The Tangled Web of People, Landscapes, and Protected Areas

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Introduction

For millennia, people have set aside land to protect flora and fauna. Utilitarian purposes, such as protecting forests for hunting, harvesting products, and grazing elephants used in battle, motivated protection in some places (Kautilya 1992). Cultural, spiritual, and religious sensibilities motivated protection as well—for example, sacred groves, which still persist in many parts of the world (Bhagwat and Rutte 2006).

Modern-day conservation has a similar variety of motivations for protecting land from human exploitation. Yellowstone National Park, the first officially recognized protected area in the world, was designated in 1872 and “set apart as a public park or pleasuring-ground for the benefit and enjoyment of people.”1 Subsequently, protected areas have been justified on the basis of protecting watersheds, providing habitat for iconic species, conserving natural resources, promoting tourism, and safeguarding the intrinsic value of nature, as well as scenic beauty and recreation (Watson et al. 2014).

Globally, terrestrial protected areas currently are a substantial land use. Approximately 14% of the land surface was under some form of protection in 2014 (Deguignet et al. 2014). Levels of protection range from strict restrictions barring human use to provisions for sustainable use of natural resources (see Dudley [2008] for definitions of the International Union for the Conservation of Nature [IUCN] categories). The extent and number of

1. Forty-Second Congress of the United States of America, Transcript of Act Establishing Yellowstone National Park (1872), National Archives and Records Administration, Washington, DC.
protected areas increased rapidly since 1970, particularly in the period between 1970 and 1995, with globalization and priorities of conservation organizations driven by rapid land-use change and habitat fragmentation (Zimmerer, Galt, and Buck 2004; West, Igoe, and Brockington 2006) (fig. 11.1). Coverage is unevenly distributed, with relatively high proportions of land under protection in the Americas and eastern and southern Africa and low proportions in South Asia and North Eurasia (see table 1 in West, Igoe, and Brockington [2006]). The average size of newly declared protected areas has decreased markedly over the last few decades, which has expanded the interface between protected and nonprotected areas even faster than the expansion of the area under protection (Naughton-Treves, Holland, and Brandon 2005; Palomo et al. 2014).

11.1. The coverage of terrestrial protected areas (A) before 1970 and (B) in 2014. Data from the World Database on Protected Areas (Deguignet et al. 2014).
Although the area under protection has increased, the current network of protected areas is inadequate to conserve biodiversity in the face of continuing habitat fragmentation and climate change. Gap analyses of ranges of threatened species indicate that regions with high levels of endemism are particularly in need of additional protection to preserve habitat for threatened species (Rodrigues et al. 2004; Pouzols et al. 2014; Jenkins et al. 2015). Moreover, downgrading, downsizing, and degazettement (removal from protected status) of protected areas is eroding the area under protected status (Mascia et al. 2014).

Despite inadequate coverage to protect threatened species, protected areas remain the primary tool for conservation of biodiversity. Other, more recent instruments for conserving biodiversity include payments for ecosystem services, decentralized management, and forest certification schemes. The evidence base for assessing the effectiveness of these recent instruments is weak (Miteva, Pattanayak, and Ferraro 2012; Naeem et al. 2015). Many studies point toward the general effectiveness of protected areas for reducing deforestation, even accounting for remoteness and other covariates and potential spillover effects that could displace deforestation outside protected areas (e.g., Andam et al. 2008; Joppa, Loarie, and Pimm 2008; Gaveau et al. 2009; Sims 2010; Ferraro and Hanauer 2011). Fires within protected areas are also generally fewer than in nonprotected areas (Nelson and Chomwitz 2011). On the other hand, there is a major shortfall in the effectiveness of the management of protected areas (Leverington et al. 2010; Watson et al. 2014), and there is little evidence to assess the effectiveness of protected areas in improving socioeconomic conditions (Andam et al. 2010; Miteva, Pattanayak, and Ferraro 2012).

The extensive area of land currently under protection is remarkable considering the intense demands to produce food and fiber for the world’s growing and increasingly affluent population. Agriculture, the land use with the most direct relevance for civilization’s survival, covers almost 50% of the land surface (Foley et al. 2005), and protected areas are the second-most extensive land use. As is the case with any land use, particularly one that has expanded as rapidly as protected areas, competing objectives from different stakeholders lead to conflicts and involve trade-offs (DeFries, Foley, and Asner 2004). For example, local populations living in and around protected areas understandably prioritize their livelihood needs for land and forest products over the conservation agenda enforced by local managers and promoted by scientists based in faraway places.

