IUCN

People in Nature

Valuing the diversity of interrelationships between people and nature

Edited by Iain J Davidson-Hunt, Helen Suich, Seline S Meijer and Nathalie Olsen

CEESP   PEOPLE *in* NATURE

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ACKNOWLEDGEMENTS

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ACRONYMS

AIBK	Australian indigenous biocultural knowledge
AMFA	Marine and Fisheries Agency, Government of Aceh
CEESP	Commission on Environmental, Economic and Social Policy
CIFOR	Centre for International Forestry Research
CIPs	coastal Indigenous peoples
FFALG	Caribbean Fisherfolk Action Learning Group
FFI	Fauna and Flora International
FPT	Forest–Poverty Toolkit
ISA	interdisciplinary situation analysis
MA	Millennium Ecosystem Assessment
MPA	marine protected area
NbS	nature-based solutions
OCR	optical character recognition
PEN	Poverty and Environment Network
PiN	People in Nature
RLE	Red List of Ecosystems
SES	social–ecological systems
SIS	Species Information Service
SLA	sustainable livelihoods approach
TEV	total economic value
TEEB	The Economics of the Environment and Biodiversity
TEKS	Traditional Entertainment and *Kastom* Support
U	potential use (of biodiversity)
Uc	current use (of biodiversity)

AN INTRODUCTION TO PEOPLE IN NATURE

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THE PEOPLE IN NATURE KNOWLEDGE BASKET

The aim of the People in Nature (PiN) knowledge basket is to promote the uptake of existing knowledge and generate new knowledge on the interrelationships between humans and nature, focussing on the use of biodiversity (genes, species and ecosystems) and its contribution to the lives of rural and remote communities.

PiN assessments will focus on people's material use of biodiversity (e.g. for food and nutrition, health and medicine, energy, shelter, income, ceremony and trade), recognising that use is embedded within worldviews that include deep-seated cultural norms, values and understandings. These assessments will also consider symbolic interrelationships with nature expressed through cultural narratives, language, and traditions, including diverse understandings of sacred and spiritual aspects of nature and our relationship with natural resources.

The absence of mechanisms for decision-makers to systematically consider the material and symbolic roles that nature plays in people's daily lives can result in interventions or policies that alienate communities from, or restrict access to resources. These can, in turn, disrupt traditional land and resource management practices, and as a consequence undermine livelihoods and threaten critically important species, habitats and ecosystem services, and the relations people have with nature. Thus PiN assessments will also contribute to the sustainable use of nature.

The PiN knowledge basket is currently in development, but is envisaged to contain approaches, tools and standards and associated capacity building to improve the understanding of the interrelationships between people and nature. Through its development and application, it will allow for more systematic data collection, documentation and analysis, and thus enhanced understanding and communication of local social–ecological contexts that are relevant to policy formulation and development interventions. These interventions should result in tangible improvements to livelihoods and well-being, or reductions in poverty in those communities PiN is working with.

PiN has two overarching goals. The first is to provide resource managers at different scales (Indigenous peoples, rural and remote communities, government and non-government agencies, etc.) with mechanisms to identify and document material and cultural uses of nature in order to influence conservation and development planning and to develop strategies to scale up and enhance their influence in decision making. The second objective is to facilitate opportunities to learn from, communicate and exchange experiences with other resource managers.

These goals will be achieved, firstly, by improving the means for rural and remote communities to document their use of ecosystems through participatory approaches and toolkits; to influence policy by communicating through various media; and to promote learning and exchange between communities. Secondly, these aims will be achieved by providing key decision makers with tools to better value and account for the material and cultural use of nature and to incorporate cultural values explicitly, in order to manage the impacts of policies and interventions on local livelihoods.

The analytical framework of PiN is the biodiversity-based system, which explicitly and comprehensively incorporates cultural elements of the interrelationships between people and nature. It has a robust approach to differentiating values and impacts arising from changes in the availability and/or management of biodiversity (i.e. the distribution of benefits and costs based on age, class and gender, etc.) and incorporating the dynamic nature of those interrelationships. The key design features of PiN include:

- prioritising the identification and use of secondary datasets and recommending primary data collection only where gaps exist;

- a modular approach to development and application;

- the inclusion of spatially explicit data;

- an emphasis on early community and multi-stakeholder engagement, and requiring the use of standards and protocols for work with rural and remote communities (including Indigenous peoples and local communities);

- the inclusion of indigenous knowledge and science;

- links with conservation and development planning and management to ensure applicability;

- integration with other IUCN knowledge baskets/products;

- encompassing scientific standards, workflow processes and relationships, capacity-building, datasets and products, as well as tools;

- scalability, to link local data collection and scaling of data to regional national and international levels for broader synthesis, trend assessment and application; and

- a robust approach to differentiate values, use and reliance by gender.

It is anticipated that the data collected using the PiN approach will be utilised to inform and improve conservation policy and development processes, enhancing transparency with respect to interventions, and better equipping historically disenfranchised resource managers to exercise their rights to legal recourse. In doing so, PiN seeks to generate knowledge that can be used to bring about tangible improvements to natural resource dependent livelihoods and well-being. The anticipated audience for PiN analyses is therefore highly varied, and will include (but not necessarily be limited to) remote and rural communities, land managers and conservation and development decision makers at various levels, major financial institutions (e.g. World Bank and regional development banks), intergovernmental organisations and donors (to help strategy development and inform priority setting) as well as representatives from the private sector, who are investing in activities affecting rural and remote communities, land and resource management.

A brief history of the PiN initiative

At the 2012 IUCN World Conservation Congress in Jeju, South Korea, IUCN identified the development of a knowledge product that would consider the dependence of people on nature as a priority in its 2013–2016 Programme. The development of this knowledge product was to be undertaken using IUCN's 'One Programme' approach, meaning that it would be co-produced by the Secretariat, Commission and institutional Members of IUCN, and would fit within the Nature-based Solutions programme of IUCN (see Box 1.1).

A Steering Group was formed, made up of Secretariat staff, members of the Commission on Environmental, Economic and Social Policy (CEESP) and IUCN Members' representatives. The Theme on Sustainable Livelihoods became the

CEESP focal point, and additional representatives came from the specialist groups on Indigenous peoples, customary and environmental laws and human rights and sustainable use and livelihoods, as well as from the Theme on Indigenous Peoples, Local Communities, Equity and Protected Areas. The focal point for the Secretariat is the Global Economics and Social Science Programme of the Nature-based Solutions Group of IUCN. The Steering Group hosted a number of workshops during 2013, 2014 and 2015, and developed a preliminary concept note to guide the development of the knowledge basket (IUCN, 2014).

It was at that time that the description of PiN as a knowledge basket was introduced, expanding the rather narrow notion of a single analytical tool to a more comprehensive framework; a basket would contain approaches, tools and standards and capacity building regarding the interrelationships between people and nature.

Framing the knowledge basket

The interrelationships between people and nature are complex, and take shape through appropriation, consumption, transformation and exchange. Likewise, aesthetics intertwine material and symbolic values, which are further nested in local perception and cultural processes. Understanding these relationships therefore requires not only the use and integration of diverse methods, but also an understanding that multiple knowledge systems and perspectives cannot be captured under a single epistemology. This reinforces why PiN moved to a knowledge 'basket' framework rather than a single methodology and 'product' approach, that would not, by itself, be able to capture the complexities of the interrelationships between people and nature.

The idea of a knowledge basket was introduced by CEESP Chair, Dr Aroha Te Pareake Mead, when she shared a story about a Māori teaching that conceptualises three baskets of knowledge. From her perspective, what we were discussing at an early meeting was knowledge which could be shared with others for the benefit of humanity, emphasising that knowledge is something that is created – and in our case would be created collaboratively by the participants of the initiative.

The term 'knowledge baskets' is inspired by the Māori tradition of the God Tāne's ascent through the twelve heavens to bring back to earth three baskets of knowledge (see Box 1.2) (Marsden, 1992). In the context of PiN and the Natural Resources Governance Framework, knowledge baskets are a metaphor for working in a holistic way, valuing ethical respectful and reciprocal relationships as well as investing in the human, social and cultural dimensions of environmental knowledge.

Baskets have meaning across indigenous cultures, almost all of whom have traditions around using baskets for functional earthly purposes as well as for sacred purposes, thus

Box 1.1 – Nature-based solutions in the IUCN 2017–2020 programme

by MA Jones

Nature-based solutions is an emerging term for environmental management and research (Eggermont, et al., 2015) that recognises the complexity of social–ecological systems and the limitations of technological responses to Anthropocene change (Steffen, et al., 2015). Potschin, et al. (2015) provide a detailed history of the emergence of nature-based solutions (NbS) and discuss its value in relation to the concepts of Natural Capital and Ecosystem Services.

The NbS concept was also adopted by the European Commission and is to be used by the European Union for investment in its research and innovation programme, Vision 2020 (Maes & Jacobs, 2015). According to the European Commission, NbS "aim to help societies address a variety of environmental, social and economic challenges in sustainable ways. They are actions inspired by, supported by or copied from nature; both using and enhancing existing solutions to challenges, as well as exploring more novel solutions, for example, mimicking how non-human organisms and communities cope with environmental extremes" (EC, 2015:24), a definition predicated on continuous economic growth.

IUCN first mentioned the concept in 2009 (IUCN, 2012) and subsequently chose 'Nature-based Solutions' as one of its Global Programme areas. In 2014, IUCN established a small working group to undertake research on the extent to which NbS and related concepts that incorporate ecosystem services are used in the scientific and grey literature. Findings of the research are being used to refine the definition of NbS and develop an operational framework that includes a goal, guiding principles, parameters and guidelines for project implementation.

A proposed definition and goal are part of a draft motion for the 2016 General Assembly of IUCN, seeking support for the development of NbS as a conservation and development framework for the 2017 to 2020 quadrennium. In essence, the working group sees NbS as interventions based on the ecosystems approach that address societal challenges to simultaneously provide human well-being and biodiversity benefits. Societal challenges include food and water security, climate change and disaster risks. The proposed goal recognises the importance of cultural values in enhancing ecosystem resilience and in determining the kinds of service provision for which ecosystems will be managed. This is explicit recognition of the co-evolutionary nature of the relationship between people and nature and the value of biological and cultural diversity as ecosystem properties that enhance resilience.

IUCN's use of the term 'knowledge basket' involves incorporating a traditional knowledge concept into IUCN's policy framework as well as providing greater scope for people throughout the global indigenous conservation community to contribute to IUCN's important scientific work.

To continue the basket metaphor, a knowledge basket is therefore something that is woven together by participants; it is formed from choices made regarding the materials used, and the warp and weft of the weave that will make it both useful and pleasing for those who interact with it.

Weaving the PiN knowledge basket has involved the discussion of conceptual and methodological underpinnings, as well as learning from existing IUCN and Members' projects. It has also included the initiation of case studies in Costa Rica and Malawi and others that are in the early stages of development. The long-term goal is to create a programmatic priority of learning within IUCN that brings together the Secretariat, IUCN Members, Commission members and partner communities to learn about and understand material uses of nature and symbolic interrelationships.

From Human Dependence on Nature to People in Nature

The initiative to develop the Human Dependence on Nature knowledge product emerged out of previous work by IUCN and others to highlight the importance of forests to the livelihoods of forest dependent communities, and through the application of the Forest–Poverty Toolkit (FPT). The work on forest dependence emerged in turn, out of early discussions with the Centre for International Forestry Research (CIFOR), the Programme on Forests and others interested in providing an evidenced-based approach to documenting the share of total household income derived from forests. Another related initiative that emerged at around the same time was the CIFOR-led Poverty and Environment Network (PEN).

PEN defined forest dependence, or more recently forest reliance, as the share of total household income derived from forests (Angelsen, et al., 2014). Forest dependence was calculated as a proportion of total household income from all sources (wages, remittances, transfer payments, environmental income, etc.). Total environmental income included

Box 1.2 – Tāne and the three baskets of knowledge

Tāne's journey to the heavens is reflected in the following ritual chant and story:

> This is the journey of sacred footsteps
> Journeyed about the earth journeyed about the heavens
> The journey of the ancestral god Tānenuiarangi
> Who ascended into the heavens to Te Tihi-o-Manono
> Where he found the parentless source
> From there he retrieved the baskets of knowledge
> Te kete-tuauri
> Te kete-tuatea
> Te kete-aronui
> These were distributed and implanted about the earth
> From which came human life
> Growing from dim light to full light
> There was life.
> Tēnei au te hōkai nei o taku tapuwae
> Ko te hōkai nuku ko te hōkai rangi
> Ko te hōkai a tō tupuna a Tānenuiarangi
> Ka pikitia ai ki te rangi tūhāhā ki te Tihi-o-Manono
> Ka rokohina atu rā ko Te Matua-kore anake
> Ka tīkina mai ngā kete o te wānanga
> Ko te kete-tuauri
> Ko te kete-tuatea
> Ko te kete-aronui
> Ka tiritiria ka poupoua
> Ka puta mai iho ko te ira tangata
> Ki te wheiao ki te ao mārama
> Tihei-mauri ora!

Tāne was the God of the Forests and all that dwells within them. To acquire the baskets of knowledge, Tāne had to ascend to the twelfth heaven, and there be ushered into the presence of the Supreme God, Io-Matua-kore, to request knowledge. The request was granted. According to Māori tradition, knowledge came before humanity. The three baskets of knowledge are usually called te *kete tuauri, te kete tuatea* and *te kete aronui*.

Te kete Tuauri (sacred knowledge) is the basket that contains knowledge of things unknown – rituals, incantations and prayers. Well respected Māori elder and scholar, the Reverend Māori Marsden, describes *tuauri* as the real world of the complex series of rhythmical patterns of energy, which operate beyond this world of sense perception.

Te kete Tuatea (ancestral knowledge) is the basket that holds knowledge beyond space and time, beyond our contemporary experiences – it is the experience we have of connections with one another and with the past, knowledge of spiritual realities.

Te kete Aronui (knowledge before us) the basket of knowledge of *aroha* (love), peace and the arts and crafts which benefit the Earth and all living things. This basket relates to knowledge acquired through careful observation of the environment. Sometimes it has been regarded as the basket of literature, philosophy and of the humanities.

Wisdom requires that the three types of knowledge should be used together, never one in isolation.

Source: Marsden (1992); Mead (2016); Taonui (2012)

the use of environmental resources for both subsistence (i.e. direct use within the household) and trade, and values were calculated using market prices, where such prices existed, and proxy values for goods without market prices. This approach requires data on the quantity of goods and services consumed and traded for each household for a year (though households were sampled quarterly to reduce recall error).

IUCN has taken two approaches to estimating the share of household income from forests. The first was the FPT, which was developed as a complement to the quantitative approaches of PEN, which was aimed primarily at project managers and practitioners. Like PEN, the objective of the FPT was to demonstrate the importance of forests to the livelihoods of the poor. The FPT was based on a more a participatory approach, working with communities using participatory rural appraisal and other participatory methods (IUCN, 2012). More recently, the European Neighbourhood Policy Instrument – Forest Law Enforcement and Governance Programme, has drawn on the PEN methodology and utilised quantitative village and household surveys to improve estimates of the share of household income derived from forests in seven eastern European countries.

While the PiN team recognises the importance of this approach to assessing and understanding dependence, it aims for a broader remit. First, PiN explores a more multi-dimensional and dynamic approach to understand the interrelationships between people and nature – looking beyond income as the single dimension to be considered, recognising the impacts of intra- and inter-year variability and shocks in affecting these relationships (Hughes, 2009; IUCN, 2013; Muller & Almedom, 2008; Turner & Davis, 1993). Second, PiN examines the full range of ecosystems that are utilised by people, not only forest resources. Third, PiN aims to document flows of species utilised from ecosystems in a landscape, for example, an indigenous community's territory. In part, this is to understand the linkages between conditions of ecosystems that provide species, and how endogenous or exogenous drivers or actions influence the availability and stability of species, ecosystems and landscapes. Finally, PiN aims to more strongly and explicitly address symbolic interrelationships, expressed through cultural narratives and ceremony.

The rationale for the initial focus on the material and cultural utilisation is two-fold. First, it is difficult to value and document the role of regulating and supporting ecosystem services, and a focus on material and cultural utilisation has more direct, and tangible, links with livelihoods. By addressing data gaps around the direct material and cultural uses by individuals, households and groups, PiN targets analysis and interventions in those areas where decision making around land use, development and poverty alleviation matters most – where species and ecosystems provide essential inputs into local livelihood strategies.

Many rural and remote communities hold rights to continued use of species and to access harvest sites, and it is a state obligation to ensure that the substantive basis of such rights continue to exist and be available for use when desired or needed (UN, 2007). The Convention on Biological Diversity and the Aichi Targets have broader applicability and require states to ensure that species and ecosystems persist and are available for sustainable use. The need to consider governance issues is also consistent with IUCN's commitment to take a rights-based approach to conservation and development, endorsement of the UN Declaration on the Rights of Indigenous Peoples and its Policy on Human Rights for Sustainable Development.

These interests led to a change in name of the knowledge basket and the adoption of a modular approach to allow work to develop with complementary but distinct approaches. 'People in Nature' was proposed as the new name for the knowledge basket in South Africa in October 2015, and was chosen because it reflected a holistic understanding of interrelationships of people as part of nature.

As is apparent from this short overview, the process is in its formative stages, with divergent thinking and dynamic development. At its core is an interest in convening the IUCN community, along with new partners, who share the goal to better understand the material contribution of nature and the symbolic interrelationships expressed through cultural narratives and ceremony. This is consistent with the need to develop this knowledge basket in a way that makes it possible for communities to express their own perspectives and voices. As a knowledge basket, PiN is both a container to hold that which we currently know, and a process of weaving to build new understanding.

PiN and other IUCN knowledge products

As noted above, the PiN knowledge basket is being developed to promote learning among PiN partners and participants through a One Programme approach to build understanding of the interrelationships between people and nature. It is being designed to complement, draw on and add value to existing IUCN knowledge products, such as the IUCN Red List of Threatened Species™, IUCN Red List of Ecosystems, Key Biodiversity Areas and Protected Planet knowledge products, and to collaborate with projects with similar aims to apply existing approaches and methodologies and develop new ones where they are lacking.

IUCN knowledge product integration is at an early stage, but early PiN applications may provide opportunities to pilot knowledge product integration. Several possibilities have been identified with the Species Information Service (SIS), through data collection on human utilisation of particular species. A potential connection may be through the classification schemes used by the Red List(s) for use and trade, livelihoods and ecosystem services. A scoping exercise has been undertaken to explore whether links could be made between secondary data regarding the use of biodiversity at

an early application site (Talamanca, Costa Rica) to the SIS and the Red List of Ecosystems to investigate the conservation status of species utilised – and important for maternal and child health – at the site (Deutsch, et al., 2016a). The objective of that scoping exercise was to explore how secondary data might be used to answer specific questions related to material and symbolic use of nature by people (Deutsch, et al., 2016b), and avoid repeatedly approaching communities to participate in new studies, in cases where information is already available.

THE FOLLOWING CHAPTERS

In the first workshop, there was much discussion of 'dependence' and whether other approaches and concepts might provide a more multi-dimensional perspective on material use of nature and symbolic interrelationships. These discussions, and agreement on expanding the PiN remit, formed the basis of the chapters presented here, which have been reviewed by IUCN staff, Commission members and a range of other interested scholars and practitioners. The chapters are summarised below and are related to the broad themes of building resilience, mixed methodologies, values, livelihoods, well-being and poverty, and the use of secondary data. In addition, between each of the chapters in this volume is a vignette, which provides readers with a brief description of a project, being worked on by IUCN and Commission members, in order to highlight ongoing work that is related to the PiN mandate.

The use of biodiversity for responding to globalised change

This chapter opens a line of inquiry for the PiN knowledge basket to consider the contribution that can be provided by nature for responses of rural and remote communities to globalised change. This builds upon a long-standing interest of IUCN in bringing people into conservation practice, linking conservation and development discourses and, more recently, the programme area of nature-based solutions (IUCN, 2016; McNeely, 1995). The chapter suggests that the resilience of rural and remote communities is, in part, linked to the potential of biodiversity from their territories and landscapes to contribute to their responses to globalised change. An analytical framework is presented for understanding how the use of biodiversity is shaped by the factors of availability, stability, access and perception. This framework can help support PiN learning groups to understand why, or why not, the potential of biodiversity to contribute to responses to change is realised in new development pathways. Such analyses may then be utilised to support rural and remote communities in identifying nature-based solutions to globalised change that may consist of, for example, technological innovation, institutional transformation and new policy development.

Mixed methodology for PiN landscape assessments

During early workshops, concern was expressed about the focus on quantitative methods in a dependence approach.

This led to an interest in developing a mixed methodology for understanding biodiversity-based systems and how these systems contributed to livelihoods and well-being. Given the impact of large-scale development on landscapes, ecosystems and species, an assessment approach was needed that could accurately represent the interrelationships between people and nature through the material and cultural contributions of species, and their flows at the individual, household and community level. In order to capture the diversity of understanding and perspectives on nature nested in Western and non-Western ontologies, the PiN mixed methodology has been designed to develop representations based on cultural narratives and other qualitative approaches, as well as quantifications where appropriate. The workflow of this methodology prioritises the use of secondary data, integrated with the use of quantitative and/or qualitative primary data collection methods to examine the multiple dimensions of these material uses and symbolic interrelationships.

Values and human interrelationships with nature

Anthropocentric perspectives towards nature provide valuable insights into human interrelationships with nature, and are often viewed from an economic perspective. However, if these interrelationships are only examined in terms of anthropocentric and economic perspectives of value, important insights into fundamental social, cultural and spiritual dimensions of human relationships with nature are likely to be neglected. When analysts use only one perspective to the exclusion of others, valuable insights will be lost. This chapter explores different meanings of value that influence human interactions with nature, how these can be categorised, and how different analytical perspectives can provide insights into human interrelationships with nature. The different types of value described in the paper are categorised as anthropocentric (instrumental and relational) and non-anthropocentric (intrinsic) values. These types of value are considered from a range of analytical perspectives which can provide insight into the different dimensions of human inter-relationships with nature i.e. economic, anthropological, psychological and ecological perspectives. The chapter concludes by considering how information on human interrelationships with nature provided by these different perspectives can contribute to initiatives carried out as part of PiN.

Understanding the interrelationships between nature, livelihoods, well-being and poverty

Poverty, social well-being and sustainable livelihoods frameworks are examined in this chapter, their major overlaps and gaps identified, and a new interdisciplinary framework proposed for use in empirical analyses for understanding and assessing the interrelationships between people and nature. Several factors are identified as requiring greater emphasis in future analyses – direct and indirect contributions, cultural norms and values and subjective assessments of material and non-material dimensions. As part of the participato-

ry principles of the mixed methodology, communities must have a role in identifying the dimensions that are important for them to live well and to fulfil their desires and aspirations. Where appropriate, highly disaggregated analyses should be conducted, focussing at the individual rather than household level, in order to consider intra-household distributional issues and ensure gender sensitivity. The analysis of contextual factors – those that influence people's opportunities and constraints – are also critical to answering questions of why people are poor and why they have (or do not have) access to resources. This new framework will help researchers and analysts overcome gaps in our knowledge about the mechanisms by which biodiversity can contribute to livelihoods, poverty alleviation and improved well-being, particularly with respect to wild, or non-cultivated, resources. It is hoped that such information will improve the ability of decision-makers to systematically incorporate consideration of the value and contribution of biodiversity use into the design and implementation of development and other management interventions.

A data module for PiN

In the early development of PiN, it was noted that a vast amount of data has already been collected in relation to the use of biodiversity by rural and remote communities. Yet, this data is rarely used in a systematic manner to improve decision making that considers the use and value of biodiversity for these communities, or to reduce the burden of repeated local primary data collection efforts. This chapter presents a broad scoping of data requirements for PiN assessments and identifies challenges associated with access to publicly available secondary data, the discovery of relevant data within existing sources, and issues around interoperability of diverse datasets. Technological solutions to data discovery, storage and interoperability are discussed, and the design of tools and a digital platform for PiN data management and contribution are proposed to ease workflows involved in compiling, sharing and analysing data. The chapter also introduces a discussion of governance issues specifically related to public secondary data use, and observations are made on the data integration with other key IUCN knowledge products, namely the Red List of Threatened Species and the Red List of Ecosystems. A combination of partnership efforts and digital tools for searching, mining, crowdsourcing and linking secondary datasets (including existing IUCN datasets) and to automate critical parts of the PiN situation analysis workflow is proposed. Conclusions are drawn on the ethical obligations of the use and repatriation of secondary data for work in indigenous and remote community contexts.

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Strengthening Caribbean fisherfolk to participate in governance through the Fisherfolk Action Learning Group

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THE FISHERIES SECTOR IN THE CARIBBEAN REGION employs over 200,000 people, directly or indirectly, who are mostly from rural coastal communities and have few other income earning opportunities. Fisheries are a major source of food and nutrition security, especially in these communities. Loss of trade agreements with some markets has severely constrained foreign exchange earning, making dependence on imported food unsustainable, and rising food prices have compounded this situation. Hurricanes and other climatic events, such as droughts, have reduced the ability to provide food regionally. Current regional fisheries governance arrangements offer limited opportunities for fisherfolk to participate in policy processes and decision making on food security.

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Inadequate networking among Caribbean fisherfolk at the regional and national levels and the limited capacity of fisherfolk organisations to articulate members' interests and positions on regional fisheries policy and food and nutrition security issues are additional challenges.

The project "Enhancing food security from the fisheries sector in the Caribbean: Building the capacity of regional and national fisherfolk organisation networks to participate in fisheries governance and management" funded by the European Union EuropeAid programme aims to address this situation. The overall objective is to improve the contribution of the small-scale fisheries sector to food security in the Caribbean by building the capacity of regional and national fisherfolk organisation networks to participate in governance.

The Caribbean Natural Resources Institute is implementing the project in partnership with the University of the West Indies Centre for Resource Management and Environmental Studies, Panos Caribbean, a regional fisherfolk network – the Caribbean Network of Fisherfolk

Organisations – and a regional fisheries body – the Caribbean Regional Fisheries Mechanism. The Caribbean Fisherfolk Action Learning Group (FFALG), comprising of 18 fisherfolk leaders, three senior fisheries officers and the project partners, was established in 2013 under the project, as a community of change agents from across the region. The FFALG provides an open forum to share information and experiences; analyse problems and devise interventions for strengthening fisherfolk organisations at the regional, national and local levels; initiate collective action on fisheries policies at the global and regional levels; and develop strategies for policy influence. Fisherfolk collective action is now less constrained by the distances between Caribbean countries, and effective networking has enhanced their capacity to be significant contributors to policy influence and decision making on a more consistent basis.

This capacity development is timely as decision makers and other key stakeholders in the Caribbean are experimenting with models to improve stakeholder participation in governance of the fisheries sector. The ecosystem approach to fisheries is being applied in the Caribbean Large Marine Ecosystem to improve fisheries governance and enhance people-centred environmental and natural resource management. This work has linkages with PiN as it directly addresses the marine ecosystem benefits provided to society through food security and nutrition, as well as the impacts of society on nature through demand for food. Central to both are the institutional arrangements for learning that allow fisheries and other stakeholders to influence policy.

If you would like to know more about this project please contact Terrence Phillips, Terrence@canari.org ■

Chapter Two

THE USE OF BIODIVERSITY FOR RESPONDING TO GLOBALISED CHANGE

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This chapter opens a line of inquiry for the People in Nature (PiN) knowledge basket focussing on the potential of nature to contribute to solutions to the multifaceted challenges experienced by rural and remote communities from environmental change and globalisation. This builds upon a long-standing interest of IUCN in bringing people into conservation practice, linking conservation and development discourses and, more recently, the programme area of nature-based solutions (IUCN, 2016; McNeely, 1995).

Resilience thinking informs the understanding of social–ecological systems dynamics over time, at different levels of organisation, and in response to internal and external pressures (Berkes, et al., 2003; Berkes & Folke, 1998; Gunderson & Holling, 2002). This can provide insights into how individuals and groups respond to change, how natural resources are managed during periods of change, and whether social and ecological sustainability are promoted as people pursue development strategies (Biggs, et al., 2015; Brown, 2016; Chapin, et al., 2009; Scheffer, 2009; Wilson, 2012).

An overview of resilience thinking is presented, emphasising the concepts and lessons of relevance to PiN. This is followed by the description of a preliminary framework for analysing and understanding the potential of nature to contribute to the development of rural and remote communities during times of globalised change. Globalised change refers here to the linked process of global environmental change and globalisation, which interact to create both challenges and opportunities for rural and remote communities (Leichenko & O'Brien, 2008). While recognising that communities may have many different responses to globalised change, the focus of PiN is on responses that utilise nature.

The approach being developed by PiN is consistent with the IUCN 2017–2020 Programme Area of nature-based solutions (IUCN, 2016). It is rooted in collaborative learning amongst IUCN Members, Commissions, the Secretariat and rural and remote communities. It recognises that the resilience of rural and remote communities can be enhanced through the creation of learning groups that support communities' responses to globalised change.

RESILIENCE THINKING

Resilience thinking has become a dominant conceptual framework in understanding how linked social and ecological systems (i.e. social–ecological systems) change and adapt across scales of time, space and social organisation. This strand of scholarly enquiry emerged as an alternative to resource management and conservation approaches that were based on models of single state equilibrium, and in which resilience was understood as the speed at which a variable returns to a pre-existing equilibrium following an externally induced disturbance (Pimm, 1991). For example, in forest management, resilience was considered to be the ability of forest stands to recover from a disturbance, such as fire, and return to the climax community. These linear, single state approaches focussed on resistance to change, recovery of equilibrium (or 'bounce back') and emergency intervention during times of rapid change (Folke, 2006; Davoudi, et al., 2012).

However, ecological systems are now recognised as non-linear, complex systems, which may have multiple potential states of equilibrium; following disturbance, an ecological system may return to one of several related possibilities within what is called a stability domain (Brand & Jax, 2007; Gunderson, 2000; Gunderson, et al., 2010; Holling, 1973). Disturbance is no longer seen in opposition to equilibrium but as integral to ongoing, cyclical processes of adaptation and renewal through which an ecological system persists. Ecological resilience, then, is the "capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure and feedbacks, and therefore identity, that is, the capacity to change in order to maintain the same identity" (Folke, et al. 2010).

The complexity of linkages between ecological systems and social and cultural processes are articulated as social–ecological systems (SES), which consist of a nested set of ecosystems linked to nested sets of management practices (Berkes, et al., 2003). An early focus of this scholarship was on understanding how disturbances in SES lead to processes through which both ecosystems and social insti-

tutions co-evolved, adapting and changing together (Folke, 2006; Folke, et al., 2002). This led to suggestions that, from a management perspective, the ability of actors to respond to change and maintain the functions, structure and identity of an SES is influenced by biodiversity, knowledge systems, collaborative and place-based learning, adaptation and innovation and multi-level governance arrangements (Armitage, et al., 2009; Berkes, et al., 2003; Brown, 2014; Brown, 2016; Davidson-Hunt & O'Flaherty, 2007; Folke, 2006).

However, while the concept of social–ecological resilience has been recognised as being useful for understanding the co-evolutionary dynamics and the sustainability of ecological and institutional outcomes (Berkes, et al., 2003), it has been critiqued for the lack of attention given to individual agency and power (Brown, 2014; Brown & Westaway, 2011; Coulthard, 2012; Davidson-Hunt, 2006; Miller & Davidson-Hunt, 2013). Subsequently, the influence of development scholars on resilience thinking has lead to a new focus on the agency of actors, and how they act individually and collectively to influence choices of responses to change.

While individuals experience risks, hazards and challenges, responses are often social and can take the form of collective action (Magis, 2010). The idea of community resilience therefore focusses on the ability of a community to take "intentional action to enhance the personal and collective capacity of its citizens and institutions to respond to, and influence the course of social and economic change" (Canadian Centre for Community Renewal, 2000:5).

Economic development can be considered as a pathway over time, formed as people exercise agency and undertake actions according to their aspirations and capabilities, aiming to move toward their idea of well-being, within an environment that includes shocks, stressors and opportunities (Sen, 1985; Sen, 1992; Sen, 1999). From this perspective, development resilience can be defined as:

> The capacity over time of a person, household or other aggregate unit to avoid poverty in the face of various stressors and in the wake of myriad shocks. If and only if that capacity is and remains high over time, then the unit is resilient (Barrett & Constas, 2014:14626).

This may mean that supporting change within a stability domain may not be sufficient to alleviate poverty and what is needed is the transformation of society (Davoudi, et al., 2012; Pike, et al., 2010; Scott, 2013). In responding to change in ways that prevent people from sliding into or remaining in poverty, actors can use their agency, individually or collectively. Resisting change is part of the spectrum of responses that individuals and groups may choose for their development pathways, to retain the current configuration of their social–ecological system. In other cases, they may choose to adopt new technologies or transform elements of the SES through transition from one development pathway to another (Béné, et al., 2014). Different strategies may be used over time, sequentially or in tandem, depending on the pressures and response opportunities available.

