INTERNATIONAL

Journal of Wilderness

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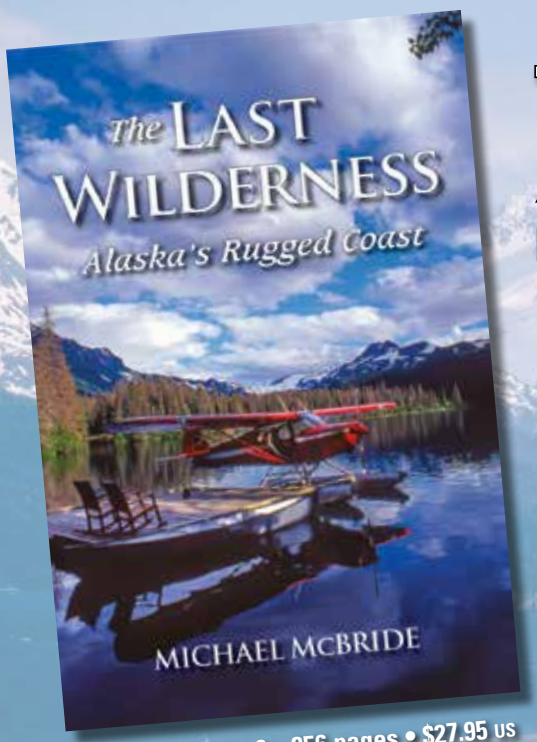
DECEMBER 2014 VOLUME 20, NUMBER 3



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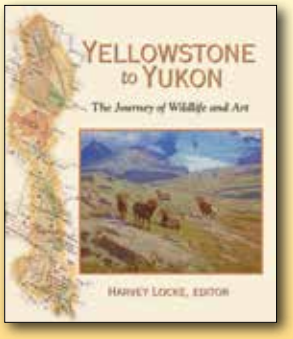

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Journal of Wilderness

DECEMBER 2014 VOLUME 20, NUMBER 3

FEATURES

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Disclaimer

The *Soul of the Wilderness* column and all invited and featured articles in *IJW*, are a forum for controversial, inspiring, or especially informative articles to renew thinking and dialogue among our readers. The views expressed in these articles are those of the authors. *IJW* neither endorses nor rejects them, but invites comments from our readers.

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

EDUCATION & COMMUNICATION

INTERNATIONAL PERSPECTIVES

WILDERNESS DIGEST

On the Cover

Main image:
© Layne Logue. Rivergator Exploratory Expedition paddling through the Ozarkian bluffs past Trail of Tears State Park on the Middle Mississippi, in between Grand Tower, Illinois, and Cape Girardeau, Missouri.

Inset image:
© John Ruskey. Mighty Quapaw youth leaders, Mark River, and Wolf Staudinger, and the Mighty Quapaw Apprentices at camp on the back channel of Smith Point, opposite Big Island and the mouth of the White River, on the Lower Mississippi River. (Left to right): Michael Wortham, Mark River, DeChaunte Gibbs, Darius Jurden, Popeye Hayes, Markevious Jones and Wolf Staudinger."

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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Submissions: Contributions pertinent to wilderness worldwide are solicited, including articles on wilderness planning, management, and allocation strategies; wilderness education, including descriptions of key programs using wilderness for personal growth, therapy, and environmental education; wilderness-related science and research from all disciplines addressing physical, biological, and social aspects of wilderness; and international perspectives describing wilderness worldwide. Articles, commentaries, letters to the editor, photos, book reviews, announcements, and information for the wilderness digest are encouraged. A complete list of manuscript submission guidelines is available-from the website: www.ijw.org.

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EDITORIAL PERSPECTIVES

The *International Journal of Wilderness*

Twenty Years and Going Forward

BY JOHN C. HENDEE and CHAD P. DAWSON

This year, 2014, is the 20th anniversary of the *International Journal of Wilderness* – a good time to review where we've been, and where we're headed.

Conceived as a partnership between wilderness managers, users, advocates, educators, and scientists, *IJW's* start-up was supported by 18 organizational sponsors: the 4 wilderness-managing federal agencies and their Aldo Leopold Wilderness Research Center; leading wilderness groups such as The Wilderness Society, Outward Bound, NOLS, Wilderness Watch, and others; and The WILD Foundation and Fulcrum Publishing, who produced *IJW* both then and now.

IJW was initially housed at the University of Idaho Wilderness Research Center where John Hendee served as managing editor, assisted by production editor Michelle Mazzolla. Guidance was provided by five *IJW* executive editors to serve as an editorial board advising on policy, recruiting articles, and providing quality control by arranging reviews, and a diverse panel of 36 associate editors as potential reviewers of submitted articles and ongoing *IJW* content.

The same basic structure remains today, with the exception of personnel changes. John Hendee was succeeded as managing editor in 2001 by Chad Dawson, who also guided *IJW*'s move online for subscriptions and the archive of 20 years of back issues (www.ijw.org), and now with Robert Dvorak ready to transition to managing editor in 2015. There have been some changes over the years among the *IJW* editorial board, but Alan Watson and Vance Martin are still active leaders in that body. Current *IJW* board members and associate editors are listed on the masthead of every issue.

Published three times a year, *IJW* content includes the following sections: Features, which comprises an editorial and a "Soul of the Wilderness" article from a leader in the wilderness community; Stewardship articles; Science & Research (peer reviewed) material with study results; Education & Communication articles; International Perspectives; and a Digest of wilderness news and calendar with important announcements; and Book Reviews.

It is difficult to single out material to highlight over 20 years, but several "Soul of the Wilderness" articles stand out: top government leaders who articulated wilderness policy and plans, numerous writers with constructive criticism regarding wilderness stewardship, and creative thinking from leaders in the wilderness movement. Summary reports from the periodic World Wilderness Congresses have provided benchmarks of progress in wilderness protection globally. More than 100 book reviews have assessed the most current wilderness-related books.

With its continuing structure, *IJW* content will take this template forward to embrace wilderness progress, challenges, and changes into the future. Going forward, we expect wilderness to assume greater importance for the increasingly valuable ecosystem services it generates – clean air, water, natural gene pools, and wildlife species; its moderating effects on climate change; and as a benchmark of natural ecosystem response. And no less important is the value of wilderness to human experience as a refuge from hectic modern life as well as a place to recover our natural balance and heal from stress. As we move ahead,

Continued on page 7

SOUL OF THE WILDERNESS

Wilderness Character, Untrammeled, Human Knowing, and Our Projection of Desire

BY ED ZAHNISER

We must remember always that the essential quality of the wilderness is its wildness.
– Howard Zahniser, 1953

Wilderness Character

The crux of wilderness character and of the 1964 Wilderness Act itself lies in the word *untrammeled* and its caveat that we must not project our human desires and mental constructs onto designated wilderness. *Untrammeled* says, as Howard Zahniser wrote, that with wilderness we should be guardians, not gardeners. *Untrammeled* says that the so-called management or stewardship goal for designated wilderness, again as Howard Zahniser wrote, is to leave it unmanaged. Untrammeled is a hard teaching for scientists and natural resource managers, especially when we are desperate to see public lands management otherwise generally guided by "good science" rather than ideology, magical thinking, or wishful thinking.

But if wild, wildness, and wilderness embody the meaning of self-willed, how else can we read *untrammeled*? Given the Wilderness Act's intent of a wilderness-forever future, we are impelled to read *untrammeled* as an urgent plea for an ethic of profound restraint and uncharacteristic humility. This is the human challenge – to preserve the self-willed-ness of the land untrammeled in perpetuity, forever, into the eternity of the future.

You may object that the Wilderness Act is ignorant of, if not naive about, invasive species, effects of fire suppression on native vegetative regimes, or the effects of extirpated apex predators and introduced so-called sport or game fish, mammals, or birds on native ecological regimes. You may object that the act is ignorant or naive about acid precipitation, climate change, or the recent distinction drawn between natural and wild.

(Left to right) Charlie Ott, Mt. McKinley National Park Maintenance; Adolph Murie; Olaus Murie; Stephen Griffith; Ed Zahniser; Howard Zahniser. Photo courtesy Zahniser family.

But the Wilderness Act may offer the rejoinder – that much of its putative ignorance and näiveté results from the best science of our recent past. Our past wildlands-managing colleagues suppressed fire because it was then the best science not to let fire destroy good forests. Louis Marshall, father of wilderness champion Robert "Bob" Marshall, defended the "forever wild" clause – now Article SIV Section 1 – of the New York State Constitution. Louis Marshall once chided the New York State Conservation Department for letting fire destroy an Adirondack

lakeshore landscape of forest preserve land for the lack of a $35 pump. He offered to buy the department such a pump to fight future fires.

Our natural resource management colleagues in the past exterminated predators and introduced invasive species because it was the best science of their day to maximize humanly desirable species. Aldo Leopold underwent a slow conversion about predator control that he would liken to watching a wolf's eyes' fierce green fire die.

You may object that our past colleagues' science was not *good* science because *they* were ignorant of the co-evolution of forests with fire. *They* were ignorant of the interspecific dynamics of the health of animal populations and of ecosystems.

However, poet William Bronk objects that we humans live, *always*, in "the permanence of ignorance." Human knowledge is always temporal and provisional: human knowledge is bound by the time in which we live, and what we think we know is only true provided that most everything else we think we know is also true.

As Bill McKibben writes, this question is at least as old as the Hebrew scriptures' book of Job. The book of Job was one of the favorite works of literature of Howard Zahniser, primary architect of and chief lobbyist for the 1964 Wilderness Act. In the book, God questions Job's knowledge and understanding. God asks Job: "Where were you when I drew a circle on the face of the deep?" "Where were you when I laid the foundations of the Earth?" As Hebrew scriptures scholar William P. Brown points out, God then takes Job on a journey to visit Leviathan. There, as Brown emphasizes, God tells Job that he, Job, was not created *apart* from Leviathan but *with* Leviathan.

Human knowledge is temporal and provisional, and science is not a smooth progression of knowledge such that errors of temporality and provisionality eventually will no longer occur. As philosopher and historian of science Gaston Bachelard has shown, the history of science is a history of epistemological breaks or ruptures. Science moves forward with episodic contradictions of its past.

Untrammeled

The epistemological question that *untrammeled* asks of those who steward – whose etymological roots include wilderness warden and guardian – is this: To what future are we the past and a past that may well be contradicted? Does our generation *alone* not live in the permanence of ignorance? If not, we must be "guardians not gardeners," as Howard Zahniser wrote. We must protect wilderness at its boundary. Humility must be our portal for entering any wilderness.

In "The Upshot" section of *A Sand County Almanac*, Aldo Leopold calls for humans to relate to the land – Leopold's shorthand for the entire biota – as a member of that community, not its master. In this sense the Wilderness Act furthers Leopold's project to enlarge the boundaries of the community, to extend our ethical regard to the entire biota. Indeed, in relation to those wild fragments of our federal public lands legacy, the Wilderness Act exists to de-center the human. It exists to de-center us, just as Henry David Thoreau wrote that Walden Pond came to de-center him. The Wilderness Act exists to de-center, epistemologically, the *sapiens* aspect of our self-styled *Homo sapiens*. William Blake as Romantic and William Cronon as postmodernist share a profound distrust of the Enlightenment project of control through knowledge.

The Wilderness Act was framed as an antidote to that human propensity to trammel the land, the entire biota.

That distrust places *untrammeled* at the heart of "wilderness character," at the heart of the Wilderness Act and how it de-centers the human – ethically and epistemologically – in relation to the National Wilderness Preservation System. Howard Zahniser wrote that a potential benefit of experiencing wilderness is how it can convey to us the reality that we are dependent and interdependent – as well as independent – members of the whole community of life on Earth that derives its sustenance from the Sun. We may come to recognize, he wrote, that we truly prosper only as the whole community of life on Earth prospers. In this sense, the Wilderness Act takes an important sociopolitical step toward Aldo Leopold's land ethic.

Human Knowing

To assert that we live in the permanence of ignorance is not to assert nihilism or to call for a fundamentalist rejection of good science. It is rather to call for a profound humility before wilderness and the wild. As theologian Sallie McFague suggests, we need not stay stuck in our subject-to-object relationship with the world's otherness. We have options. We have the option of a subject-to-subjects (plural) relation with that wonderful otherness that Howard Zahniser

described as the whole community of life on Earth.

McFague forwards what she calls an "attention epistemology," a way of knowing that feminist Marilyn Frye likens to the loving eye: "The loving eye knows the independence of the other ... It is the eye of one who knows that to know the seen, one must consult something other than one's own will and interests and fears and imagination. … The science of the loving eye would favor the Complexity Theory of Truth … and presuppose the Endless Interestingness of the Universe."

Allen Ginsberg taught that English poet and engraver William Blake saw the human world system composed of the body, emotion in the body, imagination, and reason, with reason personified by the character Urizen in Blake's *Book of Urizen*. "Blake's concept," Ginsberg said, is that if one aspect takes over "all four parts of the human universe fall out of balance. … Urizen [represents] the principle of excessively cutting intellect." Urizen's downfall to error involves his "desire for total mental control of nature." Blake illustrated Urizen's overweening hyperrationalism by painting him "bound in the hoary fishnet of his own thought-forms," Ginsberg relates.

An old meaning of *trammel* is a fishnet. So *untrammeled* here implies absence of human mental control of nature. We can illustrate our own history of projecting human desire and mental control onto the more-than-human world with the rectilinear, Jeffersonian grid superimposed onto the American West with no regard for topography or hydrology – like a hoary fishnet or trammel.

In his essay "Poetry, Language, Thought," Martin Heidegger parallels Blake's critique but in terms of human willing – as "Purposeful self-assertion in everything." "What has long since been threatening [humans] with death," Heidegger writes, "and indeed with the death of [their] own nature, is the unconditional character of mere willing in the sense of purposeful self-assertion in everything." "Self-willing [humans] everywhere [reckon] with things and [humans] as with objects," Heidegger writes. "What is so reckoned becomes merchandise."

The Wilderness Act was framed as an antidote to that human propensity to trammel the land, the entire biota. The Wilderness Act is meant to protect the wilderness character of a fragment of our federal public lands' legacy as untrammeled. Following Jack Turner, David Cole has interpreted *untrammeled* to mean "wild, self-organizing, autonomous." To protect wilderness character is to protect these qualities of wildness.

Projection of Desire

In caring for designated wilderness, we must be alert to avoid projecting onto the wilderness our thought forms, desires, and penchant to assert destructive mental control, willing, or purposeful self-assertion. We can readily image such human control – or human *desire* for control – projected onto nature with the Jeffersonian grid across the American West. The grid has no regard for ecological coherence. The grid manifests our propensity to trammel the land, to project onto it human desire and total mental control.

Wilderness management is of course an oxymoron, because *wilderness*, as David Cole, following Jack Turner, writes, means "self-willed land." Ideally, such land is untrammeled. It is not subjected to the projection of our human desires. We can't *manage* anything without projecting our human desires onto it. If wilderness management or wilderness stewardship is not about managing wilderness itself – how can we do it?

Chapter 29 of the *Tao Te Ching* advises: "If someone wants to rule the world, and goes about trying to do so, / I foresee that they simply will not succeed. / The world is a sacred vessel, / And is not something that can be ruled. / Those who would rule it ruin it; / Those who would control it lose it." Hear that morsel of ancient wisdom: "Those who would control it lose it."

The commentary on that *Tao Te Ching* passage then says that

> "the oppositions that exist among things in nature resolve themselves into a self-adjusting balance and harmony. The spirituality we find pervasive in nature, far from being a gift bestowed by some external source, is rather the flowering of this thriving harmony. In fact, this harmony is not only autogenerative and self-sustaining, but persists only as long as it remains free from calculated manipulation, well-intended or otherwise."

We no longer talk of a "balance" of nature. We now think more in terms of interpenetrating dynamisms – which can also be left to their own thriving harmony that "persists only as long as it remains free from calculated manipulation, well-intended or otherwise." In fact, wilderness stewardship asks us to work ingeniously so that nothing happens that would not happen even if we were not there. This is the ethic of restraint embodied in the Wilderness Act and its resolve that our civilization "not occupy and modify all areas within the United States and its possessions."

But it goes against the grain of our species to *not* do: We class

ourselves not only as *Homo sapiens* but as *Homo faber*, humankind the maker, the doer. Freeman Tilden, who taught how to interpret the values of our protected public lands and cultural heritage, dramatized this. He once gave what he called an "un-illustrated lecture" titled "The Constructive Aspect of Inactivity." For his audience of would-be viewers, Tilden carefully describes the slides he decided *not to use* to illustrate his lecture – whose point quickly becomes that we humans, as *Homo faber*, preserve things best through *inaction*. That sounds odd at first, but it is empirically and historically true. We preserve things best through *inaction*.

Tilden put a twist on advocating the wisdom of humility when it comes to preservation – which is this task of stewardship-in-perpetuity that the Wilderness Act requires. In the 1940s, Adolph Murie published *Ecology of the Coyote in the Yellowstone* and *The Wolves of Mount McKinley*. His writings were instrumental in turning federal policy away from exterminating predators. Later, Adolph Murie would echo Freeman Tilden's nonlecture, writing that "administrators should be told that their success will be measured, not by projects accomplished, but by projects sidetracked."

