisation (EPCO) developed a pilot project aiming to implement a sustainable and collaborative *barachois* management model. To make degraded *barachois* seascapes productive and appealing again, the project started with an investigation into the vital role of the seascape in biodiversity, local livelihoods and well-being. In this vein, the project also aimed to alleviate poverty in the fishing community, which was critically important to decrease fishing pressure in the lagoon. The project consists of six major components:

1. Restore and conserve natural resources of the marine coastal wetland;
2. Develop community-based aquaculture in the *barachois* and adjacent mangrove ponds;
3. Build local capacity for management, conservation and sustainable use of natural resources and equip the community with the necessary skills and knowledge in enterprise development;

4. Develop community-based recreational and tourism activities promoting natural, cultural and historical value;
5. Facilitate partnerships between all stakeholders and establish a collaborative management system for the targeted wetland;
6. Strengthen awareness at local, national and global levels of the link between biodiversity conservation and the well-being of local communities.

In order to ensure the effectiveness and sustainability of the restoration interventions, gaining the positive perception and attitude of the local people was crucial, especially fishers who are the main resource users living in the vicinity of these wetlands. Although often neglected by the national government, integrating local values into restoration design and planning is critical to ensure success. This study addresses this gap and presents an overview of the approaches that aimed to examine the multiple values perceived differently within and among different stakeholder groups. It also explains how an understanding of multiple local values was integrated into the planning and design phase of the project, leading to improved community participation, support and engagement.

3. Methods

3.1 Study site

The study site is located on the south-eastern coastline nearby Mahebourg, within the district of Grand Port, on Mauritius Island (see Fig. 1). It includes the *barachois* waterbody (24ha), mangrove and dry scrub forests (13 and 6 ha), and the adjacent coastal community (18ha) and extends to an islet and coral reef lagoon (app. 10 ha, see Fig. 2).

The *barachois* area had been abandoned for more than 30 years. At the start of the project, the permeable stone walls had collapsed due to waves. The degradation continued with an increasing volume of solid waste being dumped there by the local people. Portions of mangroves had been damaged or cut down. Although some endemic and native plant species were observed, such as the portia tree (*Thespesiapopulnea*), beach cabbage (*Scaevolataccada*), pemphis (*Pemphisacidula*) and the critically endangered endemic *Polysciasmaraisiana*, a widespread invasive alien plant scrub was noticed in the surrounding coastal lands (Atkinson 2017).

Approximately 2,140 local people, including 607 children, inhabit the coastal community of Résidences La Chaux, where 551 households live in 356 houses (Déja 2017). Disadvantaged by their Creole origin and past migrant history (i.e. under French rule from 1715 to 1810 and British from 1810 to 1968) (Hollup 2000), the coastal fishing community has limited access to decent job opportunities, financing and government support. The predominant livelihoods for men are artisanal fishing and construction labour. Livelihood opportunities are even less diverse for women, as 46 percent are housewives, 10 percent multifunctional maids and 6 percent cleaners. Low education level and a lack of skills and qualifications are additional reasons resulting in this low job diversity. Finally, about 30 percent of the workforce is engaged in the fisheries and tourism sectors, which directly utilize natural capital in the Mahebourg coastal ecosystems (Déja 2017, see Fig. 4).

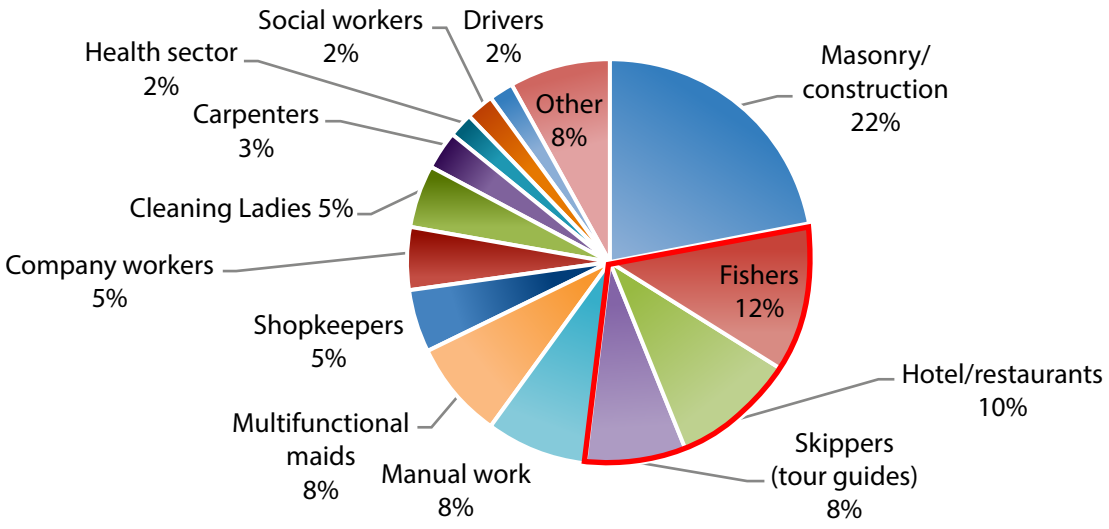

Figure 4. Major occupations of Résidences La Chaux community members (Déja 2017)

The coral lagoon outside the *barachois* harbors economically important marine vertebrate and invertebrate species (Appendix 1), and is used as the main fishing ground by local artisanal fishers. However, the abundance of lagoon corals and fishes has been in continuous decline as recorded since 1970 (Fagoonee 1990). The causes of fish catch decline and degrading lagoon ecosystems include: overfishing; past use of explosives for fishing; coral collection for ornaments and construction; water pollution by outflows from massive sugar cane fields, and sugar factory and domestic water discharges, among others (Rawson 1988; Fagoonee 1990; Hollup 2000). Declining fish catch has further exacerbated the struggling economy of the fishing community. Moreover, the government sets the bar high for new fisher licensing, making it virtually impossible for youths to operate as "legal fishers".

3.2 Data collection

In this context, to achieve restoration and conservation, the project's targets and activities needed to be valued and approved by all groups of the community. Ensuring positive local perception and attitude toward the project was considered to be critical before starting any on-the-ground restoration interventions. We employed multiple methods to comprehensively understand the value that local people associate with the *barachois* seascape. For baseline data gathering and building trust in the local community, we carried out surveys and a series of community consultations. For value elicitation, we used focus-group interviews. Furthermore, we conducted key-informant interviews with government institutions that have a stake in the Mahebourg *barachois* to gather data on the governance scheme. The scope of our analysis included the three major ecosystem domains that constitute the seascape, i.e., the *barachois* waterbody inside the stone walls; the lagoon outside the *barachois* and within the coral reef margins; and a mosaic of mangrove and coastal dry scrub vegetation patches along the *barachois* water fringes. Prior to the on-site data collections described above, we also conducted an online survey to inform the development of the field methodology.

3.2.1 Surveys and community consultations

Throughout the project, we conducted a series of surveys and community consultations to accumulate baseline data and to accommodate the reality, needs and aspirations of the local community in the project design and implementation process. These included a household survey, fishers' survey and community feedback sessions.

A questionnaire survey was conducted for fishers from March to July 2016. A total of 49 fishers participated, representing 80 percent of all fishers in the target community. The survey asked both closed and open-ended questions, falling under eight question groups: (1) socio-economic attributes; (2) income from fishing; (3) income from other activities; (4) location of fishing; (5) fishing gear type; (6) state and trend of fish catch; (7) interactions with other stakeholders; and (8) perception of and expectation for the project (Déja 2016).

We also conducted a household survey from June to December 2016. In this survey, we interviewed 76 households, which represent 14 percent of all households in the target community. The survey asked closed and open-ended questions falling under seven sections: (1) socio-economic attributes; (2) income; (3) education and skills; (4) perception of and willingness to participate in the project; (5) perception of own community and surrounding environment; (6) use of coastal resources; and (7) views on the management of the *barachois* seascape (Déja 2017).

Alongside, we held regular consultations with the local community between February 2016 and March 2019. These meetings covered various topics, including feedback on survey results and focus-group discussions. As needed, we employed participatory appraisal methods, such as transect walks and boat trips. The utmost effort was made to involve as many community members as possible using various communication methods, such as direct letters, information panels at gathering places, distribution of calendars and by word of mouth.

3.2.2 Value elicitation

We conducted focus-group interviews to elicit the values that different stakeholder groups associate with the *barachois* seascape. We identified five stakeholder groups to represent the community, i.e., fishers, skippers, women, youth and elders (see Table 1), referring to the household survey results. In each focus group interview, we developed an exhaustive list of values that the participants associate with the *barachois* seascape based on the nature's contributions to people (NCP) framework (Díaz et al. 2018). We then asked participants to rank the importance of each value item using a ten-point scale, i.e., 1 (unnecessary) to 10 (indispensable). The NCP framework evolved from the ecosystem service categories used in the Millennium Ecosystem Assessment (2005), but more explicitly captures the non-materialistic values that people perceive through their interactions with nature. Hence, the NCP framework is suitable for understanding how people in the target communities perceive the value of nature through their day-to-day interactions with the surrounding *barachois* seascape.

Table 1. Stakeholder groups and their attributes

Groups	# participants	Attributes
Fishers	8	Aged between 33 to 66, all male
Skippers	12	Aged between 15 and 60, all male, mainly engaged in taking tourists to islets and off-shore tourist spots
Women	8	Aged between 15 and 60, occupations varied, including maids, social workers, housewives and an EPCO employee
Youth	14	Aged between 15 and 25, 12 males and 2 females. Occupations varied, including fishers, skippers, construction workers, hotel workers, housewives and students.
Elders	7	Aged between 55 and beyond 61, four males and three females
Total	49	Aged between 15 and 66, 36 males and 13 females

3.2.3 Governance

To collect information on the institutional setting and policies relating to *barachois*, we conducted key-informant interviews with the public authorities that have a stake in the *barachois* seascape. These included the Ministry of Social Security, National Solidarity and Environment and Sustainable Development (MSSNSESD); Ministry of Agro-industry and Food Security (MAIFS); Ministry of Ocean Economy, Marine Resources, Fisheries and Shipping (MOEMRFS); and the Mahebourg Fisheries Post.

4. Results

4.1 Multiple values of the *barachois* seascape

Through key-informant interviews, we identified multiple values that local people attribute to the *barachois* seascape and species present in the study area, as well as their linkages with different components within the study area and the NCP categories (Figure 5). Results highlight that food and feed (NCP 12) was the value commonly derived from all ecosystem domains. Other values included

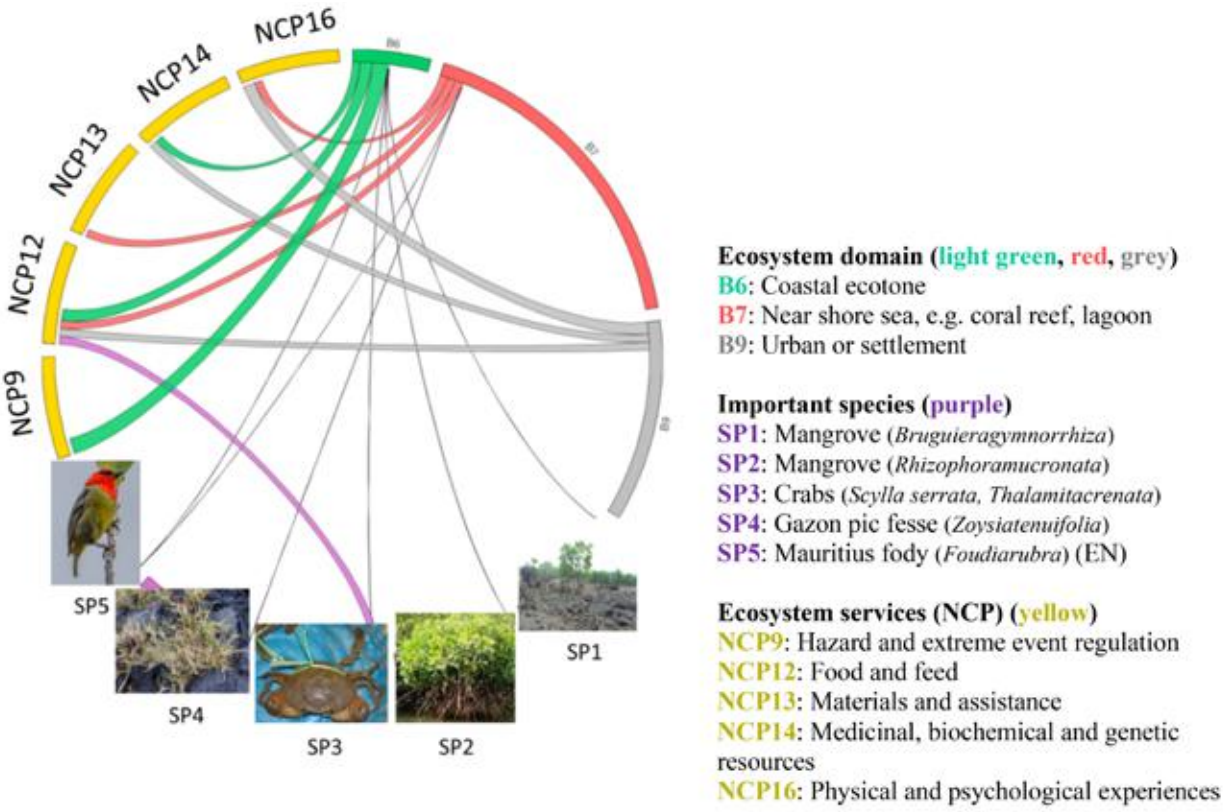

Figure 5. Connection between ecosystem domains, species and ecosystem services (NCP). The top-right arcs show the area of different ecosystems in proportions; the bottom arcs, the species present in these ecosystems that were recognized as important either for biodiversity conservation or for local people (connected to their habitat ecosystem domains by thin lines); and the top-left arcs, the value of these ecosystems and species for local people per the NCP categories (connected to the ecosystem domains and species from which these values are derived).

mitigation of storm and cyclone hazards (NCP 9) and medicinal ingredients from mangrove tree roots (NCP 14), derived from the mangrove ecosystem. Likewise, sea urchins and shells for ornament crafts (NCP 13) from the lagoon, and recreation for local people and tourists (NCP 16) was linked to the *barachois* and lagoon. We also found that commodities brought in from outside the seascape and opportunities for recreation available within the town were also important for the local community.

Focus-group interviews revealed the differences in the values that the five stakeholder groups attribute to the three ecosystem domains: coastal ecotone, near shore sea, and urban or settlement (see Table 2; Fig. 6). All five groups pointed to the importance of mangroves as nursing grounds for fish, through the provision of nesting sites, shade and protection from predators. The fishers' group stressed the undiscovered value of *barachois*, as they are still learning how to wisely utilize the site.

Table 2. Description of the values that five community groups associated with three ecosystem domains in the barachois seascape

Ecosystem	Species	NCP category	NCP description	Beneficiaries
Mangrove		01.Habitat creation and maintenance	Nursery for juvenile fish, crabs and shrimps -mangroves protect them from predators and provide shade to keep water temperature stable. Bird nests in mangroves. Important for maintaining all elements people obtain in coastal sea (maintain coastal ecosystem functioning)	Fishers
		07.Regulation of freshwater and coastal water quality	Filtration of water	
		08.Formation, protection and decontamination of soils and sediments	Prevents erosion	Whole community
		09.Regulation of hazards and extreme events	Barrier against cyclone/storm waves, surge and wind	Fishers and skippers
		15.Learning and inspiration	Parents teach their children not to cut mangrove trees	
		16.Physical and psychological experiences	Beautiful scenery -tourists visit to take pictures	Tourists
		17.Supporting identities	Beauty (seascape)	Whole community
	Mangrovetree (*Bruguieragymnorrhiza*; *Rhizophoramucronata*)	14.Medicinal, biochemical and genetic resources	Mangrove roots used as medicinal ingredient for diabetes treatment	Whole community
	Crabs	12.Food and feed	Supplemental food for local people (Kids collect crabs at night and sell them for pocket money)	Whole community
	Fish, shrimp, worms, small crams/snails, algae, crabs	12.Food and feed	Baits for fishing (fish, shrimp, worms, etc.)	Fishers
Barachois		09.Regulation of hazards and extreme events	Safe place to keep and repair boats. Boats owned by hotels are kept in the *barachois* when cyclones come	Fishers, skippers and boat owners
		12.Food and feed	Worms used for fishing bait	Local community
		15.Learning and inspiration	Kids learn swimming and fishing	Local community (mostly kids)
		16.Physical and psychological experiences	Relaxation and recreation, e.g. safe place for elders and kids to swim, picnics, recreational fishing	Local community
		16.Physical and psychological experiences	Tourist destination, e.g. kayaking	Skippers

Ecosystem	Species	NCP category	NCP description	Beneficiaries
		18.Maintenance of options	People are still learning to use *barachois* more effectively with undiscovered values anticipated by some	Whole community
	Crabs, fish	12.Food and feed	Mollusks (*tektek, bigorno*), sea urchins, fish, crabs, eels, and shrimps are harvested and collected by local people, especially for coping with temporary periods of unemployment. Kids collect crabs and sell for pocket money.	Whole community
	Gazon pic fesse	08.Formation, protection and decontamination of soils and sediments	Prevents coastal erosion	Whole community
	Migratory birds	16.Physical and psychological experiences	Some local people are curious about the birds that are only seen during limited periods (summer) of the year	Whole community
Lagoon		16.Physical and psychological experiences	Tourist destinations (coral reefs, lagoons and islands) and activities, e.g. diving and sailing. Not only used as tourist destinations, but also used by locals for boat trips and fishing for leisure. Beautiful seascape.	Tourism sector (e.g. skippers)
		13.Materials and assistance	Sea urchins and shells harvested for manufacturing ornaments. Used for room decorations and for presents	Tourists, local beach hawkers and craftspeople
	Fish, octopus	12.Food and feed	Fish, lobsters, squids, octopus and other seafood species	Local fishers /whole community
	Dolphins	16.Physical and psychological experiences	Tourist attraction (tourists pay tips to skippers when skippers successfully locate and show dolphins to them)	Tourists, skippers
N/a	Mauritius fody (EN)	16.Physical and psychological experiences	Tourist attraction	Skippers

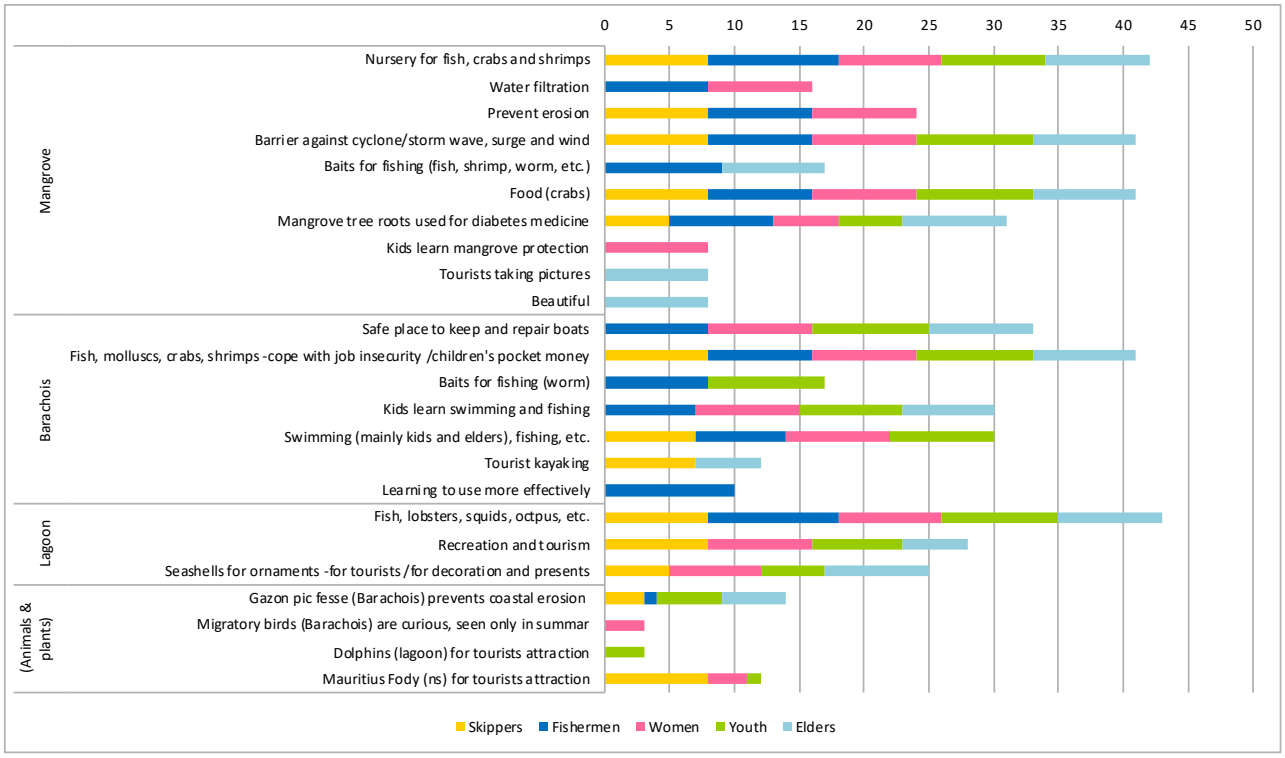

Figure 6. Aggregate of the ecosystem value scores by five focus groups (The highest value score by individual group is 10. Thus, the highest aggregate score is 50.)

4.2 Governance and knowledge of the *barachois* seascape

Key-informant interviews with the government authorities clarified their respective jurisdiction relating to the *barachois*. MAIFS chairs the National Ramsar Committee, and thus oversees the administrative procedures regarding the *barachois*, as *barachois* are recognized as wetlands under national land use classification. MSSNSESD takes responsibility for administrative procedures including Environmental Impact Assessments (EIA) and other permits. MOEMRFS takes charge of all seawaters, including those in the *barachois* and lagoon. It regulates fishing activities by licensing, gear restrictions, seasonal restrictions and surveillance. The Fisheries and Marine Resources Act 1998 (FMRA) provides the legal framework for fisheries and marine living resources management. The Fisheries Protection Service (FPS) and the National Coast Guard (NCG) under the aegis of the MOEMRFS and the National Police Force respectively, enforce fishing regulations in lagoon and off lagoon. Officers of the FPS operate in a number of fisheries posts including the Mahebourg Fisheries Post, which controls fishing activities in the Mahebourg district (FAO 2006).

In 2014, the national government of Mauritius adopted a resolution that encourages aquaculture development in the state-owned *barachois*. Under the resolution, private proponents can lease state-owned *barachois* under a concession agreement with the government of Mauritius. Under this scheme, EPCO obtained a concession for managing the Mahebourg *barachois*. As EPCO's involvement is time-bound, the project established a local cooperative for *barachois* management that would take over the management after the project end. In an interview on 27 June 2017, MOEMRFS implied the enactment of new national legislation on fisheries co-management was implied. Once this takes place, the legislation is likely to support the cooperative and the management of the *barachois* based on a collaborative approach.

Our survey also indicated a limited body of traditional or local ecological knowledge regarding the management of the *barachois* seascape. Individuals, particularly elders, held knowledge on uses, e.g. mangrove roots for diabetes medicine, location of fishing grounds and fishing techniques such as the construction of crab cages. However, all focus groups unanimously agreed that they had not inherited any knowledge for proactively managing the seascapes from their ancestors. Instead, they claimed to have started learning and accumulating knowledge with the project.

The coastal artisanal fishers in Mauritius exploit the lagoon and outer lagoon coastal fisheries. Fishers are either self-employed or under the aegis of a middleman upon whom they depend for cash advance, gear, boats, fuel, finance and marketing (FAO 2006). Others operate in fishery cooperatives. Artisanal fishery in and around the project area encompasses multi-species fishing, comprising mainly emperor fish (locally known as capitaine, dame berri, battadet, caya), parrotfish (cateau species), spinefoot (cordonnier), wrasse (madame tombee, colombine and lalo), goatfish (rouget species), grouper (vieille rouge, grise and voleur), unicornfish (corne species) and trevally (carangue), as well as shrimps, lobsters and octopus which are fished to a lesser extent (Déja 2016). Traditional means and methods of fishing are used. Hooks and lines, basket traps, large nets and gill nets are the most commonly used methods in the region. Artisanal fishers have traditional boats, locally known as pirogue, in wood or fiberglass, powered by outboard motors of 8 to 16 horsepower (Déja 2016). All registered fishers are legally obligated to take their catches to the prescribed fish landing stations, where officers of the FPS constantly record their attendance and information related to catch characteristics, fishing grounds and fishing efforts (FAO 2006). In 2016, 148 and 26 professional artisanal fishers operated from the landing stations of Mahebourg and Pointe d'Esny (i.e. Résidences La Chaux), respectively.

5. Discussion

Overall the five stakeholder groups agreed on the highest importance of two major functions of the coastal landscape. One is the mangroves' function to provide shelter against cyclones/storm waves, surges and wind. The other relates to fish reproduction and harvesting, where the functioning of the three ecosystem domains are slightly different but inseparably linked. Mangroves have a critical role in fish reproduction through the provision of spawning and nursing grounds, and produce crabs which are mainly harvested by youth for household consumption. The *barachois* provides a wider variety of marine vertebrates and invertebrates, such as molluscs, crabs, eels and shrimp, which community members harvest mainly for household consumption. This harvesting holds high importance, helping households to cope during periods of unemployment. The lagoon is the main fishing ground for professional artisanal fishers, and thus is the main source of cash income to the community.

The value scores across the five focus groups differed in several aspects of the seascape. Fishers stressed that they are still learning to utilize the *barachois* wisely, and thus placed a high value on it. They also pointed out the importance of live bait for fishing that they collect in mangroves and the *barachois*. Skippers appreciated the value of endemic birds and the *barachois* waterbody as a tourist attraction – an aspect that was entirely absent in the fishers' group.

The women's and elders' groups tended to appreciate the beauty of the seascape and animals. The women's group emphasized the importance of mangroves and the *barachois* for children to learn swimming, and to enhance environmental awareness. It is important to be inclusive of the views of all stakeholder groups in order to recognize the full value of the coastal ecosystem (Natori et al. 2018).

The understanding of multiple values that the local community associate with the biodiversity in *barachois* seascape, which differ across different groups in the community, was useful during the first phase of the project. This understanding helped and guided the project team to effectively determine the two main objectives of the project's design and planning: (1) developing the project strategic plan in a collaborative manner to ensure that the project's targets and activities fulfil local wants, needs, opinions and vision, and (2) increasing local awareness, participation, support and engagement in the project.

Indeed, understanding the multiple values held by various stakeholder groups guided the project organizers to use messages that appealed more effectively to all community groups and also to better understand the totality of the value of the seascape. For instance, organizers of the project initially assumed that conserving the *barachois* and developing aquaculture were important only for fishers. However, it turned out that the restoration and conservation of *barachois* were also important for women, for a clean and safer environment, and even for maintaining the site's beauty, as well as for a place for learning and recreation for children.

A comprehensive understanding of the multiple values of this SEPLS also allowed project organizers to foresee potential conflicts among community groups that could arise as a result of the project activities. For instance, the household survey highlighted that the local people do not rely on the resources in *barachois* for their livelihoods. Only a few people were harvesting crabs, collecting bait and fishing, while fishers depended only on lagoon and sea fishing. This implied relatively low socio-economic impact on the local community by restoring and conserving the *barachois*, which may require limiting access to its resources. On the contrary, the local people might be supportive of restoring and conserving the *barachois*, considering its recreational uses by the local community, which had been diminished due to deteriorating conditions. Similarly, when designing aquaculture activities in the *barachois* area, we carefully considered the fact that many fishers use the *barachois* waters to park their vessels, particularly when they face coastal hazards such as cyclones. This knowledge helped the project team to design aquaculture activities that do not to inhibit the use of the same water for other purposes such as this. Further, to convince the fishers, we issued official letters that stipulated a mutual agreement between the project and the fishers, ensuring fishers' access to and use of the *barachois* water. Knowledge gained on multiple values also helped project organizers to deliver messages that effectively gained the positive attitudes and proactive involvement of the fishers in aquaculture development.

We confirmed that fishers have localized, or even personalized, knowledge on resources, including the location of fishing grounds, fish migration patterns, seasonal abundance of economically important species, as well as fish reproduction and feeding behaviours. We, however, were not able to identify knowledge for proactively managing the *barachois* seascape and for sustainable resource use. We attributed this to the relatively short history of the community. The community was established around 1960 when people from Pointe Canon migrated to the current area after Cyclone Carol ravaged areas throughout Mauritius. Neither institutional arrangements by the government, nor spontaneous initiatives by the local community, have been made since for sustaining the coastal resources. During the project, the five focus-group discussions significantly increased local awareness of the multiplicity of values perceived by different stakeholders. Indeed, by sharing perceptions of value, the voice of each participant increased overall understanding and knowledge of the socio-economic and ecological value of the ecosystem domains and species, and consequently has positively influenced the community's desire to conserve them to enhance associated benefits. The result was strong local engagement and willingness to act collectively for the restoration and conservation of the marine coastal wetland. This also allowed the establishment of a local cooperative that represents all major community groups, and enhanced their ownership of the enterprise in and the management of the *barachois*.

Finally, considering local needs and wants in the restoration interventions and the predictable provision of benefits ensured local interest in the success of the intervention and increased recognition given to the management team. A relationship based on trust and mutual support developed between the local people and the project team. The collaboration was consolidated based on the increased support and participation of the local people. Indeed, 96 adults carried out activities on a voluntary basis, a testimony to the value they attach to the site. Moreover, 336 residents participated in community consultations, equivalent to 15 percent of total residents of the targeted community, and 115 in field work. Moreover, integrating these values into restoration planning provided a sense of ownership in the local community, which ensured the project's sustainability.

In this context, the planning and design phase of the project led to a strong consensus between the scientists and local people on the multiple values elicited by the community groups. Although a time-consuming phase, significant effort in carrying out the surveys and community consultations was necessary to effectively develop the project strategic plan. The value assessment approaches were considered as critical baselines, which provided information on how people view and value their natural environment, as well as their priorities and preferences for development. Indeed, the starting point of the project was to develop a clear understanding of local needs, priorities, perceptions, knowledge and values. The project strategic plan, designed based on close collaboration between the NGO, the scientists and the local community in a collective decision-making process, is a key output that is likely to guarantee the social acceptability of future restoration and management interventions within the context of sustainability. (see Fig. 7)

This plan now serves as the foundation for the implementation phase and for future dialogue and collaboration between policymakers, scientists, the private sector and the local cooperative. The implementation phase will be undertaken by recognizing and building on what local people value, need and expect. The local cooperative will work with project's stakeholder groups through the Collaborative Management *Barachois* Committee, whose members consist of representatives of governmental agencies, NGOs, local associations, the private sector, and the general public, as well as experts and scientists, to implement project activities effectively. These representatives will participate in frequent meetings to effectively determine and coordinate project activities in a collaborative manner. Although the local cooperative is expected to be the implementing entity for on-the-ground activities, the committee, the direct beneficiaries of the initiative, will be critical to ensure that all requirements, including trainings, permits, funding, labor and expertise, are available to the local people. It is however important to note that few local residents were found to have strong expertise related to wetland restoration and biodiversity conservation.

The present project framework places the local community in a central position to make decisions on planning and implementing the restoration and conservation activities (see Fig. 8). Indeed, the first phase of the project started with collaboration between the local community, NGO and scientists to elaborate on the project design and planning, with subsequent cooperation of other stakeholders including the government and the private sector, built on previous analysis of local values. The fact that the foundation of project implementation was initially based on local views has built trust between the local community and other stakeholders. This trust is considered to be critical for ensuring effective dialogue and collaboration during the implementation phase. Moreover, multi-stakeholder engagement was decisive in the enhancement of *barachois* management, where restoration and conservation priority-setting will reflect a wider cross-section of society. This will generate a constructive and effective seascape co-management alliance based on mutual support, as well as mutual sharing of knowledge and expertise, thereby enhancing the project's success in the long term. Mutual information-sharing between stakeholders will need to be carried out on an ongoing basis, through consultation and awareness-raising activities. This will build capacity and raise awareness among all stakeholders towards improved wetland biodiversity and the development of an environmentally, economically and socially sustainable seascape. The perceived values of the seascape, and consequently attitudes, will change over time and need to be monitored over the long term to gauge the seascape's management impacts on the local community. Similar approaches to assessing value will need to be repeatedly replicated to ensure long-term monitoring within the context of adaptive management.

Figure 7. Focus-group interview with local women and youth (also fishers, elders and skippers on other occasions) to elicit values associated to the *barachois* seascape.

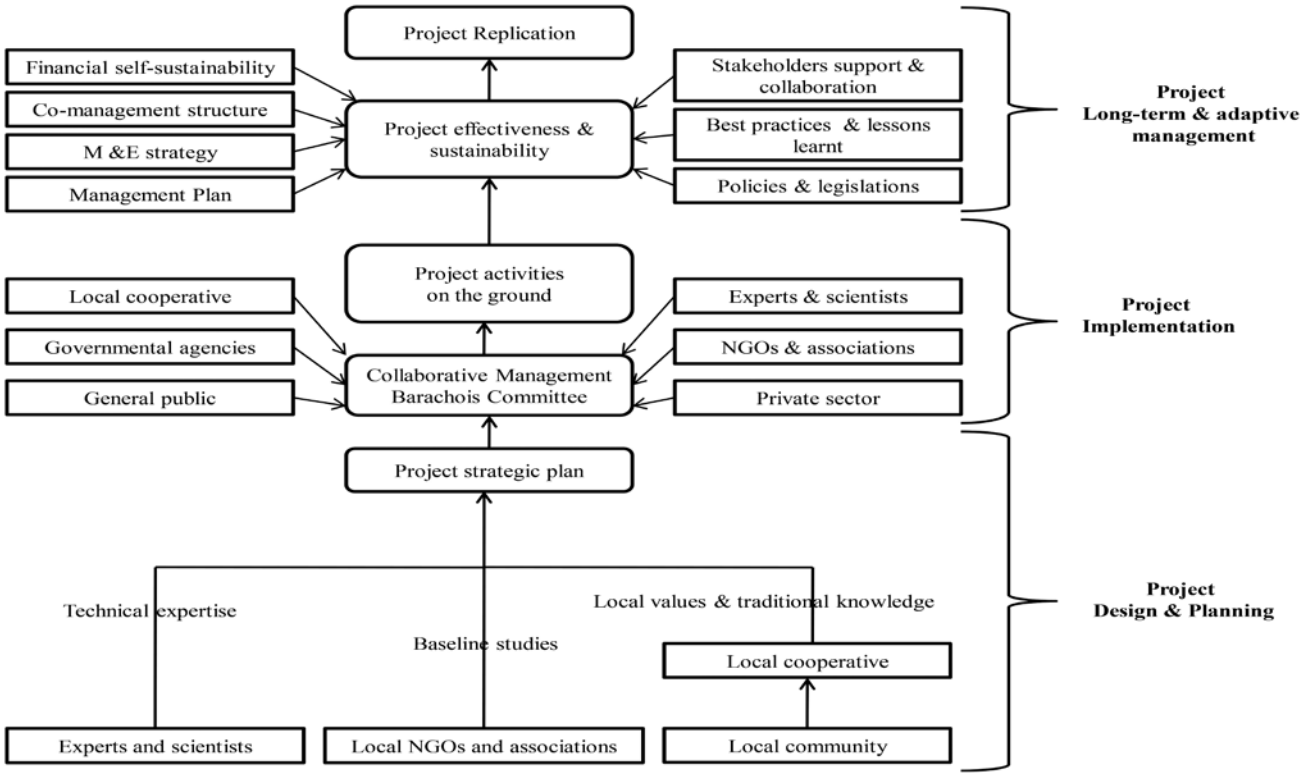

Figure 8. Proposed project development flowchart

The local cooperative developed and utilized in the design and planning phase can be used in the implementation phase to monitor the impacts of the project's interventions and changes in the perception of value held among stakeholders over time. The local cooperative will be the generator of the shared understanding and holistic benefits. The success of the cooperative will be measured based on biophysical (measuring the ecosystem health of the *barachois*), and socio-economic (measuring livelihood and well-being enhancement of the local community) factors, as well as governance indicators.

6. Conclusion

This case study provides an overview of the different approaches that were used during the design and planning process of a wetland restoration project in order to ensure a clear understanding of the values communicated by different community groups. This understanding helped and guided the project team in many ways, particularly in selecting actions that guaranteed the strong participation, support and engagement of the local community. Integrating local values in the decision-making process of project design and planning was critical in successfully achieving objectives. This approach consolidated and enhanced the collaboration between the local residents and the project team and resulted in the development of a project strategic plan which addressed community wants, needs, vision and opinions. This plan was developed considering the value of the SEPLS as perceived by both scientists and local people. The next steps will be to present the plan to the two remaining key actors in the process of wetland restoration, i.e. governmental agencies and the private sector. Once all the perceived aspects of value from the four key actors are integrated and merged into the plan, the implementation phase of the project can begin. In so doing, the implementation phase of the project is likely to be effective and sustainable. As part of a multi-stakeholder platform, the local cooperative is expected to drive the project to deliver impacts that benefit the entire community.

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Appendix 1. Description of ecosystems that constitute Mahebourg barachois seascape

Ecosystem type	Area (ha)	Fauna & flora	Sources
Near shore sea (lagoon)	approx. 10	<Fish species> For sales: emperor (capitaine, dame berri, battadet, caya), parrotfish (cateau species), spinefoot (cordonnier), wrasse (madame tombee, colombine and lalo), goatfish (rouget species), grouper (vieille rouge, grise and voleur), unicornfish (corne species) and trevally (carangue) For household consumption: cordonnier, come, vieille, ourite, rouget, kato, capitaine, mougate	Déja 2016
Near shore sea (*barachois*)	24	<Fish species> *Siganussp.* (cordonnier), *Upeneussp.* (rouget), *Valencienneasp.*(cabot), *Mugilcephalus* (mullet), *Siganussutor* (rabbit fish), *Nasounicornis* (corne) and *Acanthurussp.* (surgeon fish) <Coral species> *Porites lutea*, *Cyphastreamicrophthalma*, *Porites rus* and *Montiporacalcarea*. <Algal species>*Gracillariasp* (red algae) <Sponge species>*Tethyarobusta, Axinyssatopsenti*and*Clathriafrondifera.* <Crustaceans species>*Pilumnusverspertilio* (spider crab) and *Ucaannulipes*, *Aiptasiasp.*(sea anemones) and *Cassiopea sp.* (jellyfish) <Mollusc species>*Annulus* and *Planaxissultanus*	Nazurally & Bhoyroo 2016
Coastal ecotone (mangrove)	13	<Flora> loop-root mangrove (*Rhizophoramucronata*) (LC);	Atkinson 2017
Coastal ecotone (coastal scrub)		<Flora>love-vine (*Cassythafilformis*) (LC); grey nicker (*Caesalpiniabonduc*) (LC); poorlandflatsedge (*Cyperuscompressus*) (LC); *Dendrolobiumumbellatum* (N/A); sticky hopbush (*Dodonaeaviscosa*) (LC); sea hibiscus (*Hibiscustiliaceus*) (LC); *Hilsenbergiapetiolaris* (LC); beach morning (*Ipomeapescaprae* subst. *brasiliensis*) (LC); seashore paspalum (*Paspalumvaginatum*) (LC); pemphis (*Phemphisacidula*) (LC); common purslane (*Portulacaoleracea*) (LC); beach cabbage (*Scaevolataccada*) (LC); spotted heart(*Strictocardiatilifolia*) (LC); bay cedar (*Surianamaritima*) (LC); *Tarennaborbonica* (endemic); portia tree (*Thespesiapopulne*) (LC); Mascarene grass (*Zoysiatenuifolia*) (LC);	Atkinson 2017
Settlement/urban	18		
IUCN threatened species found in adjacent areas (e.g. Ile aux Aigrettes)		<Flora> False olive (*Cassineorientalis*) (VU); Mauritian baobab (*Cyphostemmamappia*) (EN); *Diospyrosegrettarum*(CR); bois bete (*Dombeyaacutangula*) (CR); *Dracaneaconcinna* (EN); *Erica brachyphylla* (EN); *Eugenia* sp. (VU); stinkwood (*Foetidiamauritiana*) (EN); *Gagnebinapterocarpa* (VU); mandrinette (*Hibiscus fragilis/ genevii*) (CR); bottle palm (*Hyphorbelaggenicaulis*) (CR); *Maytenuspyria* (VU); screw pine (*Pandanus*sp.) (EN); *Protiumobtusifolium* (VU); baumebush (*Psiadiaargute*) (VU); *Terminaliabentzoe*sp. *Bentzoe* (EN); *Turraeathouarsiana* (VU);	

Chapter 3

Framing cultural ecosystem services in the Andes: *Utawallu* as sentinels of values for biocultural heritage conservation

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Abstract

We describe the qualities of a cultural landscape kept within modernity by the local people of the *Utawallu* valley in Imbabura province of Northern Ecuador. Conservation efforts to incorporate cultural diversity alongside the biological diversity of the significant protected area in Western Ecuador are needed in order to improve protection of the traditional ancestral farmscape of the *Imbakucha* Basin. The different characteristics of the socio-ecological production landscape present in the site should lead to a successful initiation of a new wave of conservation in which Andean cultures are prioritized and cultural ecosystem services (re)valued.

A plea is presented to invigorate the conservation of sacred sites as a necessary step towards the *Imbakucha* watershed being declared the first candidate in a list of several prospective category V sites in Ecuador. UNESCO has recognized the area as a sacred site and there is a move from within the community to enlist it as a GeoPark, due to the impressive geological and morphological features of the watershed and the waves of tourists seeking adventure tourism, and not only recreation, but also ethnotourism from the indigenous market place. We grapple with the dilemma of conservation and sustainable development within a syncretic mountainscape where European practices and indigenous traditions have melded, producing a uniquely Ecuadorian trademark attraction signalling a syncretic mountainscape. We confronted the dilemma of conservation and development with the question: How can we measure the cultural value of the services provided by the Imbakucha mountainscape, and how would the perception of climate change make ethnotourism practices enhance nature conservation from an indigenous perspective?

We developed ethnographic research around the most important sacred sites identified by the community members and made a photographic survey of the biocultural elements that are part of the heritage of the *Utawallu runakuna.* For the first time, a map of the historic sites of religious significance was produced and an inventory of the major biodiversity components was prepared. Along with forest-páramo dynamics, we identified boundary layers for cultural ecosystem services and rectified criteria to consider the Benefits from Nature to People offered with cultural values in this biocultural heritage area. We will use the momentum and the Satoyama publication as a means to energize the declaration of *Imbakucha* watershed as National Intangible Cultural Heritage and specific areas as sacred biocultural heritage sites.

NOTE: *Kichwa* is the phonetic writing of 'Quechua' (in Peru) or 'Quichua' (in Ecuador, Bolivia, Chile, and Argentina), which is the trade language (*runa shimipi*) of the Andean people. We avoid hegemony of Spanishized words, as we support the recovery of local identity and the invigoration of vernacular culture, including the use of the non-written language of the *Inka*. In this text, we use italics to highlight the phonetic *Kichwa* alphabet, while Spanish terms appear inside single quotation marks for emphasis.

Keywords: Reification; syncretic landscape; *Imbakucha;* Otavalo; Andes; Ecuador

Country	Ecuador
Province	Imbabura
District	Otavalo and Cotacachi
Size of geographical area [1]	38,700 hectares
Number of indirect beneficiaries [2]	99,666 persons
Dominant ethnicity	Utawallu

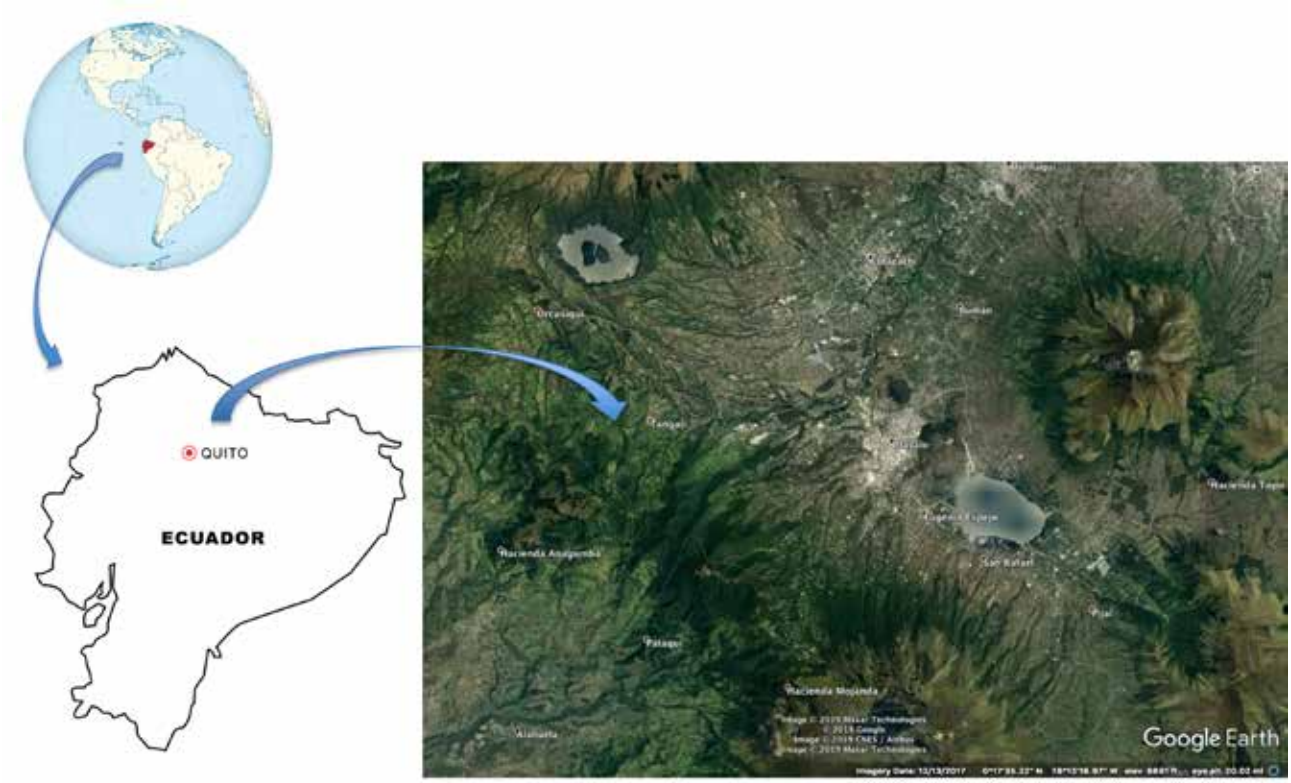

Figure 1. Map of the country and case study region

Size of case study/project area [1]	38,700 hectares
Number of direct beneficiaries [2]	99,666 persons
Geographic coordinates (longitude and latitude)	0°12'35" N 78°18'35" W
Dominant ethnicity	Kichwa Utawallu

Figure 2. Land cover map of case study site. A map of the *Imbakucha* watershed's main sacred sites and features, contained between the telluric guardians of *Tayta Imbabura* and *mama Kutakachi* volcanoes, with *Imbakucha* lake at the center of this epic mountainscape. Adapted from Google Earth and Cotacahi 2002).

1. Introduction

The *Utawallu* are the most visible indigenous nation of Ecuador. Known worldwide by the Spanish name of Otavalo, their fame in handcrafts, textile making, traditional medicine, music, sculpture, culinary and other forms of artistic representations have made them the most successful entrepreneurial indigenous nationality during the last decades, not only in Ecuador, but also in the whole of South America (Borsdorf & Stadel 2016). The Otavalo market, for example, draws thousands of tourists each year to the area, having become the largest indigenous market on the continent. Within this vibrant influence of local culture and the pressure of globalization, nature conservation has been challenged by the need for production of staple foods as well as other labour options, and policies have favoured wilderness preservation instead of cultural landscape values (Sarmiento 2015). Curiously, the Otavalo have no translation for "wilderness", and their cosmological vision includes a nature-culture hybrid of respect and reciprocity, typical of Andean communities and a conundrum for mountain research literature (Resler & Sarmiento 2016). However, in Ecuador, the commodification of nature has allowed for ecosystem services to become the new guiding principle of new payment for environmental services (PES) policies; yet, emphasis goes to provisioning, and regulating functions. We argue that cultural ecosystem services (CES) are often less served by current conservation and development strategies, despite the fact that in many facets, *Utawallu* are cultural icons of local and indigenous knowledge. Not only the garb they proudly exhibit, but also the deeply ethical connection with Mother Earth, or *Pachamama*, and the establishment of sacred natural sites such as waterfalls, lakes, trees, caves, rocks, and others, have made them the stalwarts of biocultural heritage (Oviedo, Jeanrenaud & Otegui 2005). In some cases, bringing back ancient practices, in other cases developing fusion alternatives within the prevailing Western culture, 'Otavaleños' are being empowered by environmental leadership and indigenous revival momentum. In a dynamic socio-ecological production landscape (SEPL) that seeks to maintain biocultural heritage as way to conserve biodiversity, Otavalo is leading in offering ethnotourism and ethnomedicinal services of cultural value (Sarmiento 2016a). Cultural benefits from the *Imbakucha* watershed have imprinted the Otavalo people with intangibles that define their identity markers, traditions and rites, sacred sites,

food and music that strengthen the Andean identity of the community, making those cultural values a very important factor in conservation planning and sustainability.

Our study aims to highlight the contribution of the original people's cultural values in prioritizing biodiversity conservation amidst the pressures of modernity, in what is known as 'syncretic' landscapes with hybrid cultural manifestations of the indigenous and the greater Western tradition. Our main objective is to support the narrative of biocultural heritage conservation as an option of sustainable development in socio-ecological production mountainscapes. We consider this shift of conservation paradigm (from nature pristine to nature-culture manufacture) of significance if we were to curve the tendency of biodiversity loss due to both deforestation as well as acculturation.

Data on cultural assets and information on environmental perceptions were gathered in several surveys on farmscape transformation, as well as Master's thesis research (Cotacachi 2002, Catholic University of Ecuador, Ibarra), and an honors thesis CURO research (Carter 2008, University of Georgia). This multimethod research used expert interviews, ethnographic research trails, focus groups, photo-elicitation, critical discourse analysis, archival search and personal observation to generate the body of information to identify and classify areas of importance for biocultural heritage, particularly sacred natural sites, traditional foodstuff and agrobiodiversity practices. A geographic information system GIS of the sacred sites was generated to highlight the importance of a watershed-based approach for the entire *Imbakucha* region, with a map of the suggested itinerary/ distribution and complemented with a photographic registry of every-day activities.

1.1 *Utawallu* biocultural framework

On the equator in the northern Andes (hereafter referred to as the Equatorial Andes or Tropandean landscapes) of South America, lives a unique nation of people strongly linked to ancestral ways, but fervently immersed in the contemporary market economy. This original people or '*pueblo originario*' identifies its ethnicity with a shared history of resistance, similar environmental quality, and an indigenous communitarian livelihood that is characteristic of Andean cultures after the Inka Empire (Seligman & Fine-Dare 2019). Populating the inter-Andean valley just north of the equator, some 50 thousand *Kichwa Utawallu* (known in Spanish as 'Otavalo') make their living in the syncretic reality between tradition and modernity in the Ecuadorian highlands (Sarmiento 2012). Despite a lack of confirmed data from population censuses in rural areas, it is thought that these people represent almost one third of the inhabitants of Imbabura province, with a growth trend of ca. 4% in the last census period (see Fig.1 and 2). About 70% reside in rural areas around the town of Otavalo with a young populace, with 48% of inhabitants under 20 years of age (INEC 2011).

Likewise occurring to many original peoples worldwide, the 'Otavaleño' identity has been threatened in recent decades by 1) increasing Western influences challenging indigenous values; 2) global marketing trends weakening their ancestral customs; and 3) the destruction of unique landscape features linked to traditional livelihoods (Whitten 2003). We should be aware of these people's ethnicity amidst the hierarchies of modernity (Appadurai 1988, Knapp 2018) and in light of the ever-growing homogenization of material monetary values and market-oriented societies (De la Torre 2006). The *Kichwa Utawallu* have received more attention from linguists and anthropologists at the national (e.g. Instituto Otavaleño de Antropología) and the international level (e.g. UNESCO, FAO and UNDP) than any other ethnic group in Ecuador, because they are regarded as an exemplar of the "image" of indigenous groups from the Equatorial Andes that can be exhibited to the world. Foreign assistance and governmental plans for boosting tourism in Imbabura province have catapulted the *Utawallu* to the forefront of entrepreneurship, and they have become known as the 'weavers of South America'. The *Utawallu,* thus, accept the consequences of the westernized models that have had such negative effects on the environment in the *Imbakucha* Basin, with the iconic 'San Pablo' lake (*Imbakucha*). This lake and its surrounding bucolic landscape have been known since antiquity as the 'Valley of Dawn' and are the birthplace of the last *Sapa Inka* emperor, *Utawallpa* (sometimes known as *Atawalipa* or 'Atahualpa'); today, nonetheless, this site strives to maintain its identity amidst increasing modernization (MAE 2012).

Modernity in *Imbakucha* must recognize the essence of place shared by groups of similar ethnic backgrounds that remain hidden behind political boundaries and accesses (Whitten 2003); this is the case of the *Utawallu* (in the northwestern zone), the *Kayampi* (southeastern zone), the *Kutakachi* (western zone by Lake *Tsuikucha* or 'Cuicocha') and the surrounding villages near Otavalo, such as the *Imbala*, *Atuntaki*, *Illumani* and *Karanki* (Rosales 2003). It is because of this rich mixture of cultures, still holding onto their traditional livelihoods, that efforts to turn the 'Valley of Dawn' into the 'Switzerland of Ecuador' have succeeded and led to a boom in ethnotourism, agritourism and ecotourism in the Imbabura province. A mere 110 km north of Quito, the capital of Ecuador, connected by the reshaped and improved Pan-American Highway, visitors are surprised to find lakes, mountains, farmlands, and small Andean villages, interspersed within a matrix of different shades of green.

Weekend tourism is very high, with some 50,000 potential buyers flocking to the Saturday market—considered as the largest outdoor market in South America—and actually doubling the town's population in a matter of hours (see Fig. 3). Here, the 90 concrete parasols designed in 1973 by female Dutch architect Tonny Zwollo are converted into a colorful showcase of *punchu* ('poncho') and other handicrafts. This open area—or 'Ponchos' Plaza'—is considered by many travelers as 'the mother of all markets', since the colorful market stalls have spilled over into the streets of the central district of the city of Otavalo; however, not only monetary transactions occur here, but also seed swaps, animal/goods exchanges and bartering are also frequent (Meisch 2002). The area of Otavalo, including lake *Imbakucha*, receives many tourists from all over the world. Nevertheless, the Otavalo market is not the only tourist attraction in the area: many young people, who make up 26.7% of the total visitors by age (MINTUR 2018), use ethnotourism operators to get to know ethnic group perspectives regarding conservation and development scenarios, along with the opportunities of adventure tourism or ecotourism that require a rather active lifestyle (see Fig.3).

Figure 3. The Otavalo Market side streets show the vibrancy of the exchanges, including bartering, of many different type of goods and services, including manufactured items but also swapping seeds, animals and farm products (Photo: Cesar Cotacachi).

Many elders, including Mario Conejo, the original mayor of Otavalo, emphasize that the trading and traditional tourism practices of this market have been the foundation of their local identity since antiquity. The *Utawallu* have always produced and sold valuable handicrafts throughout the Andes through relocated, sedentary or expatriated members of the *Kichwa Kayampi* (*mitima*) ethnic group and traveling entrepreneur merchants of the *Kichwa Utawallu* (*mindala*) ethnic group. Even today, it is not uncommon to find 'Otavaleños' traveling to faraway countries, becoming today one of the most recognizable original people on the global scene, with established stores in New York, Tokyo and London and street-vending in plazas from Amsterdam to Zagreb. Often mixing their selling of art and crafts with Andean musical performances in streets and squares, the 'Otavaleño' traveling merchants of today are ambassadors for Andean culture abroad, and the reason why tourists come to this corner of the world.

A dozen years ago, the most represented American countries of origin were USA (241,018 visitors), Colombia (203,326), Peru (150,436) and Chile (21,674), while the most represented European countries were Spain (46,358), United Kingdom (27,014), Germany (23,302) and France (16,856). These are figures from a census in 2007 (MINTUR 2018). At present, Chinese and Brazilian visitors have increased more than 112% and become more prominent. The largest increase in 2018 is reported as Venezuelan (956,067), USA (351,709), and Colombian (323,345) tourists. Also, a Cuban presence is noticeable more commonly than a decade ago, yet this country is distinctively underrepresented in the statistics. In fact, Otavalo is one of the top three tourist destinations in Ecuador (including the Galapagos islands); in 2018 some 2,428,536 tourists visited Ecuador, a 38.68% increase over the same period in 2007. It is calculated that about one third of these visitors went to Otavalo (MINTUR 2018). To manage this increasing trend, each county of the Imbabura province has a tourism office where operators can obtain licenses, permits, promotional materials and advice. The private sector is also very active. Most tourism companies catering to foreign visitors to Ecuador have subsidiaries specializing in tours to Otavalo. However, a new trend for cheaper accommodation, such as hostels or family apartments, has appeared of late. This so-called 'ethnotourism' involves several original families who provide experiences "from the indigenous point of view". It is this segment of the market that emphasizes the sacred sites as a destination with educational potential and cultural significance (eds. Sarmiento & Hitchner 2017). Some of the most popular tourism operators of the area are *Runa Tupari* Native Travel, Diceny Viajes, All About Ecuador and Ecomontes. Smaller tour groups are managed by Zulaytur, Leyton's Tours and *Urku*tours. There are homesteads that have converted their traditional houses and herb gardens into ecomuseums,

or living samples of 'Otavaleño' culture, complete with food and drink service and the production of hand-made textile souvenirs. Nearby, the town of Cotacachi, where mining activities and other extractive and contaminating industries have been closed down, has been declared the most ecologically oriented county in Ecuador. The town of Cotacachi has won several international awards for activities relating to good practices in public participation, peace, conservation, public budgeting and on-line resources, and it is no surprise that it has become a tourism mecca by staying high on the list of favored destinations for many amenity migrants that have transformed the social fabric with an imprint of expats and retirees.

1.2 Biocultural heritage and the spiritual dimension

Instilled in their lifestyle and spirituality, the *Utawallu* have close links with the natural environment: work on the land, respect for their sacred sites, and spirituality shared by the members of the communities that live in the valley, are important components of their lives (Cotacachi 2002) (see Fig.4) . There is a plethora of bird species to watch on private reserves in the basin, such as the Hacienda Cusín, listed within the Important Bird Diversity areas, with spots for birdwatching enthusiasts with record numbers of hummingbirds and many passerines. As an example, Table 1 shows a list prepared by BirdLife International for the surrounding areas. There are also small *in-situ* conservation initiatives, such as a condor (*Vultur gryphues*) rewilding camp, several hatcheries with local fish species and nurseries for Camelidae, particularly llamas (*Lama glama*). Locals are often referring to the mystical Andean bear (*Tremarctos ornatus*) or *ukumari*, as a frequent visitor to the borders of cloud forest areas and cultivation fronts, particularly of maize, their favorite pillaged food. The flagship cougar (*Puma concolor*) has been registered within the *Imbabura*

Figure 4. Ritual procession to reaffirm the *Utawallu* identity around the *pukara* of Reyloma, in route to the *pinllucruz*. Maintaining the identity markers and reifying the presence of sacred natural sites, such as the tree, the lake and the waterfall nearby, helps in cohesive practices of socioecological wellbeing. (Photo: César Cotacachi).

slopes and also on the western flank of the *Kutakachi* volcano, where the entire biota explodes with the influence of the Chocoan biodiversity hotspot.

The *Utawallu* not only analyze the practices employed for conserving natural resources, but also incorporate environmental conservation and protection into their lives, since environmental and religious practices are seen to be indistinguishable. Conservation practices in this area are maintained through the observance of ancestral whispers (Berkes 2012) that reveal the ecological soul, spiritual sympathy, and energy emanating from the *Imbakucha* Basin, all of which provide a basis for their cosmological worldview. This also explains the following that traditional medicine has and the number of *yacha*, shamans or medicine men and women, concentrated in the town of *Iluman*, who have been recognized by the government and certified as alternative medicine providers. Furthermore, adults work the land every day, tending gardens, livestock, and farms and passing concerns and care for the environment on to their children, along with the notion of respect for natural resources and reverence for the sacred natural sites (eds. Sarmiento & Hitchner 2017) that make them uniquely *Utawallu*. This education, transferred from one generation to another well into adolescence, is an important intergenerational legacy of these original people and a way of conserving the *Imbakucha* Basin. The majority of 'Otavaleños' (*Utawallukuna*) and 'Cotacacheños' (*Kutakachikuna*) are either Roman Catholics or Evangelical Christians due to the colonization of the area in the early 1500s by the Kingdom of Castile, the subsequent colonial alignment with Spain and the Vatican, and the presence in recent years of quite active missionaries from the United States of other Christian denominations. Nevertheless, religious affiliation has generally remained separate from spirituality in the local people. This important feature of Andean culture has been described as syncretism and allows both Western and original beliefs to coexist in the area (Rodríguez 1999; Sarmiento, Rodríguez & Argumedo 2005), providing a trope of ecocritical narratives in what are now known as syncretic landscapes (Sarmiento 2017), a reflection of the dynamic fusion of Western and native practices of this SEPL functioning within the tenets of the Satoyama Initiative (see Fig. 5).

These fusion landscapes abound in the tropical Andes, where a mixture of exotic species (e.g. Australian blue gum tree –*Eucalyptus globulus*, Monterrey pine –*Pinus radiata*, African kikuyu grass –*Pennisetum clandestinum,* Fenix palm –*Phoenix dactylifera*) with native species (e.g. Black walnut –Juglans neotropica, Hand of Puma –*Oreopanax argentata*, –Mountain cedar –*Cedrella montana*) or Andean wax palm –*Ceroxylum andicola*) form the forested matrix of the manufactured mountainscape. Here, the physical presence is luxuriant with greenery and fertility all year round, making

Figure 5. A group of people in Otavalo's central park, exhibiting the traditional garb and other attributes associated uniquely with this group, ready to celebrate *kuya raymi* to thank *Pachamama* for her willingness to receive seeds for the new harvest (Photo: Cesar Cotacachi).

the phenosystem a delightful deduced panorama. Amidst these patches or plantations, mostly prevalent in the homogenized landscapes of the countryside worldwide, there are several home gardens that still retain elements of native flora and fauna that are mostly used for medicinal or culinary purposes. Working like the *milpa* described in this volume for Mesoamerica, the *chakra* of the *Utawallu* is for the tropical Andes the treasure trove of agrobiodiversity. The *chakra* gardens include corn –*Zea maiz*; beans –*Phaseolus vulgaris*; squash –*Cucurbita ficifolia*; quinoa –*Chenopodium quinoa*; potato –*Solanum tuberosum;* 'guaba'–*Inga edulis; 'tomate de árbol'* –*Cyphomandra betacea: '*taxo' –*Passiflora tripartite,* 'aguacate'–*Persea americana;*'granadilla'–*Passiflora ligularis*; 'naranjilla' –*Solanum quitoense*; mountain papaya –*Vasconcellea heilbornii;* and many other species of great cultural significance, not only for medicine or food, but also for mystical association with the surrounding mountains, such as the 'lechero' –*Euphorbia laurifolia* described below. This unseen dimension of the cryptosystem allows the integration of inductive qualitative factors such as magic, rite, spirituality and myth. Therefore, the biocultural heritage approach also provides landscape heterogeneity accentuating the diversity of species with the various local cultural values.

