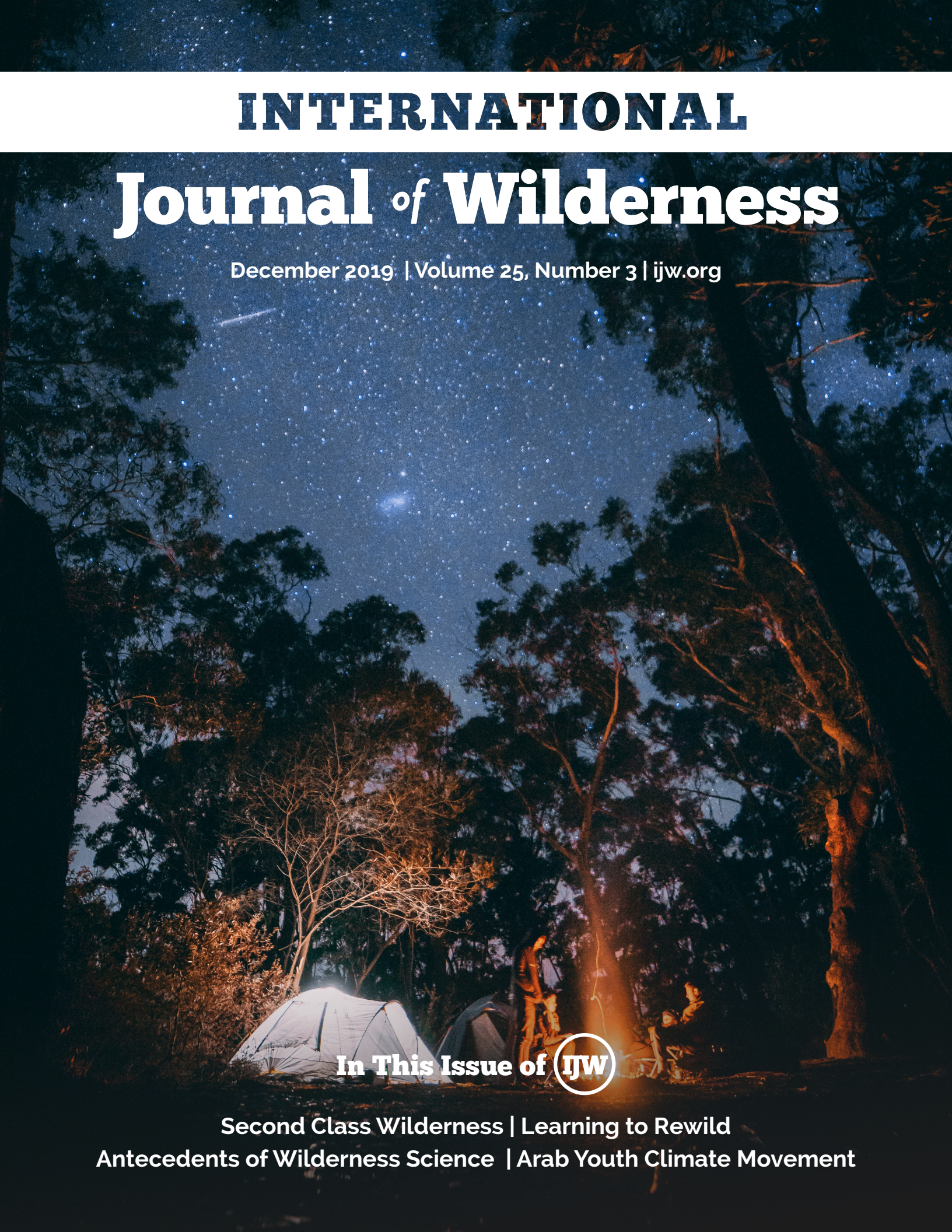

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Greta Thunberg. Photo by Extinction Rebellion Sverige.

Young Activists: Influencing the Climate Change Movement

by ROBERT DVORAK

As 2019 closes, it is noteworthy to recognize the influence and impact of Greta Thunberg, the Swedish climate activist. As a speaker at the plenary session of COP24 (Conference of the Parties) in Poland, her message was that leaders need to act. She exclaimed "our house is on fire" at the World Economic Forum in Davos, Switzerland. Most recently at the United Nations Climate Action Summit in New York in September 2019, she criticized world leaders by asking "how dare you" come to the youth for hope. What started as a school strike for climate change by Thunberg has evolved into her representing the growing youth movement for climate justice (Figure 1).

I hesitate to pigeonhole Greta Thunberg as a "youth activist," as the label "youth" can have a connotation of naivety, inexperience, or lack of wisdom. The label also associates with our misperceptions and stereotypes of generational differences. For example, the term "millennials" can have a negative connotation associate to the young people in that demographic. They are called the "me generation," considered lazy, without

Robert Dvorak

"As partners in conservation and wilderness protection, we need to embrace these and all generations in the immediate efforts to address climate change, loss of biodiversity, and impending threats to global conservation."

Figure 1 - In August 2018, outside the Swedish parliament building, Greta Thunberg started a school strike for the climate. Photo by Anders Hellberg. Licensed to https://creativecommons.org/licenses/by-sa/4.0/deed.en.

aspirations, and not wanting to earn what they receive. However, millennials were born between 1981 and 1996, and are now in their late 20s and early 30s. They represent the core of young professionals, practitioners, and activists within the wilderness and protected area "community."