The role of humility in caring for wilderness lies in recognizing, first, that we do not know all the parts, and second, that we do not understand all of their interrelationships and interpenetrating dynamisms. Nor may this be, as Wendell Berry maintains, a question of our simply not-knowing *yet*. We may never fully know. We may never fully understand. As Howard Zahniser wrote in a 1953 speech to a committee of the New York State Legislature, all in one paragraph:

> The wilderness character of the Forest Preserve must be guarded with great care – that quality of the wild out-of-doors which is so easily destroyed by roads, by buildings, by the motorized transportation which is so welcome in getting us away from the city. … Such intrusions would damage the very thing we seek to protect. Most assuredly these Forest Preserve areas that are being cherished as wilderness must be protected from timber cutting and from all commercial uses. The resources of the wilderness are not commodities for the market. But we must not only protect the wilderness from commercial exploitation. We must also see that we do not ourselves destroy its wilderness character in our own management programs. We must remember always that the essential quality of the wilderness is its wildness.

The *wilderness character* of designated wilderness is its wildness.

ED ZAHNISER speaks and writes about the Wilderness Act and the work of his father, Howard Zahniser, the act's primary author. In 2013 Ed retired as senior writer and editor with the National Park Service Publications Group. In May 2014 he received a New York State Wilderness Stewardship Award and the U.S. Department of the Interior Distinguished Service Award. Ed and his sister, Karen Bettacchi, edited their mother Alice Zahniser's 1956 journal of the family's five wilderness trips in Minnesota, Montana, Wyoming, and Washington State as *Ways to the Wilderness* (2008).

Continued from* The International Journal of Wilderness, *page 3

our goal is to provide current content to keep our readers in touch with these trends in an accurate and supportive way.

In this issue we learn about efforts to protect the lower Mississippi River, protect natural areas in the Chicago urban area, restore the forests of Scotland, protect wild trout waters, ecosystem services, and other topics.

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Engineered Wildness

The Lower Mississippi River, an Underappreciated National Treasure

BY PAUL HARTFIELD

The Mississippi River is the primary river of the largest drainage in North America. Flowing from Canada to the Gulf, bordered by the Appalachians in the East and the Rockies to the West, it is a world-class river. Although it is one of the most engineered river systems on the planet, many reaches of the river remain highly functional and productive as a natural system.

The Lower Mississippi River is defined as that portion of the river between the confluence of the Ohio River and the Gulf of Mexico – the end of a massive system draining more than 40% of the continental United States (Figure 1). As a recipient of all discharges within the Interior Basin, and developed as a flood control, port, and transportation system, most Americans visualize it as a highly polluted, engineered, and sterile channel. In reality, the Lower Mississippi River is one of the most intact and functional big river channel ecosystems in the nation, as evidenced by water quality, fishery productivity, and lack of species extinctions or even extirpations. Also, this reach of the river provides an assortment of unique and quality wilderness recreation opportunities throughout its length.

Mississippi River Wilderness?

The WILD Foundation (2014) defines wilderness as "the most (biologically) intact, undisturbed wild natural areas left on our planet … that humans do not control and have not developed with roads, pipelines or other industrial infrastructure." The Lower Mississippi River is highly developed, and significant efforts and resources are expended annually to control it; therefore, it seems unlikely that we could or should refer to it as a wilderness. However, a case might be made that although "developed," the channel ecosystem is relatively "intact" and an example of wild nature.

Paul Hartfield releases endangered pallid sturgeon. Photo by Bruce Reid, LMRCC.

The WILD Foundation (2014) suggests that "the essence of a wilderness area is that it is a place where humans can maintain a relationship with wild nature." The Lower Mississippi River emanates wildness, offering hundreds of miles of opportunities to enjoy and reconnect with wild nature on a world-class river!

The Wild Mississippi River

Undeveloped, *uninhabited*, *unmanageable, uncontrollable*, *unrestrained* … these are all used as dictionary descriptors of wildness. In the conservation literature, one finds "wildness" used to reflect the autonomy of nature or that which is not controllable by humans (Evanoff 2005; Grumbine 1995). Wildness in nature is valued for spiritual and aesthetic reasons and is perceived as characteristic of functioning, complex, natural ecosystems.

The Lower Mississippi River retains a high degree of complexity and a functioning river channel eco-

system. Although access to its historical floodplain has been limited by levees, the river remains unconstrained by dams between those levees (Figure 2). Its autonomy arises from receiving the combined rainfall, snowmelt, and discharge of 40% of the continental United States. For example, the average discharge of the Lower Mississippi River is about 600,000 cubic feet per second (cfs) (16,990 cubic meters per second, cms) or, in other terms, 4.5 million gallons (17.1 million liters) of water passing every second. For comparison, the average discharge of the Missouri River is 87,520 cfs (2,478 cms).

Changes in high and low river stages of 30 feet (10 m) occur annually along the Lower Mississippi River, with a river stage variation of 40 ft (12 m) occurring every few years. However, discharge can vary even more dramatically, from a high of 2.2 million cfs (62,297 cms) in 2011 at Vicksburg, Mississippi, to less than 0.2 million cfs (5,663 cms) in 1988 and 2012. This translates into an almost 60-foot (20 m) vertical change in water height within the active floodplain at Vicksburg, Mississippi!

In human terms, the natural hydrograph (timing, magnitude, and duration of unimpaired flow in response to weather and snowmelt) keeps the batture, or land on the riverside of levees, relatively undeveloped and sparsely inhabited. Even so, the extreme flows create local, regional, and even national economic chaos.

Figure 1 – Lower Mississippi River map.

Most agricultural exports from the Mississippi Basin move down the river by barge, passing barges moving upstream loaded with imports, and with industrial products moving both ways. Extreme low flow events transform the river from a six-lane commercial interstate to a one-lane country road, slowing navigation and affecting commerce throughout the Interior Basin; for example, the 1988 low water event brought hundreds of barges to a standstill and caused about $1 billion (U.S.) in economic losses. High water events affect not only commerce, but also land-based properties and infrastructure. Total economic damage estimates from the 2011 flood reached several billion dollars, as well as almost $2 billion in damage to the flood and navigation management infrastructure (Camillo 2012).

In ecosystem terms, it is the natural, sometimes extreme, hydrograph that builds and structures in-stream habitats and maintains the "wildness" and function of the Lower Mississippi River ecosystem. Annual high river stages not only regenerate secondary channels, oxbows, and back swamps, but they also restrict agriculture to only the most elevated lands between the levees, ensuring the dominance of bottomland forests within the river batture. Extreme high flow events maintain ecosystem and habitat complexity within the channel through periodically redistributing large quantities of sediment, maintaining or forming islands and secondary channels, and setting back plant succession on sandbars and low islands.

Wildness in Context

During the last century, large multipurpose dams were constructed throughout the larger tributaries of the Mississippi River to capture and store high seasonal precipitation or snowmelt. The purposes for these large dams are various, but most were intended to reduce downstream infrastructure flooding, and release stored water during dry seasons and droughts for irrigation,

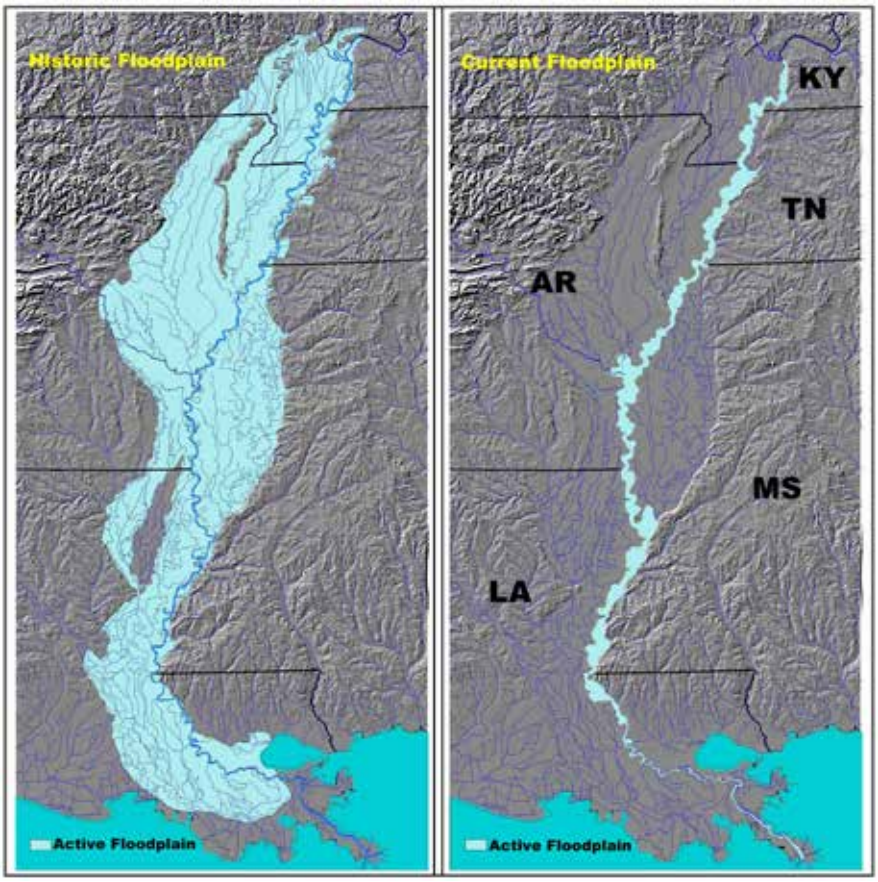

Figure 2 – The disconnection of the Lower Mississippi River from its historic floodplain has increased flood height between the levees and contributed to the Gulf of Mexico dead zone. Photo credit LMRCC.

human consumption, electricity, and/or navigation (e.g., Missouri, Platte, upper Red, upper Arkansas, Upper Mississippi, Ohio, Tennessee, Cumberland Rivers). Lock and dam systems were also built to provide efficient year-round commercial navigation (e.g., lower Red and Arkansas Rivers, Ohio, Upper Mississippi). More than 50,000 smaller dams have been constructed throughout the Mississippi River watershed (Schneider 2013). Regardless of the purpose of the dams, they all functioned to reduce extreme flow events and variation in the river hydrographs, reduce sediment movement through the systems, and decrease river channel habitat complexity. Cumulatively, these dams and their impounded waters and controlled discharges have diminished or eliminated habitat values for many river-adapted species.

Basin tributary dams affected the Lower Mississippi River through small shifts in the seasonal timing and duration of high and low flows, and diminished sediment input. However, these effects are attenuated in the Lower Mississippi River by the size of the basin drainage, the cumulative flows from all tributaries, the absence of dams, the constriction of the floodplain, and the high volume of "stored" channel sediment. Therefore, dams in the tributaries have had little effect on the dynamic nature of Lower Mississippi River flows or the complexity of its channel habitats.

The Lower Mississippi River channel ecosystem has been affected by human intervention. Channel engineering (e.g., river bend cutoffs, bank paving, dike construction) over the past 85 years by the U.S. Army Corps of Engineers (Corps), under the direction of Congress, to "fix" the channel in place, control flooding, and to develop an efficient and safe commercial navigation system in the Lower Mississippi River (Camillo 2012) have resulted in a gradual and cumulative diminishment of channel habitat complexity, measured by the loss of islands and secondary channels and floodplain connectivity at lower river stages.

Considering the extent of modification, and the separation of the river from 90% of its historical floodplain, the Lower Mississippi River channel ecosystem remains remarkably intact, especially in context with other large temperate river systems throughout the United States and the world. The forested batture and wetlands (Figure 3) remain critically important to hundreds of bird species, including Neotropical songbirds (hummingbirds, thrushes, flycatchers, warblers, and others), waterfowl (ducks and geese), colonial waterbirds (herons, egrets, pelicans, and others), shorebirds (sandpipers), gulls and terns, and other species closely associated with the river (e.g., eagles, osprey). The lower river channel itself is home to 109 of the 140 fish species resident to the entire Mississippi River (Schramm 2004), and there have been no known fish species extinctions or extirpations.

Even though the aquatic fauna is relatively intact, there have been changes in relative abundance of some channel species. For example, freshwater river shrimp (*Machrobrachium ohione*) were once so abundant they were the target of a commercial fishery from St. Louis to New Orleans. Considered a delicacy in river towns and cities, as well as on

steamboats, they supported an abundant harvest from the mid-1800s through the mid-20th century. During 1898, more than 200,000 pounds of river shrimp were reported harvested from the Lower Mississippi River (U.S. Fisheries Commission 1899) and the actual harvest likely exceeded that significantly. River shrimp are amphidromous, living and breeding in flowing fresh water but requiring a saline environment for larval development. Following a larval stage in the Gulf or an estuary, juvenile river shrimp migrate up the Mississippi River to grow, and were known to travel as far as 500 miles (805 km) up the Ohio River prior to its impoundment. After one or more years of growth, the adults swim downstream to breed and release their newly hatched larvae to drift into the salty waters of the coast. Today, collecting enough large shrimp for a single meal requires multiple traps over several days (personal observation). This decline is likely due to the increased current speed of the river resulting from decades of channel engineering, and/or by levees restricting access of the larvae to the saline estuaries lining the lower river. Even so, river shrimp remain common in the Lower Mississippi River, and the upstream movement of millions of tiny larval shrimp, and the return trip of the adults (up to a 2,000-mile [3,218 km] round-trip!) is one of the longest and most remarkable of North American faunal migrations.

Among the resident species of the Lower Mississippi River that have been increasing in abundance are two federally protected species: the endangered interior least tern and pallid sturgeon. While these are obviously very different species, they have more in common than their present status under the Endangered Species Act (ESA). Both are species of extremes, found at the north/south extremes of the continental United States from Montana to the Gulf of Mexico, under climatic conditions ranging from boreal to semitropical, and in small rivers (e.g., Yellowstone River) to the largest (Lower Mississippi River).

Figure 3 – Backswamps still exist between the levees, removing sediment, processing nutrients, and providing habitats for numerous species. Photo credit USFWS.

The interior least tern and pallid sturgeon were protected under the ESA primarily because the construction of dams in the major tributaries of the Mississippi River (Missouri, Platte, Red, Arkansas, and Ohio Rivers) eliminated their nesting or recruitment habitats in large portions of these drainages. However, both species have been proliferating in the Lower Mississippi River over the past two decades.

When the interior least tern was listed under the ESA in 1985, only about 300 birds nesting in 11 colonies were known from a short reach of the Lower Mississippi (Hardy 1957; Downing 1980), constituting less than 20% of the range-wide population at that time. Over the past decades, nesting colonies have expanded from Cairo, Illinois, to Baton Rouge, Louisiana, and now support upwards of 12,000 terns per year, more than 60% of the listed population (Lott 2006; Lott et al. 2013; U.S. Fish and Wildlife Service 2013). Based largely on this remarkable recovery, the U.S. Fish and Wildlife Service recently considered the interior least tern as "recovered," and have recommended delisting it under the ESA (U.S. Fish and Wildlife Service 2013).

Pallid sturgeons were also considered similarly historically rare in the lower river. When this fish was listed under the ESA (1990), only 28 historical records were known from the Lower Mississippi River (Keenlyne 1989). Analysis of recent collection data, however, indicates the population may now be as high as 20,000 fish (Friedenberg et al. 2013).

The recruitment habitats for both of these species are associated with river islands and secondary channels, which are formed, maintained, and dependent on extreme flow events, specifically periodic floods. These habitats remain relatively common

in the Lower Mississippi River, and are now being purposely maintained through management (U.S. Army Corps of Engineers 2013).

Management of the Lower Mississippi River

Over the past decade, the Corps, U.S. Fish and Wildlife Service, and state conservation agencies along the lower river (AR, KY, LA, MO, MS, TN) have worked together under the Lower Mississippi River Conservation Committee (LMRCC) to experiment with and develop a management approach to maintain and restore features of the river ecosystem that are tied to its "wildness." The management approach that has evolved is realistic, cost-effective, and, to date, has been extremely successful (U.S. Army Corps of Engineers 2013).

In order to reach a multiagency/state management consensus, it was first necessary to establish baseline conditions on current ecosystem health and function, along with realistic expectations for outcomes. These were and continue to be closely linked. For example, synthesis of research data on current conditions led to recognition of the improved status of the two endangered species, the importance of the river corridor to migratory birds, the quality of fisheries resources, and other aspects of the overall quality and function of the Lower Mississippi River ecosystem (e.g., the continued presence and importance of river shrimp). Consideration of these in light of congressionally mandated requirements for flood control, navigation, ecosystem management, and future human demand in the United States and world for water and food (Montgomery 2007; Solomon 2007) led to the realization that river engineering is a component of the baseline ecosystem conditions, as well as a powerful ecosystem management tool.

Putting Wildness to Work

During the 1980s, the Corps began developing and testing engineering techniques and designs to mitigate the negative effects of channel engineering to the Lower Mississippi River habitats. Some of these (e.g., grooves in bank paving to increase aquatic insect productivity) were easily and readily incorporated into engineering designs. Others were more experimental in nature (e.g., notches in dikes, novel river structures such as chevrons and hardpoints, and beneficial placement of dredged materials) due to concerns for navigation and flood control infrastructure integrity (Figure 4).