A poverty threshold has been proposed so that if individuals or groups fall below such thresholds, there is an expectation that the state will undertake emergency measures to help people (Barrett & Constas, 2014). An associated development has led to a model of inclusive and sustainable development, which suggests that there are sustainability thresholds; development pathways that lie between the (upper) planetary boundaries and (lower) social floors fall within a safe and just operating space (Rockström, et al., 2009a; Rockström, et al., 2009b; Leach, et al., 2013). To ensure inclusivity and sustainability, chosen development pathways should equitably distribute the costs and benefits of transitions.

What resilience thinking offers to PiN

PiN draws upon resilience thinking to inform its approach to the interrelationships between people and nature, which are framed as non-linear processes that are shaped by multiple dimensions over time. The ecological, social and cultural factors (e.g. worldview, values, perception, language) that shape people's aspirations are emphasised, and are recognised as influencing the ability of people to exercise agency in their use of nature, along with economic, institutional, technological and political factors. The approach can be forward looking, including the ways that people can utilise nature to meet their aspirations to live well, and considering the sustainability of these choices within particular contexts.

This perspective views people as both in nature, entangled within the ebb and flow of life (Palsson, 2013); through their agency and actions, people are also determinants of the nature of which they are part. The use of nature's materials for daily life is guided by individual and collective values, norms, institutions, beliefs and worldviews. These uses shape nature, which in turn influence potential future use. This framing shifts the focus of economic development from being predetermined, external interventions, toward the factors that enable or constrain human actions to meet individual and collective aspirations, whether the means of doing so is by resisting change, adopting technologies, or transforming institutions (Béné, et al., 2014; Brown, 2016).

NATURE-BASED SOLUTIONS AND RESPONSES TO CHANGE

The potential of nature to provide resources that can be used in responses to change can be understood through an examination of what nature provides that can be transformed into things that people value, and how it can contribute to nature-based solutions to globalised change.

A common lens to understand what nature provides is that of biodiversity: "the variability among living organisms – animals, plants, their habitats and their genes – from all sources including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part. This includes diversity within species, between species, and of ecosystems" (Convention on Biological Diversity, 1992, Arti-

cle 2). PiN emphasises the potential of biodiversity to contribute to development pathways, to be the basis of activities that help individuals and groups respond to change and that fall within the safe and just operating space. Given the focus on biodiversity use and nature-based solutions, we refer to the social-ecological system as a biodiversity-based system.

Resilience is partly dependent on the biodiversity of a specific landscape, and partly on the factors that shape the material and cultural uses of biodiversity and enable certain activities to be adopted or adapted in response to change. The biodiversity of a landscape may support many possible individual and/or collective responses to change, but the realisation of this potential is shaped by ecological, political, social, economic and cultural factors.

A practical starting point for understanding interrelationships of people and nature is understanding biodiversity and people's use of biodiversity in a defined setting (e.g. a community territory or a landscape) by examining their direct use of organisms for material use and symbolic purposes. While we focus on direct material use in this chapter, people do have other types of interrelationships with places (e.g. ceremonial sites) that make landscapes meaningful beyond provisioning functions (Bieling & Plieninger, 2013; Bieling, et al., 2014; Johnson & Hunn, 2010; Stephenson, 2008).

The approach we present to trace out the workings of a biodiversity-based system begins by identifying the biodiversity that is utilised (Davidson-Hunt & Berkes, 2010) at the most appropriate level which is that of the species, and the specific properties that make it useful for various provisioning functions (e.g. food and nutrition, health and medicine, energy, shelter, income, ceremony and trade).

Figure 2.1 – Tracing flows of biodiversity within an idealised territory of a rural and remote community and with regional actors and markets
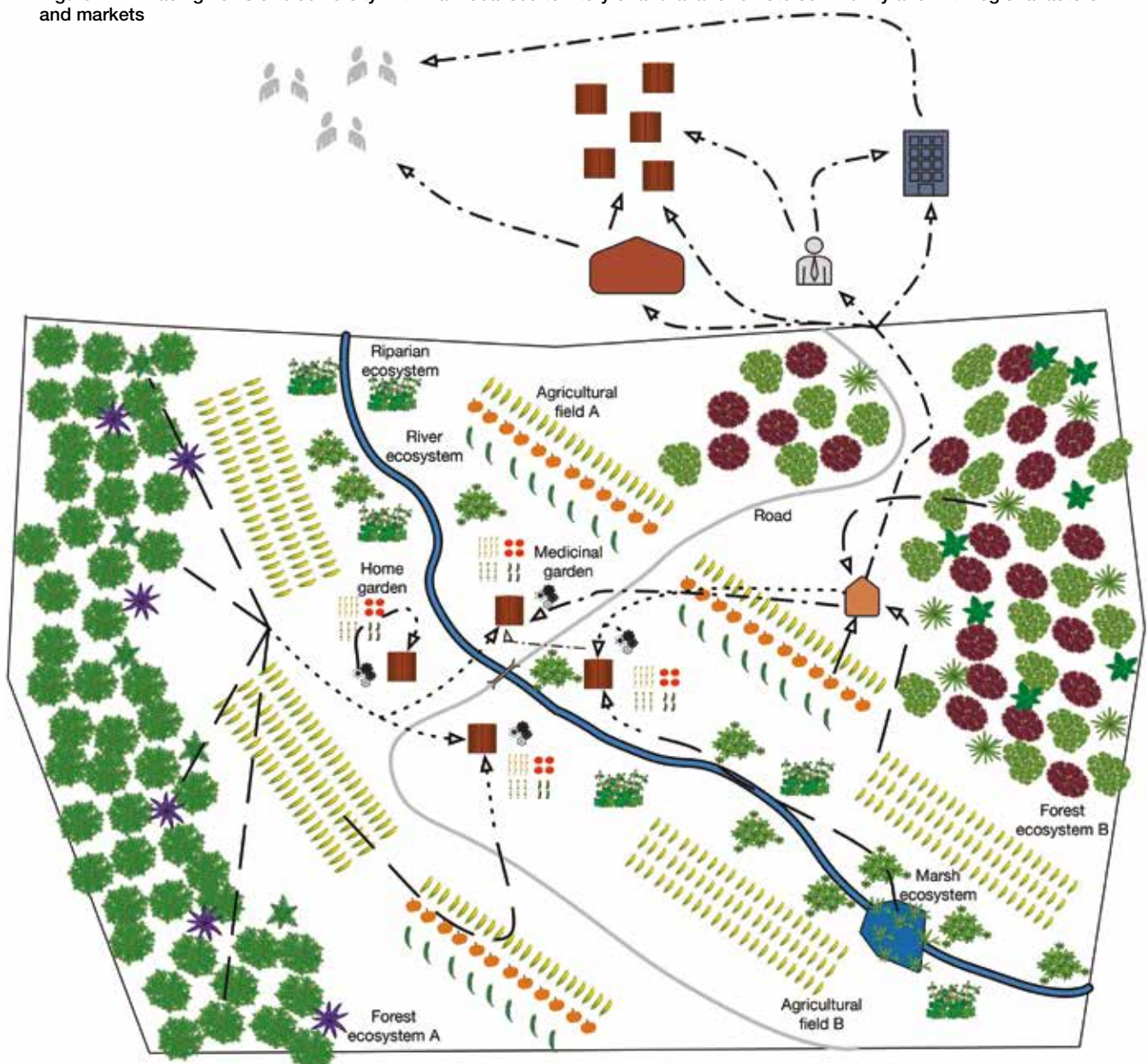
Figure 2.1 provides an idealised representation of a rural/ remote community at a point in time, to illustrate the landscape approach for understanding the linkage between use and biodiversity at various levels. The flow of biodiversity is traced through the social system, based on four phases – the appropriation of biodiversity (e.g. hunting, harvesting, etc.), its transformation (e.g. by butchering, drying, cooking, etc.), its exchange and its consumption (Ribot, 1998; Ribot, 2014; Ribot & Peluso, 2003). Ecological, political, social, economic and cultural factors enable or hinder the use of biodiversity across all four phases, and the processes and operations involved in the use of a particular species.

Figure 2.1 illustrates the flow of biodiversity across all four phases of use. Dashed lines represent appropriation (i.e. harvesting/hunting) of biodiversity and dotted lines represent direct consumption following appropriation by households. The diversity of ecosystems in the landscape (e.g. forest, marsh, agricultural fields, gardens, etc.) provides opportunities for people to alter livelihood activities as a response to change. These ecosystems are more or less modified by human use and can move back and forth along this continuum across time, and contain a diversity of 'wild' species and non-wild, or domesticated, varieties that farmers reproduce themselves or which are brought in from outside the system.

That biodiversity which is not appropriated or directly consumed is transformed into a secondary product, with transformation processes utilising various types of infrastructure (e.g. fish drying patios, abattoirs, kitchens, etc.). The (secondary) products can then be consumed directly or exchanged within the territory, or with middlemen, businesses or consumers outside the territory (represented by dashed–dotted lines in the figure). Such commodity chains link the biodiversity-based system of a territory with other communities at regional, national and/or international levels.

Current and potential uses of biodiversity

Understanding how biodiversity is currently used and its potential for future utilisation is essential to understanding the potential of nature to contribute to responses to change. The number of species currently used (Uc) as a proportion of the number that could potentially be used (U) within certain provisioning functions (e.g. food and nutrition, health and medicine, energy, shelter, ceremony, trade) is illustrated in Figure 2.2. Potential use incorporates historically utilised species, reported uses within similar environments and/or among similar cultural groups and species currently used.

The resilience of a biodiversity-based system is not determined solely by what people currently use, but also on the memory of what people used to do, as well as the creativity of new and innovative activities (Davidson-Hunt & Berkes, 2003; Davidson-Hunt, et al., 2012; Folke, et al., 2003). Why previous use has been abandoned and why potential use is not realised can be analysed to help understand what determines use, as well as the potential of nature to contrib-

Figure 2.2 – Biodiversity's potential for nature-based responses to change

Uc   ⊙   Currently used biodiversity

U   ●   Total known potential of biodiversity
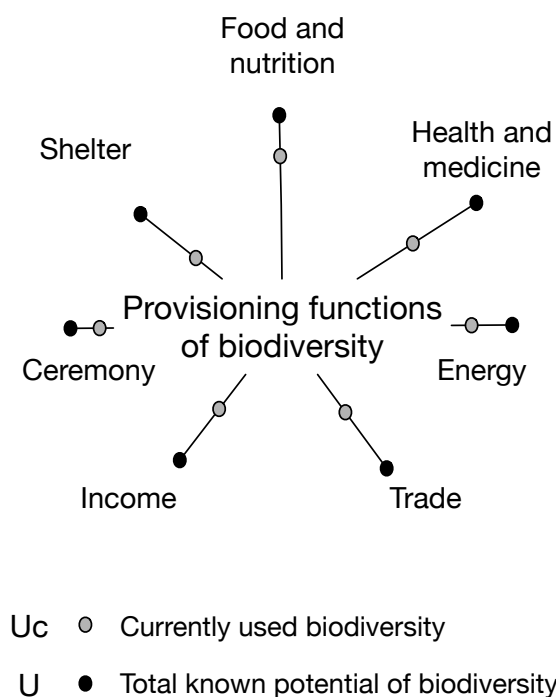
ute to new development pathways thereby enhancing the resilience of the system.

The proportion of current to potential use, Uc/U, indicates the potential of biodiversity to be utilised in designing responses to change for different provisioning functions, and is related to availability, stability, access and perception (as detailed in the next section). It is expected that the ratio is less than one, and that there is potential for biodiversity to contribute to responses to change and play a role in the emergence of new development pathways. While much work has gone into documenting change in use as loss, resilience thinking opens the possibility of considering previous use as also having a potential use in a response to change. Use can also be conceptualised as a dynamic process (Box 2.1).

Development pathways and nature's potential for responses to change

Development pathways are on-going processes in which people pursue goals by exercising agency, individually and collectively (see Figure 2.3). Pathways change trajectory as people encounter challenges and opportunities in their lives, and lead different actors to respond in different ways. These changes can be large or small, and may cause some pathways to transcend sustainable thresholds, because of either the disturbance or the chosen response. Disturbance may be resisted in order to maintain a trajectory, or it may lead to a new trajectory arising from the chosen response.

Box 2.1 - Resources people use are constantly changing

Given the dynamism of biodiversity-based systems, there are great many mechanisms by which the importance of a particular species may decline or increase, and its users and use patterns change, and the individual species used at a point in time may only be a subset of the those potentially available.

A dramatic example of this is marine resources in the Gulf of Maine, USA. Lobster (*Homarus americanus*) is the major resource currently used, and the fishery is so well managed, thanks to local rules, that both the overall harvest and the catch per unit of effort have been increasing for a number of decades (Steneck, et al., 2011). But success comes with a risk – lobster densities are higher than anywhere else in the world, and the gulf resembles a lobster monoculture – it is at risk of a major disease outbreak and lobster population crash (Steneck, et al., 2011). Historically, the gulf was dominated by a cod (*Gadus morhua*) fishery which started to decline in the 1930s, though in recent decades the cod, which is a predator of lobster, became nearly locally extinct. The dynamics of cod disappearance has been established using the local and traditional knowledge of former trawler captains to reconstruct the historical distributions and spawning movements of cod (Ames, 2004), an analysis undertaken with the restoration of cod in mind. Ironically, the social–ecological system of the gulf may now be moving toward a major transformation again.

Worldwide resource declines have been the norm, and the conservation challenge is often restoration rather than preservation. The decline may be in the abundance of a particular species (e.g. cod), or in genetic diversity. The diversity of taro (*Colocasia esculanta*), one of the most important crop plants in the tropical Pacific, is estimated to have been between 368 and 482 distinct cultivars at the end of the 19th century, but fewer than 73 still exist (Winter, 2012). This decline is significant both biologically and culturally. Known in Hawai'i as *kalo*, taro is connected to origin stories of the Hawaiian people, and is considered to be the most important crop plant at a symbolic level. However, it declined in importance following declines in cultivation, biodiversity and associated knowledge in the colonial period (Winter, 2012). However, along with recent cultural revitalisation in Hawai'i (and in Polynesia in general), there is a resurgence of interest in *kalo* varieties and their different uses. In fact, there are attempts to restore some of the ancient varieties of *kalo*.

Social memory is often important to restore the knowledge about a resource and its uses. For example, in the Canadian subarctic, beaver populations were depleted in the 1920s and 1930s by trappers responding to high market demand. In one of the earliest attempts in biocultural conservation, the government responded by establishing beaver reserves under local control, whereby the customary users would reap the benefits of restoring beaver populations. The scheme worked well and beaver populations recovered by the 1950s, with local trappers able to use their knowledge and practice of beaver harvesting.

As these examples show, declines over time may affect species or genetic resources, and while some species recover, some may be replaced by other species. The utilisation of certain species may begin again with changes in economic conditions or with cultural revitalisation. Healthy communities that maintain strong cultural traditions also tend to have strong social memory, which is important for restoring knowledge about a resource and its uses, whether the availability is tied to ecological restoration or due to long-term population cycles. Thus, the resilience of a biodiversity-based system is not solely dependent on current resource use, but rather it is a function of all the various options provided by biodiversity and the knowledge, memory and creativity in resource use.

Individual and group value systems will be influenced by endogenous and exogenous political, social, economic and ecological processes and structures, all of which will shape the choice of response. While individuals have their own pathway, they can also act collectively, coordinating the responses of individuals within a group, and resulting in common trajectories (Figure 2.3).

Individuals can participate in multiple forms of collective action both at a point in time and over time, and while collective action provides opportunities for people to pursue individual goals, it also sets boundaries on individual action through the establishment and enforcement of institutions.

Responses to change should be rooted in the particular contexts of people living within specific landscapes (Armitage, et al., 2009; Schoon, et al., 2015), avoiding prescriptive solutions and favouring broader principles or guiding coordinates that can be drawn upon when making choices about responses to change (Armitage, et al., 2009; Biggs, et al., 2015; Davidson-Hunt, et al., 2012). The imposition of solutions by external or politically powerful actors on less powerful people should be avoided (Biggs, et al., 2015; Brown, 2016), and the outcomes arising from the choices made should be assessed using sustainability criteria (Leach, et al., 2013).

Figure 2.3 – Rural and remote community pathways for sustainable responses to change

Guiding coordinates for sustainability

Guiding coordinates for sustainability

- - - - -   Individual development pathways

———   Bundled pathways through collective action within institutional boundaries
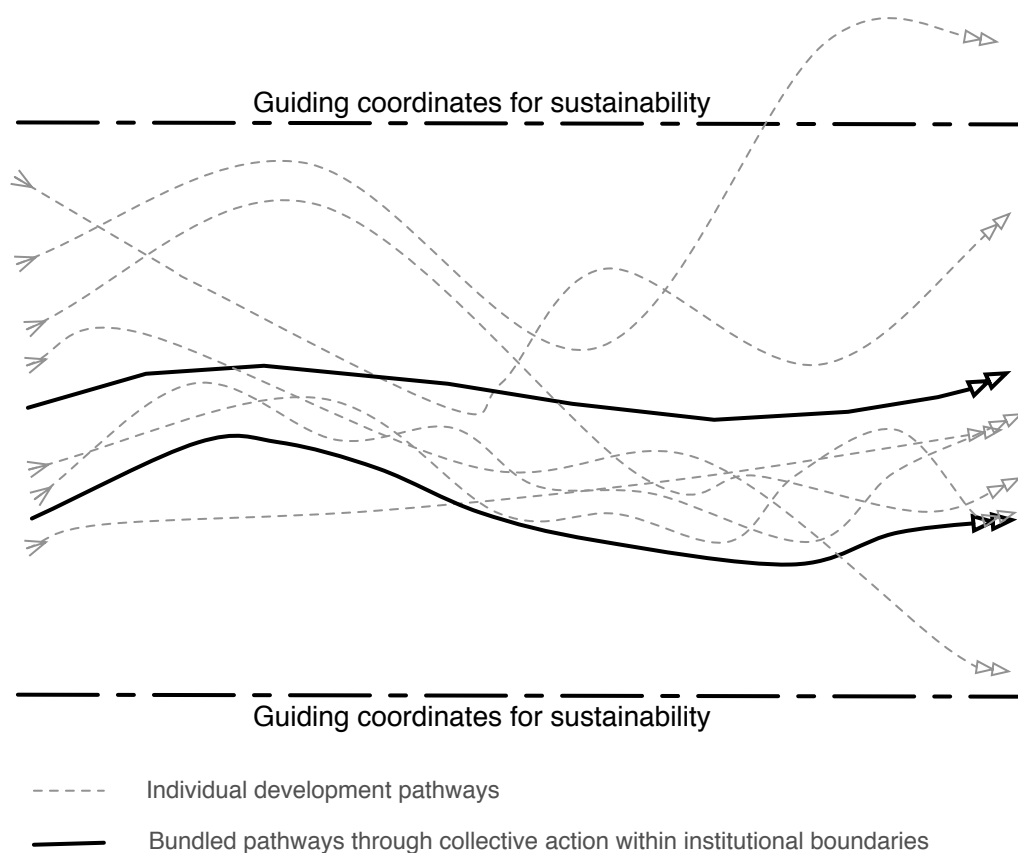
The set of principles outlined in Table 2.1 describes the way PiN incorporates resilience thinking. The principles were derived from some of the key normative assumptions about building resilience, and interrogated by a review of the scientific literature (see Biggs, et al., 2015). This table synthesises, very briefly, what these principles might mean for management of people and biodiversity together in social–ecological systems. As PiN moves from conceptualising the knowledge basket and toward weaving it together, the principles of participation, learning and polycentric governance are likely to be further emphasised (see also Idrobo, et al., 2016).

A framework for analysing the use of biodiversity for responding to change and building resilience

This section provides a preliminary framework to understand current and potential use of biodiversity to respond to change and build resilience. This framework reflects the literature that considers factors enabling and constraining the use of biodiversity as a response to ecological, social and/or economic change (Brown, 2016; Mohamed-Katerere & Smith, 2013; Power, 2008), and systematises the collection and analysis of information within the methodological workflow described in detail in Idrobo, et al. (2016).

Availability, stability, access and perception are the four analytical categories that are considered necessary to

understand the current use of biodiversity and the potential for biodiversity to be utilised for nature-based responses to change. These categories should be analysed within the phases of appropriation, transformation, exchange and consumption (Table 2.2) in order to identify the factors that enable or constrain use, and specific impacts should be analysed from the perspective of the provisioning function of interest (e.g. food and nutrition, health and medicine, energy, shelter, income, ceremony or trade).

Figure 2.4 illustrates the framework and the variables shaping the potential of biodiversity to be utilised for biodiversity-based responses to change. It portrays the set of biodiversity available for use (U) on the left hand side and how people choose to currently use biodiversity (Uc) for individual and group development pathways and for changes in trajectories. While U represents the potential contribution of biodiversity for use within development pathways and response to change, what becomes used (Uc) is influenced by availability, stability, access and perception.

Availability

Food security literature uses availability to refer to the supply of a food, irrespective of its origin, at a site (FAO, 1996; Council of Canadian Academies, 2014). Within PiN, availability refers to the supply of biodiversity (e.g. a species) for a

Table 2.1 – Principles for building resilience

Principle	Explanation	Description/example
1. Ensuring diversity and redundancy	Systems with many different components are generally more resilient; having a diversity of potential responses is especially important.	Biodiversity, agro-diversity, livelihood and cultural diversity can be important to develop thriving and resilient resource management systems.
2. Building connectivity	Connectivity refers to the structure and strength with which resources, species or actors disperse, migrate or interact across different domains in SES. Connectivity has both positive and negative effects.	Connectivity is key to conservation and protected area network design, and in whether and how different social actors can benefit, participate and interact in resource management.
3. Addressing slow variables and feedbacks	Slow variables and feedbacks are important drivers of change and may help to keep an SES 'configured', but are often difficult to detect and monitor. (Much policy and many interventions only address fast variables.)	Slow variables such as institutions and values – for example around traditional use of resources might be critically important for natural resource management.
4. Understanding complex adaptive systems	Acknowledging uncertainties and interdependencies shifts understanding towards a more adaptive management, rather than trying to maintain a status quo.	Shocks and perturbations (e.g. fire or drought) are often part of how systems work. Supressing them may not be ideal for people, nature or resilience in the longer term.
5. Ensuring learning	Adaptive and collaborative management is achieved through experimentation and learning.	Integration of 'traditional', indigenous technical, traditional ecological and other forms of knowledge (e.g. via farmer field schools and participatory processes) can be valuable in supporting the development of natural resource management strategies.
6. Safeguarding participation	Involving diverse stakeholders to build legitimacy and trust, and expand opportunities for sharing knowledge and detecting and managing change.	Involving key stakeholders, especially those often excluded from formal processes (e.g. the poor, women, indigenous groups) is important for the development of equitable and robust institutions.
7. Developing polycentric governance	Governance and the alignment of regulations takes place at multiple scales (i.e. local through to international).	Working at, and across, multiple scales helps to improve connectivity and learning, improving the ability to respond more readily to change and disturbance, and is critical for effective resource management and long-term sustainability.

Source: adapted from Biggs, et al., 2015.

Table 2.2 – An analytical matrix to document factors affecting nature-based responses within specific use domains

Phase / Factor	Appropriation	Transformation	Exchange	Consumption
Availability				
Stability				
Access				
Perception				

provisioning function (e.g. food and nutrition) from a defined landscape, and is the primary substantive basis for the material use of nature.

Availability refers to the amount and quality of biodiversity available; the potential for current and future use will be minimal if the population of a species is low or habitats are too small, while if a species is contaminated from some development within the landscape, or perceived to be 'unhealthy', it will not be considered as available for use. Thus, availability is the supply of a species for appropriation, or that can potentially be used by people if other conditions (e.g. access, perception) are also met. As conveyed in Box 2.2, the ability of a community to use biodiversity within the context of globalisation is an outcome linked to other factors. While we include these factors as discreet analytic categories to analyse the processes that shape use, there is the added complexity that they also interact with and influence each other.

Biodiversity assessments (i.e. of availability) are a core focus of the species unit of IUCN and these will provide an oppor-

tunity for PiN assessments to link to the Species Information Service and other biodiversity assessments (see Deutsch, et al., 2016).

Stability

Stability refers to the reliability of the supply of biodiversity, and can be viewed as a stock, where availability is a flow. Stability is affected by both short- and long-term influences; for example, the short-term stability of species may refer to seasonal variations, while long-term stability would refer to the variations in species abundance.

Analyses of stability may provide a means to link to other IUCN knowledge products such as the Red List of Threatened Species™ and the Red List of Ecosystems, in dealing with current and future threats. For example, if the Red Lists consider future threats and risks to species and ecosystems, such as how climate models may anticipate impacts on species and ecosystems, then the risks to the supply of biodiversity can be better understood.

Figure 2.4 – The potential of biodiversity for nature-based responses to change in development pathways of rural and remote communities
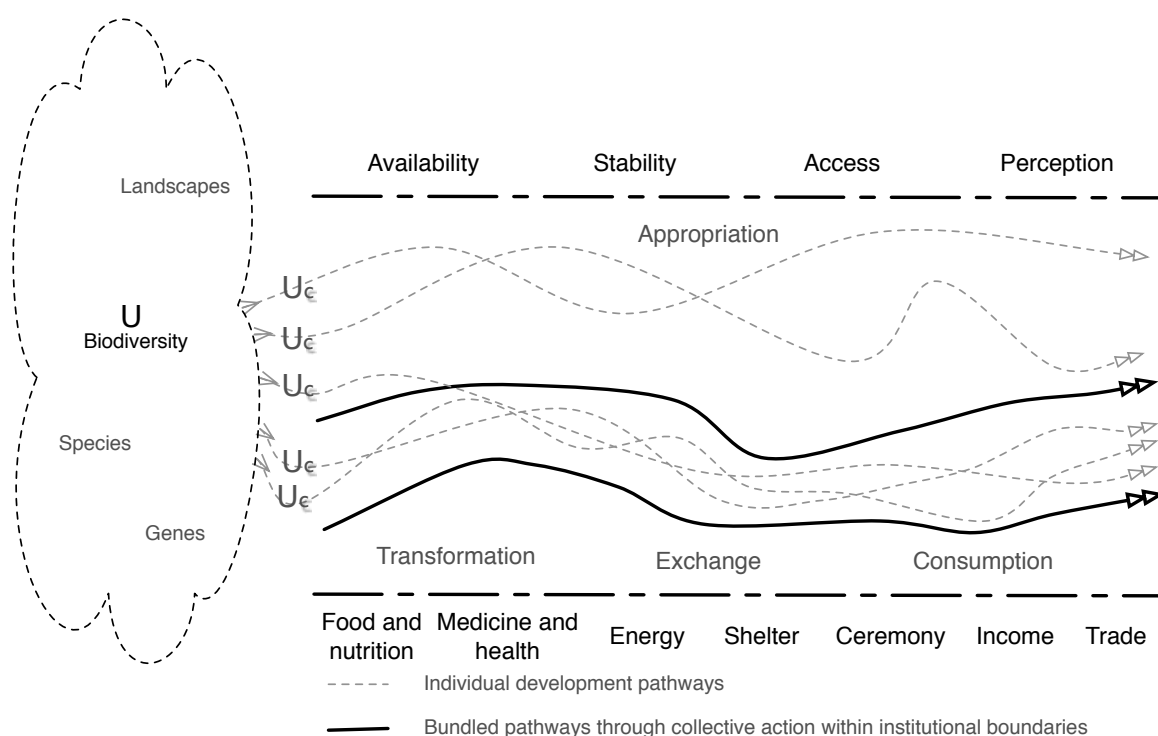
Box 2.2 – 'Roving bandits' and globalised drivers

The 'roving bandits' phenomenon illustrates some of the complications of commons management in the globalised world (Berkes, et al., 2006). Roving bandits are highly mobile enterprises that can move around the globe, exploiting resources in response to market opportunities, typically depleting a resource in one location and then proceeding to the next. This creates a global version of the 'tragedy of the commons' because global markets do not generate stewardship incentives, the self-interest that arises from attachment to place. Mobile harvesters have no incentive to save for tomorrow because whatever they do not take today will soon be taken by others. Indeed roving bandits are a problem for a large number of species and stocks used as commons.

Sea-urchin is a valuable resource in Japan and internationally, for sushi production. The international sea-urchin fishery illustrates the geographic expansion of harvests and the dynamics of roving banditry. After Japan's own resources declined around 1960, harvests began in Korea, primarily for export to Japan. Following the depletion of Korean resources, these same harvesters then moved to exploit resources on the coasts of Oregon and Washington states in 1971, followed by Baja California and California in 1972/73, and Chile in 1975. Alaska and British Columbia came under exploitation in 1980, followed by Russia in 1982, and Maine, New Brunswick and Nova Scotia in 1987/89. With continuous expansion of the fishery by these harvesters into new regions, the global harvest peaked in about 1990, but declined after that because no frontiers remained to be exploited.

Because of the nature of international market demand, threats are simultaneously felt at the local, regional and global levels. Local marine tenure alone is insufficient to deal with roving bandits because high-speed market development overwhelms not only local management institutions, but often also outstrips the ability of national or international institutions to deal with the problem. In the case of small or highly localised stocks or species, the resource may vanish even before the problem is detected.

Access

Access refers to "the ability to benefit from things – including material objects, persons, institutions, and symbols" (Ribot & Peluso, 2003:153). Within PiN, understanding access requires the mapping of access to biodiversity and the distribution of benefits from production or extraction, transformation, exchange and consumption amongst the actors involved (Ribot, 1998; Ribot & Peluso, 2003).

Access is analysed by considering the mechanisms by which people gain, control, maintain and distribute benefits flowing from the use of biodiversity. These include rights-based (e.g. law, custom, convention) and illegal access (e.g. theft) mechanisms, and a number of structural and relational mechanisms (Ribot & Peluso, 2003), including technology, capital, markets, labour, knowledge, authority, identities and social relations. Each of these mechanisms is considered as a strand within a bundle of power and understanding the mechanisms that make up the composition of an individual's, or a group's, bundle provides a lens into their power and why they may benefit, to a greater or lesser extent than others.

As access is mapped across the four phases of use, it is anticipated that linkages between PiN and the work developing the Natural Resources Governance Framework will emerge.

Perception

Perception refers to an individual's awareness of something as the result of their practical interrelationships with nature in their everyday life (Ingold, 2000). Perception affects all four phases of use (Appadurai, 1986), and is concerned specifically with how cultural and idiosyncratic understandings, and not material presence in the environment, affect flows of biodiversity.

Perception, and the ways in which biodiversity is taken up and used, can be influenced by the material properties of a specific resource, and by the way that resource contributes to personal and collective status and identity (Power, 2008). While the material properties of a species may enable use, perception will influence the salience of this use, as peoples' values may prevent them from using specific organisms (Bourdieu, 1984). For example, a food resource that is associated with poverty or social taboo may not be used as a food because of the low status or shame associated with its consumption, or because it is prohibited by a society's values (see Conner, et al., 2016).

Perception is used to address cultural processes, which are recognised as a gap in other frameworks (Power, 2008). While culture has often been considered as a distinct category of value people hold in relation to nature, using perception as an analytical category allows cultural processes to be brought into the understanding of use and potential use – provisioning is cultural (Hinde & Dixon, 2007). That is, perception is developed through cultural processes, via the values that influence how people interact with biodiversity (e.g. what animals can be hunted) and as instrumental knowledge about biodiversity (e.g. the skills and knowledge necessary to hunt and to process what is hunted) is transmitted.

Thus, perception focusses attention on the integrated economic, social and cultural dimensions that shape use and potential use, and is one way to understand how use can simultaneously meet material needs, be shaped by values and be constitutive of cultural processes.

COLLABORATIVE LEARNING FOR NATURE-BASED RESPONSES TO CHANGE

This proposed framework draws upon developments in resilience thinking to consider the interrelationships between people and nature. Its purpose is to help identify the potential of biodiversity to contribute to nature-based responses to change and to new development pathways for specific rural and remote peoples and landscapes. It can be used for analysing specific provisioning functions (e.g. food and nutrition), or be applied more broadly to the basket of uses that make up a livelihood. By tracing use from appropriation through to consumption, it produces an understanding of flows of biodiversity and the system that is supported by these flows. Examining availability, stability, access and perception helps to identify the factors that affect flows of biodiversity at present, as well as historically, and potentially in the future.

An underlying assumption of this framework is that resilience is enhanced when rural and remote communities are able to utilise biodiversity to respond to change, and can incorporate such utilisation in their choices of development pathways (Armitage, et al., 2009; Biggs, et al., 2015; Brown, 2016). Rather than impose 'responses' upon rural and remote communities, it will be important for PiN to support communities in their own analysis and subsequent choices of appropriate and desired responses.

