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Editorial, part of Special Feature on [Traditional Knowledge](#)

Traditional Knowledge in Social–Ecological Systems

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- [Responses to this Article](#)
- [Literature Cited](#)

Ecosystems are complex adaptive systems, and their governance requires flexibility and a capacity to respond to environmental feedback (Levin 1998, Berkes et al. 2000, Dietz et al. 2003). Carpenter and Gunderson (2001) stress the need for continuously testing, learning about, and developing knowledge and understanding in order to cope with change and uncertainty in complex adaptive systems. Knowledge acquisition of complex systems is an ongoing, dynamic learning process, and such knowledge often emerges with people's institutions and organizations. It seems to require institutional frameworks and social networks nested across scales to be effective (Gunderson and Holling 2002, Berkes et al. 2003).

It comes as no surprise that knowledge of resource and ecosystem dynamics and associated management practices exists among people of communities that, on a daily basis and over long periods of time, interact for their benefit and livelihood with ecosystems (Berkes et al. 2000, Fabricius and Koch 2004). The way such knowledge is being organized and culturally embedded, its relationship to institutionalized, professional science, and its role in catalyzing new ways of managing environmental resources have all become important subjects (Kellert et al. 2000, Gadgil et al. 2000, Armitage 2003, Brown 2003, Davis and Wagner 2003). It has been suggested that the management and governance of complex adaptive systems may benefit from the combination of different knowledge systems (McLain and Lee 1996, Johannes 1998, Ludwig et al. 2001). There are those who attempt to import such knowledge into the realm of scientific knowledge (Mackinson and Nottestad 1998); others argue that these knowledge systems are culturally evolved and exist as knowledge–practice–beliefs complexes that are not easily separated from their institutional and cultural contexts (Berkes 1999). There are those who question the role of traditional and local knowledge systems in the current situation of pervasive environmental change and globalized societies (Krupnik and Jolly 2002, du Toit et al. 2004); others argue that there are lessons from such systems for complex systems management, lessons that also need to account for interactions across temporal and spatial scales and organizational and institutional levels (Barrett et al. 2001, Pretty and Ward 2001), and in particular during periods of rapid change, uncertainty, and system reorganization (Berkes and Folke 2002).

The special feature of *Ecology and Society* on [Traditional Knowledge in Social–Ecological Systems](#) consists of 11 contributions, covering issues of conservation, ecosystem management, and governance in arctic, temperate, and tropical environments. These articles reflect on the difficulties, but also the potential to be found, in combining

knowledge, institutional arrangements, and cultural foundations of traditional and local societies with contemporary society. Several of the articles describe co-management and adaptive co-management of biodiversity and ecosystem dynamics in social–ecological systems (Olsson et al. 2004), and the role that traditional knowledge may play in this context. They provide insights into how ecosystem assessment and management by local people can fulfill several important objectives, can inform contemporary society, but can also be influenced and supported by contemporary science and institutions. The aforementioned objectives include: promoting participatory processes; creating new information to share across scales; making improved use of existing knowledge; developing indicators of change and resilience to monitor ecosystem dynamics; transforming existing institutions toward ecosystem management; and developing social responses for dealing with uncertainty and change (Peterson et al. 2003). Local ecosystem assessment and management can create alliances between owners of formal and informal knowledge. It can establish links between governments, local users, and scientists. It can create new information about local ecosystem conditions, to be shared vertically from local to national levels, and horizontally among regional groups of indigenous peoples (Gadgil et al. 2003).

