ETHNOBIOLOGY AND CONSERVATION

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Summary

The lives of indigenous and other peoples who depend heavily on their physical environments are intimately linked to the conservation of biodiversity. This chapter presents an overview of the ethnobiological research that has explored those links. We begin with a discussion of traditional ecological knowledge (TEK) and its relationships to biodiversity conservation. Local knowledge of the environment, traditional management practices, social institutions that guide resource use, and worldviews are integral and overlapping components of TEK and shape its relationships to conservation. Most TEK systems are dynamic and adaptive, and their focus on maintaining ecological processes and regeneration cycles have allowed many of them to sustain local biodiversity over long periods of time. The relationships between TEK

and conservation are also complex, as TEK is heterogeneous within and across communities and influenced by socio-economic, political and cultural factors. Today the economic dependence of many local communities on the commercial extraction of wild resources presents both opportunities and challenges for biodiversity conservation. Participatory ethnobiological approaches that more fully integrate the social and ecological sciences will help provide a better understanding of the links between the conservation of biological and cultural diversity, and of how TEK can be better integrated into conservation plans and policies.

1. Introduction

The lives of indigenous and other peoples who depend heavily on their physical environments are intimately linked to the conservation of biodiversity. Indeed, their survival depends on the long-term availability of local biodiversity to meet, or to complement, their needs for food, medicine, fuel, timber and shelter, as well as for spiritual purposes. Many indigenous and local communities today are also economically dependent on biodiversity and are involved in the harvest and sale of a diversity of plant and animal species through local, national and international markets. Given that most of the world's remaining biodiversity remains in areas inhabited by people, an understanding of the ways in which people interact with their environments and its consequences for biodiversity, is critical. Ethnobiologists have employed a variety of approaches to gain insight into these relationships, which are both complex and dynamic.

2. Traditional Ecological Knowledge (TEK)

An understanding of Traditional Ecological Knowledge (TEK) provides an important way to appreciate the relationships between cultural communities and biodiversity conservation. TEK has been defined as " a cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationships of living beings (including humans) with one another and with their environments" (Berkes 1999, p.8). It is important to emphasize that TEK is not restricted to indigenous groups, but rather extends to any cultural community that has resided in a particular location for a long period of time. In addition, many ethnobiologists prefer the term Local Ecological Knowledge (LEK) to TEK. We choose to use the term TEK here only because it has been more widely employed in the ethnobiological literature.

Berkes (1999) conceptualizes TEK as consisting of four overlapping levels. The first is local knowledge of the environment, which includes identification, taxonomy, life-histories and ecologies of plants, animals, fungi, soils, as well as knowledge of local landscapes. At the second level are resource management practices. These are based on local knowledge of the environment, but consist of sets of practices, techniques and tools for managing local ecosystems and their elements. At a third level are social institutions, which include sets of rules and regulations that guide traditional management practices. Finally, the fourth level consists of worldviews – belief systems that shape the way people perceive of, understand, and act on their environments. Turner (2000) provides a similar framework for understanding TEK, which she refers to

as Traditional Ecological Knowledge and Wisdom (TEKW). TEKW encompasses the three broad themes of: practices and strategies for resource use and sustainability; philosophy and worldview; and communication of knowledge and information.

The above-mentioned levels or themes of TEK/TEKW are interrelated and overlapping. However for the sake of simplicity, we start by addressing each separately to provide an overview of their relationships to biodiversity conservation. We then discuss the complexities involved in the relationships between TEK and conservation, highlighting the dynamic nature of TEK, its heterogeneity within and across communities and the factors that influence and shape it. We move on to address the contemporary commercial extraction of local resources by local communities and its conservation implications, and conclude with suggestions for improving our understanding of the links between biological and cultural diversity.

2.1. Local Knowledge of the Environment and Conservation

Ethnobiological studies have illustrated that the TEK held by many indigenous and long-term settlers involves a highly detailed knowledge of the local environment. The environmental knowledge held by every cultural group is unique, embodying each group's own way of perceiving, classifying, using, and living with, the flora, fauna and other elements of their physical landscape, as well as the spiritual relationships and cultural histories that bind people together and to the land. TEK is therefore necessarily place-based and intimately linked to the local biodiversity. A cultural group's local knowledge of the environment forms the basis of their traditional resource management practices, many of which have been able to sustain local biodiversity over long time periods (see Section 2.2).

