INTERNATIONAL

# Journal of Wilderness

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- Wilderness Ecosystem Services
- Economics of Wilderness in Europe
- Mexican Biodiversity Conservation Model
- Europe, Mexico, Oman, Congo

DECEMBER 2012 VOLUME 18, NUMBER 3

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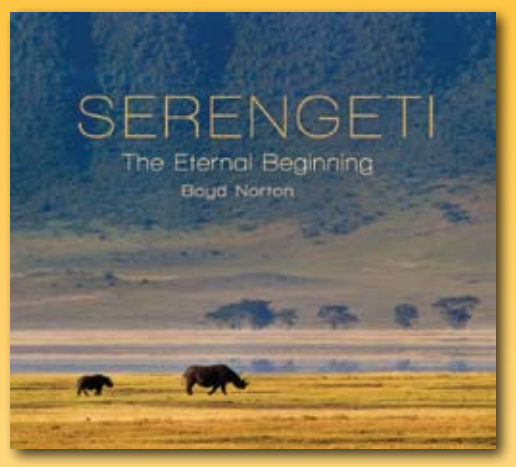


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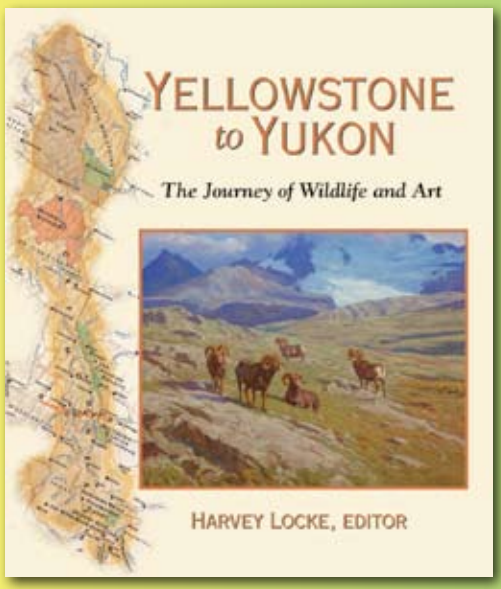


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—John C. Hendee, *IJW* Editor-in-Chief Emeritus

### *On the Cover*

**Main image**: Evening light, the Horuseb (a dry river valley), highlights a herd of Gemsbok (*Oryx gazelle*) grazing in a small oasis in Namibia's Skeleton Coast National Park.

**Inset image**: To start the expedition in the Tracks of Giants (www.tracksofgiants.org), a project of The WILD Foundation and The Wilderness Foundation (SA), local conservationists hike through the awesome sand dunes of Namibia's Skeleton Coast. Both photos courtesy © Vance G. Martin.

# International Journal of Wilderness

The *International Journal of Wilderness* links wilderness professionals, scientists, educators, environmentalists, and interested citizens worldwide with a forum for reporting and discussing wilderness ideas and events; inspirational ideas; planning, management, and allocation strategies; education; and research and policy aspects of wilderness stewardship.


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EDITORIAL PERSPECTIVES

# Wilderness Ecosystem Services, a Focus on Applications

BY ALAN E. WATSON and TYRON VENN

In November 2011, government scientists, managers, representatives from nongovernmental organizations (NGOs), and academic partners from Canada, the United States, and Mexico (with an invited guest from Hungary) met in Montana for discussions about challenges in accounting for ecosystem service values from wilderness and protected areas in North America. Although there are several definitions of ecosystem services, we define them as the wide range of benefits people receive from nature, including provision of goods that people use or harvest (provisioning services); regulation of negative impacts of natural processes such as floods and droughts (regulating services); supporting many services to humans and nature, including things such as water purification and soil formation (supporting services); and the cultural meanings derived from nature such as spiritual, aesthetic, and recreation benefits (cultural services). This group was focused on these types of benefits flowing to people from protected nature in North America.

The meeting was hosted by The University of Montana, who provided excellent facilities and cofunded the affair with the Rocky Mountain Research Station of the USDA Forest Service and the USDA Forest Service National Forest System, Washington Office. The articles in this issue of *IJW* are a sample of some of the presentations at this meeting and were chosen to expand the knowledge of our readers about some of the four categories of services described earlier. Emphasis was more on describing the reasons we want to include ecosystem service values in decision making and less on specific methods to quantify, qualify, and value ecosystem services. Methodologies and data sources were a topic of discussion but are not the focus of this issue of *IJW*.

**We define ecosystem services as the wide range of benefits people receive from nature.**

In the articles included here, it is apparent that the unique protected area system in Mexico requires special attention to inhabitants of these areas in order to meet protected area objectives. The reliance of their major cities on water flowing from protected areas and the importance of protected areas for regulating impacts from storms is increasing public awareness and support of their protected area system. All good news from Mexico!

The U.S. Bureau of Land Management (BLM) has a new, broadened science focus resulting from designation of the National Landscape Conservation System (NLCS). BLM is unique even among wilderness management agencies in the United States, operating in a decision space and set of ecosystem services that they are mandated to provide across the NLCS. The article from Europe explains why there is so much interest in wilderness there right now, leading up to the 10th World Wilderness Congress in Spain in 2013. Taking continental approaches to protecting ecosystem services flowing from protected areas is certainly a worldwide trend.

***Continued on page 7***

SOUL OF THE WILDERNESS

# Making Estimates of Ecosystem Service Values Useful

BY JOE KERKVLIET

I have witnessed several heated debates about land protection, as various as spotted owls in the verdant Pacific Northwest to antelope migration corridors in wide-open Wyoming. It seems to me that most of these debates soon devolve into shouting matches among stakeholders speaking different languages. At the risk of oversimplifying, advocates of less land protection speak of traditional commodities, such as timber, grazing, metals, natural gas, and transmission lines. A characteristic these commodities share is that they can all be readily translated into jobs and dollars. Advocates of more land protection speak of water quality, wildlife, nontraditional forest products, recreation, untrammeled vistas, and, yes, spiritual renewal. It is much more difficult to translate these things into jobs and dollars. Yet, I am hopeful that discussing them in the context of "ecosystem services" can serve as a translator for these diverse stakeholders, speaking the common language of human well-being.

## Ecosystem Services Framework

Ecosystem services may be a unifying framework first of all for recognizing all the ways that humans depend on the structure and function of healthy natural systems. The typical debate about land protection will change in three productive ways if monetized ecosystem services values can be estimated in ways that are reliable, credible, and operationally useful (Daily et al. 2011). First, advocates of greater or lesser protection will be grounded in the utilitarian approach that the goal of land management decisions is to improve human well-being, in all of its dimensions. Ecosystem services encompass all the diverse benefits (and costs) arising from healthy natural capital. These include the things emphasized by advocates of more protection – clean water, a stable climate, a diversity of plants and animals, pollination, flood control, and the beauty of nature. Ecosystem services also include things emphasized by advocates of less protection, including food, wood products, and motorized recreation. Nearly everyone can find their voices represented in the all-encompassing organizing framework of ecosystem services.

**Joe Kerkvliet in the Bob Marshall Wilderness Complex. Photo courtesy of J. Kerkvliet.**

I realize that some land-protection advocates are uncomfortable with the utilitarian approach. They argue that utilitarianism is bound to leave out things that simply cannot be priced and that land protection should reflect more intrinsic values, especially stewardship responsibilities toward future generations. I respectfully disagree for three reasons. First, the ecosystem services framework is broad enough to include the myriad ways that human well-being is linked to well-functioning natural systems. After all, ecosystem services include the many emotional, psychological, and even spiritual benefits people obtain from nature. Previous multiple-use and cost-benefit frameworks ignored many of these linkages, but the ecosystem services framework, depending as it does on cooperation between the ecological and social sciences, is less likely to do so. Second, the utilitarian ecosystem services framework can show that conservation, rather than being at

odds with people's economic interests, can actually improve them (Kareiva and Marvier 2011). This can be a game changer in conservation debates. The framework has already drawn attention to many underappreciated or previously unknown linkages between healthy ecosystems and human prosperity, and I expect many more to be found. Third, I don't expect the ecosystem services framework to be decisive in most land-protection decisions. No doubt, politics, and perhaps intrinsic values, will also count. Nevertheless, the ecosystem services framework and the research that supports it will serve the valuable function of making ecological and economic trade-offs more transparent and will improve the efficiency and effectiveness of management decisions (Kareiva and Marvier 2011).

The second way that using ecosystem services as an organizing framework will change the debate is to focus discussions and resources on what we do not know about the relationships among various types of ecosystem services. Some of these services may be complementary (e.g., clean water and native fish) but others are likely to be in conflict (e.g., building materials and old-growth trees). Common recognition of the state of both our knowledge and our ignorance has the potential to lead to informative research and monitoring, as opposed to heated, unproductive, and resource-wasting debates.

Third, the organizing framework lends itself to development of "payments for ecosystem services" initiatives. Seldom will decisions about protection apply to all the land in a specific ecosystem, and payments have the potential of providing incentives to adjacent landowners and residents to complement protection decisions. These private landowner incentives can be critical in restoring full flow of ecosystem services to landscapes with mixed public and private ownerships. Moreover, properly designed payments provide the means of implementing decisions that make a positive net contribution to human well-being by having the winners in protection decisions compensate the losers.

## Estimating the Values of Ecosystem Services

So how do we proceed to develop estimates of the values of ecosystem services that are reliable, credible, and operationally useful? I think there are six measurement criteria.

**First:** Estimates must be spatially explicit. The production of ecosystem services varies widely from one setting to another, and the human values attached to these services will likely vary also with the availability of substitutes and complements, incomes, and other demographic characteristics of affected stakeholders. To provide credible and usable estimates, ecosystem services values must explicitly relate to the on-the-ground choices being made. Working together, ecological and economic scientists are developing the capacity to provide spatially specific estimates of ecosystem services. This is facilitated by the availability of geographic information system software. Some software is specifically designed to make estimates of ecosystem services values (Kareiva et al. 2011).

**Second:** Estimates must be of marginal, not total or average, values. Economically efficient decisions must be based on marginal, not broader and more easily estimated, total or average values. Although estimates of total values have provided a valuable service in generating awareness of the importance of ecosystem services and their values to economies (Costanza et al. 1997), these values are of limited use in on-the-ground land protection decisions. Most decisions will not result in a complete elimination of any or all ecosystem services. For example, changing a land management regime from complete protection (e.g., wilderness designation) to less complete protection (e.g., commercial timber harvest) will not eliminate important ecosystem services such as carbon storage or flood protection. Marginal values are needed to evaluate the consequences of varying degrees of protection. Moreover, the production of many ecosystem services is nonlinear in land-use change, so average values are not representative of marginal values (Goulder and Kennedy 2011). Weiler (2005) provides an excellent example of marginal values. He estimates that the act of newly designating an area as a national park provides a signal to potential visitors and yields, on average, 12,831 visitors to a newly designated area. Moreover, each 1,000-acre (404.9 ha) addition to a national monument or park attracts 116 new annual visitors. Although Weiler (2005) does not translate these marginal effects into dollars, it would be a simple matter to do so using visitor expenditure data.

**Third:** Statistical estimates must take into account the fact that varying degrees of protection are not randomly assigned on the landscape. Many studies estimating the effects of land protection on the production of ecosystem services use comparisons between protected and unprotected land. Biases are likely to result from such comparisons because generally, protection is not randomly assigned across landscapes (Andam et al. 2008). Instead, protected status is often determined by characteristics also affecting the production of ecosystem services. To see why this is so, consider what would happen if the least productive

land were designated as wilderness in 1964. Years later, scientists might compare the marginal production of some ecosystem service in wilderness versus nonwilderness areas. They would find that wilderness areas produced lower levels of the ecosystem service, but it would be false to conclude that the low productivity was the result of wilderness designation. Instead, the low productivity finding arises from the initial non-random assignment. Andam et al. (2008) find that failure to take non-randomness into account leads to a 65% overestimate of the effect of protection on reduced deforestation. In addition, the non-random choices of which lands to protect can also be correlated with the economic values being estimated (Eichman et al. 2010). With few exceptions, studies comparing economic outcomes between protected and unprotected land fail to correct for non-randomness.

Several methods exist for testing and controlling for non-random protection assignment. One that shows the most promise for ecosystem services estimates is called propensity score matching. The idea behind matching is to find a unit of land (e.g., forest stand or watershed) that has not been protected but is similar to a unit that has been protected. The marginal impact of protection is the difference in the ecosystem services produced by the two areas. Averaging across many of these matched pairs gives an estimate of the impact of land protection.

**Fourth:** Policy makers and stakeholders are going to give more credence to ecosystem services values based on revealed preferences and replacement costs, rather than stated preferences. Stated preference studies use survey methods to obtain data on what people say they will do (Goulder and Kennedy 2011). There are hundreds of published stated preference studies, but I have never seen them taken seriously by policy makers – or even conservationists. It seems that "actions speak louder than words," and hardly anyone is comfortable with the hypothetical character of stated preference.

I see policy makers and stakeholders giving much more credibility to value estimates obtained from revealed preference. For example, people might pay more for houses closer to protected land, after controlling for other obvious things like the number of bedrooms and floor area. Also, economists track spending by visitors traveling to national parks to estimate the values of these protected lands.

**Ecosystem services may be a unifying framework for recognizing all the ways that humans depend on the structure and function of healthy natural systems.**

Replacement cost methods can also provide credible estimates. These use engineering studies to ask how much it would cost to replace an ecosystem service with a technological alternative. A famous example is that New York City could maintain drinking water quality by investing $1.5 billion in land protection efforts in Catskill watersheds compared to spending $6 billion in building and operating water treatment plants.

No method of estimating values is perfect. In using replacement cost methods, it will be hard to avoid comparing apples to oranges. A technological fix will likely provide the ecosystem service with more certainty, while relying on protected land will provide a suite of other benefits. To use revealed preference methods, clever economists and ecologists must somehow link ecosystem services to marketable goods. This will not always be possible. Although they are short on credibility, stated preference methods are the only available means of estimating non-use values. Clearly, people value protected landscapes such as the Arctic National Wildlife Refuge and Yellowstone National Park, even though they may never visit or obtain any other use value from them. Stated preference has sufficient standing as to be usable as evidence in federal natural resource damage suits (U.S. Environmental Protection Agency 2000). Put simply, however, revealed preference and replacement cost methods have more credibility with policy makers and advocates on all sides of land-protection debates. To be useful, economists and ecologists should use stated preference methods only as a last resort.

**Fifth:** Useful estimates will consider trade-offs and complementarities in ecosystem services production and their respective economic values. In the case of trade-offs, it is likely that timber production, a valid ecosystem service, can be provided only at the expense of old-growth timber, biodiversity, and, perhaps, water quality. In the case of complements, it seems likely that protecting old-growth trees enhances the ecosystem service of native fisheries, at least in the U.S. Pacific Northwest. Failure to consider a reasonable suite of ecosystem services in analysis may have at least two adverse consequences. First, statistical analyses of a single ecosystem service may yield biased, or at least inefficient, estimates. Second, modeling efforts that do not consider the relevant suite of ecosystem services may miss those

choices that yield the greatest social benefit. For example, Polasky et al. (2011), find that the land-use choice scenario yielding the greatest monetary return changes, depending on whether or not carbon sequestration is included as a monetized ecosystem service. Olschewski et al. (2010) find that "considering multiple ecosystem services can have a substantial impact on recommendations for land-use management decisions" (p. 318).

**Sixth:** Analyses of ecosystem services values should consider the distributional effects of various land management choices. I suspect that many development-heavy land-management decisions in the past were facilitated by failures to consider distributional impacts. For example, when land managers planned massive timber harvests in the Pacific Northwest, the impacts on the ecosystem services relied on by Native Americans were given little, if any, weight. In the future, they should be. Different ecosystem services are likely to have greater values for some groups of people than others. Debates about the protection of land often center on these distributional impacts. Flood protection will be more valuable for downstream residents than those residing in upper reaches of watersheds. In many cases, ecosystem services contribute disproportionately to the welfare of the poor (Tallis et al. 2011). By revealing information on distributional impacts, ecosystem services analyses can shed important light on land management debates and contribute to the design of payments for ecosystem services allowing winners to compensate losers.

If these criteria serve as aspirations guiding estimates and modeling efforts, the framework of ecosystem services has a greater likelihood of being mainstreamed into land-protection decisions.

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***Continued from WILDERNESS ECOSYSTEM SERVICES A FOCUS ON APPLICATIONS, page 3***


And we are pleased that one of our NGO participants agreed to sit back and think hard about how to define and measure ecosystem services. If in fact the concept of ecosystem services can bring a diverse set of stakeholders to the table with a common language focused on environmental well-being as a major determinant of human well-being, we may be able to find much greater cooperation opportunities in the future.