The *Utawallu*, for whom 'place' is not merely a collection of spatial features, but a spiritually, holistic home base (Carter 2008), understand many intangible values of the cultural landscape. Their esteem for water is derived from their own spirituality and the significance of sacred wetland sites in the many ancient rituals they perpetuate. The importance of this sacred dimension is derived from the *runa taytiku* ancestors, *Utawallu* grandparents, and parents, and is passed with intergenerational sharing to the very young (*wawa*) and teenagers (*wambra)* through oral history; it includes the essential rituals of initiation and purification associated with the heightened spirituality observed at sacred sites (Sarmiento, Rodríguez & Argumedo 2005). Indeed, sacred loci connected to spirituality in *Imbakucha* are mostly found in locations where water emanates: they may be where succulent plants or a sacred tree (e.g. *pinllu* or *pinkul,* or 'lechero' tree, *Euphorbia laurifolia*) grow or where water bodies such as streams (*wayku*), rivers (*yacu*), coves (*pukyu*), waterfalls (*phakcha*), lakes (*kucha*), ice (*rasu*) or snow (*kasay*) are found, or anywhere in which a form of water can exist with its purifying essence. The very presence of imposing volcanoes and life-giving lakes creates a well-respected observance of cycles of plant production and a concentration of fauna and flora in certain areas of their Andean lifescape.

1.3 A note on methodology

This work is an ethnoecological study that builds upon extensive understanding of Andean ecology and anthropological nuances of the region (Knapp 1991). This multimethod approach required intensive and extensive fieldwork and ethnographic tools. The initial study was undertaken for a Master's thesis at a local university to identify the sacred dimension of the valley and its main characters. It included more than two years of groundwork, interviews and surveys that were conducted in the different communities of the watershed. It was followed by a comparative study with more statistical and geospatial considerations for an Honor's thesis at a land-grant university in the US, with more works included in an updated literature review and incorporating critical discourse analysis, focus group workshops, expert interviews and observational studies that brought in the current tropes of the biocultural heritage narrative. Individual studies are published elsewhere (Cotacachi 2002; Sarmiento 2003, 2012; Sarmiento, Rodríguez & Argumedo 2005; Carter 2008; Sarmiento, Cotacachi & Carter 2008; Carter & Sarmiento 2011; Sarmiento & Viteri 2015) and bring the multimethod approach summarized hereby.

Table 1. A checklist of bird species found in the surrounding area of the *Imbakucha* watershed and the nearby western Andean flank of the Imbabura province. Adapted from Birdlife International 2018.

Table 1 - Resident avian diversity in the Western Andean Flank of the Imbakucha Watershed and the Cotacachi-Cayapas Ecological Reserve

Berlepsch's Tinamou	*Crypturellus berlepschi*
Baudo Guan	*Penelope ortoni*
Wattled Guan	*Aburria aburri*
Dark-backed quail	*Odontophorus melanonotus*
Plumbeous Forest-falcon	*Micrastur plumbeus*
Plumbeous Hawk	*Leucopternis plumbeus*
Imperial Snipe	*Gallinago imperialis*
Dusky Pigeon	*Patagioenas goodsoni*
Yellow-eared Parrot	*Ognorhynchus icterotis*
Rose-faced Parrot	*Gypopsitta pulchra*
Bronze-winged Parrot	*Pionus chalcopterus*
Banded ground-cuckoo	*Neomorphus radiolosus*
Choco Poorwill	*Nyctiphrynus rosenbergi*
White-whiskered Hermit	*Phaethornis yaruqui*
Purple-chested Amazilia	*Amazilia rosenbergi*
Velvet-purple Coronet	*Boissonneaua jardini*
Brown Inca	*Coeligena wilsoni*
Buff-winged Starfrontlet	*Coeligena lutetiae*
Gorgeted Sunangel	*Heliangelus strophianus*
Purple-bibbed Whitetip	*Urosticte benjamini*
Violet-tailed Sylph	*Aglaiocercus coelestis*
White-eyed Trogon	*Trogon comptus*
Crimson toucan	*Aulacorhynchus haematopygus*
Plate-billed toucan	*Andigena laminirostris*
Choco Toucan	*Ramphastos brevis*
Orange-fronted Barbet	*Capito squamatus*
Five-coloured Barbet	*Capito quinticolor*
Toucan Barbet	*Semnornis ramphastinus*
Choco Woodpecker	*Veniliornis chocoensis*
Lita Woodpecker	*Piculus litae*
Guayas Woodpecker	*Campephilus gayaquilensis*
Club-winged Manakin	*Machaeropterus deliciosus*
Orange-breasted Fruiteater	*Pipreola jucunda*
Wattled Umbrellabird	*Cephalopterus penduliger*
Agile Tit-tyrant	*Anairetes agilis*
Stub-tailed Antbird	*Myrmeciza berlepschi*
Spillmann's Tapaculo	*Scytalopus spillmanni*
Rufous Antpitta	*Pittasoma rufopileatum*
Chestnut-naped Antpitta	*Grallaria nuchalis*
Yellow-breasted Antpitta	*Grallaria flavotincta*
Uniform Treehunter	*Thripadectes ignobilis*
Flammul Treehunter	*Thripadectes flammulatus*
Turquoise Jay	*Cyanolyca turcosa*
Rufous Wren	*Cinnycerthia unirufa*
Tanager Finch	*Oreothraupis arremonops*
Golden-chested Tanager	*Bangsia rothschildi*
Moss-backed Tanager	*Bangsia edwardsi*
Black-chested Mt tanager	*Buthraupis eximia*
Glisten green Tanager	*Chlorochrysa phoenicotis*
Blue-whiskered Tanager	*Tangara johannae*
Rufous-throated Tanager	*Tangara rufigula*
Scarlet-breasted Dacnis	*Dacnis berlepschi*
Scarlet-and-white Tanager	*Chrysothlypis salmoni*
Glossy Flowerpiercer	*Diglossa lafresnayii*
Black Flowerpiercer	*Diglossa humeralis*
Yellow-green tanager	*Chlorospingus flavovirens*
Yellow Chlorophonia	*Chlorophonia flavirostris*
Black-winged Saltator	*Saltator atripennis*

1.4 The Study Area

The *Imbakucha* Basin contains the largest Andean lake in Ecuador and is located in the province of Imbabura in northern Ecuador. Here, the *Kichwa* ethnicity is the more prevalent of the two *Utawallu* groups, which are separated by the administrative county boundaries: The *Kayampi* to the southeastern reaches of the lake towards the 'Cayambe' volcano, and the *Utawallu,* referred to as 'Cotacacheños' (*Kutakachikuna*), living westward and the 'Otavaleños' (*Utawallukuna*) living northward of the lake. Further differentiation is also possible within the *Kichwa* ethnic groups, which creates a spectrum of ethnographic and epistemological oddities that makes Ecuador such a rich, pluricultural, multilingual nation (Moya 2000, Whitten 2003). A good example is found where the 'Otavaleños' live in the *Imbakucha* Basin: the *Kutakachikuna* dwell near Mother 'Cotacachi' volcano by the city of Cotacachi, while the *Utawallukuna* dwell near Father *Imbabura* volcano by the city of Otavalo (see Fig. 6). Both cities are within 48 km of each other and share many environmental traits and similar administrative histories (Keating 2007). For many conservationists, the two areas are located within the same type of ecosystem. Otavalo's sacred sites include *Taita Imbabura* (the Imbabura volcano or *Yaya Imbabura*; *Imbakucha* proper or the Lake 'San Pablo', the 'Lechero' Tree on the *pukara* of 'Reyloma', and the waterfall in 'Peguche' parish, also known as *Phakchayacu*. Cotacachi's sacred sites include *Mama* Cotacachi (*Kutakachi* Volcano), the Cotacachi-Cayapas Ecological Reserve and *Tsuykucha* crater lake in the shadow of the volcano.

Given that the views of the original people are important in this heavily indigenous-populated area, the ideas of the *Kutakachikuna* are held in high esteem by the local government, ensuring public support for the sanctity of these concepts. Thus, conservation will continue to be provided, whether or not the national government includes them as part of its mandate for the conservation of protected areas (for instance, see Ramakrishnan 2008), including the recent designation of the area as a Global GeoPark, officially declared by UNESCO in February 2019. Presumably, ecotourism helps the local economy in such a way that Imbabura residents will continue to preserve their sacred sites for as long as they have a degree of privacy that allows them to respect their ancestors according to their spiritual traditions; this will create the type of *de facto* conservation that currently occurs around the sacred sites

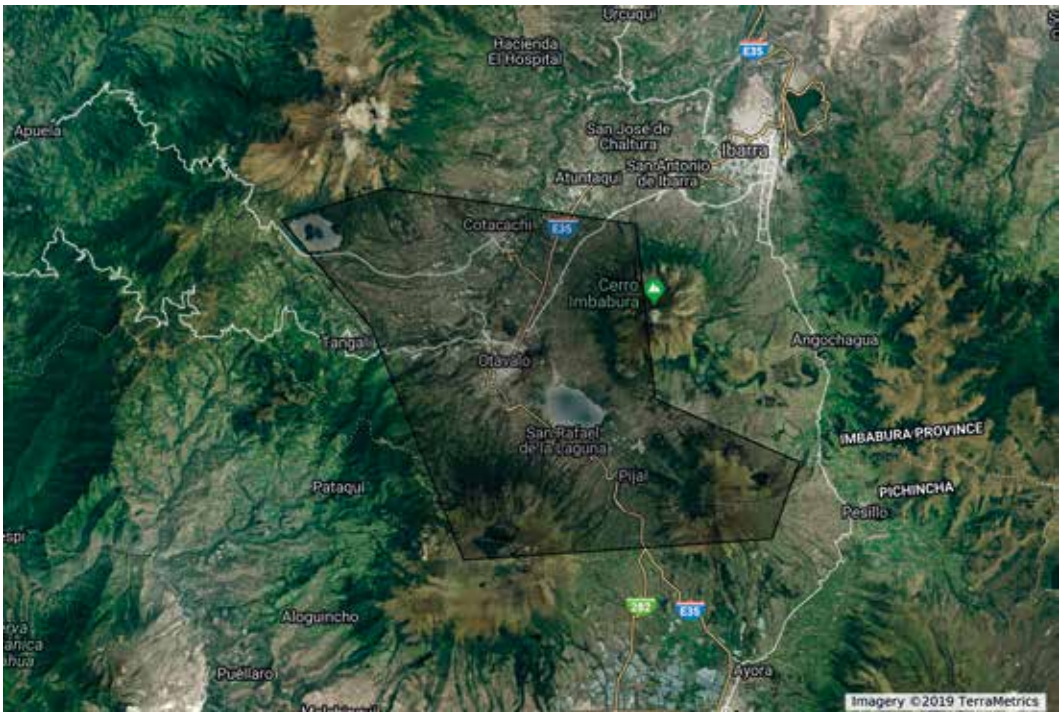

Figure 6. Google Maps view of the location of the study area in relation to the country of Ecuador in South America. The sacred mountains (Imbabura and Cotacachi) frame the valley where *Imbakucha* Lake is located.

of the world (eds. Verschuuren et al. 2010) in general, and of the *Imbakucha* Basin in particular (Sarmiento, Cotacachi & Carter 2008).

2. Cultural Ecosystem Services revisited

Ecosystem Services have experienced enormous traction in both academic and field practitioners over the last two decades, with more publications appearing each year on the topic. However, studies on Cultural Ecosystem Services (CES) have been less explored due to limited access to gather intangible values, which demands lots of time and resources spent on the ground via ethnographic research. In addition to the lacking number of CES studies, previous works have been focused on urban areas, leaving out mountain SEPLs, which hold significant CES values shared communally. In exurban areas or rural areas in which people live closer to nature in the farmscape, they have developed significant cultural ties with the mountainscape, including the spiritual dimension. Hence, communities with nearby mountains hold unique and locally inherited values, more so than aesthetic or recreational values alone (Kong & Sarmiento, in press).

Utawallu people developed shared values associated with the quality of the *Imbakucha* complex system, such as place identity, sense of belonging, and cultural heritage, as well as personal values, such as place attachment or rootedness, contentment or happiness and aesthetic beauty. The perception of their mountainscape and its lifescape engenders various intangibles that are engraved in the SEPL fabric. These individual and collective values have been labeled as intangible, social, and landscape values (Chen, Parkins & Sherren 2018) in various disciplinary fields as of late. Tourism studies also look at social values to explore destinations, imaginaries and authentic experiences. Scholars developed a framework aiming to suggest a new strategy for conservation practices incorporating economic valuation and transactions of diverse services people obtain from the surrounding ecosystem, mostly based in the utilitarian perspective of a commoditized nature. Accordingly, the framework relabeled these human perceptive values as "Cultural Ecosystem Services." They are defined as the non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, aesthetic experiences, memory banking and intergenerational exchange, which help secure the quality of life and achieve human wellbeing (Millennium Ecosystem Assessment 2005). In this framework, the categories of CES are suggested as aesthetic beauty, opportunities for recreational activities, and educational services.

However, mountain landscapes near *Utawallu* communities are under constant threat of land alteration or development pressures tending toward farmscape transformation. Also, numerous communities themselves experience rapid socioecological changes, including the segmentation of religious affiliation and the increase of new evangelical or Christian denominations, instead of the traditional Roman

Catholic affiliation, which may result in loss of traditional and syncretic value systems shared in this collective. One of the earliest stages in successful landscape conservation is to identify the values shared in the landscape. Identifying CES, therefore, supports optimizing resource management by acknowledging major features, activities, and qualities comprising the soul of the *Utawallu* mountainscape. Also, exploring various values shared communally helps to reinforce identity, which can lead to creating solid place attachment and local solidarity. This was one of the specific emphases given by one of us (César Cotacachi) as the first indigenous leader in heading the political office of Otavalo in history, reporting directly to the President of Ecuador on issues related to Otavalo city and county. Despite ardent conservation work, the pressures of industries and other productive interests, such as agribusiness, mining, and manufacturing, are strong enough to produce a rift between the cultural assets of the indigenous community versus the needs of development conceived within the economy of the global market.

2.1 Reifying the *Imbakucha* watershed

Otavalo and Cotacachi are northern Ecuadorian counties where original peoples or 'pueblos originarios' maintain a close spiritual link with the environment (or *kawsay sapi*) through several factors that are instilled within their lifestyles and spirituality (Cotacachi 2002). A main component includes their work with the land and the sacred sites that are interconnected with their spirituality (or *runa rimay*). They do not analyze the practices that are put into conserving environmental resources (or *puchuchina*) as separate issues; instead, according to many indigenous citizens, conserving and protecting the environment is incorporated into their lives, as environmental and religious practices (or *wakaychina*) are known to be indistinguishable.

According to many *Kichwa Utawallu*, the conservation practices in this area are maintained through the observance and understanding of the "ancestral murmur" (or *Aya*) that shows the soul ecology, spiritual synchrony or emanating energy found in the *Imbakucha* basin for conservation practices in their communities (or *llakta kawsay*); also, the work of ecologists in this region, the government's Ministry of the Environment, indigenous-led parochial and city governance, and the few non-profit agencies in the area are devoted to environmental conservation. Furthermore, the adult indigenous citizens work with the land on a daily basis, tending to their gardens, livestock, and farms. These adults pass their attention to and care for the environment as traditional ecological knowledge, TEK, (or *runa yachay*), along with the notion of the importance of keeping reverence to natural resources therein, to their children. This education conforming to the Andean identity trilemma (i.e., Andeanity, Andeaness and Andeanitude) observed with enthusiasm (*Yanatin*) amid a duality of choice (*Masantin*) that is being passed from their ancestors to the younger generations (or *shina nin*) is the important legacy and intergenerational equity of the original people for conserving CES as identity markers of the indigenous territory.

2.1.1 Institutional framework and local governance

The administrative structure of the Imbabura province includes six counties (Ibarra, Antonio Ante, Cotacachi, Otavalo, Pimampiro and Urcuquí) all of them managed by the Imbabura Provincial Council. According to the new Ecuadorian constitution that tends to decentralize governmental functions to the local level, several Autonomous Decentralized Governmental (GAD) units operate in the area; in particular, the GAD Otavalo, the GAD Cotacachi and the GAD San Pablo are the key players in the planning and execution of development initiatives in the *Imbakucha* watershed. The mayors of Otavalo and Cotacachi have recently given priority to community-driven initiatives and favor ecotourism development and cultural revitalization. The overall progress noticed in vital infrastructure and common areas, such as sport complexes, schools, open-air markets and gardens and boulevards, has captured the attention of urban planners for having model towns accepting modernity but imbued with local culture. There are provincial leaders dealing with tourism, forestry, agriculture and culture; however, a sectorial separation seems to pervade the bureaucratic functions of state offices. There are several civil society groups that confirm the cultural oddities of the region, particularly those that join the professional ancestral healers (*yachas*), small producers, artisans and gremial organizations. There are several youth organizations as well as student groups that tend to work with community extension work and environmental education campaigns, and cultural rejuvenation, particularly in music and dance. Private foundations and other NGOs operate to conserve specific areas, such as Lita, Pimampiro, Mariano Acosta and Intag, most of them engaged in fighting deforestation, mining, fishing and illegal traffic of endangered species in the vicinity of small private reserves or bordering larger protected areas of the Andean flank.

2.1.2 Sacred natural sites conservation

While the majority of 'Otavaleños' and 'Cotacacheños' are Christian (either Catholics or Evangelicals), their religion does not conflict with the spirituality found in their cosmovision (or *runa yachay*). This important feature of the Andean culture has been described as syncretism that has helped both Western and original beliefs coexist in the area from colonial times to the present (Rodríguez 1999; Sarmiento 2017). However, fundamentalists have

pointed out important anachronisms that cannot admit the sacredness of a tree, or a waterfall (Vasquez-Fuller 1995). In the synchronic approach, this non-formal education, in addition to the *Utawallu*'s environmental non-profit work with reforestation and education, allow the mountain communities to lead more environmentally-friendly lives while benefiting from the conservation of the two extensive protected areas on the outer Andean flanks, two of the largest ecological reserves of the country (Cotacahi-Cayapas towards de Pacific coast and Cayambe-Coca towards the Amazonian lowlands), and the clean water from these reserves, taken as more than mere spatial features, but spiritual ones. Therefore, the indigenous nation occupies the *Imbakucha* watershed flanked by the two tutelary mountains framing their conceptual sacred landscape (see Fig. 2).

These original people have great respect for the environment; therefore, they also have reverence for its natural resources, specifically water, which is one of the most important energies of the mountainscape (*urku ayacuna*). Their esteem for water is derived from their cleanness, spirituality and the significance of sacred sites in the indigenous culture. This observance of sacred sites comes from the conversations of indigenous peoples' ancestors, grandparents, and parents (*tinkuy rimay*), and the essential rituals of initiation and purification (*wuatuna samay*) associated with their spirituality and the sacred sites. This also explains the mythology associated with plants (e.g. *tutura* reed), animals (e.g. *ukumari* bear) or watery phenomena (e.g. rainbow for 'mal del arco' maladies, or seepage walls for 'rinconada' frights, or surface lake eddies for 'duende' sights).

2.1.3 Sacred water bodies

Sarmiento (2003) argued that sacred sites must integrate conservation scenarios for biocultural heritage preservation, since this will in turn protect water resources that are located in the same areas as sacred sites (Barrow & Pathak 2005), particularly when you have montane tropical cloud forest full of epiphytic gardens, often shrouded in horizontal precipitation. Although notwithstanding their spirituality, while many original peoples respect sacred sites, there are many who do not (Rhoades & Zapata 2006). In the event of the recognition of an officially declared conservation category, the sacred sites of the *Utawallu* will be protected for posterity, in the same way that its rich agro-biodiversity will be safeguarded. One way to ensure that sacred sites are protected is to place them under the protection of Category V of IUCN with detailed guidelines, as edited by Robert Wild and Toby McLead (2008). These guidelines are aimed at "improving the management of sacred natural sites in formally designated protected areas, as well as supporting those that lie outside protected area boundaries" (eds. Wild & McLead 2008). Recent investigations into the retreat of the *Mama Kotakachi* glacier provide evidence of local ethno-ecological knowledge on the global climate (Rhoades, Zapata & Aragundy 2008) and changes associated with the transformation of original lifescapes. As documented by Nazarea and Guitarra (2004), the anthropomorphic idea of the mountain landscape offers conviction to the *Utawallu* that they are connected to the land through sacred sites, where water rituals are still performed and observed as nation-building traditions among their people. The collection of rock glacier and/or glacier ice as ceremonial "payments" or 'pagamentos' to the *Pachamama*, is one example. Another example, the yearly initiation shower in the sacred 'cascada de Peguche'. The *Piguchi* waterfall (or *Phakchayacu*) is located in a small private reserve and serves as the main purification site for the *Kichwa Utawallu* during the Festival of the Sun (*Inti Raymi*), a weeklong celebration held during the summer solstice.

The 'Lechero' or *yayitu* or *taitiku* (little grandfather) is an emblematic tree (*pinllu* or *pinkul) or* 'árbol sagrado' tree (*Euphorbia laurifolia*) growing on top of *pukara* or 'Reyloma' that overlooks the watershed, as an embodiment of the fertility of *Imbakucha* lake, being a majestic landmark in their local communal lifestyle; the tree of eternal life is a medicine tree that symbolizes life and death (Wibbelsman 2005a). Located on top of 'Reyloma' hill, the 'Lechero' represents "mutual dependency" between the original people and their environment (Wibbelsman 2005a). Clones of the 'Lechero' tree are found in most households because it is highly respected and sacred; also, it has practical importance in ethno-medicine and good potential as living fences (see Fig. 7). The *Utawallu* believe that the tree protects their fields and homes: "the milky sap of the tree is a natural acid that burns the skin…[and is used] for warts, curing deafness, toothaches, eye problems, liver cirrhosis, nerves, bacteria, fungi, viral infections and abortions" (Wibbelsman 2005b).

Lake 'San Pablo' lies at 2,660 m ASL. It has a maximum depth of 35.2 m (Gunket 2000). *Imbakucha,* the largest tectonic lake in Ecuador, is nearly circular and is situated at the base of *Tayta Imbabura*; there is some shoreline development, ranging from tourist resorts and villages, to farmland (see Fig. 8) . The lake plays an important role in the *Utawallu* arable lands (*allpa)* of the community: its water is used for irrigation, for animals to drink, for collecting drinking water and for fishing, washing clothes, and the cultivation of 'totora' reeds to manufacture 'aventadores' or squared handled fans, sleeping mats, coverings and rugs, as well as to build small boats (Gunket 2000). It is also used for recreation, including boating, and tourism activities (Willis & Seward 2006). However, because of "the intensive cultivation, steep slope of the fields and high precipitation rate that results in much erosion…[as well as the] high

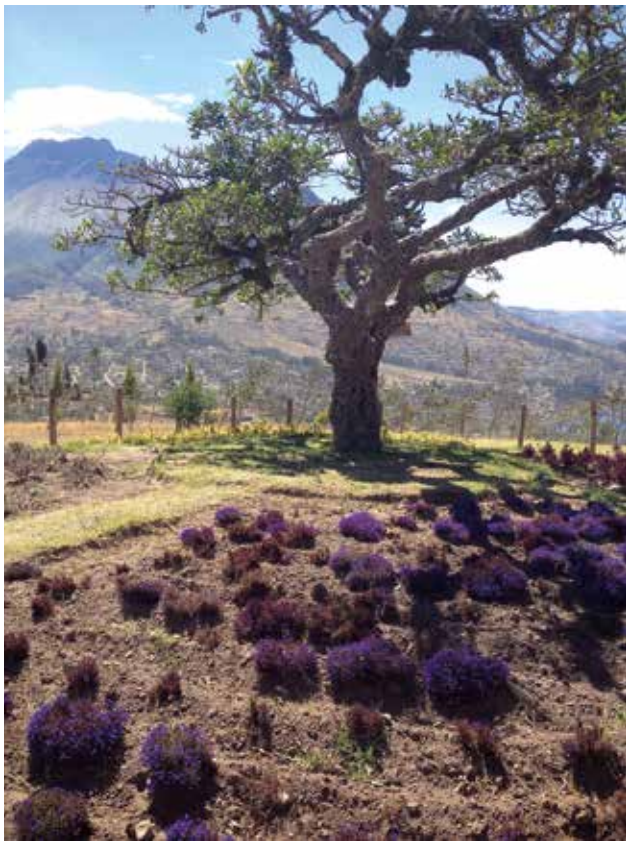

Figure 7. The sacred tree of the Otavalo is maintained with ornate plantings surrounding the ancestrak location of the mature tree of *pinllucruz*, despite the adventurers' sacrilege of burning camp fires, or even bone fires atop of the *pukara* of "Reyloma". (Photo: Fausto Sarmiento)

input of nutrients into the lake", *Imbakucha* is an eutrophic lacustrine system that needs remediation (Gómez Rosero 2017, 155). Furthermore, sewage from the main settlement flows through a pipe directly into the lake and into the *Itampi* River (i.e. the main water source for lake communities and for rural dwellings and flower greenhouses upstream and downstream) (Gunket 2000). Although development has affected *Imbakucha* Lake, its waters are still sacred among *Kichwa Utawallu* communities, as documented by Nazarea and Guitarra (2004) who reveal the relationship between the Castilian conquistadors and the original people, as well as the importance of water to the *Kichwa* culture (see Fig. 9). To a backdrop of two tall mountains and their spirits (*urku apukuna*), both 'Cotacacheños' and 'Otavaleños' refer to the *Imbakucha* Basin in terms of the cultivation of the area's different environments and the use of altitudinal defined zones that include the lacustrine (*wampu allpa*), the piedmont (*ura allpa*), the steep mountain slopes (*jawa allpa*), the Andean forests (*sacha allpa*), the high grasslands or 'pajonal' (*ugsha allpa*), and the screes of periglacial assemblage (*rumi allpa*).

The *Utawallu* associate their spirituality with the holistic lifescape (Carter & Sarmiento 2011) with more meaning than the simple tangible surroundings, possessing a deep understanding of the intangible values of the cultural landscape. The *Kichwa Utawallu*, therefore, observe Andean mythology by reverence to the environmental blessings (not services) of the valley, above all water, which is one of the most important reifications of their mountainscape. The importance of this sacred dimension is derived from *Utawallu* ancestors and is passed-down through oral history; it includes the essential rituals of initiation and purification associated with the heightened spirituality observed at sacred sites (Sarmiento, Rodríguez & Argumedo 2005), mainly around the 'rinconadas' or mountain seepage sites, the actual lakeshore or mythical 'recodos de laguna' and the *Piguchi* waterfall, where cleansing and initiation rituals are still held. Indeed, sacred loci connected to spirituality in *Imbakucha* are mostly found in locations where water emanates: they may be where useful reeds (*tutura*) were

Figure 8. A panoramic view of Imbakucha lake, formerly known as Laguna de San Pablo, the largest water body in Ecuador and the home base of the Utawallu Kichwa nation, , making evident the dilemma of keeping traditional sustainable practices of subsistence agriculture amidst the maelstrom of modernity of the globalized world. (Photo: César Cotacachi).

Figure 9. Panoramic view of the location of the study area in relation to the telluric presence of dormant volcano Imbabura. The sacred mountains frame the valley where Imbakucha lake is located at the epicenter of the sacred geographies that link water (yaku), cloud (puyu), mountain (urku) and people (runa) in a complex, yet harmonious and proud existence. (Photo: César Cotacachi).

planted, or where water bodies such as streams (*wayku*), rivers (*yacu*), seepage coves (*pukyu*), waterfalls (*phakcha, churru*), lakes (*kucha*), ice (*rasu*) or snow (*riti*) are found, or anywhere in which a form of water can exist with its purifying essence (Sarmiento 2016b). The very presence of imposing volcanoes and life-giving lakes create a well-respected observance of cycles of plant production and a concentration of endemic fauna and flora in certain areas of the Andean lifescape, making the *Imbakucha* watershed sacred a comprehensive sacred park.

3. The way forward

Incorporating the sacred dimension is only one of many ways to achieve integration of CES into biocultural heritage preservation. By presenting the uniqueness of the *Utawallu* and their mountainscape, we seek to sensitize international audiences in helping break the trend for protecting nature only because of its utilitarian value, commoditizing the services of nature (such as providing, regulating or supporting the physical content of the landscape or phenosystem), but also for protecting the nature/culture hybrid of the present—mainly because of the contributions from nature to people (such as intangibles, social and landscape values for the psychosocial mindscape or cryptosystem), including the Andean identity.

3.1 Challenges

The newly codified constitutional rights of *Pachamama*, or 'mother nature', and the new array of ministerial responsibilities on cultural heritage in Ecuador have brought cultural landscape conservation to the forefront of governmental policy (Sarmiento & Viteri 2015) and central to the concerns of decentralized autonomous local governments (or 'GADs'). Nevertheless, a number of potentially detrimental pressures that may negatively affect sacred natural site conservation exist (eds. Sarmiento & Hitchner 2017). These include an excessive number of market-oriented tourists, non-original government officials (aside from the original mayors), non-original businesses, factories and polluting industries, a rise in both original and mestizo populations and modernization as a result of the influence of television and technology, and an increment in crime due to recent immigration fluxes from troubled neighboring countries. Notwithstanding the *Imbakucha* Basin identity, its SEPL is not monolithic. These negative factors of environmental deterioration are noticeable in Otavalo. On one hand, it is more urban than Cotacachi and its inhabitants are more distant from their environment (with the exception of the 'Lechero' trees in the majority of indigenous homes and gardens). Cotacachi, on the other hand, is less affected by these negative factors; it is less built up and its inhabitants are much closer to their environment. For example, many *Utawallu* buy groceries from local stores and live in neighborhoods similar to those found in some western nations, while the majority of *Kutakachi* have their own private gardens that they tend to on a daily basis. These gardens are not only for growing vegetables, but are also used to keep animals (Sarmiento et al. 2019). However, the 'Cotacacheños' are beginning to follow the same urban trends as the 'Otavaleños' and so, there is concern that the *Kutakachi* may become more distant from their natural environment.

3.2 Management needs

Even though Cotacachi town has more of a "mountain feel" about it (given that it is located higher in the valley between Mt. *Kutakachi* and Mt. *Imbabura*), respect for the sacred is being lost (Rhoades & Zapata 2006). In order to minimize this separation in the two communities, sacred sites in Cotacachi and Otavalo must be considered for IUCN's Category V, and the principles for protected landscapes (eds. Brown, Mitchel & Beresford 2005) must be instilled into everyday lives to allow for the preservation of *Kichwa Utawallu* ancestral beliefs and values, while also providing economic income from ethnotourism. The recent declaration by UNESCO of the Global GeoPark in Imbabura brings a management plan that intersect geotourism for the natural monuments of the area with the ethnotourism, or social tourism, of intrinsic cultural aspects observable in the *Imbakucha* watershed. A new approach for heritage conservation should be energized by recognizing the sacred natural sites, and having a special designation of either: memory landscape, spiritual park, religious reserve, or biocultural sanctuary, to be included in the guidelines for conservation management of the area (Sarmiento 2013). By having this new conservation category validated in Ecuador as well in other countries of the tropical Andes, the monitoring and assessment of cultural values in biocultural heritage preservation will be assured and the ecosystem services respected and protected.

4. Conclusion

Biodiversity is threatened, since the settled area of *Imbakucha* has become overgrown with introduced species, most of them weeds and fast-growing invaders such as the African grass (*Kikuyo elephantopus)*, Monterrey pine (*Pinus radiata),* African bristlegrass *(Setaria sphacelata)* and the Australian blue gum tree (*Eucalyptus globulus)*. Towards the outer boundaries of the *Imbakucha* Basin, protected areas have been established with the purpose of maintaining examples of pristine natural habitats, including the 'páramo' grasslands and the remnants of the Andean forests. The lack of understanding of landscape archaeology of the

area and of the true 'natural' history of the elements of the cultural landscapes of the *Kichwa Utawallu* has exacerbated a divorce between the goals of preservation (i.e. nature protection) and of conservation (i.e. nature management). By continuing to consider Andean forests and 'páramo' grasslands as 'natural' ecosystems, instead of syncretic, manufactured SEPLs, conservationists and government agencies are hindering the (re)affirmation of the cultural identity of the 'Otavaleños'; instead, they are bolstering the hegemony of a foreign concept of conservation based on consumption-linked, species-oriented conservation and a forced "pristine" conceptual framework that separates the human dimension from everything else, rather than observing the ancestral cosmological vision of the *Utawallukuna,* integrating the Andean trilemma (Sarmiento et al. 2017) for a comprehensive CES valuation.

More research must be conducted into sacred site conservation and its relation to spirituality, as well as into the objectification of landscape features, ecological knowledge, ecotourism, environmental education and environmental ethics (Verschuuren et al 2010). Additionally, future studies in *Imbakucha* should include investigations of the adaptations of *Utawallu* communities to the ever-changing cultural environment surrounding them. These studies should index the reification of landscape attributes, and formal protected area status should be given to the main features of the landscape with appropriate designations such as GeoPark, 'Reserva Paisajística', 'Sitio Sagrado', Spiritual Park, Protected Landscape, Religious Monument and/or a designation within the UNESCO program for Sacred Site Conservation. Ecuador will benefit greatly from including Category V conservation in its National Strategy for the Conservation of Protected Areas; the current administration has already supported that socio-ecological production landscapes will be a goal of the new Law of Culture and the works of the Institute of Cultural Heritage. The sacred sites we have discussed must be protected not only for their environmental value, but also out of respect for the significant intangibles present in the different sacred sites of the *Kichwa Utawallu* around the *Imbakucha* Basin that contribute greatly to the Ecuadorian identity in Latin America and the world (see Fig. 10).

Figure 10. As a concluding graphic remark, happy faces portrayed to convey a message of hope that new generations will follow ancestral practices of respect for *Pachamama* and of reciprocity and self-awareness, so that the *Utawallu* sacred natural sites be venerated and maintained for future generations, achieving *Sumak Kawsay* or the collective 'good living' to which all Satoyama landscapes aspire. The celebratory ambiance of the children translates the optimistic outlook for the socioecological production landscape of *Imbakucha* to incorporate the benefits of uncommodified values in nature conservation. (Photo: César Cotacachi).

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Chapter 4

Empowering communities for natural resource management: the case of Community Resource Management Areas (CREMA) in Western Ghana

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Abstract

Natural resource management in Ghana has gone through several phases with different results. Prior to colonialism, traditional leaders and local communities devised different mechanisms to protect the integrity of natural resources, including the use of taboos, norms and customs. The adherence to these traditional practices was meant to ensure the long-term conservation of resources and safeguard economic security. The traditional practices were no longer entertained during colonial times and at the time of independence. The government then adopted the protected area management approach for natural resources, which only led to loss of biodiversity. Against this background, the Government of Ghana recognized the value of community involvement in resource governance and established Community Resource Management Areas (CREMAs). The CREMA intervention focuses on bringing together communities that share common resources and take affirmative action to jointly manage their shared resources. An expected outcome of the CREMA initiative has been the willingness of communities to set aside parcels of undisturbed community-owned forests to be sustainably managed. This result will enhance the preservation of sacred groves and other cultural attractions, as well as regulate agricultural production within the landscape.

To sustain the functioning of the CREMA initiative, a robust management strategy that will address the needs of different stakeholders is required. A study was therefore conducted to understand the needs of 1,540 stakeholders, 50.8% of whom were males and 49.2% females, to support the management of the CREMAs. The study adopted a survey and biodiversity assessment strategies to generate data from the respondents. A Community Biodiversity Value Typology was used to assess how the communities value their biodiversity. The consumptive value obtained a total score of 57, indicating that about 21% of the respondents place value on the consumptive use of the resources. This confirms that most of the local people are only involved in subsistence agriculture. There is evidence to suggest that the landscape of the CREMAs is rich in faunal and flora species of global and national importance. Unfortunately, historical and contemporary human activity have had profound influence on the structure and composition of the CREMAs. The decline in wildlife populations can be attributed

to rapid human population increases within the landscape, which have led to encroachment on wildlands that previously served as habitats for iconic wildlife species. Notwithstanding, the CREMAs are proving to be the most effective means of engaging communities to appreciate the value of natural resources and participate in their sustainable management.

Keywords: CREMA, Natural Resources Governance, Rural Communities, Traditions and Customs, Stakeholders

Country	Ghana
Province	Western Region
District	Aowin, Juabeso, Bia West & Akotombra
Size of geographical area [1]	24,153 square km
Number of indirect beneficiaries [2]	113,000 persons
Dominant ethnicity	Aowin and Sefwi

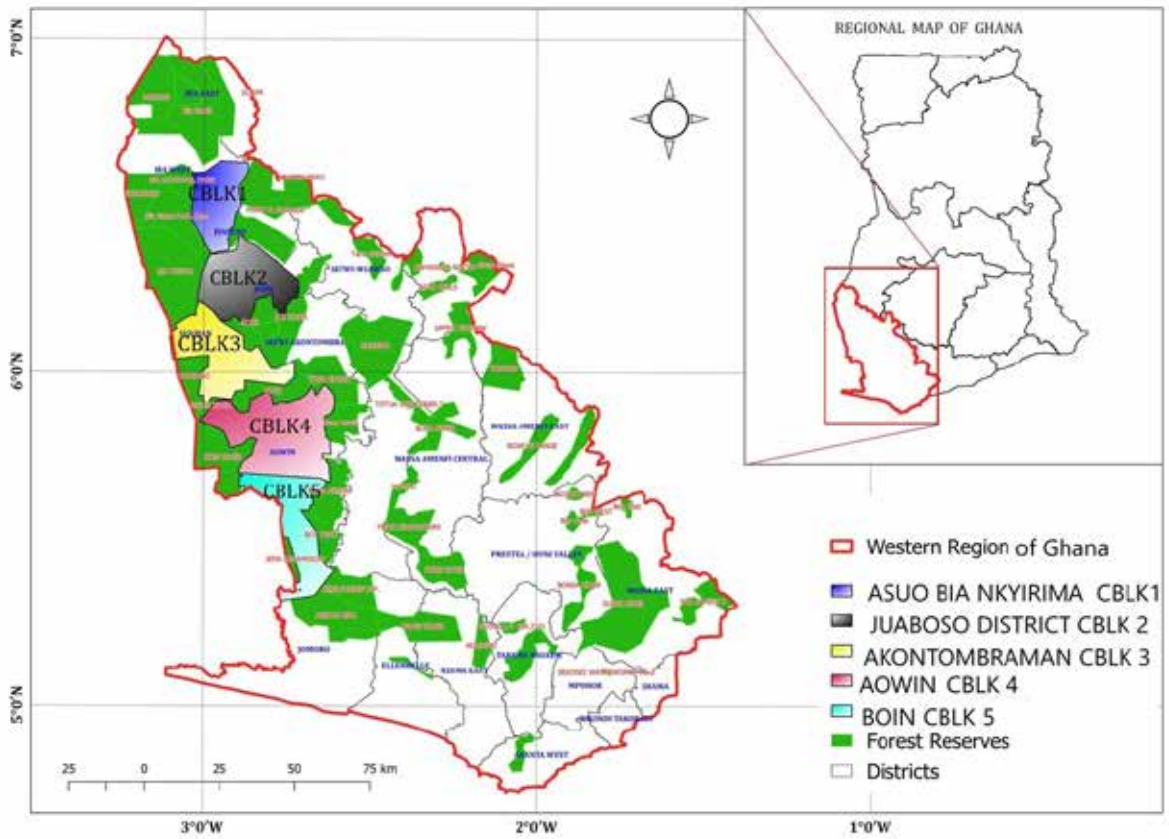

Figure 1. Map of the country and case study region, CREMA sites in Western Region of Ghana

Size of case study/project area [1]	2,391 square km
Number of direct beneficiaries [2]	1,540 persons
Geographic coordinates (longitude and latitude)	6°35'55.4"N 2°50'19.1"W
Dominant ethnicity	Aowin and Sefwi

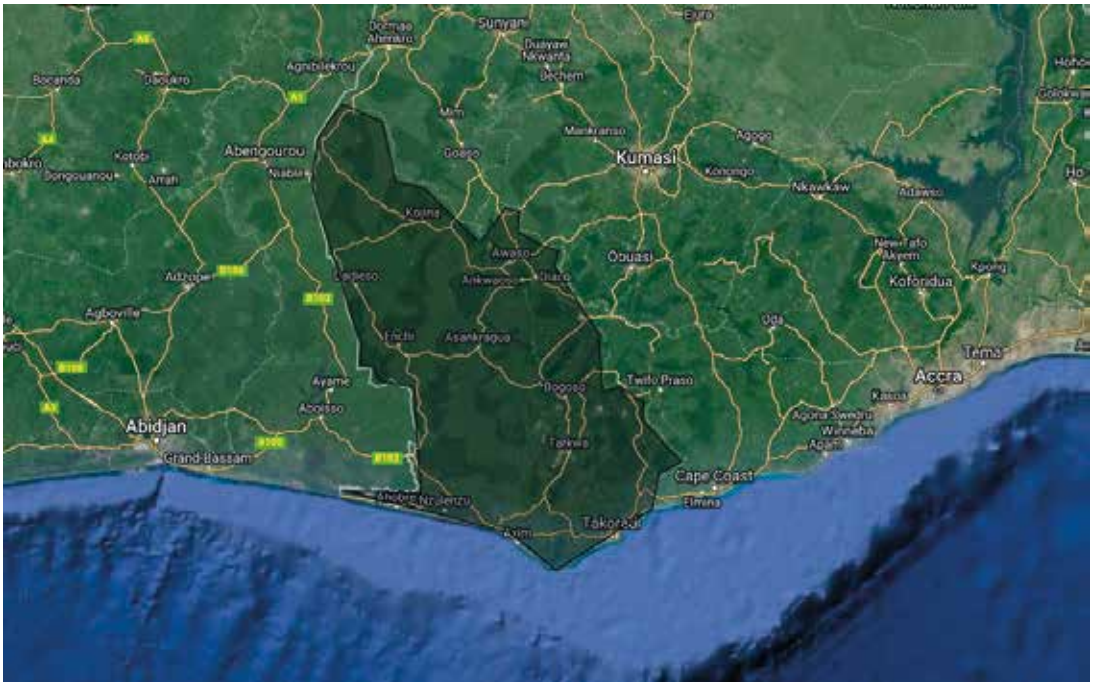

Figure 2. Land cover map of case study site (Source: Google Maps)

1. Introduction

The role of natural resources in rural development has sometimes been viewed in terms of major public investments in natural resource development such as large multi-purpose projects (Cockx & Francken 2014; eds. Fabricius et al. 2004). Increasingly, natural environmental systems have come to be recognized for their importance to the quality of rural community life. Different stakeholders within resource-rich communities depend on these resources to meet their needs through the exploitation of common property resources such as lands, rivers and forests (eds. Satterthwaite, Reid & Bass 2013). It is therefore understandable that stakeholders place high value on the diverse ecosystem services that emanate from the natural resources to sustain their livelihoods and well-being.

The dependence of rural economies on their natural environment is even more pronounced among communities located within the forest zones of Ghana, due to the diverse goods and services they provide (Ekpe et al. 2014). Any change in the capacity of the ecosystem to sustain these multiple benefits could therefore have dire consequences for rural economies (Reid & Huq 2005; eds Satterthwaite, Reid & Bass 2013). This largely explains the reasons behind the measures taken by different governments to ensure the long-term security of the socio-ecological production landscape (SEPL).

In the past, traditional ethics (norms, precepts, principles and taboos) were adopted to efficiently regulate the activities of community members towards the use and management of natural resources (Binlinla, Voinov & Oduro 2014; Harich et al. 2013; Ntiamoa-Baidu 1995; Udokang 2014). The adherence to these traditional practices were meant to ensure the long-term conservation of these natural resources and safeguard the quality of ecosystem services to the locals. The traditional system of resource government was, however, considered insufficient to ensure sustainable use of natural resources after independence because it could not be enforced by chiefs and elders under the new protected area management system.

West, Igoe and Brockington (2006) noted that post-colonial governments have promoted the protected area management approach to natural resource management by

offering enhanced protection to areas of exceptional value (socio-cultural, ecological, economic, etc.). This approach also provided a holistic and landscape perspective to natural resource management and provided added benefits to landscapes with varying levels of human alterations (Millennium Ecosystem Assessment 2010; Stolton & Dudley 2010; Wu 2013). This form of management offered opportunity for the government to sustain its revenue flow from the supply of timber, ecotourism and agriculture. As a means of safeguarding the integrity of these natural resources to be able to deliver multiple benefits to different stakeholders, management systems were modified and programs initiated to take on board the elements of traditional and protected area management.

One of such initiatives is the establishment of the Community Resource Management Area (CREMA) in 2000 by the Government of Ghana to devolve management rights and responsibilities, and authority for natural resources outside protected areas, to local communities. This project was implemented by Conservation Alliance in collaboration with the Wildlife Division of the Forestry Commission and other partners. The CREMA intervention focuses on bringing together communities that share common resources and take affirmative action to jointly manage their shared resources. The increasing demand for the landscape to deliver multiple values and benefits to all the different stakeholders within the SEPL poses a great challenge to the sustainability of the initiative.

2. Project area

The project area lies within the Western Region of Ghana and covers an area of approximately 2,391 square kilometres, which represents about 10 percent of Ghana's total land area (see Fig. 1 and 2). Ghana's Western Region constitutes part of the Upper Guinean forest hotspot. The region has about 75 percent of its vegetation within the high forest zone of Ghana, and lies in the equatorial climatic zone that is characterized by moderate temperatures. It is also the wettest part of Ghana with an average rainfall of 1,600 mm per annum. The CREMA sites lie within latitude 6.598734° and longitude -2.838630°.

The landscape is restricted to a number of isolated patches of forest that contain exceptionally diverse ecological communities, distinctive flora and fauna, and a mosaic of forest types that provide refuge to numerous endemic species. The total area of the CREMAs in the western corridor now stands at over 102,000 ha, and they are located within 182 communities with an estimated population of 113,000 persons in the landscape (CA 2018).

Agriculture is the main economic activity within the landscape. Both tree and food crops are widely cultivated. Cocoa production is an important economic activity and the region accounts for more than 50 percent of Ghana's cocoa export. Traditional land ownership hierarchies and governing systems prevail over the area. The communities within the project area have a unique attachment to natural resources as exhibited in the naming of villages (e.g. '*Bokaso*', name of a village, translates 'mountain top'), as well as the festivals that are directly related to celebrating the fruitfulness of agricultural lands (e.g. '*Eluo* Festival' celebrates fruitful harvests) (see Fig. 3 and 4). The CREMA landscape is well structured thus making it easy to communicate and monitor the use of natural resources by stakeholders.

3. The problem

The 1992 Constitution vested all minerals and natural resources in the presidency (Government of Ghana 1992). The Government, therefore, established the Lands, the Forestry, the Water Resources and the Minerals Commissions and their allied agencies to manage these resources. Until the change in management regime, the locals had adopted norms, precepts, principles and taboos to efficiently regulate the actions of community members towards the

Figure 3. Rural housing within CREMA (Photo: CA, Ghana, 2018)

Figure 4. Women carrying baskets of cocoa pods (Photo: CA, Ghana, 2018)

use and management of natural resources (Binlinla, Voinov & Oduro 2014; Harich et al. 2013; Ntiamoa-Baidu 1995; Udokang 2014). With an increasing pressure on resources and the resulting land degradation, an urgent action to develop a more efficient management system that would sustain the integrity of the natural resources and serve the needs of all stakeholders was required. The CREMAs were thus put in place to allow for local participation in natural resource management and to address multiple demands on ecosystem goods and services. A knowledge of the needs of the different stakeholders was thus critical in designing a more robust management system to enhance the health of the socio-ecological landscape and reduce biodiversity loss.

Figure 5. Chiefs and elders at CREMA Meeting (Photo: CA, Ghana, 2018)

3.1 Approach

This study sheds light on the multiple values that different stakeholders have placed on the CREMAs and the health of the production landscape. It used two main approaches to generate data for analysis and reporting: a Community Biodiversity Value Typology (CBVT) and a rapid biodiversity assessment using the Rapid Assessment Program (RAP) technique.

The CBVT approach links local perception of place to a broader measure of environmental values at the landscape level. The approach was thus used to assess how the communities value their biodiversity (see Table 1). The tool provided insight into how these values are likely to motivate certain community behaviors, as well as facilitate the design of appropriate biodiversity conservation projects. To capture the communities' perception of the socio-ecological value of the CREMA landscape, the study purposefully categorized stakeholders into seven groups for ease of assessment, analysis and reporting. The groups included chiefs and elders, a religious group, farmers, a men's group, a women's group, herbal medicine practitioners, and the youth. There were 1,540 participants, with 50.8% males and 49.2% females. This is consistent with the demographic characteristics of the area, with the female population being less than 2% that of their male counterparts (Ghana Statistical Services 2018). Through a participatory manner, the groups identified eight multiple values, including consumptive, production, naturalistic, aesthetic, symbolic, moralistic, education and training and ecosystem services, that the CREMAs are perceived to deliver. Members of each identifiable group were given the opportunity to rate the values on a scale of 1 to 10 at several informal meetings. Each group had a total of 220 persons and each member of the group rated the CREMA in terms of the services it is perceived to provide (see Fig. 5).

Additionally, a rapid biodiversity assessment was also conducted to obtain first-hand information on the state of biodiversity in the CREMA sites. The field assessment by a team of taxonomic experts focused on the forest condition and the levels of primary species, such as the large and small mammals present within the site. The ecological health of the sites could further explain the differences among stakeholders' perception of the value of the landscape and could also be key in determining the success or otherwise of similar initiatives.

3.2 Project activities

The project activities were also consistent with the objectives of the International Partnership for the Satoyama Initiative (IPSI). In particular, the project promoted increased knowledge and understanding of biodiversity and the production landscape (*Objective 1)* and addressed the causes of loss of biodiversity and cultural diversity (*Objective 2*). Similarly, it promoted improved benefits to communities from socio-ecological production landscapes and seascapes SEPLS (*Objective 3*). The outcome of the project is reflected in the health of the SEPL and the well-being of the locals. The study was thus built around two main thematic areas, as shown below.

i. Establishment of the multiple values of the CREMA sites held by stakeholders; and

ii. Establishment of the socio-ecological health of the production landscape.

3.2.1 Establishment of multiple values placed on the CREMA sites held by stakeholders

Information on the socio-cultural significance of forest resources can be gleaned from anthropological, ethnobotanical, geographic, ethnomedical, and linguistic studies. The variety of socio-cultural values, beliefs and symbolic functions ascribed to forests are as numerous

and diverse as the communities and cultures within forest landscapes of Ghana. Physically and mystically, forests have defined the environment of communities in the region throughout time (Falconer 1990). The distinction that has been made between cultural values and the functions of forests is actually an artificial one. These values are not merely an additional layer of issues to consider as constraints to normal management, but are the vehicle through which the value of biodiversity to society is realized (Tabush 2010). Tangibly and intangibly, forests feature in all aspects of culture: language, history, art, religion, medicine, politics, and even social structure itself, and actually define people's sense of identity.

The forest has traditionally been regarded as the home of ancestral spirits who provide protection, success and progress to the people of the Traditional Area. The forest symbols thus provide social structure and cultural identity in the rapidly changing environment of the CREMA landscape. The trees, the links between the sky and earth, symbolize the links between the spiritual world of ancestors and people. Rituals and ceremonies which draw on forest symbols serve to link the people to their cultural heritage, as well as their ancestral past (Calame-Griaule 1970). A number of taboos, customs and other norms are thus observed by a group of people within a defined forest fringe locality to show reverence to the forest through regulation of the use of forest resources. The community forests are thus sources of stories, myths and local traditions which provide strong justification for the continued protection of the CREMA landscape. The CREMAs also provide a range of products for traditional ceremonies, from food and beverages to costumes and musical instruments. While some of these products are now perhaps less often used on a day-to-day basis, they still form essential elements of a variety of cultural activities.

Some wild animals in the CREMAs are regarded as totems for some of the clans. Some streams and rivers are also regarded as gods by the fringe communities (CI-Ghana 2002). The reverence for these resources accounts for the taboos and norms that prohibit the hunting of these sacred animals. Several studies have established the commitment of the people within the landscape to support any measures that will contribute to the continuous existence of the forest and maintenance of its ecological integrity (CA-Ghana 2015; CI-Ghana 2002). The ecological services provided by the CREMAs largely account for the large number of migrants involved in agricultural production. (CA-Ghana, 2015)

3.2.2 Establishment of the ecological health of the production landscape

The landscape of the CREMAs forms part of the moist-evergreen forest described as vertically compressed with canopy trees rarely exceeding 40 metres (Hawthorne & Abu-Juam 1995). The high forests of the project area, like the other tropical forests of the upper Guinea, are characterized by a rich and complex floristic and faunal composition. The landscape is made up of many different tree species (including *Triplochiton scleroxylon, Khaya invorensis, Celtis sp., Terminalia superba, Entandrophragma ivorensis, Ceiba petandra, Antiaris africana* and *Milicia exelsa*). Deforestation through logging and clearance for agricultural land has occurred over much of the species range, especially in the last century. In addition, both subsistence and commercial hunting have heavily impacted populations of these species.

The distribution and trends in all wildlife populations within the landscape point to a steady and continuous decline (CA 2018). It is evident that the major threats to species are habitat loss and degradation and hunting. Improved access to forest interiors through logging roads has increased hunting pressure on these species. The CREMA initiative is thus meant to reduce habitat and species loss through collaborative and sustainable management of community forests.

4. Results of the study

The survival of the communities is precariously linked to the biodiversity resources of the area. Community members depend on the biodiversity resources for their income, health, food, housing and cultural practices (CI-Ghana 2003). The respondents expressed striking differences in the value they place on the CREMA SEPL.

4.1 Establishment of the multiple values placed on CREMA sites by stakeholders

Whilst biophysical, and increasingly economic, values are often used to define high priority hotspots in planning for conservation and environmental management, community values are rarely considered (Raymond et al. 2009).

The numerical values placed on the eight identified biodiversity values by the different identifiable groups were computed to establish scores, as shown in Table 1.

The consumptive value obtained a total score of 57, which means that about 21% of respondents consider their biological resources to be for consumptive use (see Table 1). This supports the fact that the people are only involved in subsistence agriculture (i.e. to feed their families), since there is virtually no new land to support the cultivation of cocoa and other cash crops due to population increase in the area.

The community members traditionally use their forests and agricultural lands as training grounds for their children.

Table 1. Community biodiversity values (scores) (Source: Conservation Alliance International 2018)
Scoring legend: On a scale of 1 to 10, with 1 (10%) = least value; 10 (100%) = highest value

Communities Biodiversity Values	Identifiable Groups in the Community								
	Chiefs & Elders	Religious Group	Farmers	Men's Group	Women's Group	Herbal Medicine Practitioners	Youth	Total	%
Consumptive	9	9	6	6	9	8	10	**57**	21
Production	1	1	4	4	1	1	0	**12**	5
Naturalistic	2	4	2	3	3	6	8	**28**	11
Aesthetic	1	2	1	1	4	1	4	**14**	5
Symbolic	9	2	5	5	4	8	1	**34**	13
Moralistic	4	5	3	4	5	7	3	**31**	11
Education & Training	8	4	10	8	6	10	4	**50**	19
Ecosystem Services	6	5	8	5	6	6	3	**39**	15
Total	40	32	39	36	38	47	33	265	**100**

Farmers traditionally train their children on farms. By working with their parents on farms, children acquire hands-on training and professional maturation. It is for this reason that the table shows a second highest score of 50 (19%) for the education and training value of the biodiversity of the area. The community rated ecosystem services as the third most important value at 39 (15%), after considering the key ecological services, i.e. provisioning, regulating, cultural and supporting. Symbolic value received the fourth place (13%) since the landscape is made up of indigenous communities. In such a rustic society, much of the daily language is full of proverbs and euphemistic expressions, which is not often the case in urban areas with their cosmopolitan nature.

4.2 Establishment of the ecological health of the production landscape

The physiology of the sites under review make the landscape a critical component enhancing the environmental resilience of the surrounding area in terms of being able to withstand environmental stresses such as drought, mineral deficiencies, unfavourable temperatures, and air pollution. The landscape has rich flora and faunal species, including mammals, amphibians and reptiles, butterflies and birds. Over 50 species of birds have been recorded; they include the internationally endangered white-breasted guineafowl. Unfortunately, historical and contemporary human activity have had profound influence on the structure and composition of the forests. The average condition score of 3 was established by the taxonomic experts after the biological assessment. This score (based on Hawthorne & Abu-Juam 1995) indicates a high level of degradation of the landscape with opportunity for improvement.

The landscape has a network of rivers and streams, thus plays an important watershed protection function, preserving the quality and quantity of water for major towns and environs. Approximately half a million people depend on these water sources and the critical watershed services provided by the landscape that soaks up rain and mist and then holds, cleans and discharges the water for all to utilize.

The CREMAs also provide local communities with a broad range of products, including food, medicine, materials for building, and energy in the form of fuelwood (CA-Ghana, 2018). Where sufficient, communities are able to harvest these products for commercial purposes (see Fig. 7). Over 150,000 m^3 of timber and about 400 tonnes of other wood products are extracted yearly from the CREMA sites (Ansah 2014). Other timber products obtained from the forest include firewood, and wood for mortars and pestles (Ansah 2014; Ayivor & Gordon 2012). Cocoa plantations also supply a portion of the non-timber products to local communities that also benefit from the harvesting of cocoa itself. The herbaceous cover, however, provides suitable conditions for only part of the extensive list of non-timber products provided by forests, and in most cases also in smaller amounts.

The forests provide a number of regulating services including local microclimate amelioration and air quality maintenance, moderation of extreme events, erosion prevention and maintenance of soil fertility, pollination and biological control of pests. One striking feature in terms of

Figure 6. A Community Forest (CREMA) (Photo: CA, Ghana, 2018)

Figure 7. Wattle and Dubb house under construction (Photo: CI-Ghana 2006)

regulating services by CREMAs is their carbon sequestration potential. The vegetation in the CREMAs, including cocoa and herbaceous cover, contribute to capturing and storing carbon from the atmosphere, thus contributing to the maintenance of favorable global climatic conditions. Forest loss and fragmentation, which generate various negative environmental and ecological consequences, have become widespread phenomena across Ghana.

5. Discussion

The study has clearly established the significance of the CREMAs in promoting multiple benefits to communities within the landscape. The use of the Community Biodiversity Value Typology helped to define the differences among stakeholders with respect to the value they place on the CREMAs. There was evidence to suggest that different stakeholders have different preferences.

The high consumptive value of the CREMAs is an indication that most respondents expect the landscape to support agricultural activities. Any management system should therefore ensure that the ecological health of the CREMAs is sustained to deliver ecological goods and services.

Considering the total value of biodiversity to the groups, the herbal medicine practitioners considered the CREMA environment as very important and lucrative. This probably stems from the fact that they are able to make money out of the various herbal plants in the area despite the current level of degradation. It also indicates that there is demand for herbal medicine and that if development operations lead to deforestation, the public health and the livelihoods of the practitioners could be drastically affected (see Fig. 8 and 9).

The chiefs and elders, religious group, women's group and the youth, generally considered the biological resources of the area to be mainly for consumptive purposes. Only the farmers and the men's group pointed out that the biological resources of the area are of limited production value. Similarly, only the women's group and the youth indicated that the biological resources of the area have some aesthetic value. These marked differences clearly capture the relative importance of the CREMA sites to the various groups.

The overall interpretation of responses show that the CREMA communities view their biological resources as valuable for consumptive purposes and an excellent training ground for their children going into adulthood (CA-Ghana, 2018). Even though the land is degraded and cannot support adequate food production for the communities, the chiefs and elders consider it to have great value important to their survival. Since they are, by tradition, the custodians of all the lands, they periodically obtain royalties from developers to support their survival and the chieftaincy institution. They are also enjoined by their traditional oath of office to hold the land in trust for the next generation. The assessment has shown there to be a strong bio-cultural relationship between the CREMA community and its natural environment. In view of this, subsistence farming and the collection of wood and non-wood forest produce form the community's lifeline.

There is evidence to suggest that the landscape of the CREMAs is rich in faunal and flora species of global and national importance. Unfortunately, historical and contemporary human activities have profoundly influenced their ecosystems resulting in decline iconic wildlife species. This encroachment poses challenges to both humans and wildlife, with their encounters often resulting in human-wildlife conflicts.

Figure 8 and Figure 9. Two community herbalists showing the team plants of medicinal importance (Photo CI-Ghana 2002)

The CREMA initiative makes provision for routine monitoring of the ecological health of the landscape and the socio-economic impacts of the project at the community and landscape levels. This is to ensure that potential risks are addressed and opportunities utilized. The CREMA constitution provides the main guiding principles for all activities within any given CREMA. It was therefore developed with broad consultation and deep reflection on the part of all CREMA communities. A well-defined governance structure guided by the CREMA constitution was put in place to oversee the general management of the CREMAs. Each CREMA sets up a monitoring team that monitors the progress of their action plans, with teams usually including CREMA leaders, members and relevant stakeholders. The teams make periodic visits to the CREMAs and make the needed recommendations for uptake by the Wildlife Division, statutorily responsible for facilitating the efficient management of the CREMAs. A CREMA Secretariat is provided for the CREMAs to undertake all administrative functions. At the national level, a forest and wildlife monitoring scheme has been developed to guide periodic field assessment of the CREMAs. This activity is undertaken by the district office of the Wildlife Division and reported to the national office to help address any challenges confronting the CREMAs.

In spite of the positive contribution of the CREMAs to the ecological health of the landscape, the system is saddled with a number of challenges. The most important challenge is the sustainability of the funding support from the government and its international partners.

6. Conclusion

The diverse but critical services delivered by CREMAs to the vast majority of the communities justify their continued protection through a community-based arrangement. Further investigation into the value that the different categories of stakeholders place on the CREMAs and the services they provide could help in the development of appropriate management actions that ensure the delivery of conservation outcomes, the distribution of social benefits and management effectiveness.