By 2001, the Corps was prepared to work with its LMRCC partners to focus these tools on the habitat needs of species such as the interior least tern and pallid sturgeon, and to experiment with their uses to mitigate the ecosystem effects of almost a century of channel engineering. Novel channel engineering designs are intended to use the natural (wild) hydrograph to move excess sediments and water into areas important to the ecosystem and its species. Because these designs can be incorporated into planned channel construction and routine maintenance actions, they can also be implemented incrementally at little to no extra cost to the program.

The Corps works with LMRCC partners to cost-share the reengineering of secondary channels (more than 14 secondary channels over just the past few years, increasing flows and connectivity to more than 50 miles [80 km] of channel and thousands of acres of channel habitats). Following more than a decade of testing by the rise and fall of the river (including the record discharge of 2011), the Corps has adopted most of these modifications as channel engineering Best Management Practices in the Lower Mississippi River (U.S. Army Corps of Engineers 2013).

Multiple species of migratory birds and fish, including both the interior least tern and pallid sturgeon, are benefiting from the LMRCC partnership and the Corps' new management strategy. Secondary channels, dike notches, and dike tips provide spawning and feeding areas for multiple game and forage fish species and are the most productive fisheries habitats in the Mississippi River. Another species that appears to be benefiting is the endangered fat pocketbook mussel, which has recently expanded its range into the Lower Mississippi River by colonizing secondary channels characterized by notched dikes (U.S. Army Corps of Engineers 2013). Secondary channels also provide safe fishing, paddling, and wildlife-viewing recreational opportunities outside of the navigation channel.

Because of the increasing societal demand for water, flood control, and commerce, the Lower Mississippi River is unlikely to return to its preindustrial wilderness condition. The Corps, U.S. Fish and Wildlife Service, and LMRCC partners have demonstrated the use of "wildness" as a management tool, and the ability to transform threats to endangered species and their habitats into conservation tools.

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Figure 4 – A dike notch at the Shipland Wildlife Management Area maintains connectivity between the secondary channel and the river. Photograph by Bruce Reid, LMRCC.

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The Wild Miles

A One-Thousand-Mile Journey

BY JOHN RUSKEY

Wild Miles

Looking at a map of North America you will inevitably be drawn to the bottom center of the continent where a meandering blue line broader than any other of the blue lines gracefully loops southward and empties into the Gulf of Mexico. It reaches out with long fingers and tentacles of other skinny blue lines that branch out eastward and westward from the Rockies to the Appalachians encompassing the second largest catchment basin in the world. Along the way this line carves elegant river bends and giant oxbow lakes. One of the loops goes 20 miles (32 km) to make 1 mile (1.6 km). This enchanting blue line marks the Lower Mississippi River, the largest river on the continent. Its big muddy waters and wide floodplain create a paradise for paddlers, birders, and anyone else seeking the solace of the wilderness. Expansive swaths of green are seen parallel to the loopy blue line and indicate the extensive and healthy bottomland hardwood forests still surviving between the levees.

The origins of these waters are found upstream in America's heartland, St. Louis (Figure 1), where the Upper Mississippi River joins with the Missouri River to form the Middle Mississippi River. The Middle Mississippi separates the Pawnee Hills from the Ozarks and then meets the green waters of the Ohio River at the southern tip of Illinois to form the Lower Mississippi. You can trace this mysterious curvy blue line deep into the gut of America, the Deep South, down to the Gulf Coast. This valley was once an inlet of the Gulf of Mexico, then a glacial floodplain, and later a thriving forested landscape of millions of acres. Even after it was settled – its trees chopped down, its back channels cut off and main channel vigorously maintained – even still the river rules the landscape with unimaginable power, annually rising and falling 50 vertical feet (15.2 m) with water flow fluctuations of millions of cubic feet per second, which prepares the stage for an unlikely setting in wilderness travel.

Wild Miles are the places along the river where nature predominates and little is seen of humankind...

John Ruskey. Photo © by Mathieu Despiau.

The wonderful thing about the Lower Mississippi River is that it's still wild! You will see some industry and agriculture between Cairo and Baton Rouge, but for the most part your experience will be big water, big forests, big sandbars, big bluffs, and big skies. Does this sound like other wild places? Yes – but it's nothing but the muddy big river, the biggest river in North America, and the longest stretch of free-flowing waters in the lower 48 states.

There are 105 "Wild Miles" (167 km) on the Middle Mississippi River between St. Louis and Cairo, Illinois, and 515 Wild Miles (828 km) on the Lower Mississippi River between Cairo and Baton Rouge, Louisiana, which means that 71% of the scenery viewed from canoes or kayaks paddling down that stretch of river looks and feels "wild" (www.wildmiles.org). Wild Miles are the places along the

river where nature predominates and little is seen of humankind save passing tows (and other river traffic) and maybe a tiny hunting camp or a single angler buzzing by in a johnboat. These are places where the landscape is filled with giant islands bounded by endless mudbanks and sandbars, where the river is overseen by big skies, and where the sun sets uninterrupted by buildings or wires. These are places where the big river predominates with wild beauty, each high water results in shifting sand dunes and remade sandbars (Figure 2). These are places where only deer and coyote tracks are seen along the sandbars and enormous flocks of shy birds such as the white pelican and double-crested cormorant are comfortable enough to make landing for the night, and once-endangered species such as the interior least tern and pallid sturgeon have regained a foothold in an altered but predominantly natural ecosystem. These are places where it's dark and quiet at night, where the stars fill the skies like brightly shining jewels poured out on a dark purple velvet blanket, almost as thick and vibrant as the night skies of the Great Plains or the Rocky Mountains.

America has an opportunity to find the "wilderness within" by recognizing and preserving the Wild Miles in the center of the country. And it just so happens that the gigantic floodplain of the Mississippi River creates these Wild Miles. These places have been preserved mostly by neglect, by the power of the river, by its catastrophic rises and falls, and by the danger of building anything within its floodplain. Moreover, in light of recent flood cycles and the declining population of the lower floodplain, this area is receiving attention as one of the best places to restore native bottomland hardwood forests, and reopen back channels with notches in the old dikes. Restored forest creates habitat for wildlife, improved water quality, a buffer to flooding, and is an important means of reducing the Gulf of Mexico's "dead zone," caused by nutrient runoff into the river.

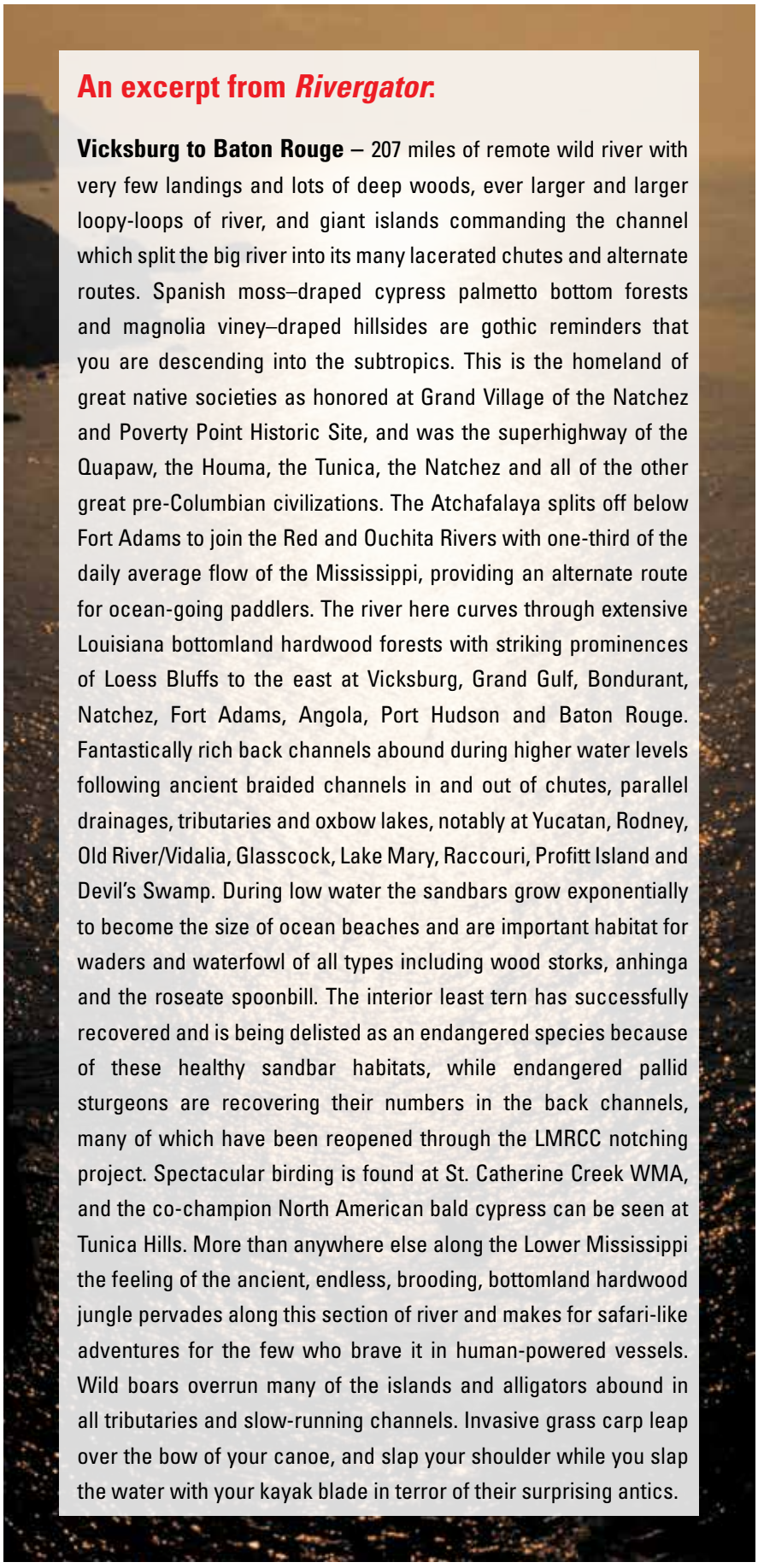
Figure 1 – Paddling the Mississippi River at St. Louis, Missouri. Photo by John Ruskey.

The Lower Mississippi River Valley was historically a vast expanse of bottomland and adjacent upland hardwood forests with scattered openings primarily created by fires, beavers, or large flood events by the Mississippi River and its tributaries. These openings generally comprised herbaceous moist-soil areas that created excellent waterfowl and other wetland wildlife habitat, or giant switch cane that was almost impenetrable and an extremely important habitat component for a variety of wildlife species. Once covering 22 million acres (8.9 million ha) in the Mississippi River Alluvial Plain, bottomland hardwood forests have decreased in extent to only 4.9 million acres (1,.9 million ha). Extensive clearing for agriculture (soybeans, corn, or cotton) and urbanization are two of the primary reasons giant bald cypress and oak trees of presettlement times no longer exist. However, giant bald cypress and oak trees characteristic of yesteryear can still be seen on some of these sections of the Lower Mississippi River.

Rivergator Project

The Rivergator is a four-year project to describe the Lower Mississippi River for modern-day human-powered explorers, namely canoeists, kayakers, stand-up paddleboarders, and rafters. A very detailed written guide called *Rivergator: Paddler's Guide to the Lower Mississippi* is being developed for publication. The title *Rivergator* is derived from a national

Figure 2 – Sandbars along the Lower Mississippi River. Photo by John Ruskey.



An excerpt from *Rivergator*:

Vicksburg to Baton Rouge – 207 miles of remote wild river with very few landings and lots of deep woods, ever larger and larger loopy-loops of river, and giant islands commanding the channel which split the big river into its many lacerated chutes and alternate routes. Spanish moss–draped cypress palmetto bottom forests and magnolia viney–draped hillsides are gothic reminders that you are descending into the subtropics. This is the homeland of great native societies as honored at Grand Village of the Natchez and Poverty Point Historic Site, and was the superhighway of the Quapaw, the Houma, the Tunica, the Natchez and all of the other great pre-Columbian civilizations. The Atchafalaya splits off below Fort Adams to join the Red and Ouchita Rivers with one-third of the daily average flow of the Mississippi, providing an alternate route for ocean-going paddlers. The river here curves through extensive Louisiana bottomland hardwood forests with striking prominences of Loess Bluffs to the east at Vicksburg, Grand Gulf, Bondurant, Natchez, Fort Adams, Angola, Port Hudson and Baton Rouge. Fantastically rich back channels abound during higher water levels following ancient braided channels in and out of chutes, parallel drainages, tributaries and oxbow lakes, notably at Yucatan, Rodney, Old River/Vidalia, Glasscock, Lake Mary, Raccouri, Profitt Island and Devil's Swamp. During low water the sandbars grow exponentially to become the size of ocean beaches and are important habitat for waders and waterfowl of all types including wood storks, anhinga and the roseate spoonbill. The interior least tern has successfully recovered and is being delisted as an endangered species because of these healthy sandbar habitats, while endangered pallid sturgeons are recovering their numbers in the back channels, many of which have been reopened through the LMRCC notching project. Spectacular birding is found at St. Catherine Creek WMA, and the co-champion North American bald cypress can be seen at Tunica Hills. More than anywhere else along the Lower Mississippi the feeling of the ancient, endless, brooding, bottomland hardwood jungle pervades along this section of river and makes for safari-like adventures for the few who brave it in human-powered vessels. Wild boars overrun many of the islands and alligators abound in all tributaries and slow-running channels. Invasive grass carp leap over the bow of your canoe, and slap your shoulder while you slap the water with your kayak blade in terror of their surprising antics.

best-selling book called *The Navigator*, published in 1801 by Zadok Cramer, with 12 subsequent printings. *The Navigator* described the Mississippi Valley for pioneer settlers streaming out of the eastern United States in the first great wave of continental migrations that eventually led to the settling of the western United States. Thomas Jefferson and other leaders were fearful that the French or the English would get there first. With the Lewis and Clark explorations and the introduction of the steamboat to the Mississippi River in 1812, Americans followed the big rivers up and down through the heart of the country, and *The Navigator* was their guide. In this spirit, I have adopted the name *Rivergator* with the hope that Americans will rediscover their "wilderness within," the paddler's paradise along the Lower Mississippi River, and that the *Rivergator* will be adopted by successive generations of canoeists and kayakers and rewritten as the river changes. Zadok Cramer also invented the numbering system for Lower Mississippi River islands, a system that survives to this day.

Rivergator is written by paddlers, for paddlers (Figure 3). It will open the river for local experienced canoeists who have always wanted to paddle the Mississippi River but didn't know how or when or where to start, including canoe and kayak clubs, outdoor leadership schools, friends and families, and church and youth groups. It could be used by the Girl Scouts for a weeklong summer expedition down the Middle Mississippi below St. Louis, or a group of Boy Scouts working on their canoe badge in the Memphis area. You could read *Rivergator* during the winter months from your home, and by spring snowmelt you could be making your first paddle

strokes on a life-changing adventure down the Mississippi River. *Rivergator* will help you get there if you're a long-distance canoeist starting at Lake Itasca, or a kayaker coming south after paddling the length of the Missouri River from Montana's Bitterroot Mountains. You could be a stand-up paddleboarder who put in at the Great River Confluence of the Allegheny and Monongahela Rivers to follow the Ohio down to the Mississippi. On the Lower Mississippi all of the rules of the river change as the waters get bigger, more unruly, more difficult to predict, and tougher to paddle. No more calm waters contained behind the locks and dams. Hullo big towboats pushing huge fleets of barges!

Regardless of what you paddle, the *Rivergator* will you help you find the essential landings and the obscure back channels that you would otherwise miss. It will help you safely paddle around towboats, and choose the best line of travel to follow around the head-turning bends and intimidating dikes, wing dams, and other rock structures. It will identify which islands to camp on and which to avoid, and where the best picnic spots are found and where blue holes form. It will lead you to places of prolific wildlife and surprising beauty (Figure 4). It will help explain some of the mysterious motions of the biggest river in North America. It's written for canoeists and kayakers, but is readable enough to be enjoyed by any armchair adventurers. The river is the key to understanding the history, geography, and culture of the Mid-South. It's the original American highway, migration route, freight route, newspaper route, and trade route. But it's also a church, a sanctuary, a playground, a classroom. The

Figure 3 – Paddling with friends on a long canoe trip down the Lower Mississippi River. Photo by John Ruskey.

Figure 4 – Seeing wildlife along the river adds to the feeling of wild nature. Photo by John Ruskey.

Figure 5 – Rock bluffs dwarf the canoeists as they explore the riverbank. Photo by John Ruskey.

Figure 6 – Paddling along through this grand river landscape allows time for reflection and relaxation. Photo by John Ruskey.

river is the rock star, the *Rivergator* is merely a guide to help you interpret and enjoy the songs of the river!

So what is it like actually paddling on the Lower Mississippi River (Figure 5)? What is the experience from water level, over the gunwales of your canoe, or over the deck of your kayak? By the end of 2014, we have completed 926 miles (1,490 km)of the 1,155 miles (1,859 km) total of the *Rivergator*, covering the wildest of the wild river from St. Louis down through Ozark bluffs, down the Pawnee Hills, through the Missouri Bootheel, along the Chickasaw Bluffs into Memphis, through the Yazoo-Mississippi Delta to Vicksburg, and down the Loess Bluffs/Louisiana Delta to Baton Rouge. In 2015 we will add in the coastal reaches down the wild Atchafalaya, the river of trees, and the industrious "chemical corridor," the only Lower Mississippi River section with no "wild miles."