TEK also can and does play an important role in contemporary conservation and restoration programs and policies. Since TEK is generated from empirical observations and experiments over many generations, it incorporates long-term observations of changing environmental and other conditions, and of their consequences on local ecosystems. Therefore, many TEK systems include complex knowledge of ecological processes and of interrelationships among different parts of ecosystems. This type of knowledge can provide important insight into long-term impacts of human activities on the environment. For example, TEK can – and has –shed light on the potential cascading effects of overexploitation of specific animals or plants on other members of the ecosystem, and on the cascading effects of damns, river diversions, or other types of manipulation of ecosystem processes. Similarly, due to its diachronic nature, TEK today provides key insight into how changes in global warming are altering the timing and nature of seasonal patterns and processes and the impacts of this on local plants and animals, and their interactions with each other and over the landscape.

TEK also provides key biological and ecological information on species for which little scientific information is available. In some cases this information may be critical for conserving threatened or endangered species. For example, Nabhan (2000) illustrated how traditional knowledge of interspecific relationships (such as plant-pollinator or larva-host plant relationships) is encoded in O'Odham and Comcáac names for local flora and fauna. Given that some of these species are threatened or endangered today

and little scientific information is available about them, TEK provides key knowledge for conservation and restoration research and initiatives.

While some traditional knowledge is encoded in language, other forms of TEK cannot be so easily understood or extracted from the social and cultural context in which they exist. Much TEK is encoded in stories, songs, dances, prayers, ceremonies, celebrations and other rituals. The transmission and conservation of this knowledge is therefore dependent on the persistence of indigenous languages and these cultural practices. In these ways the conservation of cultural and biological diversity are fundamentally linked.

2.2. Traditional Resource Management Practices

Traditional resource management (TRM) includes the diversity of practices that people employ to manage their local resources. In the past many small-scale human communities depended on the resources that were available to them within a relatively small radius, and there was therefore strong impetus to develop systems that allowed for the maintenance of local biodiversity. These management systems developed through adaptive processes and relied on the ability of resource users or managers to understand environmental feedback and modify practices accordingly. Some ethnobiologists have suggested that resource crises have been important in the development of TEK systems as they force social learning and therefore allow for renewal and adaptation of management institutions (see Section 3.1). Many of the traditional management systems that survive today have stood the test of time and provide important models for sustainable resource use. In addition, they continue to adapt to changing circumstances in the present (see Section 3.0).

To appreciate the links between TRM and conservation, an understanding of the nature and diversity of TRM practices is necessary. Ethnobiological studies have illustrated that traditional management systems are highly complex and involve the manipulation of local resources in many different ways and at differing ecological, spatial and temporal scales. For example, TRM may involve the manipulation of individuals, populations, ecological communities and landscapes. Culturally important species can be managed in numerous ways to expand distributions, augment populations, increase productivity, or to maintain populations in more accessible areas. Practices that achieve this include enhancement (such as transplanting individuals to areas where they have better chances of survival and sowing of propagules) as well as protection and encouragement (such as weeding competing species, pruning, digging soil around the roots, coppicing, adding fertilizer and opening forest canopy to let in more light). People also often transplant individuals, or propagules, from one location to another. The multiple ways in which people manage wild resources means that there is often no real divide between wild and domesticated species, but rather a long continuum between these extremes.

TRM emphasizes the manipulation of regeneration cycles and ecological processes, such as succession (Alcorn 1988). For example, ecological communities and landscapes are often managed through the use of temporary small-scale clearings (in the case of forest communities) and through the use of controlled fires. Although traditional

shifting agriculture methods are enormously variable, the practice generally involves clearing pieces of land (through cutting and often burning vegetation), planting, and then leaving the land to regenerate. In the process of clearing however, some desirable species (such as wild fruit trees or timber trees) may be spared or tolerated. During the process of regeneration, community structure is often manipulated so as to increase populations of culturally important species, including the preferred food species for favored game animals that then frequent the fallows.

Fire has been an important tool used by indigenous communities across the world. Depending on the context, fire is often used to promote the regeneration of successional habitats that support important wild resources for humans, including food plants for humans and/or preferred game animals; to destroy or prevent pest outbreaks; to open up corridors for hunting; and to reduce fuel loads and prevent larger wildfires. Low and controlled fires in forest understory are often used to maintain open forest understories so as to increase movement of animals for hunting, control weedy species and increase vision for hunting, among other things.

Traditional resource management practices also tend to be based on the recognition of the interconnectedness of different habitats and of all members of the ecosystem, including human communities. For example, many traditional agroecological practices involve the combined production of both plants and animals, including fish, and the integrated management of a diversity of vegetational zones that overlap in space and time, such as homegardens, agricultural fields and fallows of differing ages, agroforestry systems and adjoining and interspersed wild areas including forests, lakes, grasslands and swamps. In the Pacific Islands, management of land and ocean resources is/was based on an understanding of their interconnectedness. For example, in Hawai‘i, resource management was based on the concept of *ahupua’a* - land units (sometimes coinciding with watersheds), that extended from the mountain tops to the ocean reef and included human communities. *Ahupua’a* management was based on recognition of the interconnections between processes and activities in the montane forests, the midlevel agroforestry systems, lowland agricultural patches, fresh water streams and fishponds.