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# Ecosystem Services Input to Decision Making

## *For the U.S. Bureau of Land Management's National Landscape Conservation System*

BY LARA E. DOUGLAS, JOEL P. LARSON, and MATTHEW A. PRESTON

**Lara E. Douglas**

**Joel P. Larson**

**Matthew A. Preston**

## Introduction

The growing human population and its associated resource needs have created a widely recognized dilemma over the proper and appropriate use of natural resources (Hardin 1968). Some argue that maximizing the extraction and use of natural resources best attains economic prosperity. The opposing side of the debate has argued that undeveloped land should be protected as a last reservoir unencumbered by humans, and that such protected land has inherent, immeasurable value (Borgerhoff Mulder and Coppolillo 2005). The conflict between the two viewpoints has been frequently articulated in discussions of wilderness preservation (e.g., Leopold 1949).

One avenue to bridge this gap has been the recognition that the conservation of ecosystems can be a viable avenue to economic prosperity. An aspect of the "conservation as economically wise" argument is founded on the concept that properly functioning ecosystems provide benefits to humans, and that these benefits, if lost, would have a financial cost associated with their replacement. Such benefits are often referred to as ecosystem services and include provisioning services (e.g., clean drinking water), regulating services (e.g., the sequestration of carbon released by factories and cars), cultural services (e.g., the option to go backpacking or rafting, see figure 1), and supporting services (e.g., nutrient cycling) (Millennium Ecosystem Assessment 2005).

Although some ecosystem services (e.g., clean water, timber harvest) lend themselves to monetization better than others (e.g., cultural services), it is possible for decision makers to use wide-ranging ecosystem service analyses to compare the costs and benefits of preserving healthy ecosystems against the more classical economic consideration of extractive services alone. Furthermore, if development is necessary, decision makers can use ecosystem service analyses to make decisions that most usefully consider all relevant socioeconomic values.

Although it makes logical sense to include the valuation of ecosystem services in public lands decision making, ecosystem services have had limited application to date. In addition, the scientific research that details the biophysical processes underlying ecosystem services has only recently enabled application to policy (Daily et al. 2009; Ruhl et al. 2007). The application of ecosystem service principles to decision making on federal lands managed by the U.S Bureau of Land Management (BLM) is valuable and appropriate, although encumbered by various constraints and challenges. In this article, we discuss some of the constraints and challenges that affect the decision space of BLM managers.

The BLM manages more surface acres than any other landowner in the United States. The 246 million acres (99.6 million ha) of public lands and 700 million acres (283 million ha) of subsurface mineral estate managed by the BLM are managed subject to applicable law. BLM-administered land lies within a wide variety of ecosystems, mostly in the

western United States, including deserts, grasslands, woodlands, and tundra. About 27 million acres (10.9 million ha) of BLM-administered land are legislatively protected in the National Landscape Conservation System (NLCS), including 8.7 million acres (3.5 million ha) of wilderness in 221 units. Recognized particularly for its conservation value, the BLM's NLCS provides abundant ecosystem services for the American people.

## Obligations to Consider Ecosystem Services in Decision Making

The BLM's organic act, the Federal Land Policy and Management Act of 1976 (FLPMA), mandates that the public lands be managed "on the basis of multiple use and sustained yield" (FLPMA § 102 [a][7]). In addition, FLPMA requires the use of a "systematic interdisciplinary approach to achieve integrated consideration of physical, biological, economic and other sciences" when developing land-use plans (FLPMA § 202 [c][2]). These mandates suggest an obligation by the BLM to consider an ecosystem services framework in guiding decision making. Indeed, FLPMA specifically identifies a wide variety of ecosystem services to be maintained by the BLM for the benefit of the American public, ranging from services that support recreational use, habitat for fish and wildlife, or protection of cultural resources, to provisioning services to meet the nation's needs for domestic sources of timber, food, minerals, and fiber (FLPMA § 102 [a][8-12]). BLM's maintenance of services includes activities as varied as the protection of wilderness and the development of oil and gas reserves.

The range of potential ecosystem services within BLM's purview is unique among federal land managers, as other agencies have more limited scopes. For example, the National Park Service and U.S. Fish and Wildlife Service have strong resource protection mandates, leaving many provisioning services beyond their mission. Somewhat similarly, the Department of Defense's national defense mission means that resource management considerations on land under their jurisdiction cannot conflict with an installation's primary mission. The U.S. Forest Service mission is more similar to the BLM mission, although the Forest Service land is more limited in the diversity of biomes (primarily forests, with some grasslands).

**Figure 1 – The option value of recreational opportunities, such as rafting in the Bruneau-Jarbidge Rivers Wilderness in Idaho, is an important cultural ecosystem service afforded by wilderness and other protected public lands. Photo credit: BLM.**

The National Environmental Policy Act of 1969 (NEPA) is another legislative authority that obliges the BLM to consider ecosystem services in decision making. NEPA requires that all BLM actions be analyzed to determine how they will affect the quality of the human environment (NEPA § 102[c]). The reliance in NEPA on the effects to the human environment implies that ecosystem services must be considered, as ecosystem services are defined by their benefits to humans. The BLM has responded in policy to these and other legislative requirements by advocating consideration of nonmarket values associated with ecosystem services in the economic impact analysis for public land-use plans and authorizations (BLM 2005, Appendix D, p. 6).

In addition to the legislative mandates and policy guidelines for incorporating ecosystem services into public land management, there have been requests by external groups and other agencies for the BLM to include these values in decision making. For example, the U.S. Environmental Protection Agency (EPA) requested that the BLM analyze the impacts to ecosystem services under various alternatives for the Western Oregon Plan Revision (U.S. EPA 2008). Specifically, they asked the BLM to examine how various management options would impact the ability of forested areas to provide clean drinking water for local communities. In 2011, The Wilderness Society requested that the BLM acknowledge the contribution that undeveloped

lands have on the regional economy through the provision of amenity values such as recreation, scenic landscapes, and wildlife habitat (Culver and Slivka 2011; Hanceford et al. 2011).

## Constraints on Full Consideration of Ecosystem Services in Decision Making

Even though there are clear reasons to consider ecosystem services in the BLM's decision-making process, there are several potential objections to including ecosystem services analyses. Access to public land is often both nonrival (uses do not compete) and nonexcludable (use of the good cannot be prevented) (Stiglitz 1997). If uses do not compete and are not excludable, payments for those ecosystem services are unlikely to occur, so some would argue that consideration of ecosystem service values in a benefit-cost analysis would not be fruitful. Nonetheless, consideration of values outside of a market context could still inform decision making and outreach related to the rationale for decisions.

The application of ecosystem service principles and data to the management of BLM's NLCS is further constrained by the lack of legal authority to procure or offer the full suite of ecosystem services provided by the BLM lands. Although authorities exist for fees, leasing, and sale with respect to some on-site resources (e.g., recreation fees, grazing permits, and mineral leasing), no authorities exist for the sale of many ecosystem services on public lands. Therefore, revenue from the sale of ecosystem services is not among the considerations that federal managers are able to typically address. In contrast, private landowners may consider the production and sale of ecosystem services on their lands using existing or novel markets, and as a result, they are able to make land management decisions based on maximum economic return (Ruhl 2010). For example, a private landowner may sell the carbon sequestration value of his or her land to developers seeking off-site mitigation for carbon emissions (Kiesecker et al. 2009; Keisecker et al. 2010); federal land managers do not typically have the authority to market this type of ecosystem service value.

In addition to these general concerns limiting the value of ecosystem services analysis, there are specific legislative acts constraining the BLM's decision space. Where law or policy specifies the primacy or prohibition of a particular use, federal land managers must comply with the resulting limitations.

One specific piece of legislation, the Omnibus Public Land Management Act of 2009, legislatively established the NLCS and mandated that these lands be protected, conserved, and restored (OPLMA § 2002[a]). This mandate for conservation limits the consideration of many services. For instance, the proclamation for Carrizo Plain National Monument prohibits "all motorized and mechanized vehicle use off-road" to protect monument objects (Clinton 2001). Therefore, managers cannot consider off-road vehicle recreation as a cultural service in decision making at the monument. In another example, because the Wilderness Act of 1964 obligates the BLM to preserve the wilderness character of designated wilderness areas, including preserving the land's untrammeled and natural condition, wilderness managers lack the authority to consider provisioning ecosystem services related to forestry.

## Balancing Ecosystem Services: Grazing as a Case Study

Although the direct marketing of many ecosystem services is not always available as an option to federal land managers, managers do make decisions that can be enhanced by understanding ecosystem service values. Due to BLM's multiple-use mission, rival (competing) uses are actually somewhat frequent. For example, large-scale timber sales compete with simultaneous recreational use of an area. As a result, managers must make decisions that balance values to the public while simultaneously upholding the law. The concept of excludability is one tool that can be used to provide this type of balance. Managers can limit access or use of the land with, for example, fences, fees, or permits. By doing so, benefits from some ecosystem services may be constrained while others are enhanced. For instance, a special recreation permit associated with a large race might restrict other users from entering the area, thereby ensuring both safety and competitiveness as well as enhancing the recreational value associated with the event.

A good example of balancing uses by land managers surrounds livestock grazing in the NLCS. Livestock grazing has been an integral part of BLM's land management since 1934, when the Taylor Grazing Act established the agency that would later become part of the BLM. Grazing is permitted throughout most of the NLCS, where the designating legislation for most areas specifies that their designation for conservation primacy does not alter the permitting of grazing activities. Livestock grazing is permitted even in most designated wilderness, as long as grazing was established prior to the wilderness designation (Wilderness Act

§ 4 [d][4][2]). Livestock grazing constitutes a use that is rival to some other uses; for example, the presence of cattle in a public campground could detract from the recreational experience of campground users. Similarly, livestock grazing on the public lands is also excludable: grazing allotments are associated with a particular base property and are offered to a single ranch. Both permitting and fence construction contribute to keeping other ranchers from grazing cattle on the allotment.

Lands used in part for the grazing of livestock contribute, obviously, to the provisioning of fodder for animals used to feed humans. Although food provision may be the primary ecosystem service offered by rangelands, livestock grazing can also reduce diversity of invasive plants, increase grassland diversity, and maintain a disturbance regime mimicking the disturbance associated with native herbivores (Chan et al. 2006). Additionally, livestock grazing on public lands is associated with the maintenance of open rangelands and the retention of cattle ranching as a traditional livelihood, both of which are culturally important to many areas of the West. BLM therefore often manages NLCS lands via grazing in part to maintain and support several ecosystem services. However, in contrast, livestock grazing can also impact some ecosystem services detrimentally. For example, if cattle damage riparian plants and contaminate water sources, rivers may lose some of their viability as a water source for local communities. In such scenarios, managers must abide by the relevant laws to allow grazing but may have authority to limit the number of animal unit months or the seasons when grazing occurs, close particular sensitive areas, or otherwise alter grazing patterns to minimize impacts (e.g., during the land-use planning process).

## BLM's Prevalent Arid Lands

Much BLM-administered land is in arid environments, with more than 128 million acres (51.8 million ha) of shrub or scrub habitat (BLM 2011). Deserts, grasslands, and rangelands contribute less value in most ecosystem services than an equivalent area of forested land or wetlands, particularly in terms of climate regulation, soil formation, recreation, and raw material provision (Costanza et al. 1997). Small changes in policies that affect ecosystem services in arid environments, such as those that might result from the small-scale decisions made by land managers, can therefore result in proportionally large changes in ecosystem service provision. The prevalence of arid landscapes on BLM lands makes the consideration of certain ecosystem services, particularly those related to water, especially important for the agency. Riparian areas in arid environments (see figure 2), for example, provide critical ecosystem services related to groundwater return and flood regulation, even beyond the valuable services provided by all riparian systems, such as wastewater dilution, water purification, erosion control, fish and wildlife habitat, and recreation (Loomis et al. 1999). Even outside riparian areas, many of the important ecosystem services in arid landscapes tend to be related to water: for instance, water regulation, water quality maintenance, soil retention, and nutrient cycling (Le Maitre et al. 2007). Analyses of ecosystem service values in arid systems are not common, but they are necessary to inform decisions on such landscapes.

## Flow across Landscapes

Many ecosystem services flow across jurisdictional boundaries. Knowledge of the total value of such services is beneficial to BLM managers when balancing the varied uses of public lands. For example, recreation in designated wilderness areas in the lower 48 states has been valued at $634 million per year, based on the amount that visitors would be willing to pay

**Figure 2 – Aravaipa Creek, which flows through Aravaipa Canyon Wilderness, is home to seven native fish species and a is major tributary to the San Pedro River, which provides migratory bird habitat, clean water, and climate regulation services. Photo credit: Bob Wick, BLM.**

**Consideration of ecosystem services serves as a valuable component of the decision-making process, despite the constraints under which managers make decisions.**

for such an experience (Loomis and Richardson 2001). Although the actual recreation experience only occurs in the wilderness, secondary benefits of recreation flow outside the wilderness, in the form of local economic benefit derived from support services for recreation. For instance, Lorah (2000) shows that counties with wilderness exhibited higher growth in employment, population, total income, and per capita income than counties without wilderness. Similarly, the maintenance of wilderness and the on-site services it provides (e.g., wildlife habitat) also offer watershed protection that yields downstream cost savings to local, county, and state governments through avoidance of sedimentation and purification costs in water treatment plants (e.g., $9–18 million in savings annually in the lower 48 states; Loomis and Richardson 2001).

Flow of ecosystem services across landscapes is especially important to the BLM due to its unique land ownership pattern. Until the passage of FLPMA, the BLM's mission was in part to survey the public lands and convey them into private ownership (Gregg 1982). As a result of this history, the BLM's remaining land base became a noncontiguous checkerboard, with many private inholdings (Gregg 1982). For example, streams flowing through the Canyons of the Ancients National Monument in Colorado intersect 11 parcels of private land and 1 unit of National Park Service land (BLM 2010). Ecosystem service values both upstream and downstream of those inholdings and edge holdings have implications for management decisions made for the BLM lands in the monument. For instance, a private landholder's decision to fence off a riparian area to cattle may improve water quality downstream, reducing the public land manager's costs to maintain the health of that watershed.

## Conclusions

While BLM-administered lands are managed for a broad range of economic, social, ecological, and other public interests rather than for optimum economic solutions, consideration of the broad spectrum of human benefits to be derived from functioning ecosystems is certainly appropriate. For the BLM, and especially the National Landscape Conservation System, consideration of ecosystem services serves as a valuable component of the decision-making process, despite the constraints under which managers make decisions.

To assist the BLM in incorporating ecosystem service values into its decision-making processes, data suited to BLM's unique mission and mandates would be beneficial. For instance, analyses of influences on ecosystem services in arid lands and on disconnected land parcels would be informative for BLM decision makers. Particularly important are data that speak directly to the decision options for BLM land managers, as a BLM land manager does not enjoy the entire realm of options available to a private landowner. Furthermore, BLM managers could make use of information tied to the specific and multiple different uses authorized on any particular BLM parcel.

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# The Economics of Wilderness

## *Overcoming Challenges, Seizing Opportunities in Europe*

BY ZOLTAN KUN and JOËL HOUDET

**Abstract:** Wilderness protection is a relatively new concept in Europe. Nonetheless, there have recently been several policy successes with respect to the protection of Europe's last remaining wilderness areas and the promotion of the restoration of wilderness attributes in other areas. Ecosystem services analysis and valuation are progressively becoming important for protected area management, promotion, and expansion worldwide. In addition to their intrinsic spiritual, landscape, and biodiversity values, wilderness areas can offer several sustainable economic, social, cultural, and environmental benefits to local European communities, landholders, some business activities, cities, and society in general. However, despite the progress recently made in understanding the values of ecosystem services in a range of contexts, there are relatively few studies providing a comprehensive analysis of the bundle of ecosystem services generated by European protected areas. Houdet and Kun (2012) recently provided a better understanding of the economic benefits and costs of European wilderness areas to European stakeholders. Indeed, although TEEB (2010) reports have successfully mainstreamed concepts such as the economic values of nature and payments for ecosystem services (PES) to support effective protected area (PA) management, tangible mechanisms and tools are needed by PA managers to help them engage with stakeholders to achieve ecological and financial stability.

## Wilderness in Europe

Wilderness protection is a relatively new concept in Europe. Recently, however, there have been several policy successes with respect to the protection of Europe's last remaining wilderness areas and promotion of restoration of wilderness attributes in other areas. A special report on wilderness was adopted in 2009 by a majority of the European Parliament. This notably led to the development of an Agenda for Europe's Wilderness and Wild Areas ("Message from Prague," www.panparks.org/learn/wilderness-resource-bank/an-agenda-for-europes-wild-areas-message-from-prague), outlining 24 tangible recommendations. This also provided a welcome mandate for European conservation NGOs to strengthen work for wilderness. In 2010, the NGO community formed a Wilderness Working Group (WWG) chaired by a representative of Europarc Federation to develop a wilderness definition for a multicultural continent and prepare a set of criteria for a wilderness register for Europe. The WWG finalized this process in 2012 and agreed on the following definition: "Wilderness areas are large unmodified or only slightly modified natural areas, governed by natural processes, without human intervention, infrastructure or permanent habitation, which should be protected and overseen so as to preserve their natural condition and to offer people the opportunity to experience the

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spiritual quality of nature." The WWG also set the minimum size requirement at 3,000 hectares (7,410 acres).