The Floating Sensation

When traveling on the river, be sure to stop paddling at some point and enjoy the sensation of floating along in the meeting of the big rivers. If the wind is contrary you might only be able to enjoy this for one minute. But on a calm day with no tows to navigate around you can float for miles. Floating with the flow of the river will enable you to best appreciate the dimension and scope of this landscape as you silently roll over the curvature of the Earth and are buoyed along by the big waters (Figure 6). With a little imagination you can dwell upon all of the places this water has traveled from to reach here and visualize the big bends upstream and downstream that come together at this location along the "wilderness within" the southern United States.

Acknowledgments

For detailed reading and photos concerning paddling the wilderness of the Lower Mississippi River, visit www.rivergator.org. For more information about the Wild Miles, go to www.wildmiles.org.

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Ecosystem Services from the Wilderness

BY EVAN E. HJERPE

I feel at home, yet somewhat out of place. I am with a group of ecologists and students learning about fire ecology, deep in the Bob Marshall Wilderness below Glacier National Park in Montana. As a forest economist, I am comfortable with measuring trees and investigating the impacts of recent forest fires, but I feel a bit out my comfort zone in the tedium of recording plant taxonomies. Getting out of your comfort zone, however, is the only way to learn. And as I learn more about the ecological connections in the Northern Rockies and their dependence on fire, my brain files it all under a greater, hierarchical system of ecosystem services from the wilderness.

In economics jargon, ecosystem services are the myriad benefits that nature provides to humankind. As an economist, I see the world through an ecosystem services lens. My perspective accords with the worldview of most economists – that individuals and society look to maximize their well-being and happiness through whatever means possible. Where my perspective differs from many economists, however, is my focus on learning how nature, rather than money, contributes to societal welfare. Nature provides humans with almost everything, from provisioning services such as food, water, and shelter, to cultural services such as recreation and sacred inspiration. While we have become quite adept at adding our human capital and labor to the raw materials found in nature to produce novel technology and services, the fundamental building blocks of society are virtually limited to that which is produced by nature.

Likewise, nature provides numerous regulating services such as climate regulation and absorption of pollution, as well as many supporting services such as pollination, water purification, and nutrient cycling. These regulating and supporting ecosystem services are also critical for human survival and are easily degraded and disrupted by humans' industrious activities. All ecosystems, including the most artificial and human-influenced ones such as downtown urban centers, produce benefits to humankind. However, the quality of ecosystem services provided by nature increases in the absence of human trammeling. The production of high quality ecosystem services is perhaps one of the greatest contributions that wilderness areas offer to society.

Evan Hjerpe. Photo by Jodi Lando.

During our expedition in the Bob Marshall Wilderness, we find many provisioning ecosystem services in the form of clean drinking water and food supplements. We bring life to our bland dehydrated breakfasts and dinners with raspberries, thimbleberries, huckleberries, onions, mint, and native cutthroat trout. We also investigate 500-year-old ponderosa pine and western larch trees that show signs of bark peeling by native tribes hundreds of years ago. By peeling away bark patches, Native Americans were able to sustainably harvest cambium wood and sap from the same tree year after year. The trees were no worse for the wear and remained healthy (Figure 1).

Cultural ecosystem services include more abstract benefits to society such as recreational opportunities, spiritual development, and cognitive enrichment. One of the most important cultural ecosystem services provided by wilderness areas is scientific research. Being representative of more natural ecosystem processes, wilderness provides an excellent study control that can teach us many lessons to be applied in more managed, frontcountry lands. In Aldo Leopold's essay "Wilderness as a Land Laboratory," he notes the tremendous scientific value of wilderness and illustrates the need to retain wilderness specifically for its research merits. This "land laboratory" can produce scientific findings both

Figure 1 – Bark-peeled ponderosa pine. Photo by Evan Hjerpe.

directly and indirectly relevant to the field of economics. While the physical sciences and ecology may produce the most direct benefits of wilderness research, economics is increasingly contributing to wilderness science. For example, ecological economic theories of optimal foraging efficiency of wildlife, biomimicry, and life-cycle analysis all draw conclusions directly from observing untamed nature. Indirectly, research from wilderness illustrates opportunities for efficiency gains in green infrastructure, agriculture, and mitigation of environmental impacts stemming from development. These findings help society save money and resources and help inform our attempts at sustainability.

Bob Marshall, the namesake of the wilderness area we are studying, also saw the unparalleled value of wilderness for scientific research. As co-founders of The Wilderness Society, Leopold and Marshall made the value of wilderness research explicitly clear. In The Wilderness Society's Articles of Incorporation, the first means listed for the purpose of preserving American wilderness is scientific investigation. Both Leopold and Marshall were trained as foresters. And while they saw opportunities to use wilderness controls to inform more productive and efficient timber production, it was the nonmarket values of "undesirable" trees and wildlife present in wilderness that they were fond of pointing out. Leopold and Marshall also valued what we left on the land even more than what we took from the land, and essentially began to define the unique bundles of ecosystem services provided by wilderness. This conservation economics ethic has grown and is a major rationale for preserving wilderness for future generations (Figure 2).

While it can be difficult to assign a dollar value to research, the benefits of wilderness research are far-reaching through space and time. Our research expedition into the Bob Marshall Wilderness was my first trip into this area, but it was the third year of data collection by the project leaders. And already, initial findings had been published and were being utilized by land managers and regional collaboratives to inform management strategies for the restoration of natural fire regimes in areas closer to communities where wildfires are more controlled.

Other cultural ecosystem services, such as recreational and

Figure 2 – Measuring larch diameter. Photo by Evan Hjerpe.

spiritual benefits, are perhaps most visibly on display in the Bob. As we move through the South Fork corridor, we experience the busyness of anglers, backpackers, and rafters. But as I move off trail, I am overwhelmed by the solitude. The howling of a pack of wolves and the discovery of their tracks coming to investigate our camp at night, leave us all with a feeling of ecological connectedness and increased spiritual respect for the wild. An ambling black bear, and the ubiquitous grizzly sign, remind us of a greater pecking order that can exist in wilderness. Osprey, bald eagles, red-tailed hawks, kestrels, and a prairie falcon pull our eyes skyward, while a pine marten and kaleidoscopic caddis fly casings give us reason to look downward. The dizzying array of native flora and fauna provides for myriad recreational and spiritual benefits, along with critical regulating and supporting ecosystem services.

But we are here to study the return of natural fire to a wilderness area that had seen fires suppressed for about 70 years. Recent fires had obvious, beneficial effects on a number of regulating and supporting ecosystem services, including nutrient cycling, scarification, and habitat creation. The team had plans to come back and focus on understory biodiversity and the relationship between wildfire and pollinators. Judging by the increased number of yellow jackets, bees, and flies in the burned areas, fires sure seemed to boost overall understory production and associated pollination.

As we move camp downriver to another burned study area, we witness the starring role of a fire ecology class – the birth of a wildfire itself. Floating into our second base camp, we see the telltale, billowing smoke plumes across the river. A lightning strike from two days prior had been smoldering, and on this hot and windy afternoon it becomes a full-fledged wildfire – the Damnation Fire (Figure 3). For the next two days and nights, we are able to work and watch as this fire ebbs and flows up and down ridges into the next drainage. With the safety of a river between us and the wildfire, and a very fortunate prevailing wind taking the smoke away from us, we lay out bedrolls and tents under an eerie orange glow (Figure 4). Seeing 200-foot torching flames and mini-tornados of embers and heat provided a living "land laboratory" for students and teachers alike. The noise of the fire sounds like a freight train, and occasionally we hear huge snags tumbling downhill. This is an unforgettable educational opportunity that is unique to wilderness and not afforded in most places. There are no base camps of fire fighters, no helicopters dropping water and retardant on this fire. It is a wilderness fire, shaping the landscape as wildfires have done for millennia.

Figure 3 – Damnation Fire. Photo by Evan Hjerpe.

The economic value of wilderness ecosystem services can be difficult to quantify, as they are not typically traded in the market and have not been assigned a dollar value. But some of my market behavior, and the behavior of other wilderness visitors, represent partial values (or price) held for these services. For example, I had to purchase a plane ticket, lodging, vehicle transportation, and recreational equipment for my visit to the Bob Marshall Wilderness. I also had to incur the opportunity cost of lost personal work time despite helping with others' work. The sum of these travel costs represents a minimum dollar value that a wilderness visit is worth to me. Extrapolating the hundreds of dollars that it can cost to visit wilderness areas to the millions of annual wilderness visitors presents a societal baseline for the value of these ecosystem services. But, the enjoyment of spending time in the Bob Marshall Wilderness is worth more to me, and my well-being, than what was paid to experience it. This additional value, known as consumer surplus to economists, can be significantly greater than just the costs paid to visit the area.

The travel costs primarily represent the use values I get from experiencing wilderness ecosystem services firsthand. But, I also hold many nonuse values for wilderness ecosystem services, including services from wilderness areas that I might never visit – especially knowing that there are still places where nature is mostly intact and that wilderness might exist for future generations. The same is likely true for many U.S.

Figure 4 – Damnation Fire at night. Photo by Evan Hjerpe.

residents. Collectively, these existence, option, and bequest values held for wilderness ecosystem services can be very large, as the national pool of wilderness advocates is much greater than the annual number of visitors to just the Bob Marshall Wilderness.

Despite the nonmarket nature of many wilderness ecosystem services, they still result in numerous economic impacts such as employment opportunities, regional wages, and taxes. In the Bob Marshall Wilderness, numerous packers, guides, and outfitters are making a living by facilitating trips for people to enjoy the many recreational and spiritual benefits associated with such a grand and pristine landscape. Surrounding communities reap monetary returns by providing services to visitors. Likewise, wilderness and other protected lands have been shown to attract entrepreneurs, retirees, and other amenity migrants that bring outside income with them and spur greater economic impacts in regions adjacent to wilderness. Other wilderness ecosystem services such as carbon storage, pollination, and water filtration also have cascading economic impacts in regions near and far. The avoided costs associated with such services as clean and abundant water production are counted in billions of dollars, yet unfortunately are not widely valued until drinking water has become too polluted.

The last couple days of our research trip in the Bob consist of floating and hiking equipment out of the South Fork of the Flathead River. Our group that had bonded during a week and a half in the wilderness is now splitting apart and going our separate ways – out of the feral woods and back into various work, school, and family routines. Leaving the Bob, I think of the upcoming winter and how life will continue largely untouched and unobserved in the wild. I take comfort in knowing that wilderness still exists, where wildfires can play their natural role in keeping a mosaic of forest and wildlife in all stages of life and decay. I am not worried about the extent of the Damnation Fire, because I know it is burning within mostly natural conditions in a patchwork of previous fire scars, fire-tolerant old growth, and freshly renewed understory. Nor am I worried about the wildlife; rather, I am excited about the "land self-renewal" and the "health" of this ecosystem that produces the optimal mix and abundance of biodiversity. My journey back to the city accentuates just how little land is left in this natural condition, as there are too many pressures on our working forests for wood production, fire suppression, and the unstoppable wave of development. As I drive by cutover forests, dammed rivers, and irrigated fields, the significance and value of wilderness is only magnified.

Pondering the unique and numerous benefits afforded by the Bob Marshall Wilderness, I give thanks to the previous generations that had the foresight to understand that the economic value of wilderness is much greater and more complex than its immediate market value in board feet of timber. I hope that future generations, our grandkids, might also be able to reap the rewards of wilderness ecosystem services at a landscape level – not token parks or zoos where "wildlife" becomes an oxymoron. As naturally functioning landscapes become fewer and fewer in our industrial society, wilderness and its associated high quality ecosystem services is becoming a scarce commodity. The scarcer wilderness becomes, the greater its value becomes to society. The Bob, and its wilderness ecosystem services, has given me hope that we might be able to have both wild places and advanced economies, a concept that is uniquely American and will yield numerous known and unknown benefits, now and into the future.

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Chicago Wilderness

A Model for Urban Conservation

BY LAURA REILLY

Embedded in one of North America's largest metropolitan regions and stretching from southeastern Wisconsin, through northeastern Illinois, into northwestern Indiana and southwestern Michigan is a network of natural areas that includes more than 545,000 acres (220,553 ha) of protected lands and waters (Figure 1). These natural areas are Chicago's wilderness, and home to a wide diversity of life. Thousands of native plant and animal species live here among the more than 10 million people who also call the region home.

Chicago Wilderness is a regional alliance that connects people and nature. More than 300 alliance members work together to restore local nature and protect the lands and waters on which we all depend – improving quality of life for all.

Brief History

In 1996, 34 public and private organizations joined together to launch Chicago Wilderness, an extraordinary effort to conduct conservation on a regional scale in the greater Chicago metropolitan area (Figure 2). Surprising as it may seem, world-class nature survives in and around the city. Within a half hour of the nation's third-largest metropolis is some of the finest and most significant nature in the temperate world – unique Midwestern plant and animal communities of global biological significance. This same remarkable landscape is home to more than 10 million people.

While the mosaic of fragmented natural lands and waters in the Chicago metropolitan area still harbors a rich natural heritage, the region's biological diversity is under great stress. Two centuries of farming, industry, and urban development have transformed the landscape. Nature has been squeezed into small, fragmented, and vulnerable patches: prairie, woodlands, wetlands and dunes are overrun by invasive species and languish without fire and

Figure 1 – The Chicago Wilderness region.

renewal. Due to lack of management, wildlife populations are disconnected, losing genetic diversity, and declining or stressed by overpopulation. The lakes, rivers, streams, and natural communities within this region have declined gradually from the impacts of pollution and global climate change.

In response, Chicago Wilderness was initiated when visionary people from a handful of individual institutions in the Chicago region came together to work strategically to conserve these significant natural communities. Among the challenges they faced were how to transcend political and institutional boundaries to share resources and expertise, how to foster collaboration in setting regional conservation goals, and how to attract new funding to support this innovative approach to conservation in an

Figure 2 – Chicago – a city on the prairie. Photo courtesy of Chicago Wilderness.

urban area, on a regional, landscape scale. The result was unconventional and revolutionary: the formation of Chicago Wilderness, an alliance to protect, restore, and study the biological diversity of the region, and to connect people to nature in the huge metropolitan area. The alliance successfully brought on board the conservation and corporate communities, and has since grown to more than 300 public and private member organizations; including conservation organizations, cultural and education institutions, volunteer groups, local, state and federal agencies; municipalities; businesses; and faith-based groups.

Why Is Wilderness as an Issue and a Reality Important to Urban Dwellers?

People need natural areas. Nature enhances and enriches our lives. Numerous studies have demonstrated that access to green space and open lands improves quality of life through opportunities for recreation and renewal. The book *Last Child in the Woods* (Louv 2008) reveals some of the negative outcomes associated with the growing distance between our children and nature. Other studies (Jackson and Kochtitzky n.d.) have established connections between aspects of built environments and public health. This research finds that green space improves mental health, reduces violence, and promotes community. In addition, communities derive economic benefits from functioning natural areas in the form of flood control, groundwater protection, and improved air and water quality. Chicago Wilderness addresses these needs head-on by providing a framework for future land use, resource conservation, and development that joins the needs of humans and nature, and puts nature into "backyards" throughout the region.

As people across the globe seek to widely protect biodiversity and enhance quality of life, there is no doubt that urban centers such as Chicago are critical to the success of conservation efforts, both in terms of public support and for the preservation of functional natural systems at a landscape scale. Cross-sector partnerships such as the Chicago Wilderness alliance make sense in large urbanized regions that are ecologically, organizationally, and politically complex. Chicago Wilderness helps harmonize conservation action across a region spanning 38 counties in parts of four states, and including more than 500 municipalities, each with local control of land-use decisions.

How Chicago Wilderness Works

When Chicago Wilderness launched in 1996, the founding members consisted primarily of land-managing government agencies and partners working closely with them. Their partnership was catalyzed by what was happening on the landscape: while early regional planners had protected more than 200,000 acres (80,937 ha) of land in the Chicago region in the form of parks and forest preserves, by 1996, when Chicago Wilderness was formed, these lands were under threat from habitat fragmentation, changes in hydrology, invasive species, and a lack of natural processes such as fire to restore the landscape. Most challenging was the lack of public understanding of, and support for, local conservation efforts. The conversations that preceded the alliance's formation were about bringing together organizations that could make changes both on the landscape and in the culture, through a highly strategic

Chicago Wilderness is a regional alliance that connects people and nature.

partnership. Ultimately Chicago Wilderness's 34 founding member organizations changed the way conservation is done in the Chicago region and beyond.

Chicago Wilderness's launch attracted new resources to the region in the form of federal funding, which, in turn, increased the number of partners engaged. With these resources, members developed shared tools such as the Chicago Wilderness Biodiversity Recovery Plan, as well as education and outreach tools including the Chicago Wilderness *Atlas of Biodiversity* and teacher training programs emphasizing concepts of biological diversity. Chicago Wilderness members continue to develop position statements and model policies on issues particularly relevant to conservation in the Chicago region, such as invasive species and deer control. They also developed methods to share data, expertise, and best practices in natural resource management, environmental education, and sustainable development. Over time, the alliance developed organizational capacity, and today its work is coordinated and facilitated by six staff members. With their support, alliance members have developed and implemented more than 500 conservation, research, education, and outreach projects.