Like other places where people use land—whether croplands, pastures, or cities—protected areas are inherently social-ecological systems (also
known as coupled human-natural systems, human ecological systems, or human-environment systems) (Turner et al. 2003). Social-ecological systems are complex, dynamic, integrated systems in which humans and nature interact, and are characterized by feedbacks and nonlinearities (Berkes, Folke, and Colding 2000). For example, people living in protected areas are coupled with ecological systems through reliance on biological resources such as wood, medicines, and wild foods. Feedbacks occur when human use alters the ecological conditions that provide the resource, which in turn alters the availability of the resource and affects social systems. Managers, political leaders, local communities, flora, fauna, nutrients, water, and soil are all parts of a holistic whole in the conceptualization of protected areas as social-ecological systems (Cumming et al. 2015).

This chapter traces the evolution of approaches toward studying and managing protected areas as social-ecological systems, followed by examination of social-ecological processes operating at multiple spatial scales: inside protected areas, surrounding protected areas, and in the larger landscape encompassing protected area networks. Processes at all these scales are influenced by national- and global-scale dynamics that set priorities and allocate financial resources. The chapter concludes with next steps in the evolution of managing protected areas to account for the reality that protected areas are embedded within larger socio-ecological settings. The focus is on protected areas in the Global South where high biodiversity and rapid land-use change currently converge, creating a priority for conservation.

The Evolution of Managing Protected Areas as Social-Ecological Systems

Most protected areas today have people residing within their administrative boundaries; for example, 85% of protected areas in Latin America are inhabited (Colchester 2004). Millions more live on the fringes of protected areas. High-biodiversity areas with conservation priority generally overlap in space with rural, poor, and often indigenous populations in the tropics whose livelihoods depend on local ecosystems. This intersection exacerbates the complexities and ethical dimensions of establishing and managing protected areas.

Protected areas have not always been recognized as social-ecological systems. The original conception of Yellowstone in the 1830s by the painter George Catlin was as a “nation’s park” set aside to preserve wilderness including Native Americans. When the establishment of Yellowstone was
put into law about 40 years later, Native Americans were excluded (Nash 1970; Colchester 2004). The exclusionary “fortress” model of conservation, based on the premise that nature can only be preserved if devoid of people, spread to other places around the world. The number of people who have subsequently been displaced by protected areas, or “conservation refugees,” is unknown. Estimates include 600,000 tribal people displaced by protected areas in India (Nash 1970) and between 1 and 16 million on the continent of Africa (Geisler and De Sousa 2001). Even less is known about the impacts of displacement on their well-being, although many historical examples exist about denial of rights to land and natural resources and criminalization of traditional land-use practices (see West, Igoe, and Brockington [2006] and Brockington and Igoe [2006] for a summary of this literature).

By the 1970s, as the area under protection began its upward trend, the view of protected areas as scenic treasures had evolved to encompass their value for conserving biodiversity. The rights of indigenous and other people living in parks were not yet high on the agenda (Watson et al. 2014). By the 1980s, with increasing contact between protected areas and local people, the international conservation community recognized that conservation needed to encompass the realities of people in and around protected areas. Two rationales justified this view: ethical considerations that hardly need an explanation and the realization that conservation cannot be effective without local resource-users whose actions affect biodiversity on a daily basis. In other words, protected areas were increasingly recognized as socio-ecological systems, although this terminology may not have been used explicitly. In 1982, consensus at the World Parks Congress in Bali was that “protected areas in developing countries will survive only insofar as they address human concerns.” (Naughton-Treves, Holland, and Brandon 2005).