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Chapter 5

The San Antonio Forest Key Biodiversity Area Governance Scheme: collective construction based on differences

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Abstract

The San Antonio Forest (SAF) is a key biodiversity area (KBA) located in Valle del Cauca in the Colombian Andes, and one of the regions most threatened by human intervention, with less than 30 percent of its natural ecosystems conserved. This productive and biodiverse landscape is a dynamic mosaic of ecosystems and land uses, including villages, crops, forests, pastures and private properties containing luxury country houses and small farms. It is considered as a socio-ecological production landscapes and seascapes SEPLS for the reason that it generates many services important to and needed by neighboring cities and rural settlements. Even though this area connects six protected areas (one National Natural Park, three National Forest Reserves, one Forest Reserve and one Natural Reserve of the Civil Society), the laws that regulate the use and conservation of these areas are not respected. As a result, the agricultural and livestock frontiers have extended over the past few years, causing habitat loss, fragmentation and overpopulation, which in turn have increased the pollution of water sources and threatened biodiversity. However, these threats have not been properly quantified, and neither information on the status of the SEPLS, nor monitoring tools are available. In response to this problem, the Corporación Ambiental y Forestal del Pacífico (CORFOPAL) and Social and Environmental Sense SENSE, with the support of other organizations working in the area, evaluated the resilience level of the SEPLS applying the Toolkit for Indicators of Resilience, to obtain information about the SEPLS, the communities and local stakeholders. During workshops with the different stakeholders, such as peasants, ranchers, large farmers and wealthy landowners, among others, marked differences were observed in how different

stakeholders conceptualize nature and how their differing perceptions are related to their appropriation practices. Based on an understanding of these differences, we developed a governance model called the "SAF-KBA Governance Scheme". The scheme is made up of four focus groups, with the representation of community leaders, ten locally-based NGOs that act in the four municipalities present in the SAF, private companies and government entities. This participatory scheme seeks to build a strategic and inclusive vision among the stakeholders, taking into account their different beliefs, attitudes, roles and responsibilities towards nature in order to facilitate inclusive and consensual decisions in the implementation of conservation strategies.

Country	Colombia
Province	Valle del Cauca
District	San Antonio Forest Key Biodiversity Area - Cali, Dagua, La Cumbre and Yumbo
Size of geographical area [1]	8,795.25 hectares
Number of indirect beneficiaries [2]	491,500 indirect beneficiaries
Dominant ethnicity	Without ethnicity

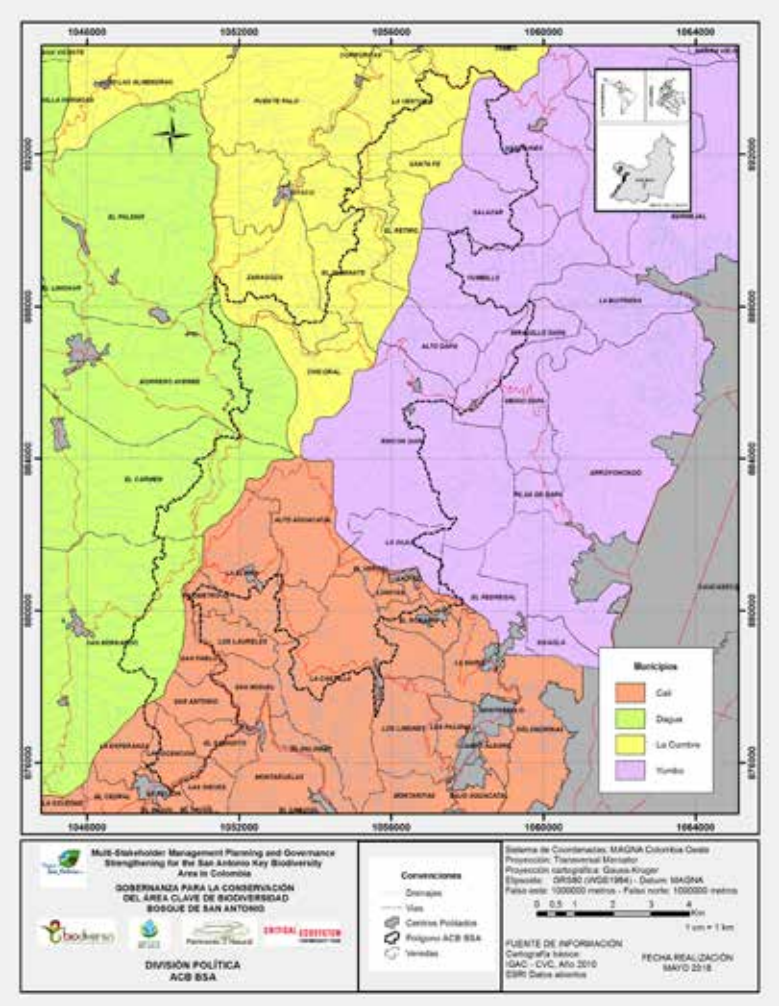

Figure 1. Map of the country and case study region

Size of case study/project area [1]	8,795.25 hectares
Number of direct beneficiaries [2]	114 stakeholders
Geographic coordinates (longitude and latitude)	Between 3°38'40"N and 3°28'0"N and 76°33'40"W and 76°39'45"W
Dominant ethnicity	Without ethnicity

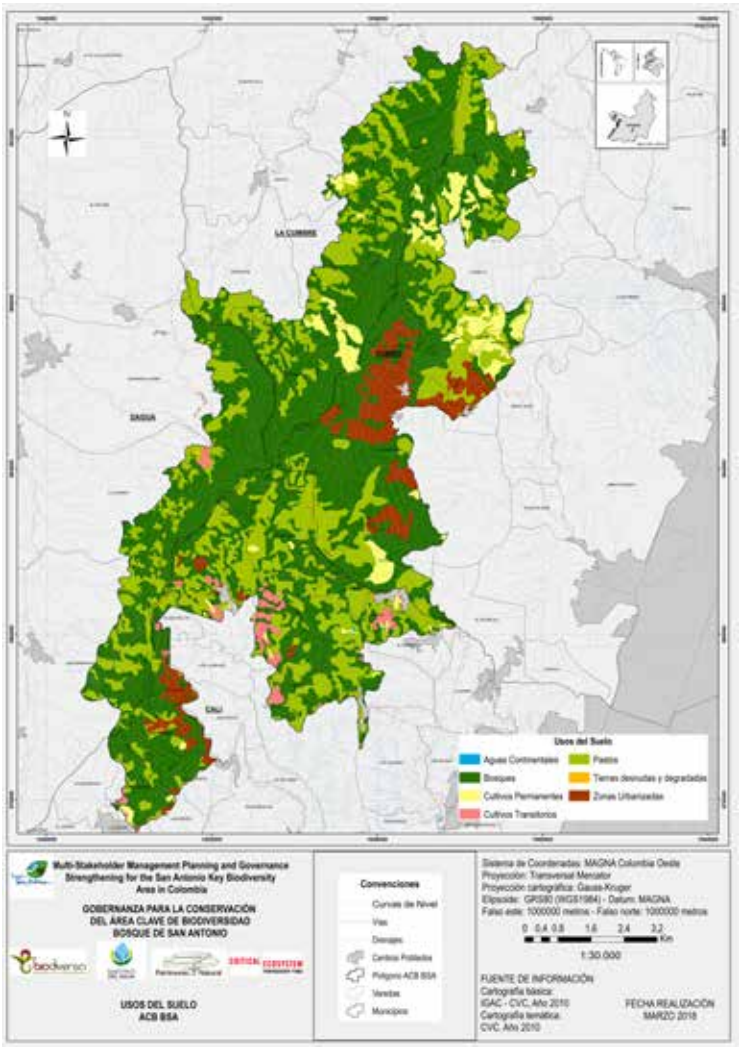

Figure 2. Land use and land cover map of case study site, geographical location of San Antonio Forest Key Biodiversity area SEPLS

1. Introduction

The notion of the social construction of nature has been immersed in a debate between radical and moderate environmental constructivism (sociology) that considers nature as a social construction, and realism (philosophy) that considers nature to be provided with its own ontology existing independently of human beings. Both positions can be considered radical, because the social construction of nature can be seen as a relational process of co-evolution that takes thousands of years, and whose final result is the transformation of society in the human environment (Arias 2011).

When a society interacts with nature, it does so through the exchange (sometimes involuntarily) of matter and energy, and intentionally through the application of certain technologies and labor in order to increase the benefit of elements taken from nature (Fischer & Haberl 2007). This link with nature generates environmental impacts and a reciprocal relationship of co-evolution, which leads to a situation in which both systems depend on each other, and influence and limit each other (Singh et al. 2010).

The socio-natural interaction in the construction of the concept of nature varies according to concrete spatial-temporal or historical contexts, giving place to both

positive and negative meanings or views of nature, being at times catalogued as the origin of the wealth of a country, and others as a wild and dangerous environment, where geophysical hazards such as extreme rainfall or earthquakes must be controlled (Gudynas 1999). If we look back at the medieval period (5th-15th century), nature was viewed from an organicist point of view, considered a living being of which humans were one component. On a different end, during the Renaissance period (16th-18th century in Europe), nature was regarded as the source of resources that the human being had to control and could manipulate at will. During the same centuries in Latin America, when the conquest and colonial periods were taking place, nature was viewed as an uncontrollable entity, as a wild and dangerous place due to the presence of wild animals and unknown diseases. Between the 18th and 19th centuries, there was a utilitarian vision of nature as a source of goods and materials that contribute to human development. Moving into the 19th century, the natural world started to be perceived as a machine that has its own mechanisms and operations (laws, that humans cannot violate), which allowed the field of ecology to emerge. By the end of the 20th century, nature was regarded as capital, reducing it to a factor in productive processes and integrating it into the tools and concepts available to economists (Gudynas 1999, eds. Pálsson & Descola 2001).

Moving towards the present day, in the 21st century nature has multiple faces or meanings. For some, it appears as the source of natural resources, which are used to achieve development (efficient utilitarianism vision), and for others, nature is equal to biodiversity and is viewed through its parts but also as a whole. Moreover, nature is seen as wilderness, described as an idyllic space where cooperation and symbiosis between living organisms predominate, for which it should be an example to humanity (Gudynas 1999, eds. Pálsson & Descola 2001). As for indigenous people and farmers or peasants, knowledge on the environment is valued, human beings are seen as part of nature itself, and there is a religiosity predominating towards the environment. Lastly, nowadays nature is considered an organism, and the planet constituted a system that self-regulates with emergent properties that make it a higher-level organism (Gudynas 1999, eds. Pálsson & Descola 2001). Considering this historical background, we can see that ecological processes are viewed as real, but the interpretation of these processes is built by the societies that interact with them, resulting in the construction and interpretation of nature itself (Camus & Solari 2008). Nevertheless, "nature has its own intrinsic values, independent from any human considerations of its worth or importance, and also contributes to societies through the provision of benefits to people, which have anthropocentric instrumental and relational values" (Díaz et al. 2015, p. 4).

These models, or representations of nature, are what define human action for or against nature. Likewise, they are influenced by scientific paradigms, e.g., the laws of thermodynamics were not enunciated or established until 1840-1850, and the connection between thermodynamics and evolution was not traced until the 1880s (Martínez 2005). Consequently, it was necessary to understand the different models and values of nature present among the stakeholders in the study area, in order to improve conservation and environmental management of nature and particularly of the socio-ecological productive landscapes and seascapes (SEPLS), as well as its governance. The latter is fundamental to better understand how environmental decisions are made and whether resultant policies and processes lead to environmentally and socially sustainable outcomes (Bennett & Satterfield 2018). In this context, this study aims to document the development of a participative governance scheme for the SEPLS present in the San Antonio Forest Key Biodiversity Area (SAF-KBA), which integrates the different visions of nature held by the main stakeholders.

1.1 Description of San Antonio Forest – Key Biodiversity Area

The San Antonio Forest (SAF) Key Biodiversity Area (KBA), part of the Paraguas-Munchique corridor, is one of the 31 Hotspots of the Tropical Andes of Colombia and one of the regions most threatened by human intervention, with less than 30 percent of its natural ecosystems conserved (Etter & Van-Wyngaarden 2000; Kattan 2002). This area in particular is prioritized by its very high species richness, their high level of endemism, and because some of these species are threatened with extinction (Critical Ecosystem Partnership Fund-CEPF 2015).

Comprising an approximate area of 8,795 hectares, the SAF-KBA is located on the northern side of South America, in Southwestern Colombia, on the eastern flank of the western Andean Cordillera (system of mountain ranges) in the Department of Valle del Cauca (see Fig. 1). It is under the jurisdiction of the municipalities of Cali, Dagua, La Cumbre and Yumbo (see Fig. 2), and comprises the area between grades 3°38'40" and 3°28'0" North latitude and 76°33'40" and 76°39'45" West longitude, with an altitudinal range between 1,700 and 2,150 meters. Three types of climates and humidity provinces predominate in the area: cold thermal floor and humid province, medium thermal floor and humid province, and medium thermal floor and dry province, defined by the gradient altitude and the influence of the Pacific, determinants of the great diversity.

The SAF-KBA is a dynamic mosaic of ecosystems and land uses, including villages, crops, forests, pastures and private properties with country houses and small farms,

Figure 3. Panoramic view of the dynamic mosaic of ecosystems and land uses of the SAF-KBA (Photo: Sebastian Orjuela)

Figure 4. Permanent tea crops in La Cumbre municipality (Photo: Jose Silva)

and therefore is considered to fall under the category of SEPLS (UNU-IAS, Bioversity International, IGES & UNDP 2014) (see Fig. 3). It provides important ecosystem services for the surrounding human settlements, including Cali, the capital of Valle del Cauca, as well as the Dagua, La Cumbre and Yumbo municipalities. It is also important because it connects six protected areas that the polygon-shaped area overlaps: the Farallones National Natural Park, the National Forest Reserve of Cali, the National Forest Reserve Cerro Dapa Carisucio, the National Forest Reserve of La Elvira, the Forest Reserve of Bitaco, and the Jurásico Natural Reserve of the Civil Society. However, the law is not respected and the agricultural and livestock frontiers have extended over the past few years, causing habitat loss and fragmentation, thus polluting water sources and threatening biodiversity.

1.2 Socioeconomic characteristics of the area

The distribution of the population in the SAF-KBA SEPLS reflects the disparity between the municipalities of Cali and Yumbo (where the population is concentrated in urban areas, and the municipalities of Dagua and La Cumbre, where population is concentrated in rural areas). Thus, there are two densely urbanized municipalities, with a large demand for environmental services, especially water, for their populations and that of the productive sectors, and also rural populations that require access to the same services.

Although a large part the SAF-KBA is regulated through the protected areas present in the polygon, there are still conflicts over land use. Productive activities in the municipality of Dagua focus mainly on livestock, agriculture and tourism. In the municipality of La Cumbre, livestock is the basis of the economy, as well as permanent crops such as tea (see Fig. 4), coffee, flowers and some transient crops such as vegetables and spices; however, the precarious road network makes it difficult to market these products. There is a trend towards increased land parcelling for recreational use, resulting in an increase of the floating population. If we look at the municipality of Yumbo, subsistence crops and livestock predominate, and the number of recreational homes has climbed in the past years. Finally, in the Cali municipality, livestock and temporary crops, mainly aromatic and spices, are the main economic activities, along with coal mining in some sectors. The tendency to convert properties for recreation and the adaptation of tourist sites is also booming over the whole area. Ecotourism stands out, motivated by birdwatching and hiking activities.

2. Methodology

Taking into account the aim of the study, to construct a participative governance scheme that represents the different visions of nature held by the SAF-KBA stakeholders, we designed and implemented a four-step method (see Fig. 5). We first obtained historical information through the review of literature regarding the study area and the social processes that have shaped it into the present SEPLS. We then visited the field and organised socializing sessions, where we identified and became familiar with the stakeholders, and introduced the project to them. Third, we undertook a process to develop a conservation plan (Granizo et al. 2006) tailored to the needs of the study area and the stakeholders that inhabit it. Finally, we conducted four focus group discussions with 10 to 20 community leaders respectively. These groups played a key role in the construction of the SAF-KBA governance scheme.

2.1 Identify and characterize stakeholders

We identified the main stakeholders, both community and institutional (i.e. government institutions, such as municipal

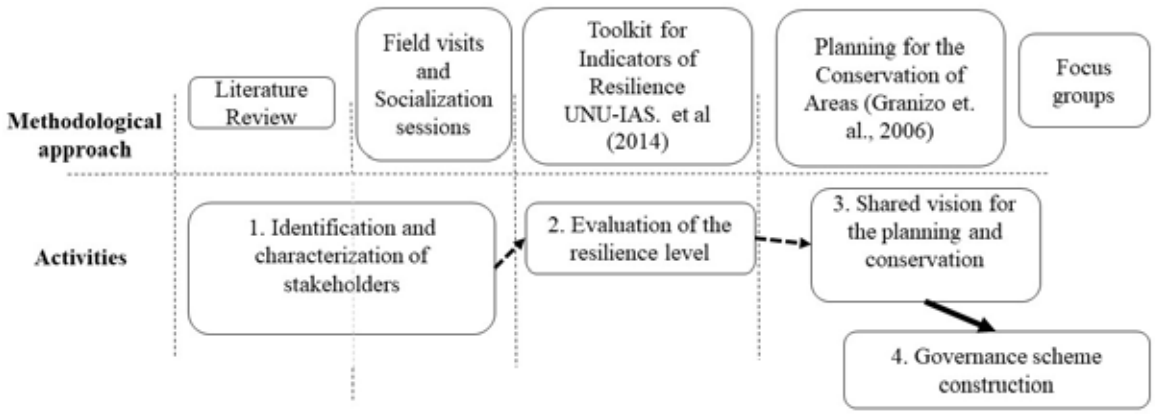

Figure 5. Methods and activities description

mayoralties and regional environmental authorities), prior to introducing the project and engaging them in the process. We identified stakeholders in the four municipalities that make up the SAF-KBA SEPLS through field visits and a review of information provided by the institutional stakeholders that work in the territory. Likewise, we reviewed secondary information in the form of documents and studies, particularly those produced by organizations that have worked in the area and that could contain information, either of a technical nature and/or about the stakeholders. On the other hand, we took into consideration the contributions of each one of the institutional and community stakeholders regarding the socio-environmental conditions of the territory, as well as their level of interest in participating in the project during the socializing sessions.

2.2 Evaluate the resilience level of SAF-KBA SEPLS

We evaluated the resilience level of the SEPLS using the Toolkit for Indicators of Resilience (UNU-IAS, Bioversity International, IGES & UNDP 2014), that provides a subset of 20 indicators to assess the trends and level of resilience of the study area. We then moved to implement four key activities, that are grouped under two major components (see Table 1). The two major components are: i) assessment of the resilience level of the study area, which includes preparation, training, diagnosis and analysis of the indicators (activities 1-3), and ii) community empowerment for conservation, that consists of activity 4, divulgation and community empowerment. This last activity embodies an approach that needs to be integrated into all aspects of conservation programs and sustainability, and that was addressed transversely to activities 1-3. Community empowerment was key to linking people with nature for conservation and for encouraging them to think about resilience, as it connects local knowledge and needs with policies and conservation goals.

Figure 6. Methods and activities description

The resilience indicators, as mentioned above, have 20 subsets falling under five categories: i) landscape diversity and ecosystem protection; ii) biodiversity; iii) knowledge and innovation, including agricultural biodiversity, iv) governance and social equity; and v) livelihoods and well-being. In activity 2, we asked community members to rate the state of the indicators using a five-point scale: (5) Very high, (4) High, (3) Medium, (2) Low, and (1) Very low. We also asked them to evaluate trends using three categories: ↑ Upward trend, → No change, and ↓ Downward trend. We implemented this activity with the support of our partner, an NGO called Social and Environmental Sense (SENSE), as well as that of other organizations working in the area.

2.3 Shared vision for the planning and conservation of the SAF-KBA SEPLS

During the workshops (see Fig. 6) with the different stakeholders, such as peasants, ranchers, large farmers, and wealthy landowners, we identified marked differences in the way they conceptualized nature, their relationship with nature and the sustainable practices they implement. Based on these differences, we searched for common points to build a shared vision for the planning and conservation of

Table 1. Activities carried out to assess the resilience level of SAF-KBA

Component 1. Assessment of the resilience level of the San Antonio Forest - KBA SEPLS			**Component 2.** Establishment of community empowerment for conservation
Activity 1. Preparation and training	**Activity 2. Diagnosis**	**Activity 3. Analysis and follow-up**	**Activity 4. Divulgation and community empowerment**
Activities were carried out related to the training of the work team, and the establishment of contacts with stakeholders present in the region, as well as possible partners.	In this phase, the resilience indicators were evaluated through workshops with the community.	The evaluation and qualification of the indicators were analyzed and then socialized.	Empowerment is more than a set of activities; it is an approach that must be integrated into all aspects of conservation programs and the sustainable use of biodiversity. It is a process driven by people, so there is no single strategy that works in all cases. However, we have introduced some elements that according to our experience, have helped develop community empowerment. These can be summarized as: i) collective strengthening, ii) application of knowledge to local needs, iii) support for change, iv) involvement of as many members as possible, v) promotion of a social environment based on human rights and social equity, and vi) explanation of existing laws and policies and creation of adequate spaces for compliance. Considering the above, a flexible approach was adapted to the individual needs of the community. Therefore, the activities were carried out in different order. In addition, this phase was transversal to previous ones (activities 1-3).

nature and biodiversity of the SAF-KBA SEPLS, with the goal of improving the protection of this important area through a participative and collaborative planning exercise between the community, public stakeholders (government), and cross-sectoral stakeholders.

2.4 The SAF-KBA SEPLS Governance Scheme

Prior to the evaluation of resilience levels, the Corporation for Environmental Management BIODIVERSA advanced the planning process for managing the SAF-KBA SEPLS using the "Planning for the Conservation of Areas" methodology (Granizo et al. 2006) for the design and management of this conservation area, based on a diagnosis and an integrity analysis of the definition of conservation objects that were carefully selected with the accompaniment of experts. This activity produced knowledge about the area and reconnected it with the expectations of the local stakeholders in each municipality, as well as with the institutional stakeholders.

Using this information and understanding of the differences in the way of conceptualizing nature and the shared vision for the planning and conservation of the nature of the SAF-KBA SEPLS, we have developed a governance model, which we call the "SAF-KBA Governance Scheme". This scheme is based on norms, concepts and policies at national and international levels, such as: the right of petition (as a fundamental right in the Colombian Constitution) and participation mechanisms; the ordering of the territory; the generation of knowledge with the management of information and incentives for conservation to strengthen the exercise of governance by the institutions; the political empowerment of the community base; financial sustainability by the guilds and human well-being of the owners of the properties; the communities' identity, freedom, health, safety, and material goods in relation to biodiversity and ecosystem services; and the processes of ecosystem functioning and climate change.

3. Results and discussion

3.1 Characterization of stakeholders and differences in the way of conceptualizing nature

We identified 17 public stakeholders, 40 community-based stakeholders, seven unionists and 50 private landowners (people who own an area of land and give various uses to it; some make their livelihoods from it, while others just use it recreationally) as the main stakeholders of the SEPLS in the SAF-KBA. We divided the 50 private landowners into three categories based on their educational, sociocultural and socioeconomic backgrounds: i) peasants, ii) ranchers and large farmers and iii) wealthy landowners (who use the land mainly to build country houses, but their livelihoods do not depend on the productivity of the land). The results we obtained from the characterization of stakeholders and the differences in the way of conceptualizing nature are summarized in Table 2, showing the representatives of each group of stakeholders, their interests, needs, and visions of nature. The latter corresponds to multiple values of nature and its benefits (IPBES 2015), such as recognition of the intrinsic value of nature by public entities that are concerned with ecosystem conservation, or as the instrumental value assigned by community-based stakeholders, ranchers and large farmers, who recognised nature's benefits to people for production. Also noted are the economic values trade-union stakeholders recognise in nature, seeing it as a source of income, therefore making its management and

Table 2. Analysis of stakeholders in the SAF-KBA SEPLS

Stakeholders		Representative Groups	Interests	Needs	Vision of nature	IPBES classification of MVN (IPBES 2015)
Public (17)		UMATAS, Municipal systems of protected areas (Cali and Yumbo), Environmental authorities (DAGMA AND CVC), Farallones de Cali Natural Park, Ministry of Environment, Government of Cali, Community action boards of townships of Cali, Dagua, La Cumbre and Yumbo.	Comply with regulations, maintain the sustainability of the forest in quantity and quality.	Connect the forest covers with the declared protected areas.	The remnants of nature are spaces protected by national, regional or local regulations, therefore their threats must be diminished in order to guarantee their preservation.	Intrinsic value – Non-anthropocentric
Community-based stakeholders (40)		Educational institutions of El Saladito and La Elvira (Cali) and Bitaco (La Cumbre) townships; Universidad del Valle, Universidad Santiago de Cali, Pontificia Universidad Javeriana and Universidad Autónoma; Focus groups and local NGOs.	Apply for conservation incentives; food safety; peasant identity; community work; forest conservation.	Implementation of the strategic plan of the SAF-KBA; Teamwork; knowledge and research on local biodiversity; communication channels between stakeholders; training in organizational management.	Nature is the central axis to guarantee human well-being, therefore it must be conserved in order to maintain the ecosystem services produced.	Nature's benefits to people - Instrumental value; Anthropocentric
Trade-unions (7)		Agrícola Himalaya; Best Pacific Adventures; Celsia; Hotel City Express; BNI-Frutos del Sol.	Contribute with corporate social and environmental responsibility to its stakeholders.	Implementation of compensation measures; alliances to promote the design and implementation of conservation strategies.	Nature is a source of income, therefore its management and care must guarantee continual production.	Good quality of life - economic values.
Private land-owners (50)	**Peasants**	25 Peasants	To be able to legalize the possession of the property and thus be able to live off the land as their ancestors did.	Strengthening and sustainable production.	Nature is the source of life, it is what gives us the air, water, food and nutrients that our crops and we need. This must be respected and taken care of so that our children can stay in the territory. Without nature there is nothing.	Nature's benefits to people - Relational

	Ranchers and large farmers	5 Ranchers and 7 large farmers	Produce at a low cost and generate higher income.	Improve access routes and marketing channels.	Nature can be part of the productive system, but it must be managed in order to make a profit.	Nature's benefits to people – Instrumental; Anthropocentric
	Wealthy land-owners	13 Wealthy landowners	Conserve the forests to be able to continue enjoying the landscape and the climate of the region in their country houses.	Receive some kind of financial compensation for conserving the forests at their country houses.	Nature is a source of rest and well-being, it is an escape from the city.	Good quality of life – Relational

care fundamental to guarantee its continuous production. Furthermore, the good quality of life—relational value given by wealthy landowners who consider nature to be a source of rest and well-being, and the relational values peasants hold, who consider nature as a source of ecosystems services that benefit people, are among other values that assign a multitude of roles to nature in its interaction with human societies.

These MVN and its benefits, as assumed by stakeholders, correspond to different nature models or visions and determine the actions or possible actions against nature in the SAF-KBA SEPLS. According to Díaz et al. (2015), the value of nature's benefits to people varies among individuals, within groups, and across groups at various temporal and spatial scales. For instance, the value of the vegetation and soils of watersheds in filtering water for drinking will vary when there is no built alternative (e.g. a water filtration plant). Stakeholder perceptions are transformed into values of nature in accordance to their environmental rationale. The latter can be understood as the implication of reason in the meaning of actions against the environment, which stages the capacity that guides and directs the action of stakeholders (González-Rodríguez 2014). This environmental rationale and the associated values of nature help define what a society perceives as important, beneficial or useful in search of achieving a good quality of life (Díaz et al. 2015).

The productive and extractive activities of some stakeholders in the SAF-KBA SEPLS, together with their rationale, as well as State and private-sector actions that promote these activities, show a real and potential conflict between conservation and development in the planning for the territory (Quintero-Ángel 2015). The two environmental rationales, the predatory (trade-unions, ranchers and large farmers) and the alternative (oriented to the conservation of nature, held by farmers, community-based stakeholders and wealthy landowners), present in the SAF-KBA SEPLS, are closely associated with the vision of development that western modernization imposes, which according to Toledo, Alarcón & Barón (2009):

[…]establishes as the only referent the bipolar scheme between "tradition" and "modernity", explained solely in function of the productive and economic (and sometimes social and cultural) aspects and that proposes rural development as the productive transformation of "traditional" peasant, or preindustrial ways into agro-industrial or "modern" modalities, both in its state-socialist version and in its free market version (p. 341).

Even though both rationales relate to the environment, they do so in a different way: one is a predatory relationship in which human beings profit from nature to satisfy their needs and desires without considering or respecting it, and the alternative is a relationship where human beings also serve the ecosystems. The latter is associated with a cosmic worldview and conception of nature with an ethical consideration of no-abuse in the use of nature (Quintero-Ángel 2015).

3.2 Evaluation of the resilience level of the SAF-KBA SEPLS

In the evaluation workshops on the level of resilience, participants evaluated the indicators individually and subsequently discussed within the group to reach consensus among each of the interested parties (see Table 3). In these workshops, 69 of the participants were women (65%), and 38 were men (35%). Below, we present the results obtained for the SAF-KBA SEPLS, grouped into five strongly-interrelated areas..

3.2.1 Landscape diversity and ecosystem protection

Regarding the diversity of the landscape, most of the stakeholders recognize the great diversity present within the SAF-KBA SEPLS, as well as the fact that the presence of patches of cloud forest, riparian forests and the variety of microclimates, make this area more resilient to external shocks. According to Pascual et al. (2017), the variety of views and values associated with nature's goods and services gives place to diverse points of view in relation to areas such as conservation, resilience, equity and ways to accomplish

Table 3. Results of the evaluation of the resilience level of SAF-KBA SEPLS

Indicator	Indicator question#	Public		Community-based stakeholders		Trade-unions		Private landowners					
								Peasants		Ranchers and large farmers		Wealthy landowners	
		Score	Trend	Score	Trend	Score	Trend	Score	Trend	Score	Trend	Score	Trend
Landscape diversity and ecosystem protection	Landscape diversity	5	↑	4	↑	4	↑	4	↑	3	↓	4	→
	Ecosystem protection	5	→	4	↑	2	↓	4	↑	3	↓	2	↓
	Ecological interactions between different components of the landscape	3	↑	3	→	3	↓	5	↑	3	↓	4	→
	Recovery and regeneration of the landscape	4	↑	4	↑	3	↓	3	↑	2	↓	3	→
Biodiversity (including agricultural biodiversity)	Diversity of local food system	2	↑	2	↓	2	↓	2	↓	2	↑	1	↓
	Maintenance and use of local crop varieties and animal breeds	2	↓	3	↓	2	→	2	→	1	↓	3	→
	Sustainable management of common resources	2	↓	2	↓	3	→	4	→	3	↓	3	→
Knowledge and innovation	Innovation in agriculture and conservation practices	3	↑	3	↓	3	→	3	↑	2	↑	4	→
	Traditional knowledge related to biodiversity	1	↓	2	↓	2	↓	4	↓	3	↓	2	↓
	Documentation of biodiversity-associated knowledge	5	↑	3	↑	1	↓	2	→	1	↓	1	↓
	Women's knowledge	3	→	2	↓	1	↓	3	→	3	↓	1	↓
Governance and social equity	Rights in relation to land/water and other natural resource management	4	→	2	↓	1	↓	2	→	1	↓	1	↓
	Community-based landscape governance	1	↑	2	↑	1	↓	3	↑	1	↓	1	↓
	Social capital in the form of cooperation across the landscape	1	↑	2	↑	1	↑	3	↑	1	↑	1	↑
	Social equity (including gender equity)	4	↑	4	↑	4	↑	3	↑	4	↑	4	↑
	Socio-economic infrastructure	3	→	2	↑	2	↑	4	↑	3	↑	3	↑
Livelihoods and well-being	Human health and environ-mental conditions	5	↑	5	↑	4	↑	5	↑	5	↑	5	↑
	Income diversity	3	→	4	↑	3	↓	3	↓	3	↑	3	↑
	Biodiversity-based livelihoods	3	→	4	↑	3	↑	2	↑	3	↑	4	↑
	Socio-ecological mobility	2	↓	2	→	1	→	1	→	1	→	2	↓

sustainable development goals, but this diversity of views is rarely acknowledged or taken into account when making decisions.-

As for the protection, recovery and regeneration of the landscape of this area, results are uneven. For public and community-based stakeholders, the SAF-KBA SEPLS is protected because it overlaps with protected areas of national order; however for the peasants, the protection of the SAF has taken place for a different reason. For them, the recovery and protection of forest areas is due to the fact that many old people who used the land have died, and young people have moved to the cities (mainly to Cali). The younger generation does not engage in the peasant vocation, so the lands that were productive 40 years ago are now secondary forests. From the viewpoint of the productive sector (trade-unions, ranchers and large farmers), the protection status of the area is low and shows great deterioration. This may be due to the fact that land use is restricted for some productive activities inside the protected areas, meaning that these stakeholders have frequent negative interactions with environmental authorities, a factor that can polarize responses.

According to the wealthy landowners, the area is deteriorating as the dynamic mosaic of ecosystems and land uses, including villages, crops, forests, pastures and private properties with country houses and small farms becomes increasingly evident, due to the increase of a floating population. For most stakeholders, the ecological interactions between different components of the landscape were not clear. Most gave an intermediate rating with a clear tendency mainly because the forests protect water sources. Still, the peasants recognize that the forests not only protect the water sources, but also benefit other areas through pollination, pest control, and an increase of animal population.

3.2.2 Biodiversity (including agricultural biodiversity)

In terms of biodiversity, all stakeholders recognize the great richness of fauna and flora species of the region, especially birds—in the SAF-KBA SEPLS polygon alone, 357 species of birds have been recorded (BIODIVERSA 2018). Nonetheless, in terms of agricultural biodiversity, most stakeholders agree that it has been lost over time, which may be due to the migration of local farmers to the city or the arrival of foreigners. Nonetheless, aromatic crops and medicinal plants are mainly maintained in the area. Maintenance and use of local crop varieties and animal breeds does take place, but only among some peasants who call themselves seed keepers. In this sense, these types of practices should be promoted to conserve the genetic diversity found in local crop varieties and animal breeds, which is important because it confers resilience to the SEPLS in the climate change scenario.

Regarding sustainable management of common resources, ratings are low mainly due to the fact that most common resources, such as forests and water sources, are located within private properties. The situation of the water sources that supply farms is probably the most complicated, since by law water sources belong to the State (Decree 1076 of 2015). However, located inside farms and properties with country houses, access to this resource is difficult in some cases. In some parts of the SAF-KBA SEPLS, there are water concessions legally established by the environmental authority regulating the quantity and flow taken. Yet in other cases there is conflict, generating a so-called war of the hoses, which involves of the connection of many hoses to the same stream, where the one that takes more water is the one that has more economic resources and can pay for a longer or bigger hose that takes up more water.

3.2.3 Knowledge and innovation

On innovation in agriculture and conservation practices, neither the qualifications nor the trends given by stakeholders are completely uneven, which can be explained by the large number of people interested in the preservation of the SAF-KBA SEPLS (international funds, more than ten NGOs including local and regional, universities and inhabitants in general). In addition, the generation of income from nature tourism, or simply from the tourist attraction that the change of landscape and climate just 20 minutes away from the city of Cali represents, makes those involved in this practice keep innovating in terms of conservation strategies and sustainable production methods.

Regarding traditional knowledge, innovating and learning practices in the SAF-KBA SEPLS are being lost. This loss occurs for various reasons, among the most outstanding are those already mentioned (migration to the city and little interest in the peasant vocation), but it is largely attributed to the absence of elders that can transmit traditional knowledge to the floating population and the remaining peasants. Thus, it is not uncommon to find that all stakeholders have qualified the trend downwards, a factor that confirms that these practices are being lost.

For public and community-based stakeholders, the documentation of biodiversity-associated knowledge is doing well and on an increasing trend because management plans for the protected areas are present in the SEPLS, and also due to numerous studies in various related topics in the area. For example, the study of birds in the area has been researched for over 100 years (Kattan, Álvarez-López & Giraldo 1994; Kattan et al. 2016). For the remaining

stakeholders, scores are low with a downward trend due to the fact that such publications are not known, or are written in a scientific manner and even in other languages, such as English.

Women's knowledge, experiences, and skills are recognized between medium and very low scores and present a downward trend. While it is still recognized that women hold knowledge of medicinal and aromatic plants (which are traditional crops), the fact that girls and young women are not very interested in learning these practices puts this knowledge at risk. When qualifying this indicator, women (on average 65% of workshops participants) changed their way of qualifying (in the individual case) positively and with a tendency to improve by lower scores and a negative trend, which can be understood as a search for recognition. This result is particularly curious considering that during discussions and group work, it was almost always the women who directed and clearly presented their position.

3.2.4 Governance and social equity

The classification of indicators grouped in this area is very uneven, due to the legal land tenure problem of the majority of peasants. As already mentioned, most of the land belongs to wealthy landowners who live in the city and have their country houses in the SEPLS. In addition, conflict exists with the national protective forest reserves present in the SEPLS, because although these protected areas do not put restrictions on the property, they do restrict some uses. Thus, many economic activities are incompatible with these protective institutions.

For community-based landscape governance and social capital in the form of cooperation across the landscape, scores are low, but the trend is toward improvement. This is because alliances have been created to seek effective governance of the SAF-KBA SEPLS. This can be evidenced by the technical board of the SAF that is connected to nine NGOs and that, together with the participation of other stakeholders, has created the SAF-KBA governance scheme.

The social equity (including gender equity) indicator is one of the most similar in qualification and trend. In this sense, the rights and access to resources and opportunities for education, information and decision-making are fair and equitable for all community members, including women, as evidenced by the great participation of women in the workshops.

3.2.5 Livelihoods and well-being

According to our results, socio-economic infrastructure in the SEPLS has an intermediate qualification and a tendency to improve. This evaluation is due to the existence of rural schools in the area, as well as health centres, safe drinking water, electricity and communication infrastructure. The only aspect requiring improvement in some sectors is the roads. The indicator for "human health and environmental conditions" has the best rating with a tendency to improve. People are very healthy because of the good weather and good air quality. For the indicator on income diversity, scores fall in the middle. Although many traditional forms of income have been lost, such as work in growing certain crops, there are new opportunities for income with the development of activities related to tourism.

For biodiversity-based livelihoods, scores range from high to low—high for those who are finding new ways to obtain income based on biodiversity, such as eco-tourism and birdwatching, and low for the peasants who used to have a close relationship with biodiversity, but with the loss of cultural identity during the last decade, also lost this relationship. Socio-ecological mobility, according to the stakeholders, is low and very low, given that most agree that there are no opportunities for mobility.

3.3 Shared vision for the planning and conservation of the nature of the SAF-KBA

According to Leff (2004), the environmental crisis is crisis of the ways of understanding the world. Since the human being is as an animal endowed with language, human history is separate from natural history. Thus natural history is the meaning assigned by words to things, generating strategies of power in theory and knowledge that have disrupted reality to forge the modern world system.

Therefore, the social construction of a solution to the environmental crisis that affects the modern world must be focused on a shared vision of the stakeholders interested in, or involved in, the problem. The construction of a solution must start from the points they (involved communities and stakeholders) have in common.

In this sense, the existing similarities and differences among the stakeholders' opinions were evaluated. The main similarities or factors that stakeholders had in common were searched out to allow for the integration of a shared vision of nature for the SAF-KBA SEPLS. In this case, we found that for all stakeholders, nature is the source of life and the central axis to guarantee human well-being and production of income. Therefore, nature must be respected, taken care of, conserved and well managed in order to maintain the ecosystem services that it produces.

With this in mind, in order to guarantee the conservation of the SAF-KBA SEPLS, the ecological integrity of the present ecosystems must be ensured through the improvement

of connectivity and the reduction of pressures that lead to fragmentation and deteriorate the quality and quantity of ecosystem services.

3.4 The SAF- KBA Governance Scheme

The SAF-KBA governance scheme is based on both national and international concepts, norms and policies, such as petition rights, territory ordering, incentives for conservation, and management of information to strengthen institutional governance. It also involves actions to empower the communities, achieve financial sustainability, secure and improve ecosystem functioning and mitigate and adapt to climate change. The governance scheme seeks to build a strategic and integrated vision among stakeholders, to ensure inclusive and consensual decision-making and implementation of conservation strategies.

Considering the above, the governance scheme is a shared management tool in the holistic construction of SAF-KBA conservation strategies for implementation, with balance between the State, civil society and the economic sector, and in line with the personal attitudes of the community through agreements and consensual alliances between the stakeholders. This political exercise is based on environmental and social sustainability, and validated by the principles of good governance of IUCN for protected areas: 1. Legitimacy and Voice: participation and search for consensus; 2. Direction: strategic vision; 3. Performance: ability to respond effectively and efficiently; 4. Responsibility and Accountability: transparency; and 5. Justice and Rights: equity and law enforcement (ed. Dudley 2008).

The scheme seeks to build, in each component, a strategic and integrated vision among all stakeholders, taking into account their different roles and responsibilities, as well as ensuring inclusive and consensual decision-making for the implementation of conservation strategies. This aim is combined with the objective of maintaining and improving the resilience of socio-ecological systems at local and regional scales, considering scenarios of change and through joint, coordinated and concerted action by the State, the productive sector and civil society.

Accordingly, the objective of participatory governance is to conserve and recover biodiversity along with its ecosystem services, with emphasis on the connectivity of the landscape and the ecological integrity of the selected conservation objectives: 1) natural forest cover; 2) water system and edaphic system; 3) community of insectivorous and frugivorous birds; 4) the amphibian community; 5) the multicolored tanager (*Chlorochrysa nitidissima*); 6) the Colombian Night Monkey (*Aotus lemurinus*) (see Fig. 7a), a threatened species prioritized for the SAF-KBA; the cerulean warbler (*Setophaga cerulea*); and the Ruiz's robber frog (*Strabomantis ruizi*) (see Fig. 7b).

The governance scheme is compiled in a technical document, structured into seven interrelated components: 1. characterization of actors and socio-economic activities; 2. participatory diagnosis of the territory; 3. administrative structure; 4. game rules and safeguards; 5. strategic planning and monitoring (which addresses the following topics: conservation and restoration, use and sustainable management of biodiversity with its ecosystem services, knowledge and research, empowerment, and joint and shared co-management); 6. implementation of the financial sustainability plan; and 7. continuous improvement. The components are adhered to a legal and conceptual framework as well as to the mechanisms or instruments of political participation, the ordering of the territory, the generation of knowledge, the information systems, communication strategies, and to the incentives for the conservation of biodiversity with its ecosystem services.

In the "Strategic Planning and Monitoring" document, goals were set to be fulfilled between 2018 and 2028, which is

Figure 7 (a and b). Examples of the conservation objectives in the participatory governance, a) Colombian Night Monkey (*Aotus lemurinus*) (Photo: Armin Hirche); b) Ruiz's robber frog (*Strabomantis ruizi*) (Photo: Oscar Cuellar)

consistent with the social, business and environmental responsibilities of the different stakeholders of the SAF-KBA SEPLS. The main goals are: 1) to restore 600 hectares in river protection zones; 2) to secure 50 private properties with incentives for conservation; 3) to develop mitigation and adaptation measures to climate change and establish them in five localities within the SEPLS; 4) to establish a biological corridor connecting with the NNP Farallones de Cali for forest compensation certified by the Colombian Institute of Technical Standards; 5) to continuously train the community and decision-makers through specific programs; and 6) to implement five green- business projects.

As part of the governance scheme, two fundamental structures were created: 1) the four focus groups (one for each municipality present in the SAF-KBA SEPLS), with community leaders as representatives, that are connected with the Municipal Agricultural Technical Assistance Units (UMATAs for its name in Spanish), Municipal Planning Secretariats, the environmental authority, trade or business associations and other public entities such as schools or universities (see Fig. 8), and 2) the technical board, constituted by nine locally-based NGOs (see Fig. 9) that have been working in this area for some years and that are members of the departmental system of protected areas SIDAP Valle del Cauca (Corporación Biodiversa, CORFOPAL, Maestros del Agua, SENSE, Dapaviva, Ecotonos, Ecovivero, Asociación Río Cali y Fundación Agrícola Himalaya). These organizations are connected to different stakeholders (local communities, NGOs, private companies and some government entities) with recognition of differences and mutual respect. In addition, ongoing virtual communication and meetings are carried out. Each player serves a different role within the governance strategy. Community-based stakeholders (local NGOs) help establish management strategies among the communities, and institutional stakeholders (government entities) represent governance and policies. Likewise, private landowners (community leaders) have a role in implementing conservation strategies, and trade-unionists (private companies) are involved in the financial supporting aspect.

Figure 8. Representatives of the four focus groups during a birdwatching training (Photo: Linda Valencia)

Figure 9. Members of technical board at the launch of the Alliance for the Conservation of SAF-KBA (from left to right: Andrés Quintero Ángel (CORFOPAL - SENSE), Alvaro Castro (Ecovivero), Santiago Sierra (Corporación Biodiversa), Hernando Diez (Maestros del Agua), Armin Hirche (Dapaviva), Sebastian Orjuela (CORFOPAL), Bertha Quesada (Maestros del Agua), Rubén Palacios (Ecotonos), Amparo Rivas (Ecovivero), Martha Silva (Corporación Biodiversa) and Freddy Hoyos (Focus Group Cali) (Photo: Corporación Biodiversa)

Among the scheme's main achievements since its establishment in 2018 is the signing of voluntary agreements for the conservation and shared management of the SEPLS in the Alliance for the Conservation of SAF-KBA, the management of payments for environmental services (PSA for its initials in Spanish) of the focus group of Cali and private landowners with the Department of Administrative Management of the Environment, DAGMA (the environmental authority of the municipality of Cali), and the award received from the Call for the Recognition of Local Conservation Areas and Complementary Conservation Strategies, for contributions to the improvement of the conditions of Brazil, Colombia, Ecuador and Peru to conserve biodiversity through effective and equitable management of protected areas and other conservation measures. Implementation was carried out by the German development agency GIZ, the International Council for Local Environment Initiative-ICLEI and the International Union for Conservation of Nature-IUCN, with international support from the International Climate Initiative-IKI, the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety (BMU) and the Ministry of Environment in Colombia.

4. Lessons learned and conclusion

These results allow us to infer that while interactions between stakeholders and nature do depend on the particular interests of the respective stakeholder groups, above all these interactions depend on the gender and the educational, sociocultural and socioeconomic levels and backgrounds of the stakeholders involved. One of the main lessons we have learned through previous work is that in this type of exercise, it is fundamental to guarantee the participation of different stakeholders in the territory in the execution of the project, since they are the ones that provide the most accurate information on the social and environmental situation of the territory and contribute to the definition of the most appropriate routes for applying the Toolkit for Indicators of Resilience. In this sense, we carried out an analysis of stakeholders based mainly on qualitative information collected from the available participating persons in order to: i) determine their interests in relation to the political proposal or to projects (be it a research project, a development project or an information policy proposal); ii) identify the key stakeholders that exert a greater influence via their power or leadership; and iii) determine the most important issues or points for the design, development and implementation of the project.

Ongoing challenges for the SAF-KBA governance initiative, with the agreements and alliances between the stakeholders, include the creation of a culture for the conservation of biodiversity and its ecosystem services, and securing the positioning and integral welfare of the individuals, representing the community. In order to face these challenges, the continuous promotion of community empowerment is required, which will be addressed through follow-up in the focus groups and on the technical board within the programs and projects established in the governance scheme, as well as in the Alliance for the Conservation of SAF-KBA, which established specific goals to address these challenges.

Likewise, understanding the models or representations of nature held by the stakeholders in a SEPLS is very important to consolidate governance processes. If different visions are not understood and considered in the construction of a shared vision, the conservation objectives and the actions of the stakeholders can differ, leading to major conflicts associated with environmental rationale related to human welfare. In the same way, those who work in the governance of the SEPLS will be able to contribute to contexts such as the SAF-KBA, not only through understanding the forms of appropriation of nature and derived environmental conflicts, but also by promoting decision-making by different stakeholders to find more sustainable forms of appropriation of nature, which allow for the conservation of ecosystems, as well as the well-being of their inhabitants, key factors that contribute to the conservation of the SEPLS and its continuity over time.

The main challenge we faced when constructing the shared vision was reconciling the differences in the way stakeholders relate to nature; these rationales were at times almost opposed to one another, making it difficult to find common points. Furthermore, the relationships of power over diverse goods of nature, and the sense of ownership over a particular value, in addition to a general lack of trust in the environmental authorities, were hurdles that had to be overcome in order to build a shared vision of nature in the SEPLS.

Finally, the conflicting visions and changes in nature models in the SAF-KBA SEPLS can be managed in the proposed new governance scheme, maintaining the participatory processes in the focus groups and the technical board. This approach will recognize, make visible, and respect the diverse values of stakeholders and address the power relations through which these are expressed (Cundill & Rodela 2012). Additionally, considering the diversity of worldviews and values of nature may lead to an iterative approach to identification of policy objectives and instruments in the governance scheme (Pascual et al. 2017).

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Chapter 6

Landrace maize diversity in *milpa*: a socio-ecological production landscape in Soteapan, Santa Marta Mountains, Veracruz, Mexico

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Abstract

We will present the results from a project implemented in the village of Soteapan, Veracruz, in south-east Mexico, by the Foundation *Semillas de Vida*. The objective of the project was to increase understanding of the multiple values associated with sustainable use of resources in the socio-ecological production landscape (SEPL) known as *milpa*, particularly in terms of native maize. In Mexico, maize is staple food and a central crop which dominates all landscapes. Agriculture and a whole civilization were constructed around this crop. Maize's cultural importance is highly relevant to understand the indigenous people's worldview and relationship with nature. In Mexico, knowledge about agriculture has been developed around maize, heightened by the crop's especially great capacity to adapt to different kinds of climates around the planet. *Semillas de Vida*, in collaboration with local communities, as well as authorities, students and researchers from the Intercultural University of Veracruz, studied maize diversity, its use and application. We also learned of the small-scale farmers' knowledge concerning diversity and adaptation to climate change. Henceforth, we were able to understand how stakeholders in the SEPL have different visions of the landscape and its resources as well as their usage priorities and perceptions of value. Samples were collected and characterization of native maize performed, analyzed by their pigments and association to specific uses.

The results highlight the importance of the agrobiodiversity cultivated by the indigenous and small-scale farm communities, and illustrate the wide knowledge they have and the multiple values of nature (MVN). This exceptional diversity is related to the special type of slope agriculture applied in the Santa Marta Mountains. The 15 variations of native maize found demonstrated important adaptation to the specific climatic conditions and the MVN the farmers received from the *milpa* production. We concluded that the knowledge and diversity is exceptional, and probably greater than in other tropical regions in the country. The diversity is associated with multiple values of the SEPL, such as different food uses, especially for black and dark blue maize, preferred in the traditional drink *pozol* and cultivated by practically all the families in the mountains. Together with maize cultivation, accompanied by ample plant diversity within *milpa*, the *Popoluca (Nuntajiyi)* people have traditional diverse small-scale coffee plantations and in recent years they have also added production,

management and commercialization of understory palm, selling their foliage. The diversity of native maize grown by the *Popoluca (Nuntajiyi)* people still requires further studies and projects developed together with the communities, as well as an institutional framework for its protection and development.

Keywords: Landrace maize, small-scale farmers, biocultural diversity, *milpa*, knowledge, indigenous people

Country	Mexico
Province	Veracruz
District	Santa Marta Mountains
Size of geographical area [1]	41,000 hectares
Number of indirect beneficiaries [2]	720 persons
Dominant ethnicity	Popoluca (Nuntajiyi)

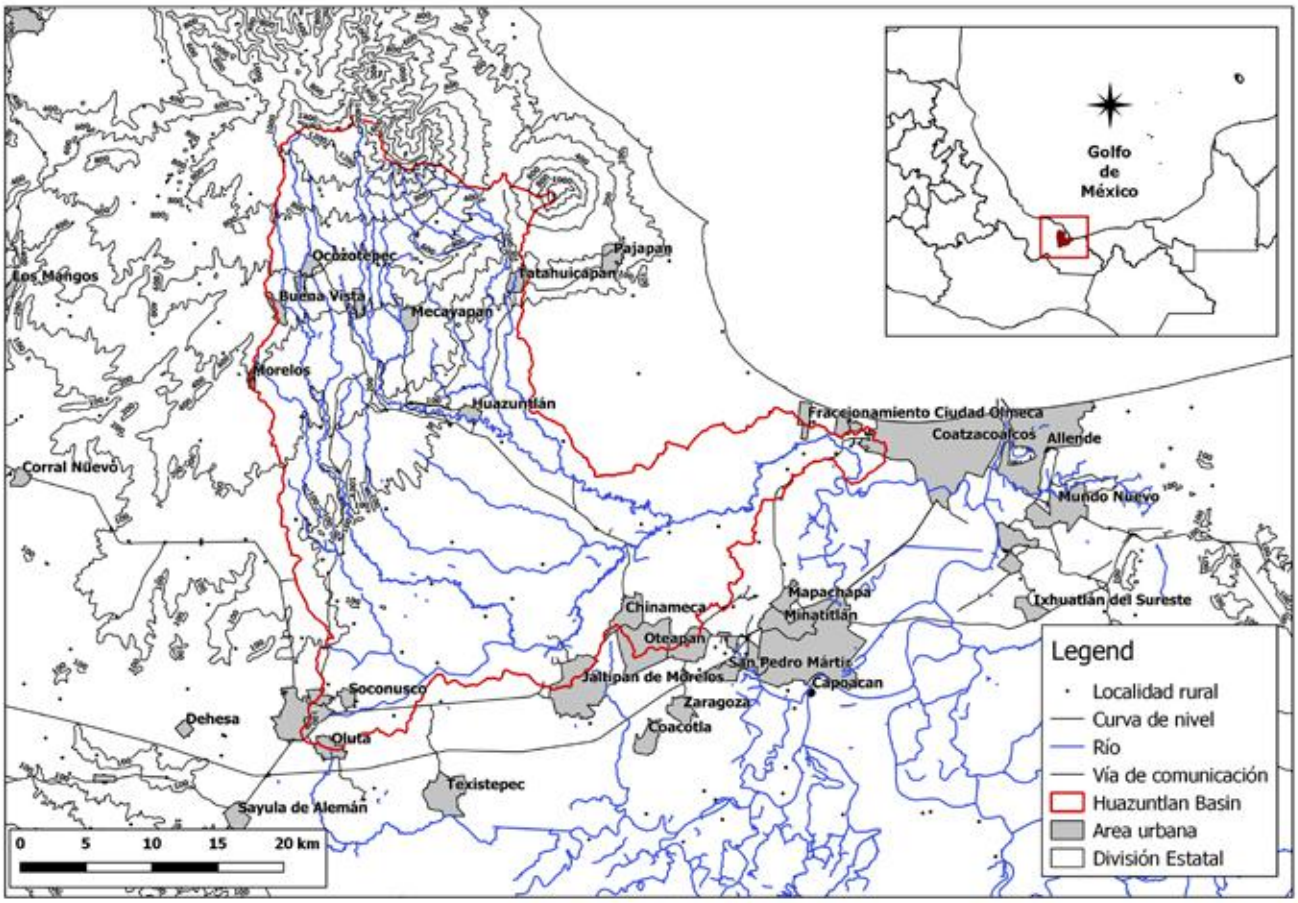

Figure 1. Map of the country and case study region

Size of case study/project area [1]	41,000 hectares
Number of direct beneficiaries [2]	144 persons
Geographic coordinates (longitude and latitude)	18°13'50.4"N 94°52'23.7"W
Dominant ethnicity	Popoluca (Nuntajiyi)

Figure 2. Land cover map of case study site (Source: Google Maps)

1. Introduction

In this chapter, we present the results of a project implemented in the municipality Soteapan, Veracruz, in south-east Mexico (see Fig.1 and 2), initiated by the foundation *Semillas de Vida* (Seeds of Life, http://www.semillasdevida.org.mx/). Through the study of vast diversity of the landrace maize used by the farmers, as well as their knowledge and adaptation to climate change, the project has contributed to a deepened understanding of the multiple values associated with sustainable use of resources in the socio-ecological production landscape (SEPL), especially production in the *milpa*.

Bartra (2008) asserts, "the Mesoamerican people do not just plant maize, we make *milpa*, with all the intertwined diversity it beholds" (p. 42, own translation from Spanish). *Milpa* is a part of the Mexican indigenous people's worldview; it is a way to understand and relate to nature (see Fig. 3). It represents a landscape with multiple values of nature (MVN). Within the polyculture *milpa* system, each one of the virtuously combined species contributes with its special characteristics to support the others. For example, the bean, as a legume, fixes the nitrogen from the air into nutrients required by the maize. Together with maize and bean, chilli and squash constitute the foundation of the *milpa*. In fact, the number of different plant types can reach as many as 10 to 20; the combination depends on the geographical place and local conditions. Likewise, in these production systems the small-scale farmers conserve and manage their own varieties of seeds which maintain and drive the germplasm evolution process forward.

Figure 3. *Milpa* in Sotepan

In general, Mesoamerican indigenous people, the inventors of the *milpa*, have an inclusive vision of nature. This applies particularly to the region where the study was conducted, a region still inhabited by the *Popoluca (Nuntajiyi)* people. The indigenous vision of nature considers all of the elements as a whole, interconnected: plants, insects, forests, water, marine life and soils, among others. The vision includes human life as a part of the interrelated whole, thus consequently, harmonious relations become necessary for nature's reproduction and permanence, which is represented in the *milpa*. They preserve the supreme symbolic meaning of nature as "Mother Earth", which gives life and allows reproduction of the universe. This is reflected in agricultural production where the *milpa* itself creates its own ecosystem as a part of the environment, not destroying it.

The established relations between humans and nature have generated a profound knowledge about natural processes and reproduction itself. In fact, this part of the planet, Mesoamerica, is considered as one of the centers of origin of agriculture due to these processes that were initiated by the people more than 8,000 years ago. Today millenary agricultural practices, such as the *milpa*, are upheld by indigenous people and other small-scale farmers in the region.

The *milpa* itself has been, and still is, a fundamental tool, used by small-scale farmers and indigenous people, to conserve and develop agrobiodiversity. The importance of emphasizing agrobiodiversity and the agroecological matrix as an analytical category, including the definition of agrobiodiversity, has been established by Blanco (2006, quoted in Boege 2010, p. 42, own translation from Spanish):

> Agrobiodiversity implies a domesticated part of the biological diversity. Because of this it should be analyzed as a special category, above all since it is a vital element of development. Its lack of recognition has prevented its conservation, protection, encouragement and also its incorporation in the market economy.

The *milpa* production method is mostly applied in south and central Mexico, where we find highly diverse territories with differing climatic conditions, with cultivation on the hillsides in the mountains, conditions which make mechanized monoculture practically impossible. There are thousands of examples of families and small-scale farmers in Mexico using the *milpa* system. One example can be found in a collaboration *Semillas de Vida* had with the organization *Alternativas Sustentables Agropecuarias* (RASA) in the state of Jalisco, which has worked on sustainable agricultural alternatives within *milpa* production over the last 20 years. Other examples are the cooperative *Tosepan* in the mountains of the state of Puebla and coffee producers in Chiapas. Various organizations and communities there insert coffee plants as a part of their *milpa* (Bartra et al. 2014).

2. Maize – the backbone of the *milpa* SEPL and Mexican agrobiodiversity

It is important to specify the importance of maize in the Mexican context, as the axis of the agricultural production system, particularly in *milpa*, and as central to every food table. Maize has been a vital part of the civilization process that began approximately ten thousand years ago. In Mesoamerica, maize is found at the center of creation; its circle of life makes human life possible, shaping the community social life. This long process finds its roots in maize and *milpa*: the former as the backbone and the latter as the tissue established to complement and promote a series of supporting relations.

Maize is not only the most important grain in our country, but also worldwide. Its rapid expansion across the world is likely due to its considerable capacity to adapt to different production conditions and also thanks to its versatility of use, making it an ingredient in various industrial products. The global market is dominated by a yellow maize, modified

to generate an increased amount of starch; a large part is also genetically modified (GMO) and produced with seeds owned by a few transnational corporations. Álvarez-Buylla & Piñeyro (2013) argue, "their main interest is the economic profit, very much above the cultural, symbolic and sometimes religious value that maize has in many cultures, also the value it has in Mexico for the entire population as one of their basic food products" (p. 18, own translation). Precisely because of this global homogenization of maize, it becomes more relevant to emphasize the importance of the vast biodiversity that still exists; landrace maize is conserved and developed by farmers themselves. In this chapter, we will illustrate this prominence.

The state of Veracruz is in seventh place for national maize production, where five percent of this sacred grain is produced. Of this, 97 percent of the maize is seasonal without irrigation, which means that production mostly comes from small-scale farming of less than five hectares per farmer. It becomes interesting when compared to Sinaloa in northern Mexico, where 93 percent of the maize production in Sinaloa comes from irrigated land with agro-industrial monoculture production based on homogeneous seeds and agrochemicals, that is to say, the opposite of the production type we find in the south-east of the country (SIAP-SAGARPA 2018).

Maize diversity in Mexico is widespread at a national level and tends to be concentrated and present patterns of larger variation in specific regions, mainly in the mountains where there is a higher presence of indigenous people. In these regions, maize's ample adaptability and uses are illustrated since it has been adapted successfully to the adverse ecological conditions. Agrobiodiversity plays a central role in food provision, and maize is the basis of a diet which is rich, balanced, diverse, appropriate to the environment and accessible to the population. Thanks to polyculture, the necessary quantity and variety of foods are cultivated together, and surpluses can also be generated which are sold commercially in local and regional markets. The species produced in these regions are useful for food, feed and medicine.

A region that is particularly distinguished by its diversity is the Santa Marta Mountains in the south of Veracruz. This region is located in the distribution corridor of maize from the group *Dentados Tropicales*, represented by the landraces *Tuxpeño, Tepecintle* and *Olotillo* (Kato et al. 2009). Despite the especially complicated conditions in the mountains, indigenous peoples such as *Nuntajiyi* and *Nahua* have succeeded in creating exceptional pigment variations and adaptations of these tropical maize varieties.

3. Santa Marta Mountains, Veracruz

Different political and socioeconomic factors have influenced the evolution of maize diversity and other species from the *milpa*, generating a change in the Santa Marta Mountains' SEPLs. The study, documentation and analysis of this diversity represent a significant step in contributing to the profound knowledge of the communities and the conservation and use of this diversity, as well as a basis for defending the communities in this region.

The Santa Marta Mountains interrupt the plains of the Veracruz coast, generating mountainous environmental conditions in a tropical zone with high humidity, from which life flourishes in its multiple diversity expressions. The indigenous people have developed and conserved great landrace maize diversity and species associated with the *milpa* in line with the mountains' environmental variation. The area's geological history and orographic conditions, with forests and jungles, generate moisture and rain catchment. This makes it a, fluvial filter, vital for populations in low-lying areas, mainly in the cities Acayucan, Minatitlán and Coatzacoalcos (Ávila, Morales & Ortega 2016). This region, with its biological richness, is a part of the Los Tuxtlas Biosphere Reserve.

Thanks to the hard work of generations of small-scale farmers and also the special environmental conditions, the mountains are not only a reserve of vital resources and biological richness, but also a haven for a particularly vast agrobiodiversity of landrace maize. The maize grown here is distinguished in the impressive variation of pigments, uses and adaptations (Ávila, Morales & Ortega 2016; Negrete et al. 2013).

The mountains are the home of the *Nuntajiyi* people, as they call themselves (Elson & Gutiérrez 1999; INALI 2010; Leonti 2002), also known as *Popoluca* or *Zoque-Popoluca*, inheritors of the territory where the Olmec culture flourished. The land is shared with other communities such as *Nahua* and *Mestizo people*. Our project was developed in communities in the municipality of San Pedro Soteapan, "the natural home" of the *Nuntajiyi* people (Blanco 2006) (see Fig. 4).