It is believed that only 1% of Europe's land territory remains in a relatively pristine status. At a recent European Commission workshop it was suggested that 13% of the Natura 2000 (N2000) network is managed to protect wilderness attributes. The N2000 is a network of areas across European Union (EU) Member States established for biodiversity protection. The primary aim of the network is to guarantee long-term survival of Europe's most valuable and threatened species and habitats. This network contains Special Areas of Conservation (SAC) designated by Member States under the Habitats Directive, and also includes Special Protection Areas (SPAs) that are designated under the so-called Birds Directive, approved in 1992.

It must be noted that the N2000 network is not a system of strict nature reserves where all human activities are excluded. As the N2000 network covers roughly 17% of the land territory of the EU Member States, we can infer that wilderness areas may cover around 2% of the 27 member states. This clearly underlines our lack of accurate information and constitutes a real barrier to enhancing European wilderness protection. This in fact highlights why the "Message from Prague" included clear recommendations to improve the scientific background for wilderness protection in Europe, including mapping of wilderness and linking societal benefits to wilderness protection.

## Ecosystem Services of Wilderness Areas

In addition to their intrinsic spiritual, landscape, and biodiversity values, wilderness areas can offer several sustainable economic, social, cultural, and environmental benefits to local European communities, landholders, some business activities, cities, and society in general. However, the ecosystem services linked to wilderness are not exclusively provided by wilderness. Depending on their ecosystem characteristics and dynamics as well as their spatial configuration in relation to human populations and economic activities, some of the most significant benefits provided by wilderness may contribute to many important regional regulation and cultural ecosystem services, including:

- Addressing climate change through carbon sinks/sequestration;
- Providing clean water, water purification, and flood mitigation services;
- Growing nature-based tourism and job opportunities in rural landscapes; and
- Providing opportunities for youth development, education, and health care, and acting as places of inspiration, renewal, or recreation far from the bustle and pressure of modern stressful urban lives.

The exploitation of certain provisioning ecosystem services from wilderness areas in Europe – such as harvesting timber, extracting minerals, using land for food production/vegetation for livestock grazing, and water resources for development opportunities – may be detrimental to other wilderness values. In the Protected Area Network (PAN) Parks certified wilderness areas in Europe (see "Principles and Criteria" at www.panparks.org/learn/partnerships-for-protected-areas/apply-for-verification), management authorities restrict access to and use of provisioning resources, as well as prohibit infrastructure development and certain recreation activities (see table 1). Therefore, legally protecting areas worthy of wilderness status is highly likely to impact certain stakeholder groups with preexisting economic or social uses of ecosystem services (loss of benefits) or others that are looking for new development or use opportunities. In other words, stakeholders may depend and impact on different ecosystem services from wilderness areas, whether legally protected or worthy of legal protection. The effective protection and management of wilderness areas calls for efficient stakeholder engagement at local, regional, and (sometimes) international levels. To that end, the economic valuation of ecosystem services can be a very useful tool.

## Benefits and Costs of Wilderness Protection

Ecosystem services analysis and valuation are quickly becoming important for protected area management, promotion, and expansion worldwide (Hein 2011; Kettunen et al. 2009). This is, first, because the socioeconomic benefits of protected areas are often not quantified, and they may be underestimated in policy-making and land-use planning (e.g., Tallis et al. 2009). This is critical given the current economic crisis that is leading to further pressures on government budgets and hence on the budget available to maintain existing protected areas or create new ones. Second, integrated ecosystem management has become an integral part of protected area management. It requires the provision of different types of ecosystem services simultaneously to satisfy the needs and aspirations of different stakeholder groups. As previously argued, many protected areas provide additional benefits to their primary goal of biodiversity conservation so that the total value of their ecosystem services can be divided into two components: the added value

**Table 1 – Use status of ecosystem services in PAN Parks certified wilderness areas.**

| Theme | Ecosystem services class | Use status |
|---|---|---|
| **Provisioning** | Nutrition | Use forbidden, apart from extensive livestock grazing in appropriate areas |
| | Materials | Use forbidden: e.g., no mining, no forest exploitation |
| | Energy | Biomass/minerals extraction and energy production forbidden |
| **Regulation and Maintenance** | Regulation of wastes | Benefits to various stakeholders: e.g., assimilation of effluents in soils and plants |
| | Flow regulation (natural risks) | Benefits to various stakeholders: e.g., erosion control, wind breaks, flood control |
| | Regulation of physical environment | Benefits to various stakeholders: e.g., global and local climate regulation, water purification, air quality purification, soil structure and quality maintenance |
| | Regulation of biotic environment | Benefits to various stakeholders: e.g., maintenance of habitats and population sources for many species with positive impacts on economic activities, including pollination services (wild bees) and the regulation of pathogens |
| **Cultural** | Intellectual and experiential | Only wilderness recreation (hiking) and ecological research opportunities; no hunting and motorized access |
| | Symbolic | Spiritual and heritage benefits |

of designation and the value of services maintained without designation (see figure 1).

However, despite the progress recently made in understanding the values of ecosystem services in a range of contexts, there are relatively few studies providing a comprehensive analysis of the bundle of ecosystem services generated by European protected areas (Gaston et al. 2008; Jongeneel et al. 2008) as well as the associated management and opportunity costs (see table 2). Studies on European forest ecosystem services are rare (Elsasser and Meyerhoff 2007; EUSTAFOR and Patterson 2011).

The situation appears even worse for European wildernesses, which are a subset of the larger network of protected areas, thus resulting in a general lack of understanding of the actual and potential economic benefits and costs associated with their specific management frameworks and rules. Unlike some protected areas that may allow for some controlled economic activities to take place within their borders (e.g., hunting, harvesting of wild food and medicinal products, motorized recreation access), legally protected wilderness areas provide

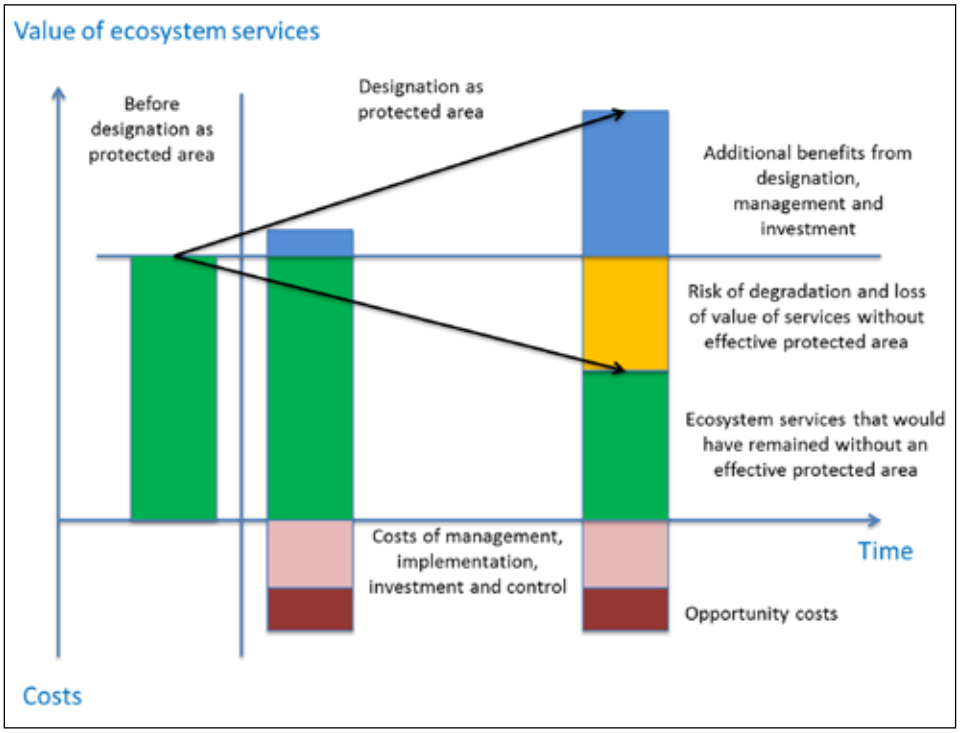


**Figure 1 – The total value and costs of protected areas before and after designation (ten Brick, in Kettunen et al. 2009).**

**Table 2 – Examples of protected area benefits and costs accruing at different scales (Kettunen et al. 2009).**

| | Benefits | Costs |
|---|---|---|
| **Global** | Dispersed ecosystem services (e.g., climate change mitigation/adaptation) | Protected area management (global transfers to developing countries) |
| | Nature-based tourism | Alternative development programs (global transfers to developing countries) |
| | Global cultural, existence, and option values | |
| **National** | Dispersed ecosystem services (e.g., clean water for urban centers, agriculture, or hydroelectric power) | Land purchase |
| | | Protected area management (in national protected area systems) |
| | Nature-based tourism | Compensation for forgone activities |
| | National cultural values | Opportunity costs of forgone tax revenue |
| **Local** | Local ecosystem services (e.g., pollination, disease control, natural hazard mitigation) | Restricted access to resources |
| | | Displacements (people, economic activities) |
| | Local cultural and spiritual values | Protected area management (private landowners, municipal land) |
| | Consumptive resource uses | Opportunity costs of forgone economic activities |
| | | Human-wildlife conflict |

more limited income opportunities for stakeholders, especially local communities. They may also generate additional management and opportunity costs.

As argued by Kettunen et al. (2009), "Not all protected areas are expected to generate income to help local communities, but where the opportunity exists they can make an important contribution to livelihoods. … Protected areas also impose costs on society, arising from restricted access to resources and foregone economic options." When making the case for effective protection and management of wilderness areas toward securing both their ecological and financial viability, their costs must be recognized alongside their benefits. This calls for embedding the valuation of biodiversity and ecosystem services into the cost-benefit analysis (CBA) of existing and proposed protected wilderness areas to allow stakeholders to better understand the trade-offs – at the local, national, and international levels – between the benefits from legitimate (authorized) consumptive and nonconsumptive uses of their ecosystem services and the associated management and opportunity costs.

For all these reasons, wilderness managers and promoters recommend putting emphasis, within the scope of full CBA, on accounting for the costs of inaction (i.e., the costs of not protecting the ecological assets and ecosystem services underpinning wilderness values). This would imply:

1. Accounting for the potential loss of non-monetary values of all key ecosystem attributes (assets, functions, processes, and services) contributing to wilderness status (e.g., naturalness assessment methods, Winter et al. 2010);
2. The mainstreaming of the biodiversity no-net-loss/enhancement principles for the effective management and restoration of wilderness ecosystem attributes; principles borrowed from research on the impact mitigation hierarchy, biodiversity offsets, and ecological equivalency accounting (e.g., Germaneau et al. in press; Quétier and Lavorel 2011);
3. As appropriate given the local circumstances, accounting for the costs:

- Of the potential loss (or degradation) of key ecosystem attributes if various development opportunities (e.g., hunting, wood harvesting, dam construction) had not been forgone (i.e., no effective legal protection for the wilderness area). This would amount to assessing the added value of wilderness area designation as avoided damage costs to wilderness values (see figure 1) and would be instrumental for comparative analysis with the opportunity costs

of wilderness area protection.

- Of restoring lost wilderness values: costs of future increases in ecological values due to management and investment (see figure 1).

The resulting coupled non-monetary and monetary information could then be used as tools for engaging with stakeholders, from national/state treasury for budgetary negotiations to local communities for comanagement purposes. Indeed, exclusively relying on economic valuation of ecosystem services may not always constitute the most efficient approach to make the case for promoting the expansion and ensuring the ecological, social, and financial viability of wilderness areas. Two major risks may occur. First, it is easy to spend large amounts of money on economic studies that attempt, against all odds, to assign monetary values to changes in ecosystem services. Second, it is easy for stakeholders to misuse the results of these studies in ways that can undermine support for wilderness protection, for instance through overestimation of direct use values, the underestimation of bequest values, or the inability to demonstrate short-term economic benefits to some users of areas warranting wilderness protection. As argued by Farrell (2007), the goal is to articulate accurately the appropriate set of monetary and non-monetary values to various stakeholder groups in different contexts (i.e., economic valuation is not an end in itself). Therefore, it may sometimes be more useful or practical to make decisions based on ranking or prioritizing the expected benefits of ecological investments. These can be used to set priorities by determining the greatest benefits per euro spent, without resorting to monetary valuation of biodiversity.

## Making European Wilderness Areas Both Ecologically and Economically Sustainable

Making wilderness areas ecologically sustainable in the face of rapid change (e.g., climate change, land conversion) in Europe involves both their effective protection and significant expansion. Provided management and restoration objectives are clearly defined, the framework of Natura 2000 does provide enough flexibility to implement nonintervention management techniques and hence secure wilderness areas in the long term. This would also imply investing in restoration of degraded and fragmented landscapes: approximately 200,000 kilometers[2] (77,220 sq. miles) of farmland could be abandoned by 2050, which offers huge opportunities for restoring wilderness conditions (Secretariat of the Convention on Biological Diversity 2010).

Wilderness restoration could occur both naturally and with human assistance throughout Europe. Examples of the former include wolves crossing from Poland into Germany, with at least 30 of them currently inhabiting Saxony. Depending on the history of the protected area, intervention may be needed only for a limited time in order to undo past damages, as in the case of some old-growth forests where the elimination of pressure due to logging and grazing will suffice (passive restoration). However, active restoration may be needed in certain circumstances, especially where more profound changes have taken place, resulting in the loss of various ecological components. Such active restoration measures may involve the reintroduction of extinct species, the control or removal of nonnative and invasive species, prescribed burning, replanting to hasten forest regeneration, or seedling selection. However, given the scale of current ecosystem damages, cost-efficient ecological restoration should play an important role in wilderness area expansion in Europe. The current financial crisis in Europe generates panic reaction among politicians, and they want to provide more opportunities to traditional exploitation of protected areas. For instance, a new zoning proposal discussed in the Czech Parliament would limit the size of nonintervention management zones while allowing for further fragmentation of wilderness by making areas available for ski resort development projects.

**Ecosystem services analysis and valuation are progressively becoming important for protected area management, promotion, and expansion worldwide.**

The emergence of payments for ecosystem services (PES) seems highly appealing for the sustainable financing of European wilderness areas. Combining strategies for mitigating biodiversity and ecosystem services (BES) loss (OECD 1975; SLWRMC 1999) and remunerating BES supply (Aretino et al. 2001; Hackl et al. 2007; Siebert 1992) opens the door to new forms of arbitrage with respect to land-use planning, including the expansion of wilderness areas. This approach sees ecosystem services provision becoming an integral part of interactions among economic agents (Houdet et al. 2012).

If the various ecological and institutional challenges (Perrings et al. 2009; Pascual et al. 2009) for economic agents to fully embrace markets for biodiversity and ecosystem services

are overcome (see table 3), payments for ecosystem services could provide significant support for the sustainable financing of European wilderness areas. This would imply diversifying income sources for PA, in addition to public subsidies, and may include:

- Payments for certified wilderness recreation services (e.g., PAN Parks Foundation's tourism model);
- Payments for water-related and natural-risk regulation services (direct payment by beneficiaries);
- Payments for carbon-related services (payments by polluters – voluntary carbon offset market);
- Voluntary payments for biodiversity conservation: i.e., payments by organizations seeking to improve their brand or image (e.g., Green Development Initiative, – gdi.earthmind.net/); and
- Offset measures (mitigation credits) for residual development impacts (polluters pay – regulated impact mitigation markets).

Combining these payments is also called stacking PES, which can be contrasted with bundling ecosystem services for a single payment, such as a carbon offset project, with both Verified Carbon Standard and Climate Community Biodiversity Standard (www.climate-standards.org/) certification, which makes available for sale carbon credits with social and biodiversity cobenefits. PES may be stacked in different ways: (a) multiple payments for different ecosystem services; (b) one or more PES with one offset measure; and (c) multiple offsets or mitigation credits. Furthermore, stacking PES may occur in several ways (Cooley and Olander 2011): (1) horizontal stacking, which means selling credits from distinct, nonspatially overlapping parts of a single property; (2) vertical stacking, which involves multiple payments for a single management activity on spatially overlapping areas (i.e., in the same hectare: e.g., planting a forested riparian buffer to receive both water quality credits and carbon credits); and (3) temporal stacking, which implies one main management activity but payments separated in time (e.g., restoring habitat to receive endangered species credits, and then later receiving carbon offset credits – or vice versa). However, wilderness area managers or promoters should take great care in avoiding the potential pitfalls of stacking PES. Indeed, where offset and mitigation programs are part of the stack, there is potential for negative overall ecosystem service outcomes, and this is because these offset credits allow others to impact the environment (Cooley and Olander 2011).