Management to reconcile the well-being of local populations and conservation met with mixed success. With the trend toward decentralized rather than top-down management (Ostrom 2008), considerable investments from conservation organizations and international development agencies were directed toward projects under various terms including integrated conservation and development projects (ICDPs), community-based management, and eco-development. While generalizations are difficult based on anecdotal case studies, a body of studies indicates widespread underachievement from ICDPs (Wells and McShane 2004; Palomo et al. 2014). Reported problems with ICDPs relate more to the implementation than the principle of managing protected areas to benefit both local popu-
lations and conservation. Contributing factors for the disappointing results include naive assumptions that local communities share the same values as the conservation agenda, rapid implementation that cannot sufficiently address the deep complexities of socio-ecological systems, and unrealistic expectations that significant benefits could be accrued from protected areas and equitably shared. Lack of clarity of objectives and real conflicts between aspirations of local people and conservation plagued the laudable push to account for local people’s needs in conservation (Brown 2002; Adams et al. 2004). Moreover, external, powerful interests such as mines, dams, and roads, which were out of the control of protected area managers, could have impacts on biodiversity at least as great as local communities.

By the turn of the millennium, myths of widespread win-win solutions fell by the wayside, with the possible exception of ecotourism that potentially benefits local people if opportunities are available for them to participate. From the conservation perspective, attention shifted toward corridors and networks to connect protected areas and foster movements of organisms between them (Palomo et al. 2014). From the social perspective, rights for indigenous peoples were codified into international law (Colchester 2004).

Recent attention has turned toward the role of protected areas in maintaining ecosystem services such as food provisioning for people living in local proximity, watershed protection for people downstream, and carbon sequestration with global benefits (Watson et al. 2014). With questions unresolved about how to balance the often-competing goals of local populations and conservation, some researchers have examined the role of protected areas in poverty alleviation (see section below on socio-ecological interactions surrounding protected areas).

This brief recount of the evolution of trends in conservation reveals the unavoidable realities that protected areas are embedded within socio-ecological systems, involve multiple stakeholders, and bring to the fore differing values about which land uses are in the best interest of society. Future management will continue to grapple with these difficult problems for which there is no single or “right” answer.

**Inside to Outside: Socio-ecological Dynamics of Protected Areas at Different Scales**

As protected area management incorporates socio-ecological systems, it is useful to consider these dynamics according to varying spatial scales. These dynamics and their management implications differ across scales: inside
the boundaries of protected areas, surroundings in proximity to protected areas, and the larger landscape that encompasses networks of protected areas (fig. 11.2, table 11.1). All of these dynamics are influenced by national- and global-scale processes that trickle through to finer scales.

Socio-ecological Dynamics within Protected Areas

People are part of ecosystems in a variety of ways. Between 50% and 100% of stricter protected areas in South America and Asia have people using or living within them (Brockington et al. 2006). Traditional lifestyles of people living in protected areas include hunting, foraging, collecting plants for medicines and other uses, and setting fire. While an overly romantic view considers these uses to be part of “nature” and undamaging to biodiversity, an equally unsupported view is that these uses necessarily cause damage. In some cases, such as in the Amazon, indigenous reserves play a major role in preserving forest and halting deforestation (Nepstad et al. 2006). In other cases, unsustainable human use undoubtedly has a negative impact on biodiversity. Mines and timber extraction within protected areas, either legal or illegal, can also have a major impact for conservation (Rangarajan and Shahabuddin 2006).

As noted above, an undetermined but large number of people have
been relocated from protected areas in the presumed interest of conservation. Enforcement and new legislation suggest that millions more face relocation in the future (Brockington and Igoe 2006; Brockington, Igoe, and Schmidt-Soltau 2006). Relocation of people living within protected areas is among the most sensitive topics for conservationists. The effectiveness of relocation for conservation in any particular place depends on whether people are damaging, beneficial, or neutral for promoting biodiversity. The answer to this question is likely to be context specific, that is, dependent on population density, the extent to which local people use resources from the protected area, and ecological conditions that affect regeneration.

Evidence is scanty to assess either the benefit to biodiversity or the well-being of people following relocation (Brockington and Igoe 2006; Brockington, Igoe, and Schmidt-Soltau 2006). Some evidence suggests that relocation can improve access to health care, transportation, electricity, jobs, and overall quality of life (e.g., Karanth 2007). Other evidence indicates loss of culture, poor nutrition, and violation of human rights (e.g., Colchester 2004). The outcomes are likely to depend on the context-dependent details of how managers implement relocation schemes, conditions where people relocate, and myriad other details that are difficult to unravel to decipher generalizations.