This framework is context sensitive, and assessing the potential of nature to contribute to responses to change, to new development paths or trajectory changes, requires appropriate attention be given to the social, cultural, economic and ecological dimensions of sustainability (Brown, 2016). While being attentive to local specificity, the framework provides a stable structure for understanding how different levels of biodiversity contribute to livelihoods and well-being, and how this differs by, within and between locations, and how individuals and households are affected differentially (e.g. by age, gender or wealth ranking).

The process of data collection and analysis should be directed by site-based representatives/residents within virtuous partnerships rooted in respect for, and supportive of, an endogenous approach to developing responses to change. PiN partners could provide different types of support, such as information and technology not available to the community, political support for collaborative approaches to innovation and development of guiding coordinates to assess the sustainability of responses (Blythe, 2015; Davidson-Hunt, et al., 2012; Mahon & McConney, 2013).

Nature-based solutions to globalised change are not solely to be found in exogenously imposed new technologies or ecosystem restoration, but by supporting communities'

own analysis of the factors that affect their ability to utilise biodiversity to respond to challenges and pursue new development pathways. This framework can be used as part of a PiN approach to support collaborative learning about the potential of nature to contribute to the responses of rural and remote communities to new challenges from globalised change. Additionally, while the importance of learning, participation and governance for building resilience is stressed within PiN, further attention to how they are woven into the knowledge basket is required, so that on-going collaborative learning about responses to change can be enhanced.

Collaborative learning is anticipated to enhance the resilience of communities through the creation of a supportive IUCN community, and through jointly undertaken analyses to enhance efforts to understand and respond to globalised change. Given the historic context of colonisation in many rural and remote communities, and the associated loss of power over their use of nature, it is expected that such solutions will be multidimensional. For example, some indigenous communities have focussed on restoring a particular plant to provide economic opportunities for their members, however, such an activity may also by perceived by community members as a process of decolonisation of their food system. Processes of globalisation may have led to the diminishment of a plant within a community's territory through the industrialisation of their landscape. However, current processes linked to conservation interests in ecological restoration may open new opportunities for a community to use such projects to address economic, political, social and cultural aspirations. Globalised change presents both challenges and opportunities for communities to pursue responses that address these multiple dimensions, as well as technological innovation and institutional transformation (Davidson-Hunt, et al., 2013; Leichenko & O'Brien, 2008; Pengelly & Davidson-Hunt, 2012).

In conclusion, rather than assessing resilience, this framework draws upon resilience thinking and principles, and suggests that collaborative learning can enhance resilience by strengthening rural and remote communities' ability to respond to change. The proposed analytical framework provides a way to support communities in reflecting on the potential of nature to support responses to globalised change and to pursue new development pathways. In some communities, resilience cannot be separated from the political processes they use to resist external control over their development, and also supports the transformation of institutions that allow a greater degree of self-determination. We fully expect that further engagement with resilience scholars and rural and remote communities living with the challenges of globalised change will lead to further refinement of the ideas presented in this chapter.

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Local knowledge and valuation of agroforestry practices and species for climate change adaptation in the Peruvian Andes

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THE ANDEAN REGION OF PERU is highly vulnerable to the impacts of climate change. Climate models predict significant increases in temperature, leading to increased glacier melt, with implications for water supply and regulation in both Andean and coastal zones. Furthermore, the Peruvian Andes are highly susceptible to natural catastrophes related to climatic extremes, particularly flooding, which affect predominantly the rural Andean population that lives below the national poverty line. Agroforestry – the use of trees and shrubs in agricultural landscapes – is a practice with a long history in the Andes that is currently seen as a promising tool for sustainable land management and climate change adaptation. A diversity of agroforestry practices currently co-exist in Andean landscapes, ranging from community- and household-led tree management within traditional agricultural systems, to large-scale plantations with exotic species encouraged by governmental extension services and non-government organisations. However, there is an urgent need for critical examination of such practices in the context of climate change. Not only should agroforestry practices, as options for climate change adaptation, be compatible with local livelihoods, but they should also build on local knowledge. This is especially true in the Andes, where local people have developed complex knowledge systems and coping strategies in a context of extreme climatic conditions and high climate variability.

Not only should agroforestry practices... be compatible with local livelihoods, but they should also build on local knowledge.

Since 2014, the World Agroforestry Centre has been conducting a research project on "Local knowledge and valuation of agroforestry practices and species for climate change adaptation in the Peruvian Andes", in partnership with the Swiss Agency for Development and Cooperation's Andean Forests Programme. The project compares different agroforestry practices as options for climate change adaptation in the Andes, by determining the benefits of trees in rural landscapes from the perspective of smallholder women and men. The research involves three indigenous communities, mostly Quechua-speaking of Chanka and Inca origins located in the valley of the Apurimac River in the southern Peruvian Andes. The site covers an altitude range from 2,000 metres up to 3,800 metres, which means that there is a diversity of ecological habitats, land use and livelihoods systems, and thus also of farming practices being studied. The research takes a transdisciplinary approach that involves the use of interdisciplinary and participatory tools. A combination of ethnographic (participant observation, in-depth interviews), ethnobotanical (inventories, preference ranking) and participatory tools for gender research in climate change and agroforestry are being used for data collection. All data is sex-disaggregated and analysed with a gender focus to consider gender differences in the knowledge and valuation of agroforestry species, practices and forest resources.

Preliminary findings show that Andean farmers have important knowledge on the buffering role of shrubs and trees for increased temperatures and soil and water conservation, including erosion control, promotion of soil fertility and the management of increasingly scarce resources. However, their knowledge is more limited regarding species that can protect their productive systems against extreme climatic events such as heavy rainfalls, hail and strong winds. While no significant differences were found between the agroecological knowledge of men and women, their valuations of agroforestry practices vary greatly. Men give more importance to the direct uses of agroforestry practices, such as the provision of food or income, while women value more highly socio-cultural benefits, such as the delimitation of the territory and aesthetic values. Both women and men value equally the ecological benefits of agroforestry practices.

This work provides an example of a gender sensitive approach to understanding the values of including species as part of a response to global environmental change. This shared interest with PiN opens up opportunities to bring together more examples of the ways by which people utilise nature to respond to globalised change.

For further information about this work contact Sarah-Lan Mathez-Stiefel, s.mathez@cgiar.org ■

Chapter Three

MIXED METHODOLOGY FOR PiN LANDSCAPE ASSESSMENTS

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Food and nutrition, medicines, energy, building materials and fibres and clean water are some of the material benefits humans receive from nature. Deep-seated cultural norms, values, identities, and beliefs often underpin this material utility. However, data are scarce on the uses and benefits that people – particularly rural and remote communities – receive from nature. The aim of the People in Nature (PiN) knowledge basket is to promote the uptake of existing knowledge and to generate new knowledge on the interrelationships between humans and nature, focussing initially on the cultural and material use of species and their contributions to local livelihoods and well-being. PiN is a knowledge basket, containing approaches, tools and standards and associated capacity building to increase understanding of the interrelationships between people and nature. Through its development and application, PiN will promote the collection of data to document and improve the understanding of the uses of, and benefits to people from nature. These data are needed for policy formulation and development interventions that are responsive to the needs and aspirations of local communities and that result in tangible improvements to their livelihoods and well-being.

In this chapter, we discuss a mixed methodology approach to research design and data collection and propose landscape assessments as the methodological framework of the PiN knowledge basket. A mixed methods approach combines qualitative and quantitative methods to collect and analyse data about a complex problem (Creswell, 2008).

A biodiversity-based system is the framework for the landscape assessment, which refers to the species within a landscape and their uses – from harvest and production (also known as appropriation), transformation, to exchange and consumption sites (Davidson-Hunt, et al., 2016; Ingold, 2012). Within this biodiversity-based system, both the components of biodiversity and the interactions amongst those components at multiple levels of organisation, geographic and temporal scales are emphasised.

Biodiversity is "the variability among living organisms – animals, plants, their habitats and their genes – from all sources including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part. This includes diversity within species, between species, and of ecosystems" (Convention on Biological Diversity, 1992, Article 2). That is, biodiversity refers to the species (including subspecies, varieties and races) and ecosystems with which people interact and which produce services that benefit people.

Biodiversity-based systems emerge from the interactions between people and the environments in which they live, including humans as part of the system. A species that is harvested or produced is the central object of analysis and its flows through the biodiversity-based system are traced from its sites of appropriation and production, transformation, exchange and consumption (Davidson-Hunt, et al., in press). That is, species are used as the analytical entry point for tracing the interrelationships that constitute the system.

In beginning with the biodiversity-based system we build upon existing strengths within IUCN and its focus on biodiversity, including relevant datasets and knowledge products such as the Red List of Threatened Species™ and the Red List of Ecosystems, and methodologies such as Integrated Wetland Assessment (e.g. Springate-Baginski, et al., 2009).

PiN aims to build understanding of the interrelationships between people and nature from a perspective that re-embeds cultural values associated with biodiversity into the examination of how people benefit from nature. Approaches derived from the Millennium Ecosystem Assessment have applied the concept of ecosystem services, including separate categories of provisioning and cultural ecosystem services, to assess how humans benefit from nature (MA, 2003). However, this approach has been criticised for being anthropocentric, promoting exploitative human–nature relationships and an overemphasis on assigning economic value to nature (Schröter, et al., 2014). Some have also noted

that the cultural services category appears as a residual category in which services not easily attributed a monetary value were placed (Chan, et al., 2012; Pert, et al., 2015; Plieninger, et al., 2015).

The Intergovernmental Panel on Biodiversity and Ecosystem Services has made efforts to address the issues related to cultural ecosystem services by incorporating categories in their framework that are analogous to other knowledge systems, such as labelling 'ecosystems goods and services' as 'nature's gifts' (Díaz, et al., 2015:5). However, this still favours a perspective that sees nature as being at the service of humans (a typically Western perspective), as opposed one viewing humans as interconnected with nature, and also at the same level as other organisms, without command of them (a perspective more typically associated with Indigenous peoples) (Asselin, 2015; Blaser, 2009; Ingold, 2011; Viveiros de Castro, 2004). These critiques inform the development of this mixed methodology for landscape assessment of biodiversity-based systems.

This chapter describes the mixed methodology design for the PiN knowledge basket, provides an overview of the phased workflow and details the steps within each phase. While linkages with specific methods for the modules are sometimes indicated, the purpose of the chapter is to provide an overview of the approach rather than identify specific tools or methods to be utilised; the identification of appropriate data collection tools and methods will be undertaken in the future. In documenting the biodiversity-based system, data standards are proposed for collating and using secondary data sources and for collecting primary data.

Recognising that an approach focussing on biodiversity and species is based on a perspective that favours a western understanding of nature, the framework includes a module for collecting cultural narratives, which is designed to allow communities to express their many and varied perspectives on the interrelationships between people and nature. Though cultural narratives could be incorporated within a qualitative methods set, it has been assigned a separate and specific module because its purpose is to represent human and nature relations from a specific cosmology or worldview whose outcomes may not always be integrated into the outcomes of other qualitative methods utilised.

MIXED METHODOLOGY FOR LANDSCAPE ASSESSMENTS

Mixed methodologies have become increasingly prevalent as an overarching research framework and are often linked to a pragmatic worldview, in which researchers and practitioners use available approaches, methods and resources to deal with a specific problem (Creswell, 2008). Those who adhere to this pragmatic worldview as part of their research paradigm find it a useful way to bring together quantitative and qualitative data to address applied research questions. In the social sciences, this would be seen in contrast to a post-positivist worldview. Post-positivists hold the position that credible, valid and legitimate knowledge is best produced through the use of the hypothetic–deductive scientific methods, utilising quantitative data. This is the dominant approach in the natural, engineering and medical sciences and present in the social sciences of sociology and economics.

Other approaches view the production of knowledge through many different lenses, including interpretive, phenomenological and emancipatory lenses. In these cases, the construction of meaning, as well as the political processes by which knowledge is constructed, is emphasised. What unites these is a commitment to mixed method approaches, some of which may collect data to understand a research question or problem, and some of which may focus on the processes and the knowledge generated as a means to political emancipation (Creswell 2007, 2008).

Adherents to pragmatic research worldviews focus on the use of different ways of producing knowledge to answer the problem at hand, and recognise that rural and remote communities may have different understandings of, and interact differently with, the problem being studied, which in this case is nature. The use of a mixed methodology is often adopted because of investigators' recognition that qualitative data can shed light on a problem, and also that people's understandings, meanings and values add nuance, texture and detail to quantitative data, and are often necessary in generating solutions with broad legitimacy (Johnson, et al., 2007). The PiN mixed methodology approach recognises that both qualitative and quantitative data are necessary to co-produce knowledge with rural and remote communities that will be useful for influencing policy domains.

The challenge with the application of a mixed methodology is in how to sequence and relate diverse data collection methods and subsequent data analysis, as there is no clear consensus on the degree to which different knowledge sets must be integrated, nor on the consequences of such integration (Clark, et al., 2008; Creswell & Clark, 2007; Morse & Niehaus, 2009). Whether quantitative or qualitative data receive more prominence in a given design should depend on what is most appropriate to the specific research problem being addressed. Investigators must then make choices about which quantitative or qualitative methods are implemented and their sequence, as well as when, or whether, data integration occurs, and about the priority given to the different types of data.

Four distinct mixed methodology designs have been identified: triangulation; embedded; exploratory; and explanatory (Clark, et al., 2008). Triangulation undertakes quantitative and qualitative data collection concurrently, gives equal weight to both and integrates data during the analysis and interpretation phase. Embedded designs prioritise either quantitative or qualitative, embedding the other within the chosen priority, and can collect the two data types concur-

rently or sequentially. The embedded data is integrated into the dominant data collection frame through analysis.

Exploratory and explanatory designs are similar in that they sequence one type of data collection before the other, and one data type often takes precedence over the other. In explanatory designs, quantitative methods are used to characterise individuals within a population and qualitative approaches are used to explore the traits of interest to the research question. An exploratory design is used when knowledge of the research question is limited and the design of quantitative methods is not possible using existing knowledge. In this case, qualitative approaches can be utilised to increase the understanding of the research question within a specific context, the analysis of which is then used to design quantitative instruments aimed at gathering specific information about the study site. Given the absence of available information about the interrelationships between communities and nature at the local level, it is this latter approach that has guided the development of a mixed methodology for PiN landscape assessments of biodiversity-based systems.

PiN landscape assessments of biodiversity-based systems are an adaptive phased workflow, which allows teams to build upon existing knowledge and use qualitative and quantitative data collection methods as appropriate. The framework has been developed to be participatory from the inception phase, in identifying the challenges, problems or questions to be examined during the assessment and in how data is collected, analysed and interpreted. Working with rural and remote communities comes with provisions for data integration as well as allowing knowledge produced to stand independently, as can be the case in multiple-evidence based approaches (Tengö, et al., 2014). This will allow for the standardisation of information regarding the use and cultural values of biodiversity where appropriate, as well as more narrative approaches for understanding the form of interrelationships between humans and nature.

Guiding principles

The PiN mixed methodology has been designed to follow two guiding principles to ensure that the information gathered and the networks established are relevant to the objectives of the assessments: that the approach is participatory and is systems-based (IUCN, nd).

Participation: PiN assessments will be conducted in a participatory manner, with local stakeholders and partners that provide access to expertise and information. Participation ensures that the design of the assessment includes key issues as identified by relevant stakeholders. Having communities in the driver's seat and working with stakeholders and partners allows for an accurate assessment of what information is available, what information gaps remain and what interventions are already in place. A methodology conceived to be participatory from the outset also encourages the sharing of perspectives, building of capacity and skills development for data gathering and monitoring.

Systems approach: A systems approach to interrelations between people and nature considers both the direct interactions people have with biodiversity and the broader context in which these interactions take place. A systems approach will integrate knowledge and experiences from outside the area of the PiN assessment with information gathered in the assessment area. The assessment may use studies from sites with similar socio-economic characteristics and/or ecosystems. Information about income, health and education, for example, can contribute to providing an understanding of what allows or hinders access to and benefits from biodiversity.

Protocols for examining interrelationships between humans and nature

Collecting information about communities' knowledge and territory is a sensitive endeavour that requires agreement with those communities about what data can be gathered, produced and made public (Davidson-Hunt & O'Flaherty, 2007; Posey & Dutfield, 1996; Robson, et al., 2009). There are a number of initiatives, protocols or codes of ethics that the PiN team can draw upon that guide the types of information being gathered and the ways in which researchers and practitioners should interact with rural and remote communities. In particular, the United Nations Declaration on the Rights of Indigenous Peoples (HRC, 2008, Articles 10, 11, 12, 28, 29 and 32) established free, prior and informed consent as a right that Indigenous peoples have to actively participate – according to their own rules and institutions – in decision-making processes associated with projects and actions that in any way impact their land, resources, knowledge and culture.

The purpose of adopting a code of ethics is to foster ethical, responsible and just collaborations among scholars, practitioners and communities in agreement with local rules and institutions and national and international law and policy. Such codes emerge from the awareness of the harm that research without consent has caused some communities, and they aim to ensure external researchers support local development initiatives and the continuity of cultures and language, and acknowledge intellectual property rights (see also Smith, 1999).

Ethics codes will be relevant in any case where the collection and/or management of information (e.g. collections, databases, publications, images, audio or video recordings) resulting from research with communities is undertaken, for example, about their local knowledge and the lands and resources that are part of their biocultural heritage. While there are a range of protocols and codes of ethics available, those adopted should provide implementation guides that detail steps from initial contact with a community, through the definition of objectives and discussion of available infor-

mation, decision making and negotiations with the community and other relevant stakeholders, to implementation of the landscape assessment and dissemination of results.

Each PiN landscape assessment will be guided by a protocol agreed in the inception phase between the relevant local stakeholders and the PiN team. This protocol will identify the research objectives and define a strategy to collate, collect and analyse data, and define the data that can be collected and which can be made public. The primary goal of adopting or developing this kind of protocol is to ensure that the communities in the assessment sites remain in control of the process, and that the PiN team and associated intervening agents remain in a facilitating role (Davidson-Hunt & O'Flaherty, 2007).

THE BIODIVERSITY-BASED SYSTEM

This mixed methodology has the goal of providing a thorough understanding about the interrelationships between humans and nature, and is intended to be tailored for use in specific locations. The system is based on an examination of both current and potential use of biodiversity.

Current use

In order to understand current use, flows of biodiversity are analytically followed through the distinct phases of appropriation, transformation, exchange and consumption. In each phase, attention is paid to the activities that occur, the specific locations in which interactions between biodiversity and stakeholders take place, as well as to the sets of formal and informal institutions that mediate these interrelationships. These flows may involve multiple phases of exchange and/or transformation before final consumption, so these phases should not be assumed to occur in a linear or sequential fashion.

The appropriation phase focusses on how biodiversity is harvested, collected or hunted at specific sites, and whether the biodiversity appropriated are wild or cultivated species. Following appropriation, a particular species may be transformed from a primary product into secondary and tertiary products, directly consumed or stored for later consumption. In the consideration of exchange, attention is given to the sites, actors, types of exchange, and to the formal and informal institutions that mediate the exchange of a given species or species assemblage. Multiple dimensions are associated with the consumption of a particular species or their assemblages, for example, what a species contributes to an individual or group in terms of nutrition, identity, power or status.

Potential use

The potential use of biodiversity at a site must also be examined, as it is this potential for use that may contribute to the resilience of a community, by providing a resource that can

be used to respond positively to change. The factors that affect this potential use are availability, stability, access and perception (see also Davidson-Hunt, et al., 2016).

Availability is the flow of biodiversity that can be appropriated, while stability is the underlying stock from which flows emerge. Access refers to the ability of individuals or groups to benefit from and manage a resource, focussing on institutional factors which enable or constrain potential use. Perception refers to an individual's awareness of elements of biodiversity, and the influence this has on how people interact with it. Access and perception are relevant across all four phases of use.

PIN MIXED METHODOLOGY WORKFLOW

The PiN mixed methodology workflow (Figure 3.1) has three sequential phases: a situation analysis (Phase I), the collection of qualitative and quantitative data and cultural narratives (Phase II) and a data integration and analysis process (Phase III). This workflow follows protocols to examine interrelationships between people and nature according to the ethics and institutions of the community with whom the assessment is being conducted. Communities must agree to work with the PiN team, participating in research design, implementation and analysis, in a process where all data collated and collected must be given back to the community. Community stakeholders must also agree with the research team on what data can be made public. This methodology is also sensitive to the interactions between power and knowledge at the community level in terms of gender, class, age and ethnicity (Suich, et al., 2016a).

PHASE I: THE INTERDISCIPLINARY SITUATION ANALYSIS

An interdisciplinary situation analysis (ISA) is useful to understand the broader context in which projects and assessments take place so that these can be designed accordingly (MacKinnon, et al., 2012; Try & Chambers, 2006). In Phase I of the PiN mixed methods workflow an interdisciplinary team – including community representatives – is assembled and tasked with identifying key stakeholders and the objective(s) of the assessment, scoping the appropriate geographical area, executing the assessment and building the baseline. The ISA draws upon the situation analysis approach and methods developed by previous IUCN programmes, including the Integrated Wetland Assessment Tool and the Highland Aquatic Resources Conservation and Sustainable Development programmes (IUCN, nd; Springgate-Baginski, et al., 2009) as well as the Socioeconomic Monitoring Guidelines for Coastal Managers in the Caribbean (Bunce, et al., 2000; Bunce & Pomeroy, 2003). It is sensitive to assessing biodiversity, its uses, and understanding its relations to local livelihoods and cultural meanings.

The main purpose of the ISA is to contribute to the construction of a secondary data baseline that will serve as the

Figure 3.1 - PiN landscape assessment workflow
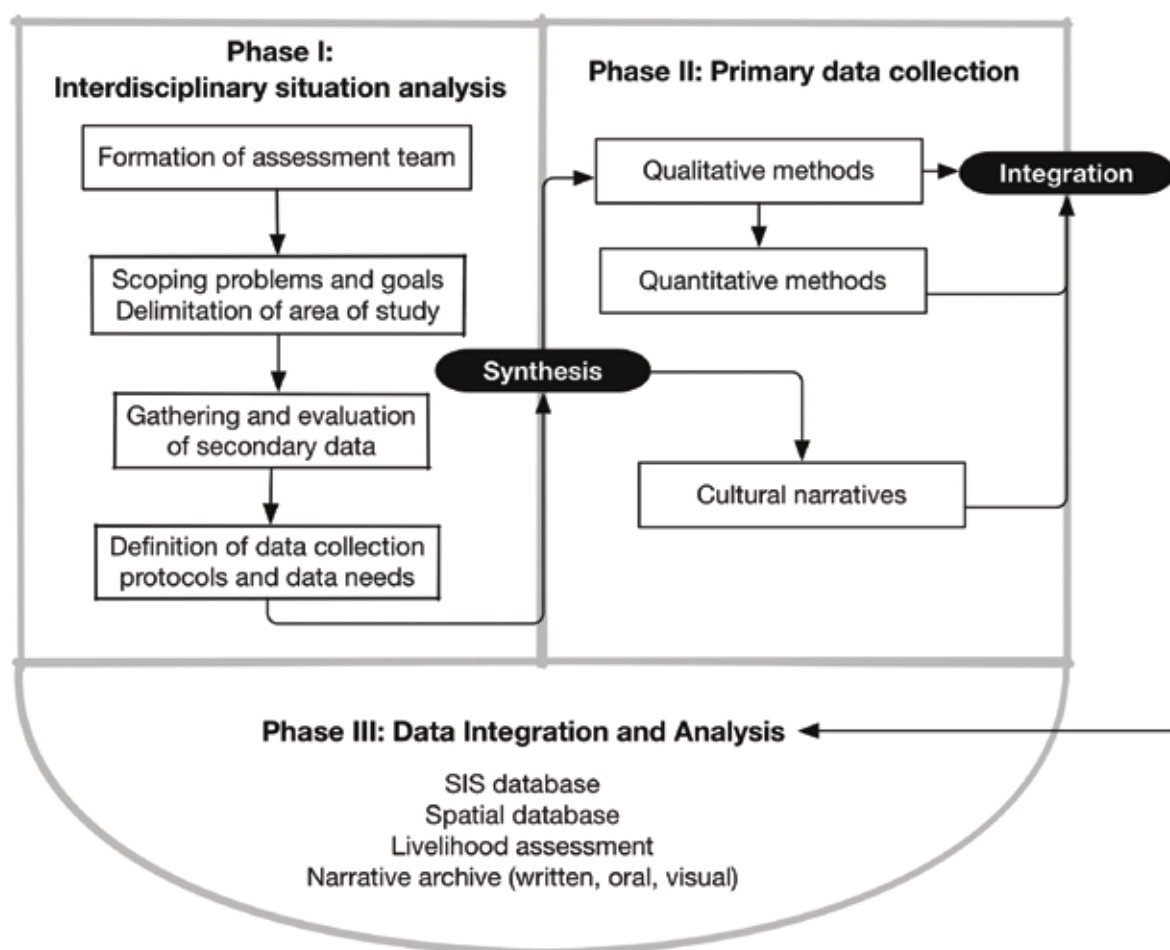
basis for identifying knowledge gaps and designing data collection strategies according to the needs of the assessment, and avoiding the duplication of efforts. By providing this contextual assessment, determining what information is available and what knowledge gaps remain, the ISA guides strategic decisions about data collection and analysis requirements in Phase II. The ISA is also useful for establishing working relations with community leaders and organisations, government authorities, non-governmental organisations and researchers active in the area of the assessment. Stakeholder identification and engagement make it possible to identify areas of potential cooperation and/or conflict.

The ISA has four steps: establishing the assessment team; scoping the assessment; reviewing secondary data; and identifying further data requirements and defining data collection protocols for Phase II (Figure 3.2). Outputs should be evaluated after each step to allow the team to address any persisting gaps, for example to determine whether additional skills are needed, or if the objectives need revising as a result of more relevant information surfacing. The final output of the ISA is a synthesis report that describes the challenge addressed and the objective of the assessment,

provides comprehensive inventories and synthesis of secondary data, identifies information gaps and proposes a set of protocols for any data collection required in Phase II.

Establishing the assessment team

A PiN ISA brings together a team composed of members of the PiN core and steering groups, regional IUCN officers as well as available researchers, non-government organisation representatives, government authorities and key community members from the region and site. Having a team with a diversity of disciplinary backgrounds and sufficient knowledge of the assessment site will ensure that the assessment process provides information and knowledge most relevant to the issue identified throughout its different phases.

Scoping

The specific objective(s) of the assessment and challenges to be addressed will be negotiated and agreed amongst the stakeholders at the start of the ISA (Springate-Baginski, et al., 2009). Though the objective should remain fixed during Phase I, it may be refined at the end of Phase I on the basis

Figure 3.2 - Phase I workflow

Phase I: Interdisciplinary situation analysis

Establish the assessment team
Form the assessment team
Identify and consult with stakeholders

Scope the assessment
Identify assessment objectives, the problems and goals to be addressed, and define the assessment area boundaries

Review secondary data
Collect and collate available secondary data on the material and symbolic aspects of the biodiversity based system (appropriation, transformation, exchange and consumption)

Identify remaining data gaps and propose data collection protocols

Synthesis

of information that has emerged during the review and synthesis of available data. To fit within PiN, each assessment will examine the interrelationships between humans and nature, and though the specific objectives will vary according to location and context, emphasis will remain on material and cultural aspects.

The protocol between the PiN team and the local community should be negotiated initially during the scoping phase and adapted during the assessment. The initial protocol should outline the research objectives and the collection, collation and analysis of secondary data (see also Deutsch, et al., 2016). At the end of Phase I, when data gaps and future data requirements are known, a second phase of negotiation will need to take place, to determine what data collection can take place and what data can be made public. Negotiating this protocol ensures community participation in the research design and implementation plans.

The geographical scope of the assessment area must be defined during this process, and in the case of PiN assessments implemented within IUCN projects, boundaries should coincide with the area of the project. A PiN assessment site may be an ecological area (e.g. a watershed, an ecosystem, the distribution area of a species) or a socially defined area (e.g. where particular livelihood or cultural practices are undertaken) (Springate-Baginski, et al., 2009). The knowledge, expertise and skills available within the assessment team, available resources, and the social and economic reality of the site should also be taken into consideration in the delimitation of the assessment area.

Reviewing secondary data

This step collates and collects existing secondary data, focussing on information relating to the variables underlying the biodiversity-based system, and current and potential use of biodiversity in the study area (Springate-Baginski, et al., 2009). Secondary data used will include biodiversity information from IUCN's Species Information Service and the Red List of Ecosystems, as well as information from projects, management plans, land use studies and other research. Other studies may provide complementary information about the value of biodiversity from the perspective of its use domains (e.g. food and nutrition, medicine, trade) for rural and remote communities. Likewise, demographic and socio-economic datasets can provide insights about the contribution of biodiversity and its material and cultural uses to one or more dimensions of welfare and livelihoods, as well as insight in to its governance. Finally, ethnographies about the cultural groups in the region may provide perspectives about the cultural values and local perceptions of biodiversity.

The collation and synthesis of secondary data sources will take particular note of whether original sources respected property rights over knowledge in their data collection efforts, and data will be repatriated to communities as part of the ISA process (see Deutsch, et al., 2016 for detailed discussion of these issues).

Identifying additional data needs and developing data collection protocols

The gathering, evaluation and review of secondary data will make information gaps and additional data requirements apparent (Bunce & Pomeroy, 2003). Based on these gaps and requirements, the team will select appropriate qualitative and/or quantitative data collection methods to be used to meet outstanding information needs.

It is at this stage that the mixed methodology design should be revisited, in order to choose a suitable design for any primary data collection that may take place following the completion of the ISA. This choice will be influenced both by the availability of secondary data and the specific objectives of the PiN assessment. The assessment team can then review and select the appropriate mix of qualitative and quantitative tools and methods and the methods to capture cultural narratives. The design of specific data collection tools and methods should be tailored using the secondary data and synthesis from the ISA, and can be refined using open-ended methods if necessary (Martin, 1995; Huntington, 2000).

This is also the stage at which protocols to guide data collection should be negotiated. Based on local institutions and agreements, these data collection protocols will help to define what kind of information can be collected and what can be shared in the public domain. Following the participatory principles of the mixed methodology ensures these methods and protocols will be co-created with stakeholders.

Synthesis of Phase I

The final output of Phase I is a synthesis report, which will bring together the initial objectives, a review and synthesis of the secondary data and an identification of remaining information gaps. The two stages of the protocol negotiated among the stakeholders involved in the assessment during Phase I should also be complete. Based on these products, the refined objectives of the assessment and the selected methods to be employed in Phase II will be proposed. The synthesis will describe the information that needs to be collected in Phase II, and what protocols must be followed to ensure that data collection is undertaken according to the ethics and worldview of the local stakeholders involved.

PHASE II: PRIMARY DATA COLLECTION

The purpose of Phase II is to undertake primary data collection to fill any remaining gaps in the empirical assessment by collecting complementary information on the biodiversity-based system and narratives about human–nature interrelationships (Figure 3.3).

This section does not describe any particular tools or methods for data collection or analysis, but rather describes in more detail the types of data associated with each of the variables underlying the framework of the biodiversity-based system; i.e. those related to current and potential use of biodiversity. As will be evident from the following discussion, much of the information required to fill out this framework could be either qualitative and/or quantitative, and in some cases, it is likely that some mix of natural and social science methods will be necessary to fill the information gaps identified in Phase I. It will also likely be necessary to use a balance of methods that examine individual, small group and community activities; such a mix will be necessary in understanding distributional issues amongst individuals, households and amongst groups within the wider community (Suich, et al., 2016a).

According to the particular needs of a PiN assessment, different methods can be bundled to address specific data needs. Methods that focus on individual responses can provide detailed information, those based on collecting information from groups can facilitate the discussion of contentious issues (Angelsen, et al., 2011). Both qualitative and quantitative data can be collected from individually-focussed and group collection methods (Chambers, 2010). It is possible that the implementation of some tools may be viewed as being more extractive than participatory; however the principle of participation holds in terms of the negotiations with partner communities about the types of data that can be collected, and in the subsequent return of that data to the relevant community.