## What Way forward for Wilderness Managers and Promoters?

First, we need to have more information to effectively engage with stakeholders on wilderness protection decisions. Indeed, there is a general lack of understanding of the actual and potential economic benefits and costs associated with wilderness designation. A comprehensive comparative assessment of the benefits and costs of use and non-use of ecosystem services from wilderness areas and other types of protected areas in Europe is clearly warranted. For instance, this would be

**Table 3 – Market mechanism options for biodiversity and ecosystem services (Houdet et al. 2012; adapted from Parker and Cranford 2010).**

| | Beneficiaries pay | Polluters pay |
|---|---|---|
| Ecosystem services | **Direct PES**<br>Beneficiary pays for ES that flow to them. ES are not wholly public, but can be captured to some degree by paying beneficiaries (bilateral arrangements – e.g., payments for watershed services) | **ES markets**<br>Polluter pays for damage they have done by buying an offset/credit. The beneficiaries are the population that receive the ES and are usually different from the population that is paying (bilateral/market arrangement -e.g. water quality trading, forest carbon storage) |
| | **Indirect PES**<br>Consumers of final goods and services pay a premium for the sustainable ecosystem management practices higher in the supply chains (e.g., organic food) | |
| Biodiversity | **User fees**<br>Beneficiary pays for access to/use of in situ biodiversity. Direct use biodiversity benefits accrue to those who pay for access (single payments – e.g., ecotourism, hunting licenses) | **Impact mitigation markets**<br>Developer pays for damages it has done to biodiversity (habitats, species) by buying an offset/credit (bilateral/market arrangement – e.g., biodiversity offsets/banks, tradable fisheries quotas) |

instrumental to establishing effective policies and mechanisms for the equitable sharing of costs and benefits arising from the establishment of protected wilderness areas, as well as create appropriate win-win incentives to overcome opportunity costs for affected stakeholders where this is justified by broader benefits.

Second, we need to make it clear that economic valuation is not a panacea, as putting a monetary value on non-use wilderness attributes is potentially both ethically and technically questionable (Farrell 2007). It is often more useful or practical to make decisions based on ranking or prioritizing the expected benefits of ecological investments. Although monetary measures of ecosystem benefits may be necessary to justify spending on wilderness, non-monetary indicators of the expected socioecological benefits can effectively be used to set priorities by determining the greatest benefits per euro spent. European wilderness area managers and promoters need to master such coupled economic and non-monetary accounting tools for effective negotiation outcomes: In other words, capacity building is critical.

Finally, although emerging markets for ecosystem services seem attractive, proactive actions and lobbying would be required to embed them into strategic conservation planning. The recent budget crises in several European countries will put pressure on efforts to secure the ecological and financial sustainability of wilderness. In addition to sustainable state subsidies, stacking payments for ecosystem services could well constitute new financing mechanisms for cost-effective wilderness conservation, restoration, or expansion. This, however, will require creative land-use planning and clear institutional mechanisms.

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# Mexican Biodiversity Conservation Model

## *Protected Areas*

BY ALEJANDRA CALZADA-VÁZQUEZ VELA, ANDREW RHODES ESPINOZA, ERIKA RODRIGUEZ-MARTÍNEZ DEL SOBRAL, FERNANDO CAMACHO-RICO, LIZARDO CRUZ ROMO, MARIANA BELLOT ROJAS, and MIRIAM TERESA NÚÑEZ LÓPEZ


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Mexico's National Commission for Natural Protected Areas (CONANP in Spanish) is the federal government's institution responsible for conservation of the country's natural heritage through establishment, protection, and safeguard of protected areas (PAs). PAs are portions of land or water in the country where the original environment has essentially not been altered and that produces environmental benefits increasingly recognized and valued. PAs are the instrument of environmental policy with greater legal definition for conservation of biodiversity in Mexico (DOF 2011).

CONANP is within the Ministry of Environment and Natural Resources (SEMARNAT in Spanish) and manages 175 federal protected areas, covering nearly 13% of Mexican territory (more than 25 million hectares or 61 million acres) (see figure 1). These protected areas are classified into six different management categories, described in table 1.

Although wilderness areas are not included in the Mexican legal framework, some of the protected area categories, especially national parks, are very restrictive when it comes to natural resources exploitation (DOF 2011), and much of Mexico's protected area system is intended to protect or restore nature in much the same way as in the U.S. National Wilderness Preservation System. In addition, Mexican protected area guidelines define different management zones and regulate activities permitted within each zone. Buffer zones may include human communities and production activities, while core areas are under strict protection.

In addition, in order to ensure the maintenance of healthy ecosystems, protected areas must be managed under a landscape approach, considering the processes that occur beyond the boundaries of the PA (transition zone) that represent important threats (see figure 2).

## Conservation and Development

Due to the country's social and environmental conditions, Mexico has developed a protected area system somewhat different from others in the world, with more than 80% of Mexico's protected territory being private or community-

owned lands, called *ejidos*. Mexican protected areas have the North American particularity of being inhabited by human populations, unlike Canadian or U.S. PAs. Thus, in Mexico, PA management and conservation strategies must be closely related with development and human activities (CONABIO 1998; CONABIO y SEMARNAT 2009).

CONANP developed a Conservation for Development Strategy, promoting ecosystem conservation through rural sustainable development and incorporating the interests of communities living within and around the boundaries of protected areas, mainly because indigenous communities depend largely on the natural resources that PAs hold.

The strategy is implemented through three lines:

1. Interinstitutional communication to promote coordination among sectors (forestry, agriculture, tourism, etc.) oriented toward conservation and sustainable use of resources.
2. The promotion of community organizations, oriented toward conservation and sustainable use of resources.
3. Alternative production activities that ensure employment and income for communities living within protected areas.

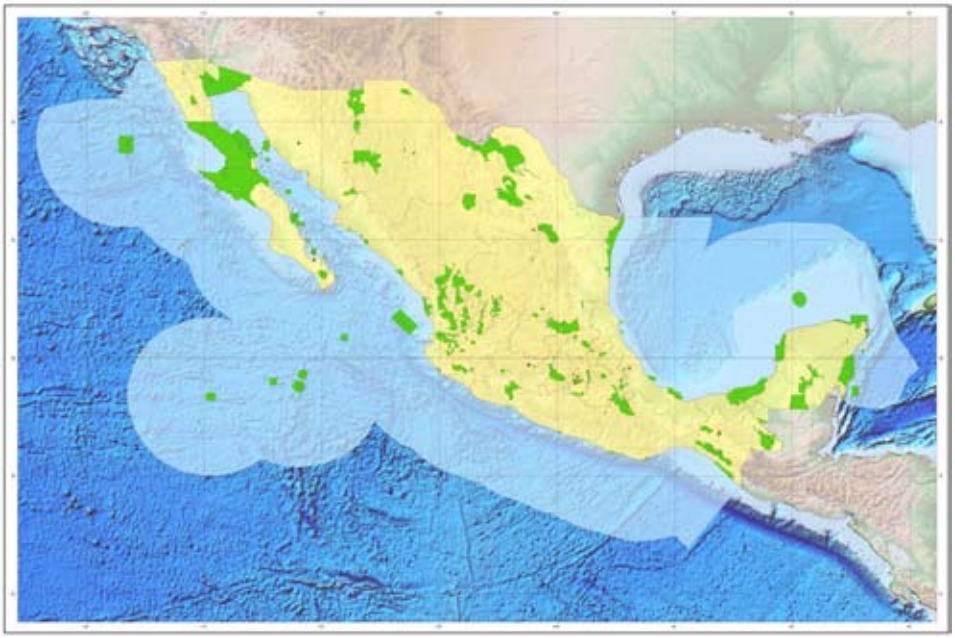

**Figure 1 – Protected Areas of México.**

Even though it might appear to be an ambitious program, by implementing this strategy through multiple instruments, CONANP aims to conserve Mexico's natural heritage through protected areas, and by addressing environmental degradation and poverty as well as the marginalization of communities living in the protected areas (CONANP 2007).

**Table 1 – Natural Protected Area categories (DOF, 2011).**

| Number of PAs | Category | Description |
|---|---|---|
| 41 | Biosphere reserves | Areas representative of one or more ecosystems that have not significantly been altered by people and that need to be preserved and restored. Representative species of national biodiversity, including endemic and endangered species, inhabit biosphere reserves. |
| 67 | National parks | Areas consisting of one or more natural elements with unique natural, historic, or scientific value under absolute protection. |
| 5 | Natural monuments | Areas with one or more ecosystems with significant scenic beauty and scientific, educational, or recreation value, meant for tourism development or similar purposes. |
| 8 | Natural resources protection areas | Areas meant for the preservation and protection of natural resources such as soil, water, or watersheds located in forestlands. |
| 36 | Flora and fauna protection areas | Sites preserving habitats on which the preservation and development of flora and fauna depends. |
| 18 | Sanctuaries | Areas holding a considerable amount of flora and fauna. They include several topographic units to be preserved. |

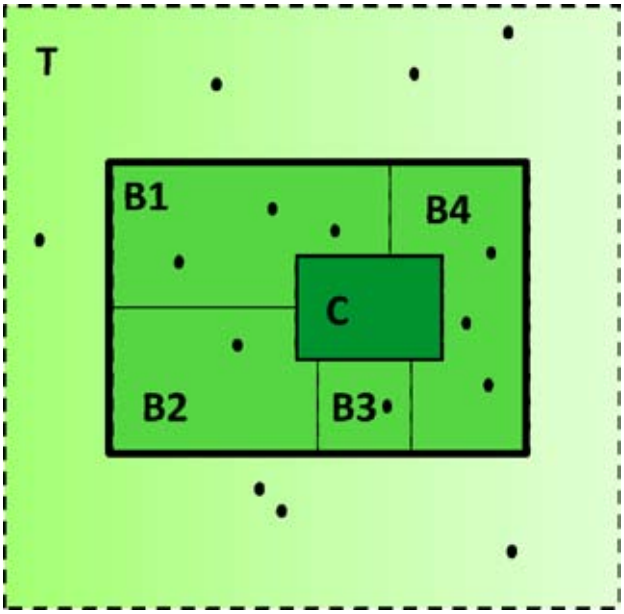


**Figure 2 – Common schematic of a Mexico protected area and its transition zone. C: Core area; B1, B2, B3, and B4: buffer zones; and T: transition zone. Black dots represent communities.**

CONANP is one of the federal government institutions in Mexico that works directly in the field through the instrumentation of programs and activities that involve community participation, such as fire management community brigades, community surveillance teams, and ecological restoration projects, among others, which contribute directly to the management and conservation of ecosystems. Moreover, CONANP develops an array of actions that help communities develop and diversify productive activities with low environmental impact, such as sustainable agriculture, ecotourism, and apiculture (CONANP 2007).

## From International to Local Cooperation

In addition to the Mexican government's conservation efforts through CONANP, international initiatives have also supported Mexico's conservation activities. CONANP has been intensively working for the past few years, through capacity building and institutional development, on the implementation of several projects and collaborative programs with different countries and in different modalities.

CONANP has also carried out many South-South Cooperation Projects, which are one of the international cooperation modalities allowing developing countries with a similar socioeconomic context to create synergies and join efforts in cooperation activities. Common problems within the Latin American region have a similar ecological and socioeconomic context, and the exchange of experiences and knowledge has been very enriching. Some of the issues addressed collaboratively with Mexico's Latin American neighbors are shared ecosystem conservation, protected area management in developing or emerging countries, rural sustainable development, and protected areas sisterhood.

In addition to the projects developed in the international cooperation context, CONANP works on the implementation of many international collaborations in protected area and biodiversity conservation. Some of these include international treaties and protocols, as well as some of the most important international conventions, such as the Convention on Biological Diversity and the Framework Convention on Climate Change, both derived from the Earth Summit of Rio de Janeiro in 1992.

On the national level, CONANP recognizes the importance of coordination among government agencies as well as collaboration with academic institutions, nongovernmental organizations, and international cooperative institutions. Therefore, in 2011 CONANP promoted the creation of the México Resiliente (Resilient Mexico) Alliance, which encourages the coordination of those stakeholders that participate actively in the conservation of PAs by taking actions related to climate change mitigation and adaptation. Currently, the alliance has attracted 18 partners, including the National Autonomous University of Mexico, the United Nations Environment Program, The Nature Conservancy, WWF-Mexico, the German Agency for International Cooperation, and the Mexican Fund for the Conservation of Nature, among other very important partners.

## Priorities for Conservation

Conservation of Mexico's natural heritage represents a great challenge for the future. Although enormous efforts have been made in the last decade to promote biodiversity conservation through the establishment and management of protected areas, the country's experts are aware that PAs cover only a portion of priority ecosystems. For the last couple of years, for example, the country has developed a Gap Analysis for Conservation Priorities of Terrestrial Biodiversity in Mexico, which identifies priority sites to be protected in the near future, according to diversity indicators and other environmental variables (Koleff and Urquiza-Hass 2011). In order to prioritize the sites to be conserved, the analysis considered several criteria such as types of vegetation, species distribution, and biodiversity threats. Mexico has complied with the commitments set by the Program of Work on Protected Areas of the Convention on Biological Diversity (CONABIO-CONANP-TNC-PRONATURA-FCF-UANL 2007).

This Gap Analysis represents an important input for the accomplishment

of many goals, including the ones established by the Convention of Biological Diversity, which has set a list of biodiversity targets to be accomplished by 2020. As part of Strategic Goal C,

> To improve the status of biodiversity by safeguarding ecosystems, species and genetic biodiversity, the Convention set target 11: By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes. (CBD 2011)

## Species at Risk: A Complementary Strategy

Since 1997, Mexico's environmental policy has recognized the relevance of incorporating the conservation of species at risk as an important part of schemes both to maintain and prevent biodiversity loss. Public policies developed to recover species have included regulations and law enforcement activities (NOM-059-SEMARNAT-2011).

However, programs with specific budgets, planning, and assigned personnel were not established until 2007, through CONANP's creation of the Species at Risk Conservation Program (PROCER in Spanish). This program provides the implementation capacity for CONANP in PAs and transition zones by providing qualified personnel, budget, equipment, and collaboration with stakeholders.

PROCER has three main strategies:

1. The National Program for Conservation of Sea Turtles. This was the first program in the Mexican federal government to result in increased populations and a long-term conservation and protection effort.
2. The Exotic and Invasive Species Management Program, which responds to one of the most important threats to biodiversity (the first threat is in insular ecosystems and the second in terrestrial ones). This program addresses the eradication of important alien populations on islands, prevention of introductions and reintroductions, increased PA management, education and outreach, and monitoring and research.
3. The Species Conservation Action Plans (PACE in Spanish), which are developed by specialists, researchers, wildlife managers, local governments, and landowners, are coordinated by the federal government. The PACEs are built with six areas of focus: management, restoration, protection, research, culture for conservation, and administrative issues.

PROCER has a feasible objective to be accomplished from 2007 to 2012, which is to contribute to conservation of 30 species at risk. These species were selected by specialists from universities, academic institutions, nongovernmental organizations, and federal institutions, with the purpose of identifying species with certain characteristics and improving conservation efforts to maximize results with available sources. According to Mexican rules, those species should be at risk, strategic as umbrella species, viable to recover, and keystone species for ecosystem functions and processes.

Activities under PROCER commonly include reintroduction and translocations, population and habitat management, habitat and species protection with the participating landowners and rural communities, research, and others (see figure 3).

PROCER has achieved important

**Figure 3 – California condor (*Gymnogyps californianus*), once extinct in the wild. The California condor reintroduction program is one of the long-term recovery programs developed in protected areas in Mexico. Photograph by Luis Felipe .Lozano.**

species recovery results. However, a great challenge is to consolidate this program in the long term in Mexico, evaluate the effects and results at population and habitat levels, and reorient efforts if using adaptive management calls for it. We must enhance the program at a scale that allows it to contribute to conservation of ecosystems and ecological functions and that links with other programs such as climate change (ECCAP), management units for wildlife conservation, forest management, and, probably most importantly, align public conservation policies with production policies at the national level.

## A New Global Context: Protected Areas and Climate Change

Climate change represents a growing threat to natural and human capital worldwide. Therefore, CONANP has joined the Mexican government in its effort to guide conservation policies and actions in a context where climate change is not only a threat, but also an opportunity for protected area conservation. To preserve ecosystems and to increase the area under protection, as well as sustainable management, are no doubt the best approaches to reduce the causes and effects of climate change. In 2010, CONANP published its Climate Change Strategy for Protected Areas (ECCAP), which describes strategies and actions to mitigate climate change, to identify priority measures for adaptation, and to establish guidelines for CONANP's management decisions. The ECCAP recognizes the importance of incorporating key stakeholders in such processes, as well as strengthening technical and institutional capacities in climate change issues.

The ECCAP consists of two main components that guide operative processes: mitigation and adaptation, and three support components: knowledge, communication, and capacity building.