With the blatant injustices of the past now recognized, research on the effectiveness of relocation schemes for biodiversity and the well-being

<table>
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<td>Human-wildlife conflict; collection of fuelwood and NTFPs by local communities; livestock grazing; impacts from ICDPs</td>
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Note: NTFP = nontimber forest product. ICDP = integrated conservation and development project. Outcomes at all three scales are influenced by national and global processes (such as climate change), national policies for conservation and other sectors that affect habitats (such as highway development), and shifting priorities of international NGOs.
of relocated people is urgently needed to guide future decisions and approaches that balance the trade-offs.

**Socio-ecological Dynamics Surrounding Protected Areas**

A number of socio-ecological processes affect biodiversity and resources for people in and around protected areas. Such processes include migrations of organisms beyond protected area boundaries, hydrological flows, transport of air and water pollution, disease, and fire (Hansen and DeFries 2007). In the 1970s, recognition of these processes led to the concept of biosphere reserves that establish gradients of decreasing human use to buffer protected areas (Palomo et al. 2014). More recently, zones of interaction or park-centered ecosystems have been defined to delineate those areas with strongest interaction with protected areas based on ecological principles (DeFries, Karanth, and Pareeth 2010; Hansen et al. 2011).

People living in surroundings of protected areas influence dynamics inside protected areas. Surrounding communities may graze livestock, hunt bushmeat, and collect timber and other products from within the boundaries of many protected areas. These uses contribute to food security and income (Food and Agriculture Organization 2014). For example, greater access to bushmeat is associated with higher protein in children’s diets in Madagascar (Golden et al. 2011) and reduced stunting in central Africa (Fa et al. 2015). People in the surroundings can also encroach into protected areas to expand cropland, pasture, or tree plantations (e.g., Curran et al. 2004).

Conversely, dynamics within protected areas influence people living in their surroundings. The ability of local people to gain food, income, and livelihood needs from functional ecosystems in protected areas is positive for people. On the negative side, livestock predation and crop raiding by wildlife roaming beyond protected area boundaries is a major hardship for farmers and herders nearby and can lead to retaliatory killing of wildlife (Barua, Bhagwat, and Jadhav 2013). Tourism, which becomes more prevalent as people have discretionary income, is a double-edged sword. On one hand, it can create economic opportunities for local people and contribute to support for conservation as visitors have opportunities to appreciate nature. On the other hand, extensive land-use changes and infrastructure associated with tourism can sever connectivity and usurp land from agriculture (Karanth and DeFries 2011; Karanth et al. 2012).

The impacts of protected areas on poverty alleviation for local populations on the fringes of protected areas are particularly relevant as economic
aspirations and the need to conserve biodiversity grow in tandem throughout the developing world. The outcome is unclear and the evidence base is weak to draw general conclusions. Protected areas could exacerbate poverty traps by forgoing options for agricultural development and exploitation of natural resources. Or protected areas could alleviate poverty by providing employment opportunities from tourism and improved connectivity through roads and other infrastructure that provide access to markets, health care, and education.

The dual goals of poverty alleviation and conservation can create a mismatch of objectives, the former to alter the system to a new state away from poverty traps and the latter to maintain the system to conserve biodiversity (Barrett, Travis, and Dasgupta 2011). In Costa Rica and Thailand, two relatively economically advanced countries, people living around parks are poorer than the national average, but the net impact of protected areas has been alleviation of poverty (Andam et al. 2010). Benefits to poverty alleviation did not overlap in space with benefits for conservation at a fine scale (Ferraro, Hanauer, and Sims 2011), suggesting that win-win options are not in play. Two-thirds of the poverty alleviation in Costa Rica is attributable to tourism (Ferraro and Hanauer 2014). Other empirical studies indicate that the impact of protected areas is context specific (see the papers in a special feature on biodiversity conservation and poverty traps in Barrett, Travis, and Dasgupta [2011]). Clearly, considerable research is required to develop general principles about conditions that lead to poverty alleviation or exacerbation for people living around protected areas.

Socio-ecological dynamics surrounding protected areas imply responsibilities for management beyond those pertaining to the ecological system within protected area boundaries. Managers need to address damages of human-wildlife conflict through compensation and other measures, establish communication with sometimes hostile communities, control tourism, and consider the repercussion of their actions for poverty alleviation. These responsibilities often are not congruent with the training and background of managers of protected areas.