Figure 4. Landscape of San Fernando, Soteapan, Veracruz

4. Methodology

During the year 2017, *Semillas de Vida*, in collaboration with communities and authorities in the municipality Soteapan, and graduates and researchers of the Intercultural University of Veracruz, guided experiences in the study, collection and characterization of the diversity, management and use of landrace maize seeds in communities in the Santa Marta Mountains. We collected and characterized samples of this diversity, as well as carried out pigment analyses with help from researchers at the university. A portion of the results is presented here for the knowledge and use of the communities and as a modest acknowledgement of the farmers who preserve the agricultural activity indispensable for the vast richness and legacy which the landrace maize of this region represents (see Fig.5).

The agrobiodiversity of maize was studied through identification and preliminary characterization of landrace maize in the communities. This methodology involved collecting maize samples and interviewing the small-scale maize farmers, after which information was gathered and samples were characterized. This method is applicable in the future and could be useful to follow changes in the maize agrobiodiversity and adaptation achieved in face of climate change.

During collection and documentation of maize diversity, 106 small-scale farmers participated from different communities: 25 in La Magdalena, 24 in Ocotal Grande, 11 in San Antonio, nine in El Tulín and Santa Marta, eight in San Fernando, seven in Ocotal Chico, five in Ocozotepec, four in Mirador Saltillo, two in Soteapan and one in Buenavista. All of the communities are a part of the Santa Marta Mountains.

In developing the activities, the university students' participation was fundamental; they were trained in collection, documentation and preliminary characterization, with the intention that they would be able to continue the assessment of the agrobiodiversity in the future. The samples contained around 5 to 10 representative maize cobs of each type cultivated by the farmers.

We consider that the recuperation of knowledge and processes provided us with keys to understanding how the seeds have been preserved and developed over the centuries, and also, most importantly, how we will keep on preserving them in the future. The objective was to revaluate this richness and generate larger benefits for small-scale agriculture and indigenous communities, who are the keepers of agrobiodiversity, through the design of highly diversified agroecosystems.

5. Farmers – essential for agrobiodiversity and for the *milpa* SEPL

Maize is the foundation for food and the economy in the *Nuntajiyi* communities, and is closely linked to the family as a unit. It is also the nucleus and an essential part of the profound worldview *(cosmovisión)* of these people, which is reflected in the mythical presence of the god-hero of maize, *Homzhuc*. The god of maize tradition is an expression of maize's relevance and connection to the sustenance of Mesoamerican people. Today this tradition is still a part of

Figure 5. Small scale maize farmers in the municipality Soteapan

Figure 6. Maize from Ocotel Chico

the worldview, culture and agricultural practices of Mexican and Central American indigenous people, and is particularly vivid in villages of the *Nuntajiyi* people in the Santa Marta Mountains.

5.1 Agrobiodiversity of Maize

In the communities of the study, we collected 234 maize samples with the following distribution: 65 in Ocotal Grande, 55 in La Magdalena, 24 in San Fernando, 18 in El Tulín, 17 in San Antonio and Santa Marta, 16 in Ocotal Chico, eight in Mirador Saltillo, eight in Ocozotepec, four in Soteapan and finally two in Buenavista. Each sample contained one type of maize that was cultivated by the farmers in these communities (see Fig. 6).

On average, the farmers cultivated 2.3 different types of maize, but this number varied depending on the community. For example, the average in San Antonio was 1.5, but rose to 2.7 in Ocotal Grande and 3.0 in San Fernando. We observed that some families planted four or five different varieties of maize; the maximum was ten different varieties by the same farmer.

Consistent with the environmental variations in the mountains, the *Nuntajiyi* people conserve a diversity of maize and other crops adapted to the temperature, precipitation and high relative humidity conditions. The special conditions are created by the rain shadow effect which comes from humidity captured in the Mexican Gulf and brought to the mountains' foothills. Together with maize cultivation, accompanied by plant diversity in the *milpa*, the *Nuntajiyi* people also practice traditional diversified coffee production; in Veracruz we find 25% of the amount of coffee produced in Mexico (SIAP-SAGARPA 2018). In fact, traditional coffee agroecosystems are an excellent source of connection between different patches of original vegetation. This can be a basis, not only for programs to maintain connections between agroecological matrices, but also for reforestation and productive diversification, placing special emphasis on the use of native evergreen species, mainly in places with sleep slopes. Recently the production of understory palms for commercialization of its foliage were also added.

One of the first things that surprises during the study of landrace maize diversity in the Santa Marta Mountains' communities, is the already mentioned vast color variation of the grain. The communities mainly use this characteristic to distinguish the varieties of maize they grow. It is common for each family to have at least one white and one black maize. However, variations could be greater due to various reasons, for example: 1) the ample crossing that exists between the landrace maize of different colors; 2) selection made for distinct uses; 3) environmental adaptation; and 4) in some cases for the association of cultural concepts, such as the so-called "blood maize".

While white or cream-colored maize is predominant, next is the black maize that is widely appreciated in the communities for preparing one of the most important drinks and foods in Mexican tropical zones: *pozol*. Unlike in other regions of the country (e.g. Yucatán, Chiapas) where this drink is generally made from white or yellow maize, here the preference is for *pozol* made from black or red maize.

The natural pigments in landrace maize, expressed in colorations such as dark blue, black, red and orange, are of great importance not only for their natural origin, but also for food and health benefits. It is known that the pigments contain antioxidants, anti-cancer and anti-inflammatory elements and can contribute to the control of degenerative diseases such as diabetes (Castañeda 2011; Miguel 2011; Salinas et al. 2012, 2013).

In these mountains, the entirety of agrobiodiversity is adapted to hillside agriculture. Here we find heterogeneous soils and extreme meteorological phenomena–such as strong wind and hurricanes– together with the incidence of pests and diseases, making production conditions somewhat complicated. Nevertheless, over the generations, farmers have succeeded in adapting close to 15 different landrace maize varieties, which are grown between 300 to 1,700 meters above sea-level, to these special conditions.

Compared to commercial hybrids, these landrace maize varieties are most adapted to local conditions. Farmers continue to use them, even though they have had only very limited state support for their conservation and production initiatives. The state policies have favored the use of commercial hybrid seeds through technological packages and financing schemes connected to inputs related to these seeds, such as chemical fertilizers and other agrochemicals.

In the lower parts of the mountains (as in other parts of Mexico), the hybrid seeds have practically displaced the landrace maize seeds. Even though some families, even in lower parts, preserve the landrace maize for their own consumption, especially the red and black for *pozol*, it is in the middle and higher parts of the mountains where most farmers produce only the landrace maize (see Fig. 7). This trend could be explained by cultural aspects, but also by the special climatic and geographical conditions. For example, few hybrids are appropriate for growing high above sea-level.

5.2 The most common maize landraces

In the following landrace identification, the person responsible was the agronomist and landrace maize expert, Cecilio Mota Cruz. The three most common types found in the study were *Tepecintle, Olotillo* and *Tuxpeño*. The preliminary characterization is based on relevant references to the region (Wellhausen et al. 1951; ed. Sierra 2010; Ávila, Morales & Ortega 2016), and Mota's own ample experience.

5.2.1 *Tepecintle*

This landrace has received little attention in Mexico, but it is definitely a staple food for the communities located in the hot-humid mountainous regions of practically the entire slope of the Gulf of Mexico, reaching into the mountainous region in the states of Tabasco and Chiapas (also south-east). With this study, it was possible to confirm the extraordinary diversity of this landrace for its adaptation abilities, thanks to the indigenous groups in this region.

The name itself, with roots from *Nahua* (*tepo* = mountain, *cintle* = maize), refers to the different niches or environments where it has been developed and grown (Wellhausen et al. 1951). It is characterized by semi-cylindrical cobs, and its top tends to be devoid of kernels, which simplifies its identification. The kernels have a considerable variation in texture, from serrated to semi-crystalline. Within the landrace, the colors white, cream and yellow are common. Nevertheless, as observed in the region of the study, this landrace can also be black, dark blue, pink, red and mixed colors.

Tepecintle is the predominating landrace with the greatest diversity in the region. We found 113 samples of this landrace, accounting for 56% of the samples (See Fig. 8). Of these, 76 were identified as only *Tepecintle,* and 37 were combined with other landraces, such as *Olotillo, Tuxpeño, Olotón, Zapalote Chico, Dzit Bacal* and some other mixes and influences by hybrid maize.

Figure 7. Making tamales, Veracruz

5.2.2 *Olotillo*

We also found the landrace *Olotillo* to be widely distributed in the communities of the Santa Marta Mountains. It had the second largest prevalence in the Soteapan communities, with 52 samples associated and identified as belonging to this landrace (see Fig.9).

This landrace is particularly adapted to hillside areas and often grown on stony or less fertile ground. As expressed in its name, *Olotillo* is distinguished for its "slim cob". This characteristic makes for a fewer number of kernel rows, making it almost always possible to bend the cob. This landrace is highly appreciated since it grows in thin soil and/or in marginal lands and, thanks to its structure, is easy to thresh.

Figure 8. *Tepecintle* (Photo by Cecilio Mota)

Figure 9. *Olotillo* (Photo by Cecilio Mota)

The *Olotillo* has an ample variation of cob and kernel characteristics, and particularly diversified is the dimensions of the cob. The kernel's texture can be semi-crystalline, serrated and semi-hardened. The color can range from all-white or cream to dark blue, black, yellow, orange or red.

5.2.3 *Tuxpeño*

The most representative and important landrace in the tropical areas around Mexico is called *Tuxpeño*. A total of 16 of the samples were characterized as this landrace. Its material is the best adapted to local conditions; it also has the largest output and excellent agronomic characteristics. Therefore, it has been widely used in not only in Mexico, but also in other tropical regions in the world. *Tuxpeño* has also been used as the base for generating hybrids or varieties produced in special selection processes, to develop so-called "improved" hybrid seeds.

Tuxpeño is characterized by cylindrical long cobs (around 20 cm) and the number of kernel rows is usually more than 12. But it is also known for its jagged kernels with an ample variation of colors, predominated by the white and creamy-colored (Wellhausen et al. 1951).

Due to environmental conditions, this variety of maize is cultivated together with a vast array of other varieties, such as the previously mentioned *Olotillo* and *Tepecintle*. We mostly found it in the lower lands of the mountains, and in the municipality of Soteapan, it grew in the community of La Magdalena (See Fig. 10).

Figure 10. Examples of kernel colorations of landrace maize in Soteapan, Veracruz. (Photo by Cecilio Mota)

6. Discussion

This case study illustrates the vast agrobiodiversity in the *milpa*, particularly concerning maize. Henceforth, we conclude that in the same plot you can find not only different species (maize, chilli, squash, beans, green plants such as *quelites,* tomatoes, etc.) but even different varieties of maize itself. The preliminary characterization carried out in our study is vital for the community itself to learn about the vast

diversity of their own maize. In this way, the diversity can be protected, preserved and developed. Information has thus been gathered about this richness created by the farmers.

In Mexico, the *milpa* constitutes a SEPL, a space in which, even though maize is central, there is a diversity of plants. Various different kind of plants, from combinations of the three basic plants grown at the same time, to intercropping, to the succession of crops at different times, can all be found in the same space. The possibilities and variations in this system are many. Today we can also find *milpa* intercropped with fruit trees.

Even though *milpa* are one of the systems that contributed to constructing the base of agroecology (Morales 2011), they have not yet been sufficiently studied and analyzed. This production system represents vast opportunities, and analyzing it is highly relevant to accomplish biodiversity conservation and sustainable development. Firstly, we have observed the importance not only of the study of maize, but also of the diverse agroecosystems of the whole region. Subsequently, there is a need to understand the beneficial relationships between these species and agroecosystems. We also consider it fundamental to observe and quantify the *milpa* as a system in terms of energy recycling and nutrition.

The *milpa* of Mexican farmers make up a part of a worldview where biodiversity is identified and respected as a part of the culture, and are therefore also of a way of thinking. This conception permits the sustainable management of the landscapes. As such, while the ecologically-termed relationships should be further studied by evaluation and monitoring methods, it is also vital to know and recognize the profound knowledge of the farmers. These capacities have been despised and even fought against as a remnant of the past, but today they are central to landscape conservation and sustainable management.

The most important challenge is to achieve acknowledgment for the *milpa* SEPL, considering its contribution to multiple values. Unfortunately, the value of agricultural production, relegated to the so-called Green Revolution, has been measured through the output of the plants cultivated. This is a challenge for the agrobiodiversity of maize since even though there are MVN benefits, the economic value of the amount that can be sold has been prioritized. Aside from the output itself, another challenge is the use of agrochemicals, which are problematic for different reasons. For example, herbicides kill all the plants except for the maize and have been developed for monoculture. Often these chemicals contaminate, for instance fertilizers that destroy the soil. So, even though *milpa* and agro-industrial monocultures are for the most part grown in different places due to the diverse geographical and climatological conditions, there is still a high risk of the small-scale diverse production without agrochemicals being eliminated, since these farmers are competing in the same deregulated market as the monoculture production. The import of cheap maize puts at risk the small-scale landrace production of maize.

While throughout the last century and still in this one, public policies have tended towards terminating the *milpa* system, aiming to impose monoculture, today there are some programs beneficial towards farmers producing in this system. One example of this is told in a book published by Semillas de Vida, entitled, "The countryside in the city. The city in the countryside" (*El campo en la ciudad. La ciudad en el campo*, San Vicente & Mota 2018). This book discusses a rural part of Mexico City called Tlalpan, where the municipality has given subsidies in the form of financial support for maize and *milpa* production. The book presents a similar case study to the one of this chapter and illustrates the impact of policies that foment the *milpa* production system.

To solve today's challenges of sustainable food production, input from multiple actors is necessary. Hence, the foundation *Semillas de Vida* promotes what we call social *milpa*, which aim to reproduce social relations based on the concept of a system which benefits from a diversity of multiple characteristics and that allows for complex agroecological matrices.

7. Conclusion

The biodiversity conserved and in constant development in Mexico, particularly that supported by indigenous people such as the *Nuntajiyi*, still deserves and needs further research, and projects need to be implemented together with the communities. This further research is required not only due to the vast variation of species cultivated and the adaptation of landrace maize to the particular conditions of the mountain, but also because important aspects of the uses of this biodiversity have not yet been discovered and described.

There are various aspects to the SEPL and MVN apart from those addressed in the case study. Since the *milpa* production system reproduces and increases the number of species and different varieties of maize, the MVN are increased. It is essential to preserve the production and seeds in the hands of the farmers to keep this elevated number of different varieties. Agrobiodiversity is not only important in and of itself, but also in relation to other aspects of life, such as food culture. Each species and maize variety has its own special destiny as food, foremost for humans, but also for animals. This value is multiplied through the dialogue of knowledge, which at the same time produces

and deepens farmers' indispensable knowledge about the *milpa* system, agrobiodiversity and the selection of seeds, amongst other aspects. Also, it is important to build high-quality agroecological matrices by increasing biodiversity. Doing so would achieve water catchment and improve its quality and reduce global warming, which would lead to preservation of the integrity of biogeochemical cycles and conservation of forest resources, and accordingly food self-sufficiency, preservation of culture, and protection of the rights of *Nuntajiyi* people.

To maintain and develop maize agrobiodiversity, it is necessary to support farmers, for example through subsidies that remunerate them for their meaningful work of selection and adaptation. In fact, in Mexico the possibility of paying the farmers for conserving biodiversity has been discussed, and another suggestion has been paying a higher price in the market, particularly for their maize. This could be accomplished by a governmental institution buying the maize for a dignified price. Nevertheless, it is also possible to increase the income of the farmers though opening up new markets, since today a direct connection between market and production is lacking.

The characteristics of the maize pigments have great value as an important part of the socio-ecological landscape due to their importance for food, health, environment and culture. The results of the study illustrated that the agrobiodiversity cultivated by the indigenous people and small-scale farmers in this region has great value in the rich variation of the grains' colors: white, cream, light yellow, intense yellow, orange, black, dark blue, red, violet, purple, mixed colors, etc. This exceptional agrobiodiversity is associated with different types of food, for example, *pozol*.

If this type of agricultural activity is going to be conserved and supported, support should be given through the dialogue of knowledge. This methodology implies that ancestral knowledge is recognized and a dialogue with modern science can be established to accomplish the sustainable management of nature and agriculture. As we have shown in this study, these small-scale farming communities are indispensable to the conservation and development of the vital landrace maize agrobiodiversity, not only from an environmental perspective, but also from a social one.

The struggle to defend landrace maize, together with the farmers, contributes to re-establishing relations and empowers the profound historical and contemporary connection that we as Mexicans have with maize, our food and agriculture. The diversity and strategies of humans have similarities to the basic principle of the *milpa* system. As at the heart of sustainable agriculture species lives together in harmony, human communities support each other in established relationships based on cooperation taking advantage of the particular characteristics and abilities of every member. This is how the MVN inserted in the social context could be understood, from the perspective of smallholder and indigenous communities in the municipality of Soteapan, through the study of the use of landrace maize.

Acknowledgments

This project was made possible thanks to the agricultural communities, who with tenacity, and in spite of all the circumstances going against them, have conserved the agricultural production in Mexico. Therefore, firstly we would like to express acknowledgement to them who preserve and develop agrobiodiversity in the countryside, in our case, landrace maize within the *milpa*. A particular thanks to the small-scale farmers in Soteapan, who kindly welcomed us and opened up for dialogue about the vast maize richness and its management. They shared their time and knowledge, and facilitated our access to the maize samples they cultivated.

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Chapter 7

Enhancing communication and co-learning in socio-ecological landscape management through elicitation of local communities' visions and values

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Abstract

Serra do Xistral is a medium-range (maximum height: 1,052 m) mountainous area in the North of the Autonomous Community of Galicia (Spain). Its Atlantic oceanic climate, characterized by abundant precipitation, winds, and fogs, facilitated the formation of a landscape characterized by extensive wet heathland and bog habitats. These are considered the most valuable ensemble of bog and wet heathlands for biodiversity conservation in all the Iberian northwest, and include blanket bogs unparalleled in all of southwestern Europe. The area is also a European Natura 2000 network site (i.e. nature conservation instrument defined by European environmental regulations). In addition, an essential component for the formation of this ecosystem was the coevolution of natural features with human activities, e.g. cattle and horse livestock husbandry. The area is characterized by a singular ownership regime, the "Communal Forest Land" (MVMC). Decisions on both management approaches and the benefits obtained from the common land are made at MVMC Community Assemblies. Visions and values of local communities are essential in the decision-making process, and in turn a major influence on the management of natural resources and the configuration of the landscapes. However, in many instances such visions and values differ from institutions at different administrative levels. More in-depth knowledge on the visions, values and narratives of local communities would help to enhance communication in the socio-ecological system and ultimately, in its management.

The European Union financed "LIFE in Common Land" was developed in Serra do Xistral, involving eleven MVMC. Its aims include the development of management approaches for the protection of priority habitats, including incentives like payment for conservation results. A qualitative approach for obtaining information from local communities was developed. Semi-structured interviews with board members of the MVMC Communities were recorded, gathering information about management systems, community organization, and natural resource uses in the area. In addition, questionnaires specifically designed to assess perceptions of ecosystem services and nature conservation measures were collected. Results allowed

for characterization of views on nature and ecosystems of the local communities, whose values in many instances differ from those of environmental conservation institutions. Also, important elements of sense of place and attachment of the community members to their environment were identified, as well as environmental conflicts related to wildlife-livestock interactions. These results could be used to develop new ways of understanding and co-learning, which could form the basis of novel approaches to ecosystem management and conservation.

Keywords: Socio-Ecological Production Landscapes (SEPL); Participatory approaches; Co-Learning; Value conceptualization; Common Land; Ecosystem Management;

Country	Spain
Province	Galicia (Region)
District	Lugo (Province)
Size of geographical area [1]	22,964 hectares
Number of indirect beneficiaries [2]	407 persons
Dominant ethnicity	Caucasian

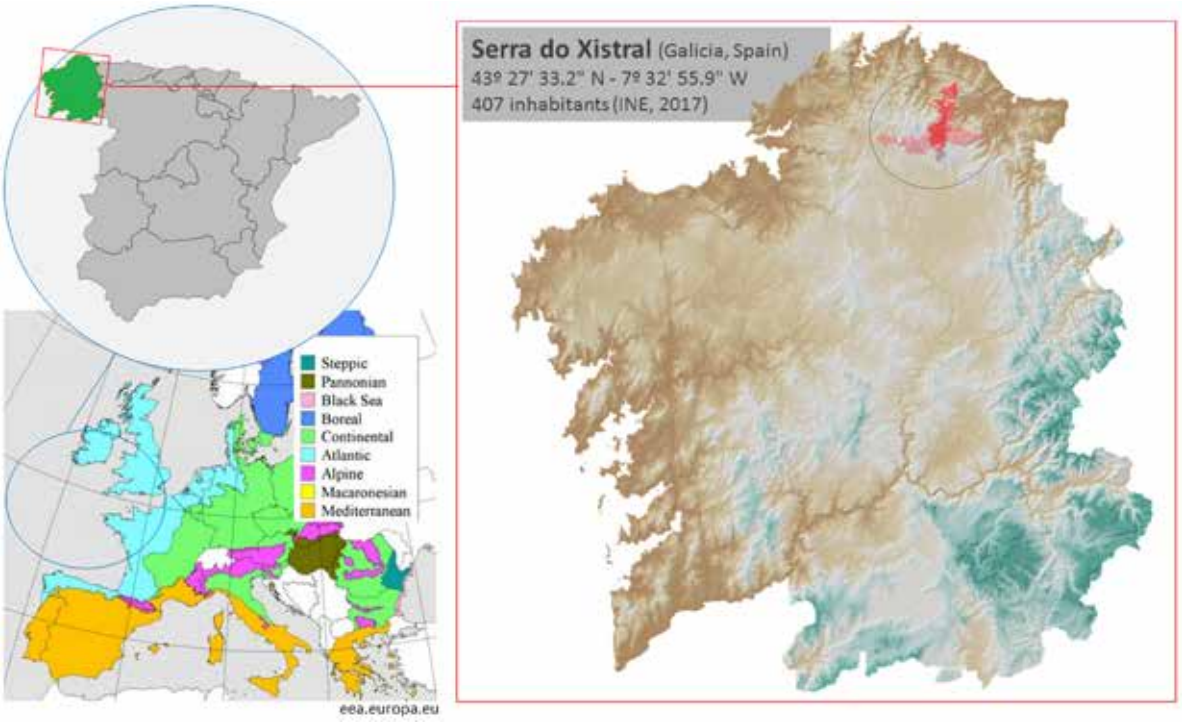

Figure 1. Map of the country and case study region – Galicia, Spain

Size of case study/project area [1]	9,938 hectares
Number of direct beneficiaries [2]	291 persons
Geographic coordinates (longitude and latitude)	43°27'33.2"N 7°32'55.9"W
Dominant ethnicity	Caucasian

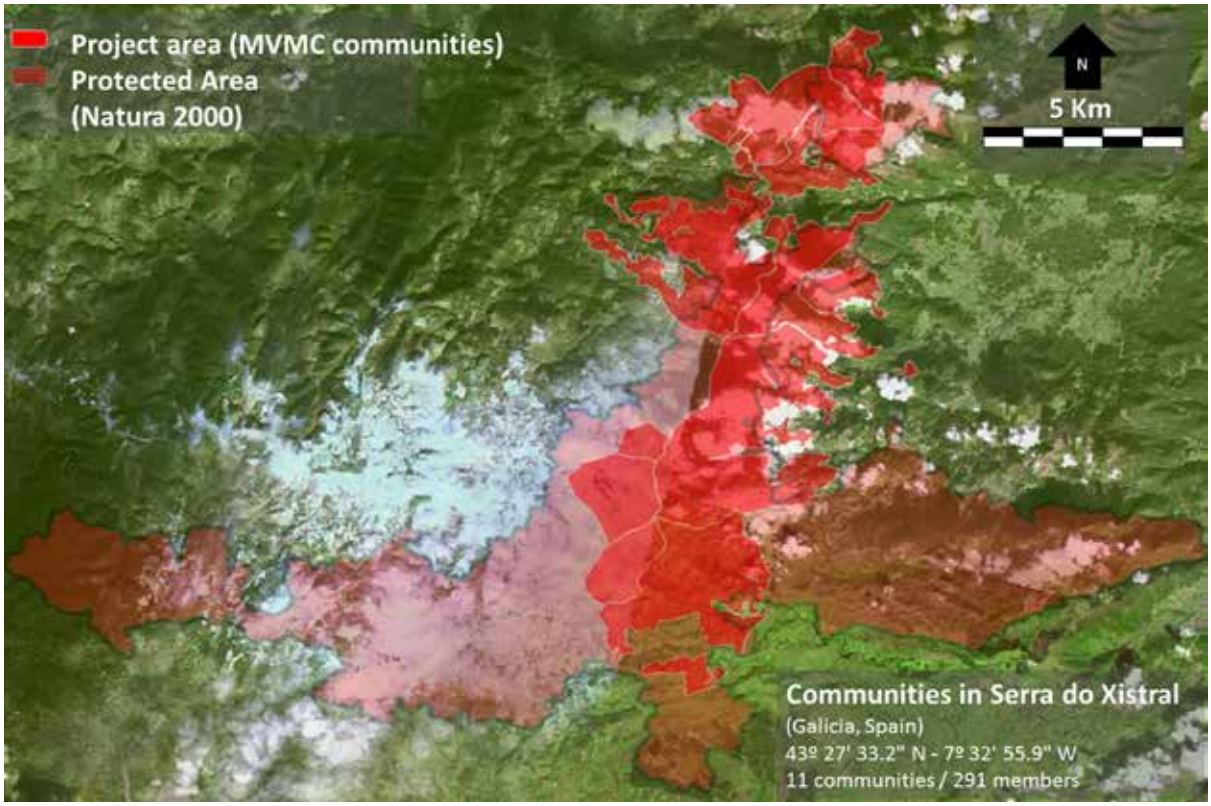

Figure 2. Land use and land cover map of the case study

1. Introduction

1.1 The role of visions and values in Socio-Ecological Production Landscapes

Socio-Ecological Production Landscapes and Seascapes (SEPLS) are the result of the interactions of nature and society in a given geographical and temporal context. Their sustainability through time has depended on the careful management of ecosystem services and the multifunctional use of land within the carrying capacity and resilience of the environment. As a result, they constitute examples of areas with high capacity for biodiversity conservation, socioeconomic development and preservation of cultural assets such as traditional knowledge and local traditions (eds. Bélair et al. 2010; Okayasu & Matsumoto 2013). In many instances, these outcomes have depended to a high degree on the capacity of societies to agree on specific visions and values, which guide the actions collectively undertaken (e.g. what crops and where to produce them, how to repair a wall, etc.) and to set up control elements for individual actions that could go against the collective interest (Ostrom 1990).

The complexity of modern day societies challenges this capacity for vision alignment (Folke et al. 2005; Ostrom 2005). One example is the current understanding of the concept of value. In many cases, and specifically in the field of ecosystem services, the concept tends to be interpreted as monetary value (Gómez-Baggethun et al. 2010). The use of conceptual models for the process of value attribution for ecosystem services, from their recognition as biophysical entities to their trade in the market (e.g. the "ecosystem services cascade"; see e.g. Potschin-Young et al. 2018), is useful to characterize them in the socio-economic subsystem, but has the risk of confounding it with the whole socio-ecological system. A proper understanding of the whole system should include the interactions between society and the environment in all its complexity, including components not exclusively definable by their economic role or value (Constanza et al. 2017). Consequently, and given the plurality of the term, a conceptualization of value is needed (Pascual et al. 2017; Small, Munday & Durance 2017). In this sense, the conceptual framework and approach of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (Díaz et al. 2015; Pascual et

al. 2017) represents a system based on series of elements and the interrelations among them, in which different interpretations of "value" should be taken into account and integrated. In general terms, a distinction may be made between non-anthropocentric values and anthropocentric values. Among the former, the intrinsic value of nature can be considered of major relevance, and may include the 'per se' value of biodiversity; among the latter both instrumental (i.e. contributions of nature to people) and relational (i.e. components for the good quality of life) can be included (IPBES 2015). An inclusive perspective of values should also take into account their definition at different levels, ranging from the whole society, the community and specific groups, to individuals, and distinguish between more transcendental (i.e. shared collectively in the form of social principles of general application) or contextual (i.e. dependent on a given object or situation) values (Kenter et al. 2015). This will help to understand how values can take the form of principles, preferences, measures or needs (IPBES 2015), and in the latter case, how they are dependent on context (abundance or scarcity of a given resource), barriers (either physical or social obstacles for resource use), or trade-offs between different goods and services for their use (Daw et al. 2011).

Taking all this into account, the analysis of visions, preferences and values and their influence on decisions affecting the environment and natural resources becomes of primary interest to understand the dynamics and sustainability of SEPLS. This would also imply the identification of differences and conflicts between different visions and divergences in the interpretation of values, not only among individuals in a community, but also between different levels and components of the general society.

In the case study presented here, the mountainous area of Serra do Xistral (NW Spain) is analyzed in the framework of a European Union (EU) financed LIFE Program ("LIFE in Common Land"). This project aimed to develop environmental management instruments, including payment for conservation results incentives, in order to improve the conservation state of a series of habitats declared of priority interest in EU environmental regulations. A major area covered by these habitats is in community-managed common lands, so conservation of habitats has a strong relationship with decision-making on the activities and management of these lands by the communities. Considering the strong relationship between incentives and values, the local communities were approached in order to learn in-depth about how they manage their resources, their visions on the social-ecological systems they are integrated into, and their perspectives and opinions about the conservation policies developed up to now.

1.2 Study site: Serra do Xistral

Serra do Xistral (Galician language for Xistral Mountains) is a mountainous area in the northern part of the Autonomous Community (region) of Galicia, in Spain (43º 27′ 33.2″ N - 7º 32′ 55.9″ W) (see Fig. 1 and 2). The oceanic climatic influence, which provides the area with abundant precipitation, winds and fogs, combines with medium-range relief (maximum height: 1,052 m ASL). The livestock-centered activities of local communities, dating back to time immemorial, form the characteristic heathland and bog socio-ecological production landscapes (SEPLs).

The Serra do Xistral SEPL supports a diverse ecosystem, rich in plant communities (Romero-Pedreira 2015) and endemic species, and presents three habitats declared of priority interest in the EU Directive for the conservation of natural habitats: active raised bogs (7110*), active blanket bogs (7130*) and Atlantic wet heathlands (4020*). These priority habitats have developed over centuries through their use as pastures (see Fig. 3). Thus, the state of their conservation depends on the management regimes, including the grazing intensity using different livestock species (mainly horse, cow and sheep) and other practices for the regulation of woody biomass for burning and cutting (Fagundez 2016, 2018; Díaz-Varela et al. 2018). While the habitats are recognized to be in a good state of conservation, their continuity over time depends to a large extent on the careful maintenance and improvement of the management regimes, especially those related to pastoralist activities (Muñoz-Barcia et al. 2019).

As mentioned above, livestock in a semi-wild regime, specifically horses (official sources in the Galician regional government consulted for the project account for a total of 1,324 individuals currently in the study area), cattle and sheep, have played an important role in the use of land from ancient times (Bouhier 2001), and form the backbone of a multifunctional landscape. In present times, a number of ecosystem services are provided by the area, including

Figure 3. Horses grazing under windmills in the heathlands of Serra do Xistral (Photo: Emilio Diaz-Varela)

the production of food (e.g. meat, cheese, honey), energy (windfarms), and ecosystem regulation (biodiversity, pollination, and water purification, to name a few), as well as cultural services (from local knowledge and sense of place to tourism and recreation).

In Serra do Xistral, pastures are mostly common lands under an ownership regime called "Communal Forest Land" ("Montes Veciñais en Man Común" (MVMC) in Galician language). Lands under the MVMC ownership regime are, by law, indivisible, inalienable, imprescriptible and unseizable. The MVMC are community managed, and all decisions (from management approaches to the destination of benefits) are made democratically through the assembly of the Community of MVMC (CMVMC), with a board acting as representative body. Community decisions thus have a major influence on the management of natural resources in the MVMC, and ultimately, in the configuration of the landscapes. Consequently, the visions and values of local communities are linked to the future of the socio-ecological landscape. Nowadays, different visions of nature and human-nature interactions and the values thereof can be found among the local inhabitants and different institutions and administration levels, especially regarding conservation practices and measures. In many instances, these differences hinder the communication process across the governance system. More in-depth knowledge on the visions, values and narratives of the local communities, and how they perceive themselves in their environment, could lead to a mutual-learning and understanding process which would enhance communication in the socio-ecological system and ultimately, in its management.

2. Description of activities (methods)

Inside the areas protected under the Natura 2000 network live 407 inhabitants (INE 2017). A total of 11 MVMC communities were addressed in this study, totalling 291 communal forest owners. Information was collected on the communities and their management of the common land with three different goals: a) to check the attitudes of community members towards environmental protection actions, and specifically the EU Natura 2000 program. Discernment of these attitudes will help in understanding the visions and conceptualization of "nature" and associated values; b) to assess the degree of awareness and perception of the ecosystem services provided by the common lands. Such perceptions will be interpreted as an indicator of how people prioritize natural resources and their use, thus informing about the related values; and c) to gather information about the different aspects of management in the common land, both as an organization and a production unit, in order to understand the system and its dynamics. In addition to previous and ongoing studies made by other members of the team (Izco et al. 2006; Ferreiro da Costa et al. 2013; Fagundez 2016, 2018; Díaz-Varela et al. 2018; Muñoz-Barcia et al. 2019), a mixed qualitative-quantitative approach was utilized to retrieve information from the communities.

Semi-structured interviews were conducted, addressing the boards of the 11 MVMC communities that participate in the project, considering that they fulfill the conditions of availability and knowledge required by the approach (Gorden 1975; Vallés 2009; Hernández-Carrera 2014). Different subjects were covered including use of the common land, pastureland and livestock management, internal organization of the community and the historical evolution of the use of common land. Next, a questionnaire including 24 questions related to perceptions of and attitudes towards the Natura 2000 program was utilized (covering topics on the utility of the approach, general knowledge about the program, positive and negative views and the level of involvement of the community). Finally, 17 additional questions related to perceptions of ecosystem services were asked (respondents scored provision and regulation services on a 1-5 scale, and were asked to refer to and locate important cultural services-providing areas on a map). In total, 11 meetings were held (one for each community). Interviews and questionnaires were undertaken in the same meetings (see Fig. 4). The entire process was sound-recorded. The contents of the questionnaire were set up as a reference to define the list of initial topics, for which a summary is shown in Table 1.

From the interviews, the identification of induced topics was expected. The initial topics were designed to inform about the specificities of the system, leading to

Figure 4. Two different moments in the development of interviews (Photo: C. Blanco-Arias)

Table 1. Summary of initial topics on which information was gathered. Numbers in brackets refer to the number of actual topics covered.

Summary of initial topics	
Involvement of communities in management (1)	Organization of the MVMC (7)
Species used (forestry, agriculture, livestock husbandry) (3)	Intra- and Inter-community conflicts (3)
Number of livestock individuals (1)	Changes in land use and management (4)
Typologies of pasture (1)	Provision of ecosystem services (7)
Pasture management details (4)	Regulation of ecosystem services (6)
Livestock management details (8)	Cultural ecosystem services (4)
Conflicts in management (including wildlife) (1)	Opinions on Natura 2000 network (1)

an understanding of its dynamics, and allowing for the identification of relationships between human activities and biodiversity conservation. On the other hand, induced topics would be more concerned with specific values through their relation to the priorities and visions of the communities for resource use.

The interviews were directly analyzed from the audio files. This helped to save time and resources, avoiding the transcription of unnecessary sections of the interviews (e.g. explanations made by the interviewers, deviations from the main subject, etc.), and focusing on those aspects initially considered as relevant for the study (Gibbs 2007). Those fragments considered as significant were directly transcribed, coded and registered in a digital database. We assumed the possible loss of context in the fragmented transcription and the possibility of change in what is considered relevant across the study (Gibbs 2007).

In the framework of the "LIFE in Common Land" project, beyond the gathering of information for analysis of the socio-ecological system, the interview protocol was also aimed at the future assessment of changes in the attitudes and values of the local population. To this aim, the interview protocol will be repeated at the end of the project, to check the extent to which the incentives for habitat conservation changed visions, values and priorities in the communities.

3. Results

3.1 Systemic interpretation of the SEPL

Information gathered from interviews, together with previous studies (Izco et al. 2006; Ferreiro da Costa et al. 2013; Fagundez 2016, 2018; Díaz-Varela et al. 2018; Muñoz-Barcia et al. 2019), allowed for a general description of the social-ecological system. This characterization is considered as a necessary initial step for the understanding and comprehension of the interactions of stakeholders amongst themselves and with the biophysical environment (see Fig. 5), and thus, with the conservation of priority habitats and ultimately, biodiversity.

Figure 6 shows conceptually the functioning of the ecosystem and some parameters for its resilience. The management of pastoralism, synergistic with the cycles and characteristic functions of the ecosystem, is the central element that defines the continuity of priority habitats, essential for the conservation and enhancement of biodiversity. This approach is characterized by cyclic management, alternating horse and cattle for the use of pasture, depending on the pasture's height, species composition and lignification degree. This management acts as the stabilizing force of the system, defining a metastable (i.e. "almost stable") state. In parallel with this management, subsidies promoted by public administration and institutions favoring territorial governance and alternative economic activities, also support stability. All these factors increase the resilience of the system in the face of external destabilizing forces, which could drive the ecosystems out from their metastable state. In such a case, two possible thresholds were identified, generating two alternative trajectories (see Fig. 7), in both cases leading to a decrease in biodiversity in the ecosystems: the abandonment of livestock activity, leading to high shrub ecosystems, and eventually to pre-forest and forest ecosystems, or to a degraded ecosystem if forest fires take place. The second trajectory would occur in the event of excessive intensity of management (overgrazing, excessive vegetation clearing) beyond a certain threshold, causing the system to evolve towards a degraded ecosystem.

A third trajectory would be driven by the transformation of the heathland ecosystems (priority habitats) to artificial herbaceous pastures or forest plantations. These changes in land use involve important modifications in the management system, and currently their development is limited by regulations for the conservation of natural areas.

Finally, the social structure and relationships are represented in a stakeholder map (see Fig. 7), defined from references to actors, institutions and relationships obtained in the interviews. The MVMC communities show a strong link and/or mix with local producers, the local tertiary sector (tourism), and local cultural NGOs. In addition, there are important links with producers associations. Links with non-local individuals include visitors interested in tourism, recreation and other outdoor activities. Indirect connections with institutions include regulations and programs, both in the framework of nature conservation strategies or in rural planning and development. Direct

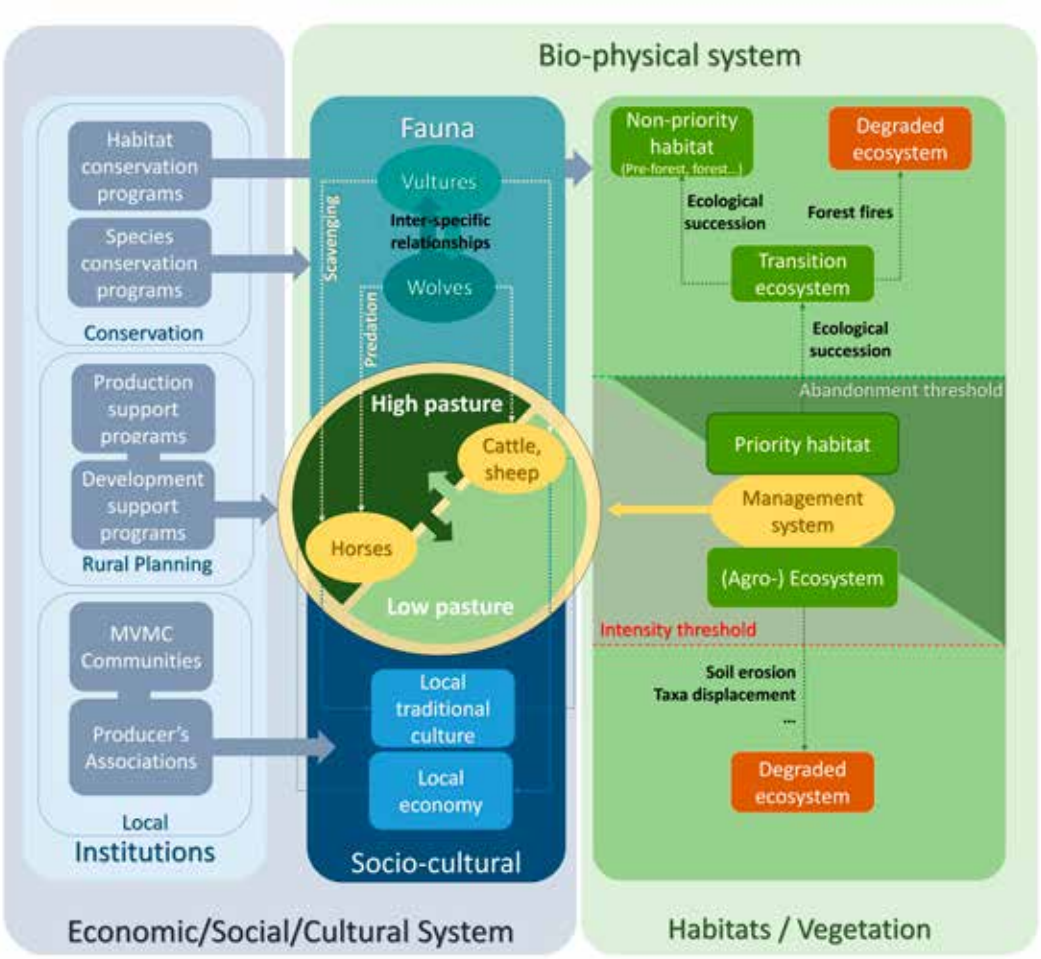

Figure 5. Synthetic scheme of the relationships detected between livestock management systems (in the central position), elements of the biophysical system (above and to the right), and elements of the economic, social and cultural system (below and to the left). The scheme includes both different ecosystems of the area and main relevant wildlife species, as well as elements of the economic, social and cultural system, both local and from extra-local administrative units.

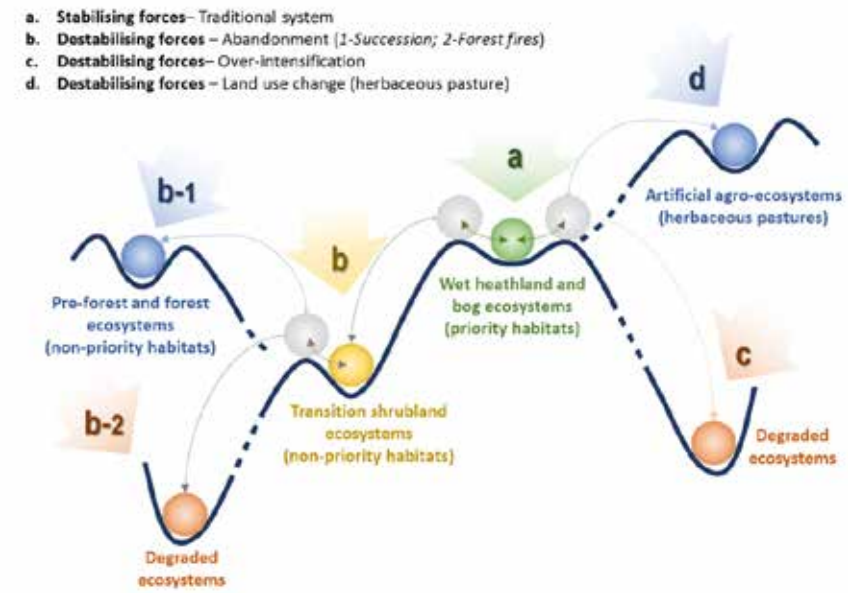

Figure 6. Conceptual model and possible evolution trajectories for the ecosystems in Serra do Xistral. See text for details.

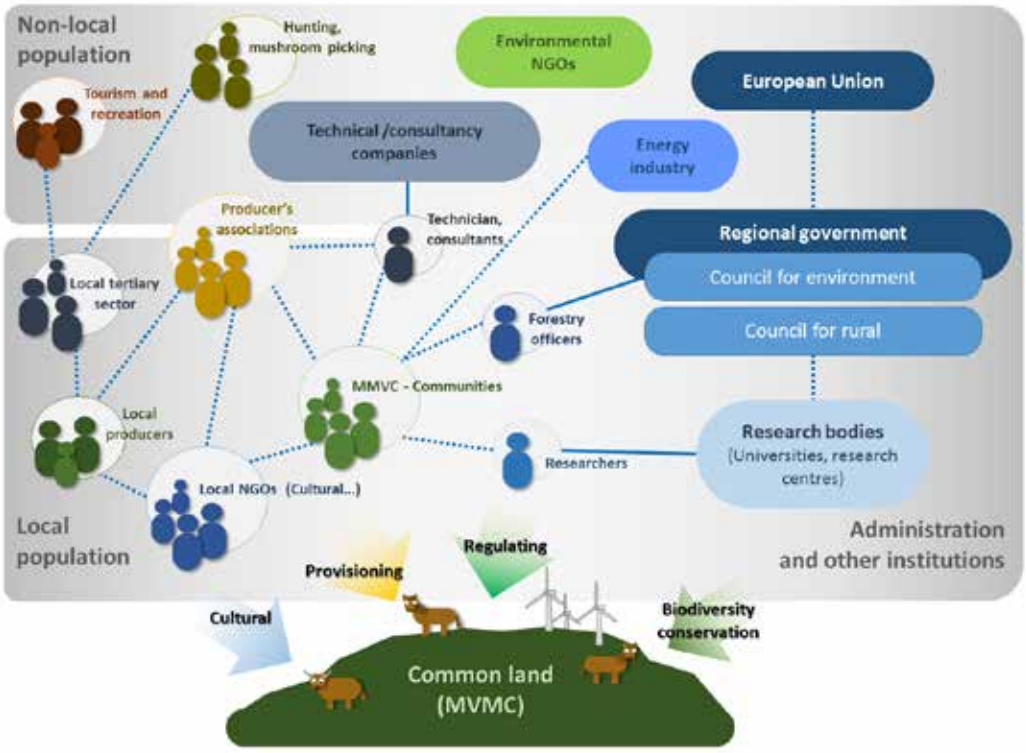

Figure 7. Stakeholder mapping

relationships involve public (e.g. forestry officers) or private (e.g. technicians and advisors) intermediaries, with functions including administrative support and extension advisory services. Non-administrative institutions, like non-local environmental NGOs and research institutions, also have interests in the area, and their interaction with the local population is varied – more direct in research projects, and less in conservation activism.

3.2 Specific results for ecosystem services

The questions regarding provisioning ecosystem services resulted in ordinal scores from 1-5 regarding the importance of the provision of food from livestock, agriculture, honey production, and mushroom and wild fruit picking; the production of wood; and the production of energy (mainly in windfarms). Energy production got the highest score followed by the provision of food through livestock husbandry, followed by hunting/fishing and honey production (see Fig. 8 for more details).

For regulating services, the highest score (see Fig. 8) corresponded to protection against floods, followed by water quality, for which a special awareness has been perceived. The next services in order of importance were habitat, erosion control, and pollination. The least valued service was the climate regulation. Regarding cultural services, the only one measured on the 1-5 ordinal scale was the perception of the possibility of tourist and recreational activities in the area, with relatively high scores (4.27 out of 5). The interviewees also located areas of provision for cultural services, resulting in the identification of 19 spots considered important for their historical value; 20 spots for their outstanding aesthetic landscape; and 9 locations for festivals, fairs or local pilgrimage destinations. Twenty of the former locations were geo-located (see Fig. 9). In general, all local community members declared a high level of personal connection with Serra do Xistral through their way of living. In general terms, the higher importance conferred to provision services, and to those regulation values with clear relationships to production, can be interpreted as a preponderance of instrumental values. Nevertheless, the clear identification and the relationships with the ecosystem of the culturally-valued spots, which can be interpreted as important relational values contributing to the local construction of identity, have to be considered.

3.3 Specific results on perceptions of nature conservation activities

As commented above, the information gathering approach included questions about the perceptions of the communities concerning conservation initiatives, and specifically, the EU Natura 2000 network.

There was not a consensus among the communities on the utility of the conservation programs for the protection of species, habitats, improvement of water quality or the promotion of sustainable practices. Nevertheless, while all the communities had a general knowledge of the conservation program, important deficits were identified related to information exchange between the administrative bodies and the communities. All of the communities reported that the information received from the administration on Natura 2000 was not enough (72% stated a total absence of information), and all of them had insufficient information (36%) or none at all (63%) about subsidies and support measures linked to the protected

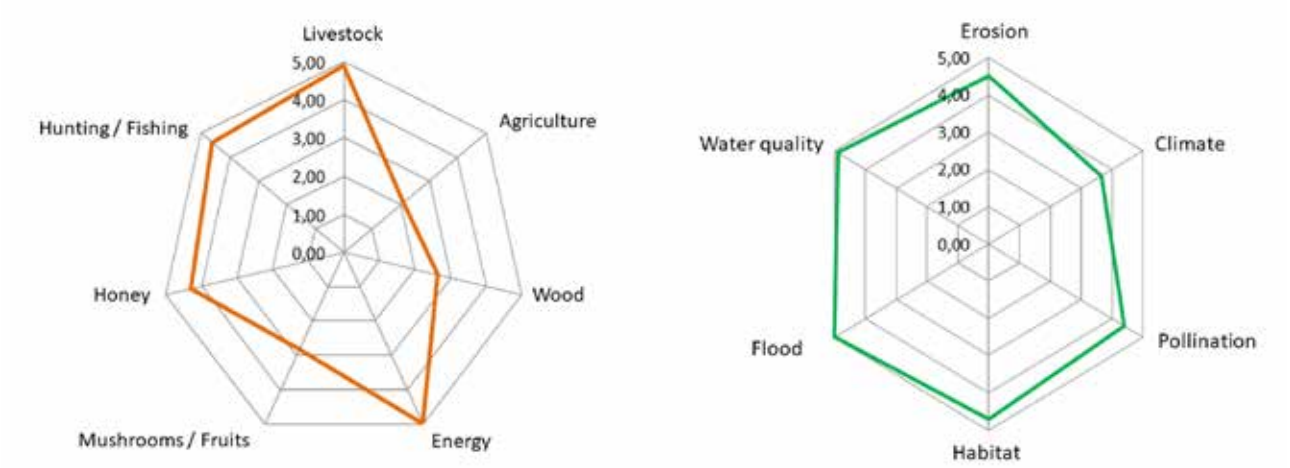

Figure 8. Scores obtained on a 1-5 ordinal scale for provision (left) and regulation (right) ecosystem services

areas. In addition, all referred to the fact that they were neither asked to be involved in the delineation process, nor informed on how the process developed. Finally, it was generally perceived (82%) that conservation measures linked to the protected areas are prejudicial for agricultural or forestry activities to some degree; nevertheless, almost half of the communities positively view the inclusion of their MVMC in the program.

3.4 Extended information and induced topics

During the interviewing process, a series of frequent themes were identified, which were classified as induced topics. The topics are not mutually exclusive, and in fact have strong mutual relationships. Those identified so far are described below.

Different understanding of "conservation value". When asked about conservation initiatives, communities normally identified more or less clearly the *subject* of the conservation (e.g. either by naming a single species or a particular habitat), but in many instances, they did not clearly acknowledge the *reason* for conservation. This may be due to a confrontation between conservation and production - i.e. they see that conservation threatens the productive activities linked to their way of living. More specifically, some of the statements may suggest that conservation menaces their own rationale of management, and/or that of their ancestors. However, they expressed a clear understanding that their activities contribute to the preservation of the landscape and/or the habitats of interest. Therefore, while there is some agreement on *what* should be preserved, there are divergences on the vision of *why* and *how*.

Lack of communication and neglect by the administration. The lack of communication with administrative bodies was clearly reported in the answers to the initial topics. Communities felt uninformed in different aspects regarding the declaration of protected areas. They also reported several instances of administrative barriers to compensatory measures, like subsidies or payments for wildlife attacks on livestock. Communities therefore reported feeling neglected by the administrative bodies.

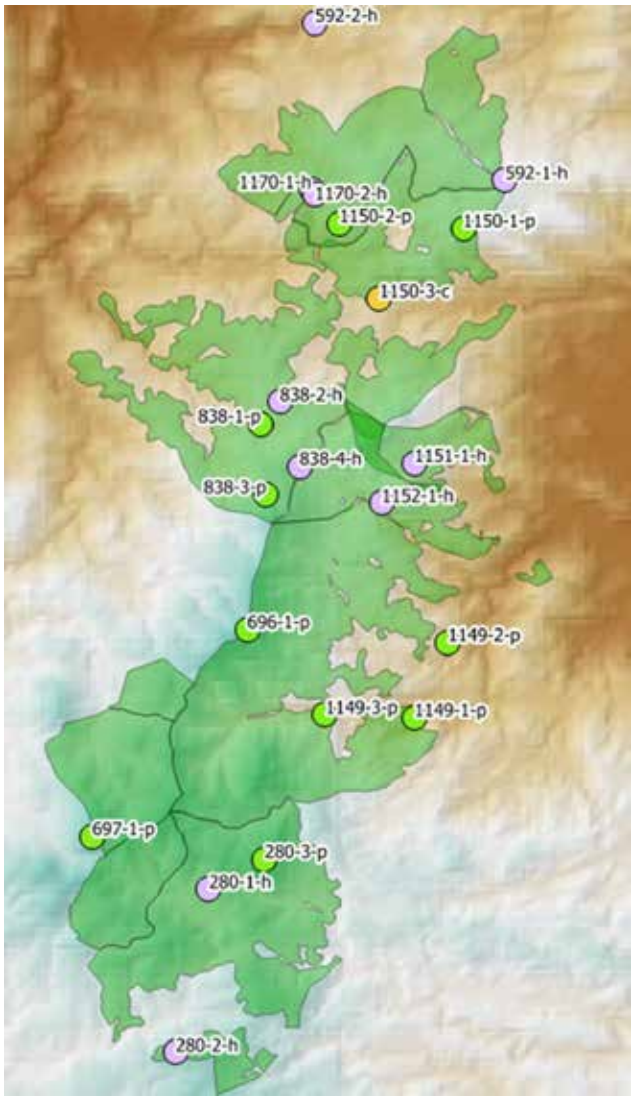

Figure 9. Places identified in the interviews related to cultural ecosystem services. Letters in the codes make reference to heritage (h), landscape (p) or celebration (c) related services.

Frequent comments regarding the absence of policymakers and other public representatives "stepping on the ground" in the area also may be interpreted as a lack of interest or understanding on the part of the administration.

Conflicts with wildlife. In general, conflicts with wildlife were considered an important issue in all the communities, the main ones being wolf (*Canis lupus signatus*) attacks on livestock (mainly foals and calves). Also, the griffon vulture (*Gyps fulvus*), while not considered a threat, was pointed out as a worsening factor, as they remove the carcasses making it difficult to prove the attacks and thus to ask for compensatory payments. It is generally acknowledged that wolf attacks have happened from ancient times, but the perception is that they have increased in recent years. Attitudes towards wildlife as a threatening factor reveal possible conflicts between intrinsic values of nature (i.e. conservation of wildlife), and relational values (the continuity of a way of living). The consequences also extend to a conflict with the administration, as it is perceived as a "protector" of the wildlife, instead of the people.

4. Discussion

The current vision of the Natura 2000 network program for nature conservation acknowledges farming as a major contributor to biodiversity. In fact, due to the non-exclusive character of the protected areas regarding human activities, the latter are recognised as an integral part of nature in a mutual partnership process (Olmeda et al. 2014). However, the protection character of the Natura 2000 imposes some specific limitations on productive activities, namely those that can be harmful for the habitats or species of interest that are meant to be protected. This can be a source of conflict with local inhabitants, acknowledged and studied in the search for solutions (Bouwma et al. 2010). In our study, we consider these conflicts as confronting visions of local communities and environmental administrative bodies, whose vision can also be shared by other stakeholders like non-local environmental NGOs, and to a certain extent, some visitors attracted by the natural values of the area.

As shown in our analysis, the structure and dynamics of the system, the preferences of communities regarding provisioning ecosystem services, and the importance given to the obstacles to productive activities set by the administrative nature conservation regulations, characterize the vision of the local communities as centered on productive aspects. Thus, instrumental values are the most apparent. Nevertheless, productive activities should not be considered simply as entrepreneurial activities, but also as an important component of a way of living. The results of the assessment of cultural ecosystem services indicate that an important part of the identification of local inhabitants with their environment is made through their activities in the MVMC, but not only the productive ones. This is evident in the location of a variety of sites recognized as providers of cultural services in Serra do Xistral. Consequently, the consideration of relational values (Chan et al. 2016) as part of the visions of local stakeholders becomes necessary.

While other values and visions could also be acknowledged in the different stakeholders, we identify an important failure in the mutual acknowledgement of two perspectives – one centered in the *productive* vision, and other in the *conservative* vision. Consistent with other works in EU states (see e.g. Gallo et al. 2018), this failure emerges through different conflicts: lack of understanding of restrictions, bureaucratic barriers, or communication deficits. The deficiency of a common language, the lack of information channels and the absence of participation of local communities in decision-making are all indicative elements. As a result, the communities have a general perception of the conservative vision as restrictive, viewing the conservation efforts as giving more attention to the preservation of wildlife in the area than to the maintenance of the local inhabitants. This will hinder the acceptance of conservation measures by the communities, which will paradoxically result in a deterioration of the priority habitats, dependent on the traditional perspectives of management.

In addition, it should be considered that the SEPL behaves as a Complex Adaptive System (Preiser et al. 2018). As such, the system itself adapts to changes in ways that are difficult to understand and foresee in many instances. For instance, in the last decades, windmills were installed in the mountains, involving the construction of road infrastructure. Also, in some areas heathlands were transformed into artificial grassland. While the first caused impacts in both landscape and hydrological regimes (Diaz-Varela et al. 2007), it brought new income sources for the MVMC communities, as well as improved access to remote pastures. The second reduced the area of habitats (Gómez-Orellana et al. 2014), but improved the availability and quality of fodder for livestock. Both actions would involve potential harms for the ecosystem, but improve the quality of life for the communities, thus securing their permanence in the area. In addition, changes in management regimes may have consequences for the system's functioning (e.g. the behavior of wildlife and their interaction with livestock, the outbreak of diseases or invasive species, etc.) that are, together with the influence of global changes, still to be examined.

5. Lessons learned and conclusions

The information obtained through interviews, questionnaires and direct observation of the SEPL provide strong support for the elicitation of the inhabitants' visions and values, from which a series of lessons can be learned:

- Differing views on the reasons for conservation have been detected between environmental administrations and local communities. For the first, conservation is related to the intrinsic value of habitats and ecosystems – for the latter, as they consider the ecosystems as part of their way of living, instrumental and relational values are behind their visions for conservation.

- Communities reported being ill-informed about the decisions made concerning the conservation areas, from their initial delineation to current management approaches. Also, they feel neglected with regard to the decision-making of administrative bodies. To integrate the participation of communities in conservation schemes, new forms of communication have to be enabled.

- Important changes have affected the socio-ecological system in the last decades, including new road networks and the transformation of heathlands in herbaceous pastures. While these changes may be considered by the local communities as sources of improvement, they will eventually modify the management system. This may bring about new unexpected system behaviors (e.g. new behaviors of wildlife, outbreaks of invasive species, etc.) which are difficult to understand and foresee.

To overcome the conflicts derived from differing visions, restoring common trust and enabling communication strategies are recognized among the necessary measures (Bouwma et al. 2010). Specifically for Serra do Xistral, a conversational approach between the different stakeholders would favor an openness to the variety of visions and values of the SEPL, the incorporation of other perspectives (e.g. those related to rural development or new alternatives of management) and the integration of information about the new dynamics of the system. Such approaches would be a necessary first step for the establishment of an integrative understanding of protected areas, inclusive of local communities' values, and for the implementation of innovative management schemes. In this specific project, the schemes will be related to payment for results in conservation (i.e. reception of incentives if ecosystem conservation goals are achieved), as well as the development of strategies to add value to conservation-friendly products developed in protected areas. The integration of economic revenue may help to define new dimensions for the instrumental and also relational values associated to the communities' way of life and, hopefully, to facilitate a common acknowledgement of the intrinsic value of the ecosystems.

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Chapter 8

"The Sundarbans is our mind": An exploration into multiple values of nature in conversation with traditional resource users

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Abstract

This study captures and depicts the understanding on multiple values of nature (MVN) by traditional resource users (TRUs) of the Sundarbans. The research, using multiple evidence-based approaches, combining participatory insights of the TRUs of the Sundarbans and interdisciplinary heterodox perspectives, demonstrates that valuation of environmental resources through market penetration pricing does not reckon the social benefits and values coproduced through complementarity between humans and nature. The TRUs of the Sundarbans treat the forest as their mind, through which human-nature sociality flourishes. The traditional knowledge system can significantly contribute to the sustainable management of biodiversity resources, both within the protected areas system and potentially within other effective area-based conservation measures, if given a chance and supported by governmental and non-governmental agencies. Moreover, TRUs argue that due to lack of a proper market structure and equal distribution of power, rents are dissipated through market pricing, going into the pockets of the rent-seeking powerful class. This rent-seeking behaviour induces unproductive, expropriating activities that bring positive returns to the individual but not to society. Dividing the tranformational pathways into three phases – stabilization, transformation and sustainability – this chapter argues that such processes require approporiation of nature, as oppossed to expropriation, for harmony of nature with people.