- Mitigation: The main objectives are to reduce deforestation and degradation emissions and increase carbon sinks. The main strategies include overall fire management (forest fire protection, rehabilitation of affected ecosystems, and prescribed fire); development and implementation of Reducing Emissions from Deforestation and Forest Degradation (REDD+) programs within and around PAs; conservation and management of carbon sinks; restoration projects and establishment of new PAs with high biodiversity and carbon mass; among others.
- Adaptation: The main objectives are to reduce ecosystem and social community vulnerability and increase ecosystem resilience to climate change impacts. The main techniques include conducting ecological and social vulnerability analyses to climate change impacts; developing adaptation plans for PAs under a landscape vision; formulating environmental contingency plans; creating marine, coastal, and terrestrial restoration projects; and increasing system connectivity and local stakeholder projects.

Regarding adaptation, CONANP has worked on a set of climate change adaptation programs that were developed under a landscape approach as protected areas were grouped into clusters. These programs identified adaptation strategies based on ecosystem vulnerabilities, human communities, and productive systems. These strategies were then prioritized based on diverse criteria such as feasibility and impact. To date, CONANP has developed 4 climate change adaptation programs, including 12 protected areas, as well as a guide to developing climate change adaptation programs for protected areas (CONANP 2011).

Currently, adaptation actions are being implemented in multiple protected areas where the adaptation measures identified are occurring on the ground, including climate monitoring actions, capacity building for integrated fire management, and reducing vulnerability in priority watersheds (soil conservation actions, water management measures, risk mapping). In order to perform adaptive management, the protected area personnel are conducting monitoring of these adaptation actions and measures. Maintaining ecosystem integrity is a way to guarantee the permanence of ecosystem services for local communities.

**Mexico has developed a protected area system somewhat different from others in the world with more than 80% of Mexico's protected territory being private or community-owned lands, called *ejidos*.**

Altogether, these instruments and programs intend to contribute to sustainable development, which will redound in ecosystem and biodiversity conservation for the country, the main objective of CONANP. Mexican protected areas have proved to be effective

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# Natural Protected Areas in Mexico

## *Provision of Ecosystem Services to Inhabitants*

BY ADRIAN MENDEZ BARRERA

**Abstract:** Mexico has 174 federal protected areas, including 24 million hectares (59 million acres) of the world's most biodiverse ecosystems, and this comprises 11% of the country. Almost unknowingly, Mexican society interacts with these ecosystems, receiving multiple benefits. For example, 17 of the nation's largest cities receive crucial water supplies from 20 protected areas. There are crucial support, production, regulatory, and cultural services coming from these protected natural areas. Many of these services are threatened, as forests, rain forest, mangroves, wetlands, and grasslands have evolved into agricultural systems to produce food, places for tourism, and infrastructure for economic empowerment. These changes alter the ability of ecosystems to provide other benefits. We have exchanged the high contribution of forests to climate regulation or control of erosion by the limited environmental contribution from agricultural systems. Thus, in the pursuit of satisfactions of our needs, we have undermined the ability of natural ecosystems to maintain the quality of our lives. This situation is common worldwide, but Mexico presents a special case that combines the high biological and cultural diversity of our country along with, a profound deterioration of the systems that host this biodiversity, with negative consequences for the human population.

## Ecosystem Services in Mexico

Mexico is one of the most biologically diverse countries in the world. It ranks first in number of species of reptiles and amphibians and is among five countries with the highest number of vascular plants. This biological mosaic is also accompanied by a cultural mosaic and history of environmental degradation that has put Mexico into a time of crisis. Because historically Mexico has exchanged the benefits provided by forests, jungles, swamps, and all types of ecosystems for the benefits provided by agricultural land, tourist developments, mining, and other interests, ultimately there is concern that Mexico has focused on short-term benefits at the expense of those in the medium and long term.

The transformation of ecosystems for food has been a sustained trend for many years. These natural ecosystems have become agricultural systems with one or a few species, and even these have been genetically modified species, and soils supporting these systems have been altered by the presence of fertilizers, herbicides, and pesticides. This has caused a change in scenery and in the contribution to ecosystem services. The expansion of the agricultural frontier has paradoxically led to what was expected: 49% of the land surface is concentrated in just three crops – corn, beans, and sorghum – even though Mexico is the center of origin of many species that are traded in the world. The balance between supply and demand for grains is negative: Mexican ecosystems converted to agricultural activity satisfy only about 65% of consumption, so the remaining demand is met through imports.

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In addition, Mexico has transformed natural ecosystems to bovine livestock production, and this is the most widespread land use throughout the country. In fact, livestock is the main factor associated with change in land use in the country (SEMARNAT and PNUD 2005). About 106.9 million hectares (264 million acres) are used for livestock.

**Seventeen of the nation's largest cities receive crucial water supplies from 20 protected areas.**

Regarding the use of wood from forests, Mexico is underutilizing the resource with a focus on production of a single genus of trees (Pinus spp.), despite the enormous diversity within the country. Additional wood is wasted as a result of changing land use. Each year in Mexico, between 183,400 and 485,830 hectares (453,000 and 1.2 million acres) of tropical forests and between 123,077 and 162,267 hectares (304,000 and 400,800 acres) of temperate forests are lost to make way for agricultural use. Another problem in the forests is illegal wood exploitation. It is estimated that the volume of illegal logging is around 13 million meters$^3$ (17 million cu. yards) per year (Torres-Rojo 2004), equivalent to more than double of what is produced legally (CONABIO 2009).

In terms of water availability, defined as the volume of surface water and groundwater potentially usable in a territory, in Mexico the availability is limited: In 2000, the availability average per capita was 4,841 meters$^3$ (6,342 cu. yards) per year (CNA 2002). More recently, some critical areas, such as in La Baja California Peninsula, availability was only 1,520 meters$^3$ (1,991 cu. yards) per capita each year. In the Central Watershed, it was 1,813 meters$^3$ (2,375 cu. yards) per capita per year, and in the Valley of Mexico it was 194 meters$^3$ (254 cu. yards) per capita per year (CONABIO 2009). Considering the growth trends in water demand of the population, agriculture, and industry, the outlook for Mexico is critical.

Maintenance of relationships among biodiversity components or biotic interactions is particularly important for the provision of some regulatory services, such as the control of pests, disease vector control, or regulation of pollination and invasive species (Díaz et al. 2005). In Mexico this aspect is singularly important because there are 5 million hectares (12.4 million acres) planted with agricultural crops that depend on pollinators. The reduction of biodiversity in agricultural ecosystems brings about a reduction in the capacity of ecosystems in regulating pests. In the last 10 years, Mexico has spent more than 1,200 million pesos (approximately 96 million in US dollars in 2012) in the eradication of pests and diseases (CONABIO 2009). As for the regulation of soil erosion, climate, air quality, and response to extreme natural events, there are clear examples of the benefits of conservation of ecosystems. Some management techniques are causing severe soil degradation processes that affect 45% of the country. The states of the southeast are more affected by from water erosion, whereas the northern states are more affected by wind erosion. On the other hand, the change in land use, and deforestation in particular, has important effects on climate regulation and regulation regarding extreme natural events. Terrestrial and coastal ecosystems have varying capacities to respond to the incidence of these events. The maintenance of adequate soil conditions (depth, texture, and organic matter content) in the upper parts of the mountains and along rivers and coastal areas, wetlands, and lakes is essential for flood control. The protection of mangroves, coral reefs, and coastal lagoons moderates the impact of hurricanes on coastal areas. In Mexico extreme events have caused damage in excess of $5 billion pesos (approximately 400 million in US dollars in 2012) , but the areas protected have been essential, otherwise the damage would have been much higher.

## The Value of the Goods and Services from Natural Protected Areas

There are many values protected natural areas provide, including direct-use values, such as commercial uses, or consumption, such as recreation, tourism, fishing, gathering, use of genetic resources, education, and research. In the Biosphere Reserve Bahia de los Angeles of the Baja California Peninsula, observations of whale sharks generate an economic impact of $111,843 (US dollars) per year (Bezaury 2009). At Sump Canyon National Park in Chiapas, in the high-use season more than $150,000 dollars a day (US dollars) is collected, just for the boat ride into the park (CONANP 2010). The 14 million people who visited Mexico's protected areas in 2007 are believed to have contributed $556 million (US dollars) and generated more than 25,000 jobs (Bezaury 2009).

An outstanding value of protected areas is the conveyance of water uptake and thus contribution to the availability of water in 17 major cities, including Mexico City, Guadalajara, Monterrey, Saltillo, La Paz, Tijuana,

Toluca, Colima, and Tuxtla Gutierrez. This also includes major resort locations such as Huatulco and Los Cabos. People and businesses in these locations are dependent on the natural functioning of nearby protected natural areas (Carabias 2005). The value of the associated water from natural protected areas for agricultural and industrial water supply and electricity generation is on the order of $264 million (US dollars) annually.

There are also indirect use values that Bezaury (2009) described as those derived from natural ecological functions and processes, which include watershed protection, climate stabilization, and local hydrological regulation. Several protected areas were declared in the early 1940s for this purpose.

Natural areas such as the Montes Azules Biosphere Reserve in Lacandon rain forest in Chiapas, Manantlán Biosphere Reserve in Jalisco, and Cuatro Cienegas in Coahuila, to cite only a few examples, protect option values; that is, benefits that future generations may receive because they have the option to use the resources as they were not exhausted. An example is the resource of the wild genetic relative of maize (*Zea diploperennis*), or endemic species with values for medical sciences.

There are also other quality-of-life contributors flowing from protected areas in Mexico, described as those intangible values that enrich "the intellectual aspects, psychological, emotional, spiritual, cultural and creative existence and welfare of man" (WCPA 2000). Protected areas such as the Pinacate and Great Altar Deserts are sacred sites for Tohono O'odham people (Papago), and for the Comcaac (Seri) the protection area of Shark Island flora and fauna is culturally important. Some areas have been created to protect natural and mixed-values cultural and national parks, such as Palenque in Chiapas or Tulum in Quintana Roo.

The protective value of protected nature has gained recognition following weather extremes, such as Hurricanes Wilma and Stan in 2005 and Dean in 2007. People recognized their importance, and these areas were given more attention after that. An article in a national newspaper, in the wake of Hurricane Felix, reflected on these values: "Researchers from various regions have been shown that the social disaster caused by these weather phenomena are more substantial in areas where wetlands, mangroves and coral reefs have been devastated and not in protected areas."

The environmental impacts that have affected the most areas in Chiapas Sierra and Costa were the forest fires of the 1998 season and Hurricane Mitch during the same year. The assessment of the damages suffered in 1998 showed serious environmental impacts on hydrological systems and soils. The soils were without the natural and dense vegetation cover and slow revegetation has resulted in continuing flooding problems years later. After Hurricane Stan in October 2005 (see figure 1), the regions Istmo-Costa, Soconusco. and Sierra contained the affected 75% of the flooded towns and 88% of the affected population. The affected area covers a land area of more than 34,000 square kilometers (13,127 sq miles) , which houses 41 municipalities and is the residence for 1.8 million people, equivalent to 45% of the total population of the state of Chiapas, Mexico.

In 2005, the overflow of 98 rivers directly affected 510,000 people distributed in 499 villages, of which 99% were rural and 92% had high and very high marginalization. One of the most impacted areas based on the number

**Figure 1 – Satellite image of a portion of the Chiapas coast after Hurricane Stan, where the rivers outside of forest areas and protected areas of La Sepultura y El Triunfo caused impacts on roads and entire communities.**

**Figure 2 – Grijalva River and Cañón del Sumidero. The rain forest and species such as crocodiles are popular attractions for more than half a million visitors.**

of affected communities, and with great dependence on agriculture and livestock production, was the area between the El Triunfo Biosphere Reserve, which protects a cloud forest, and the La Encrucijada Biosphere Reserve in Chiapas, which protects one of the most important mangrove forests in Mexico. In 2005, the rains continued for more than 70 hours over the Sierra Madre de Chiapas and El Triunfo and La Sepultura Biosphere Reserves and through the natural processes of runoff contributed large volumes of water to the rivers. Once outside of the protected areas and into areas devoid of vegetation, large volumes of water inundated thousands of acres and disturbed rivers with thousands of tons of sediment that generated severe impacts, including destroying roads, highways, and entire villages. This sediment came to the La Encricijada Biosphere Reserve site, which was able to stop sediment, return the flow to its natural channel rivers, and reduce solids contribution to the sea.

Residents and the government noticed all of these impacts, which led to the establishment of another national park in the Sierra Madre de Chiapas area. The newly protected area is situated between the other biosphere reserves and will cover much of the Sierra Madre Mountain region. Through numerous letters of support, the National Commission of Natural Protected Areas designated the natural area Frailescana that added to a protected area complex for the region. This initiative also discouraged the construction of a road through the El Triunfo Biosphere Reserve.

## Natural Protected Areas in the Center of Conflict Resolution to Protect Ecosystem Services

Cañón del Sumidero National Park is a main attraction in Mexico (see figure 2). This natural area has been protected since 1980 and is home to many important native species. It has sedimentary rock walls more than a thousand feet high and has faced numerous impacts that have reduced forest cover and put aquatic ecosystems at risk. It receives more than half a million visitors annually, it is internationally known, and it generates economic income very important for Chiapas. This protected area has a difficult problem to solve in the presence of thousands of tons of forest solid waste, agricultural and urban sediments, and wastewater discharges reaching the Grijalva River through tributaries of four watersheds. These discharges stay in the canyon due to the presence of a hydroelectric dam that prevents the river from running its course.

The Cañón del Sumidero National Park area consists of three water systems: (1) the Grijalva River, (2) the hydroelectric dam Chicoasen, and (3) the karst hydrological system of the limestone bordering the Sump Canyon. Sump Canyon belongs to the Grijalva basin, which contains La Angostura Dam, Chicoasen, Nezahualcoyotl, and Peñitas. This hydroelectric system is one of the largest in the country and produces 23% of its electrical energy.

The Grijalva River starts in the Cuchumatanes in the neighboring country of Guatemala. In the state of Chiapas, Mexico, the stream follows a southeast-northwest direction throughout the Central Depression of Chiapas, then cuts through the Central Plateau Cañón del Sumidero National Park, and finally descends into the plain of Tabasco, to join with the Usumacinta River, which flows into the Gulf of Mexico (Cedillo et. al 1994).

The construction of the hydroelectric dam of Chicoasen formed a reservoir 32 miles long and is now navigable. The flows of the Grijalva River were changed inside the canyon. In the rainy season, there are lot solid residues that don't move out of this site, affecting the ecosystems and the tourist activities (CONANP 2006). The watershed degradation (see figure 3), loss of ecosystem services, accumulation of waste, and disposal of contaminated water has caused damage to river ecosystems, the habitat of the crocodile (*Crocodylus acutus*), 24 fish species (one endemic), and has negatively affected the economy of hundreds of tourism services providers and dozens of fishermen, which generates more than $30 million annually.

To resolve these problems and focus on integrated watershed management, regional initiatives provide environmental education programs, construction of water treatment plants, reforestation efforts, and waste management. The federal and state governments have converged to increase capabilities. A new strategy includes working on a partnership among municipalities that will build capacity for managing and solving common problems. Collaborators implemented strategies for the gradual recovery of 15 municipalities and the water-based ecosystem services provided from the Cañón del Sumidero National Park.

**Figure 3 – Cleaning the river in the Parque Nacional Cañón del Sumidero removes annually an average of 2,500 tons of solid waste that consists of wood (85%), agricultural residues (12%), and urban waste (3%) (CONANP 2006).**

The aim is to reduce the negative impacts and deterioration of the watershed and recover the water retention capacity of soils through forest restoration and recovery of the river ecosystems. The intermunicipal approach is an associative-based tool for managing services among municipalities and solves common problems. It is a voluntary act and the councillors of the different municipalities decide whether to participate.

## Conclusions

Society and decision makers in Mexico are reassessing the role of protected natural areas and placing increased value on provision of ecosystem services and the regulation benefits they provide. This has facilitated the establishment of new protected areas in Mexico and new institutional arrangements among municipal governments for efficient management of land and recovery of lost ecosystem services. The challenge in Mexico is first to halt the loss of wild places and then protect and enhance ecosystem biodiversity and services through recovered functions. Then, to the extent possible, educate people about the connections between ecosystem services and natural protected areas. This is possible only through mounting efforts that increase preservation in the face of trends toward environmental degradation.

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***Note:*** The views expressed in this article are solely those of the authors and do not necessarily reflect the views or policies of the U.S. Bureau of Land Management or U.S. Department of the Interior.