During the last seven years, the collaborative work of Chicago Wilderness members has focused on four strategic initiatives: Restoring Nature, Green Infrastructure, Climate Action, and Leave No Child Inside. Within the first, restoring the health of local nature, Chicago Wilderness members create and implement regional conservation plans, share and apply the best science practices to restore and manage the region's natural areas, and engage thousands of volunteers as stewards of the landscape.

To protect green infrastructure, the alliance developed a "Green Infrastructure Vision" that encompasses both existing green spaces – including forest preserve holdings and natural areas – and highlights opportunities to expand, restore, and connect existing green spaces (Figure 3). A region-wide, GIS-based map enables members and communities to make land-use decisions with foresight for natural resource protection.

Figure 3 – Sand dunes along Lake Michigan. Photo by Jeff Jonjevik.

To address climate change, alliance members developed and implement the Chicago Wilderness Climate Action Plan for Nature. The plan identifies strategies to mitigate the threat of climate change through land and water conservation, and to make the region's natural areas more resilient in the face of a changing climate.

Chicago Wilderness members strive to connect people to nature, particularly through the Leave No Child Inside initiative. This regional campaign engages adults and children in improving the health and well-being of children through unstructured play and outdoor exploration, and strives to foster generations of people that will care enough about nature to protect it (Figure 4).

These initiatives reflect alliance members' commitment to using science and emerging knowledge, a collaborative approach to conservation, and a caring for both people and nature to benefit all of the region's residents.

Model, Lessons Learned

Chicago Wilderness's effectiveness as a collaboration is largely due to its carefully forged and highly stable structure. Its governance is based on consensus decision making; it has a 60-member Executive Council that meets quarterly to set the strategic direction for the alliance. Implementation of that strategic direction, however, is very much based on the bottom-up recommendations and energy of a variety of working groups organized within the four initiatives.

Chicago Wilderness's long-term conservation goals are outlined in the Biodiversity Recovery Plan. Alliance members set shorter-term goals through the various working

Figure 4 – Children planting in a community garden. Photo courtesy of Chicago Wilderness.

groups, and develop and implement collaborative projects around those. Many of the projects are investments in capacity building. For example, members created a controlled burn training program (Figure 5) for professionals and volunteers specific to Midwestern ecosystems – thereby building alliance members' collective capacity to restore and protect the landscape. Whatever the area of focus, alliance members continue to evolve their activities strategically, so that projects and initiatives are maximally effective in addressing current and emerging conservation challenges.

Chicago Wilderness's success as a regional partnership is based on several key characteristics:

- Shared leadership is the cornerstone. Chicago Wilderness is not driven by one entity; there is shared ownership of what is being delivered and the outcomes that members are trying to achieve.
- Collective capacity enhances undertakings. The diversity of Chicago Wilderness's organizations allows members to combine capabilities, furthering shared projects and helping members be more effective in their own missions.
- Organizational capacity reaps benefits. Chicago Wilderness members realize numerous advantages in working together, making them willing to invest in sustaining the organization.

Looking to the Future

To address rapid changes in the region and world, the alliance is thoughtfully determining its present actions with an eye towards boosting the health and resiliency of Chicago Wilderness landscapes. The alliance is reviewing its members' shared conservation priorities to address key issues and opportunities in the region. Through its diverse membership, Chicago Wilderness continues to deepen organizational and community relationships throughout the region, increase its conservation impact, and to expand its efforts.

Working together, Chicago Wilderness organizations are making a difference at many scales: on natural sites, in neighborhoods and communities, across the region, and even nationally. Recently, Chicago Wilderness helped found the Metropolitan Greenspaces Alliance (MGA), a national network of conservation

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Figure 5 – Controlled burn project. Photo by Carol Freeman.

Ecological Restoration of the Caledonian Forest in Scotland – an Update

BY ALAN WATSON FEATHERSTONE

The year 2014 marks the 25th anniversary of a project initiated by Trees for Life to help restore the Caledonian Forest in the Highlands of Scotland (Watson Featherstone 1996), and it is a good time to report on progress to date and what has been achieved so far. This is particularly relevant, as the project is based on an ecological timescale of 250 years, and this year represents 10% of that target. The 250-year perspective is derived from the average life span of a Scots pine (*Pinus sylvestris*), a keystone species in the forest and a critical backbone of the ecosystem upon which many other species depend. Dependent species include rare tooth fungi that grow in mycorrhizal association with the pine's roots underground (Pegler et al. 1997; Watson Featherstone 2003); shade-loving understory shrubs such as blaeberry (*Vaccinium myrtillus*); the Scottish crossbill (*Loxia scotica*), the only bird endemic to Scotland; and the red squirrel (*Sciurus vulgaris*), the UK's native squirrel species whose range elsewhere in Britain has contracted dramatically in recent years as a result of competition from the gray squirrel (*Sciurus carolinensis*) introduced from North America. With the range of the Scots pine having been reduced to a tiny percentage of its former extent (Forestry Commission 1998), it will take at least 250 years for mature trees, and all their associated species, to occur again in historic areas that are currently deforested.

By the late 20th century, the native pinewoods of Scotland (Steven and Carlisle 1959) had become restricted to 84 scattered remnants throughout the Highlands (Forestry Commission 1998), isolated from each other and with many of them numbering only a few dozen old trees. In many cases there had been no recruitment of young trees for 150 to 200 years because of grazing by excessive numbers of red deer (*Cervus elaphus*) (Staines 1995). The remnant trees were overmature, dying naturally of old age and not being replaced. The pinewood ecosystem had become further depleted and impoverished by the extirpation in 1743 of its apex predator, the wolf (*Canis lupus*). The result was a trophic cascade of ecosystem simplification and degradation, and a cessation of key ecological processes, such as predation, disturbance, and succession. These effects stemming from the loss of keystone predators and their top-down regulatory function on other species have been well documented in ecosystems around the world (Eisenberg 2010; Stolzenburg 2008; Terborgh and Estes 2011).

Figure 1 – Stumps of vanished Scots pines in a peat hag in the upper part of the Affric River watershed. Highly degraded landscapes like this can be found in virtually every glen in the northwestern Highlands today. Photo by Alan Watson Featherstone.

In the Highlands, formerly forested landscapes have been reduced to a minimum state of biological productivity, often consisting primarily of grasslands and held in check by the large numbers of herbivores, both deer and free-ranging domestic sheep. With ecological succession unable to occur and vegetation growth restricted by

Figure 2 – Here, natural regeneration of birch trees and flowering heather inside the fence contrasts dramatically with the bare, grass-dominated land outside, where overgrazing by deer prevents the process of ecological succession. Photo by Alan Watson Featherstone.

browsing, erosion by rain and wind has exposed the underlying peat in many areas, forming what are known as "peat hags" (Figure 1). These are literally open wounds in the landscape, where the growth of any vegetation on the peat is prevented. In many of them, the stumps of Scots pines from the vanished forests are visible. Preserved by the peat, in some cases for thousands of years, these stumps and their denuded, barren surroundings graphically illustrate the magnitude and extent of the biological impoverishment that has taken place in much of northwestern Scotland (Fraser Darling 1955).

Trees for Life

Recognizing the loss that had occurred, and the inability of trees to recolonize their former range due to overgrazing, the work of Trees for Life was conceived as a project in ecological restoration, with the aim of assisting the natural process of habitat recovery and the reestablishment of healthy forests with their full complement of species. It was inspired by some pioneering experiments in some sites, such as Glen Affric and Glen Strathfarrar, where deer and sheep had been fenced out of areas of surviving old pines, thereby enabling the successful growth of a new generation of young self-seeded trees.

The initial work of Trees for Life focused on establishing fenced exclosures in Glen Affric for natural regeneration on the periphery of the existing pinewood remnants, as that is the zone where recruitment of young trees occurs, with Scots pine being a shade-intolerant species. After 20 years of protection, a new generation of pines has become well established in these exclosures, with trees up to 25 feet tall (7.62 m), and providing a habitat for species such as the crested tit (*Lophophanes cristatus*), one of the characteristic birds of Scotland's native pinewoods. Birds transported the seeds of trees such as rowan (*Sorbus aucuparia*) and juniper (*Juniperus communis*) in their stomachs, having eaten the berries from trees elsewhere, so that these species also became reestablished naturally among the pines. The seeds of birches (*Betula pendula* and *B. pubescens*), like those of Scots pine, are dispersed by the wind, and the new generation of these species that grew successfully once deer were excluded are now themselves bearing seed each year, thereby furthering the process of forest recovery. (Figure 2)

Natural regeneration is only effective where there is an existing seed source nearby, such as a remnant of old woodland. In much of the Highlands the landscapes are either completely treeless or, at best, have a handful of scattered trees growing in locations that are inaccessible to deer, such as steep gorges or rock outcrops. In such sites, regeneration would be unlikely or very slow to occur, so in 1991 we began a program of planting trees in those cases. This involves collecting seeds from the nearest surviving areas of native woodland, from as wide a range of trees as possible, and growing young stock. The young trees are then replanted on suitable ground in irregularly spaced groupings at varying densities that mimic the growth pattern of naturally regenerating trees. It is surprisingly difficult to achieve such a seemingly random distribution, but the goal is to ensure that in 50 years after the trees have been planted, it will be impossible for an observer to notice any discernible difference between the new forests that have regenerated naturally and those that were planted. As with the regeneration work, these areas of new planting have to be protected by deer-proof fences, to ensure that the young trees survive and grow successfully.

The larger strategy behind this approach of establishing new woodland patches by both natural regeneration and planting inside fenced exclosures is to create areas, or "islands," of young forests across

the larger, deforested landscapes. Then the increased seed production resulting from the establishment of more trees, together with the reduced grazing pressure from fewer large herbivores and controlled numbers of deer, should result in successful natural regeneration of trees in the open areas between the exclosures themselves. This stage in the process of forest recovery has not yet been reached, but with the fences having a functional lifespan of 25 to 30 years, some of the initial ones we established will soon be reaching the time for their dismantling and removal, and the success (or not) of this strategy can be evaluated.

By excluding large herbivores, the fences enable the growth not just of young trees, either planted or self-seeded, but of other vegetation as well. Herbaceous plants such as bog myrtle (*Myrica gale*) are highly palatable to red deer, and as a result, they are also suppressed and unable to regenerate across most of the Highlands today. After more than 20 years of protection from deer, the difference between the growth of vegetation inside our earliest exclosures with that outside is dramatic. Healthy growth of plants such as bog myrtle and heather (*Calluna vulgaris*), as well as lichens and bryophytes, contrasts with the barren monotony of grass and peat hags a few meters away on the other side of the fences, where they are still overgrazed by deer. Inside, what were formerly peat hags have been largely recolonized by vegetation, including mosses (*Sphagnum spp.*), lichens, and plants such as cross-leaved heath (*Erica tetralix*) and bog myrtle. The recovery and healing process of the land is well under way, complemented by the growth of the new trees.

Figure 3 – (a) A Trees for Life volunteer, Grant McFarlane, about to plant a Scots pine seedling beside the stump of a vanished pine tree at Athnamulloch in Glen Affric in April 1991; (b) note the growth of the planted pines and the heather that has grown over the stump by 2002, because deer were excluded by a fence; and (c) the same scene with article author Alan Watson Featherstone in May 2011, 20 years after the first trees were planted and deer excluded. Photos courtesy of Alan Watson Featherstone.

Natural Succession

Crucially, one of the key ecological processes – that of natural succession – has also become reestablished. The grass-dominated landscape, which is all that survives outside the fences, is being replaced by heather, and early successional tree species (birch, rowan, etc.) are regenerating spontaneously. In time, they will give way to the slower-growing, longer-lived successional species such as Scots pines, and, in areas of better soils, hardwood species such as oak (*Quercus petraea*), hazel (*Corylus avellana*), and bird cherry (*Prunus padus*).

The increased growth and diversity of vegetation in these exclosures is supporting more invertebrates, and these in turn are attracting insectivorous birds and small mammals. In one site, the pines we planted more than 20 years ago are now supporting a breeding population of black grouse (*Tetrao tetrix*), a priority species for conservation in the UK, that lives at the ecotone of woodland and moorland, and flourishes where there are young pines. This success illustrates the fact that when the natural vegetation communities are allowed to recover and grow healthily, other elements of the ecosystem benefit and will return of their own accord when the habitat is available for them.

While the initial work of Trees for Life focused on the Scots pine, we diversified to include the other native trees in the ecosystem, such as aspen (*Populus tremula*), for which there has been a specific program since 1991. Like birch and rowan, aspen is a pioneer species, growing quickly and with individual stems being relatively short-lived. Also like rowan, it is highly palatable to deer, and as a result, it has been removed from most of its range and now survives in only the most inaccessible locations – usually rock outcrops or steep gullies – as isolated stands, often consisting of just a handful of trees. Aspen is a diecious species, so individual trees are either male or female, and in Scotland it seldom flowers and very rarely sets seed. Since a stand of aspen trees is a clone, it may often all be of the same sex, because they are in fact one organism with the separate stems all growing off the same root system. It may be several miles to the next nearest stand, which may or may not be the same sex, so pollination and therefore seed production is highly unlikely.

Figure 4 – A wild boar digging and disturbing the ground inside a fenced enclosure on Trees for Life's Dundreggan Conservation Estate in Glenmoriston. This rooting action reduces the spread of bracken and creates an ideal seedbed for the germination of the seeds of trees such as Scots pine and birch. Photo by Alan Watson Featherstone.

Despite its relative paucity in Scotland today, aspen is very important ecologically as it supports a wide range of other organisms, many of them rare and endangered (Cosgrove and Amphlett 2002; Parrott and MacKenzie 2009). These other species include mosses, lichens, a suite of saproxylic insects (insects that breed in dead wood), and a rare moth – the dark-bordered beauty (*Epione vespertaria*). Aspen is one of the preferred winter foods for the European beaver (*Castor fiber*), an extirpated species that is currently the subject of a Scottish government–sanctioned reintroduction program in Argyll, on the west coast of Scotland.

Aspen is unable to spread to sites where it has been lost, because of its inability to produce seeds, so it has suffered more from deforestation than probably any other tree species in Scotland. In 1991 we commenced a project to propagate the species from root sections and have subsequently expanded it to an annual production of more than 3,000 trees. These are planted out at strategically chosen sites to supplement the genetic diversity and sexual variation at existing aspen stands, create new stands where the species is absent, and create stands large enough to support the key aspen-dependent invertebrate species. Some of this work is targeted at creating suitable habitat in the riparian zone

around lochs and rivers for beaver populations, if further beaver reintroductions are approved in future.

Another project focuses on the montane scrub community that occurs at the natural treeline, where woodland gives way to subalpine vegetation. The montane scrub community consists of stunted trees such as Scots pines growing in krummholz formation, juniper and specialist species such as dwarf birch (*Betula nana*), and montane willows such as the downy willow (*Salix lapponum*) and woolly willow (*Salix lanata*). This community is fragile, slow growing, and highly susceptible to deer browsing because of its restricted height, and as a consequence there are very few remaining examples of it in Scotland today. Species such as dwarf birch survive but only in unfavorable sites, such as waterlogged soils on peat bogs where deer seldom go, and where it grows poorly. Trees for Life carried out the most extensive mapping project for dwarf birch in the country, commissioned biodiversity research that has discovered two sawfly species associated with dwarf birch that were not previously recorded in the UK, and has erected a series of fenced exclosures to enable the species – and the montane scrub community it is part of – to grow successfully again. The larger purpose behind this work is to link up the existing geographically isolated woodland remnants situated in valleys such as Glen Affric and Glenmoriston. The montane scrub zone on the higher ground in between them will form the missing link of woody vegetation that will provide greater ecological connectivity and continuity of habitat, to facilitate the movement of species from one wooded glen to another.

Figure 5 – The native tree nursery at Trees for Life's Dundreggan Conservation Estate. Photo by Alan Watson Featherstone.

Rewilding

The work Trees for Life has been carrying out for more than 25 years is now sometimes referred to as "rewilding" – the practice of restoring ecosystems to fully functional health so that they can sustain themselves indefinitely without the need for human management. One of the key elements of rewilding is the reintroduction of species that have suffered national extinction. Because Britain is an island, lost species such as the beaver, wild boar (*Sus scrofa*), and wolf cannot return spontaneously by themselves, as is now happening in other European countries. We have long advocated the return of Scotland's missing species, as they are essential elements of the forest ecosystem and it will not be returned to full health until they are present again.

Between 2004 and 2007, Trees for Life was a partner in a project utilizing wild boar for their ecological functions inside fenced exclosures on the edge of the Glen Affric National Nature Reserve, and since 2009 has continued this project on land owned by Trees for Life in Glenmoriston (Figure 4). The boar are helping to reduce the abundance of bracken (*Pteridium aquilinum*), a native rhizomatous fern, which has spread unchecked in the absence of any natural ecological controls. Bracken's fronds are toxic to most herbivores, and they shade out forest floor plants, preventing the establishment of tree seedlings. Bracken also spreads by rhizomes and has progressively covered more and more land throughout the UK in recent decades. Wild boar are the natural control for bracken, as they dig up and eat the rhizomes, thus restricting the fern's ability to spread and exposing the uneaten sections of rhizome to frost, which also curtails their growth. Boar turn over the soil, creating patches of bare earth that are ideal for the germination of tree seeds, thereby aiding the natural regeneration of species such as birch and pine. Inside a fenced enclosure boar provide these ecological functions, which have been lost to the forests in the UK for the past 400 years or so, since boar were hunted to national extinction.