Keywords: Interdisciplinary Valuation, Multiple Evidence-based Approach, Traditional Resource Users, Indigenous and Local Knowledge, Human Sociality, the Sundarbans

Country	Bangladesh
Province	
District	Khulna, Satkhira and Bagerhat
Size of geographical area	6,071 km^2
Number of indirect beneficiaries	3.5 million
Dominant ethnicity	Bengali

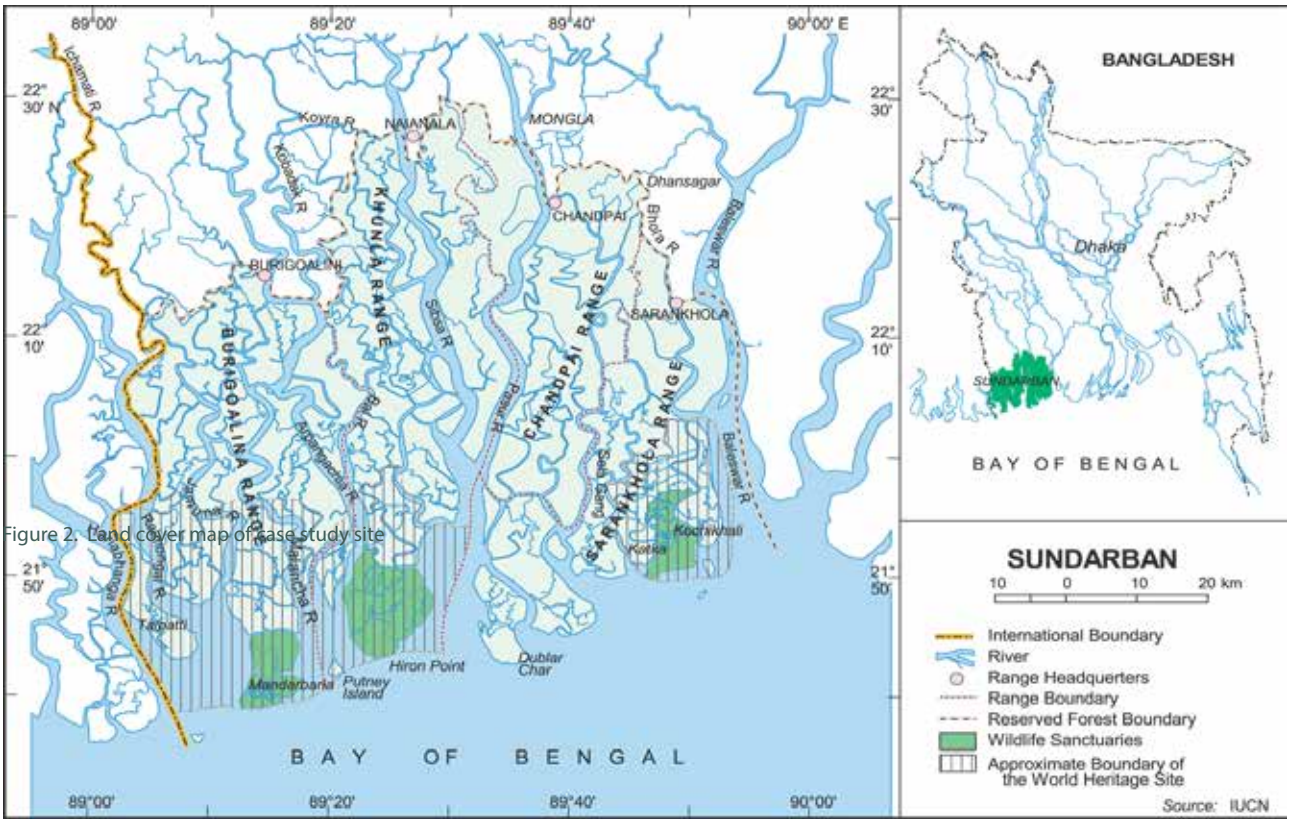

Figure 2. Land cover map of case study site

Figure 1. Map of the country and case study region, the Sundarbans

Size of case study/project area	1,775 km^2
Number of direct beneficiaries	350 persons
Geographic coordinates (longitude and latitude)	$21^0$30′ and $22^0$30′ N and $89^0$00′ and $89^0$55′ E
Dominant ethnicity	Bengali

Figure 2. Land cover map of case study site (Source: Google Maps)

1. Introduction

This is an investigation into understanding the multiple values of nature (MVN) perceived by traditional resource users (TRUs) of the Sundarbans (see Fig. 1 and 2). The TRUs pursue their livelihoods as *Bawalis* (wood collectors), *Jele* (fishermen), *Mouals* (honey collectors), *Chunari* (shell collectors) and crab collectors. This study particularly draws on the traditional knowledge of the forest people of three cooperatives that the research institute Unnayan Onneshan helped set up— *Harinagar Bonojibi Bohumukhi Unnayan Samity* (Harinagar Forest People Multipurpose Development Cooperative), *Koyra Bonojibi Bohumukhi Unnayan Samity* (Koyra Forest People Multipurpose Development Cooperative) and *Munda Adivasi Bonojibi Bohumukhi Unnayan Samity* (Munda Indigenous Forest People Multipurpose Development Cooperative). A significant amount of data has been collected from the members of these three cooperatives through participatory observations, key informant interviews and focus group discussions for gathering Indigenous and Local Knowledge (ILK). This study has also used the data reservoir of the Unnayan Onneshan, which has undertaken several biodiversity conservation programs and conducted research on the Sundarbans. Moreover, evidence collected from the field has been comprehensively rechecked and cross-examined with the available relevant literature. Apart from this, an attempt has also been made to explain the findings with analytical abstractions. Therefore, information has been verified based on multiple evidence. By using a multiple evidence-based approach, both scientific and traditional knowledge can be brought onto the same platform, striking a balance and creating a comprehensive and integrative understanding. Thus, attempts have been made to gather primary information from TRUs, as well as to collate corroborative evidence from the literature about pricing and valuation; rent, power and political settlement; and valuation, conservation and sustainable customary use of the resources.

The Sundarbans is the largest single-tract mangrove ecosystem of the world, enriched with high biodiversity. The combination of various types of ecosystems (forest, coastal and wetland) makes the Sundarbans home to uniquely adapted aquatic and terrestrial flora and fauna (see Fig.3). The Sundarbans was declared a Natural World Heritage Site (139,700 hectares of forest land comprising Sundarbans East, Sundarbans West and Sundarbans South) in 1997 by UNESCO and as a Ramsar Site of international importance in 1992 (IUCN Bangladesh 2014). It has also been listed for the selection of seven wonders of the world. It is located at the great delta of the Ganges, Brahmaputra and Meghna (GBM) rivers at the edge of the Bay of Bengal. With majestic beauty, tranquility and wilderness of nature, it is a hotspot

of biodiversity. It harbors 334 species of trees, shrubs, herbs and epiphytes and about 400 species of wild animals (Behera & Haider 2012). Of the 50 true mangrove plant species recorded throughout the globe, the Sundarbans alone contain 35 species (Rahman & Asaduzzaman 2010). It is also rich in its faunal diversity with 448 species of vertebrates including 10 amphibians, 58 reptiles, 339 birds and 41 mammals (DoE 2015).

The resources of the Sundarbans have been declining gradually (Iftekhar & Islam 2004; Gopal & Chauhan 2006; Giri et al. 2007, 2015; Rahman, Rahman & Islam 2010; Rahman & Asaduzzaman 2010; Uddin et al. 2013; Aziz & Paul 2015; Sarker et al. 2016). The forest structure is becoming simpler and the average height of the trees is decreasing, causing a decline in habitats for birds, monkeys and other tree-dwelling species. This globally important ecosystem is now vulnerable due to anthropogenic pressures amidst fragile institutions and an ineffective command-driven governance system (Titumir & Afrin 2018).

The traditional knowledge system can significantly contribute to the sustainable management of biodiversity of resources, both within the protected areas system and potentially as other effective area-based conservation measures (OECMs), if it is given a chance and is supported by governmental and non-governmental agencies (Titumir & Afrin 2018).

The value of nature can be understood from multiple angles, beyond monetary valuation, as emphasised by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Thus, conceptualizing values considers a "plurality of worldviews" of nature since people differ in how they understand the word "value" and in how they attribute importance to nature (González-Jimenez et al. 2018). Likewise, there are different scientific concepts of value—intrinsic, instrumental and relational values, which cannot be conceptualized solely through a market-pricing mechanism. As these values are subject to experience-based and/or traditional forms of knowledge, exploring human-nature relationships from different angles, operating with specific paradigms and methodologies, is regarded as a crucial way of valuing nature (González-Jimenez et al. 2018). Thus, IPBES places emphasis on multiple values and how they change across individuals, contexts and scales (González-Jimenez et al. 2018). As such, IPBES advocates for an accumulated approach that takes into account real world experience and the needs of local decision-makers (eds. Barton & Harrison 2017). The ultimate purpose is to integrate local level knowledge platforms into mainstream policy tracks to value natural ecosystems on multiple grounds.

Breaking down natural resources into commodities, mainstream economics considers the value of nature in monetary terms. Thus, natural resources are understood under this framework as valuable assets that yield flows of services to people (Freeman III, Herriges & Kling 2014). The valuing of nature in this way largely ignores the intrinsic value of the resources, and in this process the resources are regarded as extractable as much as possible for the benefit

Figure 3. Mangroves in the Sundarbans (Photo: Unnayan Onneshan)

of human beings, leading to the destruction of the resources. Moreover, neo-classical economics regards environmental pollution and natural resource degradation in terms of "market failure" and argues that a distorted market cannot ensure efficient allocation of natural resources. For efficient allocation of natural resources, the market of environmental goods and services has emerged, which entails that the market has the power to allocate environmental resources efficiently and in a socially optimal way by initiating corrective measures like taxes and subsidies which require the intervention of a regulatory or government agency (Beder 2011). Thus, mainstream economics argues for market-based mechanisms on the one hand, while it proposes some solutions through government interventions on the other.

New institutional economics, modifying market centrism with some new explanations, argues that the overuse of natural resources occurs due to lack of well-defined property rights. As a result, resources become readily available too cheaply to their current users, which forces the degradation of the resources. The argument is that when property rights are clearly defined, compensations change hands according to which party holds the natural resource, ensuring an efficient degree of economic activity. Though this school of thought emphasizes formal institutional arrangements, it focuses less on informal institutions like social norms, values and customs, which are also crucial for resource conservation and management.

Nevertheless, market-centric approaches fail to understand the dynamic nature of the problem and offer solutions that ignore political-economic factors such as power, political settlement and social order, and as a result, the solutions are found to be failing in addressing the problems. These approaches see the crisis of nature or environment as a technical problem that can be fixed within market-based mechanisms and technological innovations (Clark & York 2012). Accordingly, it ignores the issues of equitable distribution, intergenerational effects and the sustainability of resources. Moreover, in determining the optimal management of natural resources, such approaches neglect humans and their behavior (Fulton et al. 2011).

The political economy approach, which is adopted here, helps deal with the impact of power structures and power relations on the usage, management and distribution patterns of natural resources and argues that an unequal distribution of power induces over-extraction and degradation of natural resources. The political economy approach, in fact, does not explicitly discuss the problem of natural resource degradation, rather it offers guidelines to scrutinize the problem by incorporating some major factors that help explain how the resources are being accumulated for personal gains under the capitalist market economy. Nevertheless, integrating human behavior into the formal model of natural resource management is still a major challenge (Janssen & Jager 2000; Fulton et al. 2011; Milner-Gulland 2012; Schlüter et al. 2012).

Against the backdrop of valuation by IPBES and critique of different market-centric approaches, this study attempts to discover how TRUs value the Sundarbans using multiple evidence-based approaches, guided by political economy. It has been demonstrated that market pricing does not reflect the true values of the Sundarbans. Moreover, due to lack of proper market structure and equal distribution of power, rent through market pricing gets dissipated, going into the pockets of the rent-seeking powerful class. This rent-seeking behaviour induces unproductive, expropriating activities that bring positive returns to the individuals but not to society. Thus, it has been argued that, for the conservation and sustainable use of the resources of the Sundarbans, traditional customary knowledge of the TRUs and their way of valuation should be brought under consideration.

2. "The Sundarbans is our mind": an alternative conceptualization of values by the TRUs

The conceptualization of values by the TRUs goes beyond orthodox market-centric price-based mechanisms—they value the Sundarbans as their "mind". As "mind" involves various states of action and every state of mind is determined by matter, the Sundarbans have created an orientation in which they serve as the "mind" of the people. This orientation encompasses the people's existence, their social harmony, the breeding of their offspring, natural safety and security. Human beings are dependent on the Sundarbans. They have come in touch with the services provided by this forest which amalgamate plentiful values, including both use values and non-use values.

The TRUs cite numerous examples of direct, indirect and option use values. For example, the direct use value includes supplies, such as food, fuel, and water, while indirect use value incorporates the likes of climate regulation, cyclone protection, erosion control and option values such as research, education and aesthetics. The non-use values, according to them, are bequest and existence values. For example, the bequest value includes the Sundarbans as cultural heritage and historical legacy, with biodiversity and habitat among the existence values. These values not only ensure their present existence and the interlinked harmonious relationship between forest and people, but also assure goods and services for future generations (see Fig. 4).

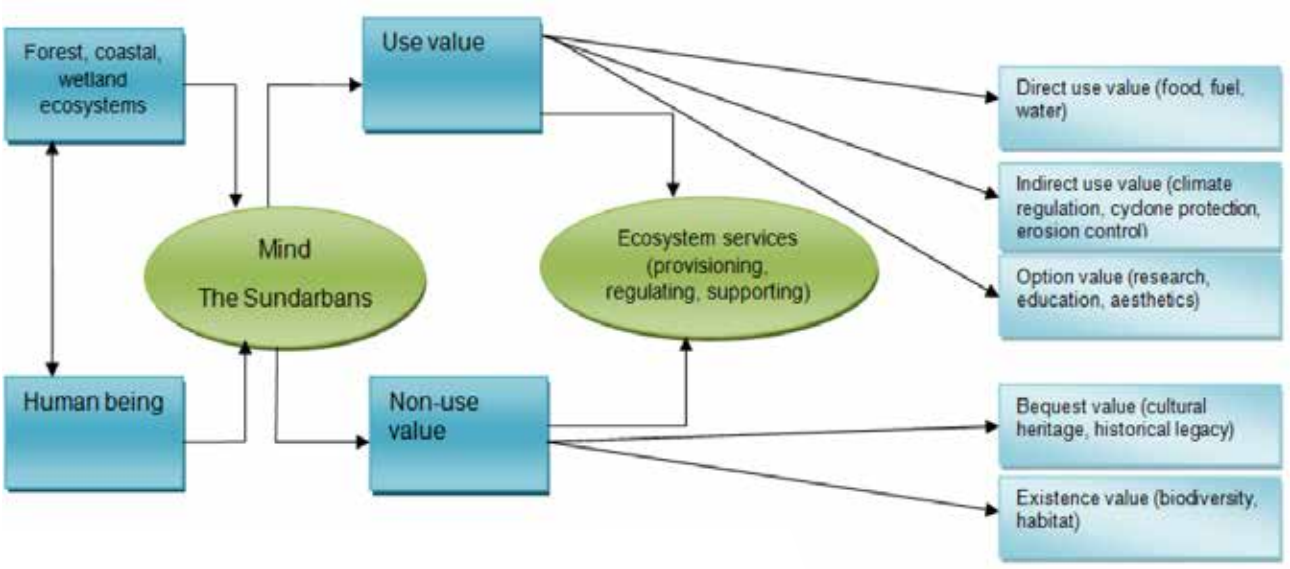

Figure 4. The Sundarbans as the "mind" of the people (Photo: Prepared by the authors)

This age-old relationship has taken different shapes through different passages. Local forest people use traditional knowledge to conserve the forest. It is not about any deliberate attempt to save the forest, rather it comes from the mind instinctively through human-nature sociality[1].

3. Multiple values of nature: Reflections from the field

According to TRUs, the services received by humans from the Sundarbans have innumerable types of value (Table 1). Not all of these values can be calculated by market-centric approaches. During focus group discussions (FGDs), they also argue that high prices derived from marketization of the natural resources causes over-extraction of the resources, which is seriously damaging the ecosystems of the Sundarbans. Instead of market-based valuation, the TRUs value the Sundarbans based on their age-old relationships with the forest.

3.1 The TRUs' perspective

All of the study participant argue that prices of the resources in the market are getting high. For this reason, it has become profitable to collect the resources of the Sundarbans. So marketizing the resources is leading to the vast intrusion of people from outside, who do not care about the conservation and sustainability of the resources. Omar Ali, one of the respondents, sums up: "*Since the market price of resources has increased, the number of resource collectors is also increasing. Now they are coming from outside areas and extracting as many resources as they can. As a result, the forest is losing its resources.*"

The TRUs have abided by customary sustainable use practices in the Sundarbans area over the ages. The way they collect resources and value nature is significantly different from the people outside this area and from the mainstream valuation perspective. Anju Ara, a female respondent, quips, "*Sundarbans not only gives us various valuable resources, but also it is our intimate relative, our life. We cannot survive a single day without the existence of this forest.*"— which reiterates the perpetual human-nature relationship and sociality.

The respondents believe that valuation to the TRUs is equal to life. They consider the Sundarbans as part of their day-to-day life, which directly contradicts the mainstream market-centric approach of valuation. Based upon the FGDs, services and values have been summarized in Table 1.

The resources are valuable to the forest people in various ways. Different parts of flora and different types of fish (and different sizes of same kind) are used by the local people for various purposes (Table 2). This elucidates that forest resources are more valuable to the local people than commodification alone entails.

Table 1. Services from the Sundarbans (Source: Prepared by the authors)

Services	Example	Value type
Food	Fish, shrimp, prawns, shells, honey, salt, crabs, fruits.	Direct use value[2]
Water	Transportation	Direct use value
Raw materials	Algae, sand, seaweed	Direct use value
Medicinal resources	Cortex of *Poshur (X. mekongensis)*, *Hargoza (Acanthus ilicifolius)*, fruits of *Sundori (Heritiera fomes)*	Direct use value
Ornamental resources	Shells	Direct use value
Air purification	Removing toxic elements like SO_2, CO_2 to reduce air pollution	Indirect use value[3]
Protection from disasters	Protection from storms, floods, tsunami, etc.	Indirect use value
Nutrient cycling	Mineralization of nitrogen and phosphorus by fish through excretion	Indirect use value
Biological control	Ecological balance through maintaining population of wildlife	Indirect use value
Life cycle maintenance	Reproduction of various species of flora and fauna	Indirect use value
Pollination and seed dispersal	Seed dispersal by aquatic animals, water, air and insects	Indirect use value
Habitat	Spawning and nursery grounds for various species of flora, fauna and organisms	Existence value[4]
Hydrological cycle	Movement and storage of water	Indirect use value
Recreation and leisure	Nature watching, sailing, recreational fishing, etc.	Direct use value
Aesthetic services	Seascape, landscape, abundance of beautiful biodiversity, etc.	Option value[5]
Cultural heritage and identity	Contribution of the Sundarbans to certain cultural traditions, e.g. different songs, dance, rituals, etc. of local community	Bequest value
Future generation possible use	All goods and services which can be used by future generations	Bequest value[6]
Right of existence	Flora, fauna and organisms that cannot be used but their existence is important to the forest and to the people	Existence value

Table 2. Usage of different parts of flora (Source: Prepared by the authors)

Name of part	Usage/importance
Flower	Honey, fruit, seeds
Fruit	Reproduction of trees, food for birds and animals, food item for human beings, such as pickles from *Keora (Sonneratia apetala)* fruit
Leaf	Fallen leaves increase the fertility of the forest land, herbal usage, e.g. leaf of *Hargoza*
Root	Prevents soil erosion
Branch	Holds leaves to provide shadow
Cortex	Used as herbal medicine, e.g. cortex of *Poshur* works against dysentery
Wood	Making of furniture, boats, pillars of houses, etc.
Others	Fishes hatch on the roots of the forest trees. Thus, trees help breeding of various species of fish

Table 3. Amount of major resources and respective revenue earnings from the Sundarbans during 2001-2002 and 2014-2015 (Source: DoF 2015 cited in Islam & Hossain 2017)

Types of ecosystem service		2001-02		2014-15	
Provisioning	**Produces (unit)**	**Amount**	**Revenue (in USD)**	**Amount**	**Revenue (in USD)**
	Excoecaria Agallocha (*Gewa*) (ft^3)	84,630	33,187	6,026	3,894
	Ceriops Decandra (*Goran*) (no.)	15,865 (MT)	47,742	118,451 (no.)	7,520
	Thatching material *Nypafruticans* (*Golpata*) (MT)	17,525	33,123	16,868	57,338
	Thatching material grass (MT)	3,621	790	668	225
	Phoenix Paludosa (Hantal)	543 (MT)	348	19,761 (no.)	1,044
	Fuel wood (ft^3)	69,370	47,523	14,455	10,190
	Honey (MT)	84	7,970	67	24,048
	Wax (MT)	23	1,665	63	8,108
	Fish (MT)	2,061	58,374	3,432	158, 368
	Crab (MT)	123	2,148	1, 123	52,026
	Dry fish (MT)	1,095	18,998	2,773	179,761
Cultural	Tourist (no.)	59,169	14,588	100,817	144,832

3.2 Corroborative evidence

Over extraction of resources has created serious threat to the conservation of the biodiversity resources. Therefore, present resource extraction as well as revenue earning is at stake, leading to overvaluation of the current resources by powerful syndicate.

It becomes visible that extraction of most forest resources has increased over the years (Table 3). As a result, producer surplus of the forest has reduced. On the other hand, the government is losing revenue due to over-extraction by powerful groups who are grabbing the resources and selling them in the market at high prices. Thus, consumers are also facing losses in their accounts. As a result, benefits for the local forest people are decreased.

3.3 Analytical abstraction

When non-marketable goods are transformed into marketable goods, it creates rent and deadweight loss. This valuation through pricing mechanisms results in higher prices, loss of consumer surplus, loss in growth and loss in the endowment of the resources (i.e. the producer surplus).

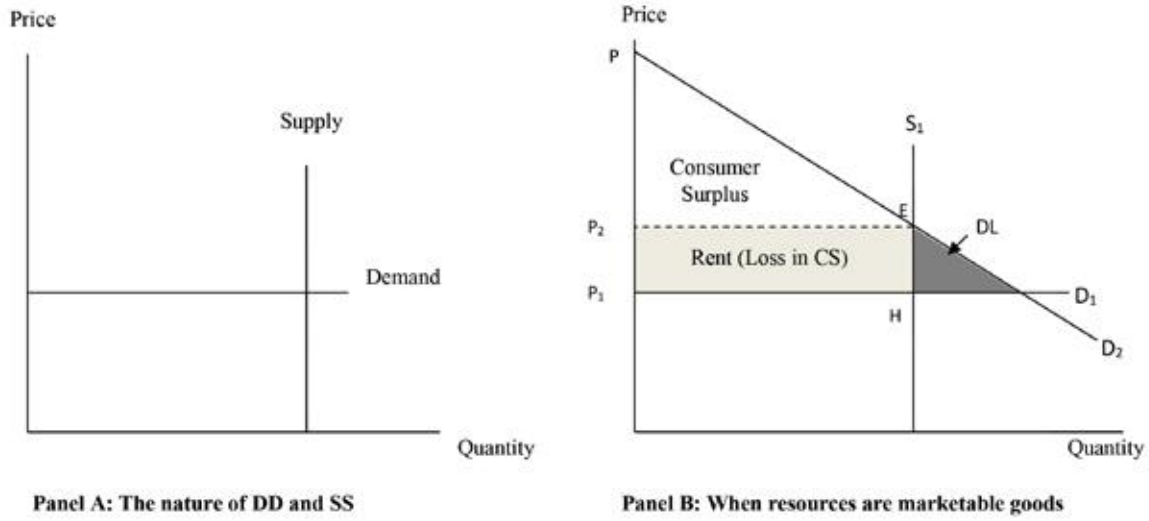

Figure 5. Price effect if natural resources are turned into marketable goods (Source: Titumir, Afrin & Islam, n.d.)

Figure 5 (in Panel A) explains the same as the reality of the natural resources markets. The x-axis in horizontal line indicates price, where y-axis in vertical line indicates quantity. Initially, at a very low level of price or sometimes with no price, the demand for natural resources is infinite measured through a perfectly elastic demand curve. Simultaneously, the earth herself is endowed with a fixed amount of resources. There are some resources that have regenerative capacity, but are depleted when the harvest rate is greater than the regeneration rate. Consequently, the supply curve is perfectly inelastic.

Panel B of the same figure attempts to depict the price effect on natural resources if they are metamorphosed into marketable goods. When non-market goods transform into marketable goods, the positive demand curve will change and consumers get to interact with different prices. The changing demand curve produces some alternative distribution and sharing. Firstly, the new equilibrium point sets at E, spiralling up the prices from P_1 to P_2. Consequently, the consumer surplus gets reduced from $PEHP_1$ to PEP_2. Thus, loss of consumer surplus as rent is P_2EHP_1. Another important change in distribution occurs if non-marketable goods transform into marketable goods. The change generates rent and deadweight loss (shaded area) due to higher demand and lack of supply, causing consumption inefficiency. Consequentially, TRUs are losing their consumer surplus, the government is losing the share of revenue and the forest is losing its endowment of resources, whereas the powerful groups are getting the lion's share of the rent (Titumir, Afrin & Islam, n.d.).

3.4 Summary of multiple values based on IPBES guidelines

Local people conceive of values based on their day-to-day interrelations and interdependence with the Sundarbans. They often value the resources of the Sundarbans by what they get from them, both directly and indirectly, including both use value and non-use values of nature. For example, they use various flora and fauna, based on which the use values can be categorized but at the same time, they also acknowledge the non-use values of nature (Table 1). These non-use values include both bequest value and existence value, which can be sorted into intrinsic value as well as relational value (Table 4), i.e. cultural heritage, historical legacy, habitat, biodiversity, etc. On the other hand, instrumental value takes the form of indirect use value, e.g. climate regulation, cyclone protection and erosion control. Certain multiple values of nature as conceived by the TRUs (Table 1), therefore, are summarised in Table 4 as illustrations, using IPBES guidelines.

Table 4. An illustrative summary of the different meanings of value: collated from the TRUs of the Sundarbans, using IPBES guidelines (Source: Prepared by the authors)[7]

	Principles	Importance	Preferences	Measures	(Explanation)
Intrinsic	The right of the Royal Bengal Tiger to survive The survival right of the other floral and faunal species	National interest in maintaining the world's biggest cat as the world's charismatic mega-fauna and maintaining ecological balance to keep the ecosystem sustainable and resilient	Tigers are natural saviors of forest and the national symbol of Bangladesh Diverse species maintain ecological balance that conserves the ecosystem	Tiger Population Census, Narratives, Indigenous knowledge based testimonies, Oral history	Bequest value, Cultural heritage of myths and beliefs, Aesthetic value, World's largest mangrove forest, World Heritage site
Instrumental	Ecosystem-based disaster risk reduction and climate regulation, Cyclone protection	Contribution as natural fortress in reducing natural disasters and contribution of carbon sequestration to global stock	Interest in maintaining habitat and biodiversity of this diverse ecosystem	Quantitative, Narrative, Indigenous knowledge based testimonies, Oral History	Resist soil erosion, combat salinity intrusion and provide fresh air
Relational	Living in harmony with nature, Customary rights, Rights to self determination, Sustainability and resilience	Identifying TRUs as key to conservation and sustainable use of biodiversity for sustainability and resilience	Interest in maintaining these multiple ecosystems that provide different ecosystem services (provisioning, regulating and supporting)	Economic price based measures are inadequate and the following are to be explored: Narrative, Indigenous, Deliberations, Multiple evidence-based approaches	Provides livelihood services (food, water, fuel etc.), Identity and autonomy, Living well in harmony with nature, Spirituality of nature, Cohesion, Governance and justice

Figure 6. Sundarbans with complex network of tidal waterways (Photo: Unnayan Onneshan)

4. Valuation, conservation and sustainable use: indigenous and local knowledge and customary use

The consultations suggest that the rules and practices the TRUs follow help conserve the forest as ecological harmony remains unchanged and their socio-ecological life cycle thrives. They treat the resources of the Sundarbans as blessings and try to make sustainable use of them so that resources are not harmed. They have respective values, norms and behaviors which create conventions, restrictions, taboos and other socially-formed characteristics for using the Sundarbans.

4.1 The TRUs' perspective

In terms of netting the fish, Habibur Rahman Gazi, a fisherman says, "*We catch fish by rocket nets that do not kill the carp. Therefore, fishes are not being killed by the local people.*" In conjunction with Gazi's words, another fisherman says, "*Outsiders catch fish by using 'Bainjal' which kills most of the carps.*" Like the fishermen, other TRUs also follow traditional norms, rules and practices to conserve the resources of the forest. Khalilur Rahman says, "*Certain religious rituals are followed before going to the forest for honey and Golpata collection, like performing special prayers and collecting 'tabij' (amulets) so that tigers cannot harm them.*" These norms, rules and practices come from their belief that the forest is the perpetual kin to the TRUs, and they tend to instinctively use the resources of the forest sustainably. Ambia Khatun, a TRU woman opines, "*The Sundarbans is our life. If it dies, we will not be able to survive for a single day. You cannot buy life with money.*" (see Fig.6)

Apart from the traditional norms, other rules by which TRU fishermen sustainably use forest resources are worth mentioning. To understand these more clearly, a comparison between the traditional rules followed by the TRUs and the practices of non-traditional users are provided in Table 5.

Table 5. Traditional rules vs. non-traditional practices followed by the fishermen of the Sundarbans (Source: Prepared by the authors)

Item	Traditional rules followed by TRUs	Practices of non-traditional users	Remarks
Spatial restrictions	Temporary closure of 1-2 weeks to get substantial amount of fish in certain areas which are abundant with more species of fish.	No spatial restrictions are followed; extraction of fish is performed constantly from all the water bodies.	Fishing opportunities are decreased and some important species of fish are getting reduced.
Temporal restrictions	Normally they do not go fishing on Friday. Also, some small period restrictions are imposed when necessary to get more fish.	No temporal restrictions are maintained.	Because of incessant fishing by outsiders, fish resources are getting fewer day by day.

Gear restrictions	They do not use fishing techniques which destroy the carp.	Detrimental nets like "*bainjal*", "*chorjal*" are used for fishing.	Because of the pernicious fishing techniques, larvae, carp and fish eggs are diminished.
Effort restrictions	There is mutually negotiated fishing opportunities using traditional nets like "*chawrpata*" and "*khalpata*".	No particular restriction over using techniques, spaces and who can use or not.	Outsiders are extracting as much fish as they can evading the rules and regulations.
Species restrictions	Restrictions are put in place during ovulation periods of certain species like "*paissha*", "*dadne*", "*vetki*" and other fishes.	During the use of nets like "*chawrjal*", *"bainjal"* and some foreign nets, fishes including carp get caught in the net.	Carp die which results in less fish in the canals, rivers and coastal areas.
Catch restrictions	Only consumable species of fish are caught.	Most species of fish are caught.	Natural biodiversity gets disrupted and harmed.
Water color	When the water gets reddish, they predict more Hilsha production in the coastal region. Amount of fish increases in turbid water. Number of fish decreases in polluted water.	Outsiders are mostly unaware of this idea.	Due to use of engine boats and trawlers by the outsiders, water gets polluted which kills many species of fish and hampers reproduction.
Water, wind direction and current	Fish increase during high tide. Wind from both southern and southeast directions indicates increase in amount of fish.	Non-traditional resource users do not follow this perspective. Many of them have learnt traditional rules recently.	More extraction of fish occurs as outsiders utilize the derived knowledge of the traditional fishermen.
Lunar periodicity	During a full moon the amount of fish increases. Hence it is wise to wait for the full moon to catch more fish.	They go fishing all the time irrespective of full moon and new moon.	More extraction occurs and carp get killed.
Sediment and topography	High amount of siltation is dangerous to the topography of the water bodies. They also detect type of mud using their fingers and can predict the best fishing sites.	Non-traditional forest users cut trees incessantly, which create more sedimentation.	Due to more sedimentation, marine and coastal ecosystems are disrupted and fishing sites decrease.
Traditional celestial navigation	They use traditional method of static (e.g. location of the site) information to calibrate the relative position of the fishing boat.	Non-traditional resource users mostly have wristwatches to get the direction of the fishing site.	Traditional method is more reliable because of years of experience in practice.
Birds	They consider birds like pigeons, egrets, common tern, and kingfishers as sacred. These birds also help them find suitable places for fishing.	No particular affiliation with any particular species of birds.	Birds are also killed by hunters which damages the biodiversity of the forest.
Fishing sites	They divide fishing sites based on different canals, e.g. *"Bustamkhal", "Keora kata"* and *"Kodal kata".*	They tend to go fishing where they can extract more fish.	Due to encroachment in almost every waterbody, traditional fishermen are getting deprived of fish more than before.
Netting the fish	They use *"rocketjal", "berjal"* mostly to catch fish.	They use *"bainjal", "chawrpata"* and some foreign nets to catch fish.	Because of nets used by outsiders, carps and larvae get caught and killed also, causing less fish reproduction.
Nets	The nets have medium to big holes which are mainly used to catch medium to big fish. Length of *"berjal"* varies from 4-5 meters to 90-100 meters and width is around 7-8 meters.	The nets they use are normally more than 100 meters long and have very tiny holes.	As the nets of the non-traditional users are dense with very tiny holes, carps and larvae get caught and killed.
Boats	They make boats using *"sundori"* mostly. The boats are traditionally called *"dingi nouka"*.	Most of the non-traditional resource users use engine boats and trawlers made from different kinds of wood like *"gewa", "goran"* and *"sundori"*.	As more outsiders come for fishing, they are using more engine boats, which are polluting the water and destroying the ecosystems of the fish.

Besides the fisherman, other TRUs also uphold traditional rules. When collecting honey from honeycombs, usually during the months of April, May and June, the *Mouals* (honey/wax collectors) usually cut a specific section (about two-thirds) of the honeycomb and leave the rest for reproduction. They also try to make sure that no young bees are killed while collecting honey and squeeze beehives by hand, never using metal tools. They revisit the colonies after a period of one month or more depending upon the size of the colony and the flowering conditions of nearby vegetation. When collecting the honey, the *Mouals* produce smoke using dry leaves but never put fire on a beehive. The *Bawalis* (wood collectors) leave at least one stem in each clump of trees after cutting. Once the *Bawalis* have harvested wood from a compartment, they will not use the same compartment for harvesting the following year, rather will harvest on a cyclical basis so that there is an adequate re-growth of plants. They usually cut wood where there is abundance. They do not cut young and straight trees.

According to the rules followed by *Golpata (Nypa fruticans)* harvesters, exploitation in any area is not allowed more than once a year and is not allowed during June to September specifically as it is the growing period of *Golpata*. They cut only leaves that are approximately nine feet long, and the leaves are cut in a way so that the central leaf and the leaf next to it in each clump are retained. They maintain the rule that the flowers and fruits shall in no way be disturbed when cutting leaves. They also maintain that young plants with only one utilizable leaf should not be cut (see Fig.7).

4.2 Corroborative evidence

Traditional knowledge is followed in conservation of natural resources in other countries as well. In Papua New Guinea (PNG), the Solomon Islands, Vanuatu, and Fiji, there are examples of temporary reef closures before religious ceremonies (Polunin 1984) to replenish supplies of fish and invertebrate species (Hviding 1989; Aswani & Weiant 2004; Hickey 2006), after the death of a landowner or village chief (Wright 1985; Hickey 2006; Macintyre & Foale 2007), and after a marriage or birth (Ravuvu 1983). In Maluku, Indonesia, certain community leaders used customary management to ban cyanide fishing associated with the live reef food fish trade (Thornburn 2001). In some areas, particular groups have rights to specific fishing techniques, which are restricted for others (Carrier & Carrier 1983). Currently, coastal groups in the Roviana Lagoon, Solomon Islands, are not only excluding non-owners from using restricted technologies such as spear fishing at night, but they are also relentlessly demanding that inclusive stakeholders should not use these fishing methods (Aswani & Hamilton 2004). Also, there are restrictions on who can catch particular species of fish, which methods are to be followed and which areas allow for fishing (Cinner & Aswani 2007).

4.3 Analytical abstraction

The existence of interrelationships between human sociality and nature is the key to optimal usage and conservation of natural resources. In the following graph (see Fig. 8), the vertical axis measures the individual's preferences. On other hand, the horizontal axis measures welfare, as well as the cooperation and defection that depend on two different functions of the individual preferences. The graph explains the rational choice view versus social cooperation. At point A, the expected cooperation and the expected defection intersect, showing a lower level of welfare and a low level of individuals' consensus. Individuals as social beings belong to the web of ecological and social environment. Therefore,

Figure 7. TRUs in the Sundarbans collecting *Nypa fruticans* using their traditional knowledge (Photo: Unnayan Onneshan)

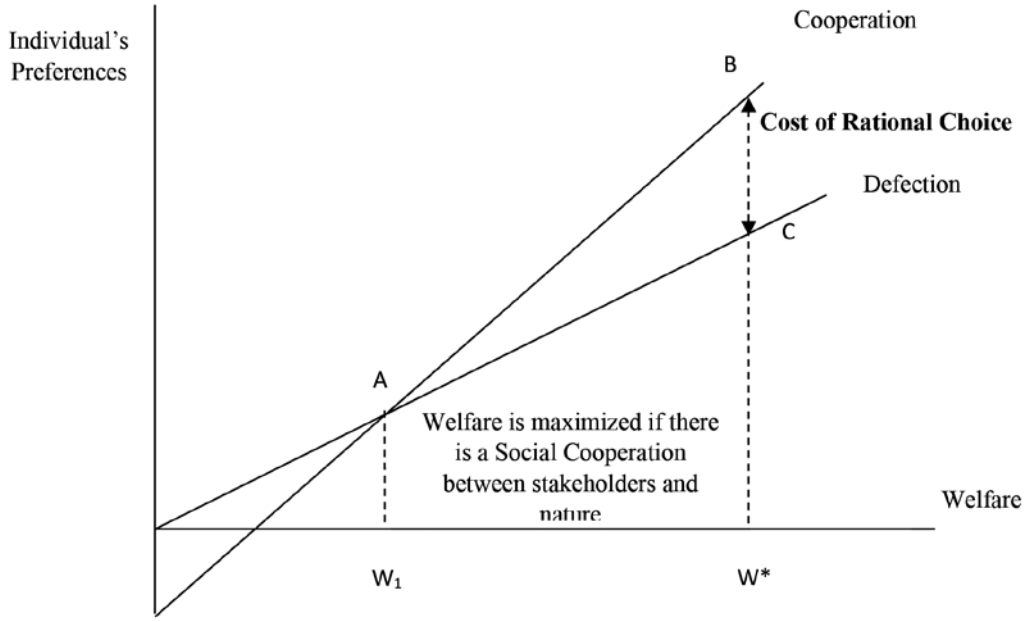

Figure 8. Rational choice vs. social cooperation (Source: Titumir, Afrin & Islam, n.d.)

ecosystem carries the function of individual social being as the process of reservation and reiteration. The graph shows that, as a social being in a particular ecosystem, the individual can enlarge its welfare at W*, which is greater than point A. So, the total welfare generates the area of AW_1W^*B (Titumir, Afrin & Islam, n.d.).

The essence of this proposition is that social norms can organize the equitable benefit-sharing of the resources. The traditional evolution of norms and knowledge can efficiently manage the resource rent and the sustainability of resources. The power of sanction imposed by the stakeholders can informally organize the rights of resource consumption and accretion. Social norms are so powerful that social beings are ready to sacrifice to prolong the relationship between nature and human beings. The recognition of social norms and social ownership, thus, can sustainably manage natural resources and the equitable sharing of natural resource rents (Titumir, Afrin & Islam, n.d.).

4.4 Institutionalizing traditional knowledge and customary practices

The rights of the local communities of the Sundarbans are not clearly defined and acknowledged in Bangladesh. A few issues regarding the rights of the forest people are found in certain project circumstances.[8] Likewise, project-based participation has little impact on the activities of government organizations. Thus, existing acts, policies and regulations provide few opportunities for local people to participate in the conservation process of the forest. According to the law, the state is entitled with the responsibility for the protection of the Sundarbans. The main responsibility to protect the Sundarbans is incumbent on the forest department. But the people who are dependent on this forest are not entitled with any responsibility. Participation of TRUs, recognition of their knowledge and practices, and the well-defined rights of TRUs are considered to be crucial for management and conservation of the Sundarbans (see Table 6).

5. Rent, power and political settlement

The opinions of the TRUs demonstrate that there is a triangular-shaped power distribution among employees of the government agencies (e.g. forest department, law enforcement), (illegal) businesses, and politicians. These powerful groups dictate the pricing strategy of the resources and control the market structure through political settlement. Despite several rules, regulations and embargoes, they get extra privilege by giving bribes to the employees of the forest department and police. In some cases, they too also get involved in extraction of resources. TRUs have to get permission to access the forest (e.g. boat licenses, *Golpata* and honey collecting licenses). This process requires some amount of money, but the forest people also have to give an extra toll of money in the form of bribes to the forest department, which compels them to extract more resources from the forest. As a result, biodiversity reproduction is hampered and damage occurs to the ecosystem of the forest. On the other hand, even if powerful groups get caught by the forest people while violating any ban or rule, they immediately get released by giving extra amounts of money. Local forest people have mentioned such a group, known as the "*black party*", which extracts resources regularly, violating the laws. If anyone by any

Table 6. Institutional steps for resource management and appropriation (Source: Prepared by the authors)

Institutional steps	Present state	Suggestions
Participation of TRUs in policy making, management of ecosystem and conservation of biodiversity of the Sundarbans	Little scope of participation by TRUs	TRUs' practices, perspectives and participation are needed to yield better conservation outcomes and sustainable use of biodiversity Enacting laws and regulations to ensure the rights and empowerment of TRUs to practice their ILK in the conservation of the forest Engaging TRUs in co-management and conservation process
Recognition of traditional knowledge and practices in management and conservation of the forest	No/little recognition of traditional rules, norms, values and practices in existing management and conservation framework	Legally recognizing traditional rules, practices and values of TRUs Incorporating these in formal conservation and management strategies
Definition of rights of the TRUs in laws and regulations	Declining user rights of the TRUs in existing rules and regulations	Clearly defining the rights of the TRUs, not exclude them from forest resources but to ensure customary and sustainable use by TRUs

chance sees them violating the law, they capture the person and do not release him until their extraction is finished. Thus, rent dissipation and unequal distribution of power have created a clientelistic network through which extraction of resources occurs randomly in order to accumulate more rent. This state of affairs is highly responsible for the degradation of the ecological biodiversity of the Sundarbans.

5.1 Governance structure of the Sundarbans and signs of unsustainable resource extraction

The Sundarbans was declared a reserve forest in 1875. About 32,400 hectares of this forest have been designated as three wildlife sanctuaries. These wildlife sanctuaries were established in 1997 under the Bangladesh Wildlife Preservation Amendment Act, 1974. Afterwards, the Sundarbans was declared an Ecologically Critical Area (ECA) by the Department of Environment (DoE) of Bangladesh in 1999 under the Bangladesh Environment Conservation Act, 1995, which was amended in 2010. According to the Conservation Act of 2010, an Ecologically Critical Area refers to an area which is rich in unique biodiversity, or due to the importance of its environmental aspects, is necessary to protect or conserve from destructive activities. The ECA also falls within the category of natural and cultural heritage.

Despite the ECA designation, rules were not enforced and most importantly, the rights of inhabitants of the Sundarbans were equivocal and trifling for the most part. As a result, opportunist groups took advantage, engaging in over-exploitation of the resources of the forest. Problems arose including lack of participation of the TRUs in the conservation process, declination of user rights, lack of implementation of laws and rules, emergence of imposed development projects and also use of top-down approaches in the co-management process of the Sundarbans. As a result, decisions are being made from a level of authority and are transmitted to the lower level without any substantial degree of discussion. Likewise, due to a lack of recognition of traditional knowledge and other kindred circumstances, the significance of the ECA designation has been smothered to a large extent. Recently, a coal-based electric power plant named *Rampal* is being constructed only 14 kilometers away from the Sundarbans ECA zone. Another electric power plant has been planned for construction only 10 kilometers away from the ECA area. According to the environment law of Bangladesh, establishing this kind of power plant within 10 kilometers of the ECA zone is strictly prohibited.

Despite objections and violations of the existing laws, industrialization is advancing on the periphery of the Sundarbans. Hence, it could be recapitulated that the legal and governance structure of the Sundarbans has been feckless and contradictory in terms of its implementation process. As a consequence, conservation strategy is being hampered while sustainability of the forest is at stake due to incessant exploitation by powerful groups and the ineffective role of the administration.

5.2 The TRUs' perspective

The respondents argue that their collection processes are not harmful to the conservation of the forest. As Abu Musa, one of the respondents argues, "*TRUs usually collect resources keeping in the mind that if they cause any harm to the forest, they will be sufferer.*" However, after enactment of laws, rules and regulations, access to the forest has become restricted, and the powerful are extracting resources secretly by bribing the police and personnel of the forest department. Abu Musa further added, "*As the powerful class is getting access to the forest bribing huge amounts of money, they are extracting as many resources as they can without caring about*

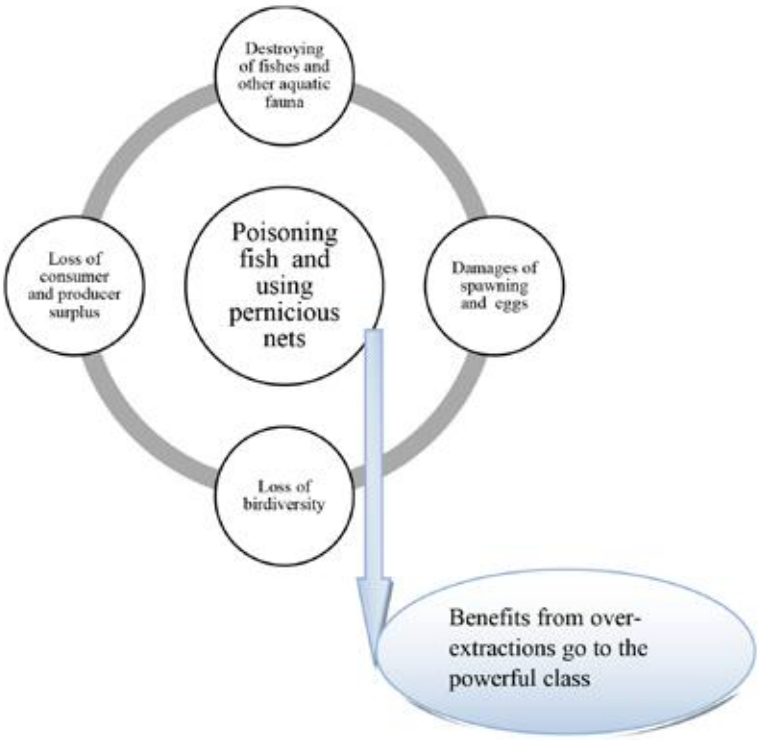

Figure 9. Effects of poisoning and use of prohibited nets for catching fish (Source: Prepared by the authors)

the survival of the forest. But TRUs are being deprived." Though clientelist groups are illegally extracting resources through unsustainable practices, the TRUs say, illegal activities go unpunished. Rather TRUs are being harassed, and they do not have any voice in decision-making processes of the forest management. Tanjila, a TRU woman says, "*They (forest department and other governance body) do not listen to us. They only pay heed to the opinion of the powerful class. We, the TRUs, are the victims*". During the FGDs it came forth that the rent-seeking groups who are powerful both politically and bureaucratically are using illegal means to extract resources. Moreover, a group of people are using poison and prohibited nets to extract more fish at a time, which not only destroys all kinds of fishes but also other aquatic species (see Fig. 9).

5.3 Corroborative evidence

A few studies show that the existence of organized groups of mongers who illegally cut and remove valuable trees are acutely prevalent in the Sundarbans (Rahman, Rahman & Islam 2010). The forest department allows illegal means of fishing by taking bribes from the fishermen (Hassan, Nabi & Mozumder 2012). Moreover, the existence of vertical relations in society and upward enforcement of rules enable the powerful groups to capture resources with impunity (Adhikari & Goldey 2010). Due to unequal distribution of power and wealth, conflict and discrimination among different stakeholders emerge (Hassan, Nabi & Mozumder 2012). Accordingly, biodiversity degradation not only occurs due to the non-existence of markets, but also because of unequal power distribution among different groups. Thus, infiltration and illegal removal of valuable wood from the forest occurs due to the absence of sustainable management practices and well-functioning institutional arrangements (Rahman, Rahman & Islam 2010).

5.4 Analytical abstraction

The agents assert control over the potential rent under the extractive institutional arrangements that are historically prevailing, not only by the dominant goals of production, but also by the prevailing social relations and the scale of production, as well as relations of distribution and property regimes. Specifically, it can be said that in a developing economy, the likelihood of unstable property rights for natural resources is very high. A strong institutional arrangement can check the stability. Here, we try to visualize the way in which different agents behave in strategic ways under vulnerable institutional arrangements to further their own interest under a game theory approach, and which ultimately results in the destruction of natural resources.

To explain the phenomenon as well as the rational incentive to break the contract under weak institutional arrangements, the above graph (see Fig. 10) that depicts the prisoner's dilemma and the Nash equilibrium[9], can be very useful. Here, the vertical axis measures the resource extraction by agent A, and the horizontal axis measures the resource extraction by agent B. Under mutual contract, both agents

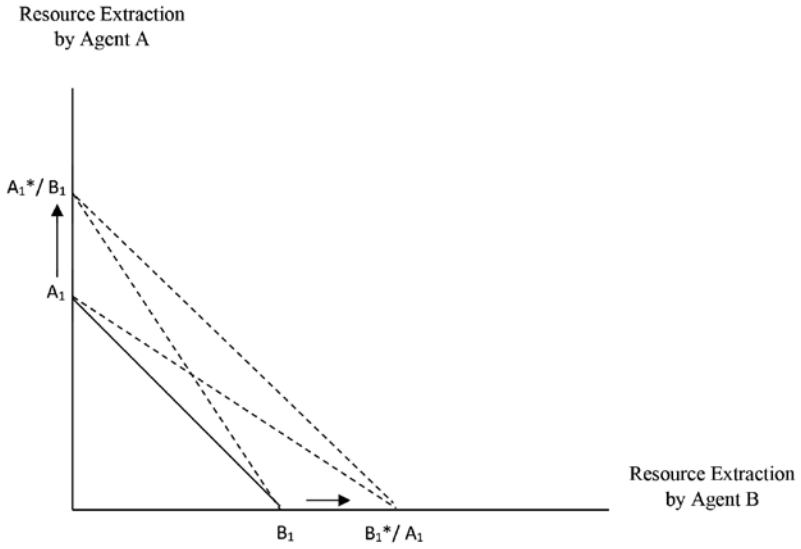

Figure 10. Institutional vulnerability and destruction of resources (Source: Titumir, Afrin & Islam, n.d.)

extract resources on the A_1B_1 line. The next scenario is that as a rational being, agent B can maximize his extraction if B thinks that by holding agent A constant he (B) can extract more resources as there is no one to monitor him. So, agent B will go for more extraction at B_1*, and keeping the A_1 fixed is the symptom of cheating, pointing to B_1*/A_1 in the graph. Similarly, another rational agent of this model A will do the same at A_1*, keeping the B_1 fixed is another symptom of cheating, pointing to A_1*/B_1. Therefore, under weak institutional arrangements, the contract does not hold. In the graph, the new resource extraction line is now A_1*/B_1 and B_1*/A_1, galloping up from A_1B_1. Despite the Nash equilibrium, it is not stable. Until the complete extraction of natural resources happens, the shift and alteration of the non-cooperative game will persist. The key underlying essence of this proposition is that the faulty persistence and the adverse development of the institutions of the ex-colonial country are the reasons for massive resource destruction (Titumir, Afrin & Islam, n.d.).

6. Towards transformational pathways

Tranformational pathways require stabilization of ecosystems, that is, the conservation of the Sundarbans through damage limitation. For stabilization of ecosystems, it is necessary to identify the drivers of ecological degradation. These drivers include both natural and anthropogenic pressures on the Sundarbans. Moreover, institutional and governance structures are seen to be involved in degradation processes through various means of exploitaition of natural resources, even though they are supposed to serve as the savior of the Sundarbans. Since indigenous local knowledge has been kept outside of this governance and institutional framework, it is crucial to incorporate it in the stabilization process. This stabilization will transform the biodiversity and ecosystems of the Sundarbans bringing about a situation where sustainable use and benefit-sharing between human beings and nature will be ensured. Transformation of natural resources towards sustainability and resilience would thus create an ambience of well-being for both humans and nature (see Fig. 11). When nature and humans live in harmony, ecosystems become balanced through sustainable use, access and benefit-sharing.

If the transformation of ecosystems to sustainability is not achieved, there will be imbalance in the ecosystem, leading to destruction of biodiversity, which is delineated in the following three scenarios.

6.1 Scenario A: Loss of biodiversity (level of alienation)

The TRUs say human beings consider themselves, at the present time, to be independent and the master of nature, though they are part of nature. They argue that generally people treat nature as "mere matter" that can be extracted for human purposes, destroying the natural resources in various ways. In this way, according to them, human beings alienate themselves from nature. People become alienated from the world when they fail to recognize its humanity, when they are unable to see the world as their world and themselves as the part of the world. Thus, alienation derives from people's failure to recognize the sociality between humans and nature. These alienated relations, as they suggest, lead to commodification of natural resources through market pricing. In this way valuation becomes equal to the market price and the intrinsic values of natural

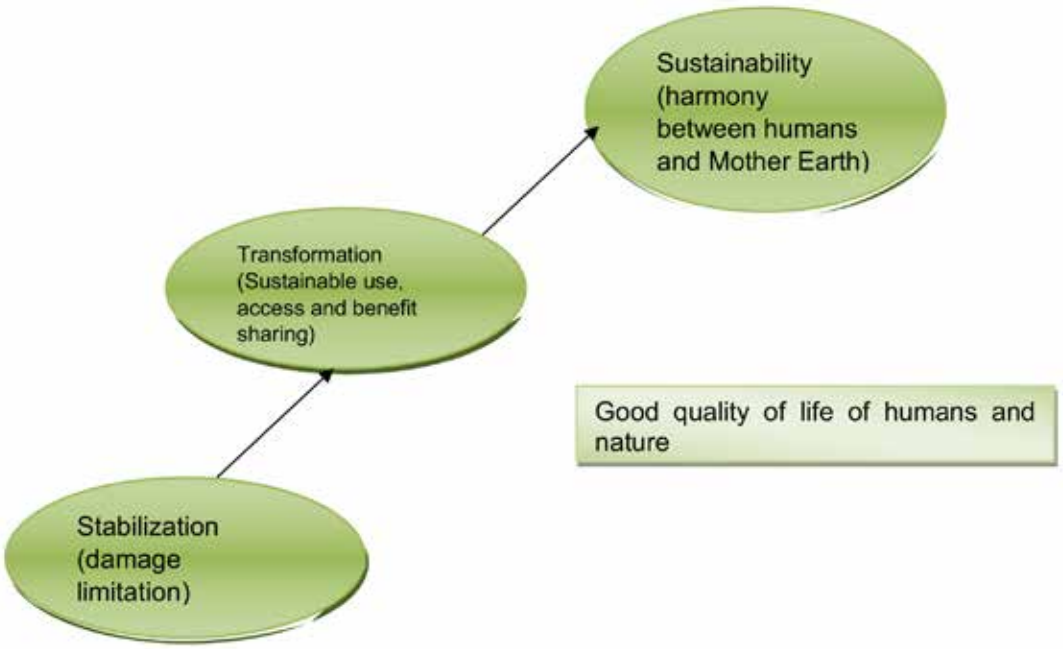

Figure 11. Transformation pathways (Source: Prepared by the authors)

resources and the sociality between nature and humans is ignored, leading to over-extraction and thus destruction of the natural resources (see Fig. 12). On the contrary to the virtuous cycle of the ecosystem, they draw the vicious cycle of how producers, consumers and decomposers - all of them start to get alienated from each other and have to bear loss in each of the provisions.

6.2 Scenario B: Loss of biodiversity (commodity fetishism)

The TRUs often talk about pervasive commodification of natural resources. Everything produced or received from nature is seen as commodities in their mind. In this way, commodities turn into fetishes in the sense that human beliefs on commodities have created an obscure hierarchy of value of the natural resources on which demand for commodities depend. The high price commodities are seen as the most valuable. This commodity fetishism induces over-extraction of the resources through primitive accumulation of nature (see Fig. 13). The more money the powerful class gets, the more influence it can wield on extracting resources from the Sundarbans. Through this pervasive motivation, according to the TRUs, a clientelistic network emerges wherein members of the network thrive through primitive accumulation. Through this, only material provision of the forest comes forward ignoring the intrinsic and underlying values of mutual existence. Degradation of the forest, loss of biodiversity and overall socio-ecological imbalance occur.

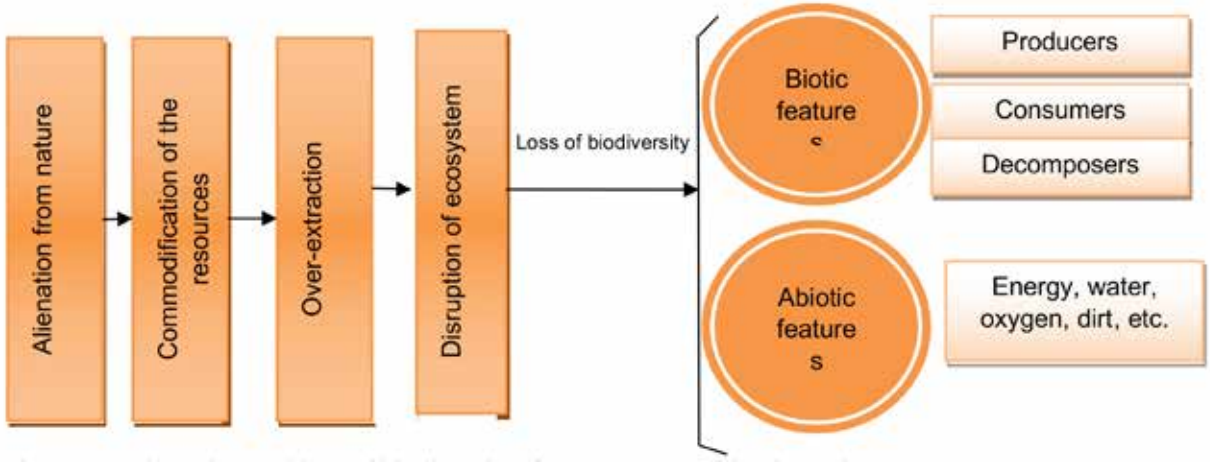

Figure 12. Alienation and loss of biodiversity (Source: Prepared by the authors)

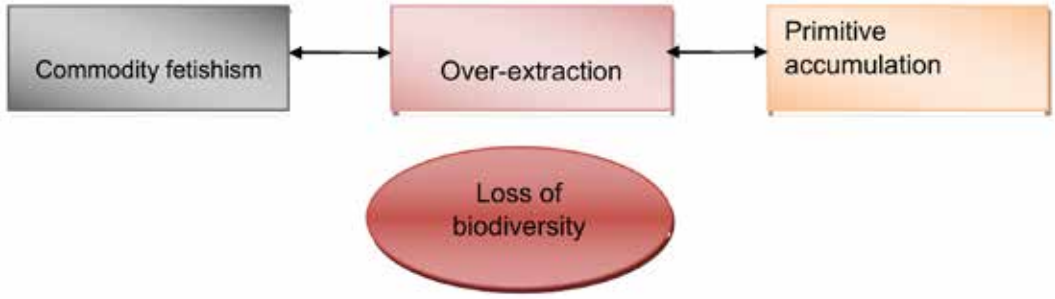

Figure 13. Commodity fetishism and biodiversity loss (Source: Prepared by the authors)

6.3 Scenario C: Sustainable and non-sustainable scenarios (appropriation and expropriation)

As stated above, alienation occurs through materialistic provision of commodities where the capitalist class tends to get access to the resources and sell them in the market at high prices. By using the power of institutions, powerful agents expropriate the resources. The extractive institutions exclude the TRUs and the primary producers from equitable benefit-sharing of natural resources. Likewise, the state also loses a significant share of revenue in natural resource rents. The TRUs claims that the officials of the local forest department, police and leaders of political parties "successfully" marginalize the general people or community people.

Contrary to this non-sustainable use of the resources, proper appropriation of the natural resources of the Sundarbans is healthy. In conjunction with this statement, it is important to consolidate the customary and traditional rules and practices of the forest people who actually treat the forest as their mind. The key understanding is that these socially constructed norms and values, which are an informal institutional set-up, can solve the natural resource problem. The norms and values create a collective organization that can preserve the natural resources sustainably and equitably. The authority to impose credible threats and sanctions by the stakeholders of the resources on the resource distribution could immensely contribute to solving the natural resource problem and ensure distribution of benefits. As forest people regard the forest as their intimate relative, they do not think of harming the natural resources of the forest. Therefore, their values, norms and traditional rules and practices should be incorporated in the conservation processes of the Sundarbans (see Fig. 14).

7. Conclusions

By using a multiple evidence-based approach, the diverse knowledge system of the TRUs and corroborative scientific evidence, this chapter conceptualizes nature and its values. TRUs consider the Sundarbans as their mind, through which human-nature sociality thrives. The TRUs challenge

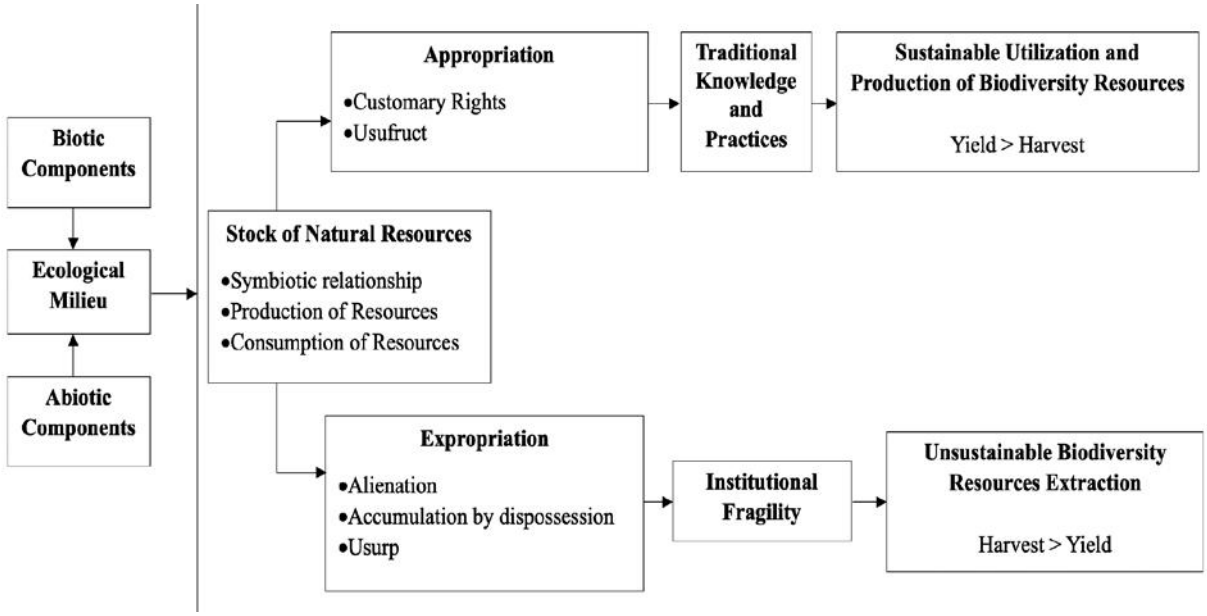

Figure 14. Human-nature-sociality framework: sustainable utilization, customary rights (Source: Titumir, Afrin & Islam, n.d.)

mainstream valuation methods and argue that valuation of environmental resources through market penetration pricing does not reckon the social benefits and values coproduced through complementarity between humans and nature. Their reasoned knowledge and practices, documented and demonstrated, cast a shadow on the orthodox view of sustainable governance as an abstract tradeoff between human activities or environmental protection based on cost-benefit analysis (CBA), which assumes human beings are the external agents to the natural resources governance. In such processes, any monetary tag does not reflect the social opportunity costs stemming from the dependence of the community on the resources for income, jobs and livelihoods. As a whole, the value of the production network within the socio-ecological production landscape remains undervalued in the market-based valuation system. The TRUs argue that a weak market structure and unequal distribution of power cause rents to be dissipated, going into the pockets of the rent-seeking powerful class. As a result, rent-seeking agents including bureaucrats, businesses and politicians extract resources as much as they can, thereby destroying the biodiversity. These unproductive, expropriating activities bring positive returns to the individual but not to society. Finally, the TRUs demonstrate that the traditional knowledge system can significantly contribute to the sustainable management of biodiversity resources, both within the protected areas system and potentially in other effective area-based conservation measures, if they are given a chance and are supported by governmental and non-governmental agencies.