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ALWRI RESEARCH NOTE

# Aldo and Leonardo

## *Science and Art of Wilderness*

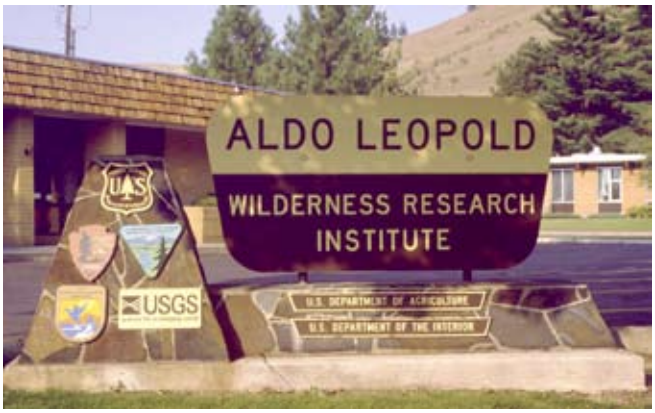
BY CINDY S. SWANSON

*The artist sees what others only catch a glimpse of.*
– Leonardo da Vinci

The issues facing wilderness and human beings today require complex thinking. Complex thinking requires both broad and narrow perspectives. The problem-solving approach used by artists gives rise to a range of possibilities previously unimagined, and the possibilities can enrich the framework for scientific inquiry. For example, Leonardo da Vinci (both an artist and a scientist) imagined the helicopter centuries before a working version could be realized. His vision gave scientists and engineers the basis for the ultimate invention. Artists and scientists are similar in that their work starts with questions about the what, why, and how of the world's phenomena, yet the methods they use to ask questions and find answers are poles apart. When artists and scientists work together, their different perspectives and ways of thinking can lead to conclusions that combine the best of right-brain and left-brain thinking. Scientists may begin to think like artists, and artists may begin to think like scientists. Disruption of their typical ways of seeing and the cross-fertilization of ideas facilitate creative problem solving.

*To those devoid of imagination a blank place*
*on the map is a useless waste; to others,*
*the most valuable part.*
– Aldo Leopold

Passed into law on September 3, 1964, the U.S. Wilderness Act will mark its 50th anniversary in 2014. An art-science interdisciplinary collaboration is planned to celebrate the lands protected by the Wilderness Act. The project, entitled *Aldo & Leonardo*, is inspired by the scientific wisdom of




Aldo Leopold and the artistic genius of Leonardo da Vinci. During 2013, the Aldo Leopold Wilderness Research Institute and the Colorado Art Ranch will sponsor small groups of visiting artists and resident-scientists for one-month projects at six wilderness locations. The scientists and artists (visual, literary, or performing) will collaborate to produce a body of work that creatively illustrates the value of wild areas and honors the scientific efforts to preserve wilderness.

*The preservation of a few samples of*
*undeveloped territory is one of the most*
*clamant issues before us today.*
– Bob Marshall

Wilderness locations will be selected by the Aldo Leopold Wilderness Research Institute in conjunction with wilderness manager recommendations, based on (1) representation of a variety of biomes, (2) representation of all

Leopold partner agencies (Bureau of Land Management, National Park Service, Fish and Wildlife Service, and Forest Service), and (3) significance of potential outcomes *and* openness and willingness of managers to collaborate with artists. Six art-science wilderness residencies are planned for 2013.

*Art is the queen of all sciences*
*communicating knowledge*
*to all the generations*
*of the world.*
– Leonardo da Vinci

Colorado Art Ranch will select the artist, in conjunction with the Leopold Institute and the Forest Service Rocky Mountain Research Station. The call for artists will be posted internationally to attract artists who are using their skills, talents, knowledge, and passion to react to the world we live in. Travel will be coordinated through Colorado Art Ranch. The Colorado Art Ranch is a 501(c)(3) organization with headquarters in Arvada, Colorado (www.coloradoartranch.org). Founded in 2005, the ranch hosts interdisciplinary artist residencies in small towns throughout Colorado. In 2012, Colorado Art Ranch completed a groundbreaking transdisciplinary collaboration to envision uses for an inactive silver mine site in Lake City, Colorado. The missions of Colorado Art Ranch and the Aldo Leopold Wilderness Research Institute are in close alignment. Colorado Art Ranch believes that the arts, in concert with the sciences, can help solve contemporary land and social issues. Colorado Art Ranch envisions a world where creative interdisciplinary thinking is cultivated, valued, and used to solve land and social issues.

**When artists and scientists work together, their different perspectives and ways of thinking can lead to conclusions that combine the best of right-brain and left-brain thinking.**

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# Planning for the Commemoration of the Wilderness Act

BY LISA EIDSON

## Introduction

In 2014, the Wilderness Act will celebrate its 50th anniversary. To coordinate planning efforts, the 50th Anniversary National Wilderness Planning Team (Wilderness50) is a growing coalition of wilderness- and recreation-focused nonprofit organizations, businesses and companies, universities, and the four federal wilderness managing agencies. Wilderness50 is directing national-level activity and event planning and helping groups around the country organize and plan local, state, and regional 50th anniversary celebration events and activities that will be held throughout 2014.

## Official Commitment to Celebration Planning

To spur the acceleration of planning efforts, a formal signing ceremony occurred on August 23, 2012, in Washington D.C., attended by employees, volunteers, and supporters from several Wilderness50 member organizations. At this ceremony, representatives from the Society for Wilderness Stewardship (representing all nonfederal Wilderness50 member organizations), Bureau of Land Management, Fish and Wildlife Service, Forest Service, and National Park Service signed a memorandum of understanding (MOU) signifying Wilderness50's commitment to a collaborative effort to develop and implement effective and consistent education programs, activities, events, and products that celebrate the establishment of the wilderness system and efficiently convey the ecological and social benefits of an enduring wilderness resource to the public.

**In 2014, the Wilderness Act will celebrate its 50th anniversary.**

## Making It Local

**Lisa Eidson backpacking in Montana's Great Burn as part of the Arthur Carhart National Wilderness Training Center's 2011 National Wilderness Stewardship Training Course. Photo by Joan Suther.**

Although national events and media efforts will ensure broad awareness of the 50th anniversary of wilderness, the true power of this historic time lies in outreach to local communities around the nation. The MOU signing has served as a catalyst for local planning groups, which already exist in many states and are steadily increasing to soon cover nearly all 50 states. These groups are planning community-based celebratory events such as walks, stewardship projects, conferences, workshops, trainings, fairs, concerts, art and photography shows, contests, exhibits, presentations or lectures, book and poetry readings, and classroom education programs. The most popular types of awareness events emerging are Walks for Wilderness – symbolic walks in nonwilderness areas easily accessible to urban residents, such as city parks or trails, that often feature horse packing and other traditional skills, speakers, workshops, booths, food, and music – and wilderness exhibits in visitor centers, museums, airports, or other public spaces.

To facilitate local planning, Wilderness50 has identified local planning leaders and produced a variety of resources for local planning groups, including diverse lists of potential organizations to reach out to – garden clubs,

Lyndon B. Johnson used this fountain pen to sign the historic Wilderness Act into law on September 3, 1964. Photo credit: www.wilderness.net.

chambers of commerce, sportsmen's groups, church/faith groups, youth and scouting groups, and so forth. A celebration idea generator titled "50 Ways to Celebrate the 50th," and materials, such as a Wilderness Walk planning guide, exhibit space-request-letter template, and key wilderness media messages, are available online as part of a planning toolbox.

Once local planning groups have formed and made decisions about what types of local events to host, they are asked to catalog their events on the national 50th anniversary wilderness website: www.wilderness50th.org. This website serves as the national clearinghouse for all information and events related to the 50th anniversary, provides national marketing and recognition for local events and their planners, and helps match potential attendees with available local events through an event location, type, or calendar search.

## Conclusion

With the 50th anniversary year fast approaching, much work remains to successfully position wilderness in the public eye. National events in 2014 – a September Hill Week in Washington, D.C., and the National Wilderness Conference in Albuquerque, New Mexico, from October 15–17 – along with other possible national projects, including public service announcements, magazine article and book publications, studio-quality movies, a commemorative poster, an enhanced podcast, photography and youth art competitions, high-profile museum exhibits, and teacher education workshops will supplement the 200–300 local events estimated to occur during 2014. Collectively, these efforts serve to ensure that Americans truly celebrate the golden anniversary that "50 Years of American Wilderness" represents.

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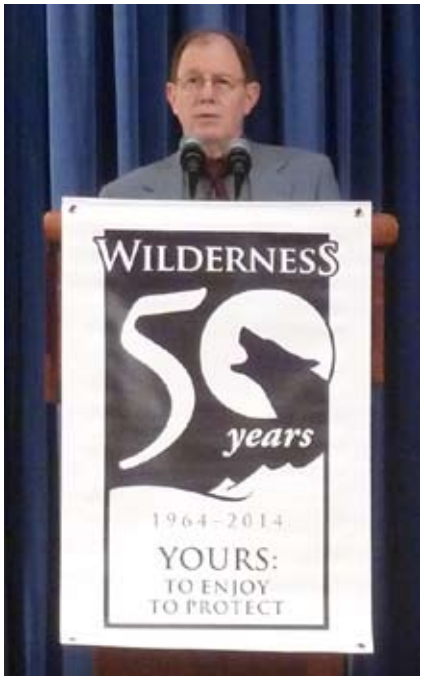


Ed Zahniser, son of Wilderness Act author Howard Zahniser, spoke briefly before the August 23, 2012, MOU signing, followed by short remarks from each signatory. Photo credit: Andrew Pike, Campaign for America's Wilderness/Pew Trust.

# The University of the Desert

## *Using Wilderness in Oman to Bridge the Cultural Divide*

BY MARK EVANS

In 2005, in what was to be one of his last major acts as secretary general of the United Nations, Kofi Annan announced the creation of the United Nations Alliance of Civilizations (UNAOC). To send out a message of what the UNAOC stood for, Annan chose to deliver his address overlooking the Bosphorus Bridge in Turkey, a bridge that connected Europe to Asia, and connected cultures.

Explaining why it was felt that a new UN body needed to be established, Annan argued that the world had changed. He was speaking to a group of 20 prominent world figures meeting in Istanbul to present him with the findings of more than a year of work. The high-level group included Anglican archbishop Desmond Tutu and the former Iranian president Mohammad Khatami. It was convened to produce a report examining the root causes of a growing gulf between the Muslim world and the West, and the report called for a series of cultural, educational, and youth projects to help bridge a growing gulf in understanding between the two cultures.

Two years later, the UNAOC announced plans for its first major forum in Madrid, and more than 800 delegates and an equal number of the world's media assembled. Queen Noor of Jordan, President Erdogan of Turkey, Sheikha Moza of Qatar, Prince Turki Al Faisal of Saudi Arabia, Riz Khan of Al Jazeera TV, and representatives of every nation and religion spent three days debating the causes of and solutions to the increasing polarization of cultures.

### Connecting Cultures

One of the cornerstones of the forum was the recognition that involving young people, and future opinion formers, was essential for a better future. Associates within the UN had shown me on several occasions cupboards full of workshop reports and lengthy resolutions that all arrived at the same conclusion – that involving young people in intercultural debate was key to achieving a sustainable, lasting improvement. Prior to the forum, the UNAOC had set about the task of identifying the various civil society initiatives that already existed and were actively engaging in issues based on intercultural dialogue, with young people at the core of what they did. Connecting Cultures, then fewer than three years old, was one of the handful of programs that UNAOC had identified as the world's leading civil society initiatives, and was invited to take part in the Madrid forum.

**Mark Evans. Photo by Phil Weymouth.**

> Connecting Cultures was a unique learning school that provided me the perfect opportunity to make up my mind about where I stand at this moment and which way to follow to become who I want to be. The beautiful journey we shared provided me a mirror. I learned that I am getting so many possibilities to step up and make a difference. I now feel I have a certain kind of obligation to really do so. I'm absolutely sure that the end of the experience is the start of change in a positive way.
>
> – Rachida Abdellaoui, Morocco

By 2004 I had lived in the Middle East for nine years. Periodic visits back to Europe revealed a media attitude to the region that was distinctly negative and often inaccurate, and an attitude that did not reflect my positive experiences. His Highness Prince Turki Al Faisal, then Saudi Arabia's ambassador to London, was as enthusiastic as I to do something

Figure 1 – Connecting Cultures logo.

about what was becoming an increasingly polarized situation. With his advice, and the help of several small grants, a website was created and in 2004 Connecting Cultures was launched in London with the aim of using outdoor journeys – away from distractions such as mobile phones, roads, and electricity – to bring young people from the Western and Muslim worlds together to engage in extended, focused, intercultural debate. Use of the outdoors as a vehicle to promote genuine learning and long-term outcomes by organizations such as Outward Bound has been well documented, but there was only really one model in existence that focused on youth and cultural tensions on which Connecting Cultures could be based.

Set up in South Africa in 1957 by Dr. Ian Player, the Wilderness Leadership School was the first organization in Africa dedicated to providing a pure wilderness experience for people of all backgrounds, races, and nationalities. Starting during the troubled days of apartheid, this multiracial education and experiential program made a significant contribution to easing tensions in South African society by taking mixed groups of young people on five-day journeys, or trails, into the bush. Ian Player was in his 70s when we first met. In these days of endless PowerPoint presentations, he had just delivered one of the most engaging and passionate lectures I had ever heard, image free, to a packed audience in South Africa House in London. With his advice and words of support, the first Connecting Cultures journey took place in 2005 on a remote island off the north coast of Norway for a team of young people from Saudi Arabia and the United Kingdom. To survive in a land where polar bears outnumber people, teamwork and communication were essential. On completion of the journey, the entire team was presented with awards in front of 12,000 people at an Arabian Days exhibition in Manchester. Connecting Cultures was up and running.

> This journey has made me see the real faces and voices of Middle East people, and I can say right now that they're quite different to the news about this region that we watch in our western media. Because of that prejudgment, I wasn't sure about the good understanding between all of us in this journey. Now, when this incredible experience is about to finish, I leave Oman with a very good feeling inside.
>
> – Santiago Lopez Lozana, Spain


Figure 2 – Map showing the location of Oman on the Arabian Peninsula.

**Connecting Cultures was launched in London with the aim of using outdoor journeys – away from distractions such as mobile phones, roads, and electricity– to bring young people from the western and Muslim world together to engage in extended, focused, intercultural debate.**

The logo of Connecting Cultures (see figure 1), which shows bodies sitting around a fire, has its origins in the classic book *The Seven Pillars of Wisdom* by T. E. Lawrence (of Arabia), in which he described the fireplace as the university of the desert, where stories are told, news is exchanged, and disputes settled. Working in close partnership with the Oman National Commission to UNESCO, the first Connecting Cultures journey in Oman (see figure 2) took place in 2007, with two more journeys taking place in 2008, followed by more in 2009 and 2010. With support and funding from the Oman government, international organizations such as UNESCO and ISESCO and the European Union, nonprofit/charitable organizations such as the MBI Al Jaber Foundation and the Anglo Omani Society in London; and the corporate sector, Connecting Cultures journeys are open to any young people, irrespective of their financial background. However, with funds always limited, the young people chosen to take part need to be selected carefully. The people we seek are referred to as "young opinion formers," young people who have the capacity to influence others in the future and who ensure that the lessons learned on a Connecting Cultures journey in time reach out to a much greater audience.

As with Ian Player's Wilderness Leadership School in South Africa, wild places are key to the Connecting Cultures program, and with wonderful desert and mountain scenery coupled with some of the nicest people one could wish to meet to boot. Oman is the perfect home for our desert debates; a 5,000-year-old culture that, through trade and major seafaring journeys, is receptive and open to alternative attitudes and, above all, is a society that is peaceful. In 2010, Oman ranked 23rd out of 149 countries – above the United States and the United Kingdom – in the Vision of Humanity's Global Peace Index.

While placing an environmental responsibility to leave it as we found it and by going to places where there are no mobile phone signals or other distractions, the young people are able to engage in focused, uninterrupted, and extensive dialogue over five days, a much more powerful learning environment than any hotel-based conference or workshop can ever produce. The wilderness experience is far removed from the cultural influences of our daily lives and strips participants of the normal social basis for personal identity. In the absence of masks, peer pressure, and doors to hide behind, participants must confront themselves; defense mechanisms and facades are gradually eased as trust grows. The desert is socially ambiguous; status differences dissolve and candid interactions and sharing occur. Stories are told, secrets revealed, and pains are shared, encouraged by the trust developed through the cooperation required on a shared journey. Research by Outward Bound reveals that experiential learning can have long-lasting impacts, and essentially works under the premise that "what I hear I forget, what I see I remember, and what I do I understand." Her Highness Queen Rania in

**Figure 3 – Approaching camp at the end of the first day. Photo by John C. Smith.**

**Figure 4 – Approaching the summit along a knife-edge sand ridge at sunrise. Photo by Phil Weymouth.**

Jordan, a great advocate for youth dialogue, once stated that there is a difference between information and knowledge. Clearly, the Internet is a great source of information, but it is evident from talking to young people that they are cautious of what they read online. A typical comment written on a recent Connecting Cultures application form reads:

> I believe two of the main causes of cultural tension are misunderstanding and fear of the unfamiliar. While the internet can serve as a tool to familiarise people, in my experience it is also a breeding ground for misunderstanding. Additionally it cannot convey humanity, the qualities we share, laughter, pain, triggers we have evolved to recognise and communicate. It makes everything black and white.