The biodiversity-based system

The provisioning, or use, focus of the PiN assessment considers current use of biodiversity by examining the activ-

Figure 3.3 Phase II workflow
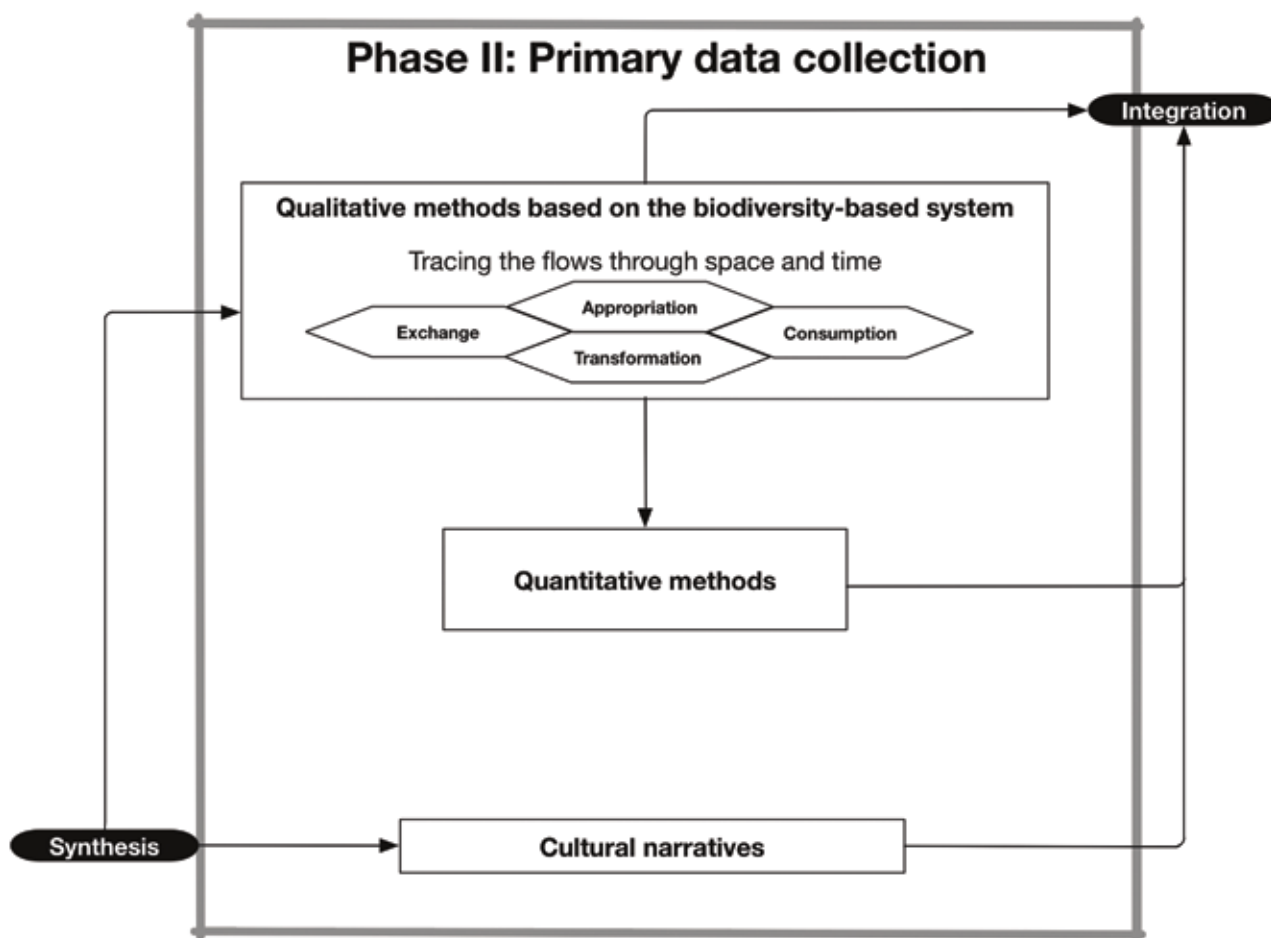
ities of appropriation, transformation, exchange and consumption, which provide a framework for organising data collection and analysis. Each of these activities brings together harvesters and other people (often with different backgrounds, gender, ethnicity, age, etc.) with biological materials, technology and infrastructure, and knowledge to accomplish a particular objective in the context of formal and informal rules and institutions (Davidson-Hunt, et al., in press). As noted above, these phases may not occur sequentially, as multiple phases of exchange and transformation may take place prior to final consumption.

Associated with the appropriation phase, information will be required on the biology, ecology and material properties of the species that are used, and on available local knowledge, to contribute to the understanding of harvesting seasons and sites, specific uses and properties. Other aspects that shape the harvesting and production contexts, including what species are appropriated, and at which sites appropriation occurs, are also necessary to understanding appropriation. To fully understand appropriation, information about the infrastructure and harvesting technologies available, the formal and informal institutions governing access and use, and the knowledge of, and demographic

information about, harvesters and hunters/collectors is also necessary. This contextual data make it possible to understand the processes by which certain species are appropriated or produced, and what hinders or enables the access harvesters and producers have to particular places.

Attention should be given in the transformation phase to information regarding the assemblages of species, local knowledge and technology involved in transformation processes, for example, the recipes and other processes that turn a species into food consumed at home, or into foods or other products intended for trade or exchange.

Sites of exchange may include (but not be limited to) formal markets, kitchens and places of ceremony, while the actors involved may include harvesters and producers, retailers, local authorities and final consumers. Demographic data about the actors (e.g. gender, age and class) is necessary to understanding the factors that shape their roles within exchange networks. Types of exchange refer to whether a species is shared, bartered or sold for cash. The formal and informal institutions governing exchange reflect how worldview, policies, laws and regulations shape transactions at specific sites.

Where and when species are consumed is important to understanding material and symbolic contributions, and should distinguish where certain species are eaten in situ, which species are taken home and which ones are consumed in restaurants, fairs and other public places, etc. The frequency of consumption is also important, for example, whether species are used on a daily basis, on special occasions, or perhaps in times of shortage. Such information improves understanding of the contribution of consumption to individuals' and groups' nutrition, identity, power and status.

Potential use can be understood by examining the variables of availability, stability, access and perception. There is some overlap in the data required to understand current and potential use, and it is likely that much of the data regarding potential use, by identifying uses in areas with similar ecology/similar cultures is likely to come from secondary sources.

Availability refers to both the amount of biodiversity available (i.e. the flow) either for current or potential utilisation, but also its quality. While this refers primarily to availability for appropriation, it can also be extended to examine the availability of technology that may facilitate processes of transformation and/or exchange further along the value chain.

As noted above, stability refers generally to the stock of biodiversity, affecting the reliability of flows and availability. Threats, risks to stability and opportunities to improve stability are critical in determining long term trends in stability. These threats and risks have potentially significant implications for the welfare outcomes of harvesters and consumers that must also be examined. While stability is primarily associated with appropriation, it should also be examined in terms of the stability of the infrastructure necessary to later stages in the value chain (i.e. to transformation and/or exchange).

Institutions, rules, norms, customs and values are key to understanding access – whether people can manage, and benefit from, a resource or not. Equally important is understanding whether individuals or groups have the power to exercise rights of management and/or utilisation across the phases of appropriation, transformation, exchange and consumption. Access is inextricably linked with governance (Suich, et al., 2016b), and can only be understood in terms of the relative power of individuals and groups to exercise their rights, and so should be examined in a highly disaggregated manner.

Perception refers to the ability individuals' have to be aware of something through their practical interrelationships with the environment. Perception provides a perspective that accounts for biodiversity and species used by communities according to their properties and how these properties (also known as affordances) become resources that make possible the maintenance of life and capacity of action (Ingold, 2000). Perception allows understanding of the processes and contexts in which biodiversity is used and socially constructed. Such construction is contingent on the histori-

cal interactions the members of a given society have had with particular resources. Using the relational perspective provided by affordances, new understandings of biodiversity emerge. Rather than something 'out there', biodiversity becomes "the discursive and material outcome of a socio-material assemblage of people, practices, technologies and other non-humans" (Lorimer, 2006:540). Perception allows the evaluation of a species in terms of its use (i.e. consumption or exchange), who uses it (i.e. class, gender and ethnicity) and how it is used (i.e. transformation).

At the community level, the biodiversity-based assessment aims to document the understanding people have of the species they use, and to explore the variables that mediate the relations people have with nature at this level. This may include the number of households that depend directly and indirectly on local ecosystems and biodiversity, the activities associated with biodiversity, where these activities take place and what species and varieties are used and for what purposes (e.g. Herrmann, et al., 2014), and the identification of important species used and products, availability, trends, and what is needed to increase the benefits people receive from natural resources. While some data collection methods may provide descriptive information about what species are used, when and how their abundance has changed in recent history, others offer space to gather multiple perspectives about underlying issues affecting abundance, availability and access to biodiversity.

The collation of individual and household-level assessments provides a basis for spatial analyses at the landscape level, and provides greater detail about individual utilisation of species (whether via one or more of the variables associated with current use) and the contribution this makes to the multiple dimensions of material and spiritual welfare. Given the significant investment of resources required to implement household surveys, any survey instrument developed must be based upon the Phase I synthesis as well as the findings emerging from the application of qualitative methods.

Narratives of interrelationships with nature

A participatory approach is necessary for examining how rural and remote communities understand their relations with nature from their own perspectives. This module is based on the premise that, although biodiversity has 'concrete biophysical referents,' it is a social construct which orders the natural world according to artificial categories (Escobar, 1998: 53). Reducing biodiversity to genes, species and ecosystems does not pay sufficient attention to how local people interact with, understand and produce knowledge about nature (Viveiros de Castro, 2004), and often results in misunderstandings about management and conservation objectives between communities and environmental authorities and other conservation-oriented stakeholders (Blaser, 2009).

Rural and remote communities can have different ways of interacting with nature, based upon their cosmologies and historical relations with the territories they inhabit (Davidson-Hunt, 2006). PiN aims to provide a mechanism and space to document these perspectives employing participatory ethnographic methods. However, 'communities' are not homogeneous, and there is a need to represent voices and perspectives informed by gender, age, ethnicity and class. Communities at the assessment site should guide the process of selecting methods and the format and approach employed for making the outcome public. By opening up alternative pathways to understanding the interrelationships between people and nature, this component of PiN will allow for richer contributions from rural and remote communities.

Synthesis of Phase II

The final output of Phase II is a synthesis that brings together biological, social, cultural, ecological and local knowledge of biodiversity, employing not only qualitative and quantitative data, but also the narratives of communities. It provides scientific knowledge about the taxonomic identification, distribution, abundance and threats related to key species. It also catalogues available local knowledge in terms of names and uses of key species, as well as the formal and informal rules that define the local management system. The synthesis should also describe the current role that biodiversity plays in the livelihoods and well-being of stakeholders at the assessment site, and describe its potential role. The biodiversity-based system framework allows for the study of variables that facilitate and impede flows of biodiversity across the landscape and the benefits and costs generated and borne by people at the sites of appropriation, exchange, transformation and consumption. Narratives about interrelationships with nature provide a platform for communities to articulate their relations with nature from their own perspectives.

PHASE III: INTEGRATION WITH OTHER IUCN KNOWLEDGE PRODUCTS

Early in the process of PiN development, it was recognised that if information was collected using species as an analytical unit there was the possibility to utilise the IUCN Species Information Service as a source of secondary data about use and conservation status of species and to develop a platform for linking secondary data sources (see Deutsch, et al., 2016). The Red List of Ecosystems may also provide information related to threats to ecosystems, and thus provide information about the availability and stability of biodiversity. This has not been explored in detail yet, but has been flagged as an avenue to explore further. In turn, it is hoped that data collected in PiN assessments can be fed back in to IUCN and other relevant databases. Linkages with other IUCN knowledge products have not yet been formalised, though preliminary discussions have been held

with the Natural Resources Governance Framework, due to the likely linkages related to the normative frameworks related to natural resource use. This linkage will continue to be explored as that framework is developed.

NEXT STEPS

This mixed methodology for landscape assessment of biodiversity-based systems represents a comprehensive way to assess the value and contributions of biodiversity to rural and remote communities. It integrates qualitative, quantitative and cultural narrative data to build an understanding of the interrelationships between people and nature, the benefits from, and costs associated with biodiversity, as well as the variables that hinder and enable access to it. This perspective encompasses more than simply the monetary or intrinsic value of biodiversity, and considers its nuanced and specific material and cultural contributions to livelihoods and well-being at an assessment site. The approach adopted gives power to communities to influence an assessment according to their needs and priorities, as well as to produce credible data for evidence-based public policy development. The data and other outcomes of this process aim to inform policy and development interventions to support rural and remote communities' defined development pathways and the needs, desires and aspirations at the individual and household level that contribute to self-determination.

In addition to formalising links with other IUCN knowledge products, in terms of the use, analysis and holding of data, this methodology will be utilised in work at 'early adoption' sites. Based on the results of these early case studies, the methodology will be further refined. Concurrently, activities will be undertaken to identify and/or adapt (as appropriate) tools and methods for specific data collection purposes. It is hoped that the biodiversity-based system framework can be adapted and expanded to specifically incorporate the consideration of water resources as part of the interrelations between humans and nature.

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Promoting and safeguarding bio-cultural diversity in northern Vanuatu

Delly Roy, Thomas Dick and Sarah Doyle, *Further Arts*
Cristina Panicali, *Independent Photographer*

IN THE SOUTH PACIFIC ISLAND NATION OF VANUATU, there are over 130 different languages spoken. With its population of approximately 263,000, this means Vanuatu has the highest per capita linguistic diversity on the planet. These languages – and the knowledge and practices that they represent and articulate – are important expressions of cultural diversity. As the cash economy penetrates deeper into the islands of Vanuatu, communities are identifying the need for alternative, locally-based approaches to the promotion and preservation of important traditional wisdom practices including dances, music, songs and stories, and connecting these with contemporary music and dance.

One of the ways that communities in Vanuatu are responding is through the Traditional Entertainment and Kastom Support (TEKS) unit of Further Arts – a local non-government organisation working with communities on arts and cultural projects. Delly Roy, an indigenous woman of Vanuatu and Kiribati descent, founded TEKS in 2011. Delly conceived TEKS to provide space and equal opportunity for traditional performers to express and expose their artistic talents in a local cultural festival on Espiritu Santo island in northern Vanuatu. TEKS also provides support to practitioners of kastom and those communities that safeguard its values.

Delly speaks fluent English, French and the local creole *Bislama* (the lingua franca of Vanuatu) in addition to her father's vernacular language, *Mwerlap*. Delly says, "I feel that I understand enough about diverse Vanuatu cultures and that I have a reasonable understanding of many foreign cultures. I created TEKS as a unit to serve as a bridge between the different conceptual worlds."

Through TEKS, Delly is nurturing the grassroots, indigenous-led biocultural diversity movement. Her work focusses on the village-based activities that embody the intergenerational transfer of traditional ecological knowledge, cultural wisdom and development in the northern Vanuatu provinces. Often this involves the co-production of creative multimedia content, to document the performance and exhibition of music, song, dance, art and storytelling. These activities are powerful in two ways. First they allow traditional ecological knowledge and culture to be transmitted across generations and ethnic groups. Second, they strongly link with their land- and sea-scapes and the maintenance and protection of

these land- and sea-scapes as the fundamental basis of life.

These creative practices, that draw on such diversity of biocultural heritage, can offer powerful tools for achieving conservation outcomes. In the Pacific, there is a wealth of traditional knowledge and wisdom in local communities, and TEKS is modelling effective ways of building new commitments to address barriers to achieving just and effective conservation and management of biocultural diversity.

In 2013, TEKS initiated a project titled "Engaging Rural Youth in Cultural Rights Activity". Through this project, TEKS is showing that by supporting local communities to document and continue transmitting important traditions and practices to younger generations, the links between cultures, people and their environment can be strengthened. Young people have performed alongside their elders in their communities' traditional songs, dances and ceremonies, thus strengthening intergenerational partnerships and exchange. They have also reinterpreted these traditions, developing new cultural expressions, through music composition, visual art and mixed dance styles. These opportunities have given youth deep insight into the process of learning and performing their traditional cultural heritage. They have enriched respect for it, and have learned the tools necessary to continue the practice, maintaining it for themselves and future generations. More than 200 young people have benefited through direct participation in project activities, and over 10,000 have benefited indirectly, through viewing of multimedia content and attendance at events.

Delly explains that "[my] idea is that if each culture can understand or at the very least acknowledge each other, a platform can be set for mutual respect." TEKS aspires to be there to facilitate that platform and foster the connections.

PiN has recognised the importance of cultural narratives to express the diverse ways by which societies perceive of themselves as part of nature and nature as part of themselves. TEKS, as a member of IUCN, and Delly, as a member of CEESP, demonstrates the type of work already being done that provides a way to include cultural perspectives within the PiN knowledge basket using a 'One Programme' approach.

To find out more about this project contact the authors at info@furtherarts.org or visit www.furtherarts.org ▪

Chapter Four

VALUES AND HUMAN INTERRELATIONSHIPS WITH NATURE

NICHOLAS CONNER, AROHA MEAD AND NATHALIE OLSEN

PiN aims to improve our understanding of the interrelationships between people and nature, focussing on the material use of nature by people and recognising that use is embedded within worldviews that include deep-seated cultural norms, values, and understandings. PiN also considers symbolic interrelationships with nature expressed through cultural narratives, language and traditions, to ensure the inclusion of diverse understandings of sacred and spiritual aspects of nature and our relationship with natural resources.

There is growing interest among donors and governments in approaches which define and categorise the value of biodiversity and nature from an anthropocentric perspective, and through economic valuation techniques, such as the Millennium Ecosystem Assessment (MA), the Economics of the Environment and Biodiversity (TEEB), the Common International Classification of Ecosystem Services (CICES) and the World Bank Wealth Accounting and the Valuation of Ecosystem Services programme (WAVES).

An anthropocentric, and particularly an economic perspective towards nature can provide valuable insights about the nature of the relationship between people and nature, such as how the perceived economic value of entities influences choices about their use, and how the direct and indirect costs and benefits of resource use are allocated. However, if discussions about human interrelationships with nature are only considered in terms of anthropocentric and economic perspectives of value, important insights into fundamental biological, social and ethical dimensions will be neglected. For example, the emphasis in the MA and TEEB frameworks on consumption and management of nature products (such as ecosystem services) may marginalise more qualitative approaches to these interrelationships, notably in relation to spiritual and cultural values rural and remote communities attach to nature.

This chapter looks at how 'value' and values are defined and categorised, and whether different ways of looking at values can contribute to a better understanding of how humans relate to nature and make decisions about how they use and manage nature. It addresses three key topics – definitions of value, categorisations of value (as anthropocentric or non-anthropocentric), and different perspectives that provide insights into types of value. The chapter also provides recommendations about the contribution of different perspectives to the values considered in PiN assessments and programmes.

The term 'value' has a range of meanings, which vary according to the context in which the term is being used (Fernandes, 2011). Value can be:

i. a synonym for standards or ethics guiding individual behaviour;

ii. a tool for cultural expression, by defining important and enduring beliefs shared by members of a culture about what is good and desirable and what is not;

iii. a criterion for direct or reciprocal exchange based on the amount of goods, services, money or obligations thought to be a fair and suitable equivalent for something else;

iv. a means of assessing usefulness (in terms of the importance or significance to the possessors of an entity); and

v. a term for non-human attributes and intrinsic qualities (Anon, 2012).

Values can be expressed in quantitative and qualitative terms (e.g. dollars, percentages, amounts, levels, degrees, etc.), or in terms of the fact of the existence of natural attributes or characteristics. It is important to distinguish values from benefits, though these terms are frequently used interchangeably (Feary, 2015). Values represent particular characteristics or attributes attributed to entities. Benefits are defined in this chapter as the advantageous outcomes of the human use of entities that have been attributed with value, where human use can be active or passive, consumptive or non-consumptive, direct or indirect. Benefits represent the additional well-being obtained from using an entity.

Definitions (i)–(iv) listed above regard value as a relative construct which enables comparisons between entities in terms of the direct or indirect benefits they provide to humans. In contrast, definition (v) regards value as a non-relative characteristic, which can be attributed to an entity irrespective of the value attributed to any other entity. These distinctions closely relate to categorisations of value provided by the International Platform on Biodiversity and Ecosystem Services (IPBES, 2015) and Turner, et al., (2003).

Values can be broadly categorised as anthropocentric and non-anthropocentric (IPBES, 2015; Turner, et al., 2003). Anthropocentric values relate to the human use of entities, whether such use involves direct-, indirect- or 'non'-use of these entities. Non-anthropocentric values reflect the idea that entities have value independent of human use, that they have value in their own right, unrelated to human needs. An example of this is the contribution of biodiversity to continued life on earth, whether including humans or not (Turner, et al., 2003). These categories can be further divided into anthropocentric instrumental and anthropocentric relational, and non-anthropocentric intrinsic (IPBES, 2015; Turner, et al., 2003).

ANTHROPOCENTRIC INSTRUMENTAL VALUE

Instrumental value is the value attributed to things that are seen as means to achieve some end, for the benefit of some individuals and/or groups (IPBES, 2015). Instrumental values refer to direct or indirect human uses of nature, rather than nature existing in its own right, as is the case with intrinsic value. Examples of entities with instrumental value include plants and animals used for food and medicine, soil fertility for agricultural production, habitats for commercially useful wild species, wetlands for water flow regulation and natural environments used for recreational activities.

ANTHROPOCENTRIC RELATIONAL VALUE

Relational values are anthropocentric values attributed to entities used by individuals and communities to achieve a particular outcome or benefit. In this case the entities provide psychological, social or cultural value to humans as individuals and groups, such as physical and mental health, well-being, livelihoods and education. These types of value are relational in that they concern values associated with community interactions, rather than values which provide benefits to people as individuals.

NON-ANTHROPOCENTRIC INTRINSIC VALUE

Several definitions of intrinsic value exist, all of which involve an ethical, moral or spiritual conviction that certain entities have value in their own right, irrespective of their value to humans (see for example Jamieson, 2008). Examples of entities which may be attributed with intrinsic value are totem animals and plants, Gaia, Pachamama and Mother Earth.

For many Indigenous peoples, intrinsic value can also mean 'of the ancestral realm'. For example, in New Zealand Māori cosmology, knowledge was imparted to the natural world before humans came. Thus, humans need to understand the ancestral nature of the natural world and respect its primacy and intrinsic value in their interactions with it. Intrinsic values can provide the ethical basis for guidance and rules about the way a community should relate to nature.

These three categories of value reflect a particular view about the relationship between individuals, communities and nature, which sees humans as external entities from nature. There are of course, other ways of representing this relationship. For example, members of Aboriginal communities in New South Wales, Australia, do not see their relationship with nature in terms of instrumental, relational or intrinsic values, but in terms of their responsibility for the health of their natural environment and its flora and fauna (pers. comm., Ridges). Sirina adds: "It is subjectively believed that the role of a person making traditional use of natural resources is active, and any action (or inaction) elicits a response on the part of nature. When people stop using the land, for whatever reason, and cease to take care of it (and so to take care of themselves also), both the land and the people are impoverished" (2008:15).

VALUE FROM DIFFERENT PERSPECTIVES

PiN aims to document both material and non-material values associated with nature. It is therefore essential that the types of values that may potentially exist in a landscape, both anthropocentric and non-anthropocentric, are defined broadly, to ensure the analytical perspectives needed to understand different types of values are deployed. There is often undue emphasis placed on anthropocentric values (particularly instrumental values) for a number of reasons, including the fact that these values are often the most easily articulated, documented and measured. For example, the sustainable livelihoods approach has been criticised for being overly materialist in its focus on the five capitals (human, social, natural, financial and physical), and for treating culture as marginal (White & Ellison, 2007; see also Suich, et al., 2016).

In order to meaningfully capture values for nature associated with culture, a broad range of value types must be recognised and documented. It is therefore important to explore how values are considered across disciplines, and how different perspectives of value can provide insights about human interactions with nature. This information should be used to guide policy making in directions which maximise not only material well-being, but a broader conceptualisation of well-being that includes cultural, spiritual and identity elements in a meaningful manner.

Table 4.1 introduces a number of analytical perspectives that can be used to explore the diverse values people have for nature, some of which are discussed in more detail in

Table 4.1 - Perspectives to explore different value categories

Type of value	Analytical perspective
Anthropocentric – instrumental	Economics Economic anthropology
Anthropocentric – relational	Cultural anthropology Psychology
Non-anthropocentric – intrinsic	Cultural anthropology

the following section. Some analytical perspectives relate to more than one type of value, for example, cultural anthropology perspectives can provide insights into both anthropocentric relational values and non-anthropocentric intrinsic values. Psychological perspectives of value may provide useful insights into human relationships with nature, but are not discussed in detail, as further work is needed to clarify how they accord with the categorisation of value used in this paper, and whether they have any useful applications in PiN assessments.

Perspectives on anthropocentric instrumental value

Anthropocentric instrumental value is the value attributed to things that are seen as means to achieve some end for individual or community benefit (i.e. 'use values') (see IPBES, 2015), as noted above.

An economic perspective

Anthropocentric instrumental values can be defined and estimated in a number of ways in economics using microeconomic and macroeconomic concepts. Microeconomics focusses on the determination of prices, outputs and income distribution in markets through supply and demand. Micro-economists are interested in how scarce resources held by individuals, households and communities (e.g. labour, capital, environmental goods and services, time) can be allocated to maximise economic welfare, and how resource owners make decisions about the use of these resources under different circumstances. Economists are particularly interested in marginal (i.e. incremental) changes in the value of these scarce resources as a consequence of some policy or management action, such as the impact of a new agricultural subsidy.

Macroeconomics is concerned with the behaviour, functioning and internal interactions of economies as a whole (at the local, regional, national, or international scale), and quantifies and measures value using aggregate indicators (e.g. gross domestic product, national income, value-added activity and price indices). In macroeconomics, economic value can be equated with the monetary amount transferred between parties as a consequence of the direct and flow-on effects of expenditure on goods and services.

Economic perspectives should be distinguished from financial perspectives. The primary concern of financial perspectives is to understand the relationship between expenditure and income in relation to investment of financial, physical and human assets (capital). In contrast, economic approaches are concerned with examining the behaviour of markets and prices and the efficient allocation of resources, the distribution of costs and benefits associated with production and consumption, (microeconomics) and the functioning of economic systems (macroeconomics).

A common microeconomic framework to assess anthropocentric instrumental values related to use of nature is the total economic value (TEV) framework (TEEB, 2016). This framework classifies values into direct use, indirect and non-use values. Direct use values refer to goods and services that are used directly for consumption, which can be further classified into 'consumptive' (e.g. direct harvest of forest products, fish or medicinal plants) or 'non-consumptive' (e.g. recreation) uses. Indirect use values concern functions and services that provide an input into another activity that has economic value, e.g. crop pollination and flood mitigation.

Non-use values include option, bequest and existence values. Option values are the benefit placed on the potential future ability to use a resource (whether by current or future generations), regardless of whether it is currently used, or whether the likelihood of future use may be very low. Bequest value is the value attributed to maintaining something for the benefit of future generations, while existence value is the value obtained from knowing certain things exist for economic, moral, ethical or other reasons.

TEV has become a popular approach (e.g. TEEB, 2016) to estimate the 'total' economic value of an ecosystem or particular environment. However, value estimates should not be summed to produce a 'total' value for several reasons, including that: total economic value is not comprehensive

as it does not address biophysical functions and goods and services that have not yet been identified as having value; there is potential for double-counting between use, indirect use and non-use values; the framework mixes stock values and flow values; conceptually different valuation methods are used to estimate use and non-use values; and because values estimated are static and changes in value over time are not considered (Turner, et al., 2003; Plottu & Plottu, 2005). Additionally, in comparison to estimating marginal changes in value, estimating total economic value is not helpful for evaluating specific projects or for carrying out strategic environmental assessments to guide the development of policies and plans (Roberts, et al., 2015).

An economic anthropology perspective

Economic anthropology can provide insights into instrumental values attached to non-monetary transactions, which occur outside the formal market economy, in particular in relation to reciprocal exchange. Unlike transactions of goods and services where value is expressed in terms of gains or losses in economic welfare (in microeconomics), in reciprocal exchange, value relates to the social function of the transaction, especially where transactions involve the giving of gifts.

The relationship between the social value of transactions involving reciprocity and the economic value of goods has been considered by economic anthropologists and historians. Historically, economic anthropology has been concerned with the debate about the extent to which neoclassical economic analysis can be applied to societies where exchange is largely concerned with gift exchange rather than exchange of commodities (Gregory, 1982).

Economic anthropologists argue that economic systems are embedded in social relationships. Such economic systems may take different forms, and are not confined to a capitalist economy. Polyani (1957) for example, argued that three general types of economic systems prevailed before the rise of a society based on a capitalist economy. The three types were:

i.   reciprocity, where the exchange of goods is based on reciprocal exchanges between social entities, including the production of goods to gift to other groups;

ii.   redistribution, where trade and production are organised around and controlled by a central authority, such as a tribal leader, and redistributed by them to other members of society; and

iii.   household economies where production is focussed on the needs of individual households for food, textiles, other goods and tools for their own use and consumption.

The main distinction between these non-exclusive forms of economic organisation and market economies is that they were based around the social aspects of the society they operated in and were explicitly tied to social relationships (Polanyi, 1957).

For PiN landscape assessments, understanding the relationships and social context in which material use of nature takes place will be important, to avoid the problem of western-trained researchers focussing on material use of nature in a vacuum. The decisions that individuals, households and communities make are based on how they value material goods and services provided by nature, and the need to build and maintain social relationships and structures. An economic anthropological perspective of reciprocity among rural and remote communities is relevant to a discussion of the anthropocentric instrumental and relational values these groups have for nature.

Bétrisey & Mager (2014) give an example of two types of reciprocal arrangements among Bolivian highland communities. *Minga* is an extra-familial work party formed to carry out an agricultural task, often harvesting or clearing land for another member of the community (a '*communero*'). The *communero* organising the *minga* is morally obliged to participate when another member of the work group calls for a *minga* on his land. The second type of arrangement is known as *ayne*, a one-to-one arrangement where one member of the community helps another, and the recipient is obliged to return the favour. Reciprocity under this system can be at another time, for a different type of work, or it can be provided by a close family member of the original beneficiary. The *ayne* creates an "affective relationship, lasting and going beyond immediate material needs satisfaction" (Bétrisey & Mager, 2014:371), and supports the suggestion that traditional reciprocal norms still play an essential role in decision making and the resilience of rural societies in the mountainous regions of Bolivia.

Social relationships relating to reciprocity typically involve a continuing sequence of giving, receiving and repaying goods and services, which may circulate through the community over time and which contribute to maintaining the balance in rural livelihoods within a family and the wider community (O'Neill, 2013). Reciprocity may not just be restricted to exchange of commodities and obligations among people, but also to exchanges with non-human beings. In some indigenous communities, e.g. in the Canadian sub-Arctic, this human–non-human interaction is an important element of the balancing act an individual needs to perform to avoid economic, social and relational losses (pers. comm., Burlando).

Perspectives on anthropocentric relational values

A cultural anthropology perspective

A cultural anthropology perspective can be used to explore anthropocentric relational values that communities ascribe to nature and its economic, social and ceremonial uses. These values are 'relational' in that access to, or ownership of, enti-

ties such as elements of biodiversity can provide the owner with social benefits in terms of status, rights and obligations or, conversely, social sanctions from the misuse of these entities.

Values are affected by culturally-mediated rules and institutions which influence the attribution and prioritisation of values relating to human interactions with nature, including values attached to places, harvesting sites and species. Additionally, different individuals and groups will hold different values, based on their interactions and their social status: "Gender, caste, class, age, ethnicity and so on shape human's interactions with nature. Diverse groups, even in the same locality, have different values and interests, and conflicting values are struggled over and negotiated in resource use conflicts" (Fisher, et al., 2005, 41-42).

Not only can values attached to specific entities differ between groups within communities, but also with values identified by external groups, such as researchers and policy makers. For example, Aboriginal health programmes in Australia tend to focus on the western view that health and nature are largely decoupled, and have ignored links between Aboriginal health and the quality of, and access to, the natural environment (Garnett & Sithole, 2007).

A cultural anthropological perspective considers the function that rituals, ceremonies and other social and community activities play in the reinforcement of social roles and norms. An example of this is the social, cultural and agricultural role played by the annual Watunakuy seed blessing ceremony in the Peruvian highlands, which involves members of local communities engaging in spiritual and social activities including singing, praying, discussing, eating coca leaves and drinking maize beer (Verschuuren, et al., 2014). These rituals of spiritual and social practice are part of the cultural rules and norms regarding seed sharing and diversification, and help communities respond to climate change and biodiversity loss and other external pressures on their livelihoods.

Non-anthropocentric intrinsic values

Non-anthropocentric intrinsic values reflect the value that individuals and communities hold for entities which they perceive as having value in their own right, irrespective of their use to humans. Entities which are attributed with non-anthropocentric intrinsic value include Gaia, Pachamama, and certain species or totem animals. For example, in Baganda communities in Uganda, there are "certain tree species that were not supposed to be cut down, as well as animal species that were not supposed to be killed … Each clan has a totem which could be an animal, insect or plant, and it is forbidden to eat one's totem, the mother's and grandmother's" (Ssozi, 2012:1).