In 1996, Trees for Life established a native tree nursery, concentrating on scarcer and harder-to-propagate species such as aspen, juniper, holly, and

others. Subsequent to the purchase in 2008 of the 10,000 acre (4,047 ha) Dundreggan Conservation Estate in Glenmoriston, the nursery (Figure 5) was relocated there and expanded to include propagation of montane scrub species such as dwarf birch and the rare montane willows, propagation trials for woodland ground flora species such as twinflower (*Linnea borealis*) and creeping ladies tresses (*Goodyera repens*), and experimental grafting work with aspen to see if that method will result in greater seed production.

The acquisition of Dundreggan represented a significant step forward for Trees for Life. Until then, we had worked exclusively on other owners' land and therefore were always restricted to a lesser or greater extent by their objectives. Dundreggan is a very biodiversity-rich site, with more than 3,000 species recorded there to date – including 10 that have not been previously found in the UK – leading to it being described as a "lost world" of biodiversity. A 50-year vision for the estate was developed with the aim of restoring native woodland and scrub to about 60% of its area and making it a demonstration project for best practice in forest restoration and rewilding. As landowners, we take an active role in the management of deer numbers to control their impact on natural regeneration of native forests. Dundreggan provides an opportunity to bring together on the one site all the different aspects of the work developed by Trees for Life during the past 25 years, from native pinewood restoration and the recovery of aspen trees to montane scrub reestablishment and the use of wild boar to control bracken and aid tree seedling recruitment.

In 2012, Trees for Life reached a major milestone when the one millionth tree of the project was planted.

Milestones

In 2012, Trees for Life reached a major milestone when the one millionth tree of the project was planted, and we subsequently set ourselves the ambitious target of achieving a million more, through both planting and natural regeneration, by 2018. The range of sites where Trees for Life works was expanded beyond the existing project area to a region of about 1,000 square miles (2,590 sq km) to the west of Loch Ness and Inverness. The goal is to expand and link up remnants of the Caledonian Forest and create a much larger contiguous extent of healthy woodland habitat, which, in time, will be large enough to support populations of all Scotland's missing wildlife species, such as the moose (*Alces alces*), Eurasian lynx (*Lynx lynx*), and European brown bear (*Ursus arctos*). Although some reintroductions of raptors have taken place in Scotland, to date none of the missing terrestrial carnivores have been reinstated, and this is a key gap in the goal of rewilding. While the wolf is an obvious and frequently cited candidate for reintroduction, Trees for Life and other organizations believe that the lynx is a more feasible option for reintroduction because of its solitary nature, lack of a controversial image, and lesser predation on domestic sheep. Studies have shown that even with the limited amount of woodland in Scotland today, the existing forest habitat could support up to 400 lynx in the Highlands (Hetherington et al. 2008). The ecological benefits resulting from projects such as the reintroduction of wolves to Yellowstone National Park in the United States add weight to the calls for the return of predators to Scotland, and we hope there will be forward progress on this front in the coming years.

In the past quarter of a century there has been a substantial increase in both scientific knowledge (Aldhous 1995) and public interest (Bain 2013; Cairns 2011; Crumley 2011) in the Caledonian Forest, and this has led to an upsurge of action and practical initiatives for its regeneration and expansion. Additionally, there has been an upsurge of momentum for greater political self-determination in Scotland, and it is clearly connected with interest in the landscape. As people have become more aware of the highly depleted state of the land in much of Scotland, they have sought opportunities to take positive action to reverse this. Just as in countries such as the United States, Canada, Australia, and New Zealand, among others, where indigenous peoples have been disenfranchised from their land and have gone into subsequent cultural decline and political disempowerment, so too has this happened in Scotland, subsequent to the notorious Highland Clearances of the late 18th and early 19th centuries when subsistence crofters were forced off their lands and fled either to cities such as Glasgow or to colonies such as Nova Scotia in Canada. By contrast today, the growing momentum for ecological recovery and habitat restoration in Scotland, and the increasing demand for greater political self-determination are both signs

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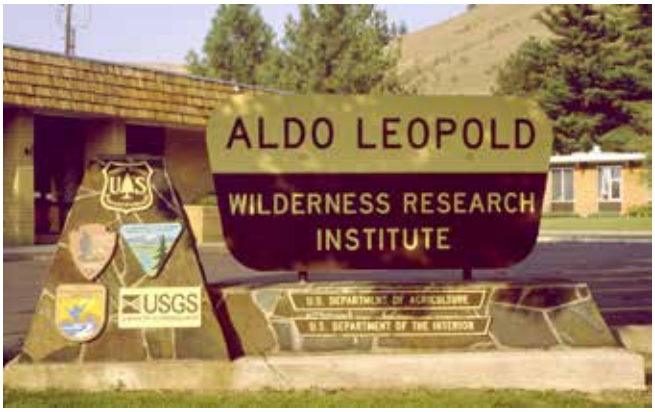
PERSPECTIVES FROM THE ALDO LEOPOLD WILDERNESS RESEARCH INSTITUTE

The USGS Northern Rocky Mountain Science Center

BY PAUL STEPHEN CORN and SUZANNA C. SOILEAU

The Aldo Leopold Wilderness Research Institute (ALWRI) was conceived as an interagency partnership, and its founding in 1993 coincided with the creation of the National Biological Service (NBS), from the biological research programs and staff in the Department of the Interior. NBS research zoologist Steve Corn moved to Missoula to join the staff at ALWRI in 1996, at about the same time that NBS was merged into the U.S. Geological Survey (USGS). USGS scientists in Montana were ultimately incorporated into the Northern Rocky Mountain Science Center (NOROCK). Dr. Corn retired in August 2014, but the USGS presence at ALWRI is continued by Blake Hossack, who joined Corn's project in 1999, earned his PhD in biological sciences at the University of Montana in 2011, and was hired as a research zoologist with USGS in 2012.

The USGS presence at ALWRI has been mainly tied to the study of amphibian populations in protected areas. Early USGS efforts at ALWRI included a workshop on the effects of stocking nonnative fish in wilderness lakes, culminating in several papers published in the journal *Ecosystems* in 2001. However, since 2000, most USGS activity has been funded through the USGS Amphibian Research and Monitoring Initiative (Corn 2001). The explicit relationship of this work to wilderness generally falls under the category of "wilderness for science" (Parsons 2007) and includes long-term monitoring of status and trend in the national parks on the Continental Divide and research on factors influencing change in amphibian populations. Monitoring data from Glacier, Yellowstone, Grand Teton, and Rocky Mountain National Parks composed a portion of an analysis of national trends in amphibian populations (Adams et al. 2013). Research, although specifically addressing amphibians, has examined issues such as fish



stocking (Pilliod et al. 2010), wildland fire (Hossack et al. 2013), and climate change (McCaffery et al. 2014) that are directly relevant to understanding the current threats to wilderness values.

Headquartered in Bozeman, Montana, NOROCK also incorporates field stations in West Glacier, Montana, and Jackson, Wyoming. Given the physical setting of the northern Rocky Mountains, it is not surprising that many of the studies conducted by scientists at NOROCK also use wilderness as the setting for research, and considerable information is generated on a broad range of topics directly useful to wilderness managers. Emeritus geographer Carl Key focused on building capabilities for the remote sensing and evaluation of wildfire (Lutes et al. 2006). Scientists with the Climate Change in Mountain Ecosystems program, led by research ecologist Dan Fagre, focus on mountain ecosystem research with an emphasis on glacier studies, snowpack and avalanche events, landscape change photography, and alpine climatology. The team's research is also part of the Western Mountain Initiative, a collaboration between USGS and U.S. Forest Service scientists to study and predict responses

of montane ecosystems to climatic variability and change (Baron et al. 2008). Research ecologist Greg Pederson has developed tools for assessing recent and historic changes in temperature and snow in the northern Rockies that can be used to assist wilderness managers in developing adaptation strategies (Davison et al. 2012). Climate change is a major component of research ecologist Clint Muhlfeld's research. For example, there are strong links between climate change and hybridization of native cutthroat with introduced rainbow trout (Muhlfeld et al. 2014), causing decreased fitness and increasing risk of extinction. Grizzly bears are an important symbol and component of wilderness ecosystems in the northern Rockies, and research supporting their conservation is a focus of much of NOROCK's work in the Greater Yellowstone (GYE), Northern Continental Divide (NCDE), and Cabinet-Yaak (CYE) Ecosystems. In the NCDE and CYE, emeritus wildlife biologist Kate Kendall and her team conducted extensive sampling for bear DNA in Glacier National Park and nearby wilderness areas and provided the first-ever population estimates for grizzly bears in these regions (Kendall et al. 2008). Research ecologist Tabitha Graves continues these studies from the West Glacier field station.

NOROCK scientists, including many not named here, are actively engaged in research partnerships that enhance the ecological understanding of wilderness areas across the West. Key partners in these efforts include the Interagency Grizzly Bear Study Team, Wyoming Landscape Conservation Initiative, Montana Institute on Ecosystems, National Park Service Inventory and Monitoring Network, Intermountain West Wetland Working Group, USGS National Research Program in Water, and, of course, ALWRI. For more information on specific projects and complete lists of publications and other products, visit the ALWRI (leopold.wilderness.net) and NOROCK (nrmsc.usgs.gov) websites.

NOROCK scientists are actively engaged in research partnerships that enhance the ecological understanding of wilderness areas across the West.

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PERSPECTIVES FROM THE SOCIETY FOR WILDERNESS STEWARDSHIP

Toward a Wilderness Community of Practice

BY DAVID COLE

[Editor's Note: This is a new regular feature provided by the Society for Wilderness Stewardship to reflect on items of interest to the wilderness community of practice.]

Wilderness has always had a community, albeit an informal one. People get passionate about wilderness when they work with it, visit it, or just care that it exists. Whether meeting in the field, on the trail, or at events and workshops, wilderness forges a common bond that feels like community. But is that sense of community waning? Several decades ago, wilderness scientists and managers met regularly at both workshops and yearly conferences. Scientists heard the challenges that wilderness managers face and managers saw how science could improve wilderness stewardship. Less interaction like this occurs today. Despite the 50th anniversary conference this year, conferences and workshops that bring together diverse members of the wilderness community are no longer the norm, falling victim to declining budgets, agency restrictions, and shifting priorities. Informal community can only go so far. Fifty years after passage of the Wilderness Act in the United States, it is time to build a formal community of practice for wilderness.

A community of practice is "a group of people who share a concern, a set of problems or a passion about a topic, and who deepen their knowledge and expertise by interacting on an ongoing basis" (Wenger et al. 2002). Communities of practice stimulate mutual learning, joint exploration of ideas, and shared practice. They connect people, enable dialogue, gather and share know-how, foster collaboration, organize action toward shared goals, innovate new techniques, and ensure that relevant knowledge is accessible to those who need it. For wilderness, a community of practice would link professional wilderness managers and practitioners, wilderness scientists, and other producers of knowledge, and those involved in formulating and implementing wilderness policy to analyze, address, and explore solutions to problems.

How do you create a wilderness community of practice? The Society for Wilderness Stewardship (SWS) is a relatively new nongovernmental organization whose mission is "to promote excellence in the professional practice of wilderness stewardship, science, and education to ensure the life-sustaining benefits of wilderness." To do this, SWS is developing the capacity and infrastructure to support a wilderness community of practice, consisting of wilderness managers, educators, scientists, administrators, members of non-profit wilderness organizations, students interested in wilderness, and others interested in advancing the professionalism of wilderness stewardship. To date, SWS has developed outreach and communication channels, a website, and various other social media outlets. It has worked on delivering a variety of professional advancement programs, including wilderness training, a wilderness stewardship certificate program, and a mentoring program. It has a stewardship committee, a vehicle for community members to come together to share information on wilderness issues and challenges, formulate solutions to problems, and, if need be, advocate for change in policy or practice. But a community is only as strong as its members. So, if you see value in a wilderness community of practice and want to contribute to the professionalism of wilderness stewardship, please join us. Learn more about the Society for

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Study on How Tourists Use Social Media in Wilderness

BY AUDREY NEVILLE AND ROBERT PAHRE

Wilderness is a solitary place. The U.S. Wilderness Act of 1964 provides that a federally designated wilderness must have "outstanding opportunities for solitude" and must be "untrammeled by man, where man himself is a visitor who does not remain." At first blush, social media would seem to be inconsistent with this vision of what wilderness ought to be. These social media connections require that people in the "wild" have wireless access and interactions with people who are back in "civilization." In other words, social media brings people who are still in the wild into contact with friends who are not. These real-time interactions presumably shape how people in wilderness view the landscapes around them, but social media are so new that we know little about how they affect wilderness behavior.

As part of a study of how visitors use social media while in national parks, we are investigating how people imagine "wilderness" in Yellowstone National Park and the Greater Yellowstone Area. We examine the use of #wilderness and related hashtags, associations between #wilderness and hashtags such as #wildlife or #solitude, and we ask whether visitors prefer less-wild locations that "play better" on social media websites – tourist locations such as Old Faithful or roadside wildlife.

We are investigating whether visitors to national parks edit their nonwilderness experiences so as to make them look more like wilderness and less like nonwilderness. Posting photos of a geyser basin without boardwalks or people, composing a photo of a roadside bear without the road, or labeling an objectively nonwild site as "wilderness" would be some examples of this editing. Another example is shown in Figure 1 with people holding smartphones over the heads of other tourists to get a picture of the "wild" Old Faithful.

Figure 1 – Visitors at Yellowstone National Park taking pictures with cell phones and cameras. Photo by Robert Pahre.

We expect that visitors will engage in this editing in an attempt to portray authentic experiences to their social media networks. We also expect that this attempt to edit their experiences will influence visitors' behavior while they are in national parks. For example, visitors might engage in misbehavior to get a unique or interesting photograph. Approaching wildlife too closely is one common example. Understanding what motivates this misbehavior will help the National Park Service know how to address and prevent these dangerous situations.

Of course, it is possible that social media encourage visitors to pursue more distinctive experiences, far from the madding crowds. This unexpected finding would suggest that social media can encourage better connections with wilderness. Whatever our ultimate findings, this study will tell us more about how individuals interact with the national parks, and we will understand more about the

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Alice Zahniser Dies at 96

BY DOUG SCOTT

Alice Zahniser, the widow of Howard Zahniser, died on July 8, 2014. Alice was a constant source of support for "Zahnie" in his years of work conceiving, drafting, and leading the campaign for the Wilderness Act.

Howard died five months before the law was passed. In sympathy, President Lyndon B. Johnson wrote to her saying:

> It was with great shock that I learned today of "Zahnie's" death. I first became acquainted with him when I served in the House and continued to have many associations with him during my later service in the Senate.
>
> He was a relentless campaigner for those measures that were in the public interest. The shadow that he cast in the field of conservation will be apparent generations hence. Although we today are in his debt, it will be the America of countless tomorrows that will have the greatest obligation to his dedication and valiant efforts to preserve part of our country as nature ordained it. He was a great fighter in a great cause.

On September 3, 1964, Alice stood in the Rose Garden as President Johnson signed the historic law, immediately extending statutory protection to the first 9,140,000 acres (3,698,826 ha) of wilderness (Figure 1). For the past 50 years she has been a living link to the momentous period in which the Wilderness Act became law.

The Zahnisers both came from small-town rural Pennsylvania. They married in 1936 and had four children: Alison Howard Mathias Zahniser of Greenville, Illinois; Reverend Esther B. Zahniser of London, England; Karen E. Zahniser of Lexington, Massachusetts; and Edward D. Zahniser of Shepherdstown, West Virginia; together with 9 grandchildren and 16 great-grandchildren.

A coloratura soprano, Alice Zahniser trained at Peabody Institute, Baltimore, Maryland, and the University of Maryland, College Park. She performed at many venues, including the Kennedy Center, Washington, D.C., and the Pablo Casals Festival in Puerto Rico.

Alice was the expert logistician behind her family's many wilderness experiences that buttressed Howard's work for the 1964 Wilderness Act. Her journal, *Ways to the Wilderness: Summer 1956 Western Trip Journal* recounts the 1956 saga of the family of six car camping on a trek to wilderness areas from Minnesota to Wyoming, Montana, and Washington and their encounters with many other wilderness leaders (Figure 2). She was known to the family as "the Mother Teresa of outdoor cooking over open wood fires."

On August 21, 1956, the Zahnisers were in the Grand Tetons, where Alice washed and hung out five loads of laundry:

> Being up in the mountains really makes one appreciate hot water in abundance. In fact a primitive experience

Figure 1 – Alice Zahniser (center) receives a pen used by President Lyndon B. Johnson to sign the 1964 Wilderness Act into law. Photo by Abbie Rowe.