**Socio-ecological Dynamics at the Landscape Level**

As early as the First World Conference on National Parks in Seattle in 1962, it was clear that protected areas cannot be big enough to capture large-scale ecological dynamics such as the flows of water, air, and nutrients; migrations of large-ranging species; and large-scale atmospheric processes affecting climate. The influential Leopold Report to the US Secretary of
the Interior noted that “few of the world’s parks are large enough to be in fact self-regulatory ecological units; rather, most are ecological islands subject to direct and indirect modification by activities and conditions in the surrounding area” (Leopold et al. 1963). Similarly, protected areas are not isolated from social and economic forces shaped by processes in the larger landscape. Such processes include economic activity in urban areas that drives tourism, downstream demand for ecosystem services such as watershed protection, and demographic changes in the structure of human populations.

The landscape level encompasses multiple protected areas that form networks, with processes in protected areas dependent on other protected areas in the network and on the landscapes between them. Networks and corridors are well-established approaches to address conservation needs for connectivity across the landscape. For example, the Mesoamerican Corridor was established by central American countries and Mexico in the late 1990s to create a land bridge between North and South America (Granida 2007). Corridors can also have negative consequences—for example, by enabling disease to spread between protected areas (Altizer, Bartel, and Han 2011). From a socio-ecological perspective, corridors traverse nonprotected landscapes and interface with local populations, raising questions about how human-wildlife conflicts can be minimized along corridors, who decides land-use priorities for the landscape, and how to balance conservation and development goals (Altizer, Bartel, and Han 2011).

A landscape approach aims to balance multiple social, economic, and environmental objectives where land uses compete. Such approaches differ from management of individual protected areas by accounting for needs for biological connectivity, economic connectivity (e.g., roads), watershed integrity, and other processes that operate at the landscape level. Although a developing area of research, principles for a landscape approach include adaptive management, multifunctionality, participatory monitoring, and recognition of multiple stakeholders with clear rights and responsibilities (Sayer et al. 2013).

With acceleration of economic growth and the much-needed expansion of roads and other infrastructure (Laurance and Balmford 2013), the need to view protected areas as embedded within larger landscapes becomes increasingly pertinent. Protected area managers have little authority over decisions in the larger landscape. The mismatches in spatial and temporal scales between ecological and governance processes calls for new ways to make decisions about balancing competing interests (Cumming et al. 2015).
Policies and priorities set at national and global scales influence the dynamics that occur at finer scales. From an ecological perspective, anthropogenic climate change caused by emissions of greenhouse gases far from a particular protected area or landscape can have major repercussions on the ability to maintain suitable habitats (Hannah et al. 2007). From a social perspective, national priorities that allocate resources for enforcement, management, and compensation influence effectiveness of protected areas to conserve biodiversity (Bruner et al. 2001), and distal market forces, or “teleconnections,” lead to habitat conversion to produce goods consumed far from the location of production (Liu et al. 2013). At the global level, priorities of international donors, nongovernmental organizations (NGOs), and multilateral treaties determine, through funding decisions, where conservation occurs, which species receive conservation attention, and how impacts on local communities are addressed. The international Convention on Biological Diversity, for example, sets the target for protection at 17% of land area by 2020 and requires national action plans (Secretariat of the Convention on Biological Diversity 2014).

These national- and global-scale processes trickle down to influence socioeconomic dynamics at all scales: namely, within protected areas (e.g., through resources allocated to conservation of a particular species or to relocation of people), within local surroundings (e.g., by shifting attention to local communities and poverty alleviation as described above), and within larger landscapes (e.g., through other sectors such as water, energy, and transport that alter habitats and connectivity outside protected areas).

These socio-ecological dynamics operating at multiple scales shape both conservation outcomes and human well-being, as illustrated in the example of the central Indian highlands (box 11.1). Research is emerging that integrates social and ecological dimensions in conservation science—for example, by studying China’s Wolong Nature Reserve as an integrated system that provides both giant panda habitat and economic benefits from ecotourism (Liu et al. 2007; He et al. 2008). Such research will become increasingly important to manage protected areas as socio-ecological systems.