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1 Human groups maintain a high level of sociality despite a low level of relatedness among group members (Gintis 2000). This signifies that pro-social behavior exists in human-beings, as Gintis called it "strong reciprocity", which in part may explain sociality.

2 Direct use value means the economic or social value of the goods or benefits derived from the services provided by an ecosystem that are used directly by an economic agent. These include consumptive uses (e.g. harvesting goods) and non-consumptive uses (e.g. enjoyment of scenic beauty).

3 Indirect use value includes benefits derived from the goods and services provided by an ecosystem that are used indirectly by an economic agent. For example, indirect use values are the provision of cyclone protection by the forest or the usage of natural water of the forest, etc.

4 Existence value is often reflected as a sense of well-being, such as existence of coastal and marine biodiversity and habitats. People may not have experienced or utilized this value directly but they benefit from the knowledge of it.

5 Option value refers to the value of retaining options for the future. These values include the potentials of biodiversity that are presently unknown and need to be explored. It is the value of knowing that there are biological resources existing in this biosphere that may prove to be an effective option for something important in future. For example, research helps explore the diversity of myriad flora and fauna of the forest. Education and aesthetics are also examples of option value.

6 Bequest value refers to the readiness of present day mankind to spend goods in order to preserve biological diversity and its components for future generations. Bequest value is often termed as beneficial or altruistic value. For example, cultural heritage and resources for future generations, which are also expressed through consumers' willingness to pay or less/delayed consumption of the resources for the sake of future.

7 These are examples that could be made into an article of their own if an attempt were made to capture them in their entirety.

8 For example, a special operation named "smart patrolling" has been being carried out for the protection of the tiger under the financial assistance of USAID, which is known as *"Bagh"*. Also another program of the forest department named "IPAC" is run by the financial assistance of USAID. In these programs, people from nearby villages were included in co-management of the forest, but their participation halted when the program ended.

9 The Nash equilibrium is a steady state where the each agent has no incentive to deviate from their chosen strategy assuming the strategy taken by opponent.

Chapter 9

Towards an integrated multi-stakeholder landscape approach to reconciling values and enhancing synergies: a case study in Taiwan

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Abstract

The case study analyzes the collaborative planning and management processes of the 'Forest-River-Village-Sea (森–川–里–海) Ecoagriculture Initiative' from 2016 to 2017 in Xinshe Village, Hualien County, Taiwan. Two indigenous ethnic groups – the Kavalan Xinshe tribe and the Amis Dipit tribe – and their farmlands are located in the same watershed between the national forests of the Coastal Mountain Range and the Pacific Ocean. Resource conflicts over water usage, hunting and fishing rights have happened from time to time between the tribes. In the past, different government agencies worked separately with each settlement based on their sectoral goals. An integrated multi-stakeholder landscape approach and cross-sector collaborative governance were required to reconcile different values and enhance synergies.

To analyze the planning and management processes of the Initiative between October 2016 and December 2017, the research framework was comprised of two task loops: evaluation of existing institutional capacity and development of new institutional capacity. Classification of multiple values of nature MVN under the IPBES and 'Ecoagriculture Stool' landscape objectives were applied to examine stakeholders' value priorities. Healey's theory of collaborative planning and the ODA's method of stakeholder analysis were adopted for the institutional capacity evaluation.

With potential risk factors and suggestions to their resolution outlined, this study demonstrates how a synthesis of 'intellectual', 'social' and 'political' capitals is capable of bridging values of various stakeholders to, on the one hand, forge a cross-border connectivity among the inhabitants, and on the other hand, encourage a cross-sector coherence among the government agencies engaged in the area.

Keywords: Socio-ecological production landscapes and seascapes (SEPLS); Multiple values of nature; Collaborative planning; Multi-Stakeholder Platform; Synergy

List of Abbreviations:
COA: Taiwan Council of Agriculture
EBAFA: Eastern Region Branch Agriculture and Food Agency, Council of Agriculture
HBSWC: Hualien Branch, Soil and Water Conservation Bureau, Council of Agriculture
HDARES: Hualien District Agricultural Research and Extension Station, Council of Agriculture
HFDOFB: Hualien Forest District Office, Forestry Bureau, Council of Agriculture
IPBES: The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
NDHU: National Dong Hwa University
ODA: Overseas Development Administration

Country	Chinese Taipei (Taiwan)
Province	Hualien County
District	Xinshe Village, Fengbin Township
Size of geographical area [1]	1,460 hectares
Number of indirect beneficiaries [2]	700 persons
Dominant ethnicity	Indigenous (Kavalan, Amis)

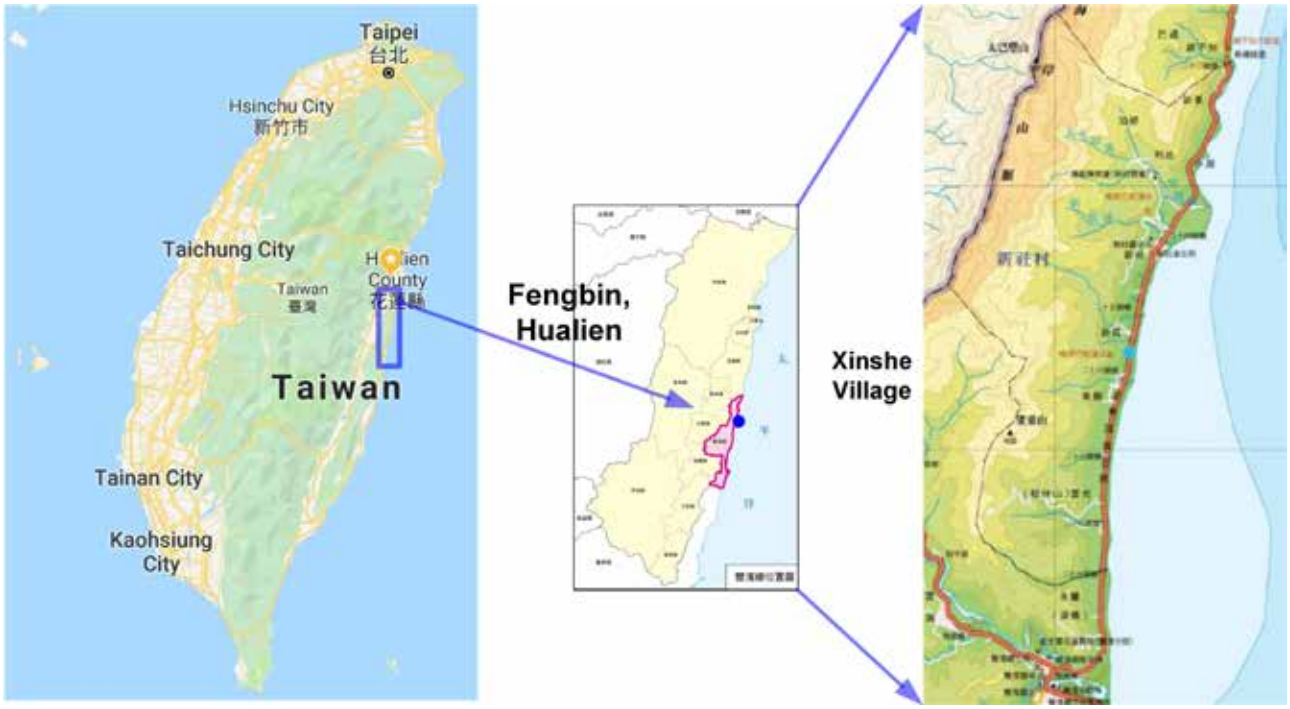


Figure 1. Map of the case study region, Xinshe Village, Fengbin Township, Hualien County, Taiwan

Size of case study/project area [1]	600 hectares
Number of direct beneficiaries [2]	250 persons
Geographic coordinates (longitude and latitude)	23°39'20.8"N 121°32'21.8"E
Dominant ethnicity	Indigenous (Kavalan, Amis)

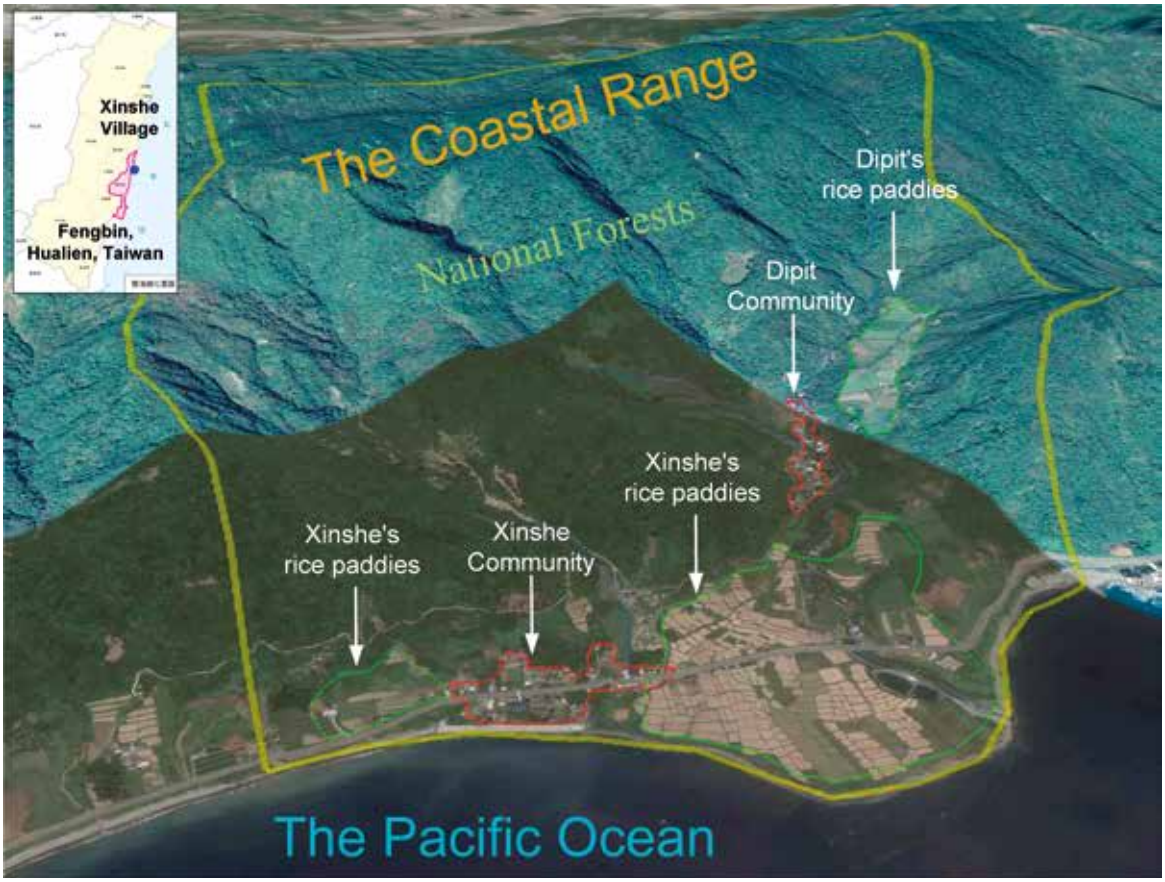


Figure 2. Land use and land cover map of the case study site

1. Introduction

'Societies living in harmony with nature' as the core vision of the Satoyama Initiative makes one take a pause and ponder upon the most suitable ways of achieving such harmony. In the context where revitalization of socio-ecological production landscapes and seascapes (SEPLS) depends on different, and at times conflicting, value priorities and decisions made by various stakeholders, it is crucial to ensure the existence of a multi-stakeholder dialogue. Presented in this study is an attempt to analyze a multi-stakeholder landscape approach in Xinshe Village, Hualien County, Taiwan, from the standpoint of multiple values of nature under IPBES (Diaz et al. 2015). While background conditions, composition of stakeholders and many other factors are unique to each SEPLS case study area around the world and may impact the *pathways* to achieving socio-ecological harmony, at the same time, local experiences, like the ones of the Xinshe SEPLS, may provide a valuable piece of knowledge to be shared on both regional and global levels.

1.1 Background

Taiwan is a small island with a high population density of average 649 people/km^2 (World Population Review, 2019). 80% of the population is concentrated in urban areas which cover only 13% of Taiwan's total land, while natural and rural areas take up 58% and 29% respectively (Lee, 2016). Rural and urban areas are mainly located in the middle and lower reaches of the island. In the past, the livelihoods of local and indigenous communities in rural areas depended on

environmentally friendly agriculture, forestry, fishery, and livestock farming. However, in recent decades, pressured by urbanization, conventional farming, and climate change, rural areas have been suffering from such problems as aging population, deterioration of production landscape, economic depression, and disappearance of traditional ethics and culture.

Due to the significant change in resource use in rural areas, which is associated with a reduced collection of firewood and the decreasing and aging population of locals able to manage forests and farmlands, SEPLS are no longer being maintained as they once were. Consequently, species that live specifically in SEPLS and have been maintained by human intervention, such as the African grass owl, leopard cat, Chinese box turtle, John's frog, paradise fish, crab-eating mongoose, greater painted-snipe and pangolin, are now in danger of extinction (Forestry Bureau 2018). In contrast, populations of wild boars and monkeys have been rapidly expanding, causing adverse effects on ecosystems, severe damages to agricultural and forestry activities, and substantial impacts on the livelihoods of rural communities.

Thus, integrity and connectedness among forests, rivers, human settlements, and seas in natural and rural areas of Taiwan are in need for an integrated landscape approach to conservation, revitalization, and sustainability. Moreover, a cross-communicative and participatory nature to this approach is required and should incorporate, on the one hand, cross-border connectivity among inhabitants of the area, and on the other hand, cross-sector coherence within government agencies engaged in the area. Also, conservation and revitalization of SEPLS call for a comprehensive assessment of values possessed by each of the stakeholders and their reconciliation and inclusion within planning activities. However, to date, there has been a lack of empirical research to develop such a kind of approach.

1.2 Socioeconomic and environmental characteristics of the area

This chapter presents a case study of Xinshe Village, Fengbin Township, Hualien County, located on the east coast of Taiwan, bordered by the national forests of the Coastal Mountain Range on its western side, extending eastward and descending into a watershed of about 600 hectares of land surrounded by the Pacific Ocean (see Fig. 1 and 2). There are two indigenous settlements in the Xinshe SEPLS. These are the Dipit tribe, an Amis settlement of 77 residents on farmland in the middle reaches of the watershed, and the Xinshe tribe, a Kavalan settlement of 366 residents (Household Registration Office 2019) on farmland located in the lower reaches of the valley down to the coastal terrace.

Geographically the Dipit and Xinshe tribes are both situated inside one watershed, which connects the communities along the 'Forest-River-Village-Sea' axis (see Fig. 3). Over time, this connectedness stimulated inhabitants of the two tribes to develop versatile land use skills, ranging from hunting wild boar and gathering wild edible plants in the forests to farming terraced rice paddy fields and fishing in the ocean. At the same time, the overall ecosystem health of the Xinshe SEPLS largely depends on the practices taking place all the way from upstream to downstream. For instance, agricultural and household activities of the settlements may lead to nutrient runoff and leaching into surface waters and groundwater, resulting in nutrient (N and P) discharge into the ocean. A hypoxic and/or eutrophic environment may

Figure 3. SEPLS of Xinshe Village (Photo: Vision Way Communication Co., LTD, Taiwan)

potentially impact the ecosystems of coastal coral reefs, and, in turn, affect the fishery resources of both tribes.

1.3 Objective and rationale

Despite a seemingly intrinsic connection between the settlements and similar perceptions towards MVN, there has never been a sufficient cross-settlement dialogue mechanism for the co-management of common resources. On the contrary, resource-related conflicts over water usage, hunting and fishing rights have occurred from time to time between the Dipit and Xinshe tribes. In the past, various government agencies worked separately on different community affairs for either one of the settlements, while their plans and actions lacked coherence. Thus, potential collaboration pathways needed to be sought.

Starting in October 2016, the case study area has been recognized and managed with the help of 'other effective area-based conservation measures' (OECMs; Jonas et al. 2018) by means of a multi-stakeholder cross-sector platform (see below as Multi-Stakeholder Platform) for promoting the 'Forest-River-Village-Sea (森–川–里–海) Ecoagriculture Initiative'. It was designed to set up and collectively implement an Action Plan for the area to enhance ecosystem services for both communities. In other words, the vision of the Multi-Stakeholder Platform was to stimulate *cross-border* and *cross-sector* cooperation to help Amis and Kavalan communities live in harmony with nature through the revitalization of the SEPLS (see Fig. 4).

This study aims to analyze the processes and outcomes of the Initiative in the period from October 2016 to December 2017 and to demonstrate how the Action Plan, based on the socio-ecological value perceptions of multi-interest stakeholders, can be collectively developed to form a new cross-border and cross-sector institutional capacity. The overarching goal of the study is to provide relevant government authorities, rural communities, and other interested stakeholders with a reference for development of a collaborative, community-based landscape approach to revitalization of rural areas.

2. Methodology and framework

1.1 Research framework

For the purpose of developing and evaluating participatory forums for the 'Forest-River-Village-Sea Ecoagriculture Initiative', two questions needed to be addressed. Firstly, is there any existing participation mechanism fit for bridging diverse values and building up partnership among various stakeholders in the area (current status review)? Secondly, if there is no such mechanism, then how should a Multi-Stakeholder Platform and an Action Plan be designed and implemented to reconcile diverse values and enhance collaborative governance among stakeholders (new forum/action plan design and implementation)?

Therefore, an action research framework for the evaluation and development of institutional capacity, based on Healey's theory of collaborative planning (1998, 2002), was constructed for addressing each of the questions. The framework itself is comprised of two task loops (see Fig. 5). The first task loop is the evaluation of existing institutional capacity, while the second task loop is the development of new institutional capacity.

Figure 4. A typical landscape of Taiwan's East Coast (Photo: Hualien District Agricultural Research and Extension Station, Taiwan)

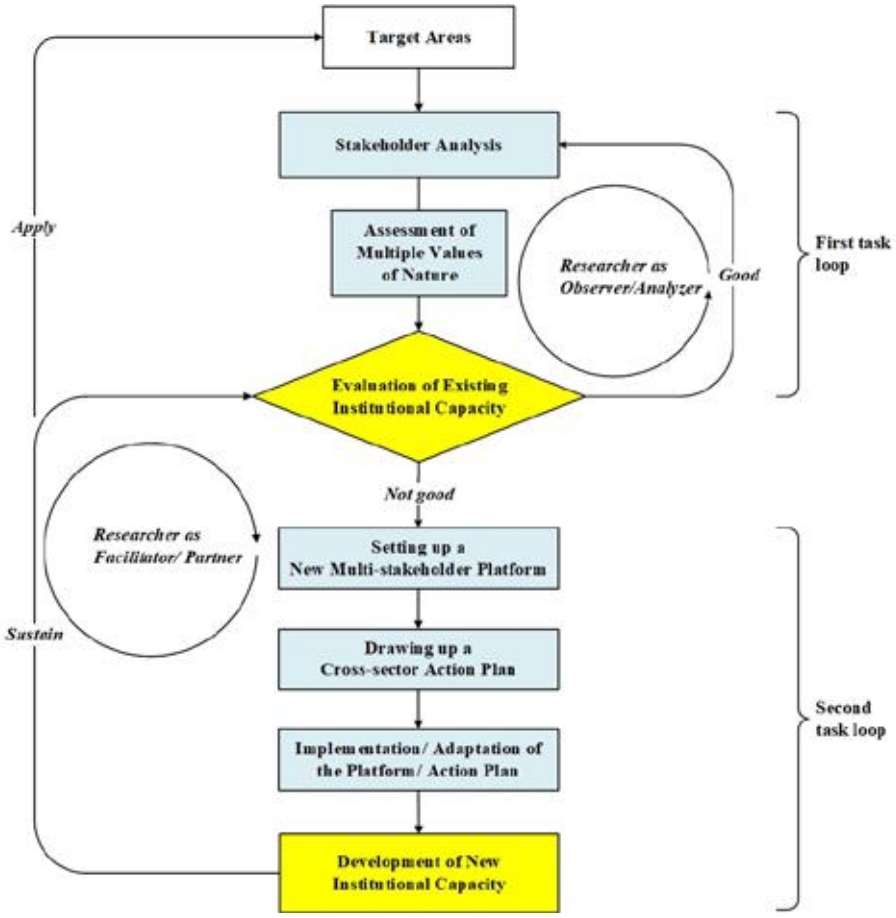


Figure 5. An action research framework for the evaluation and development of institutional capacity

Within this study, the term 'ecoagriculture' was initially visualized as a 'three-legged stool' (Scherr et al. 2014). The 'stool' concept represents an integrated landscape management that involves collaboration among different groups of stakeholders (supportive institutions) to solve shared problems and strengthen synergies among three landscape objectives (three 'legs' of the 'stool') such as viable local livelihoods, biodiversity conservation, and agricultural production (see Fig. 6). It may be observed that the three landscape objectives of ecoagriculture and three types of MVN (Diaz et al 2015) similarly point out such categories as nature in its intrinsic sense, the utilitarian function of nature, and its socio-relational function. Thus, within this case study analysis, the value aspect was regarded from the point of both approaches.

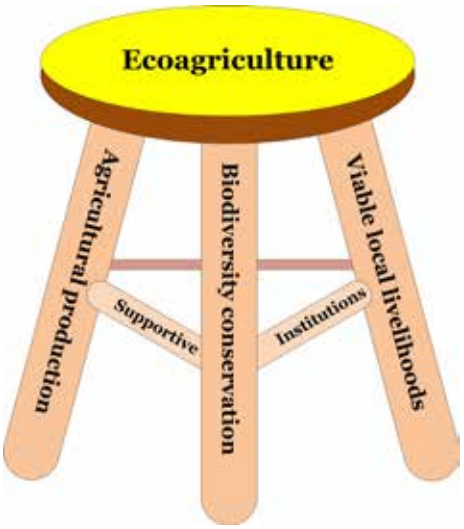
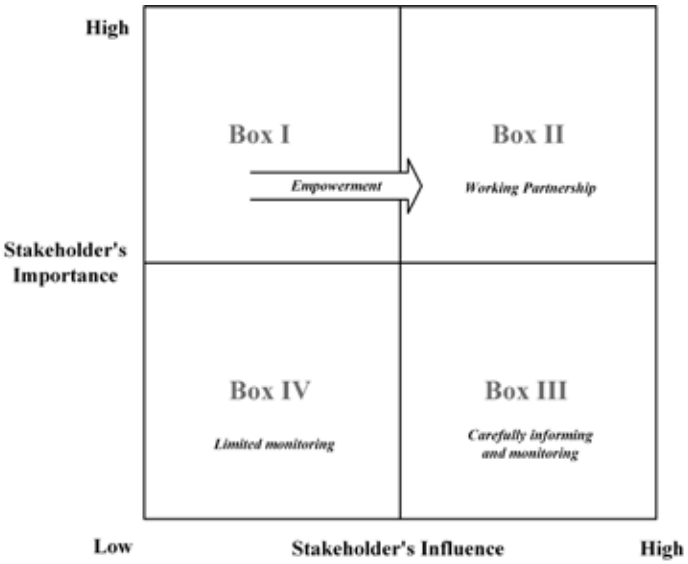


Figure 6. The ecoagriculture 'stool' (Scherr et al. 2014)

2.2 Evaluation of existing institutional capacity

Existing institutional capacity in the case study area was assessed within the first task loop by answering the first research question of 'whether or not there is an existing participation mechanism fit for bridging diverse values and building up partnership among various stakeholders in the area'. This study adopts ODA's (1995a, 1995b) method of stakeholder analysis by identifying key stakeholders and their interests, determining their importance and influence, making a prognosis of their associated cooperation or risk potential, as well as comparing appropriate and employed ways of stakeholder participation (see Fig. 7). In the first task loop, the researcher played an observer's role, while also



Explanatory note:

Box I: Stakeholders of high importance to the project, but with low influence. This implies that they will require special initiatives if their interests are to be protected.

Box II: Stakeholders with a high degree of influence on the project and a high importance for its success. This means that a good working relationship with these stakeholders is vital to ensure an effective coalition for support for the project.

Box III: Stakeholders with a high degree of influence on the project but a low importance for its success. It signals that these stakeholders may be a source of significant risk, and, therefore, might need to be carefully monitored and managed.

Box IV: Stakeholders in this box have a low influence on, or importance to, the project's objectives. They may require limited monitoring or evaluation and are of a low priority. They are unlikely to be a subject of project activities or management.

Figure 7. Stakeholder assessment matrix (ODA 1995a, 1995b)

trying to be an attentive listener to better learn from the stakeholders about local issues.

2.3 Development of a new platform/action plan for institutional capacity building

The second task loop was developed as a response to the findings of the first task loop based on the necessity of participatory forums and resources input for new institutional capacity building. Activities within this loop were aimed at answering the second research question: 'how should a Multi-Stakeholder Platform and an Action Plan be designed and implemented to reconcile diverse values and enhance collaborative governance among stakeholders'. Social capital (relational resources), intellectual capital (knowledge resources), and political capital (mobilization capacity) were the three criteria (Healey 1998) used within this task loop to evaluate the progress of institutional capacity building among the stakeholders. The whole process was facilitated and analyzed by the NDHU research team.

2.4 Qualitative data collection methods

This study employed a qualitative research methodology based on the notion that qualitative methods can provide a more in-depth understanding of 'inner experiences', 'language', 'cultural meanings' or 'forms of social interaction' than purely quantitative data (Silverman 2000). A multiple-method approach alongside a range of various reference sources was applied to maximize the understanding of research questions (Flowerdew & Martin 1997). Methods included participant observation, individual interviews, and group discussions, while each method provided a particular perspective that was able to highlight a specific aspect of the researched phenomenon. The multiple-method approach further allowed for the findings to be validated or challenged by applying the triangulation process for comparing the data collected via different methods (Denscombe 1998).

3. Results and discussion

The 'Xinshe Forest-River-Village-Sea Ecoagriculture Initiative' was carried out from October 2016 to December 2017 in accordance with two task loops for institutional capacity building. Firstly, the research team evaluated existing institutional capacity by means of stakeholder analysis and assessment of MVN. Secondly, a new Platform and Action Plan for institutional capacity building were developed, while Healey's three-capital criteria were used for progress evaluation. The main processes and findings of the Initiative, within the given time period, are discussed in this section.

3.1 Evaluation of existing institutional capacity

Focused on various value priorities (intrinsic, instrumental or relational values of nature) as well as different landscape objectives of ecoagriculture (biodiversity conservation, agricultural production or viable local livelihoods), several government institutions were separately working with either the Dipit or Xinshe tribes up until the end of 2016 (see Table 1).

Table 1. Assessment of stakeholders' value priorities and landscape objectives

Stakeholder groups	Examples of stakeholders' priorities and/ or sectoral goals		Prioritized category of MVN*	Prioritized 'Ecoagriculture stool' landscape objectives*
Kavalan Xinshe tribe	**Priority or sectoral goal**	**Specific examples**	Good quality of life (relational value)	Viable local livelihoods
	Income and livelihood (esp. for young people)	Rice production, selling of local crafts, local restaurant/coffee shop, tribal tourism		
	Revitalization of SEPLS	Marine ecosystem (fishery, corals), organic rice farming		
	Indigenous (esp. elders') knowledge transfer and education	Local primary school/ place-based curriculum, educational albums/ pamphlets/ brochures about socio-ecological knowledge, role of shaman in tribal rituals		
Amis Dipit tribe	Income and livelihood (esp. for young people)	Millet, rice and indigenous quinoa production, selling of local crafts, tribal tourism (camping included)	Good quality of life (relational value)	Viable local livelihoods
	Revitalization of SEPLS	Riverine ecosystem of Jialang stream (shrimp and fish), biodiversity checks and monitoring of the national forest (indigenous plants and animals)		
	Indigenous (esp. elders') knowledge transfer and education	Local primary school/ place-based curriculum, educational albums/ pamphlets/ brochures about socio-ecological knowledge, weekly lunches for the elders (on Tuesdays), bonding role of church		
HDARES	Agricultural productivity and farmers' income Organic and environmentally-friendly farming technology Food and agricultural education	Creating vegetative buffer strips in Xinshe rice paddy fields, inventory and monitoring of agricultural crop diversity, replanting of fallow land with traditional crops, utilization of wild edible plants and household horticulture, assistance with composting technology, processing equipment and organic labelling schemes	Nature's benefits to people (instrumental value)	Agricultural production and marketing *Supportive institution*
HFDOFB	Biodiversity monitoring and conservation (e.g. wildlife, coral reefs) National forest protection Environmental education Ecotourism	Removing alien species, preventing species harmful to the crops (wild boars), stopping deforestation, inventory and monitoring of terrestrial/ riverine/ marine biota, forest economy, green labelling of produce, promoting landscape diversity through creative art events	Nature (intrinsic value)	Biodiversity conservation *Supportive institution*

Stakeholder groups	Examples of stakeholders' priorities and/ or sectoral goals		Prioritized category of MVN*	Prioritized 'Ecoagriculture stool' landscape objectives*
HBSWC	Rural settlement development Natural disaster risk reduction and mitigation Capacity building Environmental education Ecotourism	Monitoring and prevention of landslides and coastal erosions, repairing terraced fields, roads and waterways in eco-friendly way, refurbishing of local housing, promoting ecological and cultural tourism and aboriginal crafts	Good quality of life (relational value)	Viable local livelihoods *Supportive institution*
NDHU			*Observing and facilitating role; supportive institution***	

* Categories of value priorities and landscape objectives are based on the conceptual framework of IPBES (Díaz et al. 2015) and the ecoagriculture 'stool' (Scherr et al. 2014).

** Value priorities and landscape objectives are not applicable for NDHU, as it played observing and facilitating roles in the process.

For instance, since 2010, with the help of NDHU, HFDOFB assisted the Dipit tribe by conducting annual investigations of natural resources, surveys of indigenous edible plants and ecotourism planning activities. Starting from 2015, HFDOFB took a further step by jointly implementing a 'Joint Community Forest Protection Program' with the members of the Dipit tribe, where the latter engaged in patrolling mountain forests to help prevent illegal logging and poaching. Clearly, as a supporting institution, HFDOFB primarily emphasized the intrinsic value of nature and the biodiversity conservation objective in its assistance efforts.

Meanwhile, in 2011, by the means of Rural Rejuvenation Programs, HBSWC aided the Dipit tribe with capacity building, community greening and facility enhancement, along with drawing college students back to the rural areas. Thus, within the framework of the programs, HBSWC prioritized the good quality of life (relational) and viable local livelihoods above other values and objectives.

The third government institution involved was HDARES. Its inclination towards instrumental values of nature and agricultural production and marketing was rather obvious when, starting from 2014, it became involved in promoting production and marketing of organic and environmentally-friendly rice farming in the Xinshe tribe. Visible increase in landscape diversity, achieved through planting of grass carpets on rice field ridges, slopes and surrounding hedges in order to control pests by natural enemies, had an additional positive impact on the ecotourism revenues for the Xinshe tribe.

Interestingly, for the primary stakeholders – the Dipit and Xinshe tribes – despite the existence of resource-related conflicts over water usage, hunting and fishing rights, their value priorities and landscape objectives were rather comparable (maybe this explains the nature of the conflict itself). Despite recognition of the value of nature in its intrinsic sense, good quality of life (relational value) and viable local livelihoods were given roles of primary importance by both communities. Probably, due to prevailing socio-economic hardships associated with aging population, deterioration of production landscapes, economic depression, and disappearance of traditional ethics and culture, it was the community revitalization and livelihood-oriented stance that mattered most to Amis and Kavalan residents.

NDHU, the research team, originally differed in its role as compared to other stakeholders. At this stage, by the means of participatory observations, individual interviews and group discussions, the team worked with other stakeholders in assessing their value priorities and landscape objectives. Understanding of the stakeholders' values and objectives in many ways shaped the tasks and categories of work that were further outlined in the Action Plan of the Multi-Stakeholder Platform (see Section 3.2). Prior to October 2016, however, despite the team's engagement (since 2010) in assisting the Amis Dipit tribe to work with HFDOFB on biodiversity conservation and with HBSWC on local livelihoods, there was no institutional arrangement in place (see 'supportive institutions' in Fig. 3) to promulgate collaboration among the stakeholders.

Therefore, a lack of communication between the Dipit and Xinshe tribes and of cooperation between the government agencies was resulting in functional incoherence and low efficiency of the stakeholders' efforts (see Fig. 8). Undoubtedly, though, overall economic, social and environmental problems of the area could only be resolved through a cross-border, cross-sector, and multi-stakeholder action. In other words, an integrated landscape approach

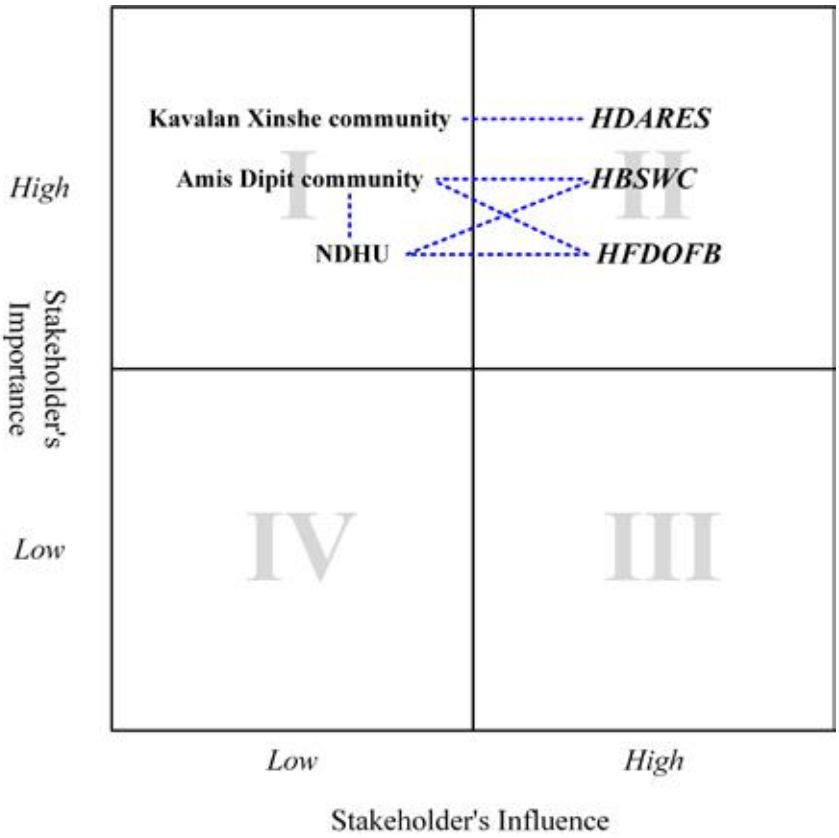


Figure 8. Stakeholder assessment matrix before the Initiative (dash line: allies)

and cross-sector collaborative governance were required to address varying priorities towards MVN and find a common ground for their management and co-existence.

3.2 Setting up a new Multi-Stakeholder Platform

Following the suggestion and with the assistance of the NDHU research team, on 11 October 2016, the vice-director of HDARES invited the directors of HFDOFB and HBSWC, and local people from Xinshe and Dipit tribes for a meeting in the Xinshe community to discuss the idea of the 'Xinshe Forest-River-Village-Sea Ecoagriculture Initiative'. Participants, ten people in total, generally welcomed the idea and suggested that HDARES and NDHU help set up a formal Multi-Stakeholder Platform for planning and management of the Initiative (see Table 2).

For the second stage, from November to December 2016, two formal multi-stakeholder meetings were held in the study area to discuss the design of the collaborative mechanism for multi-stakeholder participation. On 30 November 2016, the first formal multi-stakeholder meeting was convened by the director of HDARES on the premises of the Dipit tribe. There were 23 people, including two directors and several staff members from HFDOFB and HBSWC, as well as local people from the Xinshe and Dipit tribes, in attendance at the meeting. Based on the draft prepared by the NDHU research team, participants discussed and reached a consensus on the Collaborative Mechanism of the Multi-Stakeholder Platform in the 'Xinshe Forest-River-Village-Sea Ecoagriculture Initiative'. Additionally, participants all agreed to regard the meeting on that day as the first Task Force Meeting, a group that was to be composed of six core members, including representatives of the Xinshe and Dipit tribes, HDARES, HFDOFB, HBSWC, and NDHU.

On 20 December 2016, the first Multi-Stakeholder Platform Meeting was held by the director of HDARES in the Xinshe tribe's community. The list of attendants included about 40 people, amongst whom were two directors and several staff members from HFDOFB and HBSWC, local people from the Xinshe and Dipit tribes, NGOs and other government institutions. Members of the Task Force clarified to all participants the origin and the goal of the 'Xinshe Forest-River-Village-Sea Ecoagriculture Initiative' by also presenting a draft of the Collaborative Mechanism of the Multi-Stakeholder Platform. In the end, all participants reached a consensus on each aspect for promoting the Initiative: name, goal and the Collaborative Mechanism.

A particular unity in opinion was achieved at this stage in relation to the question of who should be the convener for the Task Force and Multi-Stakeholder Platform Meetings. Determined to have not only shared results but also

Figure 9. First Multi-Stakeholder Platform Meeting convened by HDARES on 20 December 2016 (Photo: NDHU research team)

responsibilities, at the first Task Force Meeting held in November 2016, HDARES and NDHU suggested that the meetings should be conducted on a rotational basis by HDARES, HFDOFB, and HBSWC. It was also anticipated that the local communities, Xinshe and Dipit tribes, could be in charge of convening and chairing the meetings in the foreseeable future. The above propositions were unanimously approved by the leaders of the three institutions and representatives of the two tribes at the first Multi-Stakeholder Platform Meeting in December 2016 (see Fig. 9).

Collaborative Mechanism of the Multi-Stakeholder Platform

Objectives: Multi-Stakeholder Platform working on revitalization of Xinshe SEPLS was established to realize the vision of 'living in harmony with nature' for Dipit and Xinshe tribes.

Participants and meetings: Stakeholders engaged in promoting the Initiative included the Task Force composed of six core members (Xinshe and Dipit tribes, HDARES, HFDOFB, HBSWC and NDHU), and the Multi-Stakeholder Platform comprised of all interested participants (at that time around 20 members) – local community organizations, central and local government institutions, local schools, academia, NGOs, NPOs, green enterprises, etc.

Meeting frequency: October 2016 to December 2017 was the period of intensive planning. Regular Task Force Meetings were held in January, February, April, May, July, August, October, and November, while the regular Multi-Stakeholder Platform Meetings took place in March, June, September, and December. Necessary date and time adjustments were also acceptable.

Venue, conveners and role of local communities: Both Task Force and Multi-Stakeholder Platform Meetings were convened in turn by HDARES, HFDOFB or HBSWC and were held on a rotational basis either at the community center in the Kavalan Xinshe tribe or at the activity center in the Amis Dipit tribe. The ultimate goal was to empower the primary stakeholders – the Xinshe and Dipit tribes – to be soon able to take the lead in convening and chairing the meetings.

Facilitator: College of Environmental Studies, NDHU (Laboratory of Landscape Conservation and Community Participation – the research team).

3.3 Drawing up a cross-sector Action Plan

At this stage, from January to March 2017, two Task Force Meetings and one Multi-Stakeholder Platform Meeting were held each month to determine short- and medium-term action plans for promoting the Initiative. Each of the meetings was chaired by the department heads of either of the three units. Referencing the 'vision-methods-perspectives' framework of the three-fold approach to the Satoyama Initiative, the Action Plan for the Initiative was jointly discussed, revised and completed in March 2017. The Action Plan (see Appendix A) explicitly outlined division of labor within five major categories of work, stipulated 38 tasks and their expected durations (short-, medium- or long-term), as well as specified main organizers and co-organizers (see Fig. 10).

Figure 10. Task Force Meeting held on 30 November 2016 (Photo: NDHU research team)

3.4 Implementation/adaptation of the Platform/Action Plan

In the beginning of the implementation stage, during a Task Force Meeting on 24 April 2017, NDHU suggested clearly specifying the functions of each of the two meetings (see Fig. 11). It was determined for the Task Force Meetings to give priority to reporting and discussion of the issues that required immediate attention, especially matters proposed by the two tribes. In addition, the ways of conducting meetings were seen as flexible, held both indoors and outdoors, so that the participants could explore the issues in a solution-oriented way. At the same time, the function of the Multi-Stakeholder Platform Meeting was to overview the progress of relevant tasks outlined in the Action Plan.

Figure 11. 4th Task Force Meeting on 24 April 2017 (Photo: NDHU research team)

Each main organizer mentioned in the plan was responsible for reporting the progress, difficulties and outcomes, as well as discussing collaborative strategies needed.

At the Multi-Stakeholder Platform Meeting on 18 July 2017, participants deemed the Initiative to be on the right track and decided to adjust the meeting frequency. Thus, regular Task Force Meetings were to be held in February, April, August and October, while the regular Multi-Stakeholder Platform Meetings were to be held in June and December. During the implementation stage, from April to December 2017, a total of four Task Force Meetings and two Multi-Stakeholder Platform Meetings were organized to implement the Action Plan of the Initiative.

3.5 Evaluation of new institutional capacity

The given case study demonstrates how the partnership Platform and the Action Plan, collectively developed by the multi-interest stakeholders, evoked the formation of a new cross-border and cross-sector institutional capacity.

Thus, the stakeholder assessment matrix after the start of the Initiative (see Fig. 12) demonstrates, on the one hand, established collaboration and communication between six initial stakeholders (Kavalan Xinshe tribe, Amis Dipit tribe, HDARES, HBSWC, HFDOFB, and NDHU), and on the other hand, the emergence of two new stakeholders – EBAFA and the Xinshe elementary school – as a result of planning and management processes. EBAFA joined the platform as a key member to assist in agricultural product marketing for the two communities, while the Xinshe elementary school was invited to participate in discussions pertaining to education and transfer of indigenous culture and knowledge.

Table 2. Multi-Stakeholder Platform Meetings timeline (October 2016 – December 2017)

Steps	Related Platform Meetings
Preparation and Discussion *(October 2016)*	• Preparation meeting *(October 2016)*
Consensus-building *(November - December 2016)*	• 1st Task Force Meeting *(November 2016)* • 1st Multi-Stakeholder Platform Meeting *(December 2016)*
Action-planning *(January - March 2017)*	• 2nd, 3rd Task Force Meetings *(January - February 2017)* • 2nd Multi-Stakeholder Platform Meeting *(March 2017)*
Implementation *(April - December 2017~)*	• 4th -7th Task Force Meetings *(April - November 2017)* • 3rd, 4th Multi-Stakeholder Platform Meetings *(July, December 2017)*

Moreover, stakeholders agreed on the need to inform the COA (a superior unit of HDARES, HFDOFB, HBSWC, and EBAFA), as well as Hualien County Government, about the progress and problems of the Initiative in order to ensure timely and sufficient support.

Worth noting is a special 'supportive institution' function that NDHU was playing in the process of building this new institutional capacity. While before the Initiative, in October 2016, there were no institutional arrangements in place and each government agency worked separately on their respective objectives and sectoral goals, after the Initiative was introduced, the role of NDHU shaped into a 'backbone' of the process – it became the main facilitator of cross-border and cross-sector activities.

Another way to evaluate the progress of institutional capacity building among stakeholders is to look at it from the point of Healey's 'three capitals' of collaborative planning: intellectual, social and political.

When it comes to intellectual capital, traditional planning and decision-making are usually reliant on the decisions of government officials and experts as to what constitutes the problem and what are the possible solutions. The newly established Multi-Stakeholder Platform, in this case, provided opportunities for the two local communities, government agencies, and experts to sit at a round table and vis-a-vis each other discuss existing issues, solutions, projects, financial support, and division of work. The Multi-Stakeholder Platform helped to enhance the dialogue

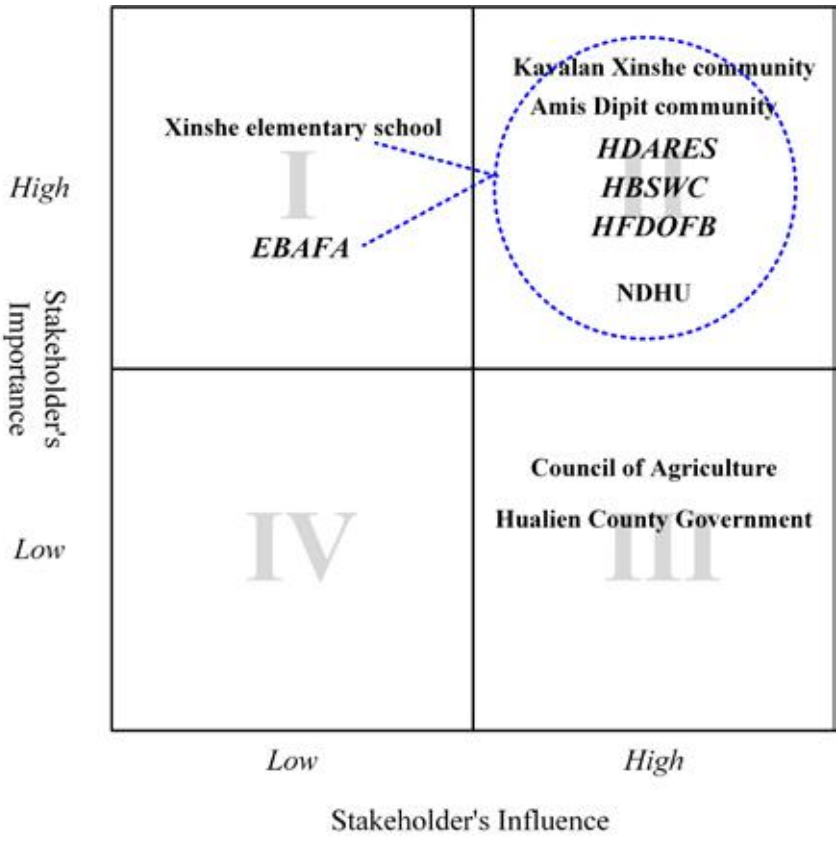


Figure 12. Stakeholder assessment matrix after the Initiative (dash line: allies)

between the "expert knowledge" and the "local knowledge", as well as contributed to mutual trust and synergy between the stakeholders' value priorities and landscape objectives.

For realizing the social capital, the newly established Multi-Stakeholder Platform not only emphasized the role of community but also reminded all members that planning and implementation of the Action Plan should match the paths of the two communities. The Platform Meetings were held in turns in the two communities, making it convenient for the local people to participate. It also demonstrated that government officials were willing to leave their offices and engage in face-to-face interactions with the local residents. Mutual trust between the local people and the officials was enhanced. Moreover, the Platform encouraged different government agencies and the two communities, who originally had no interaction, to start discussing, drafting and implementing a landscape- and seascape-scale Action Plan. This contributed to an integrated working partnership among all stakeholders.

In terms of the political capital, the newly established Multi-Stakeholder Platform helped to figure out an integrated cross-border and cross-sector Action Plan in accordance with the three-fold approach to the Satoyama Initiative. The Action Plan prescribed an overarching goal, five strategic perspectives, and 38 tasks, while short-, medium- and long-term deadlines, main organizers, and co-organizers were appointed for each task. At the end of each year, the outcomes of the integrated Action Plan were set to be reviewed, while at the beginning of each year, a work plan and resources input for the upcoming year were to be reported by the main organizers. Therefore, the Platform and the Action Plan could provide an action guidance for the required input of human and financial resources.

4. Conclusion

4.1 Lessons learned

Development of a new institutional capacity for the Xinshe SEPLS, Hualien County, Taiwan, by the means of the 'Xinshe Forest-River-Village-Sea Ecoagriculture Initiative' presented itself as an innovative, community-oriented participatory approach to conservation, revitalization, and sustainability. Being introduced in late 2016, this first-in-Taiwan cross-sectoral and landscape-scale Initiative is still too young and emerging to deduce concrete and final results and their implications. However, even the early period of implementation presented here (October 2016 - December 2017) already allowed for a few notable observations to be made.

Firstly, the Initiative demonstrated how a synthesis of 'intellectual', 'social' and 'political' capitals is capable of bridging the value priorities and landscape objectives of various stakeholders to, on the one hand, forge a cross-border connectivity among the inhabitants, and on the other hand, encourage a cross-sector coherence among the government agencies engaged in the area.

Secondly, there appeared to be an observable change in the perception of MVN and of landscape objectives pursued by each of the stakeholders. Indeed, each of the involved government agencies (supportive institutions) continued to have their own 'leg' of the 'stool' to work on, based on their sectoral goals and primary responsibilities, and both communities prioritized community revitalization and livelihoods above other factors (see Table 1). What changed, however, was the appreciation and understanding of the other 'legs' of the 'stool' as equally important for the overall revitalization of the Xinshe SEPLS. All of the stakeholders recognized that only participation and cooperation among them can ensure the stability of the 'stool' in ecological, social and economic dimensions, as well as help society live in harmony with nature.

Thirdly, the Initiative opened a new window to the enhancement of human-to-human and human-to-nature synergies in the area. It became clear that socio-ecological issues within the Xinshe SEPLS could only be resolved through the combined efforts of all stakeholders, which gave a new sense of hope and dedication to enable such synergies happen.

Lastly, it should be noted that as the initial period of the multi-stakeholder landscape approach was primarily focused on setting up the Platform, and drafting and ensuring an early-stage implementation of the Action Plan, the lessons learned presented above mainly reflect the results of collaborative experiences before and after the Initiative. Clearly, more time and consistent effort would be needed in order to witness biodiversity benefits as a result of the Platform activities. Nevertheless, there are already initiatives in place that have a high potential to contribute to SEPLS ecosystem health. For instance, starting from 2017, with the support of HDARES and HFDOFB, villagers of the Xinshe tribe took up the role of civic scientists for monitoring of the surrounding coral reefs. Moreover, from 2018 onwards, a conservation NGO assigned by HFDOFB conducted a biodiversity investigation of terrestrial and riverine ecosystems in Xinshe Village. Preliminary results showed that shrimp species abundance and diversity in the stream is extremely high. This prompted the authorities and residents to discuss how to protect, restore and utilize local stream ecological resources through stream patrol activities and ecological engineering.

In sum, following successful implementation of the Platform activities and with more stakeholders joining in (including EBAFA and Xinshe Primary School), more explicit lessons related to biodiversity benefits, the Xinshe SEPLS ecosystem health, as well as indigenous and local knowledge transfer are anticipated to become available.

4.2 Potential risks and suggestions

This early stage of the 'Xinshe Forest-River-Village-Sea Ecoagriculture Initiative' implementation also revealed several obstacles, or potential risk factors, the consideration of which is vital for the overall success of new institutional capacity. Presented below are some of the risk factors (as of December 2017) as well as the authors' suggestions towards their resolution.

Lack of a higher-ranking supervising body: Since the four government agencies involved (HDARES, HFDOFB, HBSWC, and EBAFA) are in a horizontal relationship and equally subordinate to the COA, neither of them may take a coordinating role in case of conflict. Therefore, it is recommended that a chief officer from the COA central committee should become involved in the Initiative to take on the dispute-resolution role if required.

Need for a strengthened competence and cross-partnership among the staff members of various government agencies: Working for a multi-stakeholder platform on cross-border and cross-sector issues might be a novelty and an overwhelming experience for many of the administrative staff members involved, but at the same time it provides a unique experience for learning and knowledge exchange. Setting up of a Staff Secretariat may potentially take the workload off the shoulders of single staff members through capacity building, joint learning, and division of responsibilities.

Lack of a shared resource database: As the Task Force and Multi-Stakeholder Platform Meetings are convened on a rotational basis by HDARES, HFDOFB or HBSWC, materials related to preparation and results of the meetings are in the hands of the then-convener. This might pose a danger of resources being scattered or being lost if they are not systematized in one place. Creation of a shared Resource Database might be an appropriate solution.

Voluntary and agency-focused nature of performance assessment and reporting: Currently the efforts taken by each of the government agencies involved in the Initiative are 'voluntary' – they are not monitored by and do not require reporting to the COA central committee. In addition, the results of the Initiative are traditionally viewed through the lens of a single task performed by a single agency. Therefore, there is a need for a sustainable (responsible for sustaining for a prolonged period) and comprehensive (cross-sectoral and collaborative) analysis and reporting of the Initiative's efforts.

Leadership change-related risks: Since the heads of government agencies exercise sufficient power in determining the success and the very involvement in the Initiative, it is essential to ensure the hereditary nature of agencies' participation. In other words, a newly appointed head of an agency should be fully informed and advised of the previous activities to make a positive contribution to the Initiative.

Potential territory- and resource-related issues between the Amis and Kavalan tribes: Common resource use is still an apple of discord between the Xinshe and Dipit tribes. Therefore, any projects enacted by the government agencies under the Initiative would need to be mindful of this, as well as recognize each tribe's sense of territory.

Need for a participatory monitoring and evaluation system: A relevant indicator system for monitoring the landscape's resilience needs to be developed so as to assist stakeholders, including local people and government authorities, in jointly evaluating the current situation and monitoring its progress concerning the Initiative.

In sum, continued implementation of the Initiative, with a proper consideration of the lessons learned and potential risk factors, is believed to have a high potential for the revitalization of the Xinshe SEPLS, making the experience of this case study valuable for analysis in both regional and global contexts.

Acknowledgements

This case study would not have been possible without the kind support and help of many individuals and organizations. We would like to express our particular appreciation to the Taiwan Council of Agriculture (COA) who provided the funding to carry out this research. Our thanks and gratitude also go to the local people of Xinshe Village, Hualien County, Taiwan, who kindly welcomed and assisted us throughout the fieldwork. This work is related to IPSI Collaborative Activity no. 38 and has been submitted to the IPSI Secretariat as a case study.

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APPENDIX A: Simplified Action Plan for 'Xinshe Forest-River-Village-Sea Ecoagriculture Initiative'

Perspectives	Task code and content	Division of labor among multi-stakeholders					
		Government Institutions			Local community		
		HDARES	HFDOFB	HBSWC	Xinshe Community Association	Kavalan Xinshe tribe	Amis Dipit tribe
A. Landscape diversity/ resilience	A-1 Promoting environmentally-friendly farming and enhancing crop diversity	★					
	A-2 Enhancing landscape diversity in rice paddies by planting grass carpets on ridges, slopes and surrounding hedges	★					
	A-3 Reconnecting natural stream to irrigation ditches and ponds through ecological engineering instruments			★			
	A-4 Pest control (boars, monkeys, etc.) for crops		★				
	A-5 Alien species removing		★				
	A-6 Preventing poaching of precious trees, forest products and stream resources		★				
	A-7 Inventory and monitoring of agro-biodiversity in rice paddy fields	★					
	A-8 Inventory and monitoring of terrestrial biodiversity		★				
	A-9 Inventory and monitoring of marine biodiversity, promoting community-based conservation and sustainable use		★				
	A-10 Slopes and eroded gullies monitoring and prevention of landslides			★			
	A-11 Coastal erosion monitoring and disaster risk reduction projects, safe and accessible coastal engineering	Main organizer: local county government					
	A-12 Evaluation of resilience in SEPLS	Main organizer: NDHU					
	A-13 No herbicide use around the settlements				★	★	★
B. Agro-biodiversity	B-1 Rehabilitation of fallow lands, planting of traditional and eco-friendly crops	★					
	B-2 Home gardening, indigenous edible plants, use of diversified food sources	★					
	B-3 Collecting and using forest products, and agro-forestry		★				
	B-4 Sustainable use of resources in streams and seas					★	★
	B-5 Developing new composting technologies based on traditional knowledge and modern technology						

C. Traditional knowledge and values	C-1 Establishing database for local crops and varieties	★				★	★
	C-2 Promoting environmental education activities and passing on traditional sea/land ecological knowledge and skills				★		
	C-3 Indigenous food and agriculture education	★					
	C-4 Working with Xinshe Elementary School to promote place-based curriculum	Main organizer: Xinshe Elementary School					
	C-5 Promoting indigenous wild edible plants, food art, weaving and other crafts	★					
	C-6 Making community resources maps, leaflets/booklets, books, videos concerning traditional culture and ecological knowledge	★	★	★	★	★	★
	C-7 Research/inventory on traditional culture and ecological knowledge of agriculture, forestry and fishery	★	★	★	★	★	★
D. Multi-stakeholder collaboration	D-1 Convening and operating Task Force and Multi-Stakeholder Platform meetings	★	★	★	★	★	★
	D-2 Strengthening local social capital (cohesion and leadership) and capacity (planning and action)	★	★	★	★	★	★
	D-3 Building up a community-based form of co-management, between government and community (cross-sector), community and community (cross-border)	★	★	★	★	★	★
	D-4 Promoting national forest co-management with local people: patrol in mountain forests, sustainable use of forest products, prevention of alien species		★			★	★
	D-5 Consensus on guarding ancestral properties and sale of land					★	★
E. Socio-economic benefits	E-1 Ecological engineering for disaster risk reduction and climate change adaptation (slope erosion/flood/ landslide/storm)		★	★			
	E-2 Maintaining quality/quantity of natural stream water for drinking and irrigation		★		★	★	★
	E-3 Ecological engineering for terraced fields, irrigation ditches and agricultural roads			★		★	★
	E-4 Settlement greening and facility enhancement		★	★			
	E-5 Community eldercare services, local medical services				★		
	E-6 Promoting green labelling schemes to add value to environmentally friendly products	★	★				
	E-7 Upgrading agricultural products processing equipment and enhancing marketing ability	★					
	E-8 Promoting eco-cultural tourism and native art	★	★	★	★	★	★
	E-9 Promoting local food products through community-based ecotourism and Xinshe Elementary School's food and agriculture education activities	★					
	E-10 Promoting landscape art and activities that feature local SEPLS characteristics		★				

Note: (1) This table lists only primary jobs organized by Task Force members (the three bureaus under COA and two local tribes); (2) NDHU is also a member of Task Force, whose main job is giving assistance to tasks A12, D1-D3.

Chapter 10

Direct use values and nutritional potential of selected wild edible plants from Teso-Karamoja Region, Uganda

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Abstract

The use of wild edible plants is steadily being limited by biodiversity loss. This study therefore sought to investigate the instrumental value of nature in terms of wild edible plant species, their direct use values and the nutritional potential of selected wild edible plant species in the landscapes of the Teso-Karamoja region of Uganda. An assessment of the opportunities, challenges and biodiversity benefits of maintaining these landscapes was also made. Semi-structured questionnaires, focus group discussions and field excursions were used to collect data in the field, and laboratory analysis performed following standard methods. Data was analyzed using relative frequency of citation indices, factor of informant consensus indices and one-way ANOVA. A total of 99 wild edible plant species in 78 genera and 45 families has been documented. The nutritional potential of five species, namely *Vigna kirkii* (Baker) J.B. Gillett, *Maerua angolensis* DC., *Leptadenia hastata* (Schumach. & Thonn.) Decne, *Senna obtusifolia* (L.) H.S. Irwin & Barneby, and *Dioscorea* sp., was significantly different at the p=0.05 level. The highest moisture content was 80.74±0.34%/100g in *V. kirkii*, ash content was 3.95±0.23%/100g in *M. angolensis*, gross energy was 19.04±370.65Kcal in *M. angolensis,* dietary fibre was 27.93±0.85%/100g in *L. hastata*, and crude fat was 3.40±0.13%/100g in *L. hastata*. Likewise, carbohydrate content was 65.43±2.91g/100g in *Dioscorea* sp., crude protein was 36.37±0.42%/100g in *M. angolensis,* ascorbic acid was 14.71±3.56mg/100g in *M. angolensis* and beta-carotene was 1082.12±0.08µg/100g in *S. obtusifolia*. The direct use values of wild edible plants include food (99 species), medicine (17 species), woodfuel (39 species), wine (10 species), construction materials (13 species), timber (8 species), crafts (17 species), fodder (3 species), fibre (14 species) and gum (8 species). Species such as *B. aegyptiaca, T. indica* and *V. paradox*a have multiple direct use values. Therefore, a high diversity of wild edible plant species with potential to enhance human well-being exists in the Teso-Karamoja region. This implies that various opportunities can be harnessed from the biodiversity benefits of maintaining landscapes in this region. However, the deteriorating state of the landscapes due to anthropogenic activity is one challenge that needs to be overcome. This inevitably requires adoption of methods to conduct regular assessment and monitoring of the impacts on these landscapes. These findings can be used to create awareness about the nutritional potential of selected species and incentivize the stewardship of species and landscapes in the Teso-Karamoja

region of Uganda. Microlevel domestication initiatives, adoption of improved cook stoves and clean energy sources, as well as streamlining the collection, value addition and marketing of natural products, need to be prioritized in this region.

Keywords: Direct Use Values, Wild Edible Plants, Nutritional Potential, Landscapes, Teso-Karamoja Region, Uganda

Country	Uganda
Province	Eastern
District	Abim, Moroto, Napak, Nakapiripirit, Katakwi, Serere and Kaberamaido
Size of geographical area [1]	124,180 hectares
Number of indirect beneficiaries [2]	25,000 persons
Dominant ethnicity	Acholi-Labwor, Tepeth, Bokora, Kadamites, Iteso and Kumam

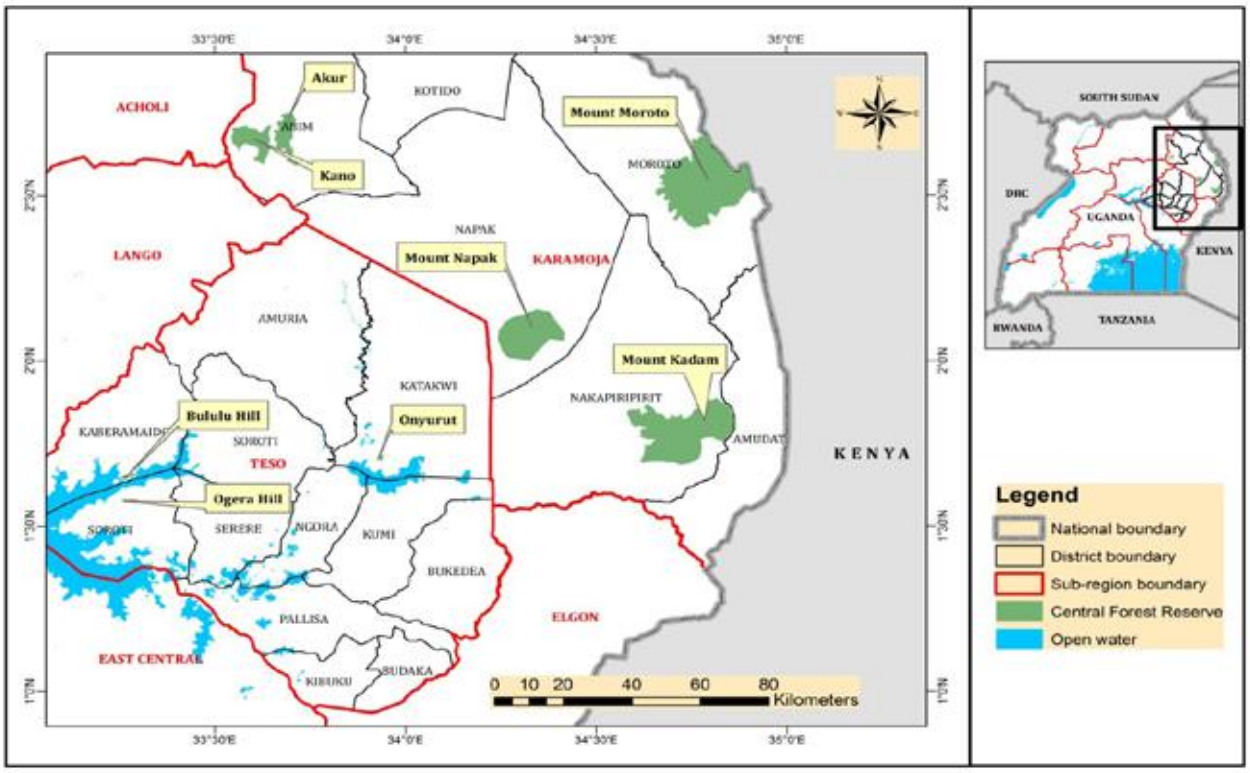

Figure 1. Map of Uganda and case study region.