A cultural anthropology perspective

Intrinsic values commonly involve an ethical, moral or spiritual conviction that certain entities have value in their

own right, irrespective of their value to humans (Jamieson, 2008). Religion and faith-based principles can play a role in fostering and promoting ethical, moral or spiritual convictions relating to nature. For example, consider the elements of environmental ethics and protection advanced by Islamic scholars:

> Humans are only part of the divinely created scheme of the perfect equilibrium of things and the universe; however, they have been entrusted to manage the earth as God's stewards. They are required to conserve the environment as a manifestation of the divine presence and live peacefully on Earth in harmony with the cosmos and the environment (Schwarte, 2003, 568-569).

Ethics, mythology, practical actions, rules and norms apply to the values New Zealand Māori attach to nature. These values underpin a sense of identity and belonging to land, water and air. Traditionally, Māori did not seek or possess anything; it was more important to belong. This sense of belonging was a belief that one was born out of the land, and implied that there was a relationship between people and land. Such relationships were, and are, embedded in Māori cosmology, attitudes and beliefs including the principles and practice of *tikanga* (which literally means to make right or correct) (Mead, 2003).

Māori values manifest themselves in many forms in the natural world, and often as attributes of land, water and culture, they can be represented in a spatial or geographic context. Values can apply to any natural resource, area, place, or thing – whether tangible or intangible – which is of physical, economic, social, cultural, historic and/or spiritual significance to *tangata whenua* (people of the land) (Anon, 2016).

The reference to 'intangible' things allows for language, as in Māori place names, particularly those used by *tangata whenua*, and the recording of information related to metaphysics or to cosmology to be included in considerations of value. Māori values are associated with the way Māori people use and perceive the environment. These values are still strongly held (Shearer, 1986), and are acknowledged in the New Zealand legal and policy natural resource management framework (see New Zealand Ministry of the Environment, 2010). However, many management procedures do not sufficiently account for Māori values (Shearer, 1986). Although indigenous values and their relevance to natural resource governance, management and use may be acknowledged in New Zealand resource management legislation, they are not necessarily well implemented in practice.

USING INSIGHTS FROM DIFFERENT PERSPECTIVES IN THE PIN KNOWLEDGE BASKET

As can be seen from the discussion above, different analytical perspectives can provide insights into the range of

values that individuals and communities have for nature. Table 4.2 lists types of information obtained from different analytical perspectives. Some types of value can be examined from several perspectives, e.g. cultural anthropology and economics can both provide insights into value as a means of assessing use and usefulness.

Cultural and economic anthropology perspectives provide information on the cultural and socio-economic dimensions of the use of nature. Economic perspectives provide information on the allocation of resources and the distribution of costs and benefits associated with access and use of ecosystem goods and services.

The different types of values and the analytical approaches of different social science disciplines needed to measure and document these values have shaped the development of the mixed methodology approach to research design and data collection for PiN landscape assessments as the methodological framework for PiN (Idrobo, et al., 2016). The mixed methods approach combines quantitative and qualitative methods applied in the context of relevant disciplines to tackle complex problems.

The need for clarity about the types of values that exist, and how to explore them, becomes critical in the implementation of the PiN mixed methodology workflow. The PiN workflow has three phases: a situation analysis, data collection and data analysis and integration. The situation analysis is designed to be interdisciplinary to identify the issues to be addressed with communities and key stakeholders, as well as to provide information on the context, scope and objective of the landscape assessment. The situation analysis provides the first opportunity to identify the full range of values at play in a landscape and amongst stakeholders, and to assess the quality and quantity of data that is already available about this range of values. An important objective of the situation analysis is to identify data gaps, and it is likely that many of these gaps will be associated with both anthropocentric and non-anthropocentric values.

Phase II of the workflow focusses on primary data collection to characterise the biodiversity-based system, and more specifically current and potential use of biodiversity. The selection of methods will depend on the objective of the assessment and on the types of values associated with current and potential use, be they provisioning services like food and energy (with instrumental values), or more for cultural purposes like rituals. Although specific tools have not yet been proposed, it is clear that different analytical perspectives can be deployed to illuminate particular issues, e.g. household surveys may be used to better understand the economic underpinning of local livelihoods and how land-use changes or other proposed interventions will affect these livelihoods, and cultural anthropological approaches may be used to capture cultural narratives to document intrinsic, instrumental and relational values associated with particular species or harvesting practices.

This chapter has considered how anthropocentric and non-anthropocentric types of values relating to human use of nature can be considered from a range of perspectives, including economic, economic anthropological and cultural anthropological perspectives. As shown in Table 4.2, different perspectives will contribute different types of information, and the choice of which perspectives to use in PiN assessments of human interactions with nature will depend on the topic and purpose of the investigation. Nevertheless, it is important that potentially useful perspectives are not disregarded out of hand by researchers because they do not accord with the concepts and approaches of their particular discipline – quantitative researchers may view qualitative researchers as too context specific, with unrepresentative samples, and with unwarranted claims (as judged by statistical generalisation). Qualitative researchers sometimes view quantitative research as simplistic, decontextualized and reductionist, and failing to capture the meanings that are attached by actors to their lives and circumstances (Brannen, 2005).

When analysts use only one perspective to the exclusion of others, valuable insights may be lost. The paper therefore recommends that further research be carried out to help provide a deeper understanding of the values individuals and local communities attach to their relationship with nature, as well as further investigation of the potential usefulness of psychological perspectives of value for PiN assessments.

Other issues for further research include, firstly, what external factors, such as increasing integration with market economies or climate change, encourage individuals and communities to adapt, trade-off or abandon particular values associated with nature, so causing a fundamental change in the interrelationships between people and nature. Secondly, how and under what circumstances do changes in local community values for nature, e.g. a decreasing emphasis on non-anthropocentric intrinsic values and greater emphasis on anthropocentric instrumental values, affect community and individual well-being?

Table 4.2 – Overview of analytical perspectives and types of information on human–nature interactions

Perspective	Information relating to human–nature interactions
Economic perspective on anthropocentric instrumental values: direct, indirect and non-use values	Quantitative and qualitative data on direct and indirect allocation of resources to supply/obtain ecosystem goods and services, including opportunity costs and other costs and benefits associated with transactions
Economic anthropological perspective on anthropocentric instrumental values: reciprocal values	Information on socio-economic dimensions of use, exchanges/trades of ecosystem goods and services, and socio-economic relationships between different parties engaged in exchanges/trade
Cultural anthropological perspective on anthropocentric relational values	Information on cultural dimensions of use, e.g. rules, rituals, customs relating to harvesting and use of ecosystem services
Psychological perspective on anthropocentric relational values (see Table 4.1 above)	Information on underlying personal values which influence a community's attitudes towards its relationship with nature
Cultural anthropological perspective on non-anthropocentric intrinsic values	Information on beliefs and attitudes to human relationship with nature

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Revitalising customary marine management institutions in Aceh, Indonesia

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ACEH IS INDONESIA'S WESTERNMOST PROVINCE, situated on the northern tip of the island of Sumatra where the Andaman Sea, Malacca Straits and Indian Ocean converge. Its waters form the western boundary for 13 Pacific hard coral species and the eastern boundary for four Indian Ocean species. They harbour a rich diversity of species including marine turtles and dugongs, sharks and rays, as well as populations of endemic and genetically distinct fauna, such as giant clams. For more than a decade, Fauna & Flora International (FFI) has been supporting the Government of Aceh's Marine and Fisheries Agency (MFA) to deliver its vision for decentralised marine management in the province. This has involved both provincial level marine spatial planning and site-based capacity-building for collaborative management of nearshore fisheries.

Historically, the natural resources of Aceh were governed by customary institutions, including local marine management institutions, known as *Panglima Laot* (literally 'Commanders of the Sea'). The existence of *Panglima Laot* stretches back three centuries or more, but their effectiveness had been undermined by changing socio-cultural and political conditions, including a decades-long armed insurgency against the Indonesian central government. In addition, many fishers in Aceh – including up to one-third of *Panglima Laot* leaders – died in the 2004 tsunami, resulting in the loss of a vast body of traditional knowledge as well as leadership within fishing communities. In 2008, FFI instigated a programme to rebuild this knowledge. Among other things, this involved equipping fishing boats with GPS devices to enable fishers to map fishing areas, and additional bathymetric mapping of the sea floor to identify changes brought about by the tectonic shifts that caused the tsunami.

FFI, MFA and local communities have been working together to develop collaborative marine management on the island of Simeulue off the northwestern coast of Sumatra. Due to its relatively small size, its distance from major population centres in the rest of Aceh, and poor transport infrastructure, Simeulue has traditionally received comparatively little economic development support. Communities here are still heavily dependent on natural resources for their livelihoods, predominately fisheries and some agriculture. In 2006, 44,911 hectares of marine area on the eastern side of the island were designated as a marine protected area (MPA). Initially, little progress was made in putting in place the management structure and activities to operationalise the MPA. In 2012, FFI started to provide participatory mapping, facilitation and GIS support to clarify MPA boundaries and kick-start the process of zonation and management planning. By 2014, a MPA management body had been established, with representatives from the district government fisheries office and other local stakeholders, including fishing communities' leaders.

At the same time, revitalisation of *Panglima Laot* institutions on Simeulue has enabled local fishers to take an active role, alongside local government, in sustainably managing near-shore resources. For example, some communities reported issues with fishers from elsewhere in Sumatra entering their traditional waters and employing destructive and dangerous practices, such as use of nets with small mesh sizes, compressor diving (often using poison), blast fishing, use of *muroami* (large encircling nets with concrete pounding and weighting devices that are dropped onto the reef) and fishing with lights. These illegal activities had led to conflicts between local fishers and 'outsiders'. With FFI's help, *Panglima Laot* members have improved their understanding of local and national rules and regulations, and been motivated to undertake patrols and to intercept, document and report illegal fishing incidents within their customary areas. Their rights to manage these areas have been formally acknowledged by relevant local government agencies and by the navy. Research has shown that where *Panglima Laot* are active, there are demonstrable environmental and economic benefits – for example, sites implementing gear restrictions have greater fish biomass and coral cover than sites without.

Interestingly, cultural practices have played an important part in this collaborative management approach. Customary laws are largely defined by religious practices attributed to Islam – for example, not going to sea on Fridays and other days of religious or spiritual significance, or in the period immediately following the death of a community member. In addition, practices such as spear fishing are traditionally taboo, as they target specific fish, whereas it is believed that God should decide which fish are caught, for example in nets or lobster pots.

As this project illustrates, governance is a complex mixture of state and customary rules, norms and values. Understanding the ways in which people benefit from and organise their interrelationships with nature and with one another to secure valued resources over time will be key to further governance developments within PiN.

To learn more about this initiative contact Helen Schneider, Helen.Schneider@fauna-flora.org ∎

The next generation of fishers. Credit: Syafrizaldi FFI

Chapter Five

UNDERSTANDING THE INTERRELATIONSHIPS BETWEEN NATURE, LIVELIHOODS, WELL-BEING AND POVERTY

HELEN SUICH, C JULIÁN IDROBO, GEORGE AKWAH NEBA AND TRISTAN TYRRELL

The aim of the People in Nature (PiN) knowledge basket is to promote the uptake of existing knowledge and generate new understanding of the interrelationships between people and nature. These interrelationships are recognised as multi-faceted and dynamic, incorporating direct and indirect uses of species and ecosystems that are underpinned by deep-seated cultural norms, values and beliefs that vary dramatically between communities and locations. This explicit inclusion of cultural values and the ability to self-define these values is one of the core elements of PiN, along with the adoption of a rights-based approach to the interrelationships between people and nature, and the use of mixed methods to identify these interrelationships and understand the distribution of impacts and changes at the individual, household and community level.

It is anticipated that the development and application of PiN will promote more systematic data collection, documentation and understanding of local social–ecological contexts that are relevant to policy formulation and development interventions, and that will result in reductions in vulnerability and tangible improvements in well-being for communities and the environments with which they are connected.

Early applications of PiN will focus on rural and remote communities, in contexts where the direct and indirect material and cultural values and uses of biodiversity, ecosystems and water resources make important contributions to securing and enhancing the livelihoods of rural peoples, alleviating poverty and improving well-being.

The way humans utilise nature was described in detail in the Millennium Ecosystem Assessment (MA, 2005), and the knowledge generated by this assessment has catalysed interest in the area of human interactions with nature in academic and policy fields, recognising that every human society, large or small, technologically sophisticated or rudimentary, has developed and maintains a system of economic, spiritual, symbolic and religious interrelationships with their natural environment. Institutions, norms and social structures that govern the daily life of these societies emerge from

the diversity of representations and interpretations of nature, and the way in which human societies relate to and use nature is determined by this diversity of interpretations and representations. The scope and importance of the contribution of nature to the sustenance of livelihoods varies considerably amongst and between social groups.

The overall purpose of this chapter is to explore the most appropriate approach to understanding interrelationships between people and nature in terms of impacts on quality of life as conceptualised by the sustainable livelihoods approach, social well-being and poverty frameworks. The review of these approaches provides the background and basis for the development of the PiN approach. However, it does not deal with issues or methods of measurement, which will be addressed in future PiN work.

A number of key features are proposed as part of the PiN approach, which are designed to provide an understanding of how change, whether internally or externally driven, could affect the interrelationships between people and nature – focussing on quality of life – in order to mitigate or minimise the negative impacts of change and strengthen or accentuate any positive impacts, based on local choices and priorities (see also Davidson-Hunt, et al., 2016).

The following section is dedicated to the exploration and conceptual clarifications of the sustainable livelihoods, social well-being and poverty frameworks. The key features of the PiN approach are then proposed, drawing upon the reviewed conceptual foundations for understanding the interrelationships between people and nature, followed by a reflection on the key benefits to policy-makers of the information generated by the proposed approach.

PRINCIPAL CONCEPTS

Sustainable livelihoods approach

In general, livelihoods refer to the ways in which people secure the necessities of life. Development scholars and practitioners have picked up the term as part a framework

that examines how households access the range of assets, resources or capitals available, and the ways people use them to live well (Rakodi, 2002).

The sustainable livelihoods approach (SLA) is one of the most popular frameworks available to examine rural livelihoods. Livelihoods are defined within that approach as "the capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term" (Chambers & Conway, 1991:6). That is, they are the means employed by a person, household or group of people, to make a living.

The SLA framework highlights five assets, known as capitals, that are the tangible and intangible resources that are available and accessible to people, and on which they build and depend for subsistence. These capitals are key to rural livelihoods and the interdependence between them, recognising that no single asset can deliver all of the livelihood outcomes that people seek (Carney, 1998; Carney, et al., 1999; DFID, 1999). The five capitals are:

- Human capital, which refers to the skills, knowledge and ability of people.

- Natural capital, which refers to stocks of natural resources and nature-based goods and services that people depend on directly or indirectly for their livelihood. Biodiversity and the benefits people receive from it, one of the main focusses of the PiN approach, is included within this category.

- Social capital, which includes social networks and connections, memberships, trust, reciprocity and exchange.

- Physical capital, which includes basic infrastructure such as means of transportation, shelter and buildings, water and sanitation systems, etc., and 'producer goods' such as tools and equipment.

- Financial capital, which involves the flow and stocks of financial resources that people can access and use to fulfil their livelihood needs (DFID, 1999).

The SLA looks at the availability of these capital assets and the factors that favour or limit peoples' access to, and use of, various assets to achieve livelihood outcomes. The SLA is underpinned by the understanding and recognition that "more attention must be paid to the various factors and processes which either constrain or enhance poor people's ability to make a living in an economically, ecologically, and socially sustainable manner" (Krantz, 2001:1).

The SLA framework integrates consideration of the social, economic and political context within which people pursue their livelihood strategies, and which may operate at one or more levels (local, regional, national, international), making the analysis of cross-scale links critical. Analysis of how access and rights regimes work fits within this element, and is of particular relevance to PiN (see also Chapter 7). The combination of capitals and the influence of policies, institutions and processes affects the choice of livelihood strategies and therefore impacts on livelihood outcomes. The inclusion of these mediating factors improved the coherence of the SLA, as compared to the typical approaches to poverty that had been in use (Krantz, 2001).

The framework provides tools to understand the roles that biodiversity and the activities associated with appropriation, consumption, transformation and exchange play in the everyday life of the households and communities that use them, and species' contribution to the overall livelihood of those who depend on them (Ellis & Allison, 2004; Rapley, 1997). Thus, the SLA has been widely applied to analyses of rural livelihoods that depend on natural resources and biodiversity (Ferrol-Schulte, et al., 2013; Pokharel & Nurse, 2004).

The SLA incorporates temporal dynamics by tracking over time not only household assets, but also changes in institutions, organisations and policies that affect the choices that individuals, groups and communities can make about livelihood strategies (Ellis, 2000). The approach can also identify the spatial organisation of livelihood activities, for example, by incorporating migration in to analyses.

A particular strength of the SLA is that it "recognises human agency and examines the way in which household livelihood strategies are built around protecting, substituting, increasing, and using assets to produce security and achieve other goals" (Hulme & Shepherd, 2003:414). The poverty neutrality (Norton & Foster, 2001) of the SLA can be interpreted as a strength, especially when combined with the less confrontational language of sustainable livelihoods and the advantage in focussing on the strengths of people, rather than on weaknesses, deprivations or lacks. However, this poverty neutrality also means that the identification of who is 'poor' remains difficult, creating difficulties when operationalising the approach in development programmes, when political responsibility or delivery of goods and services to individuals or groups is necessary.

An additional strength of the SLA is that livelihoods analyses can contribute to the design and delivery of development interventions that shift away from traditional sectoral analyses (Gilling, et al., 2001) and recognise that the interactions of different capitals affect choices and possibilities.

However, the framework has been criticised because of its instrumental nature that over-emphasises the use of capitals, even reifying them into fixed categories, as well as for marginalising of the role of culture in livelihood strategies (Allison & Horemans, 2006; Gough, et al., 2007; White & Ellison, 2007). The five capitals appear to exist independently of the individual and are understood as existing

to be accumulated, stored and used in order to achieve a particular end (e.g. Rakodi, 2002). This assumes that culture plays a marginal role in the basket of livelihood capitals or that it is merely an element of social capital, rather than a lens through which other assets are constituted (Gough, et al., 2007). By not fully acknowledging the role of culture, the SLA framework has developed a highly materialist approach to understanding the ways rural people live their lives (White & Ellison, 2007). Some critiques suggest new sets of capitals or re-arrange the existing ones, reflecting different nuances of the multiple and complex dimensions of rural livelihoods (e.g. Wardell-Johnson, 2011).

Criticisms have also been levelled at some applications of the approach, rather than the conceptual framework, because of their limited analysis of policy processes, ecological sustainability, gender and power relations (Clark & Carney, 2009; Ashley & Carney, 1999), and of the institutional contexts and micro–macro linkages.

Social well-being

The idea of well-being provides an alternative perspective of how rural and remote communities live their lives (Gough & McGregor, 2007), shifting perceptions from a narrow focus on economic- and deficit-oriented frameworks to a broader process centred on the needs of individuals and households and on their goals and aspirations (Gough & McGregor, 2007; Weeratunge, et al., 2014). Sen's capabilities approach (1999) supports this paradigm shift by analysing well-being from the perspective of the opportunities available for people to lead the kind of lives they value. However, well-being has been approached from multiple perspectives and disciplines and there is no consensus about its definition, scope or objectives (Camfield, et al., 2006).

The well-being lens produced by the Millennium Ecosystem Assessment (MA, 2003) and a social well-being framework (Gough & McGregor, 2007) are helpful in building an understanding of how nature, society and culture are intertwined through socio-political processes that co-produce the landscapes in which people exist. Both of these frameworks evolved from the SLA framework and have an explicit commitment to understanding rural societies' ways of life and interactions with nature (Bebbington, et al., 2007).

Human well-being was defined in the Millennium Ecosystem Assessment (MA) as having "multiple constituents, including the basic material for a good life, freedom of choice and action, health, good social relations, and security" (MA, 2003, p.29). Nature is understood to provide a set of provisioning, regulatory, cultural and supporting ecosystem services, which contribute to the construction of human well-being in its multiple constituents. The MA also highlights the importance of access to nature for well-being in the form of freedom of action and the way key ecosystem services, such as provisioning and regulating services, provide basic assets for living a good life.

The MA contributed a mechanistic understanding of the well-being of many rural and remote communities, arguing that it is based more or less directly on the sustained delivery of essential services, such as the production of food, fuel, and shelter, the regulation of the quality and quantity of water supply, and the control of natural hazards (e.g. Díaz, et al., 2006). Freedom of choice and action, or "the opportunity to be able to achieve what an individual values doing and being" (MA, 2003:28), depends on the access people have and the benefits they derive from specific arrays of ecosystem services. Thus, the MA framework treats well-being as an outcome of benefiting from nature, rather than an integral and underlying process that shapes what services people need to fulfil their goals and aspirations.

The framework is also limited by insufficiently incorporating the role that culture plays in the constitution of well-being. By treating the benefits humans derive from nature as services, the MA takes for granted the processes that support such resources, assuming them to exist independently of their individual beneficiaries (or alternatively the impacts on natural processes). This is clearly reflected in the MA's intrinsic treatment of culture – cultural ecosystem services are evaluated as discrete services one can benefit from (i.e. recreational, aesthetic and spiritual benefits). Such a perspective ignores the instrumental role of culture as a process that constructs the perception of services through everyday practices (Sen, 1998).

The social well-being framework from the Wellbeing Research in Developing Countries has conceptualised well-being as: "a state of being with others, which arises where human needs are met, where one can act meaningfully to pursue one's goals, and where one can enjoy a satisfactory quality of life" (McGregror, 2009, p.3). This definition is developed into a three dimensional framework, with material, subjective and relational components, that enables the examination of the experience and construction of well-being. The material dimension considers the objective circumstances of the individual, the subjective dimension considers how the individual perceives these circumstances, and the relational dimension considers how the individual establishes relations with their environment (Gough & McGregor, 2007). This relational dimension recognises that the objective circumstances of individuals and communities, as well as perceptions of them, are dependent on the social context in which they are produced. In this guise, well-being incorporates both the benefits people receive from nature and the social and cultural processes that underlie the construction of such benefits (Gough, et al., 2007).

Well-being for rural and remote communities, particularly Indigenous peoples, often focusses less on monetary stability or gain and more on their ability to undertake traditional practices and the recognition of rights (Tauli-Corpuz, 2008). This suggests a number of themes that should be incorporated into well-being analyses: land, territories and

natural resources; natural and cultural collective heritage; social organisation; identity (collective and gender); self-determination; and intercultural relations.

The social well-being framework provides an analytical lens to evaluate human–nature interrelationships, given that the experience of well-being is affected by cultural and geographic context, and depends on class, age, gender and ethnicity, as well as changes over time (Coulthard, et al., 2011; Weeratunge, et al., 2014).

In considering the role of nature specifically, the social well-being perspective acknowledges that the use and perception of biodiversity, natural resources and ecosystem services depend on the perception of and multiple ways rural and remote communities benefit directly and indirectly from them, rather than limiting nature to specific categories (White & Ellison, 2007). In contrast to the SLA, which typically conceptualises natural capital as an independent entity, the social well-being lens acknowledges the specific dimensions (i.e. subjective, social and/or material) acquired in the context of its use. Culture becomes a dynamic lens through which social life is constituted, and confers relevance to certain practices (e.g. harvesting particular species and eating certain foods). While materials from nature exist on their own, culture mediates the processes by which they acquire meaning and come to exist as specific values to individuals from a particular social group. This cultural meaning is bounded to the needs and aspirations of the individual and their immediate relations with other society members, and the environment to which they are connected. At the same time, relations with other society members are influenced – being either hindered or enabled – by current environmental, social, economic, cultural and/or political circumstances.

Poverty and vulnerability

Poverty is a contested concept and definitions and component elements therefore require careful debate and definition. It is widely accepted as meaning a lack of, or an inability to achieve a socially acceptable standard of living; and/or the possession of insufficient resources to meet basic needs (World Bank, 1990). Drawing on Sen's capability approach (Sen, 1983), in recent decades, poverty has been accepted – and increasingly measured – as having multiple dimensions and as being shaped by, and within the political, economic, social and cultural context (Stiglitz, et al., 2009; Barrett & Swallow, 2005; Tiwari, 2007).

Poverty can be understood as being absolute and relative. Absolute poverty occurs where an individual does not have the ability to meet the absolute minimum requirements for human survival (e.g. UN, 1995). In contrast, relative poverty considers the status of each individual or household in relation to the status of other individuals or households (e.g. EC, 2004), examining poverty in the context of inequality within a society. This is particularly relevant to PiN because

of the need to have a generalised acceptance in both the developed and developing world, and these viewpoints allow for different aspects to be measured depending on the information required, and to suit different contexts and scales.

Despite the widespread acceptance of the multidimensionality of poverty, there are no generally agreed upon dimensions (Alkire, 2007), though a number are frequently used, including those relating to basic needs (including food, shelter, energy, clean water and sanitation), health, education, security and good social relations, in addition to the economic or income dimension (Narayan, et al., 2000). Further, the experience and conception of poverty differs depending on local social relations, and it has been noted that poor people's definitions of poverty may differ from those assumed for them by professionals (Chambers, 1995). Thus, it has been argued that poverty is most accurately represented when it is self-defined – where appropriate dimensions are identified locally – though this can make cross-site and time series analyses difficult.

The analysis of poverty dynamics provides information about changes over time (both within and between years) and about the duration of poverty, whether it is transitory or chronic. Dynamic analyses examine the factors affecting whether people move out of poverty, stay poor, or become poor (or poorer). Understanding the factors affecting these poverty dynamics is critical to designing appropriate policies for poverty alleviation and reduction.

Vulnerability is intimately connected to poverty dynamics, and relates to the sense of insecurity that something bad could happen, from which it would be difficult or impossible to recover. It typically refers to a drop below some threshold into (greater) poverty, with most vulnerability analyses including consideration of exposure, sensitivity and adaptive capacity to shocks (Adger, 2006). Shocks can affect single individuals or households (e.g. ill health or death, unemployment), or can be widespread in a community or region (e.g. natural disasters, macroeconomic shocks). Vulnerability is therefore not only critical to understanding the short- and long-term changes in poverty status – related to both the likelihood of falling into poverty, and the severity of that poverty – but also contributes to fulfilling the basic functioning of security.

Understanding social differentiation and distributional effects are central to analyses of poverty and vulnerability, which are often undertaken using the household as the reference unit, but are more accurately determined by data at the individual level, which enables the status of different groups to be determined, for example by age, gender, disability, etc. (Daw, et al., 2011; Bessell, 2015). Such disaggregated analyses also permit the analysis of intra-household poverty dynamics and their causes, and the consideration of interactions amongst different dimensions. Context, institutions, structures and relations are critical to understanding

the underlying factors which frame individuals' and households' opportunities and choices, and therefore their access to resources and the distribution of opportunities, benefits, costs and risks (PADG, 2012).

Many of the identified weaknesses of multidimensional poverty refer specifically to attempts to measure multiple dimensions of poverty and their sometimes vague definitions (Qizilbash, 2003), rather than arguments about the merits of considering multiple dimensions. Measuring multiple dimensions doesn't necessarily change who is considered as poor (though it can), but is important for poverty reduction policies (Kanbur & Squire, 2001; Spicker, 2007), which must increase access to a wider range of assets and increase returns from those assets in order to be successful.

Few poverty analyses have, to date, explicitly incorporated the contribution of biodiversity and ecosystems, or the contributions of aesthetic, spiritual and therapeutic values. However, these elements can be included in any analysis, as long as the appropriate dimensions are chosen to suit the purpose of the analysis – that is, appropriate locally and to what outcomes are being assessed.

A FRAMEWORK FOR ANALYSING MULTIDIMENSIONAL IMPACTS OF CHANGE ON RURAL AND REMOTE COMMUNITIES

Conceptually, the three frameworks discussed above have significant overlap in terms of the material and non-material dimensions they can incorporate (see Table 5.1); overlaps that are most obvious when examining material contributions, such as those measured by income, consumption, employment, etc. These dimensions have often been measured using the same or very similar methods (specific measurement methods are not discussed here, but will be dealt with in future PiN work).

In fact, the SLA was originally designed as "a way of thinking about the objectives, scope and priorities for development in order to enhance progress in poverty elimination" (Ashley & Carney, 1999:1) and has been used in many poverty analyses (e.g. Norton & Foster, 2001; Moser & Felton, 2007). Both poverty and sustainable livelihood analyses are therefore intimately linked, as "successful livelihoods transform assets into income, dignity and agency to improve living conditions, a prerequisite for poverty alleviation" (Olsson, et al., 2014:798).

It has been argued that poverty and well-being fall along a continuum (e.g. MA, 2005). Chambers notes that poverty in multiple dimensions is the same as ill-being, both applying to "bad conditions and experiences of life in which material and other deprivations and disadvantages interact and reinforce each other as they do in the nets and webs" (Chambers, 2005:4), and if well-being and poverty are multidimensional, then the two can co-exist.

While subjective measures are central to the conceptual foundations of well-being, with the acceptance of pover-ty as a multidimensional concept, many poverty analyses have in practice used subjective measurements to complement 'objective' assessments (Frey & Stutzer, 2002; Anand & Clark, 2006) because they are recognised as an important element of multidimensional poverty (Diener, 1984; Gasper, 2004). A subjective assessment of well-being or poverty refers to an evaluation or judgement of an individuals' own life on the basis of his/her own experience and on his/her own terms, and can therefore be distinguished from perceptions of material or non-material dimensions. There are no universally accepted subjective or objective dimensions of poverty (or indeed of well-being), though there are a variety of approaches to choosing appropriate subjective and objective, material and non-material dimensions, and methods to measure and analyse them.

The well-being framework described above emerged partly in response to SLA and therefore the two have several aspects in common, particularly with respect to understanding rural livelihoods beyond their material aspects, and in viewing well-being as an outcome of household livelihood portfolios. Likewise, the social capital and relational well-being elements of the two frameworks both examine the relations and institutional arrangements that make up rural livelihoods.

The SLA has been particularly successful at incorporating environmental resources into analyses, as natural capital is explicitly recognised as one of the five main capitals. In contrast, neither poverty nor well-being analyses have been systematic in their inclusion of environmental resources, and in many cases they have been excluded. However, despite the volume of SLA literature, the links, interactions and feedbacks between environmental resources and different dimensions of poverty remain poorly understood, as does how, and under what conditions, they can contribute to improving lives or provide pathways out of poverty. The presence of trade-offs in policy- and decision-making regarding economic, social or environmental management are increasingly being recognised, though the mechanics of these trade-offs are still unclear in most situations (Howe, et al., 2014).

The importance of power is emphasised in the SLA conceptual framework, and for the understanding of poverty and well-being. However, analyses have been critiqued for the lack of systematic and sufficient investigations of the workings of power (Nunan, 2015; Green, 2008) which operate to "stigmatise the people involved, undermine their confidence, and systematically close off options for individual or collective advancement" (PADG, 2012:6). Understanding power relations is particularly important, because if they are not addressed, certain social groups will be unable to escape situations of chronic poverty and ill-being, and any intervention being implemented in ignorance of these relations risks exacerbating them.

Table 5.1 - Comparison of the key contributions, strengths and weaknesses of sustainable livelihoods, well-being and poverty

	SLA	Social well-being	Poverty
Key contributions	Five capitals - Human - Natural - Financial - Physical - Social	Three dimensions - Material - Subjective - Relational	Multiple dimensions that can be chosen to suit the context. These can include material, non-material and subjective dimensions, which can be expert and/or self-defined.
Overlaps	Well suited to mixed methods approaches Measure material and non-material dimensions Incorporate social context, power relations, etc.		
Strengths	Accounts for the multiple capitals that compose rural livelihoods. Focusses on opportunities.	Explicit incorporation of culture (e.g. takes into consideration culture as a factor that shapes the perception of nature). Particularly strong on relational aspects. Measurement at the individual level enables power dynamics associated with gender and age within the household to be accounted for. Focusses on opportunities, goals and aspirations.	Dimensions can be self-determined. Measurement at the individual level enables a greater understanding of intra-household distributional effects and power dynamics. Widely understood by many policy makers. Enables/facilitates targeting for interventions following analysis.
Weaknesses	Reifies and marginalises the role of culture. Reifies livelihoods into concrete aspects independent of human experience. No subjective dimension. Is largely determined by the five capitals structure, forcing self-definitions to fit in to a rigid structure. Typically gathers data at the household level; a level of resolution, which does not allow intra-household distribution of resources and dynamics to be understood (e.g. gender and age differences).	Can be difficult to measure change over time, and compare across locations. Need to be careful of interpretations of subjectivity, and their apparent instability over time.	No explicit incorporation of culture. Typically deficit centred, with a focus on deprivations rather than opportunities.

Thus, the gaps that most urgently need to be filled are those that build our understanding of the interactions and feedbacks between different environmental resources and different dimensions of poverty or well-being, and how these change over time. This information is necessary to understanding the trade-offs that are inherent in any situation of change.