**Beyond the Boundaries: New Frontiers for Protected Areas**

The history of protected areas shows that they cannot be isolated from their social-ecological setting. Whether people in and around protected areas are a net positive or net negative for conservation, and whether protected ar-
Box 11.1 Socio-ecological Dynamics in Conservation Landscapes of the Central Indian Highlands

India is a megadiverse country that holds remaining populations of endangered, iconic species such as tigers (*Panthera tigris*) (fig. 11.3) and Asian elephants (*Elephas maximus*). With a human population over 1.2 billion, of which 70% is rural and dependent on local resources for their livelihoods, humans coexist at high densities with wildlife. A long history of sacred spaces and cultures that revere wildlife makes conservation a deep-rooted value. Currently, approximately 5% of the land area is under protected status.

The central Indian highlands (fig. 11.4) exemplify the linkages between social and ecological dynamics at the various scales discussed in this chapter. This landscape lies at the heart of the country and is a “global priority landscape for tiger conservation” (Sanderson et al. 2006). The landscape contains many small protected areas, ranging in size from less than 100 to slightly over 2,000 ha. The matrix between the protected areas includes rice paddies and small agricultural fields. Forest cover, which generally remains only in hillier parts of the landscape, provides connectivity between some of the protected areas (Dutta et al. 2015). The landscape is also home to several tribal and

11.3. A tigress in Tadoba Tiger Reserve. Photo courtesy of Jit Bajpai.
indigenous groups and other rural populations that rely on forests for fuelwood, forest grazing, nontimber forest products, and other livelihood needs.

As in many protected areas, people in the central Indian highlands have lived for centuries within the boundaries of what are now designated as protected areas. Many people and villages are currently relocating outside protected areas through government schemes (Read 2015). In surroundings of protected areas, Joint Forest Management has been in place for several decades with the aim of decentralizing management of resources (Agarwala 2014). Recently, the growth of wildlife-related tourism has led to rapid expansion of resorts and associated infrastructure surrounding protected areas (Karanth and DeFries 2011). At the landscape level, rapid expansion of transport networks and other infrastructure to meet development needs threatens to sever connectivity critical for the genetic viability of large mammals as they move between small protected areas (Sharma et al. 2012).

These intensifying socio-ecological dynamics that are occurring over a range of scales illustrate the critical need to incorporate social-ecological factors in conservation and protected area management. These needs include ensuring the well-being of relocated peoples, managing tourism to benefit local communities without harming sur-
eas are a net positive or net negative for people, depends on the specific context and stakeholder. Generalizations are not possible based on limited evidence from case studies about such questions as the impact of relocations on biodiversity and people’s well-being, and under what conditions protected areas alleviate or exacerbate poverty. These questions are fruitful areas for research.

Three mismatches stand in the way of incorporating socio-ecological systems within protected area management: objectives, spatial scale, and governance. First, the objectives for protected areas have evolved over the decades from a single focus on scenery and recreation to multiple foci, including protection of ecosystems services and development benefits for local communities. The changing objectives for conservation have paralleled emerging evidence that apparently “pristine” landscapes have actually been shaped by long-term use by people, such as indigenous cultivation in the Amazon (Fairhead and Leach 1998; Posey and Balick 2006). While the ethical and practical needs to merge conservation and development agendas are frequently discussed, reality often divides these two objectives into distinct camps. Approaches to conservation need to recognize that human aspirations and economic advancement are critical to society. Conservation will have limited success if the objective is to trump broader societal goals. Conversely, development at all costs too often overlooks possibilities to incorporate conservation goals.

For the second mismatch, protected areas are managed according to the spatial footprint of their administrative boundaries. In reality, socio-ecological processes link protected areas to their surroundings and to the larger landscape. Management of protected areas needs to foresee the processes operating at these larger scales and to integrate them into management. For example, growth in domestic tourism with urbanization and
economic growth is an outcome of forces beyond the boundaries of reserves but requires management attention in protected areas.

Governance is a third and related mismatch. Socio-ecological processes in the larger landscape affect protected areas, but protected area managers have no control over land-use decisions in the larger landscape. New ways to govern at the landscape level are needed to account for competing objectives among multiple stakeholders.

As with all human endeavors, conservation and protected area management are evolving processes. Approaches that account for socio-ecological processes within protected areas, in their surroundings, and in larger networks of protected areas will only become more relevant for conservation success as aspirations for economic growth and rights of all peoples are realized around the world.

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Literature Cited