The designation of sacred areas or sacred species in many TRM practices is another way in which the interconnectedness of habitats and of organisms is recognized and managed. Sacred groves exist in a diversity of cultures and regions worldwide and involve designated areas or biological communities where human use is prohibited or restricted. These groves or patches, which may be forest, ponds, meadows, or pools along a stream, exist within a larger matrix of human use. Similarly, some TRM practices include total bans on the use of particular species which provide food and shelter for a wide variety of other species (see Section 2.3.1).

2.2.1. TRM and Conservation

The diverse ways in which landscapes are manipulated under TRM has important consequences for biodiversity conservation. Gadgil et al. (1993) and Berkes (1999) provide examples across the world of the ways in which traditional practices can foster conservation. For example, shifting agricultural practices, agroecological systems, the

use of fire as management, and the practice of rotational harvesting, which includes grazing lands and hunting and fishing grounds, all lead to increased patchiness and heterogeneity at the landscape scale. The new habitats that these practices generate over both space and time support a wider diversity of species and can therefore increase biodiversity at the landscape level.

At the level of populations and communities, sacred groves can act as important refugia, ensuring total protection of plants and animals that are otherwise harvested or hunted. They can also provide a source of regeneration for those outside populations subject to human exploitation. Prohibitions on the use of keystone species, such as *Ficus spp*., not only ensure conservation of the species, but of the long-term survival of the diversity of the other species that depend on them. The practices of enhancement and protection of culturally important species described above can also lead to changes in community structure and composition.

Management of the regeneration processes in agricultural fallows through sparing and planting, including planting of species that are introduced from outside of their natural ranges, can also lead to an increased diversity of plants in these regenerating habitats. In addition, the large diversity of crop and cultivars, typically planted in homegardens and traditional agricultural fields, supports a high diversity other organisms, including pollinators, dispersers, herbivores, frugivores, pests, pathogens and decomposers.

At the level of genes, the process of selection for certain characteristics over time in both domesticated and wild-harvested species has led to an enormous increase the genetic diversity of culturally important species. In addition, the practice of growing crops near wild and weedy relatives in agroecosystems can increase the genetic diversity of those plants. Consequently, the enormous agricultural diversity created and maintained by humans as security against unpredictable environmental conditions and to meet cultural and dietary needs and preferences, has direct implications for biodiversity conservation.

It is important to recognize that not all TRM practices foster biodiversity conservation; here we have illustrated common aspects of those that do. It is also important to emphasize that the ecological and conservation outcomes of TRM are not necessarily explicitly recognized by all those who carry out these practices. While those with specialist knowledge may indeed explain the ecological and/or spiritual rational for these practices (which often cannot be separated, see Section 2.4), for many others, TRM practices are often what Alcorn (1989, p.65) has called scripts. As part of TEK, these scripts are derived from experiences and experiments and passed down through the generations - and are carried out as a series of routine steps. This means that understanding the role that TRM has and continues to play in biodiversity conservation and its potential for incorporation into Western conservation strategies, is not obvious or easy to understand by outsiders. As Alcorn (1989, p.75) observes, “the traditional knowledge base of an alien culture is not available for empirical perception; it is not visible, not self-evident, no readily elicited by questioning informants”. This emphasizes the importance of in-depth and participatory ethnobiological ethnographic research that encompasses long-term field studies, includes large and diversified samples of participants, and uses multiple methodologies.

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Bibliography

Alcorn, J. (1989). Process as resource: the traditional agricultural ideology of Bora and Huastec resource management and its implications for research. Pages 63-77 in Posey, D.A. and W. Balee (eds), *Resource Management in Amazonia: Indigenous and Folk Strategies*. The New York Botanical Garden. Bronx, New York. [A comparative discussion on indigenous agricultural knowledge arguing that farmers follow particular "scripts" that evolve over time from experiences and experiments]

Altieri, M., L. Merrick, and M. K. Anderson. (1987). Peasant agriculture and the conservation of crop and wild plant resources. *Conservation Biology* 1:49- 53. [An overview of how traditional agricultural practices can foster conservation]

Berkes, F. (1999). *Sacred Ecology: Traditional Ecological Knowledge and Resource Management*. Taylor & Francis, Philadelphia, PA. [A comprehensive discussion of traditional ecological knowledge and resource management including definitions of terms, examples from across the globe and presentation of case studies]