Each day on a Connecting Cultures journey involves working as a team to overcome challenges and traveling on foot or with camel through the sands or the mountains of Oman (see figures 3, 4, and 5). The night is spent sleeping in small tents or under the stars around the fire. The lunch breaks and evenings provide opportunity for debate, sensitively facilitated by Outward Bound Oman instructors, such as identifying shared values, thinking about how one's own culture might be perceived by others, identifying the causes of and solutions to cultural misunderstanding, and, most importantly, identifying what our responsibilities are in society when we all return home (see figure 6). Sharing the journey with people from up to 13 different nations and interacting with the local Omani people provides a unique opportunity for everyone to share and absorb what is often intangible heritage and knowledge, in the process leaving much behind while taking a great deal away (see figure 7).

## Successful Experiential Learning

The media interest in Connecting Cultures has been extensive. The 2008 journeys had an estimated media reach of more than 28 million people (ASDAA public relations UAE), not including daily coverage on the BBC News online website. More recently, in 2010, Connecting Cultures was one of 20 initiatives identified from more than 1,100 applications and received financial support from the UNESCO Power of Peace Network, enabling us to seriously explore the most productive way of taking the issues debated in the deserts of Oman into the global arena by harnessing the power of technology and social media, as well as redeveloping the Connecting Cultures website (www.omandesertexpeditions.com).

As a teacher, I have worked with young people in the classroom for 20 years, yet the educational impact of these five-day journeys in the desert far surpasses anything that takes place in a more formal educational environment. Starting as complete strangers, after just five days together the tears flow freely at the airport, friendships for life have been formed, and, most importantly, an increased knowledge of self, and others, will enable these young ambassadors to make more balanced and informed judgments in the future.

> It is of great satisfaction to provide and share knowledge from your own point of view as well as gaining valuable insights on how my country and my nationality are recognized, considered and understood from perspectives that I never came across before. I have learnt more about Islam and the Arabic culture during these five astonishing days and got

**Figure 5 – Striding across the gravel plain the group covered 18 kilometers (11 miles), their best day for distance traveled. Photo by Phil Weymouth.**

into such deep and thoughtful debates than I ever was able to during my time at school.

– Peter Cramer, Germany

At the end of a recent course in the winter of 2011–2012, the participants were asked to consider what being in a wilderness location had contributed to the learning outcomes. Typical of the feedback was this statement from a girl from Singapore:

> The desert wilderness, away from electricity and mobile phones, contributed to our overall learning experience to a large extent as this environment denies us of our usual comforts, allowing us to step out of our comfort zones. We are forced to face the discomforts which we normally would not experience in our daily lives, such as lack of running water, a proper toilet, rubbish disposal and not showering for days. Being without our usual comforts, also meant that all the participants had to rely on the same resources such as tents, sleeping bags, water and food. Thus, we have to help and encourage each other to overcome the obstacles we are facing during the expedition. Having spent 5 days of our lives together in Sharqiya Sands and Oman, going through the same experiences of walking, sleeping in the desert and riding the camels have allowed us to bond more. We are very different individuals but these shared experiences have bonded us together. It is something which cannot be achieved from the comforts of the hotel/lecture/conference based programme or in our homes through the Internet. I have especially enjoyed the sunrises and sunsets together with my group mates. To sum it up, I must admit that these denials of comfort have allowed me to appreciate what I have in my daily life now and made me think of what I really need and want and what I can do in my own life and my community.

**Figure 6 – Tilila from Morocco explains how she feels others may see her culture. Photo by Mark Zelinski.**

With regards to the question on achieving the same results had we gone for a more formal hotel/lecture/conference-based program, or had we discussed the same issues over the Internet, I would say we would probably not have achieved the same results, because having a more formal setting would affect or compromise the quality of our discussions. During this expedition, we had the opportunity to talk to one another during the long treks and understand each other's cultures better. It was also more comfortable in that way, rather than through a formal avenue or over the Internet. As for discussing the issues via the Internet, this mode of communication does not allow face-to-face interaction, which would not promote mutual trust and understanding to the same degree. The thing is, there are differences between the Western, Arab, and Asian ways of communicating ideas and thoughts, which was pretty interesting. This is a fact that I could observe and see for myself during the expedition. It can be rather intimidating, but I have definitely learned a lot. This is an example of connecting cultures in real life. Thus, I would

**Figure 7 – Seventeen young ambassadors for a better future. Photo by John C. Smith.**

prefer the desert wilderness as compared to a more formal setting. Of course, there are pros and cons for both. For one, I can be nervous when meeting new friends, and thus I am more comfortable with expressing my thoughts on paper rather than verbalizing them. But this is something that I need to overcome, an area that I need to work on. To conclude, the desert wilderness provides a rare chance of experiential learning, and it is something that I would not forgo. If I have a chance to do it again, I will.

Today the Connecting Cultures journeys – three each year – are funded by His Majesty Sultan Qaboos, the Sultan of Oman, as Oman's gift to UNESCO and the UNAOC. Each year, 54 young people take part on a Connecting Cultures journey, with the challenge of returning to their communities to make them better places to be. It is these young people who are the key to a more harmonious and sustainable future. Armed with knowledge gained from experiences such as Connecting Cultures in Oman, one hopes that they will be better prepared to meet the challenges that face them.

MARK EVANS, founder of Connecting Cultures, is now executive director of Outward Bound Oman, the only Outward Bound school in the Arab world. In addition to working in the Middle East for 15 years, Mark spent 2 years living in small tents in the Arctic, including leading the IBM year-long overwintering expedition to Svalbard, featured in *IJW* in April 2002. Email: mark@omandesertexpeditions.com

***Continued from MEXICAN BIODIVERSITY CONSERVATION MODEL, page 24***

in preventing land-use change (Figueroa and Sanchez-Cordero 2008), which is one of the main causes of biodiversity loss, and reduce the generation of greenhouse gas emissions, which in turn increases climate change effects (Dudley et al. 2010).

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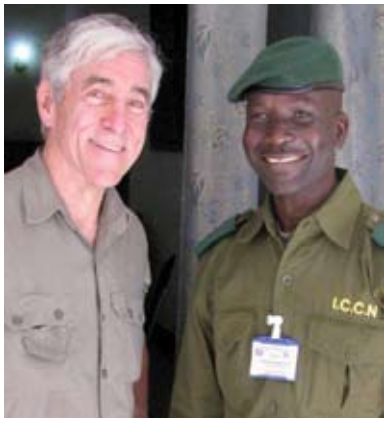
# An Alaskan in the Congo

BY MICHAEL McBRIDE

On Monday morning April 2, 2012, promptly at 7:30 A.M., a company of 42 soldiers was called to attention by their company commander. Snappy uniforms and shined boots were lit by the dappled sunlight that danced below the crown of pines. A soft breeze carried the smell of woodsmoke and the mysterious essence of all Africa with it. A curious something was at work in the 70-degree air, almost tangible here on the mile-high Upemba plateau at the Lusinga Ranger Station deep in the Congo wilderness. The clouds were somehow more interesting; there was a sweeping view across a thousand square miles of lands as wild as any on Earth. In sight were lowland gallery forests, rolling savannah grasslands, and mixed vegetative types in a dozen shades of green. This was once the home of lion and leopard, cheetah and rhino, elephant and kudu, zebra and reed buck, and scores of others in this global biodiversity hot spot.

At 5,200 feet (1,585 m) of elevation in the cool *miombo* woodland and grass savanna wilderness at the Upemba National Park (UNP) station, I was surrounded by 12,000 square miles (31,080 sq. km) of wonderland as fabulous as any in the world. A fleece jacket feels great in the evenings and the malarial mosquitoes are far away. The UNP is in a Midas-rich mineral belt called the wealthiest in the world. A decade of civil war and genocide precipitated by these riches resulted in the killing of almost all the native animals.

The scene was played out deep in the Democratic Republic of Congo (DRC) that lies in the Midas-rich province of Katanga, whose still-buried mineral treasure is estimated at $24 trillion. Just two low smoky ridges away a gun battle with escaped prisoners took place about 10 days ago. It claimed the life of a Congolese army colonel, his aid, numbers of his detachment, Mai Mai terrorists, and many civilians caught in the crossfire that left an undetermined number bleeding to death in the African sun. Mai means "water" in the local dialect, referring to their belief that bullets are deflected from them like water. A mysterious set of "ju-ju" and animist beliefs, facial painting, body decorations, and the use of bows and arrows combines to create a force that one would have thought disappeared long ago.



**Michael McBride with an ICCN park ranger in the Upemba National Park. Photo courtesy of M. McBride.**

With scant indication of what happened a few ridges away, I responded to a conservation opportunity to join an international team meeting in Lubum-bashi, the capital of this war-torn region to which a tenuous peace returned in 2004. My associates were tasked with creating a management plan for the Kundelungu National Park (KNP) and UNP. The DRC's several parks and World Heritage Sites in the north are the domains of 11 species of primate, including guerillas, bonobos, baboons, and chimpanzees. Size superlatives do not suffice until one compares this land to a larger geography. Congo, the largest African country, is the size of Spain, France, Germany, Norway, and Sweden combined. Until about 30 years ago these two game-rich parks had been crown jewels in the biodiversity crown of Africa and were teeming with animals. They have been all but extirpated during the wars that raged here for many years, and this glorious country is now almost without native megafauna.

The United States has had strategic military interests here since the early days of the Cold War when Russia was engaged on many levels for the control of mineral elements that are vital to the electronics and computer industries. The abundance of copper gives rise to the name of this north-south territory called the Copper Belt, which is also rich in gold, silver, and diamonds. There was a long period of lawlessness

across the land when all the major cities were looted and the park headquarters was burned. Those who died defending the park include the director of the rangers and the park superintendent's wife, who now rests in a well-manicured and prominent graveyard at the entrance to the park.

With a $5 million grant from the European Union and administered by the Africa-savvy Frankfurt Zoological Society, the task was to bring natural order back to the region through protecting the parks so that they might again revert to their animal-rich status. One need only go east across the border to Tanzania and Kenya to see a thriving and complex economic system dependent on game-viewing safaris. All the foundational elements are in place here to have a thriving animal-based economy that infuses money into the grass roots of the economic structure versus the mining industry, where very little of the wealth generated benefits the average DRC citizen. This disparity leaves the DRC with the unhappy sobriquet, "The poorest people in the richest country in Africa." An international commercial index rates the DRC as the 187th and it is the last place in the world for ease of doing business. Corruption, graft, and greed lie at the heart of corrupt governance and weak judicial enforcement.

Prevention of further degradation of the parks must go hand in hand with stopping the complicity of officials in the killing of animals for personal profit. Restoration of large herds of once-displaced animals is possible but extremely challenging. Consider the challenges of rebuilding buffalo herds in America's western states and the black rhino recovery in the Umfolozi Wilderness Area in South Africa.

**The historically entrenched problems of park restoration will be neither easily nor quickly resolved.**

The men who passed in review under the trees that April morning were handsomely uniformed, their black combat boots shined, pants were bloused and complemented with the leather-edged green berets common to the forces of l'Institute Congolaise pour la Conservation de la Nature (ICCN). After presentation to their company commander, the men began a call-and-response singing session that had the saucy elements of a Paul Simon sing-along and dance group. The lead voice in front of the men danced and gestured, pointed, and evoked spirited responses. This was fine theater for certain. These fellows are members of a government team placed here to protect the animals of the UNP that was founded during the Belgian colonial era in 1939.

I wear several hats as a member of this delegation and am perhaps the most unlikely. Having participated in efforts to restore elephant migration corridors in Mali in North Africa and another in South Africa, Mozambique, Botswana, and Zambia, I'm keen to represent the needs of the elephants. As an Alaskan wilderness guide, naturalist, and wilderness lodge owner, I bring an understanding of operations in the remote bush and know what it would take to entice visitors to these parks. As a member of the African Game Rangers fraternity, it is clear to me what these fellows are up against. As a bush pilot I am a cofounder of a Bateleurs, Volunteer Pilots Flying for Conservation in Africa. There is a great need for aerial support, and an opportunity exists to recruit pilots from across Africa for the job. Illegal activities in the park include the setting of wire shares, shooting animals for the lucrative bush meat trade, artisanal mining, agricultural incursion, and commercial fishing, all of which lead to the impoverishment of game.

The historically entrenched problems of park restoration will be neither easily nor quickly resolved, but my associates and the dedicated rangers and parks staff are making a heroic attempt to help the local people, the native animals, and the country. The world is wishing them well and watching to see if it is possible.

MICHAEL McBRIDE is a wilderness guide and lodge owner in Kachemak Bay, Alaska; email: Michael@alaskawildernesslodge.com.

# Announcements

COMPILED BY GREG KROLL

## Call for Abstracts for WILD10 Symposium

The Symposium on Science and Stewardship to Protect and Sustain Wilderness Values will be an integral part of WILD10, the World Wilderness Congress scheduled for October 4–10, 2013, in Salamanca, Spain. WILD10's central theme is "Make the World a Wilder Place," focusing on how people can protect, sustain, and restore wild nature while providing enhanced social and economic opportunities for human society. The symposium is being coordinated by the Aldo Leopold Wilderness Research Institute, the Global Change Research Center of the Czech Academy of Sciences, the Wildland Research Institute of the University of Leeds, and the WILD Foundation. (Source: wild10.org)

The full call for Symposium abstracts can be seen at: http://leopold.wilderness.net/whatsnew.htm#wwc.

## Australia to Host IUCN World Parks Congress in 2014

A landmark global forum on parks and protected areas will convene in Sydney, Australia, in November 2014. The International Union for Conservation of Nature (IUCN) World Parks Congress takes place only once every 10 years and is one of the world's most influential gatherings of people involved in protected area management. Since the first Congress in Seattle in 1962, the event has been seminal to conservation policy worldwide, addressing global challenges and opportunities, establishing standards to ensure that protected areas are effective, and being a source of inspiration and innovation for the decade that follows. Sydney is home to Royal National Park, Australia's first national park and the world's second national park after Yellowstone in the United States. (Source: www.iucn.org/news_homepage, June 19, 2012)

## Appeals Court Reverses BWCA Cell Tower Decision

According to the Minnesota Court of Appeals, an adjacent 450-foot (135 m) blinking cell phone tower will not significantly affect the scenic value of the Boundary Waters Canoe Area (BWCA). Reversing a lower district court decision from 2011 (*IJW* Digest, December 2011), the appellate court said that AT&T could proceed with the tower, replacing the 199-foot (60 m) structure it had just completed on the edge of the wilderness near Ely. AT&T spokesman Alex Carey said construction would begin immediately. The court of appeals said the earlier decision was wrong because it was subjective and it did not weigh the severity of the effect on scenic views from within the BWCA. It also said the effect would not be permanent because the tower could be removed.

Kevin Reuther, an attorney for the nonprofit law firm Minnesota Center for Environmental Advocacy, said he was puzzled by the decision. "The judges rejected the opinion of the lower court because it was subjective, but then inserted their own opinion by stating that the effect was not severe enough to justify intervention," he said. "It eviscerates the scenic and aesthetic resource protection from the Environmental Rights Act. … That's very disappointing." (Source: [Minneapolis] *Star Tribune*, June 18, 2012)

## Nova Scotia Establishes Two New Wilderness Areas

Raven Head and Kelly River, in Cumberland County, Nova Scotia, Canada, are some of the province's last great wildlands. The Kelly River area will now receive permanent protection, thanks to a $9 million purchase by the province from Wagner Forest Company, which will terminate its small logging operation by the end of 2012. At that point, the lands will be off limits for commercial or forestry development, and will be set aside for camping, canoeing, fishing, hunting, and other recreational activities. The new Kelly River wilderness consists of 50,000 acres (20,000 ha), including most of the Chignecto Game Sanctuary.

The Raven Head wilderness encompasses 22 miles (36 km) of pristine Atlantic coastline. According to

Submit announcements and short news articles to GREG KROLL, *IJW* Wildernss Digest editor. E-mail: wildernessamigo@yahoo.com

conservationist Harry Thurston, "I don't think there is a stretch of coastline that large in eastern North America that is being protected. This is just an extraordinary day for conservation." These wilderness additions bring Nova Scotia 75% of the way toward its goal of setting aside 12% of the province for public use, and are the first additions to the protected area system in 14 years. (Source: CBC News, June 6, 2012)

## Montana Motorized Group's Lawsuit Denied

A federal judge has denied a lawsuit brought by Citizens for Balanced Use, a motorized-use advocacy group, which claimed that the Gallatin National Forest in Montana unfairly implemented restrictive snowmobiling rules in a Wilderness Study Area (WSA). Judge Sam Haddon ruled that the Forest Service did not violate the Montana Wilderness Study Act of 1977 when it enhanced the wilderness character of the Hyalite-Porcupine-Buffalo Horn WSA south of Bozeman. Citizens for Balanced Use had argued that the Forest Service could only maintain the character of the WSA, not enhance it. Haddon cited a previous case that went to the 9th U.S. Circuit Court of Appeals in his decision, saying the court squarely addressed and resolved the issue with a 2011 ruling.