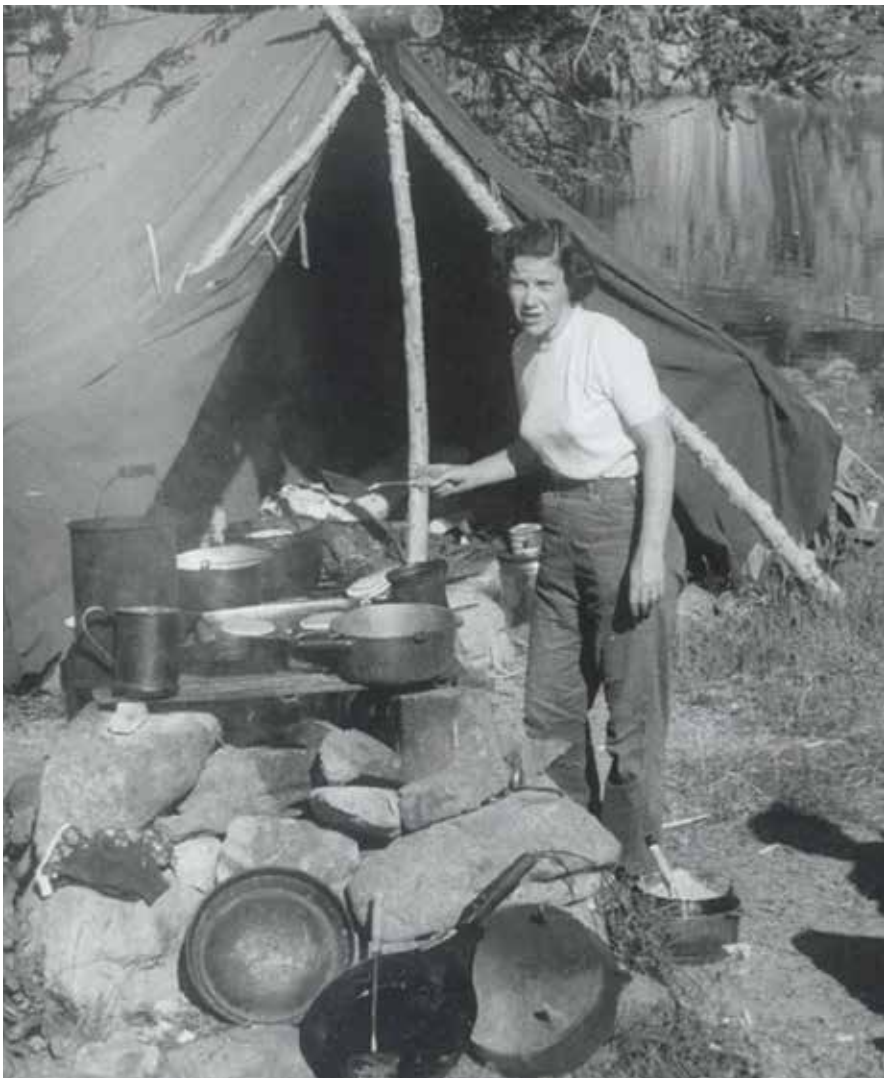

Figure 2 – Alice Zahniser camping in 1956 in the Cloud Peaks Primitive Area. Photo courtesy of the Zahniser family.

would be worthwhile if its only result were the supreme enjoyment of comforts we take for granted after we have been deprived of them for awhile, but of course that is only a fraction of the value of a primitive experience. The feeling of well-being that comes while living outdoors, the use of the body muscles involved in hiking, walking for water, hiking to toilet, bending over open fires, etc. are good things. The increase in circulation due to hiking in open air makes one feel good. Just to constantly see the green grass, beautiful lakes, blue sky, variously colored flowers and even to see and hear the rain are tonics to the body and spirit. (Zahniser 2008, p. 70)

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messages visitors are sending to their networks via their social media postings. This should help the national parks respond to these social media messages by molding their online messages to visitors, or even attempting to shape visitor experiences in the national parks. We anticipate that the results we glean from our study in Yellowstone National Park will be somewhat generalizable to other national parks.

More information about the study is available – you guessed it – on various social media websites. Search for "Pahre social media study," follow YOLOstone2014 on Twitter, or Google the hashtag #YOLOstone2014.

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Wilderness Stewardship at WildernessStewardship.org, and become part of the community.

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Looking into the Future of the Antarctic Wilderness

BY TINA TIN

Book Project

In 2010, a book project was launched to look forward into the next 50 years, examining possible future scenarios for the Antarctic environment. Over a period of 3 years, 30 international experts – researchers in natural and social sciences, environmental managers of National Antarctic Programs, and environmental advocates – worked together to review the state-of-the-art knowledge of impacts of human activities on the Antarctic environment, consider future scenarios, and examine strategic planning needs that would ensure continued conservation. Our reflections were collected in the book *Antarctic Futures: Human Engagement with the Antarctic environment* (Tin et al. 2014). Building on his/her expertise and ongoing research, in 15 chapters project contributors explored the topics of terrestrial and marine flora and fauna, nonnative species, tourism, National Antarctic Programs, environmental management tools, and the public's valuing of wilderness. For each topic, contributors explored the implications of the Business-As-Usual scenario, where the current trends of increasing human activities continue over the next 50 years and no additional conservation action is taken. Alternative scenarios were also developed and were compared and contrasted with Business-As-Usual.

Business-As-Usual: A Worst Case Scenario

The world has changed a lot over the past 100 years, and Antarctica is no exception. The scope and intensity of human activity in the Antarctic region have increased substantially during this time, resulting in significant modifications to Antarctica's environment and its ecosystems and the development of new institutional arrangements to govern human activities. Notably, since 1998 the Protocol on Environmental Protection to the Antarctic Treaty (Environmental Protocol) has provided "a comprehensive regime for the protection of the Antarctic environment and dependent and associated ecosystems … in the interest of mankind as a whole" (Preamble). It has put in place legal requirements with respect to, inter alia, Environmental Impact Assessments, designation of protected areas, waste management, conservation of flora and fauna, and the protection of Antarctica's wilderness and aesthetic values.

Tina Tin skiing in the French Alps.

Historically, the Antarctic environment has been protected from human activities and their impacts because of its distance from population centers and its harsh climate. However, in the last 100 years, these natural protections have increasingly been eroded by global and regional warming, technological developments, globalization, and increasing wealth and mobility of the global population. Looking forward into the next 50 years, the basic challenge under the Business-As-Usual scenario is that Antarctica will become busier and warmer, bearing in mind that unexpected turns in geopolitics and global affairs can always happen. Based on current trends of human activities in Antarctica, contributors to "Antarctic Futures" developed a range of different Business-As-Usual scenarios for the conservation of the Antarctic environment. Most scenarios concur that existing environmental management practices and the current system of governance are insufficient to meet the obligations set out under the Environmental Protocol to protect the Antarctic environment today. Hence, current practices will certainly be insufficient to deal with the environmental challenges that arise in a warmer and busier Antarctica in the 21st century and beyond.

Specifically, contributors expect that the number of research stations will continue to grow. The number

Figure 1 – Under the Business-As-Usual scenario, we expect that over the next 50 years, the current trends of increasing human activities will continue. This photograph is an aerial view of Fildes Peninsula, an area with the highest density of research stations in Antarctica and where environmental impacts of research stations and scientific activities have continued to increase, despite the legal obligations of the Environmental Protocol. Photograph by Christina Braun, University of Jena, Germany.

of researchers, support staff, tourists, and all forms of land, air-, and ship-borne traffic are likely to continue to increase. This in turn will increase volumes of fuel consumption, storage requirements, and spill risks. Burning more fossil fuels will exacerbate global climate change. Spatial footprints of research stations and human activities will continue to expand and extend into areas that have hitherto had little human visitation. In the vicinity of stations, occurrences of local pollution and disturbance to wildlife will become more likely, and wilderness values will be deteriorated. For the Antarctic region as a whole, areas with little or no human visitation are becoming increasingly rare. Assuming that there will be more rapid turnover of larger numbers of researchers, tourists, support staff, and their equipment, there will be an increase in the potential for the introduction of disease and other nonnative species. Meanwhile, climate change will enhance their likelihood of establishment and range expansion. Human impacts on soils and vegetation are not likely to become widespread over the Antarctic.

However, Antarctic soils and vegetation are extremely fragile. Exceedingly low levels of foot or vehicular transport is sufficient to result in very obvious damage that can remain visible after decades. Therefore, severe and permanent impacts are likely to persist at sites with high levels of use, such as popular tourist destinations and areas with a high concentration of research stations. Under the Business-As-Usual scenario, the current trend continues, where more effort is spent on documenting impacts than in mitigating them.

Contributors forecast that the Antarctic wilderness will be encroached upon and fragmented by continuous growth, expansion, and diversification of human activities. Commercial uses of Antarctica's natural resources will continue to increase. The protection of Antarctica's intrinsic, wilderness, and aesthetic values will remain a low priority. Sovereignty and national economic interests will remain the main driving values in nations' engagement in the Antarctic. Without deliberate efforts to protect intrinsic, wilderness, and aesthetic values, they will certainly diminish as the human footprint in the Antarctic and worldwide continues to grow. In the face of growing human activity, a reactive wait-and-see attitude toward the protection of these values is a de facto decision that supports their attrition. Under this scenario, environmental protection may still feature in the future, but on the margins rather than as a central guiding principle. There is a risk that the Antarctic continent and surrounding oceans will be legally protected but will become, for all intents and purposes, a "paper park."

In many cases, a Business-As-Usual future represents a worst-case scenario: globally, climate change intensifies as energy consumption and greenhouse gas emissions continue to rise unabated; regionally, the human footprint expands and intensifies without any notion of limitation or restraint.

Alternative Scenarios: Are Better Futures Possible?

In a small proportion of Business-As-Usual scenarios, contributors speculate that human activities will be able to continue to take place sustainably without compromising the environment. In the case of scientific research and its associated logistics, contributors predict that environmental change, fluctuations in oil prices, and changes in the financing and ownership of research stations could gradually have mostly positive consequences for the environment. The construction of new research stations and expansion of logistical activities would slow down as National Antarctic Programs faced budget constraints. Technological advances and experience in the use of such

technology could lead to scientific and logistical operations that have lower environmental impacts. In the case of tourism, contributors expect that the ongoing implementation of best practices by the tourism industry coupled with new and proactive regulations have the potential to make tourism sustainable in a Business-As-Usual future.

Contributors also stretched their imaginations and developed a range of alternative scenarios, capturing possible global events and changes in societal values and attitudes.

In a conservation-focused scenario, contributors imagined that Antarctica Treaty nations would demonstrate a clear commitment to prioritizing the conservation of all natural resources in Antarctica, including those that have hitherto received little attention, such as soil microfauna and wilderness. Under a wilderness conservation scenario, some areas would be closed to human access. Such inviolate areas would allow neither research nor tourism activities, in order to prevent further degradation of the area's values and landscapes and to protect its wildlife from human impacts.

The vast majority of alternative scenarios fall under a cluster that we have labeled "Utopia." In these futures, Antarctic Treaty nations are more interested in resource protection than exploitation. Decisions are guided by a vision of a desirable future. There is little or no resource use. Proactive governance takes the precautionary approach, recognizes the importance of intrinsic values, and uses Antarctica to serve the global benefit of humankind and not for nationalistic or commercial reasons. Decisions are made taking into account environmental impacts accumulated from past, present, and anticipated future activities. Long-term and large-scale considerations permeate throughout the processes of planning, decision making, implementation, enforcement, monitoring, and compliance. Contentious and strategic issues, such as territorial claims, desirable forms and volumes of tourism activity, and a cap for new stations and infrastructure are addressed urgently and proactively.

Figure 2 – Under alternative conservation-focused scenarios, Antarctic Treaty nations will be more interested in resource protection than exploitation. Conservation of all natural resources in Antarctica will be prioritized. Decisions will be guided by a vision of a desirable future that serves the global benefit of humankind rather than for nationalistic or commercial reasons. Photograph by Ryan Wallace, U.S. National Science Foundation.

Of course, the future can also take other turns. Under the "Nations Rise" scenarios, contributors projected that national interests dominate and the Environmental Protocol and other existing regulatory mechanisms are amended to allow resources to be used to support national commercial and strategic interests. In another scenario, global market pressures could force the opening of hotels or mines in Antarctica, both currently largely absent with the exception of the accommodation of paying tourists at research

stations, which has been the practice of at least one station (ASOC 2009). Similarly, if global emissions of greenhouse gases continue to rise, exacerbating global climate change, environmental management practices adopted within the Antarctic will become insufficient to protect the Antarctic environment.

Choosing a Better Future

We do not possess a crystal ball that can show us the future reliably. History and global developments constantly surprise. Who would have thought that at the height of the Cold War, in 1959, 12 of the world's leading powers would sign the Antarctic Treaty and agree to set aside one-sixth of the planet "for peaceful purposes only" (Article 1, Antarctic Treaty), banning military activity, nuclear explosions, and disposal of radioactive waste? Who would have thought that after years of intense negotiation for an international convention to regulate mining in Antarctica, 27 nations would agree to ban mining and sign the Environmental Protocol – one of the very few international agreements in which wilderness values explicitly receive legally protected status?

Quoting from the conclusion of a chapter in *Antarctic Futures* (Woehler et al. 2014):

> Predictions about threats and their impacts 50 years into the future, therefore, are substantially qualified. If researchers had been asked to undertake similar predictions in 1961 – coincident with the Antarctic Treaty coming into force – for 2010, they would have been unlikely to predict the development of commercial tourism, the extent of research stations and the complexity of the associated and obligatory infrastructures, the scale of commercial krill and finfish fisheries, and the impacts from global warming. The dramatic developments in technology and engineering since 1961 will be negligible compared to those advances that will occur in the next 50 years, *so we may confidently predict [that] unpredictable situations and circumstances that are beyond our current understanding or even our capacity to foresee [will arise]*." [emphasis added] (Chapter 2)

The world has changed a lot over the past 100 years, and Antarctica is no exception.

However, in general, it is fair to assume that the Business-As-Usual scenario has a high likelihood to become reality since it has the momentum of the current trajectory. Changing the trajectory would require an input of energy. Under the current geopolitical climate, it is unlikely that national interests will fade into the background. Looking at how consumption of natural resources has skyrocketed and how wilderness has dwindled across the planet over the past 100 years, it is difficult to imagine that these trends may be reversed in the next 50.

Quoting from the conclusion of chapter 5 in Antarctic Futures (Hughes et al. 2014): "Given the poor environmental performance exhibited to date by some National Antarctic Programs at some locations, where even the basic minimum standards set by the Environmental Protocol are not met 15 years after they came into force, the prognosis for the future is currently not good."

If the past and the present are reliable predictors of the future, then the future of the Antarctic wilderness does not look pretty: a human footprint that grows without any restraint will further fragment and erode the world's largest contiguous wilderness.

Luckily, predictions, even those with high likelihood, are only educated guesses and are still not yet reality. In reality, opportunities are available at every moment to allow the choice of an alternative future. In some cases, it may mean that a much larger catastrophe must loom on the horizon to galvanize the motivation to change. In other cases, the momentum of status quo may prove to be overwhelming. Yet, if humankind is willing, it is still possible to choose a better future for the Antarctic wilderness.

Acknowledgments

Thanks to co-editors Daniela Liggett, Machiel Lamers, Pat Maher and the contributors to *Antarctic Futures* for their aspiration for a better future.

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Announcements

COMPILED BY GREG KROLL

Kelly Bush Receives the Wes Henry National Wilderness Award

The National Park Service's (NPS) Wes Henry National Excellence in Wilderness Stewardship Award recognizes outstanding contributions to wilderness preservation and stewardship throughout the agency. The 2013 individual award was presented to Kelly Bush, district ranger for the Wilderness District at North Cascades National Park, Washington.

According to the NPS, Kelly has been a champion of wilderness at North Cascades since before the park received wilderness designation. As a seasonal ranger in the 1980s and then as a wilderness patrol supervisor and wilderness district ranger, Kelly has played an integral role in developing and implementing the park's wilderness management policies. She was instrumental in the designation of the park's Stephen Mather Wilderness in 1988 and played a significant role in writing the park's first wilderness management plan in 1989.

Kelly has collaborated with other subject matter experts on an array of interdisciplinary wilderness topics, including revegetation and plant propagation, wilderness character monitoring, and climbing. She has served as the co-chair of the North Cascade's Wilderness and Aviation Committee and as a field representative on the NPS National Wilderness Leadership Council. (Source: NPS morning report, July 16, 2014)

Hawaii to Host the 2016 IUCN World Conservation Congress

The International Union for the Conservation of Nature (IUCN) has selected Hawaii as the site of the 2016 World Conservation Congress (WCC). This will be the first time in its 66-year history that the world's largest conservation conference will be hosted by the United States. The WCC draws a diverse mix of scientists, politicians, policy makers, educators, nongovernmental organizations, business interests, environment and climate experts, and indigenous organizations for 10 days of meetings, discussions, and debates on environmental and development issues and policies. The IUCN has 85 member organizations in the United States, the largest number of any country. (Source: IPS [Inter Press Service], May 22, 2014)

National Park Service Bans Drones in the Parks

"Imagine you're a big wall climber in Yosemite [National Park] working on a four-day climb up El Capitan, and you're hanging off a bulb ready to make a difficult move, and an unmanned aircraft flies up beside you and is hovering a few feet from your head with its GoPro camera running. Think about what that does to your experience and your safety." So says National Park Service (NPS) Director Jonathan Jarvis. In a memorandum to superintendents across the system, Jarvis directed them to prohibit visitors from "launching, landing, or operating unmanned aircraft on lands and waters administered by the park service." Until a servicewide regulation is proposed, superintendents are to use their existing authority within the Code of Federal Regulations to prohibit the use of drones and to include that prohibition in the park's compendium – a set of park-specific regulations. Visitors who are caught violating the ban are subject to a fine of $5,000 and a six-month jail sentence.