Finally, the foundation for the self-definition and cultural identification of a people is drawn from their economic, cultural and spiritual interactions with nature. The way people define and interpret the natural environment, what they get from it, what they do in it, etc., are key to helping understand the interrelationships with the surrounding natural environment, the natural assets it provides to support the system of living, and its role in and contribution to the people's identity construction and claim. Therefore, PiN analyses must take into consideration both material and cultural dimensions.

Features of the PiN approach

Any conceptualisation adopted by PiN must help to meet its purpose: to promote the uptake of existing knowledge and generate new knowledge on the interrelationships between humans and nature, focussing initially on the material and cultural uses of biodiversity (genes, species and ecosystems) and its contribution to the lives of rural and remote communities.

A number of principles and elements are proposed as a framework for PiN to analyse the impacts of development interventions and/or management changes at a site and the implications of potential responses to change for livelihoods on the multiple dimensions of poverty or well-being. By using the framework, analyses should not simply be a description of a situation, focussing on individual attributes, but rather build knowledge about how and why conditions exist locally and are perpetuated, and how they might be influenced by development interventions and management choices at that site.

Analyses should incorporate an understanding of the situation of individuals, not only households. By focussing on the individual, intra-household distribution issues and differential vulnerabilities can be understood, and analyses can also be gender sensitive (which is difficult if the unit of measurement is the household). Such fine detail may also enable better targeting of strategies and interventions, if and where necessary.

The multidimensionality of poverty and well-being must be recognised. Each application of PiN will need to select dimensions that are appropriate to the local context, ensuring that there are dimensions chosen that demonstrate the contribution of biodiversity and incorporate cultural values. Further, the incorporation of subjective dimensions – those that represent individuals' judgements about their lived experience and the aspects they value in their lives – recog-

nises that individuals' and group decision making is affected by perceptions of constraints and opportunities, and is shaped by aspirations and available alternatives.

The process of selecting relevant dimensions to be included in analyses should not be constrained by available data, but rather determined on the basis of what is locally appropriate. The PiN approach should adopt the principle of responsiveness – that people must have a role in identifying elements or dimensions of their quality of life that are important to them (i.e. self-definition) (Ashley & Carney, 1999; Chambers, 1997). While dimensions should be self-defined, some comparison of core elements across PiN sites will need to be retained. It is likely that these core dimensions may include (but not be limited to) education, employment, energy, food and nutrition, health, income, water and sanitation, asset ownership and social and cultural relations.

Given the dynamic situations in which PiN will be implemented, it is appropriate to focus on the dynamics of poverty and well-being, and in particular on the vulnerability of individuals, households and communities. Identifying the sources of vulnerability of different social groups in a location can help to identify ways to protect against those vulnerabilities, and to identify strategies to mitigate or minimise anticipated negative impacts of proposed policy changes or development interventions.

The incorporation of temporal and spatial dynamics is also critical. PiN analyses must be able to represent changes over time and space, and building understanding of the interlinkages and feedbacks between and within elements of the social and ecological components of linked systems. This will be particularly important in monitoring and evaluation of management changes or development interventions. These spatial and temporal dynamics will also be important in assessing change across sites, strengthening the need for core data that allows cross-site comparisons to be made.

Analyses must incorporate sufficient contextual information, connecting individual experience to the life of the community. Contextual analyses will focus on issues of governance, power relations and political economy, which help to answer the questions of why people are poor, why they have, or do not have, access to resources (Nunan, 2015). They will also need to identify those factors at micro and macro levels that provide opportunities and constraints, recognising that asset holdings at both levels either constrain or provide opportunities for production and the accumulation of more assets, and that initial asset holdings have lasting effects on livelihoods (Ellis & Freeman, 2005).

This framework provides a systematic means of analysing how change may affect the interrelationships between people and nature, whether it is internally or externally driven, focussing on the multidimensional impacts on poverty or well-being at a particular site. It fits with the mixed methodological approach of PiN (Idrobo, et al., 2016). Commu-

nities' participation in the research design, implementation and analysis is crucial to the legitimacy of the process, any use or collection of data should follow appropriate ethical protocols and all data collated and collected must be repatriated to the community (Idrobo, et al., 2016; Deutsch, et al., 2016).

RELEVANCE TO POLICY FORMULATION AND DEVELOPMENT

Despite advances in rights-based approaches to conservation, the relationships between rural and remote communities and nature continue to be poorly reflected in planning and policy because there is little systematically documented information on material and cultural uses, or on the availability and access to various species and ecosystem services of these communities. This is compounded by weak or absent channels of communication to inform decision- and policy-makers of the perspectives, needs and practices of rural and remote communities. The absence of mechanisms for knowledge about these uses and values to be systematically incorporated in to planning and policy can result in interventions that cause a decline in, or reduced access to, critical species, associated habitats and ecological functions.

The challenge is in linking on-the-ground requirements to appropriate policy responses, based on locally-relevant evidence. The collection, collation and primary and secondary data analysis requirements can vary greatly depending on the scale, context and audience.

Traditional knowledge and practices can support the objectives of international processes, with the inputs of communities considered by a number of United Nations-related environmental processes including the Convention on Biological Diversity, the Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services, and the UN Framework Convention on Climate Change. Decision makers are more likely to be positively influenced by knowledge of these practices and their local impacts if they are presented in a rigorous manner, as would be the case for data collected and analysed using the PiN approach.

It is anticipated that the PiN approach to examining the relationship between people and nature will improve the understanding of change, and responses to change at the individual, household and community level, as appropriate at each study site. Additionally, the approach will help to fill in knowledge gaps – including, but not limited to the incorporation of culture, a focus on the individual (ensuring sensitivity to intra-household distributions), and incorporating the understanding of power relationships and how these impact on relations – all of which have been poorly incorporated into empirical studies of poverty, livelihoods and well-being to date.

By adopting the key features described above, the PiN approach will generate information that is useful to policy makers in a number of ways. They will be particularly useful in describing the poverty or well-being dimensions that are most significantly impacted by any potential change, and also those that are most valued locally, which can create a focus on local priorities. Analyses will also help to identify the aspects of the interrelationships between humans and nature – whether material or cultural – that are of critical importance to the well-being of communities, and the dimensions most vulnerable to change, or that may be critical for adapting to, or mitigating, change. The analyses can both inform the current understanding of the situation at a particular site, and be used as the baseline for a monitoring and evaluation strategy, to assess the actual impacts of any intervention. They will provide information that can also inform choices about future development pathways (Davidson-Hunt, et al., 2016), enabling a greater depth of understanding about the trade-offs and distributional impacts of different choices.

PiN analyses will be sensitive to the individual (for example in terms of gender, age, disability, etc.), multidimensional impacts at the individual level, and to impacts on the intra- and inter-household distribution of resources, given local power relations. The focus on dynamics and vulnerability will help to elicit the full range of direct and indirect impacts of changes across the social–ecological system. Understanding the distribution of impacts across social groups can help to identify those groups with the greatest vulnerabilities to particular changes, so intervention planning can offset or mitigate these costs. Such nuanced analyses are designed to ensure that proposed changes are not driving or strengthening exclusionary processes.

Understanding power relations is necessary in identifying the factors that cause and keep people in poverty, or prevent them from improving their well-being, and can help policy makers and programme designers to think through the way in which proposed changes will impact on different social groups. Such information also has potential for facilitating action to change those processes driving poverty or inequality or preventing well-being improvements, so that improvements in the equity of outcomes over the long run can be achieved.

Overall, the PiN approach will collate and generate information about how people utilise nature to meet their goals and aspirations, both now and in the future. This can help to identify opportunities for and constraints to change, and provide information to help policy makers think through the implications of any proposed decisions, i.e. how change may affect biodiversity and the multiple dimensions of poverty and well-being, and what differential impacts across and within different social groups may result, given existing power relations. Such evidence can help interested policy makers to anticipate and mitigate or minimise adverse impacts, and thus improve conservation and sustainable development outcomes over the long term.

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Farmer led climate smart agriculture and agro-processing for food, nutrition and livelihoods security in Malawi

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THE VAST MAJORITY OF MALAWI'S POPULATION ARE smallholder farmers who depend on rain fed agriculture for their livelihoods and food security. As such, households are vulnerable to changes in the climate such as rainfall variability. Due to rapid population growth and intensive use of agricultural land, much of the arable land is affected by soil fertility degradation resulting in reduced crop yields. The main food crop grown by small scale farmers is white maize, which has been actively promoted by development programmes in the decades since Independence. To enhance soil fertility, farmers often rely on inorganic fertilisers whose price has more than tripled over the past five years, and many poor households who are unable to afford inorganic fertilisers and hybrid seeds depend on government subsidies. The overreliance on white maize combined with increased rainfall variability and reduced soil fertility have resulted in reduced food security, low dietary diversity and poor nutritional status of children.

> *Orange maize is high in vitamin A, lipids and protein and is an early maturing crop compared to white maize. As such, it has the potential to tackle the problems of malnutrition and mitigate the effect of climate change and increased rainfall variability.*

A new project being implemented by Chancellor College of the University of Malawi aims to increase crop diversity, mainly by the promotion of orange maize, locally known as Mthikinya. Orange maize is high in vitamin A, lipids and protein and is an early maturing crop compared to white maize. As such, it has the potential to tackle the problems of malnutrition and mitigate the effect of climate change and increased rainfall variability. Orange maize is a local crop that used to be commonly grown in Malawi but has mostly been replaced by hybrid white maize. Although there have been some early successes in efforts to reintroduce and promote the uptake of orange maize in Malawi, there are some challenges as well. The market for orange maize is still limited, as people have forgotten about the crop and those in urban areas are either unaware of it and its nutritive value or do not have access to it in raw and processed forms. This project aims to address these challenges and scale up the production of orange maize.

This project builds on the experiences from the Malawi Farmer to Farmer Agro-ecology Project, which started implementation in 2012 in Mzimba in northern Malawi and Dedza in central Malawi. Through this first project, farmer capacity in peer participatory education, in agroecology, conservation agriculture and nutrition successfully improved agricultural production. Crop diversity was improved through distribution of landrace orange maize, legumes such as soya bean, beans and pigeon peas and tuber crops such as orange fleshed sweet potatoes and cassava. The new project is contributing to a healthier population by promoting nutrient rich diets. In addition, incorporation of crop residues and making and use of manure helps to reduce use of inorganic fertiliser by farmers and consequently reduces the cost of production. Furthermore, improved soil structure facilitates moisture retention, contributes to environmental health and crop resilience in times of rainfall variability.

The new project is being implemented in Dedza and Thyolo districts in rural Malawi and it promotes the farmer-to-farmer model of education, facilitates the formation of farmer cooperatives to improve access to markets, and trains farmers in small scale food processing and entrepreneurship skills. The work demonstrates the importance of conserving indigenous crop varieties and traditional foods in Malawi and the roles that consumers as well as policy makers can play. This work has linkages to PiN in the consideration of both the conservation of the farmer varieties that provide higher levels of nutrients, as well as the dietary diversity that comes from both agricultural fields and the broader landscape. Another element of interest is the cultural narrative around traditional foods in Malawi and how these foods are undervalued by consumers as well as policy makers.

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Chapter Six

A DATA MODULE FOR PiN

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Within the People in Nature (PiN) knowledge basket, biodiversity provides a lens for understanding and describing the myriad interactions between people and nature (Davidson-Hunt, et al., 2016). Globally, biodiversity data are increasingly available in the public domain or under open data licensing agreements.[1] This wealth of publicly available data has made it possible to undertake meta-analyses to build knowledge of the interlinkages between biodiversity and livelihoods and include the consideration of risks associated with socioeconomic and environmental change and development at global and regional levels (e.g. De la Torre, et al., 2012; Zimmerer & Vanek 2016).

When it comes to understanding the role of biodiversity in the livelihoods of rural and remote communities, available secondary data stands to be used much more effectively. Data can be put to use in order to document and safeguard traditional livelihood systems, and can also contribute to knowledge-building processes identifying potential responses to global changes. While data on contemporary biodiversity use frequently constitutes a baseline for planning decisions, PiN will consider the full range of biodiversity that is available as a starting point for an exploration of how use is shaped over time, and how biodiversity and development pathways are intertwined.

By disaggregating biodiversity data to the most relevant levels – species, subspecies and agricultural landraces – at which rural and remote communities receive material benefits from nature, communities and researchers can link to studies that express values associated with different uses (Conner, et al., 2016) and to specific elements of biodiversity. For example, linking food composition and species data demonstrates that some wild harvested species are not easily substituted by alternatives available through markets if micronutrient composition is considered (Deutsch, et al., 2016). Multiple data sources may document multiple uses of a single species found in different geographical areas. This documentation can be aggregated to form new datasets containing all species within a PiN assessment area with known material and cultural use values, including species that were historically present, species to which communities have lost access, and species with documented uses of which communities are currently unaware.

In PiN landscape assessments, this secondary data scoping, utilisation and synthesis precedes any primary data collection efforts. The identification and description of what has already been documented lowers the burden of new research on communities, and primary data collection efforts can then fill the data gaps revealed by secondary data analyses. The focus on secondary data ties in to the first phase of the PiN workflow, the interdisciplinary situation analysis (Idrobo, et al., 2016); only once secondary data syntheses are complete should primary data collection at the site level be undertaken, to fill any remaining information gaps (Phase II).

This chapter focusses on how PiN can create linkages between existing knowledge and data products and dig into publicly available data regarding the interrelationships between biodiversity and the livelihoods of people in rural and remote communities, and begins to consider ethical implications surrounding the use of secondary data. The chapter proposes a systematic approach to accessing and mining existing sources for relevant data, drawing on knowledge of local experts and global organisations regarding the availability and accessibility of relevant public data.

Issues concerning primary data collection and storage will be addressed in future, as substantive discussions are required regarding ethical issues and intellectual property rights, and these issues differ significantly from those tied

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1 Open data is publicly available data that can be universally and readily accessed, used, and redistributed free of charge. Public domain data comprises data for which intellectual property rights for persons or groups do not, or no longer, apply. This data may be available to the public, both in hard (paper) and soft (electronic formats) (e.g. in scientific journals, grey literature datasets, herbarium vouchers, university theses, reports and databanks), whether document or databases. By data, we mean 'raw facts' and numbers, but data also includes interpretation. The term secondary data refers to stored numbers, qualitative observations and sometimes interpretations of raw data in documents such as scientific papers, datasets and computer databases. Privately held data is excluded from consideration here, as a different set of approaches to data use would be required, including campaigning for data release under open data agreements.

to use of publicly available secondary data addressed here. One reason for this focus on secondary data is that more discussion has already taken place in relation to concerns over collection and treatment of primary data than around use of data that is already in the public domain.

The PiN secondary data module will contain digital tools for integration and linking of diverse datasets, and a publicly accessible digital platform providing access to data and guiding the workflow of secondary data analyses. The data module aims to be exhaustive in scope, thus, the use of as many secondary data sources as are known (including global, national and site-level datasets) is encouraged and will be made possible through crowdsourcing tools. Important PiN activities will include the integration of available datasets, and improving the interoperability between existing global datasets and IUCN knowledge products such as the Species Information Service (SIS, the database that the Red List of Threatened Species™ draws upon for global species assessment reports) and the IUCN Red List of Ecosystems.

The PiN approach to secondary data is described in this paper, which considers computer science methods for data discovery and linking of data from different domains of scientific knowledge. The challenges associated with improving the integration of data that is of interest for building a PiN secondary data workflow are addressed, and we conclude by discussing the proposed web-based platform to facilitate secondary data access and analysis. Of practical significance is that much of this data has not been previously systematically linked. Prior to the discussion of the proposed platform is a section on the ethical use of secondary data and the scaling of analyses that are of particular relevance when working with rural and remote communities.

ACCESS, DISCOVERY AND INTEGRATION OF SECONDARY DATA

Documentation of species use, their material functions, cultural use and symbolic importance and even ecosystem and habitat associations is extensive for many geographical regions. Yet data remains scattered across different sources and platforms, is not easily accessible outside of fledgling attempts to create global datasets, and datasets are rarely easy to link together to facilitate new synthesis and insights. PiN initially wishes to address a relatively stable set of use domains (scoped as food and nutrition, health and medicine, energy, shelter, income, ceremony and trade) that will require integration of diverse data sources on biodiversity use. This creates opportunities for PiN to develop the means to integrate existing data into an accessible and searchable format to better understand material and cultural uses of biodiversity, in historic, contemporary and potential future contexts.

While it is common for researchers to perform secondary data searches on a case-by-case basis, there is significant potential for the automation of a secondary data workflow

for PiN landscape assessments, considering the volume of data available and the fine-grained analysis PiN is aiming for. Computer science provides tools and techniques to link available information and additionally, to facilitate communication at increasingly large scales, for example between data custodians and users (Millett & Estrin, 2012). These approaches can be drawn upon to automate parts of the PiN secondary data module related to accessing datasets, discovery of data within documents, and integration of large datasets for novel insights into the interrelationships between people and nature.

Data access

Access to public data that is difficult to locate, and the ability of researchers to find and link data from different sources in meaningful ways may constrain the ability of PiN teams to effectively utilise data. Many data sources, even if publicly available, remain poorly accessible. Researchers are often constrained by issues of physical access to either hard (paper) and/or soft (electronic) formats. Even when data has been digitised, if it is not stored online it cannot be accessed globally. Thus, linkages between data holders in specific organisations and potential data users must be built to increase physical access to available data for PiN assessments. Experts within different fields can be called upon to facilitate access to data through the use of crowdsourcing tools. Once publically available sources have been identified, paper copies can be scanned and electronic copies can be contributed to online repositories or archives where it is possible for data users to access them.

Data discovery and description

Once data sources have been made accessible digitally, their digital format may not be easily amenable to use and analysis. This could be due to file formats that include images of pages, hand-written botanical vouchers, and even websites and pdf pages containing text or tables. Effectively, much data located within such sources are not immediately usable or linkable, and requires great effort to find and re-purpose (Thomas, 2003). For example, the Centre for Indigenous Nutrition and Environment food and nutrition tables have been made available for download in pdf format, rendering them poorly suited for initiatives attempting to link to different datasets.

Thus, once data sources have been accessed, data needs to be discovered or 'found' within these sources, and transformed into a useful format, such that digital linkages can be made with other datasets. In order to reduce and distribute the onerous labour requirements necessary to extract information from files or documents, a combination of data mining and crowdsourcing approaches can be used to simplify and automate the process of data discovery. By using these approaches, PiN could potentially continuously update its digital platform as new data sources become available.

Data mining is a means of information retrieval using computer code, including machine learning algorithms, to identify patterns in digital sources. Crowdsourcing refers to the distribution of tasks, including contributing, cleaning, validating and tagging, and curating datasets across a group of participants (usually volunteers). Crowdsourcing as a means to locate, contribute, manually extract and validate data for re-use is sometimes used in combination with other methods, such as data mining. Alternatively, data may be retrieved from datasets or text documents using data mining tools, and results can then be validated and curated using a crowdsourcing approach, an example of which is described in Box 6.1.

Crowdsourcing may involve experts in particular organisations or communities of practice, or be used to involve the general public, in order to more efficiently accomplish particular tasks. PiN could take advantage of IUCN Commission members and working groups to locate volunteers that know of, or are custodians of secondary data sources of relevance, as has been the approach within other networks, for example, the International Network on Food Data Systems (Stadlmayr, et al., 2010). This support from a broad community of volunteers could help build a library of sources and extract data from within those sources.

Data mining approaches have been employed to find relationships between data within sources. For instance, the Encyclopaedia of Life project supports data mining initiatives for the identification and extraction of habitat and ecological data from the text of online species descriptions (Pafilis, et al., 2015). Other efforts have attempted to mine huge volumes of occurrence data to model species distribution (Elith, et al., 2006). These approaches are of particular interest in developing a PiN digital workflow that can generate a list of species present and known uses within a traditional territory or assessment area, and link these species to ecosystems and habitats in which they are known to occur. Likewise, a combination of machine learning and data mining may be used to extract data on use within PiN domains from sources that contain information on species or varieties.

Machine-readable tags (i.e. metadata that can be understood by computer software) can be attached to data in order to create linkages between datasets, in a process known as a linked open data approach (Lausch, et al., 2015). Once data have appropriate metadata, the processes of data collation and linking datasets becomes more straightforward.

Data integration

Digital data often lacks consistency or interoperability with other data; they may not be in a usable format or may not follow established standards for data sharing. Even within organisations, different datasets are often highly unstructured, making it difficult to use data after the life of individual projects. Adherence to metadata standards (standardised data description sets) and widely accepted file formats can facilitate links and integration across datasets, data sources and organisational repositories.

Metadata standards may comprise shared dictionaries of terms that link concepts within and across disciplines, and it is feasible for organisations working on complementary goals to agree upon metadata standards to ease interoperability between datasets. However, different scientific communities often favour different standards, so the interoperability of data across disciplines may remain a challenge.

Biodiversity informatics uses scientific names as the linking thread to integrate information from genes to ecosystems (Sarkar, 2009), and data using standard scientific names will aid PiN in identifying data about biodiversity that can be found within a PiN assessment site. However, no agreement on standards for biodiversity use data has yet been reached, making integration of species use data challenging.

Discovery and integration of species use data for PiN assessments could potentially be facilitated by the use of standards being developed, however the efficacy of standards and their coverage in terms of data is highly variable. Thus, PiN may initially work with existing scientific communities towards specific goals that are of immediate relevance to established PiN use domains and building digital tools to link these, for example, linking biodiversity conservation and nutrition datasets as described in Deutsch, et al. (2016).

Box 6.1 - The Biodiversity Heritage Library

The Biodiversity Heritage Library (http://www.biodiversitylibrary.org/) was created as a digital platform for mining data containing scientific names of species from historical sources using the Global Names Recognition and Discovery tool. In this process, sources, including botanical garden vouchers, historical documents and scientific journals, are scanned and contributed to the digital platform by partners around the globe. Plain text is extracted using optical character recognition software (OCR), and then searched for scientific names, enabling researchers to find text related to species. Crowdsourcing is then used to verify or correct data mining errors, using a digital games approach to make OCR error recognition more fun (Orli, 2014).

SECONDARY DATA SOURCES

Species use and species threat data

As the material and cultural values and uses of species vary across social and cultural contexts, the PiN digital platform must be capable of making spatially explicit links between known values and uses of species, the ecosystems they are found in, and the threats to these species and their local habitats.

IUCN acts as a custodian for a vast amount of species use and threats data and PiN will utilise SIS data where they exist. The SIS stores use data alongside data on conservation status of species, so that once relevant species names are known, data on use, threats and threat categories can be automatically pulled from the SIS. The SIS contains a hierarchy of threat codes that may be applied to species assessments. PiN assessments may be most concerned with site-level threats to species in order for data to be most relevant to communities interested in threats to their livelihoods. However, species assessment data on threats stored in the SIS pertain to the global level. Nonetheless, this global data may be useful for community-level PiN assessments for species with smaller ranges. Additionally, SIS data may be updated more frequently than other data sources.

With digital links established between data on different domains of species use and the SIS, it will become possible to carry out a secondary data analysis on threats to species of importance at a particular site. An analysis of this kind has been piloted in relation to nutritional importance of wild and cultivated species for child and maternal health (Deutsch, et al., 2016). If only coarse information regarding threats is available for a species or ecosystem, PiN might wish to crowdsource more fine-grained information, and gain additional richness and analysis sourced from project-based reports and data repositories.

Agrobiodiversity

Agrobiodiversity is understood as a subset of biodiversity within agricultural systems, including plant and animal genetic resources used for food and agriculture (cultivars, landraces, ecotypes, weedy races and crop wild relatives) (Negri, et al., 2009; Zimmerer, 2010). While species may be the most appropriate category of biodiversity for efficiently linking SIS data to botanical garden databases and a range of ethnobiology data sources, the most relevant level of biodiversity for agrarian communities may indeed be below the species level, at the landrace or variety level. For example, from a food and nutrition security perspective, different crop varieties within a single species may have vastly different nutrient composition, meaning that the incorporation of certain nutrient-rich varieties into local diets can bring about significant changes in nutrition (Burlingame, et al., 2009; Davey, et al., 2009; Stadlmayr, et al., 2010).

Linking to agrobiodiversity data therefore may help smallholder communities to better understand trade-offs in decision making regarding available cultivated and wild biodiversity. Some global initiatives already attempt to aggregate secondary data on agricultural biodiversity at and below the species level, such as that on 'neglected and underutilised' species (Padulosi, et al., 2013). Playing a complementary role, PiN could help tell a more comprehensive story about the use of these species in relation to other locally available resources.

Challenges remain for efforts linking datasets across different knowledge domains. For example, many datasets containing food composition data do not provide scientific names for species, nor do they refer to specific agricultural varieties (CBD Secretariat & WHO, 2015). With respect to plant genetic resources informatics specifically, which deals with the documentation and analysis of conserved germplasm (Agrawal, et al., 2012), insufficient documentation and a lack of data integration from reports, crop catalogues and traditional knowledge studies holds back greater integration of available data.

While the collation and systemisation of data on global crop diversity is outside the scope of PiN, the secondary data module would benefit from greater integration with existing efforts, and may be able to contribute to such efforts by making available mined or crowdsourced data regarding the contribution of species and landraces to local diets using new and existing data standards.

Linking species to habitats and ecosystems

Data linking species to habitats and ecosystems may be mined from a diversity of datasets and linked through existing initiatives, including (but not limited to) the Encyclopaedia of Life project, the Global Index of Vegetation-Plot Databases and the Biodiversity and Protected Areas Management Programme (BIOPAMA). The Red List of Ecosystems (RLE) may also provide risk and threat assessments for ecosystems supporting species utilised at PiN sites, and spatial information regarding these threats.

Spatially explicit habitat and ecosystem data can be used to inform rural and remote communities about specific threats to species within their territories. Once species are known to be associated with specific ecological units (i.e. ecosystems and habitats), it is possible to identify spatial linkages that will provide a clearer picture of vulnerability to future land use changes or local impacts of climate change and, thus, what kinds of responses to such changes may be required in a particular area. If it is known that habitat X is critical for species Y, and that the construction of a dam will flood 90% of habitat X it is possible to infer that the availability of species Y will diminish in the future. This ability to link a species used to habitats and landscapes is of critical importance to make PiN useful in land-use planning and management.

PiN aims to draw data from the RLE to make linkages between risks to ecosystems and the material and cultural values of the species associated with them. PiN and RLE development trajectories may find synergies in exploring and defining relationships between ecosystem risk and ecosystem service provision, and the ensuing implications for management to enhance well-being.

Identification of linkages between the RLE and SIS databases (an ongoing conversation) should help to identify points for integration of RLE and PiN data. Indeed, entry points for allowing PiN and the RLE data to 'talk' to each other are evident in the current RLE database conceptual model (Figure 6.1). The Case Study object in the RLE may be linked spatially with PiN landscape assessment study sites. EcoClass data may then be spatially linked to specific ecosystem and habitat data available for the study site. Threats and Conservation Action data can help to inform an analysis of risks faced by local communities regarding both potential availability of, and risks to access to specific habitats, as related to ecosystems assessed, over time. This requires further technical discussion and eventual piloting to explore these data linkages.

ETHICAL CONSIDERATIONS REGARDING SECONDARY DATA USE

The use of publicly available secondary data raises a number of ethical concerns that are distinct from those relating to primary data collection and use. Concerns about secondary data use range from data appropriation by third parties, use of data to the detriment of communities, or without their knowledge, the political or economic benefits of data use not being shared or returned to communities, and inappropriate knowledge governance frameworks and safeguards. For rural and remote communities, the broader and most critical issue concerns access to and control of data that can be used to influence their future (Brooke & Kemp, 1994). We propose that these concerns can be mitigated through plans to consult traditional knowledge holders and data custodians on appropriate use of secondary data.

The concerns described below regarding the ethics of secondary data use fall within the larger issue of PiN knowledge basket governance. There is an overarching ethical concern that organisations and decision makers may be tempted to use primary or secondary data alone while conducting assessments without undertaking the whole PiN process. This risks those with decision-making authority taking important policy decisions about communities' based on analytical constructions from secondary data use alone, without undertaking appropriate and necessary community consultations.

Control of secondary data use and analysis and data repatriation

A challenge for PiN is to put secondary data to use in rural and remote communities in a way that is credible and legitimate at different scales and that does not threaten the rights of those communities to draw upon their own knowledge and territorial management institutions to inform choices. Communities may have had bitter experience of

Figure 6.1 - Conceptual model of the RLE database
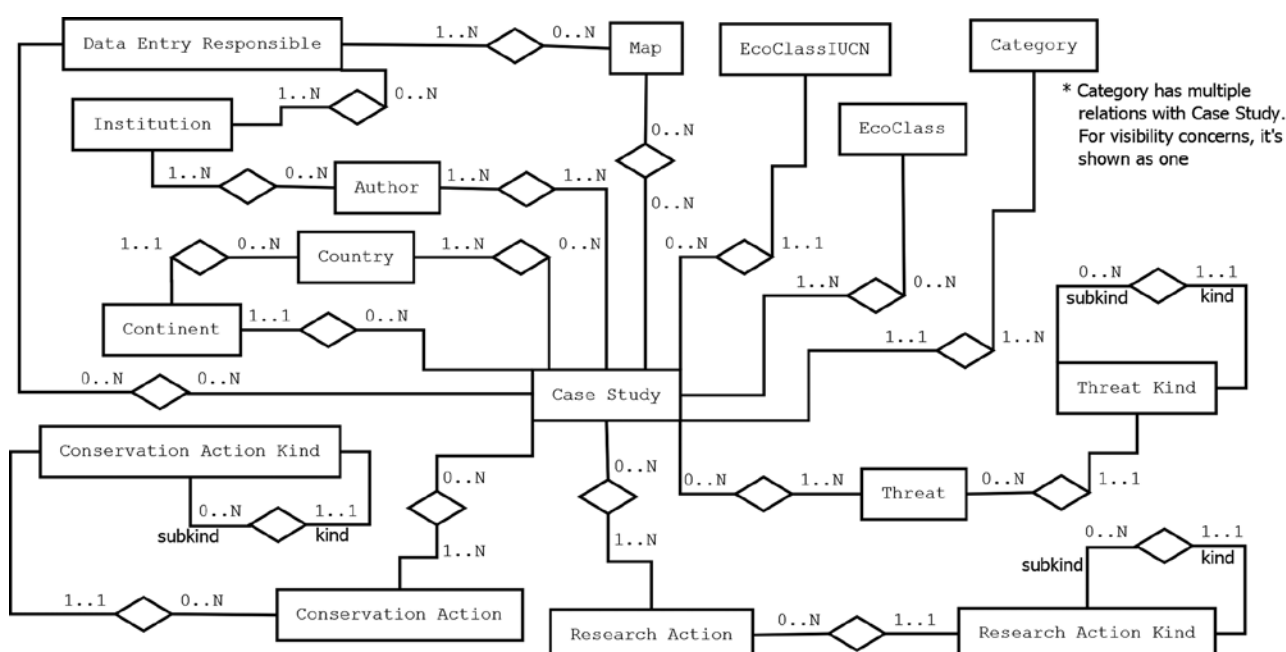
Source: Elaborated by Provita (2016) as part of the development of a geodatabase for supporting RLE applications

being unaware of how knowledge about them is put to use (Hunn, 2007), or being excluded from the benefits of data use, for example, where ethno-pharmacological data has been mined and analysed to speed up new drug development (e.g. Paniagua-Zambrana, et al., 2015). In such cases, it is in the interest of communities to understand the dynamics of such exclusions.

Further, communities may be concerned that data regarding threats to biodiversity and the conservation status of species may be used to take decisions without their knowledge, which may exclude them from future access to biodiversity. PiN thus commits to a rights-based approach and to ethical engagement with remote and rural communities. As an integral part of the PiN assessment, data will be brought back to communities (commonly known as data repatriation), such that communities are consulted on the availability and potential uses of data. Having a better understanding of what data is available can help communities to address concerns they may have about data being used by other parties to make poor choices without their involvement.

If trust around secondary data usage in PiN assessments is not built, PiN partner communities may express trepidation about how secondary data is used, and may refuse to participate in primary data collection. Researchers and practitioners thus have a moral obligation to repatriate data. Communities can then exercise better control over the way this data is – or is not – put to use, and to guide decisions regarding their resources and lands or territories.

Data provenance and public availability

The PiN assessment methodology values the contributions of traditional and scientific knowledge systems, which can be brought together for novel analysis (Tengö, et al., 2014; Idrobo, et al., 2016). Different knowledge systems – both indigenous and scientific – must be understood as dynamic, and knowledge must be seen to be situated in networks (Berkes, 2008; Ingold, 2000), though a number of concerns apply specifically to indigenous or traditional knowledge.

While international safeguards now exist to protect traditional knowledge holders from predatory efforts to extract their knowledge (e.g. the Nagoya Protocol), much traditional knowledge is already in the public domain, regardless of whether those safeguards or protocols were originally followed, and legally, no ethical approval from the original knowledge provider is required to include open or public domain knowledge in a global database.

