3 Considering diverse knowledge systems in forest landscape restoration

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Introduction

If forest landscape restoration (FLR) aims towards living sustainably within landscapes and restoring degraded socio-ecological systems, then integrating lessons of Traditional and Western knowledge systems can inform this effort (c.f. Ruiz-Mallén and Corbera, 2013). Knowledge systems represent much more than repositories of timeless information useful to today's managers and restorationists: they are intricately coupled human and natural systems that have evolved through intergenerational and community-based stewardship of natural resources. In this context, Berkes (2007) cautions that viewing community-based conservation as a panacea ignores the complexity and depth that must be considered when engaging communities and their knowledge in conservation activities. Rather, effective and equitable strategies for integrating multiple knowledge systems in the context of FLR necessarily involve: (i) respectful engagement of the holders of complementary but sometimes conflicting knowledge systems; (ii) identification of legacy drivers of degradation so as to be able to mitigate threats while decolonizing current approaches to FLR that can hinder effective communication and can prevent cross-sectoral policy coordination and governance; (iii) integrating the broadly collaborative processes that often define landscape management approaches within other knowledge or management systems; and so (iv) creating processes that facilitate the opening up of Western, agency-driven models of governance to allow more collaborative and community-based approaches for real engagement (Berkes, 2007).

Traditional knowledge and its relationship to Western knowledge

Long before the introduction of 'scientific' forest management (in Europe) in the early nineteenth century and its subsequent global expansion for timber resource management (and more generally to strengthen colonial government or state control over land resources), local, often indigenous

communities throughout the world managed forested landscapes relying on complex, place-based and multi-generational knowledge systems with the goal of sustaining resident communities and future generations (Berkes, 1999; Mann, 2002; Stewart, 2002; Parrotta and Trosper, 2012). The knowledge, innovations and practices of these communities evolved through detailed scientific observations and cause–effect management experiences integrated across generations. On the scale of centuries, these community-based, intergenerational stewardship systems sought to create abundance in resources that were deemed critical to community survival and livelihoods, and that were resilient and adaptive to changing environmental, economic, political and social conditions. These include, for example, indigenous cultural fire regimes (Jackson and Moore, 1998; Huffman, 2013), agroforestry practices (Walker *et al.*, 1995; McNeely and Schroth, 2006), traditional forms of watershed management (Wiersum, 1997; Mueller-Dombois, 2007) and sacred areas (Dudley *et al.*, 2009; Ormsby and Bhagwat, 2010). In altering the composition, structure, function and dynamics of forests at landscape scales (Farina, 2000; Stewart, 2002), these traditional systems purposefully altered ecological processes, resulting in enhanced abundance of desired, higher-valued species as well as the loss or reduction of some species and the extent of different ecosystem types.

The diverse knowledge systems that are embedded in the cultural traditions of regional, indigenous or local communities are referred to using a number of different terms, including traditional knowledge, local knowledge, traditional ecological knowledge, indigenous knowledge and indigenous science. In this chapter we will use a more general term, 'Traditional knowledge', defined by the Convention on Biological Diversity as 'the knowledge, innovations and practices of indigenous and local communities around the world, developed from experience gained over the centuries and adapted to the local culture and environment'. We consider Traditional knowledge in relation to Western knowledge (also called modern science, Western science or international science), that is, knowledge typically generated in universities, research institutions and private firms following paradigms and methods associated with the 'scientific method' consolidated in post-Renaissance Europe on the basis of wider and more ancient roots, usually transmitted through scientific journals, scholarly books and now internet/web-based platforms, with its central tenets being observer independence, replicable findings, systematic scepticism, and transparent research methodologies with standard units and categories (Díaz *et al.*, 2015).

Typically, Traditional knowledge is transmitted through active mentorship of younger generations, and codified orally to facilitate transmission of knowledge and associated cultural practices between generations. This oral transmission of knowledge in the case of indigenous communities takes diverse forms, including creation accounts, place names linked to

socio-ecologically grounded stories, traditional law teachings associated with subsistence and ceremonial activities, all of which would be transferred through direct training of youth by elders. Such knowledge systems are strengthened by and embodied in local languages, cultural values, beliefs, rituals, stewardship practices, community laws and governance systems. The resulting observational, place-based scientific knowledge underlies a diverse array of natural resource management practices that sustain these communities' food and water security, health, cultural traditions and livelihoods (Altieri, 2002; Parrotta *et al.*, 2015; Berkes, 2017).