A drone is an unmanned aerial vehicle (UAV) that can range in size from no bigger than a hummingbird to the size of an airliner. A drone's flight is controlled either autonomously by onboard computers or by remote control. Drone use is growing as prices steadily decline.

At Grand Canyon National Park, a drone buzzed around more than three dozen visitors gathered to watch the sunset near Desert View Watchtower. The operator lost control of the UAV, which had been loudly flying back and forth over the canyon, and then crashed into the canyon. At Zion National Park, volunteers watched as a drone flew close to a herd of bighorn sheep, scattering them and separating several young sheep from the adults. Drones have

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prevented birds from successfully nesting and caused nests to be abandoned when the birds felt harassed. And visitors have complained about drones invading Zion's soundscape and wilderness, while others have reported feeling unsafe as drones buzzed through slot canyons and along exposed trails such as Angels Landing and Canyon Overlook. (Sources: www.nationalparkstraveler.com, May 6, May 7, and June 20, 2014; *Denver Post*, June 20, 2014)

Australian Government Moves to Dismantle Environmental Protections

At its annual meeting in Cairns, Queensland, the Association for Tropical Biology and Conservation (ATBC) condemned the Australian government's recent moves to eliminate protections for native ecosystems, cut research funding, backtrack on commitments to reduce greenhouse gas emissions, and step up persecution of individuals and organizations that speak out in favor of environmental protection.

Australia has the world's highest extinction rate among native mammals. ATBC said the national government was failing to take adequate measures to protect endangered wildlife by cutting funds for environmental law enforcement and allowing local governments and organizations to sidestep regulations designed to limit clearing of native vegetation. ATBC further "implores the Commonwealth Government to abandon its attempt to remove the tax-deductible status of environmental groups and non-government organizations that work to protect Australia's unique and threatened ecosystems and natural capital."

Christine Milne, leader of Australia's Green Party, said that "Australia is a rich country, yet we are behaving appallingly." She noted several recent developments that undermine environmental protection, including a plan to dump dredge sludge in the Great Barrier Reef Marine Park; the abolishment of the country's $1 billion biodiversity fund; approval of mining, logging, and grazing in protected areas; and the failed attempt to remove 180,000 acres (74,000 ha) of forest from the Tasmanian World Heritage area for industrial logging. (Source: mongabay.com, July 22, 2014)

UNESCO Rejects Australia's Bid to Strip Tasmanian Wilderness of World Heritage Status

The United Nations has unanimously rejected an Australian proposal to revoke World Heritage status on 180,000 acres (74,000 ha) of Tasmania's rain forest in order to reopen it to logging. At a June 2014 meeting in Doha, Qatar, all members of the World Heritage Committee voted against the proposal. According to the Portuguese delegation, "The justifications presented for the reduction are, to say the least, feeble. Accepting this de-listing today would be setting an unacceptable precedent impossible to deny in similar circumstances in the future."

The area is part of the 420,000 acres (170,000 ha) added to the World Heritage Area in 2013 by Australia's previous federal and state Labor governments in a deal between environmentalists and the timber industry. But in its 2013 election campaign, Australia's current ruling Liberal National Party pledged to ask UNESCO to reduce the extension, arguing that the area had already been disturbed by prior logging and degradation. Prime Minister Tony Abbott told reporters that the Australian government was disappointed by the UN decision and would study it before taking the next step.

In the assessment developed by the International Union for Conservation of Nature (IUCN) to advise the World Heritage Committee, the IUCN commented that "the proposed excisions would reduce the integrity of key natural attributes of the property, notably tall-eucalypt forest connectivity. ... Whilst a detailed evaluation of the proposed boundaries would need improved mapping, the proposals also appear to reinstate threats that have previously been noted as being of concern by the World Heritage Committee, such as increasing the potential for adjoining logging to impact the property, or creating additional risks in relation to fire management." (Sources: Reuters, June 24, 2014; http://wilderness-society.org, May 21, 2014)

A Partnership of Asian Transboundary Protected Areas Is Established

Following a meeting in Bangkok, Thailand, and in coordination with the International Union for Conservation of Nature (IUCN), governments from 12 Asian countries have formed the Asia Protected Areas Partnership. It will be co-chaired by the government of Japan, as the first country co-chair, and the IUCN. The partnership consists of representatives of Japan, Bhutan, Cambodia, China, India, Indonesia, Malaysia, Nepal, Pakistan, Sri Lanka, Thailand, and Vietnam. (Source: *The Economic Times* [India], May 1, 2014)

Chilean Patagonia Celebrates the Defeat of a Wilderness Dams Project

After years of struggle by environmental groups and local communities, the Chilean government has rejected

the controversial HidroAysén project, which would have resulted in the construction of five hydroelectric dams on the Baker and Pascua Rivers in southern Chile. The dams would have flooded a total of 14,600 acres (5,910 ha) of Patagonian wilderness.

The decision was reached by a committee of ministers of the government of President Michelle Bachelet, who took office for a second term in March 2014 and who stated in her reelection campaign that the dams were not viable. The committee, comprising the ministers of environment, energy, agriculture, mining, economy, and health, unanimously accepted the 35 complaints presented against the project, 34 of which were introduced by communities and others opposed to the initiative.

The decision took six years to arrive at after a number of legal battles. The proposed project included a 1,190-mile (1,900 km) power line, the longest in the world, which was to run through nine of Chile's 15 regions. Energy Minister Máximo Pacheco said the HidroAysén project "suffers from serious problems in its execution because it did not treat aspects related to the people who live there with due care and attention. I have voted with complete peace and clarity of mind with respect to this project."

The citizen-led Patagonia Without Dams campaign managed to mobilize the entire country against HidroAysén and drew international attention, with allies in Argentina, Belgium, Italy, and Spain. In opinion polls, three-quarters of respondents said they were opposed to the dams, and in early 2011, more than 100,000 people took to the streets to protest the project. In the Aysén region, project critics waited in a local cinema for the announcement of the ministerial committee's decision, then marched through the streets of Coyhaique, the regional capital, in celebration. (Source: IPS [Inter Press Service], June 13, 2014)

First Comprehensive Survey of Europe's Remaining Wilderness Is Under Way

The University of Leeds, England, has unveiled the first comprehensive survey of Europe's remaining wilderness areas. The resulting map and Wilderness Register for Europe, which categorizes the quality of each area as well as existing levels of protection, will shape European Union policy on these sites well into the future. Dr. Steve Carver, director of the Wildland Research Institute at the University of Leeds, said the survey "will influence our thinking on areas as diverse as ecosystem services, human health and well being, climate change, biodiversity, protected areas, and the return of habitats to their natural state."

Scandinavian countries and Iceland have the largest proportions of Europe's wildest areas based on the project's criteria, which include naturalness of vegetation, remoteness from settlement and other human infrastructure, and distance from mechanized access. The Pyrenees; Austrian, Swiss, and French Alps; and the Carpathian Mountains are also well represented.

The project is funded by the European Commission (EC) and European Environment Agency (EEA). The Wilderness Register is a work in progress, with the final report to the EC and EEA due to be published in the spring of 2015. All European Union states have cooperated with the survey. (Source: http://wilderness-society.org, May 30, 2014)

The BioLite CampStove Will Charge Your Cell Phone in the Wilderness

According to the Outdoor Foundation, a nonprofit creation of the Outdoor Industry Association, 43% of 18- to 24-year-olds use smartphones during their outdoor adventures, and 40% use iPods. So to meet the demand, New York–based BioLite has developed the CampStove. It is 8 inches (21 cm) high on its foldable feet, weighs just over two pounds (0.9 kg), and burns twigs, pinecones, and other forms of biomass. Heat produced by the wood fire in the combustion chamber produces electricity via an attached thermoelectric generator, powering a fan that creates airflow for improved combustion. Surplus electricity is sent to a USB port, allowing the adventurer to charge his or her phone and other small devices.

According to BioLite's website, the CampStove reduces the user's carbon footprint since it uses renewable resources for fuel instead of petroleum products. BioLite says it is also fun: "Like a campfire, you can sit around the CampStove and watch the flames dance as you roast marshmallows and tell stories with friends." The CampStove sells for $130. BioLite has announced plans to market a larger stove for group camping: the BioLite Base Camp stove. It will cost $299 and have enough charging capacity to power tablet computers. (Sources: *New York Times*, June 16, 2014; www.biolitestove.com)

Book Reviews

JOHN SHULTIS, BOOK REVIEW EDITOR

Antarctic Futures: Human Engagement with the Antarctic Environment

Edited by T. Tin, D. Liggett, P. T. Maher, and M. Lamers. 2014. Springer, the Netherlands. 360 pp. $129.00 (hc).

The editors, along with contributing authors, undertake the daunting task of presenting the current "state of the continent" and the needs and challenges for environmental governance in Antarctica now and in the year 2060. The 15 chapters of *Antarctic Futures* discuss research from the International Polar Year (2007–2009) as presented at the June 8–12, 2010, Oslo Science Conference.

The opening chapter provides a historic overview of human activities and events that provide the background for concerns about environmental management in Antarctica and the development of international governance and legislation to respond to human impact. The next five chapters report on wildlife species and related ecosystems; in particular, the discussion focuses on fisheries, baleen whales, the introduction of species not native to the continent, and human impacts on soils as a means to assess future conditions, challenges, and the need for environmental management.

A second section of the book presents three chapters of case studies regarding human activities and environmental management: at the Fildes Peninsula, on Deception Island, and at McMurdo Station. These three regions were selected as examples of the types of impacts and challenges likely to expand in coming decades and which offer some lessons for the way forward.

The third section of *Antarctic Futures* includes five chapters written from different perspectives by stakeholders and representatives of governmental and nongovernmental organizations that have some interest in the continent regarding environmental conditions or human activities, including research and tourism. The intent throughout is to outline some "strategic thinking" based on current and projected uses, human values of the Antarctic environment, and governance that will effectively lead to acceptable and desirable futures for the environment and ecosystems of Antarctica.

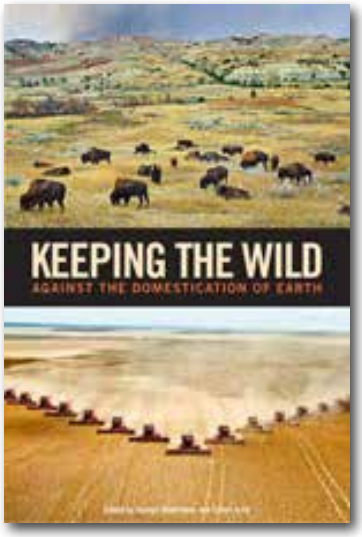
The final chapter recapitulates the diverse perspectives and scientific information presented in the preceding 14 chapters and summarizes the discussion on environmental management and governance. The call for developing a comprehensive and integrated vision for environmental governance is outlined in this chapter of the book and summarized elsewhere in this issue of *IJW* ("Looking into the Future of the Antarctic Wilderness" by Tina Tin).

Antarctica may be the least hospitable weather in which to live on the planet, but as *Antarctic Futures* points out, it is susceptible to environmental changes from competing interests in research resource use and extraction, research, tourism, prospecting, exploration, and climate change. The questions that the book addresses are: What future will Business-As-Usual bring to the Antarctic environment? Will a Business-As-Usual future be compatible with the objectives set out under the Antarctic Treaty, especially its Protocol on Environmental Protection? What actions are necessary to bring about alternative futures for the next 50 years? *Antarctic Futures* is a must read for researchers, policy makers, scientists, government officials, statesmen, diplomats, students, wilderness advocates, and environmentalists interested in the future of the world's largest undeveloped area that faces intense international competition for resource extraction and human activities.

REVIEWED BY CHAD DAWSON, current co-managing *IJW* editor and emeritus professor, Department of Forestry and Natural Resources, SUNY College of Environmental Science and Forestry at Syracuse, NY; email:cpdawson@esf.edu.

Keeping the Wild: Against Domestication of Earth

Edited by George Wuerthner, Eileen Crist, and Tom Butler. 2014. Island Press, Washington, DC. 248 pp. $24.95 (pb).



More than 20 essays in *Keeping the Wild* are conversations among conservationists that address (1) the issues and notions surrounding the underlying causes and effects of the human hegemony – the arrogance of human domination and intensive use of the Earth and its resources; and (2) the increasing dialogue about the idea of the Anthropocene – the idea that this is an age of human domination of the Earth and we should embrace global environmental management; some use this to argue for further domestication of the planet and some use it to argue that anthropocentrism is a main cause of the current global mass species extinctions.

Keeping the Wild is divided into three parts: clashing worldviews, against domestication, and the value of the wild. The views expressed throughout are alternately edgy, rational, well developed, stratospheric, rooted in ideology, supported by science, and controversial, but always intense and passionate. Where is the "heart" of the environmental movement? Is pristine wilderness a myth and a poor agenda for the conservation movement? Should the new emphasis of the conservation movement be ecological services and not preventing anthropogenic species extinctions? Should the focus be on better stewardship of the inhabited and domesticated lands, forests, and agricultural areas of the planet and less on the protected areas? These and other questions are raised and debated throughout the book.

Kathleen Dean Moore in her chapter, "The Road to Cape Perpetua," describes her observation on how succeeding generations lose track of what used to be: "Ecologists call this the sliding baseline; what we accept as normal is gradually changing. This is what we must resist: finally coming to accept that a stripped-down, dammed-up, paved-over, poisoned, bulldozed, radioactive, impoverished landscape is the norm – the way it's supposed to be, the way it's always been, the way it must always be. This is the result we should fear the most." (pp. 219–220). Each chapter delivers a personal philosophy and addresses some big ideas to ponder about humans and their use of the planet. Many are provocative and some are hopeful, while others are not optimistic.

Tom Butler in his introduction entitled "Lives Not Our Own" summarizes his closing thoughts this way: "Just as the competing urges of the wild and the domestic live within us, they are likely to persist within the conservation movement until humanity embraces a land ethic that both places the well-being of the entire biotic community first and renounces the idea that earth is a resource colony for humanity. Do we have the wisdom to exercise humility and restraint, to choose membership over Lordship? The lives that are not our own hang in the balance" (p. XV).

REVIEWED BY CHAD DAWSON, current co-managing *IJW* editor and emeritus professor, Department of Forestry and Natural Resources, SUNY College of Environmental Science and Forestry at Syracuse, NY; email:cpdawson@esf.edu.

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coalitions from urban areas including Chicago, Cleveland, Houston, Los Angeles, Milwaukee, Portland (OR), and San Francisco. Together, MGA member organizations include more than 550 private, nonprofit, and public organizations; collectively the regions represented are home to 30 million people. MGA members work together to share emerging knowledge and to bring resources to landscape-scale conservation efforts in metropolitan regions.

Chicago Wilderness's success and the emergence of similar coalitions in the United States and elsewhere are testimony to the power of collaboration, to the strategic importance of a landscape-scale approach, and to the significance of urban centers in worldwide conservation efforts.

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that the future for the country is looking better than it has for hundreds of years.

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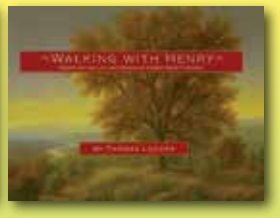

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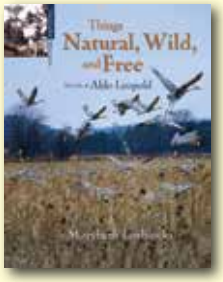

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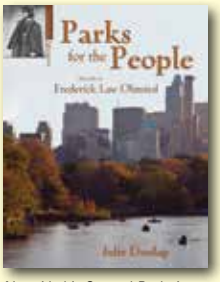

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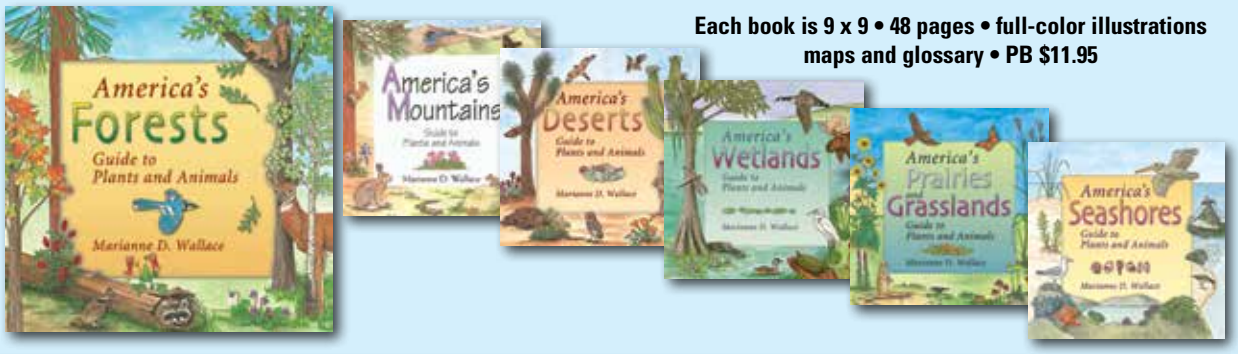

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