As PiN aims to aggregate secondary data into a digital platform to facilitate access and analysis, attention must be given to whether secondary data is derived from traditional knowledge systems and whether property rights to knowledge were respected when the data was originally published. Further, PiN must be particularly attentive to respecting rights attached to data, even if these are informal or customary in

nature, for example in cases where the Nagoya Protocol has not been ratified in national law. These concerns are reflected in the statement below, made to the fifth meeting of the World Intellectual Property Organization IGC:

> Indigenous peoples have generally called for [the] protection of knowledge that the Western system has considered to be in the "public domain" as it is their position that this knowledge has been, is, and will be regulated by customary law. Its existence in the "public domain" has not been caused by their failing to take steps necessary to protect the knowledge in the Western [intellectual property] system, but from a failure from governments and citizens to recognise and respect the customary law regulating its use (statement by Tulalip Tribes of Washington in Tobin, 2013).

There is, therefore, an important distinction between knowledge that remote and rural communities have decided is important to share with the general public, and knowledge that is to be kept privately, and that is protected under customary knowledge systems.

In some cases, remote and rural communities have become wary of processes that divorce them from the knowledge they have provided, where information volunteered by individuals has been used in a way which does not respect the way knowledge was originally given. For example, traditional knowledge has been, and continues to be, aggregated into databases to be used for development of new products in food, pharmaceutical, agricultural and other industries. Private corporations may then come to control parts of this knowledge, which is understood to be a threat to traditional knowledge systems. Thus, efforts to collate and categorise traditional knowledge for discovery have been subject to bitter critique, for example in the case of bioprospecting.

PiN's secondary data module stands to effectively make data on remote and rural communities (including Indigenous peoples and local communities) more accessible to communities, the general public and policy makers. Thus, the act of repatriating data to communities is especially important to PiN. Box 6.2 illustrates an approach to web portal design that aggregates secondary data and publications from past projects that enables the connections between knowledge holders and their data to be maintained over time.

Scaling up analysis and preparing for big data

PiN aims to aggregate relevant secondary data about the myriad interrelationships between people and nature, including data exploring the use of, and threats to biodiversity. Thus the discussions that follow are relevant to both small, site-level studies, as well as to 'big data', the traits of which are huge volume and high velocity of data creation. Present-day technologies and computational resources make it possible to collect, process and analyse much more data than was previously the case (Mayer-Schönberger & Cukier, 2013), and

Box 6.2 - The Australian Indigenous Biocultural Knowledge website

The Australian Indigenous Biocultural Knowledge (AIBK) website aggregates data and documents by spatial location using web-geographical information system technology in order to make them more accessible to general public. Documents are searchable by spatial location with the hope that they will be found and included in local decision-making processes (Pert, et al., 2015). A simple consent process for database users was felt to be necessary to protect rights of original knowledge custodians. Database custodians wrote up a terms of use page and provided links to references rather than archiving full documents. Users are thus encouraged to make contact with original knowledge custodians. A notice on the homepage of the site prompts users to click 'I agree' to terms of use:

> Please read this intellectual property and sensitivity message, before clicking on the 'Enter AIBK website' link below.

> This website is designed to direct people interested in Australian Indigenous Biocultural Knowledge to associated materials. For further use of any material contained within, we advise that the Aboriginal or Torres Strait Islander people involved in production of the material (or family members or representative bodies) be consulted to respect the intellectual property rights of the individuals and families involved.

> Users of this website should also be aware that the names and/or images of deceased people may be present.

> I have read and understood the statements given above.

features of big data analysis include exhaustiveness in scope, fine grain of analysis and the relational nature of data, allowing for conjoining of different data sets (Kitchin, 2014).

As more data becomes accessible and is available in usable formats, larger scale analyses become possible (Reichman, et al., 2011). The use of big data and big data science (computer science application to big data analysis) introduce additional analytical and ethical implications. Patterns and correlations may emerge from big data analyses that were not noticeable or conceivable from 'small data' studies, and as data gets bigger and analytical possibilities increase, new governance issues emerge. Concerns identified include asking who controls big data production and analysis, who the subjects of big data are, what knowledge they produce, and how big data is applied in relation to landscapes (Kitchin, 2014). In practice, these concerns are not limited to the realm of 'big data', but point to the risk of indigenous knowledge being further marginalised as analysis of large datasets gains popularity and acceptance, for example in the sense of a newly heralded 'data revolution in development' (Stewart, et al., 2015). Ethics of data use has yet to catch up with the increasing power of analysis that is possible with big data (Richards & King, 2014).

TOWARDS A PIN DIGITAL KNOWLEDGE PLATFORM

Innovative approaches in sustainable development depend on, and are entangled with, knowledge held in geographically disparate locations (Bathelt & Cohendet, 2014). There is increasing practical significance in creating more permanent

platforms for accessing locally and globally held knowledge, and for facilitating knowledge flows between geographically distant locations (Bathelt & Cohendet, 2014).

Existing approaches to understanding and documenting the interrelationships between people and nature rarely consider the full range of biodiversity available to communities, but usually stop at examining the subset that people currently use. The proposed digital platform, designed to facilitate the processes of data access, discovery and linking, can guide the PiN secondary data workflow to identify the full range of material and cultural uses, by integrating data held in different datasets at different locations.

The platform could facilitate partnerships with organisations that presently hold data, and provide opportunities to crowdsource IUCN staff and Commission members' expertise to provide data that is difficult to access. Large amounts of scientific and project data could thus be made accessible for re-use to inform local processes of environmental and natural resource assessment and planning.

This digital platform could simply contain a meta-database linking diverse datasets and databases, but it could also include digital tools and workflows, including spatial tools and data export options, to allow secondary data collation and analysis tasks to be performed (e.g. searches, data extracts and visualisations). A digital platform, such as the latter, may also offer rich channels for communication between peers and visitors, by incorporating space for blogs, discussion fora and social media. Table 6.1 illustrates

different facets of the PiN secondary data module in relation to the proposed platform.

Data could be contributed to the PiN platform through a crowdsourcing module, simply by submitting data accompanied with standard metadata so that it is discoverable by other users and can be cited correctly for re-use. Particular data access, discovery and linking challenges in specific fields might be brought to the attention of data custodians, whether they are IUCN Members or part of the wider conservation and development community, so that they may help expedite problem-solving efforts.

The proposed platform is envisioned as a way of facilitating secondary data workflows, and aims to link and draw upon diverse datasets. Existing databases (e.g. the SIS, the United States Department of Agriculture food composition tables) store data and are actively updated and maintained, and thus may be the appropriate sites for storing secondary data generated through PiN assessments, while the proposed PiN platform could be designed with the primary function of guiding users through the steps necessary to contribute, clean, and visualise secondary data that is brought together from a diversity of sources.

Finally, it must also be recognised that not all data will be articulated in terms of species, ecosystems or habitats. Expressions may relate to entire peoples and landscapes, to complex problems at multiple political levels and across jurisdictions, or sources may express relationships between people and particular locations or sites. Thus, the platform must be designed to ensure different perspectives can be explored using different data types, whether quantitative or qualitative and to facilitate digital story telling approaches that can combine this data in new ways.

Future work will be required to assess how much relevant secondary data are in usable formats and the degree of 'interoperability' between different datasets. A combination of partnership efforts and digital tools for searching, mining and crowdsourcing will be necessary to access sources, discover and link secondary data, and to automate critical parts of the PiN workflow that are otherwise time consuming. As a first step towards developing the secondary data module, PiN could focus on creating a set of database linkages and automated workflows for use in the situation analysis phase. In the next step, PiN could decide on a crowdsourcing strategy and ask for early expert contributions of existing datasets that are relevant to regional pilot

Table 6.1 - PiN platform workflow and design considerations

Workflow stage	Platform design considerations
Facilitating data access and checking for ethical issues regarding secondary data use	Creation of communities and partnerships for contribution of difficult to access (e.g. offline) data and documents; checking for concerns over data access and use rights.
	Exploring potential data sources that could be made open access with the help of custodians and user communities.
	Application of metadata standards for ease of data discovery within documents.
Data discovery	Machine learning tools to discover data within existing data sources.
	Crowdsourcing approaches for data discovery and verification.
Linking data across scientific knowledge domains	Creation of digital tools for linking data (e.g. nutritional composition and biodiversity threats).
Workflows for synthesis and visualisation of secondary data	Creation of workflows for PiN assessment teams to extract data relevant to assessment sites.
	Possibility for creating data visualisations and/or tools for story telling using the datasets identified in the secondary data module.

projects. Within IUCN, PiN can simultaneously pursue work on integration with the SIS and the RLE and exploration of other relevant data held within IUCN initiatives and project repositories. The ethical use of secondary data will need to be explored with custodians of data sets and communities involved in PiN pilot projects throughout the process.

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Coastal indigenous peoples fisheries database

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INDIGENOUS PEOPLE COMPRISE JUST FIVE PERCENT of the global population, at about 370 million people, but many live in difficult socio-economic conditions. The indigenous groups that live near the ocean share vital links to marine ecosystems that are currently being threatened. The ocean has shaped their cultural heritage and spiritual values for millennia, while providing a vital source of food and economic security. This dependence on the ocean makes coastal Indigenous peoples (CIPs) very vulnerable to the challenges facing oceans and fishers worldwide, including those brought upon by climate change and pollution.

The CIPs database is working to collect data on these groups around the world, including their fish catches and seafood consumption levels. The CIPs database is a product of the Nereus Programme, a global network of experts researching ocean sustainability across the natural and social sciences. Part of the Nereus Programme's objectives is to conduct research on the socio-economic impacts of climate change on coastal fishing communities, and on the cultural values and roles of the ocean for underrepresented communities.

Data collection and analysis will provide an understanding of the scale and context of the challenges faced by CIPs. This will fill a void in indigenous policy discussions, where discussion often lacks data to support arguments. Recognising and supporting indigenous fisheries and their contributions to the culture and food security of CIPs will strengthen their ability to adapt to a changing ocean.

The database is a list of CIPs worldwide, complemented by fish consumption estimates from both qualitative and quantitative research. It includes over 1,800 records

and almost 600 unique groups comprising almost 30 million people. Over 80 countries are represented. Fish consumption data are also included for 122 indigenous groups, representing one million people. Through this research, it has been found that global indigenous non-commercial fish catches are estimated at approximately 2 million tonnes per year, equal to -2% of the global catch.

The Nereus Programme shares an interest with PiN in understanding the role of secondary data in understanding the value of biodiversity to Indigenous peoples. Such data can provide an opportunity for regional analysis of the socio-economic contribution at a community scale and the role of biodiversity in cultural practice.

For further information on this project contact Andrés Cisneros-Montemayor, a.cisneros@oceans.ubc.ca or visit the Nereus Programme website, www.nereusprogram.org ■

Chapter Seven

THE NEXT STEPS FOR PEOPLE IN NATURE

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Promoting the uptake of existing knowledge and generating new understanding of the interrelationships between people and nature is the aim of the People in Nature (PiN) knowledge basket. The preceding chapters present the initial thinking about how to conceptually deal with investigating these people–nature interrelationships, focussing on material and cultural values and uses. This chapter describes the way these approaches and frameworks can be drawn together. It also identifies the gaps that remain and the further conceptual work required, as well as outlining the anticipated next steps for PiN within the IUCN 'One Programme' approach.

PiN has adopted a mixed methodology approach, combining qualitative and quantitative approaches and methods for landscape assessments as the methodological framework of the PiN knowledge basket (Chapter 3). Several frameworks have been presented to systematise the analysis of the potential of nature to contribute to building the resilience of rural and remote communities during times of globalised change (Chapter 2), and to determine how any proposed change affects the multiple dimensions of poverty or well-being at a particular site, regardless of whether change is internally or externally driven (Chapter 5).

A PiN landscape assessment has three phases – an interdisciplinary situation analysis, primary data collection and integration with other IUCN knowledge products (Chapter 3). Tied to Phase I, and with a focus on secondary data, a systematised approach to accessing and mining existing sources for relevant data is proposed (Chapter 6), drawing on knowledge of local experts and global organisations regarding the availability and accessibility of relevant public data. In order to capture the full range of values for nature, including those associated with culture (Chapter 4), consideration of the various types of value must be incorporated across all phases of the workflow.

Early applications of PiN will focus on rural and remote communities, in contexts where the direct, indirect and cultural values and uses of biodiversity, ecosystems and water resources make important contributions to securing and enhancing the livelihoods of rural peoples, so alleviating poverty and improving well-being.

HOW THE PROPOSED FRAMEWORKS FIT TOGETHER

The mixed methodology, data and data use

In developing a PiN landscape assessment, teams will need to work within the overarching exploratory mixed methodology and the phased workflow. The latter prioritises the collation and synthesis of existing information in Phase I. Primary data collection activities will not be designed and implemented until Phase II, based on the gaps identified in the Phase I analysis, and qualitative approaches will typically be used to design quantitative instruments, complemented by the parallel process of recording cultural narratives. The final phase (Phase III) involves data integration and analysis.

The process will be participatory from the inception phase – with local community and key stakeholder engagement used to identify the challenges and problems to be addressed during the assessment, and to inform how data is collected, analysed and interpreted. Thus, while the specific objectives of each assessment will vary according to context, all assessments will follow the phased workflow and the proposed analytical frameworks.

Standards are proposed for collating and using secondary data sources and for collecting primary data. The focus on secondary data (Chapter 6) ties in to the first phase of the PiN workflow, the interdisciplinary situation analysis, and proposes ways that PiN can create linkages between existing knowledge and data, initially on species use, agrobiodiversity, linkages between species, habitats and ecosystems and risks to biodiversity. A systematic approach to finding, accessing and mining existing sources for relevant data is proposed, as is creating a publicly accessible digital platform providing access to data and guiding the secondary data analysis workflow in Phase I.

Once publicly available sources have been identified, the data within these sources need to be transformed into usable formats, so that different datasets can be linked together. Data mining and crowdsourcing approaches can be used to simplify and automate the process of data identification and discovery, allowing PiN to continuously update its digital platform with new data.

The PiN assessment methodology values the contributions of traditional and scientific knowledge systems, which can be brought together for novel analysis (Tengö, et al., 2014; Idrobo, et al., 2016). However, there are concerns that relate to the ethical use of secondary data derived from traditional knowledge, most notably the use of data without the knowledge of, and/or to the detriment of communities, the benefits of data use (whether political or economic) not being shared or returned to communities, and inappropriate knowledge governance frameworks and safeguards.

These issues are of particular concern because the PiN digital platform aims to aggregate and facilitate broader access to relevant secondary data sources. Many datasets have already been made publicly available, regardless of whether protocols to protect traditional knowledge holders from predatory efforts to extract knowledge were originally followed.

PiN therefore commits to a rights-based approach and to ethical engagement with remote and rural communities. The challenge for PiN will be to credibly and legitimately put secondary data to use at different scales, without threatening the rights of communities to use their own knowledge and institutions to inform choices about their individual and collective development pathways.

Data will be repatriated to communities as an integral part of the PiN assessment, and communities will be consulted on the availability and potential uses of data, so they can exercise better control over the way this data is, or is not, put to use. Building trust around secondary data usage in PiN assessments in this way will provide the basis for establishing procedures with PiN partner communities regarding primary data collection.

The necessity of developing and following protocols with local communities is inseparable from the participatory principle, and is necessary to ensure agreement between the PiN team and the local community on the assessment goals, research design, implementation and analysis, and the repatriation of data. These protocols must be followed to ensure that communities remain in control of the process, with the PiN team in a facilitating role (Davidson-Hunt & O'Flaherty, 2007). While PiN has most closely examined protocols and ethical procedures related to the use of secondary data to date, protocols will also need to be negotiated with communities to determine what data collection can take place.

The biodiversity-based system, development pathways and impacts on people

The perspective adopted by PiN views people as both in nature (Palsson, 2013) and as determinants of the nature of which they are part. Given the focus of PiN on biodiversity use, analysis is framed around the biodiversity-based system – the factors that shape material and cultural uses of biodiversity, and enable or constrain activities to be adopted or adapted in response to change.

This framework builds an understanding of the biodiversity present at a particular location (e.g. a community territory or a landscape) and people's use of it, by examining both material use and symbolic purposes. People have many interrelationships (e.g. with places such as ceremonial sites) that make landscapes meaningful beyond their provisioning functions (Bieling & Plieninger, 2013; Bieling, et al., 2014; Johnson & Hunn, 2010; Stephenson, 2008), and the way people define and interpret the natural environment is key to helping understand their interrelationships with the surrounding natural environment.

PiN analyses must take into consideration both material and cultural dimensions. However, in developing the biodiversity-based system (Davidson-Hunt & Berkes, 2010), the focus is initially on direct material use of species, with properties that make biodiversity useful for various provisioning functions (e.g. energy, food and nutrition, health and medicine and shelter).

Analysis of the biodiversity-based system follows the flow of biodiversity through the social system, based on four phases – its appropriation (e.g. hunting, harvesting, etc.), transformation (e.g. butchering, drying, cooking, etc.), exchange and consumption. The analysis also requires tracing current uses and potential future uses, both of which are necessary for understanding the potential of nature to contribute to individual and community responses to change (e.g. development interventions, land use changes).

Potential use incorporates historically utilised species, reported uses within similar environments and/or among similar cultural groups, as well as species currently used. The proportion of current use to potential use is related to availability (the quality and quantity of flows), stability (broadly interpreted as stocks), access (the ability to benefit from biodiversity use (Ribot & Peluso, 2003)) and perception (an individual's awareness of something (Ingold, 2000)). These factors influence the salience of use and enable cultural processes to be brought in to this understanding (Hinde & Dixon, 2007).

Thus, the four analytical categories of availability, stability, access and perception are necessary for understanding both current and potential uses of biodiversity, and should be analysed within the phases of appropriation, transformation, exchange and consumption to identify the factors that enable or constrain use. Analysing the system in this way will help communities to reflect on the potential of nature to support responses to change and to pursue new development pathways.

A specific framework has also been proposed for the exploration of impacts on the lives and livelihoods of individuals, households, groups and communities at a particular site, and to provide an understanding of how changes may affect their human–nature interrelationships, so that local priorities and choices about development pathways can help to mitigate or minimise any negative impacts, and strengthen positive impacts.

This process will involve an examination of how these material and cultural uses contribute to the lives and livelihoods of individuals, households, groups and communities at a PiN assessment site. In order to do this, the contributions of current biodiversity use must be assessed, and the relative contribution of this use compared to that of other livelihood activities. Additionally, because different components of the use chain – from appropriation, transformation, exchange and consumption – are undertaken by individuals, where appropriate, analyses should be gender sensitive, and incorporate an examination of the situation of individuals and households, in order to improve understanding of intra-household distribution issues and differential vulnerabilities.

While the biodiversity-based system focusses on species used and their uses, this framework analyses the impacts of such use (or changes to it) on the multiple dimensions of poverty and well-being. PiN assessments will require several core dimensions to enable comparability across sites and time, and which are likely to include education, employment, energy, food and nutrition, health, income, water and sanitation, asset ownership and social and cultural relations. However, these core dimensions should be complemented by selection of self-defined dimensions (Chambers, 1997; Ashley & Carney, 1999), based on what is locally appropriate, including subjective dimensions, those representing the contribution of environmental resources and those that reflect cultural norms and values.

Development pathways are on-going processes in which people pursue goals by exercising both individual and collective agency in pursuit of their desired trajectory and livelihood outcomes. Given these dynamic situations, PiN assessments must also focus on both the spatial and temporal dynamics of poverty, vulnerability and well-being. This will be of particular importance if PiN assessments are to be used in monitoring and evaluating change.

These analyses must also address structural features – the conditions that constrain or enable utilisation of biodiversity that exist locally (and at the macro level), and how these might be positively or negatively influenced by development interventions and management choices in that locality. This work should help to identify points of entry for interventions which can take advantage of opportunities and mitigate costs. These contextual analyses will focus on issues of governance (see next section), power relations and political economy, which will help to answer questions about why people are poor, and why they have, or do not have, access to resources (Nunan, 2015).

Disaggregated analyses will be required to identify the factors affecting the development pathways of different individuals, groups and communities and the differential impacts of proposed changes on different groups (e.g. by age, gender, ethnicity, etc.). Further, such disaggregation will also recognise that individuals and groups, even within

a specific location will hold different values based on their interactions and social status, and have different interests that will need to be negotiated in any process of change (Fisher, et al., 2005).

Nature-based solutions to globalised change will not be found in exogenously imposed new technologies or ecosystem restoration, but by supporting communities' own analysis of the factors that affect their ability to utilise biodiversity to respond to challenges and pursue new development pathways. Therefore detailed analyses are necessary to enable better targeting of strategies and interventions (whether internally or externally driven) to maximise potential positive outcomes and to mitigate or minimise anticipated negative impacts of proposed policy changes or development interventions. Strategies and interventions from the community may be an effective means to resist change, adopt new technologies, or transition from one development pathway to another (Béné, et al., 2014).

PiN aims to document both material and non-material values associated with nature, and it is therefore essential that the different types of values that exist in a landscape (both anthropocentric and non-anthropocentric) are defined broadly. This is necessary to avoid the undue emphasis that has often been placed on anthropocentric values, particularly instrumental values, partly because of the perception that such values are often the most easily articulated, documented and measured. Understanding these interrelationships, and the social context in which material use of nature takes place, will be important in avoiding a narrow focus on the material use of nature. The adoption of different analytical perspectives for understanding these different types of value is designed to ensure that valuable insights are not lost, as they may be if analysts used only one perspective.

Recognising that an approach focussing on biodiversity and species favours a western understanding of nature, the PiN mixed methodology and associated workflow specifies the collection of cultural narratives, which is designed to allow communities to express their many and varied perspectives on the interrelationships between people and nature. These narratives will build understanding of the range of values associated with human–nature interrelationships, because such values are affected by culturally-mediated rules and institutions, which influence their attribution and prioritisation.

Thus, PiN analyses are comprehensive in their coverage of the ecological, social and cultural factors (e.g. worldview, values, perception and language) that shape people's aspirations, and which influence people's ability to exercise agency in their use of nature, and fit within the broader economic, institutional, technological and political context. While being attentive to local specificity, the PiN landscape assessments provide a stable structure for understanding how different levels of biodiversity contribute to livelihoods, poverty and well-being, and how this differs within and

between locations, and how individuals, households and communities are affected differentially (e.g. by age, gender or wealth ranking). This landscape assessment approach can be forward looking, considering the ways that people can utilise nature to meet their aspirations to live well, and the sustainability of these choices within particular contexts.

GAPS AND OPPORTUNITIES

Each of the preceding chapters identified elements of conceptual thinking that need further work and development, and provides a starting point for the prioritisation of future PiN conceptual activities. We also expect that continued engagement with scholars, practitioners and rural and remote communities will lead to further refinement of the ideas presented in this volume. Indeed, future work for PiN can be split in to three main areas: further conceptual development and refinement; the application of PiN's conceptual frameworks; and links to other IUCN knowledge products and knowledge baskets, and further data integration. The importance of fully understanding the governance of natural resources (as noted specifically in chapters 2, 3 and 5) emphasises the need for the development of a governance framework. Early thinking is outlined below, and is followed by a discussion of further PiN developments as identified in this volume.

Governance

A critical element in understanding human–nature relationships is the issue of governance. IUCN's definition of governance (with reference to natural resources) is "the interactions among structures, processes and traditions that determine how power and responsibilities are exercised, how decisions are taken, and how citizens or other stakeholders have their say in the management of natural resources – including biodiversity conservation" (IUCN, 2004:1). In this definition, 'structures' include three fundamental elements: normative frameworks (formal legal frameworks and customary law); institutions (including authorities); and socio-political actors. Structural elements interact with processes for decision making and with certain traditions that influence, or are relevant for, specific functions of governance. Thus, PiN needs to reflect the three pillars of governance – normative frameworks, institutions and processes that involve social actors in the various functions of governance.

The variable of 'access' provides an entry point for undertaking a PiN governance assessment at the site level (see Chapters 2 and 3), and describes the ability of an individual or group to benefit from biodiversity, whether through access to materials, persons, institutions or symbols. Access, thus defined, broadens attention from rights to use and manage resources, to include whether and how these rights can be exercised in reality (Ribot & Peluso, 2003). The ability of different groups to benefit is closely related to their power to participate in and influence the sphere of management decision making and governance of resources.

Recognition of rights, e.g. to consultation in the phase of project impact assessment, and access to subsistence resources may be contained in normative frameworks, including international agreements such as ILO 169, and national laws, but the ability of people to access and use biodiversity may be shaped and constrained by customary norms, institutions and actors at different levels.

Generally, the complexity of governance in relation to specific resources are determined by their scarcity, their place and function in the wider economic system, the level of effort people put into their management, and their importance for specific aspects of livelihoods and culture. However, governance at the community level has also become more complex over time, in part due to the complexification of traditional societies, to the imposition of exogenous governance systems through colonial processes, to the development of broader societies (including the establishment of nation states), and to the influence of drivers or processes that overlap with community lands and resources. In practice, such changes have created, de facto, situations of polycentric governance (i.e. the existence of multiple overlapping and interacting governance structures and systems), and legal pluralism (i.e. the existence of multiple overlapping and interacting legal systems) that are highly complex, yet often dysfunctional (Parkinson, 2015).

In PiN landscape assessment sites, the most likely situation will involve the existence of polycentric governance systems, where customary systems function to differing degrees and where the relationship between customary and statutory governance systems exhibits tensions and conflicts. This is likely to be true in both rural and remote areas of developing countries, as well as in Indigenous peoples' territories in developed countries.

During an assessment, PiN will determine the most relevant elements of these overlapping governance systems at the site level – the normative frameworks, institutions and social actors – and examine these in relation to communities' access to benefits from biodiversity. In this summary, the focus is initially on normative frameworks, while recognising the need for further thinking, and expansion to institutions and actors, before a comprehensive governance framework is fully developed.

Normative frameworks, including statutory or formal legal frameworks and customary law are, simply stated, the bodies of norms, regulations and laws used to govern natural resource use in any given context. They determine *inter alia*:

- which resources are covered (e.g. lands, water, forests, biodiversity, etc.);

- who has rights to own and use – harvest, transform, consume, exchange – these resources (disaggregat-

ed to the appropriate level to account for differential access by gender and age groups, by wealth, ethnicity, etc.);

- what the limits and parameters of access and use are (e.g. quotas, seasonal bans, permanent restrictions, area-based restrictions, etc.);

- whether there are any specific distributional aspects or special provisions for certain resources (e.g. for assistance to widows, single parents or elders);

- what the sanctions for infringement of the rules are;

- who the authorities and institutions in charge of enforcement are;

- what the procedures for investigations, hearings and recourse regarding application of the rules are; and

- what the procedures and responsibilities for dealing with extra-community issues are (e.g. negotiations with other communities regarding shared resources).

PiN analysis of normative frameworks will include both statutory and customary frameworks. For practical and political reasons, analyses will often examine statutory frameworks first (because they are codified and state-owned and -driven), but must also necessarily examine customary frameworks in order to understand their role in shaping access and use, that may sometimes contrast with, or contradict statutory frameworks. PiN will likely place an initial focus on the frameworks governing land and resource tenure, specifically rights of ownership, access and use.

Tenure systems analyses must identify different types of tenure, and overlapping tenure systems in a given area, as these systems frequently vary across lands, territories, resources and social groups. Many tenure systems include some combination of private (individual or corporate), cooperative, communal or state ownership. It is fundamental to understand the mosaic of tenure, under both formal and customary tenure systems, because the ability of individuals, households and groups to access and use resources will often depend on the complementarity of the types of tenure. For example, cultivation may be restricted to private parcels, while grazing may be an important use of communal pasturelands and government agencies may hold land dedicated to conservation or other uses.

It is also important to understand the specific meanings of 'property' or 'ownership' to individuals and groups within communities, as property rights are often differentiated by users, such as by gender and age groups. Furthermore, property rights must be considered to constitute 'bundles of rights', often including (but not limited to) rights to use the land or resource; to exclude unauthorised use; to derive income from the land or resource; to transmit rights (e.g. by bequeathing them); and to alienate all or part of the rights (over all or part of the landholding or resource) (FAO, 2002).

Property rights over land also infer a duty to not use the land in a way that is harmful to other members of society; and to surrender property rights when they are taken away through a lawful action (FAO, 2002). Therefore, in any location, it is important to understand specifically what 'rights' mean in legal terms (including customary law), and how they apply to specific areas of land, to specific resources and to specific community members.

The need for greater specificity regarding the ability of people to gain and influence management of access to resources is also the reason for the adoption by Ribot & Peluso (2003) of a 'bundle of powers' framework, which looks beyond property rights to consider relationships between people, institutions and legal frameworks. While statutory and customary law frameworks are a fundamental point of departure, PiN governance analyses should also encompass the related institutional frameworks, including the identification of roles, responsibilities, capacities, procedures and accountability mechanisms. The realities of the way in which tenure systems are implemented also need to be understood, incorporating the examination of all stakeholders in a community context, and with particular attention paid to vulnerable groups (e.g. women, those with a disability, the elderly).

A next item in examining the normative frameworks for access and use are regulations. These are often not a formal part of legal tenure systems, but correspond to a lower level of administration and management of tenure rights. The distinction is usually less clear in customary governance systems, because tenure rights are fundamentally connected with uses and socio-ecological functions.

Generally, access and use rights in customary systems work similarly to those in statutory systems, where some rights are explicitly stated, such as the right to exclusion, and other rights are 'negatively' determined – uses are allowed whenever exclusion or prohibition does not exist. This is important for analyses of norms and regulations, particularly of customary systems, where they may be hidden to the external eye.

Proper strategies for investigation of customary normative frameworks should result in some form of codification that empowers communities, and individuals in communities, to access and use resources. Codification is indeed a fundamental step for communities to negotiate regulation and control with agencies, for reflection on and evolution of the norms, for transmission to new generations and for 'harmonisation' of systems in polycentric governance situations (Vaughan & Caldwell, 2015; Vaughan, et al., 2016).

For the purposes of PiN, understanding access requires mapping the mechanisms by which people gain, control, maintain and distribute benefits flowing from the use of biodiversity, whether from production or extraction, transformation, exchange or consumption (Ribot & Peluso, 2003; Ribot, 1998). Each mechanism is a strand within a bundle of power, and understanding the different bundles held by

individuals and groups provides an insight into their power and why they may benefit, to a greater or lesser extent than others. This level of detail is key to recognising the differential benefits and costs flowing to individuals, households and groups, associated with the access and use of resources, or constraints to access or use. It is also critical to understanding how potential changes and development interventions will impact differentially on the development pathways of individuals and groups within communities at PiN sites.

Building on PiN frameworks

One area of focus for PiN advancement is further conceptual development. Both of IUCN's new flagship knowledge baskets – People in Nature and the Natural Resources Governance Framework – would benefit from the development of a discussion paper that considers ontological, epistemological and axiological perspectives of nature, as noted by chapter reviewers. Indeed, Chapter 2 utilises the variable of 'perception' to ensure that all use is understood as cultural, not simply an economic function, and in so doing does not reduce cultural to only the symbolic. While this conceptual proposition emerged too late to develop a conceptual paper for this volume it is reflected in the use of the conjunction (in) chosen for the name of the knowledge basket. This reflects on-going discussions in the social sciences, especially those who engage with Indigenous peoples, about the need to break down the ontological separation of culture-nature and society-environment (Ingold & Palsson, 2013). As these concepts, and separations, are constructed through human discourses, they lend themselves to manipulation by those with more power so that they may control how value is attributed and benefits flow to distinct actors (Castree, 1995; Escobar, 2008; Igoe & Brockington, 2007). PiN signalled the intent to document and understand the diversity of ways by which humans perceive of their interrelations with their environments through cultural narratives. This component remains under elaborated and in need of more reflection.

Seven principles for building resilience were identified in Chapter 2 (see Table 2.1, p.25). Three principles – the importance of learning, participation and governance – are of particular relevance to PiN, and will require further attention regarding how they are woven into the PiN knowledge basket, so that on-going collaborative learning about responses to change can be enhanced.

PiN will need to undertake further thinking on governance issues, to flesh out the ideas and concepts described above, and to create a framework for operationalising these concepts within the mixed methodology. Additional work is also necessary to come to grips with the full range of disciplinary (and interdisciplinary) perspectives on value, and how multiple perspectives can guide research design and analysis (see Chapter 4). It is also hoped that the biodiversity-based system framework can be adapted and expanded to specifically incorporate the consideration of water

resources as part of the interrelations between humans and nature (see also Deutsch, et al., 2016).

The focus of this volume has been on the development of conceptual framework(s) to improve and systematise the analysis and understanding of the interrelationships between people and nature, as explained in Chapter 1. It has not dealt with the selection of specific methods or tools for primary data collection, as it is only appropriate to select methods after the relevant study objectives and questions have been identified. The proposed methodology will be implemented at a number of 'early application' sites, and refined based on those analyses, which will also feed in to future PiN work on the selection of appropriate data collection tools and methods.