Berkes F, Johan Colding, and Carl Folke. (2003). Introduction. Pages 1-29 in Berkes, F., J. Colding, and C. Folke (eds.), *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*. Cambridge: Cambridge University Press. [A broad edited interdisciplinary volume addressing linked socio-ecosystems and their resilience to disturbance]

Cunningham A.B. (2001). *Applied Ethnobotany: People, Wild Plant Use and Conservation*. 300 pp. London: Earthscan Publications. [An important methods resource that details interdisciplinary approaches and field methods to assessing pressures on wild plant resources and ensuring their conservation and continued availability]

Colding, J. and C. Folke (2001). Social Taboos: "invisible systems of local resource management and biological conservation. *Ecological Applications* 11(2): 584-600. [A discussion of social taboos and their relevance to conservation]

Dwyer, P.D. (1994). Modern conservation and indigenous peoples: in search of wisdom. *Pacific Conservation Biology* 1: 91-97. A discussion of how resource management systems of indigenous people often have outcomes that are analogous to those desired by Western conservationists but that differ in context, motive and conceptual underpinnings]

Gadgil M., Berkes F, and C. Folke (1993). Indigenous knowledge for biodiversity conservation. *Ambio* 22(2-3): 151-6. [Drawing from examples from across the globe, this article presents an overview of how indigenous knowledge can support biodiversity conservation]

Kusters, K., R. Achdiawan, B. Belcher, and M. Ruiz Pérez (2006). Balancing development and conservation? An assessment of livelihood and environmental outcomes of nontimber forest product trade in Asia, Africa, and Latin America. *Ecology and Society* 11(2): 20. [online] URL: http://www.ecologyandsociety.org/vol11/iss2/art20. [This article addresses to what extent and under which conditions nontimber forest product (NTFP) trade leads to both livelihood improvement and forest conservation]

Nabhan, G. P. (2000). Interspecific relationships affecting endangered species recognized by O'odham and Comcaac cultures. *Ecological Applications* 10 (5): 1288-1295. [Discussion of indigenous knowledge of interspecific relations and its value to conservation of endangered species]

Posey D.A. (2001). Biological and Cultural Diversity: The Inextricable, Linked by Language and Politics. Pages 379-96, Maffi, L. (ed.), *On Biocultural Diversity: Linking Language, Knowledge, and the Environment*. Washington D.C.: Smithsonian Press. [A broad discussion of cultural factors common across multiple indigenous peoples and how to create equitable partnerships that ensure the rights of indigenous peoples]

Redford, K. and A. Stearman (1993). Forest-dwelling native Amazonians and the conservation of biodiversity: interests in common or collision? *Conservation Biology* 7(2): 248-255. [A discussion of the differing conservation motivations of indigenous peoples and conservation biologists]

Salick, J., N. Cellinese, & S. Knapp, (1997). Indigenous diversity of cassava: generation, maintenance, use and loss among the Amuesha, Peruvian Upper Amazon. *Economic Botany* 51: 6-19. [A case-study of the ways in which the diversity of varieties of a culturally important crop is generated, maintained and lost]

Spoon, J. (2008). Tourism in a Sacred Landscape: Political Economy and Sherpa Ecological Knowledge in Beyul Khumbu/Sagarmatha National Park, Nepal. PhD Dissertation, Department of Anthropology, University of Hawai‘i at Manoa. [This dissertation discusses how political and economic forces are influencing local ecological knowledge inside a protected area]

Stepp, J.R. and D. Moerman. (2001). The importance of weeds in ethnopharmacology, *Journal of Ethnopharmacology* (75): 19-23. [A comparative study illustrating that the use of weeds in indigenous pharmacopeias is much higher than would be predicted by their frequency of occurrence]

Ticktin, T. (2004). The ecological consequences of NTFP harvest. *Journal of Applied Ecology* 41 (1): 11-21. [A review of how non-timber forest product harvesting can affect ecological processes at many levels, from individuals and populations to communities and ecosystems].

Turner, N.J, Boelshcer Ignace, M. and R. Ignace (2000). Traditional ecological knowledge and wisdom of aboriginal people in British Columbia. *Ecological Applications* 10 (5): 1275-1287. [A discussion of how traditional ecological knowledge and practices can foster conservation, including a definition of traditional ecological knowledge and wisdom and case-studies from British Columbia]

Biographical Sketches

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Tamara Ticktin is an Associate Professor of Botany at the University of Hawai’i at Manoa. She received her PhD in Plant Science from McGill University in 2000. As an ethnoecologist and conservation biologist, her research centers on the relationships between human communities and biological conservation. Specifically, much of her work focuses on assessing the ecological impacts of local and indigenous resource management practices and their implications for biocultural conservation. She has carried out collaborative research in parts of Latin America, Asia, Africa and Hawai'i.