Size of case study/project area [1]	124,180 hectares
Number of direct beneficiaries [2]	240 persons
Geographic coordinates (longitude and latitude)	2°42'24.1"N 33°39'34.3"E 1°41'46.8"N 33°12'49.9"E 1°29'49.2"N 33°23'36.6"E 1°58'23.2"N 34°03'50.9"E 1°57'38.2"N 34°35'49.7"E 2°21'46.8"N 34°14'31.7"E 2°31'60.0"N 34°45'60.0"E
Dominant ethnicity	Acholi-Labwor, Tepeth, Bokora, Kadamites, Iteso and Kumam

Figure 2. Land cover map of case study site (Source: Google Maps)

1. Introduction

People conceptualize the "value" of nature as either principles or core beliefs underpinning rules and moral judgement, importance and preferences for something or a particular metric, indicator or symbol (Gonzalez-Jimenez et al. 2018). These values are determined by local, cultural, socio-economic and ecological contexts, shaped by human experiences and change across spatio-temporal dimensions (Gonzalez-Jimenez et al. 2018). Piccolo (2017) summarizes the value of nature into three categories, namely intrinsic (inherent value of nature and its components), instrumental (nature's contribution to human well-being) and relational (human-nature relationships).

One example of instrumental value is the consumption of wild edible plants to enhance human well-being. This practice is common in most African communities (Maroyi 2011) and these plants enable communities to cope with food scarcity (IPC 2017). As a result, they make up a significant proportion of the global food basket (Bharucha & Pretty 2010). Approximately one billion people globally supplement their diets using wild edible plants (Shumsky et al. 2014). Such plants also hold great cultural significance (Shad, Shah & Bakht 2013) and greatly increase the nutritional quality of rural human diets (Msuya, Kideghesho & Mosha 2010). Some of them contain genes that can improve the productivity of domesticated crops (Gockowski et al. 2003). In addition, their sale bolsters household incomes (Maroyi 2011).

Notwithstanding the potential of wild edible plants, their diversity and associated indigenous knowledge globally has not been sufficiently documented (Karjalainen, Sarjala & Raitio 2010). This is worsened by the rampant loss of biological resources (Bhattarai, Chauldhary & Taylor 2007) and erosion of the associated indigenous knowledge (Alves & Rosa 2007). It has been estimated that one in every five plants is at risk of extinction globally (Bachman et al. 2016). In the Teso-Karamoja region, it has been reported that 77%, 66% and 45% of the natural vegetation cover has been lost in the districts of Katakwi, Kotido and Kaberamaido respectively (Drichi 2003).

Although ethnobotanical surveys have been conducted in Uganda (Kakudidi, Bukenya-Ziraba & Kasenene 2004, Agea et al. 2011), the diversity of species in the different locales has not been comprehensively established, largely because the species used are determined by local culture and location (Bortolotto et al. 2015). Therefore, this study was designed to examine the diversity of wild edible plant species, their direct use values and the nutritional potential of five commonly used species in the Teso-Karamoja region of Uganda. This region is comprised mainly of the dryland landscape of Uganda (cattle corridor) and is an important socio-ecological production landscape (SEPL) (Olupot 2015). The drylands are a dry belt stretching between the country's North eastern and South western borders with an area of 84,000 km^2 (Olupot 2015). However, this study was only conducted in the North eastern (Teso-Karamoja) region due to information paucity created by cultural and biogeographical diversity, rampant food scarcity (IPC 2017) and few botanical surveys due to a history of armed conflicts (Kalema 2005). This study also highlights the challenges, opportunities and biodiversity benefits of maintaining landscapes in the region, futuristic assessment and monitoring of impacts, and the institutional framework involved in the management of these landscapes.

2. Materials and Methods

2.1 Study area

The study was conducted in eight forest reserves of the Teso-Karamoja region (see Fig. 1 and 2), namely Onyurut, Bululu Hill and Ogera Hills (Teso); and Akur, Kano, Mount Napak, Mount Kadam and Mount Moroto (Karamoja). These forest reserves are found in the dryland landscape and are identified as a SEPL in Uganda (Olupot 2015). The SEPL is comprised of mainly woodlands, grasslands and shrublands (Drichi 2003) (see Fig. 3). This dryland landscape is popularly referred to as the "cattle corridor" and stretches from the South western to the North eastern parts of the country. However, this study was conducted in the North eastern part only. The forest reserves studied have ecological and biodiversity conservation importance (National Forestry Authority 2005). In terms of climate, Teso experiences a humid and hot climate with rainfall between 1,000-1,350 mm annually (Egeru 2012). On the other hand, Karamoja is mainly comprised of semi-arid lands inhabited by pastoralists and agro-pastoralists (Egeru et al. 2014). It receives variable and unpredictable rainfall between 500-800 mm annually (Egeru et al. 2014).

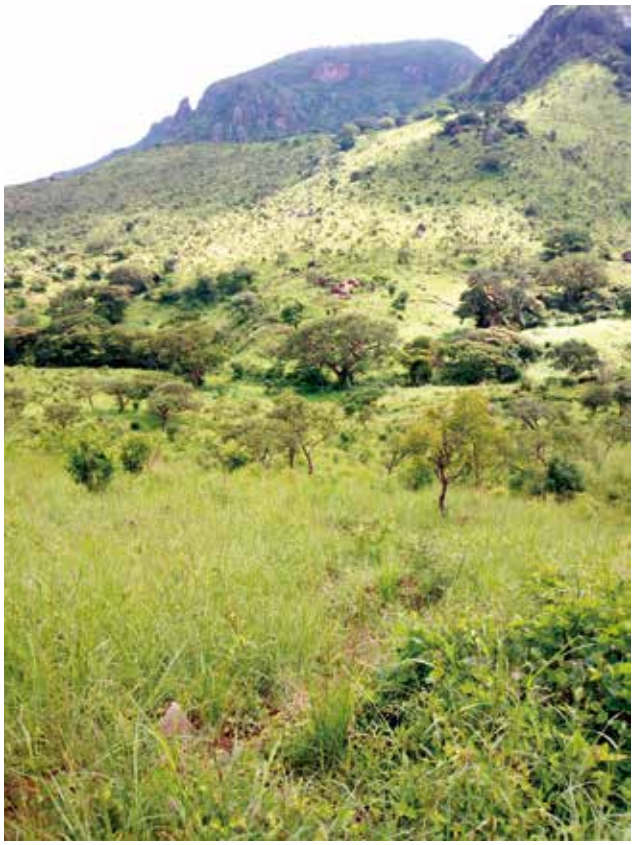

Figure 3. Human settlement in the savannahs on slopes of Mount Moroto, Uganda

2.2 Ethnobotanical survey

Semi-structured questionnaires, focus group discussions and field excursions were used to collect ethnobotanical data, namely species identity and uses. The questionnaires were administered to 240 respondents in and around the eight forest reserves of the Teso-Karamoja region (see Fig. 2) between November 2017 and May 2018. Focus group discussions were conducted to corroborate responses in the questionnaires, while field excursions were undertaken to collect the voucher specimens of the enumerated wild edible plants. Voucher specimens were identified at Makerere University Herbarium. The five wild edible plants for laboratory analysis were selected based on (i) high frequency of use, (ii) paucity of information on the nutritional potential, and (iii) use as ingredients for making local sauces.

Figure 4. Commonly used wild leafy vegetables; A (L. hastata), B (V. kirkii) C (S. obtusifolia) and D (M. angolensis)

2.3 Laboratory analysis

Analysis of the nutritional composition of four leafy vegetables (see Fig.4) and a tuber was carried out in triplicate following standard methods: Moisture content (AOAC 2016), Ash content (AOAC 1996), Protein (Kirk & Sawyer 1991), Crude fat (AOAC 2016), Dietary fibre (Kirk & Sawyer 1991), Carbohydrate (Nielsen 2003), Gross energy (AOAC 1995), Ascorbic acid (Kirk & Sawyer 1991) and Beta-carotene (De Ritter & Purcell 1981).

2.4 Data analysis

The Relative Frequency of Citation (Tardio & Pardo-de-Santayana 2008) and the Informant Consensus Factor (Trotter & Logan 1986) were determined for each species and use category respectively. The statistical difference in the means of macro-element, ascorbic acid and beta-carotene content was analyzed using one-way ANOVA at $P<0.05$ in SPSS vers. 16.0.

3. Results

3.1 Socio-economic characteristics of respondents

A total of 54% female and 46% male respondents were interviewed. They had varying levels of education, whereby 36% had no formal education, 42% primary level, 19% secondary level and only 3% tertiary level. The respondents were comprised of 91% peasant farmers rearing livestock and/or growing crops, 4% petty traders, and 3% fishers, while 2% were civil servants.

3.2 Diversity of wild edible plant species

A total of 99 wild edible plant species in 78 genera and 45 families (Appendix 1) was recorded. These species are in five lifeforms, namely trees, forbs, shrubs, climbers and graminoids, corresponding to 35%, 29%, 26%, 9% and 1% respectively. The families with the highest representation of species are Fabaceae, Moraceae and Malvaceae, each with at least six species each.

3.3 Nutritional potential of the five wild edible plant species

The five wild edible plant species selected for analysis of nutritional potential are shown in Table 1. Table 2, on the other hand, presents the mean values for the macro-element, ascorbic acid and beta-carotene content for each species. A one-away ANOVA test of the means of species showed a significant difference at the $P<0.05$ level for all the parameters.

Table 1: Five wild edible plant species from Teso-Karamoja for laboratory analysis
Key: RFC=Relative frequency of citation

Family	Scientific name	RFC	Edible parts
Apocynaceae	*Leptadenia hastata*	0.06	Leafy vegetable
Dioscoreaceae	*Dioscorea* sp.	0.19	Tuber
Capparaceae	*Maerua angolensis*	0.20	Leafy vegetable
Fabaceae	*Vigna kirkii*	0.03	Leafy vegetable
	Senna obtusifolia	0.03	Leafy vegetable

Table 2: Macro-element, ascorbic acid and beta-carotene content of five wild edible plant species from Teso-Karamoja region, Uganda

Wild edible plant species					
Parameter (/100g)	*Leptadenia hastata*	*Senna obtusifolia*	*Maerua angolensis*	*Vigna kirkii*	*Dioscorea sp.*
Moisture content (%)	79.30±0.20	78.86±0.38	66.09±0.19	80.74±0.34	59.36±0.82
Dietary fibre (%)	27.93±0.85	16.93±2.54	12.42±0.26	21.46±0.58	2.74±0.24
Carbohydrate (g)	22.45±1.96	25.27±1.18	23.77±2.02	17.32±0.40	65.43±2.91
Ash content (%)	2.84±0.10	2.37±0.10	3.95±0.23	2.60±0.01	0.63±0.03
Gross energy (KCal)	18.40±56.69	19.03±903.25	19.04±370.65	18.49±73.13	16.17±91.26
Crude fat (%)	3.60±0.13	2.02±0.09	0.94±0.03	2.72±0.18	0.08±0.02
Crude protein (%)	19.14±0.26	27.26±0.12	36.39±0.42	28.37±0.42	7.17±0.17
Ascorbic acid (mg)	6.89±1.33	10.77±2.70	14.71±3.56	7.62±0.54	8.78±0.37
Beta-carotene (µg)	363.54±0.09	1082.12±0.08	817.31±0.05	965.14±0.01	5.15±0.01

3.4 Direct use values

The number of species in each direct use value is summarized in Figure 5. It is worth noting that some species have multiple direct use values. Such species include, but are not limited to *B. aegyptiaca, T. indica* and *V. paradoxa*. It is clearly evident that these wild edible plant species serve other multiple purposes in addition to the foods (spices, leafy vegetables, fruits, oils, seeds) derived from them.

4. Discussion

4.1 Diversity of wild edible plant species

The diversity of wild edible plant species (Appendix 1) identified by the local people in the Teso-Karamoja region demonstrates that they still rely on the wild plants for food. *Carissa spinarum* L, *Strychnos innocua* Delile, *Balanites aegyptiaca* (L) Delile, *Tamarindus indica* L. and *Ximenia*

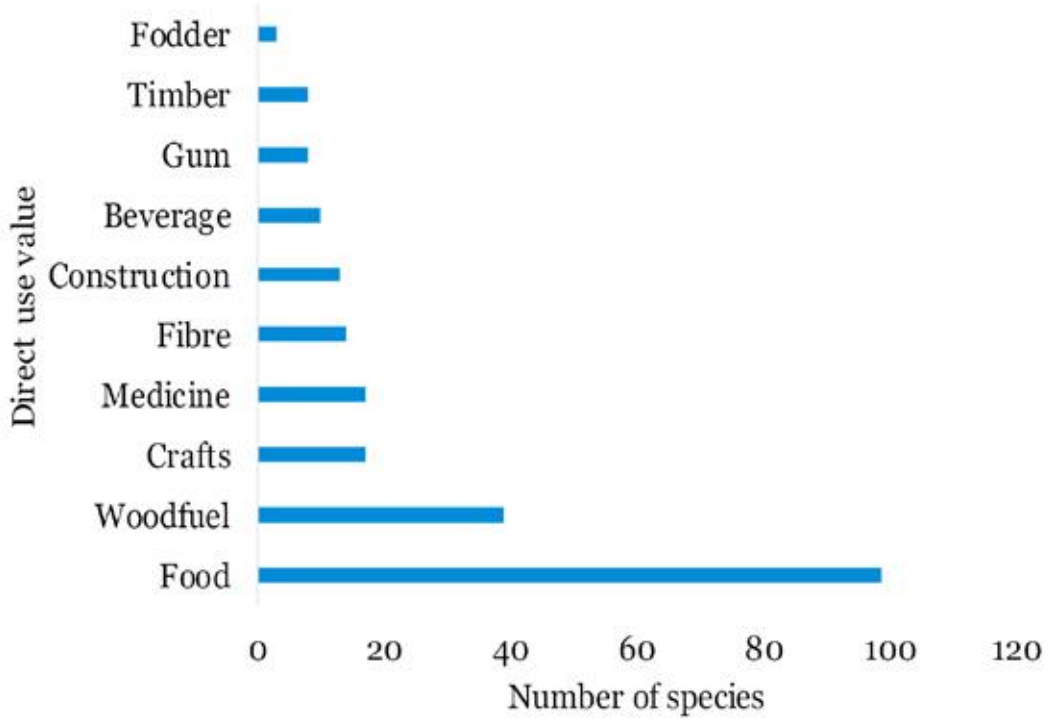

Figure 5: Number of wild edible plant species in each direct use value

americana L. were the most cited species. The Rubiaceae, Fabaceae, Anacardiaceae, Amaranthaceae and Moraceae families with the highest number of species are generally among the largest, economically important sources of food and are widespread in the tropics (Maroyi 2011). Trees are the dominant lifeform because the landscapes surveyed are woodlands.

4.2 Use and nutritional value of the five wild edible plants

The wild edible plants documented in this study are used are varying ways. The five major parts used categories are fruits, leafy vegetables, seeds, tubers and gum. Most of species produce edible parts that are eaten without cooking (64%), while the reminder (36%) require cooking or preparation. Some of the species eaten without cooking are fruits from *C. spinarum, Psilotrichum axilliflorum* Suess and *V. doniana*. The method of preparation depends on the edible parts. For instance, *V. kirkii* and *S. obtusifolia* leafy vegetable preparation starts with plucking young leaves, followed by wilting under direct sunlight for about 30 minutes, washing and then boiling. Thereafter, local salt called "*Abalang*" is added and then sodium chloride is added to give a good taste. The vegetable can be eaten at this stage, or with sour milk, groundnut or simsim paste added to spice it.

Nutritional parameters in food play different roles in the human diet. Moisture content determines the growth of micro-organisms (Nollet 2004) and the shelf life of food (Agea et al. 2014). All the leafy vegetables in this study have moisture content values between 59 and 80%/100g (see Table 2), which is within the acceptable range of 60-83% moisture content for vegetables (FAO 1986). The Adequate Intake (AI) for dietary fibre ranges from 19-29g per day for different life stages and groups (IOM 2005). Therefore, consuming 100g of *L. hastata* (27.93±0.85%/100g) per day supplies the AI for normal laxation in adults. The Recommended Daily Allowance (RDA) for carbohydrates for different life stages and groups ranges from 130-210 mg per day (IOM 2005). Thus, consuming 200g of *Dioscorea* sp. daily can ably meet the RDA of carbohydrates for healthy individuals aged 1-70. Ash content is the residue after burning and it represents the total amount of minerals within a food (Nielsen 2003). The lowest ash content was recorded in *Dioscorea* sp. (0.63%/100g), while the highest was in *M. angolensis* (3.95%/100g). The AI for crude fat in infants between 0-12 months (30-31g per day) is higher than the values obtained for all the wild edible plants from the Teso-Karamoja region. This conforms to earlier findings that leafy vegetables are inferior sources of crude fat (Agea et al. 2014). The RDA of protein for different life stages and groups ranges from 13-71g per day (IOM 2005). Therefore, consuming 200g of *M. angolensis* daily (36.39%/100g) supplies the RDA of protein for a lactating mother (71g per day). *Dioscorea* sp. (16.17Kcal) provides the lowest gross energy while *M. angolensis* provides the highest (19.94Kcal). However, there is no RDA for energy because energy intake that is above the Estimated Energy Requirement (EER) would be expected to result in weight gain (IOM 2005). The RDA of ascorbic acid for different life stages and groups aged 1-70 is 15-120mg per day (IOM 2005). Therefore, consuming 100g of *M. angolensis* (14.72mg/100g) daily can meet the RDA of individuals aged 1-3. The RDA for beta-carotene for different life stages and groups aged 1-70 is 300-1,300µg per day (IOM 2005). Thus, consuming 100g of *S. obtusifolia* (1,082µg/100g) meets the RDA of healthy males and females aged 9-70.

4.3 Direct use values

The consumption of wild edible plant species in the Teso-Karamoja region is highly valued due to: (i) hunger due to food scarcity, (ii) spicing staple foods, (iii) preservation of cultural practices, (iv) nutri-medicinal value and (v) their delicacy. *Zanthoxylum leprieurii* Guill. & Perr was a commonly mentioned nutri-medicinal plant for flavoring tea but also used in treating various ailments.

The direct use values of wild edible plants enhance human nutrition, healthcare, housing and energy (see Fig. 5). Earlier studies have also reported this pattern, for instance in Nepal, where 80 percent of 62 wild food plants have multiple uses (Shrestha & Dhillon 2006), and in the Mekong Delta and Central Vietnamese Highlands, where several wild food species are used as medicine and livestock feed and one-fifth are used as all the three (Ogle et al. 2003).

The direct use values of the wild edible plants offer opportunities, which include but are not limited to low-cost and low-input boost to human nutrition; enhancement of household incomes through the sale of natural products such as shea butter, gum Arabic, tamarinds, etc.; provision of employment opportunities especially to women and youth; sustainable harvesting of Non-Timber Forest Products (NTFP) and apiaries. In a nutshell, the landscapes in the Teso-Karamoja region make a vital contribution towards Ecosystem-based Adaptation (EbA).

The sustenance of values from these landscapes is however, being threatened by detrimental human activity. Examples of such anthropogenic activities include indiscriminate tree cutting for woodfuel (charcoal and firewood), clearing for agricultural expansion, as well as demand for land for settlement caused by the high population growth rate. Olupot (2015) observed that although wild resources such as fruit plants may be appreciated by local people in the Teso region, this has not translated into their active

retention, and instead resources are being decimated by unsustainable uses, for example wood over-exploitation. It has also been noted that weak forest management capacity has largely contributed to the poor state of forest reserves in Uganda (Obua, Agea & Ogwal 2010).

It ought to be noted that the benefits of maintaining biodiversity are enormous, although not well appreciated by many. As illustrated by some of the direct use values of wild edible plants in Figure 5, biodiversity has a huge potential to enhance the well-being of mankind, especially in rural smallholder communities. The species, landscapes and associated Traditional Ecological Knowledge (TEK) in the Teso-Karamoja region represent living libraries where cultural heritage is being preserved for posterity. The benefit of biodiversity in this region is even critical because the majority of the population are peasants predominantly engaged in rain-fed subsistence agriculture. In addition to Figure 5, plant diversity in this region also offers services such as nutrient cycling, eco-tourism opportunities, and maintenance of water quality in the rivers running through the mountainous and hilly areas of Moroto, Nakapiripirit, Kano and Akur, as well as the water catchment areas of Lakes Bisina, Opeta and Kyoga.

4.4 Assessment and monitoring of values and benefits

The design of effective conservation actions is premised on accurate biodiversity information (Lovett et al. 2000). In order to generate this information in the landscapes of the Teso-Karamoja region, a mixture of methods ought to be pursued. For instance, spatio-temporal surveys of key indicator taxa, such as vascular plants, birds and arthropods, can offer vital information on species richness and diversity. Furthermore, measures of landscape structure, land use change as well as intensity of human activity are pertinent. This combined with remote sensing can help assess the spatio-temporal aerial extent of these landscapes.

In terms of assessing the value of nature in these landscapes, different methods can as well be used. These include but are not limited to: (i) ecological valuation such as field visits and species richness, (ii) socio-cultural valuation such as ethnographic studies, participatory approaches, interviews, cartography, etc. and (iii) economic valuation such as choice experiments. As a precaution, when planning for value assessment, it is pertinent to recall that the choice of valuation methods is not only a technical but also a political decision because underlying worldviews will determine which types of value, valuation approaches and methods may be perceived as appropriate in any given context (Gonzalez-Jimenez et al. 2018).

4.5 Institutional frameworks on management of landscapes

The level of awareness and adoption of the concept of Socio Ecologically Productive Landscapes (SEPLs) in the Teso-Karamoja region (Uganda at large) is still in its infancy. The institutions include clans with clan elders as custodians of TEK and advocates of principles and values, and cultural institutions such as the Iteso Cultural Union and Karamoja Women Cultural Group. These advocate for the preservation of TEK for posterity. Recently, the concept of SEPLs has been championed by Nature and Livelihoods, a civil society organization in the Teso region. This is now followed by another organization, Save Aseed for the Future (SAFE), in this region. At the national level, the epitome of this movement was the formation of the Satoyama Initiative National Network (SINN) for Uganda in 2016. On the side of government, both local and national institutions exist to advocate for the protection and sustainability of biodiversity and ecosystems. These include local government departments, parastatal bodies like the National Environment Management Authority (NEMA), the Uganda Wildlife Authority (UWA), National Forestry Authority (NFA), and ministries such as the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) and directorates.

Appreciation of the value of nature has elicited various decisions and actions. These include among others, parkland farming systems; cultural beliefs and ethics attached to individual species; community by-laws; home and kitchen gardens; local government ordinances; afforestation and reforestation programs; adoption of improved cook stoves; environmentally-friendly sources of income like bee-keeping; clean energy sources like solar energy; research and development of natural products; trade in natural products like gum Arabic, shea nuts, shea butter, tamarinds and desert dates; protected areas like forest reserves; legislation such as the National Forestry and Tree Planting Act 2003; and ratification of international conventions, targets and agreements such as the Aichi Biodiversity Targets.

5. Conclusion and recommendations

A high diversity of wild edible plant species and direct use values exist in the Teso-Karamoja region of Uganda. The nutritional potential of the five wild edible plant species analyzed can be harnessed to bolster human nutrition among communities in the region. Generally, the wild edible plants encountered in this region contribute to improving human well-being. Opportunities are, however, being threatened by a number of challenges that need to be addressed. It is therefore recommended that (not in order of relevance):

i. a handbook of wild edible plants and their values is produced for this region as a step towards preserving cultural heritage for posterity. This will give ownership of Indigenous Knowledge to this community in the event of any bioprospecting agreement.

ii. awareness is raised regarding the nutritional potential of the wild edible plants investigated. This will greatly improve their appreciation and stimulate the protection of individual species and the landscapes where they are found.

iii. mineral content and anti-nutrient profiling is carried-out on these wild edible plant species.

iv. assessment of the multiple values of nature in the landscapes of the Teso-Karamoja region is carried out in order to reveal power asymmetries in land use and in decision-making. It is envisaged that this will promote formulation of equitable and just development-related decisions.

v. microlevel domestication initiatives for key wild edible plants are encouraged and supported. This can be through vegetable gardens, kitchen gardens, parklands and home gardens.

vi. the collection, value addition and marketing of natural products such gum Arabic, shea nuts, and tamarinds are streamlined. This will contribute to the bolstering of community incomes and eventually to incentivizing the stewardship of the landscapes where these species are found.

vii. improved cook stoves and clean energy are promoted widely in the region in order to reduce the felling of wild edible plants (especially trees) for woodfuel (firewood and charcoal).

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Appendix 1: Diversity and direct use values of wild edible plant species from Teso-Karamoja region, Uganda

Key: RFC = Relative Frequency of Citation, , NF= English name Not Found

Family	Scientific name	Name (English)	RFC	Lifeform	Direct use values
Acanthaceae	Asystasia mysorensis (Roth) Anders.	NF	0.03	Forb	Leafy vegetable
	Justicia flava (Forssk.) Vahl	NF	0.03	Forb	Leafy vegetable, fruit
Amaranthaceae	Amaranthus graecizans L.	Mediterranean amaranth	0.01	Forb	Leafy vegetable leaves are anthelmintic
	Amaranthis hybridus L. subsp. cruentus (L) Thell	NF	0.01	Forb	Leafy vegetable
	Amaranthus spinosa L.	NF	0.01	Forb	Leafy vegetable
	Amaranthus spinosus L.	NF	0.01	Forb	Leafy vegetable, leaves treat diarrhoea
	Psilotrichum axilliflorum Suess.	NF	0.13	Shrub	Fruit
Anacardiaceae	Mangifera indica L.	Mango	0.16	Tree	Fruit, firewood, timber, juice
	Sclerocarya birrea (A.Rich) Hochst.	Marula	0.23	Tree	Fruit, wine, timber
	Searsia pyroides (Burch.) Moffett	NF	0.17	Shrub	Fruit, stems used as toothbrushes, woodfuel
	Searsia ruspolii (Engl.) Moffett	NF	0.17	Shrub	Fruit, stems used as toothbrushes, woodfuel
Annonaceae	Annona senegalensis Pers.	Wild custard apple	0.09	Shrub	Fruit, tool handles, woodfuel
	Monanthotaxis buchananii (Engl.) Verdc	Buchanan's dwaba-berry	0.12	Shrub	Fruit
Apocynaceae	Carissa spinarum L.	Carrisse	1	Shrub	Fruit, wine, anthelmintic, woodfuel
	Ceropegia johnstonii (N.E.Br.) Bruyns	NF	0.1	Forb	Tuber
	Leptadenia hastata (Schumach. & Thonn.) Decne	NF	0.06	Climber	Leafy vegetable
	Saba comorensis (Bojer) Pichon	Rubber vine	0.25	Tree	Fruit, eating fruits cures pimples, white latex
Araceae	Colocasia esculenta (L.) Schott	Taro	0.01	Forb	Tuber
Arecaceae	Borassus aethiopum Mart.	African fan palm	0.04	Tree	Fruit, beehives from stem, oil, thatch material
Asparagaceae	Asparagus flagellaris (Kunth) Baker	NF	0.13	Forb	Leafy vegetable
Asteraceae	Lactuca inermis Forsk.	NF	0.04	Forb	Leafy vegetable
Basellaceae	Basella alba L.	Indian spinach	0.1	Climber	Leafy vegetable
Boraginanceae	Cordia monoica Roxb.	Snot berry	0.01	Tree	Fruit, woodfuel, poles, tool handles
Brassicaceae	Arabis alpina L.	Alpine rock cress	0.01	Forb	Leafy vegetable
Cactaceae	Opuntia monacantha (Willd.) Haw.	Drooping prickly pear	0.01	Tree	Fruit
Capparaceae	Capparis fascicularis DC.	Zigzag caper-bush	0.09	Shrub	Leafy vegetable
	Cleome sp.	NF	0.03	Forb	Leafy vegetable
	Maerua angolensis DC.	Bead-bean	0.2	Shrub	Leafy vegetable, treats epilepsy, woodfuel
Caricaceae	Carica papaya L.	Pawpaw	0.1	Tree	Fruit
Celastraceae	Catha edulis Forsk.	Bushman's tea/Khat	0.06	Shrub	Leafy vegetable
Cucurbitaceae	Cucumis ficifolius A. Rich.	NF	0.06	Climber	Fruit
	Cucurbita sp.	NF	0.06	Climber	Leafy vegetable, fruit
	Momordica foetida Schum.	NF	0.01	Forb	Leafy vegetable

Family	Scientific name	Name (English)	RFC	Lifeform	Direct use values
Dioscoreaceae	Dioscorea bulbifera L.	Aerial yam	0.04	Climber	Tuber
	Dioscorea sagittifolia (De Wild.) Nkounkou	NF	0.1	Climber	Tuber
	Dioscorea sp.	NF	0.19	Climber	Tuber
Ebenaceae	Euclea divinorum Hiern	Magic gwarra	0.03	Tree	Fruit, leaves treat diarrhoea
	Diospyros abyssinica (Hiern) F.White	Giant diospyros	0.06	Tree	Seed, woodfuel, tool handles
	Diospyros mesipiliformis	West African ebony	0.07	Tree	Fruit, gum from bark, woodfuel, furniture
	Diospyros sp.	NF	0.13	Tree	Fruit, woodfuel, tool handles
Fabaceae	*Senegalia senegal* (L.) Britton	Gum Arabic	0.01	Tree	Gum, roots treat dysentery, woodfuel
	Crotalaria sp.	NF	0.03	Forb	Leafy vegetable
	Rhynchosia goetzei Harms	NF	0.01	Shrub	Leafy vegetable
	Senna obtusifolia (L.) H.S.Irwin & Barneby	Sicklepod	0.03	Forb	Leafy vegetable, leaves are anthelmintic
	Tamarindus indica L.	Tamarind	0.52	Tree	Fruit, juice and wine, woodfuel, tool handles
	Vigna kirkii (Baker) J.B.Gillett	NF	0.03	Climber	Leafy vegetable
Hydnoraceae	Hydnora abyssinica A.Br.	NF	0.14	Shrub	Fruits
Lamiaceae	Hoslundia opposita Vahl	Kamyuye	0.03	Forb	Fruit, woodfuel (firewood)
	Ocimum gratissimum L.	Clove Basil	0.01	Forb	Fruits
	Vitex doniana Sweet	Black plum	0.38	Shrub	Fruit, wine from fruits, timber, woodfuel
	Vitex madiensis Oliv.	Rough fingerleaf	0.14	Tree	Fruit, wine from fruits, timber, woodfuel
Loganiaceae	Strychnos innocua Delile	Monkey orange	0.84	Shrub	Fruit, wine from fruits, woodfuel, poles
	Strychnos spinosa Lam.	Kaffir Orange	0.06	Shrub	Fruit, wine from fruits, woodfuel, poles
	Strychnos sp.	NF	0.01	Tree	Fruit, woodfuel, poles
Malvaceae	Grewia mollis Juss.	NF	0.19	Shrub	Fruit, woodfuel, fibre (bark), gum (root bark), poles, sticks
	Grewia trichocarpa Hochst. ex A. Rich.	Raisin bush	0.03	Tree	Fruit, fibre, poles, tool handles, woodfuel
	Grewia villosa Willd.	Mallow raisin	0.38	Shrub	Fruit, fibre, making granaries and sticks
	Hibiscus acetosella Welw. ex Fic.	False roselle	0.01	Shrub	Flowers and leaves used for tea making
	Hibiscus cananabinus L.	Kenaf	0.03	Forb	Leafy vegetable, seeds roasted and pound
	Sterculia setigera Del.	NF	0.04	Tree	Seeds, oil, fibre, gum, bark treats snakebites
Moraceae	Ficus amadiensis De Wild.	NF	0.23	Tree	Fruit, latex (gum), woodfuel
	Ficus ingens (Miq.) Miq.	Red-leaved rock fig	0.1	Tree	Fruit, latex (gum), woodfuel
	Ficus mucuso Welw. ex Ficalho	Mulberry fig	0.33	Tree	Fruit, latex, woodfuel
	Ficus natalensis Hochst.	Natal fig	0.01	Tree	Fruit, latex from bark, fibre, woodfuel
	Ficus ovata Vahl	NF	0.01	Tree	Fruits, fibre from bark, latex, woodfuel
	Ficus platyphylla Del.	Broadleaf fig	0.03	Tree	Fruit, latex from bark, woodfuel
	Ficus thonningii Bl.	Strangler fig	0.06	Tree	Fruit, woodfuel, latex, timber, woodfuel
Musaceae	Musa paradisiaca L.	Plantain	0.01	Forb	Fruit, fibre, crafts

Family	Scientific name	Name (English)	RFC	Lifeform	Direct use values
Myrtaceae	Psidium guajava L.	Guava	0.01	Shrub	Fruit, woodfuel
Passifloraceae	Passiflora edulis Sims	Passion fruit	0.1	Climber	Fruit
Pedaliaceae	Sesamum angustifolium (Oliv.) Engl	Wild simsim	0.03	Forb	Leafy vegetable
Phyllantanceae	Bridelia scleroneura Müll. Arg.	Assas	0.13	Tree	Fruit, wine, woodfuel, poles
Poaceae	Oxytenanthera abyssinica (A.Rich.) Munro	Savanah bamboo	0.01	Grass	Leafy vegetable, construction materials, tool handles
Polygonaceae	Oxygonum sinuatum (Hochst. & Steud. ex Meisn.)	Wavy-Leaf oxygonum	0.03	Forb	Leafy vegetable
Rhamnaceae	Ziziphus mucronata Willd.	Buffalo thorn	0.22	Shrub	Fruit, roots treat snakebites, poles, reeds
Rubiaceae	Afrocanthium lactescens (Hiern) Lantz	Gummy canthium	0.1	Shrub	Fruit, poles and tool handles, woodfuel
	Catunaregam nilotica (Stapf) Tirveng.	NF	0.16	Shrub	Fruit, woodfuel
	Mitragyna stipulosa (DC.) Kuntze	African linden	0.01	Tree	Fruits, leaves treat cough, woodfuel
	Gardenia ternifolia Schumach. & Thonn.	Large-leaved common gardenia	0.03	Tree	Fruit, firewood, making tool handles
	Rytigynia neglecta (Hiern) Robyns	NF	0.01	Tree	Fruit
	Vangueria apiculata K.Schum.	Triangle-flowered wild-medlar	0.26	Tree	Fruit, woodfuel, leaves treat stomach-ache
Rutaceae	Zanthoxylum leprieurii Guill. & Perr.	Satinwood	0.04	Tree	Bark, roots and leaf treat measles, woodfuel
Salicaceae	Dovyalis abyssinica (Rich.) Warb.	Abyssinian gooseberry	0.2	Shrub	Fruit, woodfuel, bedsteads, hand tools
	Oncoba spinosa Forssk	Snuff box tree	0.06	Shrub	Fruit, edible oil from seeds
Sapindaceae	Allophylus rubifolius (Hochst. ex A. Rich.) Engl.	Lowveld false-currant	0.07	Shrub	Fruit
Sapotaceae	Vitellaria paradoxa C.F.Gaertn.	Shea butter tree	0.22	Tree	Fruit, oil (edible and cosmetics), woodfuel, boats, poles, gum, timber
Solanaceae	Capsicum frutescens L.	Tabasco pepper	0.07	Forb	Fruit, leafy vegetable, fruits treat intestinal worms
	Physalis lagascae Roem. & Schult.	Cape gooseberry	0.01	Forb	Fruit, crushed leaves relieve joint pains
	Physalis peruviana L.	Goldenberry	0.06	Forb	Fruit, leaf juice treats intestinal worms
	Solanum lycopersicum L.	Tomato	0.09	Forb	Fruit
Verbenaceae	Lantana camara L.	Wild sage	0.06	Shrub	Fruit, firewood, roofing reeds, hedges
	Lippia abyssinica (Otto & A.Dietr.) Cufod.	Koseret	0.03	Forb	Seeds
Vitaceae	Cyphostemma cyphopetalum (Fresen.) Desc.	NF	0.07	Climber	Vegetable
Xanthorrheaceae	Aloe sp.	NF	0.01	Forb	Leafy vegetable, medicine (various ailments)
Ximeniaceae	Ximenia americana L.	Tallow wood	0.43	Tree	Fruit, leaves treat headache, seeds treat snakebite, woodfuel
Zingiberaceae	Curcuma longa L.	NF	0.19	Forb	Fruit
Zygophyllaceae	Balanites aegyptiaca (L.) Delile	Desert date	0.64	Tree	Leafy vegetable, fruit, hand tools, poles, oil, woodfuel
	Balanites rotundifolia (van Tiegh.) Blatter	NF	0.03	Tree	Fruit, hand tools, poles, woodfuel, fodder
	Tribulus terrestris L.	NF	0.01	Forb	Leafy vegetable

Chapter 11

Re(Connecting) with the Ifugao Rice Terraces as a socio-ecological production landscape through youth capacity building and exchange programs: A conservation and sustainable development approach

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Abstract

The Ifugao Rice Terraces (IRT) in the Philippines was inscribed as a World Heritage Site in 1995 by the United Nations Educational, Scientific and Cultural Organization. In 2005, the Food and Agriculture Organization of the United Nations also designated it as a Globally Important Agricultural Heritage Systems (GIAHS) site, the first in the Philippines. Despite these recognitions, the IRT faces various challenges such as under-management of biocultural diversity and socio-ecological systems, poor maintenance, abandonment of rice terraces, unregulated tourism activities, and out-migration of young Ifugaos. To address these challenges, rehabilitation efforts and initiatives have been initiated by various sectors to restore conditions in the IRT and aid in its conservation and sustainable development. This paper examined the youth capacity building and exchange program which intended to reconnect Ifugao youths and connect urban youths with the IRT as a socio-ecological production landscape (SEPL). The youth capacity building and exchange program was implemented to address the knowledge transfer and out-migration problems confronting the IRT. Through a conservation and sustainable development approach, the program was executed in four phases: needs analysis, development of tablet-based training modules, youth training and exchange program, and contextualization of the training modules. The needs analysis indicated that the youths are still interested in being involved in the conservation and sustainable development of the IRT as a SEPL

and recommended the integration of digital platforms to help them understand and appreciate their culture better. Based on these needs, experts from collaborating universities developed tablet-based training modules with the following topics: IRT as a Satoyama Landscape; Ecosystem Services of the IRT Landscape; Sustainable Development in the IRT; My Culture, My Nature and My Heritage; and, IRT as a Satoyama Landscape in the 21st Century. Results showed that Ifugao youths revisited the importance and value of IRT; however, there were overlooked values (e.g. traditional knowledge and living in harmony with nature). Additionally, these youths reported that they see the IRT only for its aesthetic and global designations value. On the other hand, the urban youths were able to connect to the knowledge and value systems of the Ifugao culture, through the exchange program, thus, enabling them to learn the values of Ifugao towards IRT and nature. It is recommended that the program be expanded to other youths in the IRT landscape and other SEPLs.

Keywords: capacity building, exchange program, conservation, sustainable development, Ifugao Rice Terraces, tablet-based learning

Country	Philippines
Province	Ifugao
District	Batad (Banaue), Hungduan, Kiangan and Mayoyao
Size of geographical area	250,630 hectares
Number of indirect beneficiaries	202,802 persons
Dominant ethnicity	Tuwali

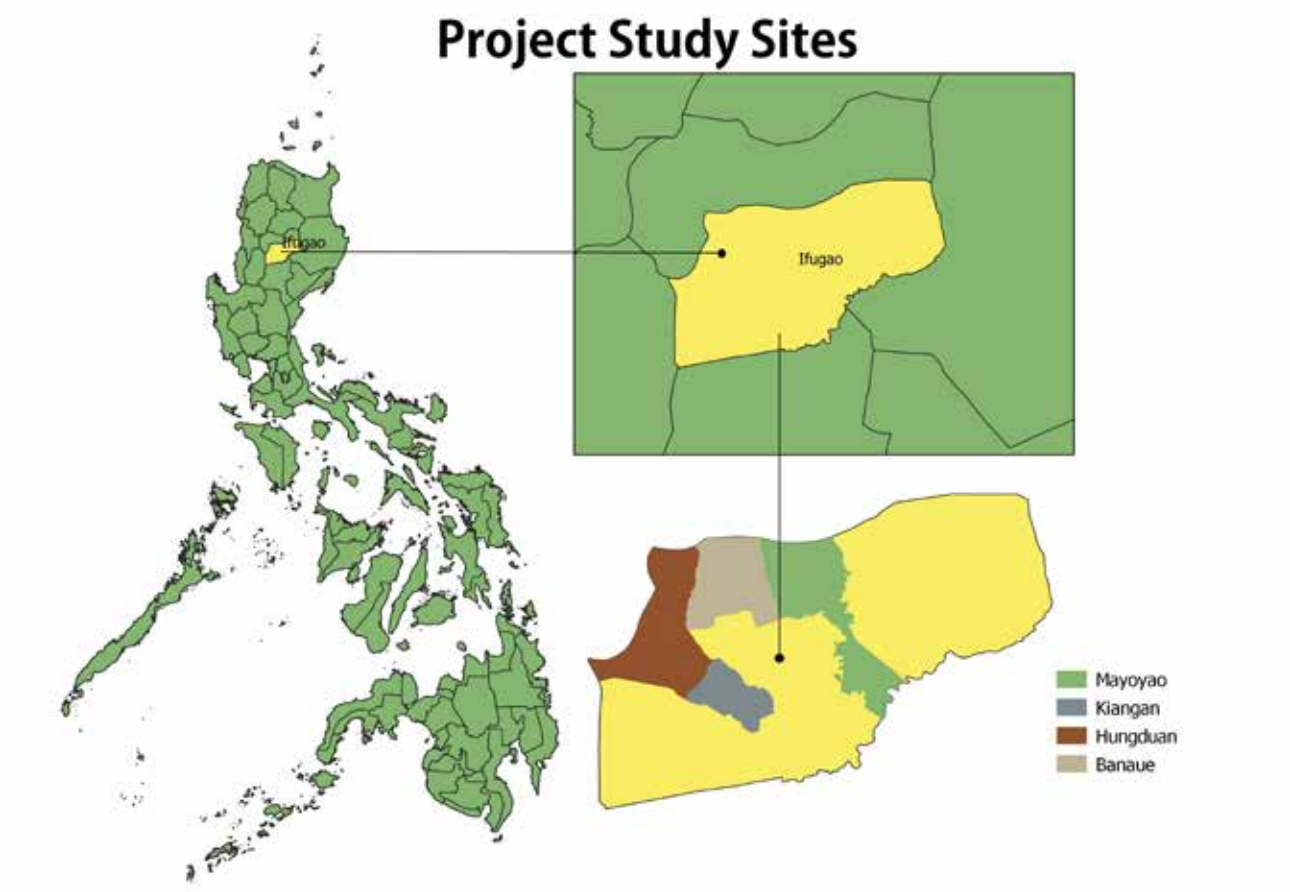

Figure 1. Map of the country and province. (Source: Map data from GADM 2011)

Size of case study/project area	59,550 hectares
Number of direct beneficiaries	25 persons
Geographic coordinates (longitude and latitude)	(Batad) 16.95°N 121.13°E (Hungduan) 16.84°N 121.01°E (Kiangan) 16.77°N 121.10°E (Mayoyao) 16.95°N 121.22°E
Dominant ethnicity	Tuwali and Tagalog

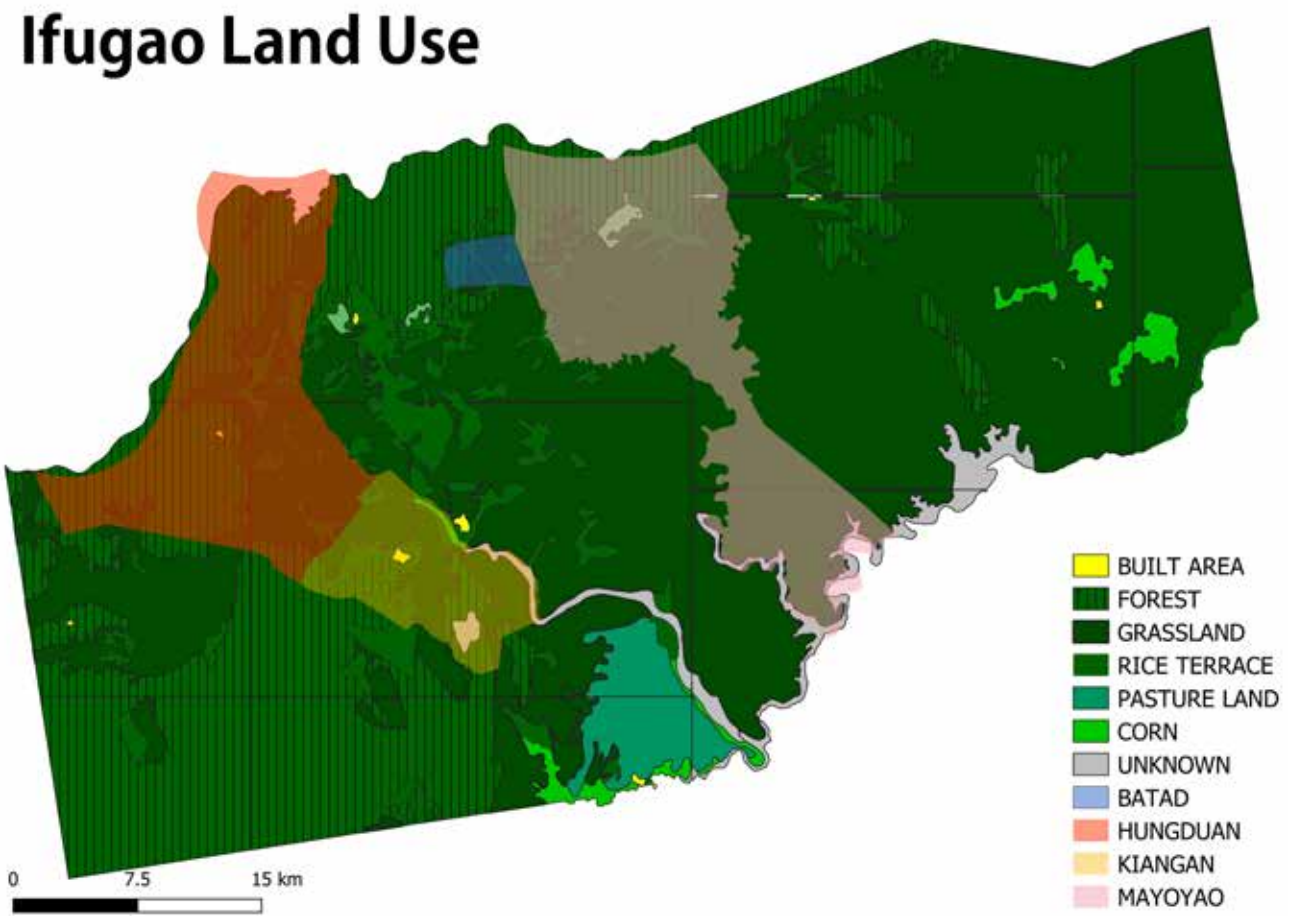

Figure 2. Land use and land cover map of case study sites. (Source: Map data from Bureau of Soils and Water Management – Department of Agriculture, Philippines 1987)

Introduction

Over the years, drastic changes in the natural environment, global economy, and societal conditions have negatively affected ecosystems and contributed to climate change, habitat destruction and natural resources depletion. Human activities heavily influence these changes in the human attempt for active and dynamic adaptation, survival, and development. For a continuous supply of natural resources, humans have learned to manage materials and to adapt to the environment. Thus, sustainable systems were created. These unique systems are based on a congruous relationship with the natural environment and encourage balanced and effective land and natural resources management. Sustainable systems like socio-ecological production landscapes (SEPLs), a term coined by the Japan Satoyama Satoumi Assessment, are dynamic systems that reflect human-nature interactions compatible with maintenance, resource generation, conservation and sustainable use (Centre pour l'Environnement et le Développement [CED] et al. 2010). As SEPLs are resource and service providers to their local communities and external populations, conserving and sustaining these systems are vital.

Recent conservation perspectives emphasize the relationship between nature and culture, and the role of communities in conservation and sustainable development. Van Oudenhove and colleagues (van

Oudenhove, Mijatovic & Eyzaguirre 2010) emphasize that communities have molded SEPLs through generations of coevolution—exhibiting the compatibility of human needs with conservation goals. Since human activities "have significant influences in shaping SEPLs" (Ichikawa et al. 2010, p. 178), the role of indigenous and rural communities in conservation must be accentuated in proposing and planning conservation projects. Nonetheless, SEPLs are not entities fixed in time. No amount of conservation can retain their 'initial' characteristics since these systems are dynamic and constantly evolving. However, industrialization and a diminishing rural population, to name a few socio-ecological problems, threaten these landscapes, as implied by Belair et al. (eds. 2010). A diminishing rural population, primarily caused by youth out-migration, is one of the problems confronting a renowned SEPL in the Philippines—the Ifugao Rice Terraces.

1.1 Ifugao Rice Terraces as SEPL

Covering a total area of approximately 263,000 hectares, Ifugao province is a landlocked and generally mountainous landscape characterized by thick forests, creeks, and streams that are tributaries to major rivers. Ifugao is situated within the Cordillera mountain range in the Northern Philippines. With eleven municipalities, the province is home to an approximate 203,000 people who mostly belong to the Ifugao ethnic group, according to the Philippine Statistics Authority (PSA 2016a). Christianity, among other religions, has a growing religious influence in the province. This observance of Christianity is believed to have contributed to the disregard of indigenous traditions and belief systems, which in turn affects the management and sustenance of the landscape (Department of Environment and Natural Resources [DENR] 2008). In terms of economic activities, the Ifugao people commonly engage in farming, wood carving and weaving.

The five rice terraces, collectively called the Ifugao Rice Terraces (IRT) constituting the World Heritage Site, are in four municipalities (Banaue, Hungduan, Kiangan, and Mayoyao). Inscribed by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 1995 as a World Heritage Site, the IRT is also the only Globally Important Agricultural Heritage Systems (GIAHS) site in the Philippines piloted by the Food and Agriculture Organization of the United Nations (FAO) in 2005 and designated in 2011. Figure 3 presents the four rice terrace clusters of the IRT. The IRT, a SEPL influenced and sustained by accumulated traditional knowledge and sustainable practices, is the primary source of the livelihoods of the Ifugao communities through providing food and income. It also provides vital regulating services such as biodiversity conservation (through organic agriculture), carbon sequestration and nutrient cycling, soil and water conservation, and pest regulation (DENR 2008). A typical Ifugao community, shown in Figure 4, consists of a *muyung* (community forest or private woodlot), *payoh* (rice terraces), and *boble* (village/residential area). These components of an Ifugao community are harmoniously interrelated—the *muyung* provides water and nutrients to the *payoh*, which provides harvest to residents in the *boble*, and the residents must tend and maintain the *muyung* and *payoh* the whole year round for food production and biodiversity.

Figure 3. The Ifugao Rice Terraces

Figure 4. Typical Ifugao community

Despite the abundance of resources and services in the rice terraces, many terraces farmers still consider themselves poor. Farming in the rice terraces "is labor intensive but with low economic returns" (DENR 2008, p. 11). This notion of farming causes youth out-migration and the eventual abandonment of the rice terraces. Out-migration poses a threat to IRT sustainability and Ifugao traditional knowledge transfer. Traditional knowledge (TK) stems from generations of harmonious human relationships with nature. Expressed through certain traditions, customs, and rituals, TK guides a community's interaction and utilization of land and resources—resulting in sustainable practices (CED et al. 2010). Therefore, TK has a significant role in landscape, biodiversity, and ecosystem services maintenance. If not transferred to young Ifugaos, they will lack the values that promote co-existence and co-adaptation with nature. Dialogues with elders, parents, and youths revealed that Ifugaos value formal education, and parents encourage their children to get degrees at the expense of transferring TK. Marasigan and Serrano (2014) support this notion, but they also emphasize the importance of parents instilling the values of farming, environmental stewardship and culture bearing in their children.

Aside from out-migration and TK loss, the following internal and external pressures also threaten the management of natural resources and conservation of the IRT: land abandonment, under-management of biocultural diversity, aging and diminishing population due to out-migration, neglect of traditional agricultural practices, poor maintenance, urbanization, unregulated tourism activities, and farmers' economic difficulties (Paleo 2010; Ichikawa et al. 2010; Matsui, Kawashima & Kasahara 2010). These lead to more abandoned rice paddies, unsustainable plantations, and weakening of traditional social systems. Nonetheless, Ichikawa and colleagues (2010) suggest that these problems can be addressed with raised awareness and capacity building among stakeholders.

1.2 Youth for Ifugao Rice Terraces

In response to the need for capacitating IRT community stakeholders, a project intending to reconnect Ifugao youths and connect urban youths with the IRT was implemented from November 2016 to June 2019. Youth for Ifugao Rice Terraces (Y4IRT), a tablet-based capacity building and exchange program for Ifugao and urban youths, is a collaborative two-year project of the University of the Philippines Open University (UPOU), Kanazawa University (KU, Japan), University of the Philippines Los Baños (UPLB), and Ifugao State University (IFSU). A one-year joint initiative to the project, the contextualization of instructional materials, was also executed from March 2018 to March 2019 for the Ifugao community. These two projects were funded by Mitsui & Co., Ltd. and the Satoyama Development Mechanism collaborative project of the International Partnership of the Satoyama Initiative (IPSI), respectively. Currently, the capacity building program only targets Ifugao youths as they can have immediate influences on the IRT. To specifically address the out-migration and knowledge transfer problems, Y4IRT was implemented to capacitate IRT successors to sustain the biodiversity and ecosystem services of the landscape. Y4IRT was comprised of four (4) phases executed through a conservation and sustainable development approach: needs analysis, development of tablet-based training modules, youth training and exchange program, and contextualization of training modules.

This chapter examines the youth capacity building and exchange programs in terms of their contribution to IRT as a SEPL. Furthermore, this study aimed to understand the views of the youth participants on the pressing issues of IRT, and on the services and values derived from the landscape. This chapter also aims to narrate the process, lessons learned, and views of youth participants on the modules and activities in developing and deploying the tablet-based capacity building and exchange program.

2. Description of Activities

2.1 Study Sites

Chosen study sites were Banaue, Hungduan, Kiangan, and Mayoyao. These municipalities, covering an estimated 85,000 hectares collectively, are situated adjacent to one another (see Fig. 1). Rugged terrain, extensive rice terraces, rivers and lakes, and forests characterize the study sites (see Fig. 2). Agriculture is the main economic driver of these municipalities, with most of their land dedicated to food production. Residents of the municipalities also engage in tourism, wood carving, weaving, and blacksmithing. Table 1 presents the demographic and geographic information of each municipality.

Table 1. Population and land area of the study sites (Sources: DENR (2008) and PSA (2016b))

Municipality	Population	Youth aged 15-24	Land area (ha.)	% Rice terraces	% Farming
Banaue	21,837	4,654	19,120	27.7	50
Hungduan	9,400	2,033	26,030	9.3	92
Kiangan	17,048	3,541	20,000	4.2	95
Mayoyao	17,331	3,670	23,805	13.4	100

2.2 Youth participants

Table 2 presents the demographic profile of Y4IRT's youth participants. There were 14 Ifugao youths, and 11 urban youths. It was observed that most Ifugao youth participants were female, and most participants were aged between 21-23 years old. All participants are at least high school graduates. Youths from the three main islands of the Philippines (Luzon, Visayas and Mindanao) were not equally represented in the program, as most urban youths were from Luzon. As indicated in the table, there were two Ifugao out-of-school youths who were working as tour guides in their municipalities after graduating from high school.

Table 2. Demographic profile of the youth participants of Y4IRT

Demographic Information	Ifugao youth	Urban youth
Gender		
Male	2	5
Female	12	6
Age		
18-20	2	3
21-23	9	7
24-26	3	1
Educational background		
Out-of-school youth	2	
College undergraduate	4	8
College graduate	8	3
Residency (Ifugao)		
Banaue	5	
Hungduan	4	
Kiangan	5	
Residency (urban)		
Metro Manila		2
Luzon		8
Mindanao		1

2.3 Activities

This study was conducted using a case study approach. Defined by Crowe and colleagues (2011, p. 1), the case study approach is an "in-depth, multi-faceted exploration employed to obtain an in-depth appreciation of an issue or event of interest, in its natural real-life context". Based on this approach, Y4IRT's phases were carried out, and the views and narratives of the Y4IRT youth participants on the services and values derived from the IRT landscape were elucidated. The 4 phases of Y4IRT transpired as follows:

2.3.1 Needs analysis

Since Y4IRT produced educational materials, it was imperative to conduct a needs analysis prior to material development. Youth needs, problems, knowledge gaps and challenges addressable by Y4IRT were identified through interviews and workshops. Specifically, key informant interviews with village elders and government officials, and focus group discussions (FGDs) with youths, farmers, educators, and residents of IRT communities were conducted (see Fig. 5 and 6). The utilized interview guides are included in Appendix 1. Stakeholders were asked about the values they attribute to the IRT landscape in terms of natural and cultural heritage. Photos and video footage of Ifugao and related activities were also taken. Consents for interviewing and photo/video documentation were granted by the involved community stakeholders. These activities were accomplished to ensure user-involvement, to deliver the training modules in a proper context, and to tackle the most pressing issues relevant to IRT conservation and sustainable development.

In the initial discussion with the Ifugao youth, IRT presence in social media and other digital platforms was suggested for improving youth appreciation towards the IRT. With this, a digital tools and skills assessment among selected Ifugao youths was conducted to determine the acceptability and accessibility of tablet-based modules to the target group.

Figure 5. Project team interviewing a Mayoyao government official

Figure 6. A project member conducting FGD with Hungduan youths

2.3.2 Development of tablet-based modules

Considering the identified gaps and needs, the training modules were developed with pertinent topics and multimedia materials through a series of writeshops, meetings, and online correspondences with content experts, instructional designers, and course writers. Course writer meetings and workshops, as shown in Figure 7, were regularly held to revise and ensure the completeness and quality of the training modules. Field visits and interviews among community stakeholders were conducted to ensure information validity of the modules. The modules were regularly evaluated and revised by the course writers in consultation with content experts and were pretested among selected youth and stakeholders. Peer reviews from partner universities were also considered pretesting and evaluation. Due to the limited Internet connectivity in Ifugao, the modules were deployed through an offline tablet application developed for the project.

2.3.3 Youth training and exchange program

The youth training and exchange program was conducted as an avenue for cultural and social exchange between Ifugao and urban youths. Participants from Ifugao and urban areas were invited through social media platforms and direct invitations; however, participants were recruited on a voluntary basis. Application forms were submitted to the project team, and participants were accepted based on their volunteer work, advocacies, and IRT perceptions. Youths who seemed to be physically fit and driven towards conservation and sustainability were chosen. The topics discussed in the modules were the basis and guide of program itineraries and activities to make the program holistic, engaging, and informative. This exchange program was separated into two activities: Ifugao youth and urban youth exchange activities, which took place in Laguna and Ifugao, respectively.

Figure 7. Course writer meetings and workshops in Ifugao, UPOU, and UP Baguio, respectively

Figure 8. Three urban youths in Ifugao traditional attire, with three locals and one project member after learning a cultural dance in Batad, Banaue

Figure 9. An urban youth pounding traditional rice, as guided by a local in Kiangan

Figure 10. Urban youths learning about local flora, guided by a local farmer, in the Batad Rice Terraces

Figure 11. Urban youths interviewing elders in Batad, Banaue

For the urban youth exchange activity, the participants were brought to Ifugao for a three-day immersion activity wherein they learned about the Ifugao culture and rice terraces landscape. The program occurred in Batad (in Banaue), Hungduan and Kiangan with the following activities: lectures on IRT ecosystem services and culture, learning and performing cultural dances, appreciation of a few local flora and fauna, interviews with elders and community members, immersions with foster families, and a synthesis activity (see Fig. 8 to 11).

For the rural youth exchange activity, Ifugao youths went to Laguna province for a three-day activity designed to expose them to different institutions and communities in the urban setting. Laguna is a predominantly urban province situated in Southern Luzon. Distinguished academic institutions (like UPOU and UPLB), heritage sites (old churches), commercial establishments, and local craft businesses (e.g. wood carving) characterize the province. The exchange took place in five municipalities, namely: Calauan, Los Baños, Paete, Pila and Victoria (see Fig. 12).