The travel plan drawn up by the Gallatin National Forest in 2006 for the WSA has been controversial. Wilderness groups initially sued over the access provisions; after winning their suit, the Forest Service subsequently restricted both motorized and mountain bike use in the WSA. (Source: *Billings Gazette*, June 26, 2012)

## Mexico Scraps Mega-Tourism Project

In June 2012, then-president of Mexico, Felipe Calderón, canceled the environmental permit for the Cabo Cortés resort in Baja California Sur near Cabo Pulmo, the only coral reef in the Gulf of California. Calderón said the 20,000-year-old reef requires protection. Madrid-based Hansa Urbana had planned, in the first stage of development, to build 30,692 hotel rooms, two golf courses, and a 490-slip marina on 9,400 acres (3,800 ha) of shoreline, one of several such developments planned for the area.

The Asociación Interamericana para la Defensa del Ambiente (AIDA) worked with local communities and organizations to fight Cabo Cortés and other proposed resorts, bringing in international authorities, including the Ramsar secretariat from the Convention on Wetlands, UNESCO, and the IUCN, to visit the reef and make recommendations to the Mexican government. Concerns included increased sewage runoff that would promote algae growth and limit sunlight vital for reef survival; reef damage and specimen theft resulting from marina development; and chemical runoff from golf-course maintenance that would threaten the delicate ecology of the reef. (Source: AIDA, June 29, 2012)

## "Rewilding Europe" Initiative Is Launched

Europe is currently in the middle of an exceptional wildlife comeback due to large-scale abandonment of farmland. This phenomenon is particularly notable in the continent's mountainous areas. According to the International Union for Conservation of Nature (IUCN), the continent's rewilding provides new opportunities for society and people still living in many rural areas to shift from a subsidized, natural resource extraction economy to a service economy based on nature and wild values. An estimated 50% or more of all European species are dependent on open/semi-open landscapes.

In April 2012, an agreement was reached between the Danube Delta Biosphere Reserve Authority and WWF-Romania to work together on rewilding the Romanian part of the delta. As a first step, a number of keystone species, including beaver and red deer, will be brought back to the delta to kick-start natural processes that had all but disappeared. Natural grazing systems will also be promoted, starting with a translocated population of wild horses. The reintroduced wildlife species, together with the already spectacular birdlife, unique landscapes, and interesting cultures, have the potential to create new income opportunities for local communities. In the past few decades, traditional income sources from fisheries and livestock farming have dwindled, leading to an exodus of young people and an aging population.

Rewilding Europe is also working in two other biosphere reserves: the East Carpathians Biosphere Reserve on the border between Poland, Slovakia, and Ukraine, and the Velebit Biosphere Reserve on the Adriatic coast of Croatia. With another five model areas still to be identified and launched, Rewilding Europe – a joint initiative between WWF-Netherlands, ARK Nature Foundation, Wild Wonders of Europe, and Conservation Capital – has set itself a goal of rewilding at least 1 million hectares (2,500,000 acres) of land and sea by 2020.

Rewilding includes stimulating natural processes in shaping the landscape without aiming at a predictable end state. A naturally functioning landscape that can sustain itself into the future without active human management is the ultimate goal. Wildlife comeback is at the core of this

approach, and is championed as an inspiration and attraction for people, as well as a source of revenue generation for economic development. (Source: www.iucn.org/news_homepage, May 4, 2012)

## California County Rebuffed Again in Death Valley NP Road Claim

Nearly four years after a federal judge tossed out most of the claims by California's Inyo County to historic routes in a remote area of Death Valley National Park, the judge has thrown out the remaining claims. In October 2006, the county filed a lawsuit claiming it was within its rights to maintain the right-of-way for two stretches of "highway" the county contended had been recognized for decades. Under the county's claim, the roads run through Greenwater Canyon, Greenwater Valley, and Last Chance Canyon. Those areas were designated as wilderness when Death Valley was given national park status in 1994.

Hoping to take control of the routes using the 19th-century federal right-of-way law, R.S. 2477 (IJW Digest, December 2011), the county planned to remove park service barriers and build two-lane highways in the roadless desert canyons and valleys. But in 2008, U.S. district judge Anthony Ishii ruled that the county waited too long to assert its claims to the three "roads" in the national park because they were included in wilderness study areas by the federal Bureau of Land Management in 1979. He agreed with arguments by conservation groups and the National Park Service (NPS) that the county's claims were barred because it had failed to file its lawsuit within the 12-year statute of limitations. The court thus dismissed the county's claims to all of one route and most of the other two routes.

In June 2012, the judge tossed out the final piece of litigation concerning a half-mile (0.8 km) of Last Chance Canyon, holding that "the factual context of public use indicates unequivocally that the segment of Last Chance Road at issue in these cross-motions for summary judgment never existed as a highway within the meaning of either California common law or within the meaning of federal law interpreting R.S. 2477." Six conservation groups represented by Earthjustice intervened to support the NPS in the case: Sierra Club, The Wilderness Society, California Wilderness Coalition, National Parks Conservation Association, Center for Biological Diversity, and Friends of the Inyo. (Source: *National Parks Traveler*, June 7, 2012)

## Queensland Government Returns National Park to Traditional Owners

The government of Queensland, Australia, has returned title to Mungkan Kandju National Park on Cape York Peninsula to its traditional owners, the aboriginal Wik people. In a dispute dating back to the early 1970s, the Wik people tried to buy the land back, but were stopped by the Queensland government. In a case that went all the way to the High Court, the Wik people won the case, but the government then turned the land into a national park to stop the aboriginal people from owning it. Now, although most of the land in question remains a national park, it will be managed jointly by the state and the Wik people. One hundred seventy-eight thousand acres (72,000 ha) of the parklands were revoked, but not even The Wilderness Society objected to the move as it was long accepted that the national park was only declared to stop aboriginal people from owning the land. The most environmentally sensitive parts of the park will still be managed as a nature reserve, which the Wik people have agreed to protect. (Source: www.abc.net.au/worldtoday, May 22, 2012)

## Drones to Protect Endangered Species and Habitats

Conservationists in Nepal will soon employ special drones as part of an effort to protect endangered species. The pilotless aircraft have been developed by the global wildlife organization WWF. The drones are cheap to buy and operate, and could prove invaluable to land managers throughout the developing world. In Nepal, where rhinos and tigers are suffering from the combined effects of poaching and habitat destruction, it is hoped that the new drones will be useful in detecting poachers as they enter the parks so that rangers can more effectively apprehend them. In addition, regular flights can monitor changes to park boundaries and support the long-term battle against encroachment.

The small-scale, remote-controlled drones are still being refined. They are light enough to be launched by hand and fly a preprogrammed route of up to 12 miles (20 km), filming the ground below with still or video cameras. They are also equipped with sensors and GPS. Each drone, which can be carried in a backpack, costs about $2,500, compared with commercial systems that range in price from $10,000 to $50,000. This new generation of drones is driven by batteries that can be recharged in half an hour.

In North Sumatra, Indonesia, drones have already been used to map deforestation, count orangutans and other endangered species, and get a bird's eye view of hard-to-access forest

areas. During four days of testing, drones flew 30 missions – collecting hundreds of photos and hours of video – without a single crash. A mission, which typically lasts about 25 minutes, can cover 50 hectares (120 acres). (Sources: BBC News/Asia, June 20, 2012; Mongabay.com, February 23, 2012)

## First U.S. Tribal Wilderness Turns 30

Thirty years ago, the Confederated Salish and Kootenai Tribes of Montana established America's first tribal wilderness, the 93,000-acre (38,000 ha) Mission Mountains Wilderness. In June 2012, some 200 celebrants gathered beneath those peaks to honor the courage and foresight of the tribal members who worked to set aside in perpetuity a full quarter of all the lands the tribes controlled on the reservation at the time.

In 1936, the very first tribal council had tried to establish an Indian-administered national park there. Although the idea had the backing of the local Bureau of Indian Affairs superintendent, the proposal died in Washington, D.C. It wasn't until the 1970s that the three YaYa's – grandmothers and tribal elders – addressed the tribal council, one by one speaking at length about the Mission Mountains. They reminded the council of its obligation to maintain a traditional way of life, saying that the mountains were a treasure and that it was important not to destroy them "in the short time we are here." When the chairman thanked them and waited for them to sit down, the three remained on their feet. "Is there anything else you want to say?" he asked them. "No," he was told. "We'll just wait here until you vote."

The wilderness area has subsequently taken on an even more vital role. Ten thousand acres (4,000 ha) are now designated as a Grizzly Bear Management Zone that is closed to humans at critical times of the year when grizzlies occupy the area. (Source: *Missoulian*, June 15, 2012)

## Wilderness Act History Is Now Online

An online database has been created that includes early drafts of the U.S. Wilderness Act, congressional reports addressing why changes were made to the bills, and testimonies from the hearings. One can read about the proposed National Wilderness Preservation Council, how grazing was originally to have been phased out, how the minimum-requirements language changed over time, as well as early definitions of wilderness. Go to bulk.resource.org/gao.gov/88-577/index.htm.

## Society for Wilderness Stewardship Is Recruiting for Leadership Positions

The Society for Wilderness Stewardship (SWS) is a young, growing, and evolving organization dedicated to advancing the professions of wilderness stewardship, science, and education to ensure the life-sustaining benefits of wilderness. Current efforts include development of a Wilderness Ranger Academy, supporting efforts to celebrate the 50th anniversary of the Wilderness Act, partnering with federal agencies to implement wilderness character monitoring, participating in wilderness meetings and conferences, preparing a survey to help identify priority issues and solutions, and engaging with agency wilderness leadership and research scientists and educators.

From its inception, the work of the SWS has largely been accomplished by an all-volunteer board of directors who chair committees and form work groups with support from SWS members. The board has recognized the need to grow the SWS membership and expand the capability of the SWS to be an effective voice for wilderness stewardship and the professions of wilderness stewardship. The SWS has identified many opportunities to achieve these goals, but they all require dedicated individuals with a little time and a commitment to wilderness.

Currently there are several vacancies on the SWS board, which include the chair and vice-chair positions. The SWS is seeking individuals who can demonstrate a dedication to wilderness stewardship and have the skills and abilities to help lead others in achieving our goals. To learn more about the SWS, visit www.wildernessstewardship.org. If you are interested in joining or helping to lead the SWS board, please email the SWS at info@wildernessstewardship.org to request more information on the positions available.

# Book Reviews

## *The Promise of Wilderness: American Environmental Politics since 1964*

By James Morton Turner. 2012. University of Washington Press, Seattle and London. 576 pp. $39.99.(hc)

*The Promise of Wilderness* is a highly anticipated and already lauded book. William Cronon, who provides the book's foreword, also serves as the editor of Weyerhaeuser Environmental Books; this book joins the already impressive list of books relating to wilderness published in this series (e.g., Paul Sutter's *Driven Wild*).

The central premise of the book is that debates over wilderness are a direct reflection of American society and politics. In particular, "How Americans have debated wilderness and public lands reform more generally has raised questions not just about environmental protection, but about the power of the federal government, who speaks for the public interest, and the rights of individuals" (pp. 1–2). Further, because public lands debates were a "commanding portion" of the environmental movement from the 1950s, the author believes wilderness issues are the best way to understand these questions.

Turner focuses his attention throughout the book on three related questions. First, he explores "who holds the reins in American environmental advocacy?" (p. 8) by examining the strategies used by public lands advocacy groups, especially The Wilderness Society, to lobby for wilderness creation. Turner demonstrates that The Wilderness Society's strategies evolved with changing social, economic, and political conditions. The second question is, "Why has environmental reform become such a divisive issue in American politics?" (p. 9). Turner notes that although a bipartisan approach to wilderness protection was originally present (e.g., during the passing of the Wilderness Act), a more partisan debate over wilderness (and environmental) protection emerged in the 1980s. The third question, related to the first, asks, "Which policy strategies have been the most important and successful in environmental/wilderness politics? (p. 11). Turner notes The Wilderness Society moved in the 1980s to strategies that emphasized scientific evidence (often taken from conservation biology), economic analyses, and environmental values. In addition, environmental advocacy groups began to abandon the U.S. Congress, which became increasingly partisan and gridlocked, and encouraged politicians to use alternatives to legislation such as executive action, administrative rule making, and litigation.


This change also reflected the loss of public support for a major role of the federal government in society: "A faith in government, a commitment to the political system, and a belief in the public good" (p. 68) all characterized early efforts to protect wilderness, but the rise of neoliberalism in the 1980s changed these previously shared values. Turner examines the Sagebrush Rebellion and the Wise Use movements to illuminate this social shift.

In his conclusion, Turner suggests several lessons emerge for the contemporary environmental movement: (1) wilderness protection has been a positive, tangible success for the environmental movement; (2) a politically pragmatic approach to reform with strong local/regional support has been successful; (3) alliances linking local and national level organizations to a common cause are critical; (4) public lands reforms require different policy pathways and thus organizational strategies; (5) science has facilitated wilderness advocacy; and (6) bipartisan support is important, but Democratic support is essential.

*The Promise of Wilderness* is a beautifully written and erudite addition to the wilderness literature, an environmental history approach examining the politics of wilderness debates from the 1960s to the 1990s and relating them to larger questions present in American (and global) society; it is highly recommended for both wilderness academics and advocates.

Reviewed by John Shultis, *IJW* book editor; email: john.shultis@unbc.ca.

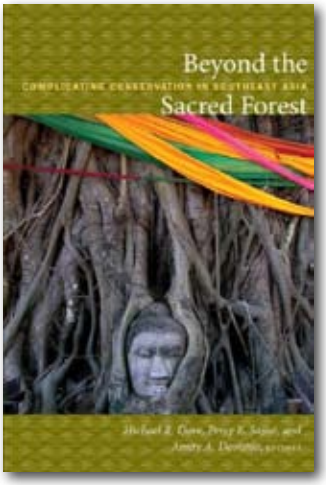
## *Beyond the Sacred Forest: Complicating Conservation in Southeast Asia*

Edited by Michael R. Dove, Percy E. Sajise, and Amity A. Doolittle. 2011. Duke University Press, Durham and London. 392 pp. $26.95 (pb).

As part of the New Ecologies for the Twenty-First Century series, this edited book addresses the complexity of the links between nature and culture using an interdisciplinary approach and emerging theories and concepts (e.g., resilience and "new ecology"). *Beyond the Sacred Forest* focuses on the link between indigenous management of natural resources and its relationship with both indigenous and state conservation practices in Southeast Asia (particularly in Malaysia and Indonesia), primarily using a combination of historical and anthropological (i.e., ethnographic) perspectives. More specifically, most chapters assess, either directly or indirectly, indigenous people's use of the natural environment in this region, and how changes in state and global conditions (e.g., conservation policies) can alter indigenous behavior and culture. The chapters collectively challenge the normal conception of indigenous culture as homogenous and static, and demonstrate that indigenous "management systems we see today are neither necessary nor inevitable but are the product of particular historical processes" (p. 14).

In the book's introduction, the editors identify four key perspectives that highlight the sophistication in each study's academic foundation: postlocal, postequilibrium, postmodern, and post-Western approaches are used. These perspectives suggest that (1) local environmental relations can only be fully understood by understanding the broader regional, national, and international contexts, (2) traditional views of nature and culture as static and tending toward stability are flawed, (3) a social constructivist approach is most useful, and (4) Western perspectives on conservation and indigeniety should not be privileged.

Several chapters note the importance of championing indigenous management and the rise of community-based conservation models by international donors and agencies in the 1980s to many indigenous groups in this region. Communities were able to use this paradigm shift in conservation to their own ends (e.g., to convince governments to return traditional lands to the communities). The long history of indigenous responses to various local, regional, national, and international social, economic, and political changes is also a key lesson: Indigenous people are not static, homogeneous communities but rather are active, creative peoples continually dealing with natural and cultural shifts. Indigenous management of natural resources is similarly responsive: "Environmental relations are an arena of constant negotiation, as communities




constantly reconstruct and transform their social and ecological realities according to new social conditions and events" (p. 235).

Many wilderness researchers are still uncomfortable with social constructivist approaches, and the strongly theoretical approaches in the 10 chapters in this book are certainly not "easy reading" material, but the case studies provided here provide field-based, thought-provoking analyses of key conservation questions that transcend the book's regional focus. The book challenges many traditional views of wilderness, conservation, indigeniety, and nature-culture relations in indigenous communities and highlights the complexity of these relationships and the role of environmental politics and policy in affecting these changing relationships.

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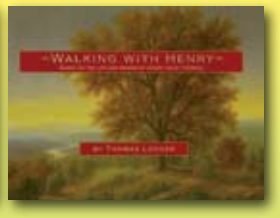


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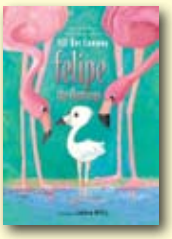


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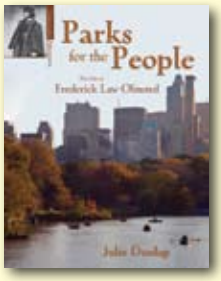


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