For example, [Watson et al.](#) (2003) argue that traditional ecological knowledge serves an important function in the long-term relationships between indigenous people and vast ecosystems in the circumpolar north, and can contribute to understanding the effects of management decisions and human-use impacts on long-term ecological composition, structure, and function. Maintaining the web of relationships of people and places seems to be critical to adaptive learning among the Anishinaabe people of the Iskatewizaagegan No. 39 First Nation in northwestern Ontario, Canada, analyzed by [Davidson-Hunt and Berkes](#) (2003). They document the social memory of landscape dynamics as a combination of biogeophysical structures and processes, along with the stories about how the Anishinaabe people wrote their histories upon the land. Elders play an essential role in the adaptive learning process. [Long et al.](#) (2003) demonstrate that myths, metaphors, social norms, and knowledge transfer between generations of the White Mountain Apache tribe facilitate collective action and understanding of ecosystem dynamics, and provide a cultural foundation for guiding modern ecological restoration and restoration techniques. They argue that cultural traditions have sustained a system of adaptive management throughout the 20th century, and now provide hope for restoring productive ecosystems through individual and collective efforts. The role of cultural diversity in biodiversity conservation and ecosystem restoration is further addressed by [Garibaldi and Turner](#) (2004). They stress that human cultures are crucial components of conservation and restoration, and they focus on the concept of “cultural keystone species” in this context, giving examples from First Nations cultures of British Columbia.

Some articles in this special feature propose that using a combination of traditional ecological knowledge and science to monitor resources can greatly assist co-management for sustainable use. In a case study of extraction of non-timber forest products, [Donovan and Puri](#) (2004) show how traditional knowledge among local groups can help resource-management science unravel complex ecological interactions and develop sustainable management of forest resources. [Moller et al.](#) (2004), in their case studies from Canada and New Zealand, make the argument that, although traditional monitoring methods may often be imprecise and qualitative, they are still valuable complements to science-based approaches because they are founded on observations over long time periods, incorporate large sample sizes, are inexpensive, invite the participation of harvesters as researchers, and sometimes incorporate subtle, multivariate, cross checks for resource and ecosystem change.

Management practices of ecosystem dynamics and change in agricultural landscapes are the focus of the paper by [Tengö and Belfrage](#) (2004). They compare smallholder farming in northeast Tanzania and east-central Sweden. Almost half the identified practices were found to be similar in both cases, with similar approaches for adjusting to and dealing with local variability and disturbance. They also identified social mechanisms for the protection of species that served important functions in the agroecosystem, and found a social memory of practices that served as a source of adaptations for dealing with new conditions and for shaping ecosystem dynamics. [Ghimire et al.](#) assess variation in knowledge relating to the diversity of medicinal plant species, their distribution, medicinal uses, biological traits, ecology, and management within and between two culturally different social groups living in villages in northwestern Nepal. They stress that recognition of the heterogeneity and fine-scale knowledge and associated management practices within a given area is crucial to design management practices that build on the intricate links between knowledge, practices, and institutional context.

[Roth](#) (2004), in her paper on forest management in northern Thailand, shows how a better understanding of the spatial expression of knowledge operating at distinct scales can help lead to a more fruitful integration of local knowledge and practice with state knowledge and practice. In her article, she identifies moments of convergence, compatibility, and conflict between local and state management institutions to inform more effective cross-scale links in environmental management. A successful example of such integration is provided by [Becker and Ghimire](#) (2003) in their article on the establishment of a community-owned forest reserve in western Ecuador. They show

the important role of organizations, such as NGOs, in bridging traditional knowledge and scientific insights, and in providing social space for mobilizing a synergy between traditional knowledge and western knowledge for sustaining ecosystem services and biodiversity in a forest commons. [Milestad and Hadatsch](#) (2003) analyze the potential for organic farming in the Austrian Alps to flourish under the Common Agricultural Policy of the European Union in relation to the farmers' perspectives on sustainable agriculture, and whether or not organic farming and traditional practices are capable of building social–ecological resilience in the area.

The papers in this special feature demonstrate the value of understanding and promoting diverse cultural foundations of resource management, restoration, and ecosystem governance and the potential to be found in complementing and combining diverse knowledge systems in the management of complex adaptive social–ecological systems. They highlight the significance of accounting for the social dimension, participation, and cross-scale interplay in ecosystem management.

I am very pleased to be able to publish such a rich set of contributions in *Ecology and Society*, contributions that offer direction, potential, and hope for improved stewardship of the ecological resource base that provides the foundation for societal development, and that is shaped by cultural perceptions.

RESPONSES TO THIS ARTICLE

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