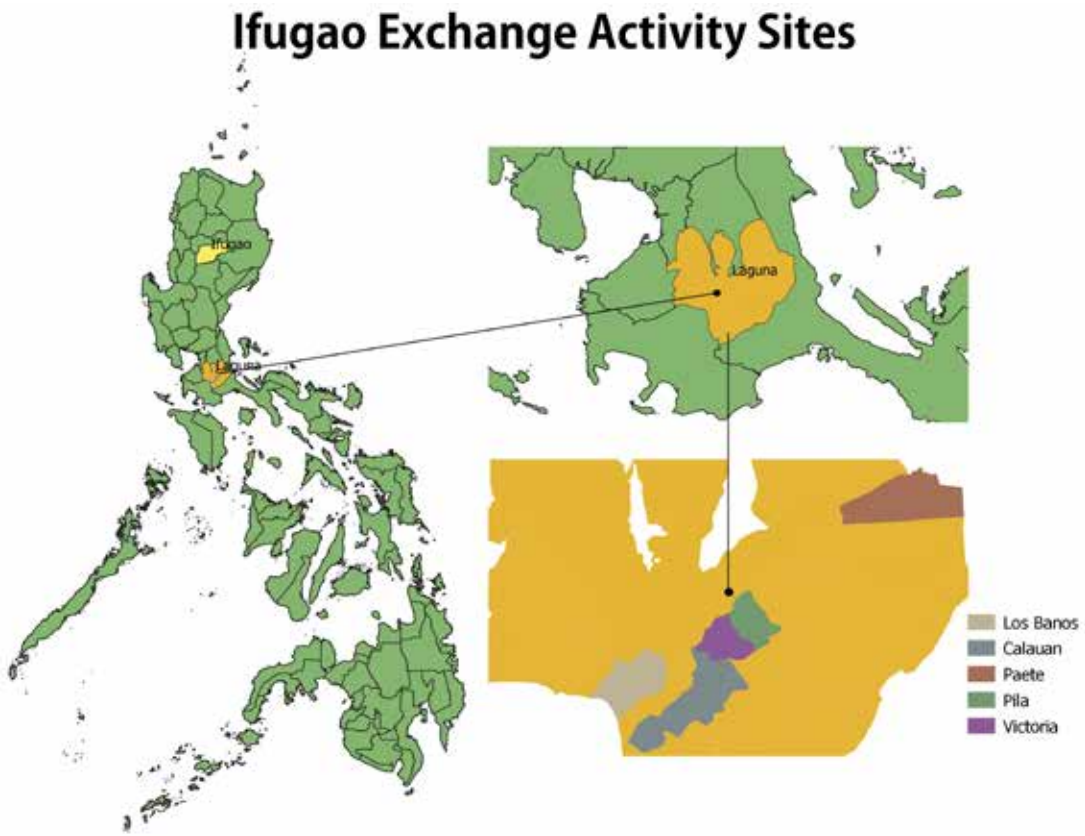

Figure 12. Map of the country, province and Ifugao exchange activity sites. *(Source: Map data from GADM 2011)*

This exchange activity also aimed to equip the Ifugao youths with knowledge and ideas they can apply to their respective communities. Through the activity, the Ifugao youths were able to experience firsthand the contrast between Ifugao and an urban area. Program activities were: lectures on sustainable development, site and institution visits, interactions and observations of livelihood programs in relocation communities, interviews and study on textile, paper, and forest products technology, wood carving industry, and heritage house preservation, and a synthesis activity (see Fig. 13 to 16). Furthermore, the tablet-based modules were only given to and utilized by the Ifugao youths.

Figure 13. Ifugao youths attending a lecture on paper and forest products technology in UPLB

Figure 14. Ifugao youths interviewing a textile-making worker in a relocation community in Calauan

Figure 15. Ifugao youths interviewing a trolley-pusher about this livelihood in Los Baños
Note: Trolley pushing is a form of transportation on inactive train tracks.

Figure 16. A wood carver in Paete demonstrates his craft to the Ifugao youths

2.3.4. Contextualization into translated materials

As a joint initiative of Y4IRT, the developed training modules were translated into two local dialects: *Ayangan* and *Tuwali*. This initiative will sustain Y4IRT's impacts by making the modules more relevant to a wider scope of community stakeholders. Experienced English-to-local-dialect translators, who were retired teachers and community elders, were identified by IFSU colleagues. This choice of translators assured the congruent context between the locally translated and English modules. Evaluation workshops with other experts and selected community stakeholders were also conducted to ensure the materials' validity. Conclusively, the translated materials were well-received by the evaluators and stakeholders.

3. Results and Discussion

3.1 Addressing needs through tablet-based modules

Categorized according to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) multiple values of nature (MVN) framework (IPBES 2015), Table 3 shows the needs, issues, and Ifugao values identified during the needs analysis. Among all needs assessed, these were the most pressing/recurring: knowledge transfer to younger generations, attracting youths to conservation projects, digital technology to engage youths, IRT learning resources, and emphasizing the values in sustaining the IRT.

Table 3. Needs, issues, and values identified by Ifugao community stakeholders

Category	Needs and Issues	Values
Nature	Control of invasive pests (i.e. earthworms, snails) Retention of sustainable agricultural practices (organic pest elimination, non-introduction of invasive species) Shift in economic activities unrelated to farming and cultivating causing biodiversity loss (unregulated farm and terrace management) 'Disconnection' of youths from nature Low level of people's awareness on biodiversity value Lack of support from local government units (lack of regulatory policies for tourist access in the rice terraces [terraces are susceptible to damage/trampling], and addressing abandoned rice terraces, and misallocation of government funds)	Presence and interrelationship of *muyung* (tree, plant and animal species), rice terraces (rice varieties, insects, vegetables), swidden farms (root crops, fruits and vegetables), bodies of water (fishes) for biodiversity

Category	Needs and Issues	Values
Nature's benefits to people	Abandonment of some rice paddies Changes in the agricultural practices in the rice terraces: use of non-traditional rice varieties, farming other crops	Provision of food, water, timber, materials, TK, cultural services Sustainability of rice terraces through traditional rice production system (water and soil management for terrace maintenance prevention of soil erosion)
Good quality of life	Children and younger generations are discouraged from farming and are losing interest in their production and traditional systems resulting in reduced knowledge transfer Youth out-migration causing a decrease in manpower in the rice terraces, resulting in less harvest Food insecurity (rice produced in the rice terraces is not enough for some families because of yearly agricultural cycle) Conservation and sustainability of IRT Ways to attract youths to help in conserving the rice terraces Social media and digital technology use among Ifugao youths Learning materials and documentation on IRT Equal promotion of all UNESCO-inscribed rice terraces Lack of inter-agency collaborations	IRT as symbol of ingenuity and Ifugao pride IRT sustainability and management with human coevolution Culture and tradition as 'guides' in living with nature Preservation of indigenous values and culture through knowledge transfer

Although not explicitly mentioned during the needs analysis, it was deduced that most youths do not readily recognize and appreciate the intrinsic value of nature. However, data indicated that youths were interested in being involved in the conservation and sustainable development of the IRT and suggested the use of digital tools. To entice youths in involving themselves and appreciating the IRT, digital modules were developed. The digital assessment yielded results indicating Ifugao youths are digitally proficient and can utilize digital materials (computer=57, tablet=46, smartphone=44, Internet=58, search engine=60). Full results are shown in Appendix 2.

The contents of the training modules were written based on the identified needs, issues, and values, and based on the following principles: is engaging for youths; does not use terms/concepts that are too technical since target audience is both uneducated/educated youths; introduces and discusses scientific topics; contains actual, relevant and valid IRT information; and utilizes multimedia materials and interactive learning activities. Briefly described in Appendix 3, the training modules discuss natural landscapes, sustainable development, ecosystem services and culture.

These tablet-based training modules, shown in Figure 17, are comprehensive innovations in the development and delivery of education and training programs. Since Ifugao is a remote province with limited Internet accessibility, accessing the modules using a portable and mobile device through a non-Internet-dependent application was the project's approach. Having tablet-based training modules makes it easier for target youths to learn more on the IRT as they can access the materials anytime, anywhere, through a single device.

Figure 17. Tablet-based training modules

There are existing frameworks, policies, and organizations involved in the conservation of the IRT. Initiatives (forest,

agriculture and water management, tourism, livelihood assistance, restoration and conservation) for the IRT are abundant, from local government units (LGUs), non-government organizations (NGOs), academia, and private institutions. Y4IRT differs from other initiatives since it focuses on the youths through value '(re)connection' and digital education. Furthermore, Y4IRT can attain long-term sustainability as opposed to other efforts.

3.2 Values perceived during the exchange program

With the exchange program, the youths interacted with each other, resulting in the interchange of ideas and reflections. This in turn affected their current perceptions and value of IRT conservation and sustainable development. Views about the values of the IRT were shared by the youths during the respective synthesis activity of their exchange programs. Table 4 summarizes these views into the MVN framework (IPBES 2015).

Additionally, one core Ifugao value, as narrated by the Ifugao youths, is their belief that they belong to the land, and that the resources they acquire from the landscape are not truly theirs, and therefore must be replaced to ensure a sustainable supply of resources. However, just as the value for TK, the Ifugao youths are admittedly 'indifferent' towards this value they must possess as IRT successors. They also shared that they sometimes overlook the IRT's significance and only perceive its aesthetic and recognition values. Nonetheless, the Ifugao youths believe that interacting with elders and older adults, who strongly embody the Ifugao values, must be done to instill the same gravity of the values in them.

Furthermore, the Ifugao youths have also stated that learning some information about the IRT through the modules has influenced their perceived values. It is noteworthy to report that the Ifugao youths, after witnessing the views of the urban youths, or the 'outsiders', were able to 'reconnect' and ponder on the significance of their culture and the IRT. Moreover, three major points about the rural-urban life contrast emerged during their synthesis activity: recognition of the importance of having permanent residences in their family/ancestral land and of not having problems related to housing, encroachment, and relocation; appreciation of innovations and technology on sustainable practices (maximizing resource utilization); and acknowledgement of government roles in providing support (e.g. livelihood programs and assistance).

For the urban youths, although they showed an appreciation for IRT, they only recognized its 'theoretical' value as they are not its direct beneficiaries. These youths have 'less grasp' of the extent of the IRT's importance to the Ifugao people. Nonetheless, through the exchange, they indicated that they were 'connected' to other knowledge and value systems by the introduction and immersion in the Ifugao culture. These youths shared that the immersion became an avenue for them to be more concerned and involved individuals on the IRT's conservation and sustainable development since they saw and experienced firsthand the importance of the landscape to Ifugao livelihoods and culture.

Table 4. Perceived values of the youth participants towards the IRT

Category	Types of value	Focus of value	Specific values	
			Ifugao youth	Urban youth
Nature	Intrinsic	Individual organisms	Rarity and importance of *tinawon* (traditional rice) to the Ifugao culture	
		Biophysical assemblages		Ecosystems in the rice terraces
		Biodiversity	Significance of *muyung*, rice terraces, swidden farms, bodies of water	Significance of farm and terrace labor in biodiversity management (regulated terrace harvest and cultivation)
Nature's benefit to people	Instrumental	Nature's ability to supply benefits		Maximum resource utilization and avoiding wastes (dropped rice grains from pounding and dehusking—realization of the gravity of farm labor and value of a single rice grain)
		Nature's gifts, goods and services	*Muyung* for temperature regulation, water and timber supply Aesthetic value of IRT	IRT as a rewarding experience (serenity and 'clean' air compared to lowland and urban areas)

Category	Types of value	Focus of value	Specific values	
			Ifugao youth	Urban youth
Good quality of life	Relational	Security and livelihood	Source of livelihood and food through sustainable and organic agriculture	
		Living well and in harmony with nature and Mother Earth	Significance of natural and cultural heritage TK, which is related to the indigenous religion that honors deities, flora, and fauna, is essential to have a positive relationship with nature	'Union' of natural landscape and human intervention in IRT
		Education and knowledge	Culture benefits indigenous knowledge (provides information on how to behave and interact with nature and its services)	Recognition for its scientific value (the utilization of irrigation channels and terraced rice paddies to downstream water) Cultural and indigenous knowledge contributes to educational materials Importance of knowledge transfer for stewardship
		Identity and autonomy	Important landscape for identity, pride and heritage	
		Good social relations	Traditions and cultural values (e.g. *badang* or cooperation, a core Ifugao value) give a sense of community	*Badang* as an essential value to push and continue conservation advocacies and efforts between locals and 'outsiders' for IRT Ifugaos have a strong sense of community and inclusivity Diverse action-takers can make a difference through planning and implementing holistic and sustainable approaches for IRT conservation and sustainable development
		Art and cultural heritage	Representation of legacy and ingenuity of Ifugao ancestors who have built and cultivated the IRT without 'proper' education on ecosystems and engineering principles Reminder to honor their ancestors who have accumulated traditional knowledge which ensures continuous ecosystem services benefits to future generations Living in/with the IRT resulted in (the production of) many songs, stories, and rituals which characterize the Ifugao culture. Culture comprised of traditions and rituals (chanting, agricultural practices, forest management, *badang*)	IRT contributes to local and national cultural heritage
		Spirituality and religions		Rituals, prayers and chants of the culture are respectful towards nature

As the Ifugao and urban youths embody significantly different cultures and values, evidently their concept and appreciation of the IRT differ as well. For Ifugao youths, who have a culture of intimate relationships with nature, TK and sustainable practices, it is expected of them to appreciate and regard nature better than the urban youths. Nevertheless, through Y4IRT, the youths improved their current knowledge and values for the IRT and nature and improved their conviction to contribute to the conservation and sustainable development of the landscape.

Diverse youth perceptions were evident in this study; however, these results are not representative of the Ifugao and urban youth populations. Moreover, this study acknowledges a potential data bias from the skewed female-male distribution of the Ifugao participants. Although the project tried to evenly invite youths to the program, still few Ifugao male youths joined. Literature indicates that males are less likely to participate in studies or in trainings due to indifference (Holloway et al. 2017; Boyle et al. 2011; Markanday et al. 2013).

3.3 Assessment and monitoring of Y4IRT's sustainability

The assumption of the project is that the Y4IRT's modules will be used by other youths and sectors, and both Ifugao and urban youths, to sustain their engagement in similar sustainable development engagements. Through follow-up FGDs, field visits, and interviews with the youths, the sustainability and extent of use of the modules (by other youths, sectors, and partner academes) will also be assessed after six months and a year after the project has concluded. Monitoring these activities can be performed with an established youth network for continued communication and coordination with IFSU and Ifugao LGUs. Additionally, Ifugao youths were tasked to devise an action plan as part of the activities in the tablet-based training modules. These plans must engage and mobilize their communities in initiatives/actions that will benefit the ecosystem and the IRT (i.e. proper waste management in tourism spots, agri-ecotourism, and tradition documentation). Discussing the youths' progress, through field visits and online correspondences, on their action plans is also one of the monitoring strategies of the project.

On the other hand, monitoring the Ifugao youths' progress and measuring the knowledge gained with the training modules can also assess the impacts of the project. This can be accomplished by consolidating the outputs from the learning activities and self-assessment questions in the modules.

After acknowledging the learnings from the pilot run of the Y4IRT, it is recommended to plan for and carry out a more inclusive and effective implementation of the project, and to develop a framework that can be used by the community to evaluate the impact of education and capacity-building initiatives on the maintenance of the SEPLs. Indicators will be used to assess whether the outcomes led to tangible improvements such as behavioral change.

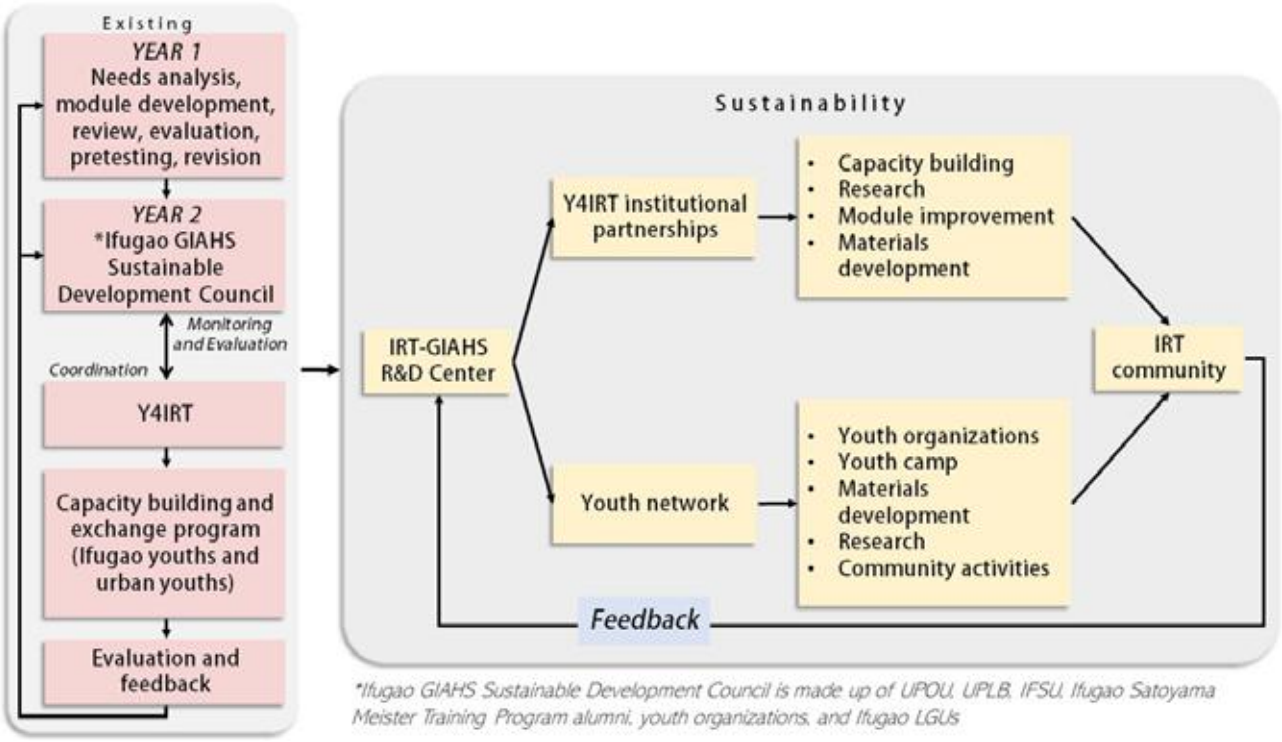

Figure 18. Y4IRT institutional frameworks

3.4 Institutional frameworks

Figure 18 presents the guiding and sustainability frameworks of Y4IRT. The tablet-based modules will be situated in the IRT-GIAHS Research and Development Center (IRT-GIAHS R&D Center) at IFSU-Lamut, Ifugao. The Center will be a space for collaboration among institutional partners and the youth. For Y4IRT's sustainability, activities to be undertaken by institutional partners and youth networks are listed in the framework. Execution of these activities will result in various materials to be presented to IRT communities for feedback. Returning feedback to the Center repeats the process, and these interactions will translate to sustained community interest for IRT sustainability.

3.5 Challenges, opportunities, and biodiversity benefits of Y4IRT

The Y4IRT was challenged in logistics and recruitment. Distance, schedules, other responsibilities, and weather conditions made visits to Ifugao limited and often cancelled. Youth availability and schedules also affected the progress of the exchange program. However, when field visits were postponed, online correspondences and meetings were conducted to accomplish project tasks.

On the other hand, Ifugao youths, especially males, were difficult to recruit to the exchange program. The call for participants resulted in an influx of urban youths, but only a few Ifugao youths responded—which forced IFSU project members and colleagues to personally invite some youths. The project team expected many aspiring Ifugao participants since they were Y4IRT's target. This could reflect a lack of drive among Ifugao youths to act and sustain the IRT and its biodiversity, resulting in the non-participation of young Ifugao males in training programs. Perhaps a longer and more intensive period of recruiting participants could be included in future programs. It is recommended that a study on indigenous youth non-participation (factoring in gender and socioeconomic aspects) in education and training programs be conducted. In addition to the challenges, opportunities to sustain Y4IRT impacts are identified and discussed in Table 5 below.

In line with the opportunities, the biodiversity benefits of Y4IRT are projected through execution of the biodiversity conservation activities discussed in the tablet-based modules: regulating and continuous silviculture, strict tree-cutting regulations and policies, efficient utilization of timber crops, multiple cropping in swidden farms, regular production in the rice terraces (traditional rice farming, then during the fallow period, vegetable farming), and regulated pesticide use. These could be incorporated into the action plans to be executed by the Ifugao youths.

Table 5. Suggested opportunities for sustained Y4IRT impacts

Opportunity	Description
Exploration of further use of mobile technology in training indigenous youth	Further studies can be undertaken to establish the benefits of mobile technology in indigenous youth capacity building.
Use of tablet-based modules as learning materials for academic institutions	Partner institutions utilizing the modules.
Contextualization of modules into translated materials	This phase emphasizes the vital role of "education in their own language" (CED et al. 2010, p. 34). Utilizing translated modules makes the Y4IRT more inclusive, accessible, and relevant to community stakeholders not adept in the English language. Both the English and locally translated materials can be used as supplemental learning resources in Ifugao academes. This opportunity can also sustain, assess and monitor Y4IRT's impact by gathering feedback and evaluation from locals occasionally.
Established network with the local communities	Community networks will provide resources and audiences in future IRT endeavors.
Influence/reference for future capacity-building programs	Similar projects can be expanded to other youths driven to act on conserving and sustaining SEPLs, culturally significant landscapes, and other indigenous rural farming communities across the country.
Youth action plans as avenues for collaboration with local units	Youths can collaborate with LGUs, NGOs and other institutions in implementing and expanding their action plans.
Family for Ifugao Rice Terraces (F4IRT)	Educating the whole family, where early values are formed, on IRT conservation and sustainable development. This can potentially result in improved TK and nature appreciation. Instead of parents discouraging terrace farming, they can convince their children to recognize sustainable agriculture as an occupation and craft—prompting youths to tend, learn, and value the IRT more.

Conclusion

Capitalizing on digital technology, Y4IRT utilized tablet-based training modules which provided information on the IRT, Ifugao culture, ecosystems, and sustainable development. Through these modules, the Ifugao youths reportedly gained new knowledge about the landscape. Their values towards IRT were influenced by the modules and by the urban youths' views. Similarly, the urban youths have experienced and gained a deeper understanding of the IRT and Ifugao culture. These value (re)connections will strengthen, maintain, and build the youths' positive relationship with nature that benefits the conservation and sustainability of the IRT.

Alongside increasing the knowledge and improving the values of the youths, it is also necessary to develop stewards who will initiate change and will advocate and commit to sustainability. This case signifies the role of individuals and communities inside and outside of Ifugao for sustaining SEPLs such as the IRT. After Y4IRT, youth participants have the capacity to mobilize community stakeholders for additional IRT management practices and policies.

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Appendix 1. Interview guides and FGD guide questions

Break out Focus Group Discussion

Module 1: Conserving Ifugao Rice Terraces as Satoyama landscape & GIAHS site

- For you, what is the Importance of IRT to the Ifugaos?
- What do you really want from IRT? (Food? Clean food? Freshwater? Income? Etc.)
- Do you think IRT has importance to communities outside of Ifugao, say those in Manila, Visayas and Mindanao?
- And do you think other countries consider IRT as important?
- Do you think there is a need to conserve the IRT as a resource?
- If you would think there is a need to conserve IRT as it was handed by the forefathers, what initiatives are best for every individual to do? How about for groups or organizations, what should be the best thing to do?
- What is your conservation scheme for the IRT?
- If we do not conserve, what are your reasons?

Module 2: Ecosystem services of the Ifugao Rice Terraces Landscape

- Is food enough? Is water enough? Has the microclimate changed? Can you still drink spring water?
- Plan for FGD
  a. ECOSYSTEMS / LAND USES within IRT: (Community Forests (*inalahan*), Private Forests (*muyung/pinugo*), Rice Terraces (*payo*), Grasslands (*mapulon*), Streams / Creeks)
  b. ECOSYSTEM SERVICES (Source: Millennium Ecosystem Assessment Framework)
     i. Supporting: Nutrient cycling, soil formation, primary production
     ii. Provisioning: food, freshwater, wood and fiber, fuel
     iii. Regulating: climate regulation, flood regulation, disease regulation, water purification
     iv. Cultural: aesthetic, spiritual, educational, recreational
- As a community, what do you think are the benefits you obtain from the following ecosystems:
  a. Community Forests (inalahan)
  b. Private Forests (muyung/pinugo)
  c. Rice Terraces (payo)
  d. Grasslands (mapulon)
  e. Streams / Creeks
- What are your views regarding the interconnectedness of these systems?

Module 3: Ifugao Rice Terraces and Sustainable Development (focus on sustainable tourism, sustainable agriculture, livelihood, etc.)

- What's your definition of "sustainable development" for IRT and the IRT community?
- What is "sustainable development" for? What are its goals?
- What are the practices/customs/traditions in your: a.) family, b.) barangay/community, c.) municipality, and d.) province that sustain the community/livelihood development?
- Do you know any practices/customs/traditions in your: a.) family, b.) barangay/community, c.) municipality, and d.) province that maintain the beauty/services provided by the IRT?
- Do you think these two practices are suitable/relevant: developing/improving livelihoods and maintaining the beauty/services provided by the IRT? In what ways?
- What are your suggestions in maintaining the IRT?
- Plan for FGD:
  1. Introduction - give a short introduction that answers the following:
     a. What does the phrase "sustainable development" mean?
     b. How is sustainable development defined in Ifugao?
     c. What are the goals of sustainable development?
  2. After the introduction, ask the participants about their ideas on:
     a. Importance of sustainable development in my locality/in IRT community
     b. Association between sustainable development and protection of the Ifugao Rice Terraces
     c. Ways on how the IRT community can arrive at sustainable development

Module 4: Nature, Culture & Heritage of Ifugao Rice Terraces

- In your opinion, what are challenges faced by the Ifugaos in terms of your culture and heritage?
- What are your views in conserving Ifugao culture? Do you still see its relevance in the 21st century?
- How do you view the connection of nature, culture and heritage and your role in it?

Module 5: Ifugao Rice Terraces as a Satoyama Landscape in the 21st Century

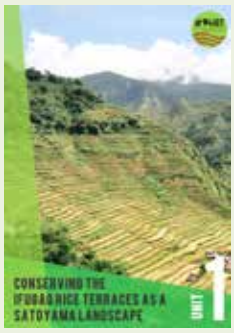
- Is population mobility in this modern time affecting IRT? How?
- With the rise of digital literacy even in Ifugao, how will this affect IRT? (Follow up and qualify every answer)
- Is organic farming common now in Ifugao? Do people like it?
- Is there a move to use cement on IRT walls and dikes? (details)
- Do you think people are satisfied with organic farming and may forego with total rehabilitation of IRT?
- With organic farming, do you think people will reminisce and long for Satoyama in the IRT?
- Do we need to conserve IRT when we are satisfied with organic farming?
- Or just conserve a portion of IRT and the rest of organic farming?
- If it will be like this, what do you think will happen to IRT landscape, the muyung/forest, the farm, and the village?
- What could be the scenario to the ecosystem services (food, water, climate, etc.) with its deterioration?

Appendix 2. Results of digital proficiency and digital skills assessment among selected Ifugao youths

	Level of proficiency			Frequency of use		
	Can use	Cannot use	Never use	Seldom	Often	Always
Computer	57	3	0	42	6	12
Scanner	32	28	24	28	8	0
Printer	48	12	12	30	12	6
Multimedia projector	42	18	16	36	4	4
Tablet	46	14	14	34	8	4
Smartphone	44	16	14	32	6	8
MS Word	54	6	6	30	10	14
MS Power Point	58	2	2	36	12	10
MS Excel	50	10	8	34	10	8
E-mail	42	18	20	22	12	6
Internet	58	2	2	22	12	24
Search engine	60	0	0	22	16	22
Photo editing	44	16	16	26	14	4
Audio editing	32	28	26	20	10	4
Video editing	32	28	28	26	2	4
Screencast tool	22	38	36	18	6	0
Translation tool	22	38	36	18	6	0
Conversion software	30	30	28	22	6	4
Programming tool	22	38	36	20	4	0

	Poor	Good	Neutral	Very Good	Excellent
I can search on the Internet	1	14	7	22	16
I can find the particular information that I want on the Internet	0	14	13	23	10
I can evaluate the information that I find on the Internet	1	15	14	22	8
I can use digital media to create my own texts	1	18	19	13	9
I can manage the information that I find (organize, save and store it for reuse)	0	12	13	21	14
I can decide if the information that I find on the Internet is honest, relevant and useful	1	14	15	19	11
I can use the information and what I have learned from it to create new work by blending, adapting, applying, designing, inventing	2	21	10	16	11
I can communicate with others by exchanging information, by sharing knowledge and creating information products to suit the audience, the context and the medium	2	12	15	18	13
I can communicate with others by sharing knowledge digitally	2	17	13	19	9
I can create information products to suit the audience, the context and the medium	3	21	11	19	6
I can use ICT appropriately and responsibly	4	23	12	17	4

Appendix 3. Content of Y4IRT training modules

Unit	Unit Cover	Topic	Brief description	Learning activities
1		IRT as a Satoyama Landscape	Emphasizes the value and role of human-nature interactions in the IRT Discusses nature's values	Reflective questioning Situational activities
2		Ecosystem Services of the IRT Landscape	States concrete examples of biodiversity benefits and values in the IRT Discusses nature's values and benefits to people	Field visits Documentation Habitat characterization
3		Sustainable Development in the IRT	Introduces sustainable development as a concept and the 17 Sustainable Development Goals; Identifies approaches in sustainable development Discusses nature's values and benefits, and values for good quality of life	Reflective questioning Situational activities Relating SDG concepts in their communities, experiences and goals
4		My Culture, My Nature and My Heritage	Emphasizes the relationship of nature and culture Discusses nature's benefits to people and values for good quality of life	Observation activities Development of multimedia materials Understanding meanings of chants and songs Development of an action plan
5		IRT as a Satoyama Landscape in the 21st Century	Directs sustainable Satoyama advocacies using digital technologies accessible at IRT Discusses values for good quality of life	Digital skills assessment Drafting advocacy strategies

Chapter 12

Mainstreaming Community-Conserved Areas (CCAs) for biodiversity conservation in SEPLS - A case study from Nagaland, India

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Abstract

In Nagaland, located within the Indo-Burma and Himalaya biodiversity hotspots in India, customary rights are protected by the Indian Constitution, and the majority of natural habitats (88.3%) are owned and managed by individuals and clans overseen by village councils, district councils and other traditional institutions. However, in the absence of alternative livelihood options, most of the economic activities in the villages are based upon utilization of natural resources. This has led to over exploitation of forest resources and threats to biodiversity due to the increasing needs of local people. However, in Nagaland, traditional conservation practices have helped protect biodiversity, and there are records of Community-Conserved Areas (CCAs) being declared in the early 1800s, especially in response to forest degradation and loss of wildlife. Thus, the revival of traditional conservation practices through the creation of CCAs offers hope for conservation and ecosystem resilience, as communities set aside parcels of forests within productive, shifting cultivation landscapes. It has been documented that one-third of Nagaland's villages have constituted CCAs, and as many as 82% of 407 CCAs have completely or partially banned tree felling and/or hunting, and enforce various regulations for conservation. These CCAs, covering more than 1,700 km^2, also contribute to carbon storage (an estimated 120.77 tonnes per ha), and are an important mitigation and adaptation strategy for climate change.

A pilot scale project was initiated in the three villages of Sukhai, Kivikhu and Ghukhuyi in Zunheboto district of Nagaland, which aimed at creating and linking Community-Conserved Areas across the landscape and supporting conservation through livelihood creation. The model adopted aimed at strengthening the resilience of these mountain communities and their forests by rejuvenating traditional conservation practices and providing supplementary livelihoods. Activities included compiling information on Indigenous Ecological Knowledge (IEK), developing long-term ecological monitoring mechanisms, motivation and sensitization on landscape conservation and capacity building of the community members in biodiversity identification, documentation and monitoring, as well as promoting ecotourism as a livelihood option. Today, the project has yielded positive results in terms of sustainable use of biological resources by adopting long-term sustainability, enhanced governance and effective conservation of SEPLs. Around 222 species of birds and 200 species of butterflies have been documented and protected by declaring 939 hectares as CCAs and banning hunting and destructive fishing across the remaining landscape of forests and rivers (total area being 3,751 hectares). The positive impacts of the project activities were evident at the end of the project as communities reported increased protection of natural resources after the formation of a joint CCA and improvement in management of common resources of socio-ecological production landscapes (SEPL). The elders were satisfied with the documentation of their indigenous knowledge in the People's

Biodiversity Registers (PBRs) while the youth, women's groups and the marginalized members of the community reported increased household income due to ecotourism. This model of biodiversity conservation is being mainstreamed within the governance mechanism and up-scaled through a multi-pronged approach including financial support, legal recognition and long-term ecological monitoring.

Keywords: Community-Conserved Areas (CCAs); *Tizu* valley; *Sema* community; Zunheboto; Nagaland

Country	India
Province	Nagaland
District	Zunheboto
Size of geographical area [1]	3,751 hectares
Number of indirect beneficiaries [2]	10,000 persons
Dominant ethnicity	Sema tribe

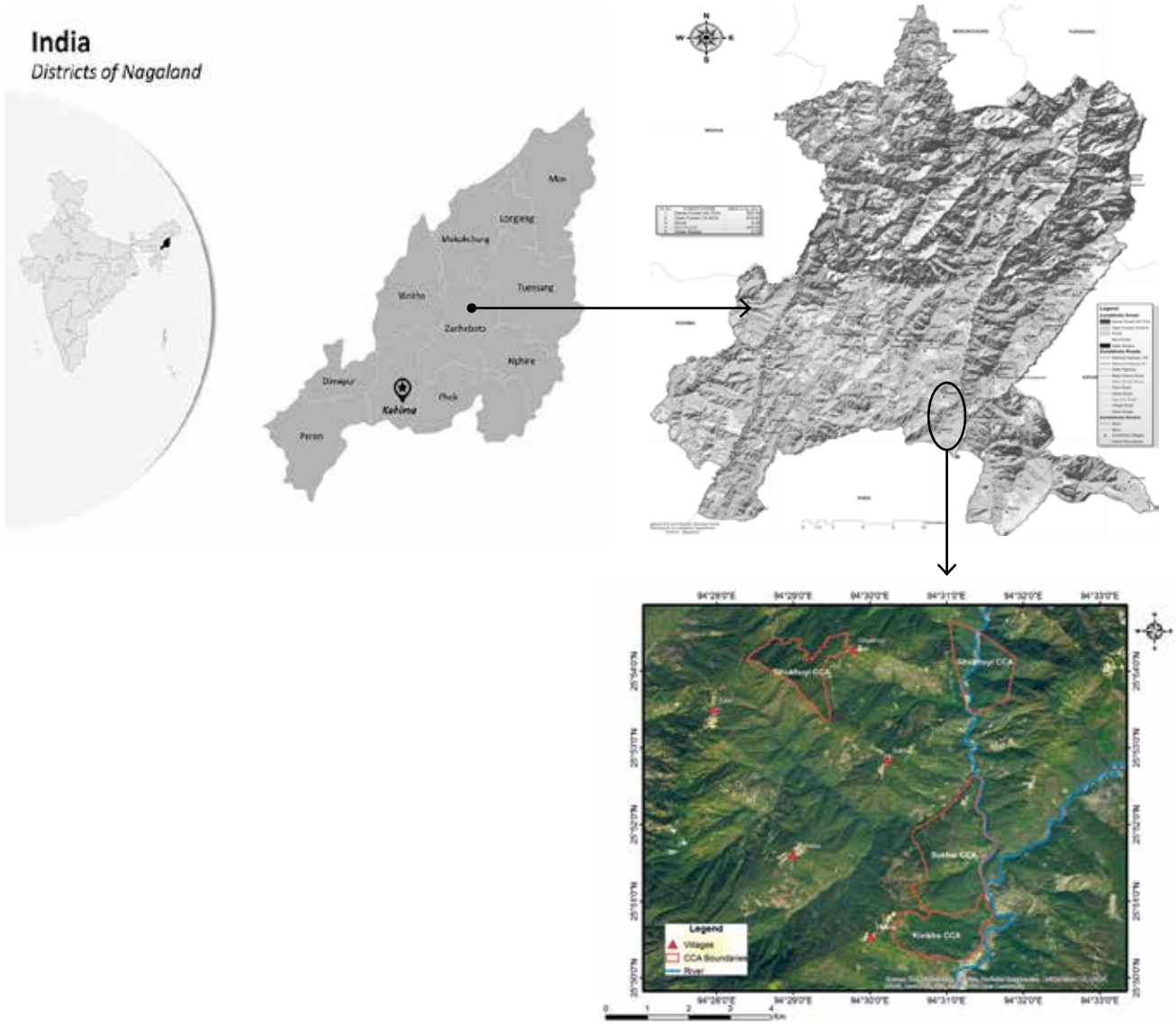
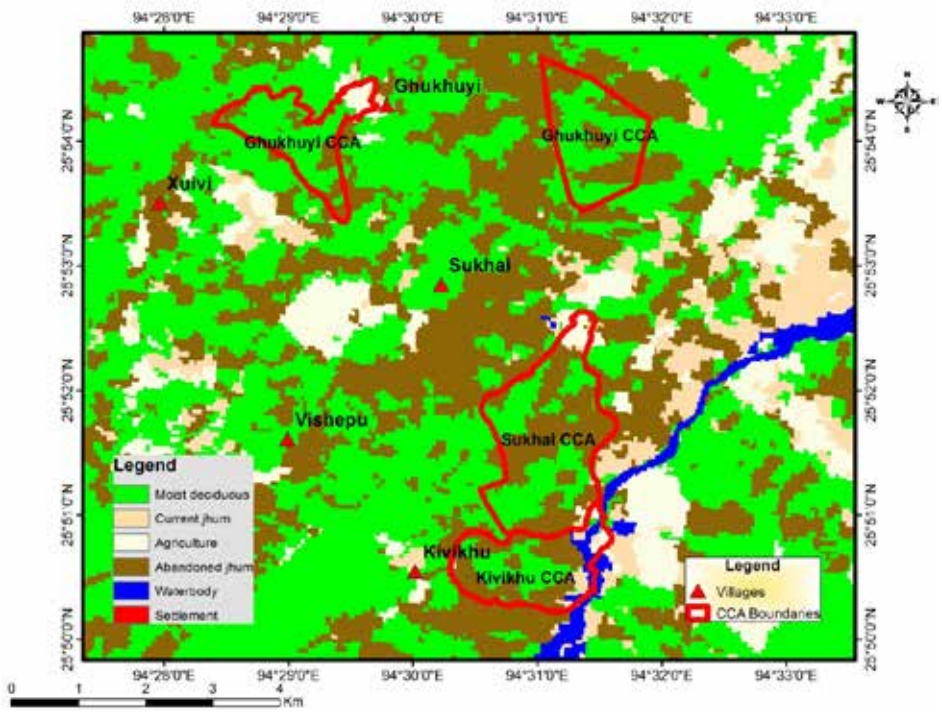
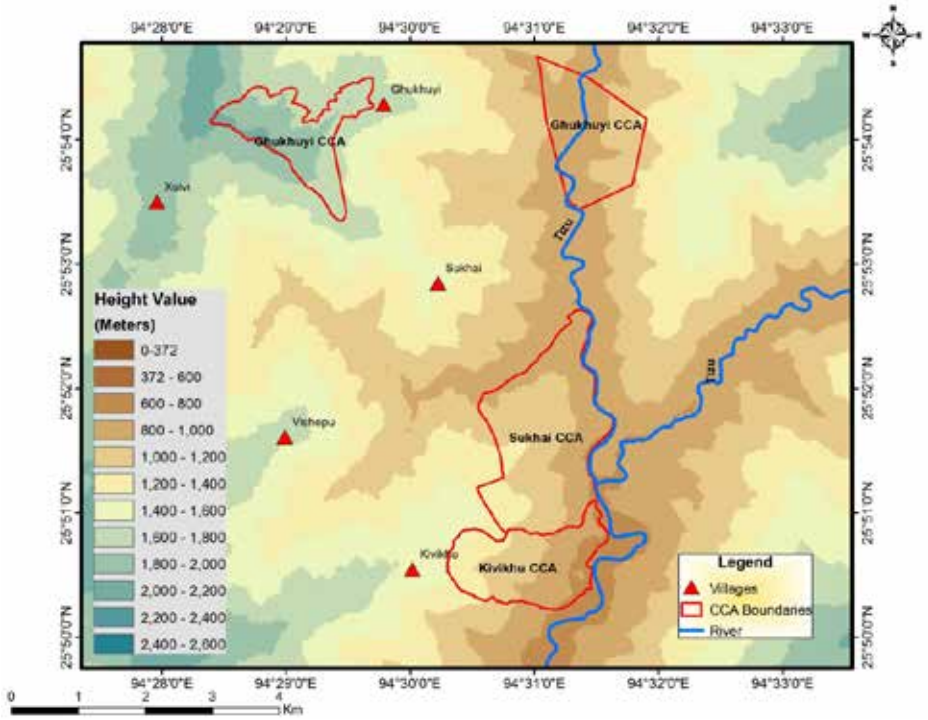


Figure 1. Map of the country and province (Source: Nagaland Forest Department) and CCA boundaries around pilot villages (Source: TERI 2017)

Size of case study/project area [1]	939 hectares
Number of direct beneficiaries [2]	1,200 persons
Geographic coordinates (longitude and latitude)	25°50′0″N and 94°31′0″E
Dominant ethnicity	Sema tribe



Land cover/land use of the area- TERI 2017



CCA Contour Map- TERI 2017

Figure 2. Land use, land cover and contour map of case study sites - CCA (Source: TERI 2017)

1. Introduction

The state of Nagaland in India, which is a part of both the Indo-Burma and Himalaya biodiversity hotspots, has a forest cover of 12,868 km^2 that accounts for 77.62% of the state's total geographical area (FSI 2017). It also supports remarkable floral and faunal diversity with high levels of endemism. Naga tribes who inhabit Nagaland follow customary laws and procedures, and their customary rights are protected under Article 371 A of the Constitution of India (see Box 1). These customary laws are plural in nature and differ from tribe to tribe and village to village. The Nagas belong to an oral culture which they have practiced through the ages till present times, where every aspect of life is governed through time-honored customs and practices. These practices have not yet been codified.

Box 1 Article 371 A of the Indian Constitution

Article 371 A: Special provision with respect to the State of Nagaland
Notwithstanding anything in this Constitution, no Act of Parliament in respect of:
- Religious or social practices of Nagas
- Naga customary law and procedure
- Administration of civil & criminal justice involving decisions according to Naga customary law, &
- Ownership and transfer of land and its resources,

... shall apply to the State of Nagaland unless the Legislative Assembly of Nagaland by a resolution so decides.

The governance structure in Nagaland is a combination of customary decision-making processes combined with a statutory system set up by the state and central governments (Pathak and Hazarika, 2012). Hence as per the customary rights, the majority of natural habitats are owned and managed by individuals and clans overseen by village and district councils and other traditional institutions. But, in the absence of alternative livelihood options, most of the economic activity in the villages is based upon utilization of natural resources leading to over exploitation of forest resources. Wildlife hunting has always been a way of life for the Naga tribes, but rampant and unregulated hunting has seriously depleted wildlife populations. Nevertheless, traditional conservation practices help protect biodiversity, and there are records of Community-Conserved Areas (CCAs) being declared in the early 1800s, especially in response to forest degradation and loss of wildlife (Pathak 2009). According to the International Union for the Conservation of Nature (IUCN), CCAs are defined as, "natural and/or modified ecosystems containing significant biodiversity values, ecological services and cultural values, voluntarily conserved by indigenous, mobile and local communities through customary laws and other effective means" (IUCN 2009). These CCAs include forests, freshwater resources, grasslands as well as agricultural-forest complexes within their ambit. One of the major characteristics of these CCAs is that the communities are the decision-makers, and have the capability to enforce regulations. Regulations and rules range from provisioning rules like patrolling and social fencing to appropriation rules like regulating collection of different forest products, restrictions on grazing, bans on felling of trees or bans on hunting. These bans may take many forms depending on the local situation. For example, a wide range of practices are in force for regulating hunting, which may range from blanket bans on hunting of all species through the year, to seasonal restrictions (e.g. during the breeding season), to bans on hunting particular species believed to be particularly vulnerable. Furthermore, when populations are perceived to be endangered, then the types of hunting weapons may be specified (e.g. use of only traditional traps and snares that are less detrimental than guns, or of fishing nets and traditional traps, while dynamite, electric currents, use of glue and poison are shunned). Similarly, the local communities may restrict wild meat consumption for subsistence purposes, banning the sale of wildlife or forest products in local markets or for commercial purposes. The motivations for declaring the CCA appear to be multiple—foremost being concern for forest degradation, followed by declining numbers of key wildlife species due to hunting and water scarcity (TERI 2015). However, CCAs face numerous challenges in their creation, effectiveness and sustainability and require sustained efforts for their conservation. This case study highlights the importance of CCAs in the socio-ecological production landscape (SEPL) of Nagaland in India.

2. Methods

2.1 Study site

Three villages, Sukhai, Ghukhuyi and Kivikhu, lying in the southern region of Zunheboto district bordering Phek district in the state of Nagaland, were selected as a pilot site under the work initiated by The Energy and Resources Institute (TERI) with support from Conservation International Japan via a Global Environment Facility (GEF) Satoyama grant (see Fig. 1). The pilot site lies in the heart of Nagaland at an altitude of 1,900 m and has sub-tropical wet hill forest primarily overlapping with the sub-tropical pine forest (see Fig. 2). The area acts as an important green corridor between the biodiversity-rich forests of the Satoi range and the Ghosu bird sanctuary and harbors endangered and threatened species like the Blyth's tragopan (*Tragopan blythii*), fishing

cat (*Prionailurus viverrinus*) and Chinese pangolin (*Manis pentadactyla*). The Tizu River, which flows through to these villages, harbors a number of IUCN Red List fish species.

The pilot villages are dominated by the *Sema* tribe, and the economy is largely agriculture and forest-centered. Though farming is mainly for subsistence, high dependence prevails on the other abundant resources of *jhum* (shifting cultivation) lands, which include timber, medicinal plants and non-timber forests products. Wildlife is an important resource for the communities and is exploited for various reasons, including food, additional income, cultural practices and as a sport. The overall SEPL comprises of a mosaic of different vegetation types and can be broadly categorized as primary forests, secondary forests, *jhum* land and plantations.

2.2 Multiple values of the SEPLs and challenging issues faced

The SEPLs of Zunheboto provide the local people with almost all of their daily subsistence and survival needs, apart from contributing to their rich cultural heritage, folklore and traditions. Landscapes of this area are comprised of diverse elements—subtropical forests interspersed with *jhum* fields and differentially aged, regenerating *jhum* fallows. *Jhum* is basically 'farming the forest', where patches of forests are cleared for cultivation and then abandoned to fallow for several years. In Nagaland, this system of shifting cultivation ensures that even landless farmers are allocated patches of forest to farm and is perhaps a reason for the high forest cover of Northeast India (Northeastern forests account for 25% of India's forest cover). Consequently, the people farm in the forest and the two are perceived to be inextricably linked by the local communities. The forests provide enormous benefits to the local communities in terms of ecosystem services such as timber, fuelwood and forest products. Food production is enhanced owing to the location within the forests (for example through enhanced pollination, water flows, nutrient enrichment, and natural fertilizers). The *jhum* fields sustain a diversity of local varieties of crops (e.g. *Miyeghu*, which is the local variety of paddy) that feed the people and their livestock. The rivers flowing through their lands irrigate their fields and forests and provide them with fish. In the valley areas adjoining the rivers, the people also grow paddy in a *pani-kheti* system (water fed agriculture/terrace farming). Local landraces are preferred and grown, including the Naga Mircha (*Capsicum chinense*) and the Nagaland tree tomato or tamarillo (*Cyphomandra betacca*), that have recently acquired the Geographical Indication (GI) tag as directed by the Trade Related Aspects of Intellectual Property Rights (TRIPS) agreement.

Traditionally, the Naga tribes had an intimate relationship with nature and their SEPLs are based on a foundation of the interconnectedness of God, people and nature. This is reflected in their rich folklore on the plants and animals of their forests. Some of these stories underline the ecological role that animals play in the ecosystem and their contribution to 'ecosystem services' for human beings. For example, the role of the earthworm in enhancing soil fertility is transmitted through a folktale (TERI 2017). The value of their SEPLs was culturally realized and codified through wise use—for example, the killing of pregnant animals and birds was a taboo that would bring misfortune to the hunter and his family. Fishing and the use of certain poisonous roots and leaves that kill fishes in the rivers or springs during the spawning season were also restricted (Lkr & Martemjen 2014).

The Naga people in general consider all land to be sacred. *Jhuming*, or shifting cultivation, involves clearing the land and burning the jungle, so people propitiate the spirit with rice, crabs and rice beer to beg for forgiveness for the many animals, plants, birds and reptiles that might be inadvertently harmed. The entire lives of the *Sema* people revolve around their forest-farm landscape. All the cultural festivals of the local people are linked to their agricultural calendar, and the *Sema* people's agricultural calendar in turn is attuned to nature, guided by the movement of the stars or of birds—their migration patterns, breeding seasons and songs. For example, the sowing of paddy is initiated only when the constellation of Orion (*Phogwosiilesipfemi*) is at its zenith or after the *kashopapu*, a species of cuckoo, is heard calling (Hutton 1921).

For the local *Sema* communities, a vibrant well-functioning SEPL implies that abundant wild fauna is present in their forests, and easily sighted when they *jhum* their fields, and that fish catches are abundant, large-sized and diverse, consisting of many species. Forests are protected at the top of hills so that their watershed services are enhanced. For example, in the pilot village of Kivikhu, the main source of water for drinking and household activities is located 2.5 km from the village boundary on a mountain top in an area that is locally called *Shoshemi-ghoki* (*ghoki* meaning stream). Traditionally, lengthening of the *jhum* cycle provides improved scope for natural biodiversity to regenerate. This is an extremely positive sign as *jhuming* is an excellent way to protect forests and associated biodiversity and yet produce crops, provided that long fallow periods allow for the forest to regrow (see Fig. 3).

Figure 3. Multiple uses of SEPLs in Nagaland in the form of forest, *jhum* (shifting cultivation) and *pani kheti* (water fed agriculture/terrace cultivation)

Of the issues currently faced in managing the SEPLs, the main challenge is the decreasing *jhum* cycles. Earlier when a forest patch was cleared, each patch was cultivated for only one to two years and then left to regenerate for upwards of 15 years. However, the decreasing *jhum* cycles at present (less than seven years and often only for three to five years) prevent effective regeneration and lead to much soil erosion. Given the dependence of the local community on forest cover for a variety of provisioning and regulating ecosystem services, loss of forest cover has affected agriculture and the availability of water for domestic and agricultural use.

Though wildlife hunting is an age-old practice and a culturally embedded practice in the Naga way of life, the use of guns has become increasingly common, and is popular due to the easier and higher probability of killing prey than traditional ways of hunting. This has led to rapid depletion of wildlife with many species on the brink of local extinction. Aggressive fishing using poisons (such as bleach and lime powder), dynamite and electrocution using battery packs has also led to reduction in fish populations of the Tizu River flowing through the villages. Fear of losing all the fish and the natural ecosystem is one of the reasons that led to local communities to declare a reserve in their mountainscape. As a wise-use practice, they believe that fish and other animal species breed in the reserved areas and their populations are revitalized and replenished over time (see Fig. 4).

2.3 Description of activities

Though a reserve area has been in existence since 2002, it did not contribute to conservation in the absence of a well-delineated program to safeguard ecosystems and conserve SEPLs. To ensure conservation of large contiguous forest areas, it was decided to mobilize support to link the community-conserved areas, revive traditional conservation practices, carry out ecological assessments of these CCAs, develop community-based ecotourism initiatives and formalize and mainstream a network of CCAs along with the Nagaland Government and the State Forest Department.

Several deliberations were held with the communities of the three pilot villages of Sukhai, Ghukhuyi, and Kivikhu, to form a joint CCA Management Committee in order to enforce rules that ban hunting, fishing, and logging as well as collection of medicinal plants in the designated CCAs, and to prepare biodiversity registers to document traditional ecological knowledge (TEK). Other activities proposed and carried out by the Tizu Valley Biodiversity Conservation and Livelihood Network (TVBCLN), a formal local CCA body, along with TERI and Titli Trust (an Indian NGO primarily focused on conservation and livelihoods in the Himalayas), were comprised of training the youths in biodiversity assessments and sustainable use of natural resources; preparing resource maps; generating awareness through sensitization campaigns; and promoting ecotourism as an alternative livelihood activity (see Fig. 5 and 6).

Figure 4. (left to right) Hunted wild animals for sale, *jhum* (shifting) cultivation and electrocution of aquatic fauna using battery packs (Photo Credit: Siddharth Edake)

Figure 5. (left to right) Members of the apex committee of TVBCLN & the CCA landscape (Photo Credit: Siddharth Edake)

3. Results

3.1 Conservation education and sensitization

Community engagement through consultation, conservation education, and public sensitization approaches was used to increase awareness of threats and integrated approaches at the community and stakeholder level. This was achieved through participatory planning, knowledge sharing, and capacity building. Around 30 sensitization campaigns were organized within the three pilot villages and on other community platforms like the local *Ahuna* festival, thus reaching out to a total of around 1,200 individuals directly, along with a positive impact on more than 10,000 individuals indirectly living in the vicinity of the project site. This resulted in many more villages urging a replication of these methods to manage their SEPLs, the latest being Chipoketa village, adjoining Kivikhu village, which is dominated by the *Chakesang* community. Also, scientific publications, popular articles, as well as websites (http://nagalandcca.org/ and http://gef-satoyama.net/) have helped to gain the attention of various stakeholders and boosted the engagement. In addition, exposure visits were undertaken for the community members to the neighboring states to showcase similar case studies, success stories and best practices with respect to community conservation.

3.2 Formation & formalization of joint Community-Conserved Areas

Due to the continuous and intense engagement with the communities, the three villages of Sukhai, Kivikhu and Ghukhuyi in Zunheboto district of Nagaland formally declared around a total of 939 hectares of biodiversity rich forest as CCAs in respective villages, which are now being jointly managed by them (see Table 1). However, apart from these CCAs, they have also banned hunting and destructive fishing across the entire landscape of their villages, covering 3,751 hectares of forests and rivers. In general, each CCA on average is about 25% of the total landscape area owned by the village, which is quite large. The CCAs were delineated and mapped and the boundaries were well-defined through demarcation, digitization and participatory mapping. This

Figure 6. (left to right) Preparation of village resource maps and People's Biodiversity Registers (Photo: Siddharth Edake) and training of youth on biodiversity assessments (Photo: Pia Sethi)

Table 1. Area of CCAs and associated landscape

Villages	Area of CCA (in ha)	Total landscape area (in ha) that is protected from hunting and fishing	CCA as % of total landscape area
Sukhai	365	1,473	24.77
Ghukhuyi	370	1,132	32.68
Kivikhu	204	1,146	17.80
Total	939	3,751	25.03

resulted in improved management of common resources. Also, a blanket ban on hunting wild animals and birds, a ban on fishing by use of explosives, chemicals and generators, strict prohibition of cutting of fire-wood/felling of trees, as well as a ban on collection of canes and other non-timber forest products for domestic and/or commercial purposes in the CCAs, have ensured conservation of large contiguous forest areas along with the unique endemic biodiversity they support (see Fig.7 and 8).

3.3 Biodiversity assessments and preparation of People's Biodiversity Registers (PBRs)

Regular biodiversity surveys in the designated CCAs found an increase in the diversity of birds, reptiles, butterflies and moths with the current checklist listing 222 species of birds, 31 reptiles, 11 amphibians, 200 species of butterflies and more than 200 species of moths. This diversity is very high in comparison to the nearby patches of forest, which do not receive protection and have been documented in the People's Biodiversity Registers (PBRs) with local and scientific names. These PBRs prepared for the three villages of Sukhai, Kivikhu and Ghukhuyi document the folklore, traditional knowledge, ecology, biodiversity and cultural practices of the locals and help codify the oral knowledge of the communities.

Biodiversity surveys by local communities have strengthened interest in conservation. The youth share pictures of wildlife snapped by them on a "*WhatsApp* group". Sightings are recorded in field registers and this has created a conservation community amongst the youth. These sightings are also important for research and are uploaded on websites such as "eBird" and "Birds and Butterflies of India". Regular assessments can provide information on seasonal variations, range extensions and changes in population abundance. The local people can use this knowledge to develop their own resource monitoring methods. Moreover, camera traps can indicate whether RET species such as the tragopan are still sighted in the area. These surveys, by documenting unique, rare or special fauna, have also acted as a catalyst to attract more outsiders to the area as ecotourists. Well-known local bird guides are now including Zunheboto in their travel itineraries. Given that unidentified species of bats and squirrels have been sighted through these surveys suggests that this documentation will be an invaluable resource base in the future and a contribution to scientific research in the area. A paper on the mandarin trinket snake has been jointly published with an active youth member (see Fig.9).

3.4 Alternative livelihood opportunities through ecotourism

The training of youth in biodiversity assessments and sustainable use of natural resources, as well as the training and capacity building of local community members as nature guides for ecotourism, has resulted in enhanced livelihood opportunities with the steady flow of tourists that are visiting this area to spot 'bird and butterfly specials'. These include birds like the Naga wren-babbler *(Spelaeornis chocolatinus)*, Hodgson's frogmouth *(Batrachostomus hodgsoni)*, spot-breasted parrotbill *(Paradoxornis guttaticollis)* and the grey-headed parrotbill *(Paradoxornis gularis)*, and butterflies like the endemic Naga Emperor *(Chitoria naga)* and Rufous Silverline *(Spindasis evansii)*. Ecotourists also engage with the local communities to understand their traditions, culture, food and conservation activities. This has further motivated the communities, including those from neighboring villages, to take up conservation and protect their natural resources (see Fig. 10).

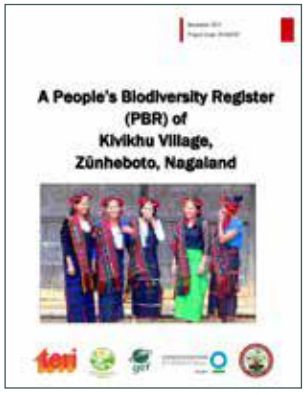


Figure 7. (left to right) The TERI team and local people in Sukhai village, People's Biodiversity Register of village Kivikhu (Photo: Siddharth Edake) and the CCA logo (Photo: TERI, Titli Trust and Tshetsholo Naro)

Figure 8. Signage of CCA in Sukhai Village, Nagaland (Photo: Siddharth Edake)

Figure 9. (left to right) State bird of Nagaland- Blyth's Tragopan *(Tragopan blythii)*, exposure visit organized for community members & documentation of butterflies in the CCA (Photo: Siddharth Edake)

Figure 10. (left to right) Ecotourists at the second biodiversity meet near the Tizu River, Barking deer *(Muntiacus muntjak)* in the CCA boundary (Photo Credit: Siddharth Edake)

4. Discussion

An assessment by TERI to document the resilience status of pilot villages at the start of the project concluded that the communities were sensitive to the diversity of landscapes within their village. Due to traditional farming and allied conservation practices, they believed that the landscape has good resilience and can regenerate; however, the loss of biodiversity due to illicit tree felling and rampant hunting is irreversible. There was also a good understanding of ecosystem services provided by community areas mainly in the form of water and wild meat. However, the elders of the village also reported that the traditional taboos and beliefs that encouraged wise-use practices in the past may be becoming increasingly irrelevant, in part because of changes in religion, culture and globalisation. While in the short term these CCAs face problems of rule breaking particularly with regard to hunting, in the long-run threatening the very sanctity of these areas are the lost revenues from timber production. As populations grow, land prices rise and people move away from their villages, more private and clan owners of CCA land may want to manage their forests for timber, rather than for conservation.

One important lesson learned through this project is that if communities are well informed and empowered, they can take steps to protect their natural resources and use them judiciously. The project directly helped the communities to strengthen the age-old practice of conserving community forests through mobilization and building synergies. The project also responded to the critical needs of the pilot area by documenting the traditional knowledge and raising awareness on the impacts of anthropogenic activities on the biodiversity and ecosystem services of the CCAs, as well as the ripple effect on the socio-economic and cultural lifestyle of the *Sema* people. Again, the project through its effort to generate alternative livelihoods built the capacity of communities on ecotourism and is contributing to biodiversity conservation. The positive impacts of the project activities were evident in the second resilience assessment conducted by TERI at the end of the project. The communities reported increases in the protection of natural resources after the formation of jointly managed CCAs, and improvement in management of common resources. The elders were satisfied with the documentation of their traditional and cultural indigenous knowledge in the People's Biodiversity Registers (PBRs), while the youth, women's groups and the marginalized members of the community reported increases in their household income due to ecotourism. The protection of a stretch of Tizu River passing along the boundary of a CCA also resulted in an increase of fish-catch downstream.

Local communities are intimately dependent upon the resources provided by their SEPLs and are well aware of the many benefits they receive from their landscapes. However, over time traditional knowledge has eroded and the folklore and practices that supported the wise use of their landscapes are being lost. Nevertheless, the way people perceive certain elements of their landscapes has shifted after this project. In particular, the importance of stopping hunting to increase wildlife abundance is now well supported. The role of wildlife in promoting forest regeneration, and the interconnections of healthy rivers and fish abundance are clearly understood. Increasingly, though slowly, the people realise that forests and biodiversity can also provide economic benefits through livelihood alternatives like ecotourism. Their fast eroding awareness of the importance of healthy SEPLs to their lives and cultures that were once traditionally embedded in their beliefs and practices is now slowly reviving. These changing perceptions have been captured through the second assessment of the indicators of resilience which further underscores that local people now understand the value of banning hunting and fishing for the benefit of future generations.

This project is just the start of what we hope will be a movement for conservation in the State of Nagaland. To date, impacts of the project have been monitored based on indicators and a baseline developed at project initiation. The project has far exceeded our expectations. Since the project is for only two years, another objective was to ensure sustainability of the initiatives. In January 2019, the local communities independently organised a *Chengu* (Great Barbet) conservation festival which was a vibrant demonstration that the local people were well on their way to independently carrying out conservation.

Future monitoring in villages will be ensured by the Village Councils themselves. The Village Councils have set in place sets of resolutions, and those failing to comply are heavily fined. The local communities now patrol their forests and prevent both outsiders and people from their own villages from hunting and fishing. They also share pictures of those disobeying their rules on a *WhatsApp* group for quick action, and educate and motivate the people of other villages to eschew hunting. The Tizu Valley Network further supports education and sensitization and livelihood activities. Moreover, the government has taken notice of this initiative and has come forward to support it by developing the area into a Community Reserve under the Indian (Wildlife) Protection Act, for which limited funding is available.

The value of linking CCAs as a network so that they act as refuges for wildlife and enhance connectivity for wildlife movement has now been recognised by the Government of Nagaland. Enabling joint CCAs as formal institutional mechanisms that promote landscape conservation and facilitate nature-based livelihoods is soon to be supported through externally aided projects to strengthen forest and biodiversity management in the State. TERI has also developed a draft policy on CCAs as institutional frameworks for conservation in the State, which has been shared with the Government of Nagaland.

5. Conclusion

The case study of the Tizu Valley Biodiversity Conservation and Livelihood Network's (TVBCLN) CCAs has yielded positive results in terms of sustainable use of biological resources by adopting long-term sustainability, enhanced governance and effective conservation of SEPLs. Up-scaling of activities initiated by the communities will involve the formalization and mainstreaming of a network of CCAs in the State which are at par with India's Protected Area (PA) network in conjunction with the Nagaland Government and Forest Department. This will also require technique, finance and institutional support to encourage and sustain the practice of CCA formation and sustainable management. Given that 88.3% of forests are under the governance of the communities in Nagaland, the Community-Conserved Areas (CCAs) constitute the primary method for forest management and conservation of SEPLs in the State. The government needs to provide the policy, technology and the funding needed to allow these conservation groups to perform their role uninterrupted.

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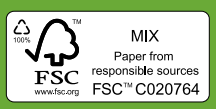

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