There are important challenges associated with, and requirements for, integration of Traditional and Western knowledge systems. Western knowledge systems often provide a more mechanistic and biophysically technical form of knowledge, whereas Traditional knowledge systems are more inclusive of holistic and metaphysical aspects. A challenge can arise when knowledge systems are pitted against each other as what is 'the best science' versus being considered complementary to enriching the collective way of knowing the landscape, or reflecting different value systems (Nadasdy, 1999; Sterling *et al.*, 2017).

While both Traditional knowledge and Western knowledge systems rely on science to understand and manage resources, they differ in philosophies and in environmental and stewardship approaches (Cajete, 2000), as summarized in Table 3.1. These important differences start with the underlying culturally determined values, norms and beliefs that influence people's perceptions and the concepts shaping their worldviews and shape their relationships to the land (Díaz *et al.*, 2015; Sterling *et al.*, 2017). Embodied in many indigenous teachings are lessons that guide humans on how to be able to 'live with their relations', which include geological (soils/landscape), biological (fungi, plants and animals) and eco-hydrological elements or processes (i.e. fire, weather, flooding, earthquakes, etc.), inclusive of all the biophysical and spiritual features contained within a landscape of interest (Lewis and Sheppard, 2005). Because Traditional knowledge systems are often place-based, they display a high degree of variation across different landscapes and forest ecosystems (Turner *et al.*, 2003). And so, the content of such knowledge fundamentally reflects integration of locally observed and codified information on a place's ecological condition and history, as well as the social, economic and cultural characteristics of the communities that have accumulated this knowledge (Berkes *et al.*, 2000; Parrotta and Trosper, 2012). These systems and associated social institutions are important components of the social capital of traditional societies, with important implications for FLR, including adaptation to environmental change (Berkes *et al.*, 2000; Galloway-McLean, 2009; Parrotta and Agnoletti, 2012; Sterling *et al.*, 2017).

Despite their diversity across regions and cultures, Traditional knowledge systems – particularly those embedded in indigenous communities – tend to share a number of common features that distinguish them from

Table 3.1 Traditional and Western knowledge approaches pertaining to forest landscape restoration

Knowledge application	*Element of comparison*	*Traditional knowledge*	*Western knowledge*
Philosophy	Human and resources environmental hierarchy	Kincentric: Humans and nature viewed as an extended family with shared ancestry and origins, often honoured through ritual, and a central focus of management attention.	Anthropocentric: Humans considered above all resources, where living and non-living are largely viewed through a utilitarian lens, that is, their capacity to provide ecosystem services.
Philosophy	Knowledge transfer: Teaching and gathering information	Transmitted across generations as oral traditions and cultural practices on landscape for specific habitats and resources.	Transmitted primarily through print and electronic media, in multidisciplinary academic and professional settings.
Philosophy	Data and knowledge acquisition	Information used for cultural purposes to support community wellbeing and security, use value-based condition assessments.	Information used for natural capital management, resources studied/analysed, data catalogued, fact based to assess landscape and resource condition.
Environment	Environmental phenomena	Biophysical explanations are complemented by metaphysical explanations for observed phenomena, including extreme events.	Biophysical explanations of environmental phenomena. Natural range of variation concept applied as explanation for extreme or unusual events.
Environment	Resolution or accuracy of data	Quantitative and qualitative: Assessments determined by past and current cultural use to predict future conditions or amounts. Patterns are anticipated based on complex phenological indicators and past experiences. Local focus.	Quantitative and qualitative: Assessments by field data, modelling, analysis and trends predicted. Patterns are anticipated based on complex data collecting methods and incorporation into simulation models. Local to global focus.

Environment	Use of reference ecosystems to guide FLR restoration and management actions	Renewal: Human services to ecosystems. Past social-ecological systems, where appropriate, guide current and future actions. Fewer technological fixes as solutions.	Recovery: Ecosystem services to humans. Past biophysical conditions or novel ecosystems. Reliance on technological solutions and regulatory compliance to control environment and influence landscape processes.
Stewardship	Values or obligation to environment	Socio-cultural and spiritual responsibility to landscape. Management is self-regulated via cultural norms. Negative impacts to valued resources are avoided, adhering to beliefs and tenets.	Social and economic responsibility to private and public stakeholders. Negative impacts to valued resources are spatially and temporally mitigable through existing policies, governance institutions and management practices.
Stewardship	Environmental management	Ethically based: Holistic stewardship a spiritual obligation and sacred responsibility for resource use. Humans necessary part of landscape.	Socio-economically based: Driven by policies, markets, laws and/or regulations. Sustainability based on thresholds of resource use. Humans not necessarily an integral part of landscape.
Stewardship	Adaptive learning/ principles	Learned from ancestral teachings (passed on knowledge), observation and direct experiences with landscapes, habitats and resources. Corrective actions to human uses to benefit resources.	Field observations, scientific literature inform conceptual theories and principles taught and applied to management of habitats and other biophysical resources. Corrective actions on resource use to benefit humans.