The ethical and intellectual property issues associated with primary data collection and storage are somewhat different from those associated with the use of secondary data as addressed in this volume, and will therefore be addressed in the future, likely in conjunction with the selection of primary data collection tools and methods.

The development of the proposed PiN digital platform is another example of future work in applying PiN's conceptual frameworks. It will guide the PiN secondary data workflow to identify publicly available data on the full range of material and cultural uses, and will facilitate the processes of data access, discovery and linking of relevant datasets. In achieving the latter aim, the platform will need to facilitate partnerships with data holding organisations, and may use crowdsourcing to find data that is difficult to access.

A number of choices regarding platform design remain. At its most simple, it could host a meta-database linking diverse datasets and databases, so that they may be found by other users and can be cited correctly for re-use. However, it could be extended to facilitate secondary data workflows, including spatial tools and data export options, to allow secondary data collation and analysis tasks to be performed. It may be that the most appropriate sites for storing (secondary) data generated by PiN assessments are existing databases that are actively maintained, and the PiN digital platform could serve to link these databases.

In developing the platform, several steps have been identified. As a first step, PiN could focus on Phase I of the workflow (the interdisciplinary situation analysis), and begin to construct database linkages and automated workflows, simultaneously working on integration with the Species Information Service (SIS) and the Red List of Ecosystems (RLE) and exploration of other IUCN datasets. The next step would be to decide on (and implement) a crowdsourcing strategy for the identification and contribution of datasets relevant to early application sites.

A number of opportunities for linking and integrating existing IUCN datasets and those of other organisations have already been identified in the process of developing these PiN frameworks. IUCN holds a vast amount of species

use and threats data, and the PiN secondary data module aims to utilise the SIS, the RLE and other data where they exist. The ongoing conversation regarding the linkages between the RLE and SIS databases should also help to identify entry points for PiN data. The secondary data module would also benefit from greater integration with existing efforts to collate and systemise data, for example, on global crop diversity.

Potential links with the IUCN Natural Resources Governance Framework have also been identified. Within the biodiversity-based system, linkages are foreseen as access is mapped across the phases of appropriation, transformation, exchange and consumption, and in identifying the factors influencing the opportunities or constraints faced by individuals and groups, affecting the activities they can undertake in trying to achieve their desired development pathways.

WHERE DOES PIN GO FROM HERE?

IUCN will implement a new quadrennial Programme from 2017–2020. The new Programme represents a blueprint for delivering on many of the ambitions set in 2015, most notably in the Sustainable Development Goals and the Paris Climate Change Agreement. The Programme focusses on opportunities to address global challenges using nature. For example, the role of natural ecosystems to achieve climate neutrality is essential. Natural ecosystems *inter alia* store and absorb carbon, mitigating climate change and reducing the risks of disasters. Ecosystems also support people to adapt to climate change, thereby increasing resilience in the face of change. The Programme also reflects the thinking that well-being at aggregate global scales can only be increased through improved understanding of the planet's complex life support systems and the interrelationships between these systems, elements of these systems and people.

In this broad context, the development of PiN aims to help IUCN meet one of its three key objectives for 2020 – that societies should recognise and enhance the ability of healthy and restored ecosystems to contribute to meeting societal challenges like climate change, food security, and economic and social development. To effectively support implementation of the Programme, PiN has been tasked with equipping IUCN, its Members and partners with the means to systematically collect, compile and interpret data on the material benefits and cultural values associated with biodiversity.

In order to underpin delivery of this work over the next four years, PiN will focus on three main themes: further methodological development and consolidation in order to provide users with sets of practical, robust tools and methods for landscape assessments; application of PiN assessments in IUCN projects and programmes for improved impact on people (and feedback for methodological refinement); and integration with other IUCN knowledge products. The con-

ceptual underpinnings of PiN have been established over the last four years, and are set out in this volume. Future work will focus on operationalising PiN through application and further methodological development. There may be a need to refine certain frameworks, including how PiN assessments include governance issues, an area of work that is not as well developed as topics covered in the chapters of this volume.

Methodological development and consolidation will focus on ensuring that the PiN mixed methodology (Chapter 3) is further developed to include specific tools and methods, as well as guidance for users at each phase of the workflow. This will need to be packaged, and the resulting modules will be tailored to either specific user groups (e.g. rural and remote communities, government and state Members, NGOs, IUCN Secretariat) or to address themes or priorities (e.g. food security and nutrition, energy). Much of what has been developed to date will provide the basis of a PiN module for Indigenous peoples, as the focus has been on developing PiN to meet the needs of marginalised, nature-dependent people whose needs and values have traditionally not featured highly in conservation or development decision making.

An important user group is the IUCN Secretariat – a key mechanism to mainstream PiN in IUCN projects is through the Environmental and Social Management System (ESMS), which is a key element of the IUCN Project Guidelines and Standards. The ESMS provides systematic steps and operational tools for managing the environmental and social performance of IUCN projects. One of the four standards which underpin the ESMS covers situations of 'Involuntary Resettlement and Access Restrictions'. PiN methods and tools are highly relevant for assessing potential social impacts of projects, for setting baselines and for monitoring whether IUCN interventions with conservation objectives benefit or harm people in the landscape. This is particularly important in the context of projects which are likely to restrict the access of local people to lands they have traditionally used, in the case of protected area establishment, or resources, such as particular species, in the case of Red List Assessment results indicating the presence of vulnerable species. While the ESMS provides guidance on what steps need to be taken to identify potentially negative impacts, it does not provide detailed guidance on how to collect the information needed to assess socio-economic impacts or on what mitigation measures may be effective. The PiN team will explore with the ESMS team how PiN can best support the ESMS through the development of detailed guidance based on the mixed methodology (Chapter 3), the identification of appropriate tools and methods, and potentially technical support provided by staff with appropriate expertise and by Commission experts.

In the second main area of work, PiN landscape assessments will be undertaken in new projects implemented with IUCN Members and partners. Experience in the last four years has suggested that PiN landscape assessments need

to be incorporated in project design, rather than retrofitted or superimposed on existing projects which are locked into specific activities, timelines and deliverables. A PiN prototype module will be applied in a number of different contexts and by different user groups. For example, a PiN landscape assessment could be undertaken to provide baseline data and analysis on the extent to which local communities rely on a local forest, that is to be gazetted as a buffer zone for a protected area, to understand the livelihood implications and the cultural values associated with the ecosystem and the species of importance to people. Through the application of PiN in 5–10 strategically selected landscapes, information will be generated on what works well and what works less well, such that modules may be built out from the prototype, and tailored to address specific themes, or by particular user groups. Feedback from PiN applications will be used to further refine PiN approaches and methods.

A third area of work for PiN is its integration with other IUCN knowledge products and baskets. Early thinking on PiN was driven by the need to overlay information on the socio-economic dimensions of conservation on biodiversity data, be it species ranges and threat status or ecosystem condition. Both conservation and development policy shaped by the IUCN datasets, e.g. those underlying the Red List of Threatened Species™ (RLTS) and the Protected Planet, would benefit from integrated geo-spatial information on how people in the landscape use and value biodiversity in that landscape.

Integration may be achieved via different pathways. First, the data collection methods of different knowledge products may be coordinated and integrated at the landscape level, e.g. combining Red List assessments of freshwater species with a PiN assessment of local values associated with those species and their habitats. Second, integration can be achieved through linking datasets through common 'fields'. For example, RLTS, RLE and PiN should aim to use the same definitions and classifications for key fields containing data on species, ecosystem type and condition.

Perhaps the deepest form of integration is represented by discussions between PiN and RLTS for PiN to build out the Use and Trade module of the SIS. Species assessments are encouraged to complete the Use and Trade module, but assessors are often constrained by lack of resources, time and skills to collect data which falls beyond their area of expertise. As a result, that section of the SIS is incomplete. It has been proposed that, at early stages of development, PiN data be stored in an expanded Use and Trade module of SIS. It may become apparent that PiN is generating data and information that is not easily stored in this module, at which time other options will be assessed.

Finally, there remains strong demand for a repository of geo-spatial data on human use of, and values for, nature at the global level. While much of the work to date on PiN has focussed on assessments at the landscape level, using both primary and secondary data, there remains a commitment to develop a global database, based initially on existing data and being expanded over time to include primary data collected via PiN landscape assessments. In this regard, the development of standards and protocols with which to screen diverse datasets is essential, and the experience of the older knowledge products provides important guidance.

There will be increasing demand for data to monitor the implementation of national and international commitments around conservation and development, particularly the Sustainable Development Goals. It will be a priority to bring together secondary datasets on the values people have for species and ecosystem services at the global scale, in order to effectively link with other IUCN knowledge products for conservation decision making that takes better account of the multiple ways that people rely on nature and the complexity of interrelationships between people and nature.

The governance of knowledge generation within IUCN has important implications for the types of knowledge generated, how it is stored, managed and made accessible, and thereby who uses it. During the first four years of development, PiN was led by a steering group with representation from CEESP, Secretariat and Members. In the next phase, some new projects should be developed jointly with Members to embed PiN governance and implementation firmly in the 'One Programme' approach with Members, Commissions and Secretariat as equal partners. This is needed to ensure that PiN uptake is broad-based and provides a consistent approach and methods across the Union. This may require developing a different governance structure for PiN, and as noted, there is much that can be learned from 'older' knowledge products about models of governance.

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BIOGRAPHIES

HUGO ASSELIN

Université du Québec en Abitibi-Témiscamingue, Rouyn-Noranda, Québec, Canada
Member, Commission on Environmental, Economic and Social Policy, IUCN

Hugo Asselin is a forest ecologist (PhD). He holds the Canada Research Chair in Aboriginal Forestry at Université du Québec en Abitibi-Témiscamingue. His work with Indigenous people in Canada and abroad relies on traditional knowledge to suggest innovative strategies to overcome the challenges associated with forest management.

FIKRET BERKES

Natural Resources Institute, University of Manitoba, Winnipeg, Canada
Member, Commission on Environmental, Economic and Social Policy, IUCN

Fikret Berkes' research is in the area of interconnected human–environment systems (social–ecological systems), and deals with commons theory, resilience and traditional ecological knowledge. He has authored some 250 peer-reviewed journal papers and chapters. His ten books include: *Coasts for People* (Routledge, 2015); *Sacred Ecology*, third edition (Routledge, 2012); *Navigating Social–Ecological Systems* (Cambridge University Press, 2003) with J. Colding and C. Folke; *Managing Small-Scale Fisheries* (International Development Research Centre of Canada, 2001) with R. Mahon, P. McConney, R.C. Pollnac and R.S. Pomeroy, and *Linking Social and Ecological Systems* (Cambridge University Press, 1998) with C. Folke. He has participated in the Millennium Ecosystem Assessment, the UNDP Equator Initiative in conservation–development, and the Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES), representing IUCN at the 2013 IPBES Expert Workshop. He is a member of CEESP and former co-chair of IUCN's Working Group on Collaborative Management.

KAIA BOE

Kaia Boe, Nature-based Solutions Group, IUCN, Gland, Switzerland

Kaia Boe is Social Science and Ecosystems Programme Officer at IUCN, based at its headquarters in Switzerland. Her background is in Anthropology and Environmental Studies (BA's, Tufts University) and she has a MSc in Biodiversity, Conservation and Management (University of Oxford). At IUCN since 2010, she has worked on social policy issues (e.g. Indigenous peoples' rights, governance, rights-based approaches), disaster risk reduction and the Red List of Ecosystems. She also spent some time with the Environment and Development Department at WWF-Norway, has studied wildlife management in Kenya and New Zealand and holds a Postgraduate Certificate in Primate Conservation. Kaia is Norwegian, Swiss and British by nationality but she has lived on four continents and among her field research experiences are documenting and analysing human–elephant interactions in East Africa and fire management in South Africa.

KATRINA BROWN

Environment and Sustainability Institute, University of Exeter, UK

Katrina Brown is Professor of Social Sciences and works on interdisciplinary analysis of social–ecological systems. She is especially interested in how people understand, perceive and respond to environmental changes. Her work uses concepts of resilience, vulnerability and adaptation, and is grounded in international development, often focussing on the interactions of poverty, environmental and other stressors and how they differentially affect peoples' capacity to respond to and affect change. She is author of recently published book, 'Resilience, Development and Global Change'.

NICHOLAS CONNER

Member, Commission on Environmental, Economic and Social Policy, IUCN

Nicholas Conner has over 30 years' experience in natural resource management, rural development, biodiversity conservation and socio-economic impact assessment. His experience includes work as a Senior Environmental Scientist with a major Australian water utility, senior research positions in agricultural economics and sociology departments at Australian universities, and numerous consultancies in Europe, Australia, South East Asia, Micronesia and the South Pacific. Nick has also carried out volunteer work in Sri Lanka, Canada, Israel and Scandinavia.

Nicholas is currently Principal Conservation Economist, with the New South Wales Office of Environment and Heritage, developing a system of environmental economic accounts to guide the organisation's natural, social, economic, and cultural heritage planning and management. He has published and presented numerous papers on socio-economic aspects of natural resource management and biodiversity conservation, especially on valuing the socio-economic contribution of biodiversity to rural development.

Nicholas is a member of the IUCN Commissions on Environmental, Economic and Social Policy, and Ecosystem Management, and the World Commission on Protected Areas (WCPA). Since 2000, he has carried out pro bono and consultancy work for the IUCN Secretariat and Commissions on socio-economic aspects of terrestrial and marine conservation, including as Lead, WCPA Economic Valuation Specialist Group. Nick is a member of the PiN Steering Committee.

IAIN J DAVIDSON-HUNT

Natural Resources Institute, University of Manitoba, Manitoba, Canada
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Iain Davidson-Hunt is a Professor at the Natural Resources Institute (NRI) in the Clayton H. Riddell Faculty of Earth, Environment and Resources at the University of Manitoba and a member of the Canadian Institute of Planners. He co-leads the Theme on Sustainable Livelihoods, Commission on Environmental, Economic and Social Policy of IUCN along with Ms. Masego Madzwamuse. He began working at the NRI in 2003 following 15 years of professional practice in Latin America and northern Canada working in the field of rural community development, land use planning and supporting community-based enterprise start-ups. He and his students currently focus on the topologies of local harvest systems and the factors that shape them. Building upon ideas from ethnoecology, resilience and planning we have also begun to formulate biocultural design as an approach to support innovation in rural and remote communities.

NATHAN DEUTSCH

Member, Commission on Environmental, Economic and Social Policy, IUCN

Nathan Deutsch is a member of CEESP and an independent researcher based in Italy. He holds a PhD in natural resources and environmental management. Nathan has focussed over the past decade almost exclusively on planning in indigenous and community territories. He has worked in Canada, and has recently contributed to PiN activities in central America and eastern Africa. Nathan's current interests and activities revolve around the potential for global open data use in community contexts and data repatriation.

C JULIÁN IDROBO

Interdisciplinary Centre for Development Studies, Universidad de los Andes, Bogotá, Colombia
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Julián Idrobo holds a PhD in Natural Resources and Environmental Management. He is assistant professor at Interdisciplinary Centre for Development Studies, Universidad de los Andes. His research intersects ethnobiology, political ecology and social well-being and aims to support rural development processes based on innovative uses of biodiversity.

MA JONES

Swedish Biodiversity Centre, Sweden

Member, Commission on Ecosystem Management, Commission on Environmental, Economic and Social Policy and World Commission on Protected Areas, IUCN

Mike Jones is an ecologist, independent consultant and leader of the Resilience Theme Group in IUCN's Commission on Ecosystem Management that promotes systems and resilience thinking for transformational change in practice and policy. Mike has been a development and conservation practitioner since 1973, working as a park ranger, park ecologist, protected area management planner and environmental management consultant in southern and eastern Africa before moving to Stockholm in 2009 where he was based at the Stockholm Resilience Centre until 2012. Mike is currently working with the Swedish Biodiversity Centre where he teaches resilience and systems thinking to Masters in Sustainable Development students and maintains networks for transdisciplinary research in partnership with land and environmental management organisations. Mike also holds an adjunct position at the Wallowa Mountain Institute in Oregon where he works with scientists and local people in a programme that integrates knowledge and social learning to create innovation for the restoration of a collapsed timber based economy.

MASEGO MADZWAMUSE

Social and Economic Justice Cluster, Open Society Initiative of Southern Africa
Member, Commission on Environmental, Economic and Social Policy, IUCN

Masego Madzwamuse is the Team Leader for the Social and Economic Justice Cluster at the Open Society Initiative of Southern Africa (OSISA). She has over 15 years of experience as a policy analyst focussing on environment, land tenure, development and community rights. Prior to joining OSISA she held various jobs including an independent researcher; Programme Manager for the UNDP TerrAfrica initiative, which was aimed at mobilising civil society engagement in processes aimed at up-scaling sustainable land management in sub Saharan Africa; Country Director for IUCN in Botswana and later Regional Programmes Development Officer for the IUCN Regional Office of Southern Africa in Pretoria. She is a Member of the IUCN Commission of Environmental, Economic and Social Policy where she serves as Theme Co-Chair for Theme on Sustainable Livelihoods and is part of a working group that is charged with developing a People in Nature knowledge basket on the interrelationships between people and nature. She has published widely on the political economy of sustainable development, climate change adaptation, natural resources management, rural development and the rights of Indigenous peoples in southern Africa.

STEWART MAGINNIS

Global Director, Nature-based Solutions Group, IUCN, Gland, Switzerland

Stewart Maginnis is the Global Director of the Nature-based Solutions Group, with overall responsibility for IUCN's work on Ecosystem Management, Forests, Water, Marine and Polar, Gender, Social Policy, Economics and Business and Biodiversity. He is also the Secretariat focal point for the Commission on Environmental, Economic and Social Policy.

He has 30 years of broad experience in the area of natural resource management, biodiversity conservation and sustainable development, including 15 years full-time field work in Tanzania, Sudan, Ghana and Costa Rica. More recently he has worked extensively in national and international natural resource and climate change policy arenas and is a recognised leader in the conceptual development and promotion of 'forest landscape restoration', an approach which has now been adopted by many national and international polices and initiatives, including the Bonn Challenge to restore 150 million hectares of impoverished and degraded landscapes over the forthcoming decade. He has also taken a leadership role in defining and promoting the concept of 'Nature Based Solutions' and he and his team are currently working on the development of practical guidance and standards for nature-based solutions approaches that can be operationalised at scale.

PATRICK MCCONNEY

Centre for Resource Management and Environmental Studies, University of the West Indies, Barbados
Member, Commission on Environmental, Economic and Social Policy, IUCN

Dr Patrick McConney is a Senior Lecturer in Marine Resource Management Planning at the Centre for Resource Management and Environmental Studies, the University of the West Indies, Cave Hill Campus in Barbados. His work covers many aspects of small-scale fisheries and marine protected areas, but especially governance, livelihoods, socio-economics and developing adaptive capacity within the contexts of resilience and social–ecological systems.

AROHA TE PAREAKE MEAD

Chair of the Commission on Environmental, Economic and Social Policy, IUCN

Aroha Te Pareake Mead is from the Ngati Awa and Ngati Porou tribes (Māori) of Aotearoa, New Zealand. She is an indigenous researcher and scholar best known for her work on indigenous cultural and intellectual property and environmental issues. Her degree is in International Relations. She has over 30 years experience working at tribal, national, Pacific regional and international levels and has published extensively on indigenous sustainable development and intellectual property issues. Prior to her academic work, Aroha had a successful public service career in roles that focussed on social justice, equity and Māori development, and as a TV journalist working on documentaries and current affairs.

Aroha was appointed to the IUCN Council in 2000 with special responsibilities for indigenous issues. She was re-appointed to the same role in 2004. At the World Conservation Congress (WCC) in Barcelona, Aroha was elected as Chair of CEESP and was re-elected to serve a second term as CEESP Chair at the WCC in Jeju. During her time on the Council, Aroha has participated in the Gender, Biodiversity and Private Sector Task Forces, as well as resolutions committees, preparatory committees and as 'Chair' of the Commission Chairs.

SELINE S MEIJER

Global Economics and Social Science Programme, Nature-based Solutions Group, IUCN, Gland, Switzerland

Seline Meijer works as a Programme Officer for IUCN. She is responsible for managing the development of, and contributing to, a new IUCN knowledge product – People in Nature (PiN) – which aims to improve the understanding of the contribution of species and ecosystems to the livelihoods and well-being of rural and remote communities. Seline has a PhD in Forestry from UCD, carried out in partnership with the World Agroforestry Centre. Her PhD research focussed on the perceptions and attitudes that farmers have towards farm-level tree planting and forest degradation in Malawi. Seline has a MSc in Biodiversity, Conservation and Management from the University of Oxford, an MSc in Forest and Nature Conservation from Wageningen University and a BSc in Environmental Sciences from Utrecht University.

GEORGE AKWAH NEBA

Global Forest and Climate Change Programme, IUCN, Gland, Switzerland

George Akwah Neba is an anthropologist and currently works with IUCN where he is responsible for delivery of the climate change mitigation projects portfolio of the IUCN's Global Forest and Climate Change Programme. He has over 16 years of experience in research and practice in the fields of natural resources management, conservation and sustainable development, with a strong focus on understanding and addressing poverty–nature linkages and sustainable and green economic development challenges.

R MICHAEL O'FLAHERTY

Adjunct, Natural Resources Institute, University of Manitoba

Michael O'Flaherty holds a doctorate in anthropology from the University of Toronto. His doctoral research focussed on community management of indigenous woodlands in southeastern Zimbabwe. In 2002, Michael began working as an independent researcher and writer supporting aboriginal leadership in the stewardship of the resources on which they depend for their survival as a people. As an anthropologist, Michael brings his experience in cross-cultural bridging to efforts in documenting indigenous knowledge and making that knowledge relevant to planning efforts for protected areas and resource development. Michael has extensive experience working closely with First Nation elders and other community members on the land to develop an understanding of their values and priorities. Michael is currently focussing on professional writing and editing, working in both cross-cultural and inter-disciplinary contexts.

NATHALIE OLSEN

Global Economics and Social Science Programme, Nature-based Solutions Group, IUCN, Gland, Switzerland

Nathalie Olsen is an environmental economist with broad range of experience in economic analysis to inform policymaking. Her technical expertise includes economic valuation of natural capital and environmental externalities, and using this information to improve decision making across the public and private sectors. She is increasingly interested in interdisciplinary approaches combining the tools and methods of economics with those of the social and natural sciences to tackle development and conservation issues in a manner that benefits all stakeholders. Nathalie has graduate degrees in economics (Cambridge) and natural resources and environment economics (University College London). She joined the IUCN economics team in 2009 after a number of years in research and in international development with UN agencies, and now leads the economic work at IUCN as a member of the multi-disciplinary Economics and Social Science Programme.

GONZALO OVIEDO

Social Policy Programme, IUCN, Gland, Switzerland

Gonzalo Oviedo is IUCN's Senior Advisor for Social Policy since 2003. He provides advice to IUCN's senior management, global programmes and regional offices on integrating social considerations in nature conservation, in particular with regard to Indigenous peoples, community-based management of natural resources, culture, rights and governance at local, national and international levels.

An anthropologist by training, Gonzalo started his career working in educational projects with indigenous and rural communities of his home country Ecuador, under several initiatives supported by international organizations, such as UNESCO and the Organization of American States, which sought to implement innovative and integral approaches to community education. He then moved to the Galapagos Islands to work as the head of environmental education at the Charles Darwin Research Station.

Working with organisations active in environment, development, and educational issues in Ecuador and Latin America, Gonzalo became increasingly interested in issues related to social and cultural aspects of nature conservation. Gonzalo has been active in international work on social aspects of nature conservation for more than two decades. He is the author of several books and technical reports on education and conservation.

JAMES P ROBSON

School of Environment and Sustainability, University of Saskatchewan, Canada.
Member, Commission on Environmental, Economic and Social Policy, IUCN

James Robson is Assistant Professor in Human Dimensions of Sustainability at the University of Saskatchewan. Prior to that he was a Banting Fellow and Visiting Professor at the Department of Environment Studies, University of Redlands, California. He received a PhD in Natural Resources and Environment Management from the University of Manitoba in 2010, his MA in Environment, Development and Policy from the University of Sussex in 2001, and a BSc in Geography from the University of Liverpool in 1995.

Dr Robson's primary expertise deals with common property resource regimes. He studies how local and indigenous communities organise to maintain and adapt systems of governance and resource use in light of the challenges and opportunities presented by economic and cultural globalisation. Current research looks at trans-local commons governance in Mexico, as driven by rural out-migration, and is designed to build scholarly understanding through a new geography of commons theory.

His peer-reviewed publications include edited books and journal issues, book chapters, and journal articles on migration–environment linkages among Mexican indigenous populations, rural development and land use in Latin America, and community conservation. Dr Robson teaches in the broad area of environmental sustainability.

MARIANA RODRÍGUEZ VALENCIA

Natural Resources Institute, University of Manitoba, Manitoba, Canada
Member, Commission on Environmental, Economic and Social Policy, IUCN

Mariana Rodríguez Valencia is a graduate of the Centro de Investigación y Estudios Avanzados del Instituto Politécnico Nacional, Mexico where she obtained an MSc in Human Ecology and worked with Mayan communities to understand hunting practices. She is undertaking a PhD in Natural Resources and Environmental Management at the Natural Resources Institute, University of Manitoba. Her broad area of research relates to the study of human–environment relationships with a particular focus on ethnobiology, resilience thinking and biocultural design. Currently, she works with Bribri communities in Costa Rica and Panama exploring the factors that motivate local landholders to produce cocoa, despite being impacted by social and environmental changes.

KEVIN SMITH

Global Species Programme, IUCN, Cambridge, UK

Kevin Smith is a conservation biologist who has worked for IUCN since 2004, working on freshwater biodiversity and more recently invasive species. He has led many projects around the world focussing on IUCN Red List assessments and Key Biodiversity Areas in the freshwater realm. He was also the lead for IUCN in a recently completed, European Commission funded project, Highland Aquatic Resources Conservation and Sustainable Use 'High-ARCS' which focussed on the integration of biodiversity, livelihoods and ecosystem services in wetland site assessment and stakeholder driven action planning at five aquatic ecosystems in Asia, which led to the development of the Wetland Resources Action Planning Toolkit (www.wraptoolkit.org).

Through his current invasive species position, he supports the implementation of the IUCN led, EuropeAid funded, Inva'Ziles project in Western Indian Ocean Islands, which is working with local and national stakeholders building capacity and developing guidance to address island biological invasions. He also supports the IUCN Species Survival Commission Invasive Species Specialist Group in international policy fora, and in the development and application of IUCN's invasive species decision-support tools such as the Global Invasive Species Database, Global Register of Introduced and Invasive Species and the Environmental Impact Classification of Alien Taxa.

HELEN SUICH

Independent researcher, Canberra, Australia
Member, Commission on Environmental, Economic and Social Policy, Species Survival Commission and the World Commission on Protected Areas, IUCN

Dr Helen Suich has been conducting applied policy research into issues of poverty alleviation and sustainable natural resource management for the last 15+ years. Her research has focussed on examining the links and pathways between vulnerability, poverty and economic development and the utilisation of natural resources, as well as the impacts on vulnerability and poverty of natural resource management interventions. Helen is also interested in decision-making behaviour, the impacts of the incentive effects of development initiatives, and the paths by which such incentives actually affect individuals' and communities' perceptions and decisions. She has extensive field experience across southern Africa and in Indonesia, and has worked as a researcher for a range of organisations including universities, the Namibian government, non-government organisations and independently. She is currently a Visiting Fellow at the Crawford School of Public Policy, Australian National University and the Environmental Change Institute, University of Oxford.

TRISTAN TYRRELL

Tentera, Montreal, Canada
Member, Commission on Environmental, Economic and Social Policy, Commission on Ecosystem Management, IUCN

Tristan Tyrrell is a freelance consultant, working at the intersection of biodiversity, ecosystem services and human well-being for over a decade, with a particular focus on policy-relevant target setting and indicator development. This has included working with and/or for national governments, United Nations agencies and non-government organisations, and has engaged with a number of major international conservation and sustainable development initiatives including the Convention on Biological Diversity (CBD), UN Convention to Combat Desertification, Ramsar Convention on Wetlands, Intergovernmental Platform on Biodiversity and Ecosystem Services, the Economics of Ecosystems and Biodiversity, the Millennium Development Goals and more recently the Sustainable Development Goals. Tristan has also been supporting a number of countries with the development or revision of their National Biodiversity Strategies and Action Plans and managing the CBD High-Level Panel process on the costs and economic benefits of achieving the Aichi Biodiversity Targets.

PHOTO CAPTIONS AND CREDITS

Page 15   Credit: Seline Meijer

Page 16-17   *Background:* Members of the Fisherfolk Action Learning Group (FFALG) conduct interviews with fisherfolk at Montagu Ramp, Nassau, to develop a participatory video during the Second FFALG Workshop, The Bahamas, October 20-24, 2014. Credit: CANARI

Page 17   *Top and centre:* Fisherfolk leaders from the FFALG hold an action learning session with fishers from the Blanchisseuse Fisherfolk and Marine Life Association, at a small-scale fisheries landing site in Blachisseuse during the First FFALG Workshop in Trinidad and Tobago, August 19-22, 2013. Credit: CANARI

Page 17   *Bottom:* FFALG members undertake a small working group activity during the leadership session at the Third FFALG Workshop, Antigua and Barbuda, October 5-8, 2015. Credit: CANARI

Page 32-33   *Background:* Typical Andean landscape including homesteads, croplands, pastures, and woody vegetation. Credit: Sarah-Lan Mathez-Stiefel

Page 33   *Left:* Typical Andean landscape including homesteads, croplands, pastures, and woody vegetation. Credit: Sarah-Lan Mathez-Stiefel

Page 33   *Right:* Using participatory tools such as resource mapping and focus group discussions to capture women's knowledge and perceptions of agroforestry practices. Credit: Sarah-Lan Mathez-Stiefel

Page 47   Credit: Nathan Deutsch

Page 48-49   *Background:* Marcel Meltherorong marks the beat, Emyotungon, Ambrym. Credit: Sarah Doyle, Further Arts

Page 49   *Centre right:* Delly Roy, TEKS Leaders, Mon Exil, Santo.Credit: Cristina Panicali, Further Arts

Page 49   *Bottom left:* Unitiated boys prepare to dance at the Salav Festival, Namasari,Gaua. Credit:Cristina Panicali, Further Arts

Page 49   *Bottom right:* Limoros Water Music Group at the Salav Festival, Namasari, Gaua. Credit: Cristina Panicali, Further Arts

Page 59   Credit: Seline Meijer

Page 60-61   *Background:* The next generation of fishers. Credit: Syafrizaldi FFI

Page 61   *Top left:* Fishing for lunch Siumat Island, Simeulue. Credit: Syafrizaldi FFI

Page 61   *Top right:* Cultural and religious norms play an important part in natural fishing for lunch Siumat Island, Simeulue. Credit: Syafrizaldi FFI resource management. Credit: C Sheske FFI

Page 61   *Centre left:* Octopus populations are recovering thanks to community enforcement of compressor diving ban. Credit: Syafrizaldi FFI

Page 61   *Bottom left:* Lobster is a major target species for export. Credit: Syafrizaldi FFI

Page 74-75   *Background:* Thyolo maize field. Credit: Mangani Katundu

Page 75   *Top left:* The participatory agroecological training of the Farmer Research Team members in Thyolo by farmer leaders and a field officer from Dedza. The Ministry of Agriculture staff from Mangunda EPA in Thyolo were involved. Credit: Mangani Katundu

Page 75   *Top right:* The distribution of orange maize in Thyolo. Credit: Mangani Katundu

Page 75   *Centre:* Farmers in Dedza, Thambolagwa area, happy to receive a very good soya variety called Makwacha. Credit: Mangani Katundu

Page 75   *Bottom left:* The OSISA SMART MAFFA project team with traditional leaders of the project area in Thyolo. Credit: Mangani Katundu

Page 75   *Bottom right:* A farmer in Dedza showing us a well germinated crop of soya in his field.
             Credit: Mangani Katundu

Page 87   Credit: Nathan Deutsch

Page 88   *Right:* Coming home at the end of a fishing day. Credit: Colette Wabnitz.

Page 88-89   *Background:* Mother and children handlining for fish in Kaviegn, Papua New Guinea.
             Credit: Colette Wabnitz

Page 89   *Top:* Indigenous communities along the world's marine coasts.
             Credit: Yoshitaka Ota, Andrés Cisneros-Montemayor

Page 89   *Bottom left:* After a night's work, a group of fishers land their pirogue on a tidal sandbank and try a last set,
             Saloum Delta, Senegal. Credit: Andrés Cisneros-Montemayor

Page 89   *Bottom right:* A fisherman casts for small fish along the boardwalk in Nuku'alofa, Tonga.
             Credit: Colette Wabnitz

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