Western knowledge systems and associated natural resource management practices (Berkes *et al.*, 2000; Cajete, 2000; Trosper *et al.*, 2012; Donatuto *et al.*, 2014). These include the high value placed on:

1 Sustainability: retaining or enhancing the ecological, social, economic, cultural and spiritual values of the land;
2 Relationships: people's connections among themselves and to their territory are not severed by the use of new knowledge, ideas or techniques;
3 Identity: communities seek to maintain their distinct cultural identities;
4 Reciprocity: people maintain their system of benefit sharing among members of the community;
5 Limitations placed on market involvement: while people may engage in market exchange with the flow of goods and services from the land, the fundamental productivity of the system itself is not viewed as a resource to be exchanged.

These values help to explain how, in the absence of external and internal pressures that result in erosion or destruction of traditional cultural and spiritual values and governance institutions, or loss of connection to their lands, Traditional knowledge and practices have survived, evolved and sustained local and indigenous communities over generations through changing environmental and socio-political conditions (Lewis and Sheppard, 2005).

As illustrated in Table 3.2 (adapted from Berkes *et al.*, 2000), traditional knowledge systems encompass a broad array of land management practices as well as underlying social mechanisms that facilitate the development, sharing and intergenerational transmission of knowledge, the functioning of local institutions affecting land management, and mechanisms for maintaining and reinforcing shared cultural values.

These systems can include many, if not most, of the necessary elements for success in forest landscape restoration: management practices for maintaining or enhancing biodiversity and provision of a range of ecosystem services; the necessary social institutions required for developing shared visions of FLR aims/objectives; strategies for reconciling the needs of diverse stakeholders; and approaches for adaptive management and sharing of knowledge as well as the risks and benefits of FLR implementation (Brown, 2005; O'Connor *et al.*, 2005; Boedhihartono and Sayer, 2012; Sterling *et al.*, 2017).

Integration across knowledge systems

In the same way that there is increasing recognition of the value of considering both social systems and ecological systems together, in what are termed 'social-ecological systems' (Chapter 5, this volume), there is also an opportunity to integrate Traditional knowledge and Western knowledge in

Table 3.2 Social-ecological practices and mechanisms in Traditional knowledge and practices.

Management practices based on ecological knowledge	*Social mechanisms behind management practices*
Practices found both in conventional resource management and in some local and traditional societies: • Monitoring resource abundance and change in ecosystems; • Total protection of certain species; • Protection of vulnerable life history stages	*Generation, accumulation and transmission of local ecological knowledge:* • Reinterpreting signals for learning; • Revival of local knowledge; • Folklore and knowledge carriers; • Integration of knowledge; • Intergenerational transmission of knowledge; • Geographical diffusion of knowledge
Practices largely abandoned by conventional resource management but still found in some local and traditional societies: • Multiple species management; • Maintaining ecosystem structure and function; • Resource rotation; • Succession management	*Structure and dynamics of institutions:* • Roles of stewards/wise people; • Cross-scale institutions; • Community assessments; • Taboos and regulations; • Social and religious sanctions
Practices related to the dynamics of complex systems, seldom found in conventional resource management but found in traditional societies: • Management of landscape patchiness; • Watershed-based management; • Managing ecological processes at multiple scales; • Responding to and managing pulses and surprises; • Nurturing sources of ecosystem renewal	*Mechanisms for cultural internalization:* • Rituals, ceremonies, and other traditions; • Cultural frameworks for resource management *Worldview and cultural values:* • A worldview that provides appropriate environmental ethics/ tenets; • Cultural values of respect, sharing reciprocity, humility and other

Source: adapted from Berkes *et al.* (2000); used with permission.

environmental conservation and restoration. In practice, this means understanding the former legacy of or current desires for indigenous landscape forest management, while respectfully challenging current scientific methods, approaches and beliefs about socio-economic institutions of forest-dependent cultures. It requires adopting new understandings of the landscape in question and its stakeholders, and adopting or designing new tools that can align application for both sets of knowledge systems.

In this book, our intention is to challenge the current 'uni-dimensional' ways of approaching FLR. We recognize the shortcomings of narrow

disciplinary and sectoral approaches, and the need for a broader perspective on FLR that considers integration across scales, across disciplines and across knowledge systems. Chapter 12 later in this volume focuses on the value of integrating knowledge systems for effective FLR implementation.

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