Members of Generation Z were born between 1995 and 2015, with many now in their late teens and early 20s. These are the "youth" represented by Greta Thunberg, who are actively speaking out for climate justice and action by world leaders. This is the generation poised to have a sustained influence on conservation and climate change. The newest generation is being referred to as Generation Alpha, representing anyone born after 2010. They are the "digital natives," the iPad generation, and coincidentally the categorization of my children. They are growing up in a time where social media platforms such as Twitter, YouTube, and Instagram are ubiquitous in daily life. Their role models may not be leaders, celebrities, or athletes but rather "influencers" celebrated for their number of social media followers.

I believe it is important to recognize that these generations should not be diminished because of their stereotypes. Yes, they are "digital natives" that are fluent in social media, technology, and communication. But they are adept at utilizing these tools to channel their passion, values, and share their voice. While Greta Thunberg has emerged as leading

voice for youth climate activists, many more voices exist and need to be heard. As partners in conservation and wilderness protection, we need to embrace these and all generations in the immediate efforts to address climate change, loss of biodiversity, and impending threats to global conservation. Their enthusiasm, passion, and commitment can be more than just nurtured by older generations, they can serve as examples that inspire, invigorate, and grow a greater global consciousness and larger community for nature and conservation.

In this issue of IJW, we explore the cognitive cost of distracted hiking. Chris Zajchowski, Anthony Desocio, and N. Qwynne Lackey discuss the unequal air resources of American wilderness. David Cole documents the antecedents of wilderness science. Helen Kopnina examines the failed case of rewilding at Oostvaardersplassen. Finally, we would like to welcome Patrick Kelly as our new media and book editor for the journal. IJW

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What impacts does technology have on outdoor recreationists? **photo credit** © Josephine Lepp

The Cognitive Costs of Distracted Hiking

by DANIEL DUSTIN, KENSEY AMERSON, JEFF ROSE, and ANDREW LEPP

Daniel Dustin

Kensey Amerson

Jeff Rose

Andrew Lepp

In a recent study of the interrelationship between time, smartphone use, and place attachment along the Pacific Crest Trail (PCT) in the western United States, Amerson and colleagues (2019) found that 97% of the thru-hikers sampled (N=514) spent an average of 3 hours and 23 minutes on their smartphones each day, and that their smartphone use increased with the number of days on the trail. The primary uses of smartphones were for navigation, listening to music, and taking photographs, none of which required cell phone service. Social media, texting, and email were also used by the thru-hikers, but to a lesser extent. This strong connection to their smartphones raises a number of questions related to the future of long-distance hiking as well as the future of outdoor recreation in general.

In this article, we focus on the costs of the increasing technologization of wilderness recreation (Beck and Dustin 2016; Dustin, Beck, and Rose 2017). While acknowledging the perceived benefits of carrying smartphones into nature, and conceding that smartphones are likely here to stay, what concerns us is the possible negative impact of smartphone use on outdoor

recreationists' higher order cognitive functioning. Recent research has shown that immersion in nature can increase higher order cognitive functioning whereas smartphone use can exhaust higher order cognitive functioning (Atchley, Strayer, and Atchley 2012). When you put nature and smartphones together, it seems plausible to suggest that increasing use of smartphones might detract from the higher order cognitive benefits nature otherwise provides. To the extent this is the case, we believe smartphones are antithetical to what long-distance hiking and wilderness recreation ought to be about.

Cognition Gone Wild

It is estimated that 85% of US citizens reside in cities and towns, which means most outdoor recreationists are likely city dwellers. They visit nature for a variety of reasons, but as B. L. Driver and associates found over decades of research, one of the primary benefits of outdoor recreation is stress reduction (Driver, Brown, and Peterson 1991; Driver, Nash, and Haas 1985). Yet smartphone use has been associated with increased anxiety (Lepp, Barkley, and Karpinski 2014) and a blurring of the work/leisure boundary (Chen, Huang, Gao, and Petrick 2018; Son and Chen 2018). The frenetic pace of urban life, coupled with constant demands on our ability to direct our attention to meet the requirements of city living, make an escape to the out-of-doors a highly restorative experience. Among our concerns is that this experience could be compromised by the siren song (e.g., push notifications) of the ever-present smartphone, making escape from the stressors of daily life all the more difficult to achieve – even in wilderness settings.

Environmental psychologists Rachel and Stephen Kaplan (1989; Kaplan 1995) have captured this understanding in Attention Restoration Theory (ART), demonstrating that our exhausted directed attentional capacity can be replenished by periodic doses of nature. Rooted in our species' long evolutionary history of being "at home" in nature, ART is well tested and commonly accepted as a reasonable explanation for nature's restorative power (Berman, Jonides, and Kaplan 2008; Berto 2005; Hartig, Mang, and Evans 1991). Research on ART further indicates that higher order cognitive processes such as selective attention, problem solving, inhibition, and multitasking are refreshed through immersion in nature (Atchley, Strayer, and Atchley 2012).

In the Atchley and colleagues (2012) study, creative problem solving improved among hikers by 50% after a four-day wilderness experience. The researchers attributed this dramatic improvement in higher order cognitive functioning to the positive emotional state that typically accompanies time spent outdoors, coupled with soft fascination and low arousal characteristic

of encounters with nature. These encounters restore our higher order cognitive capacity in a way that allows for deeper introspection and self-reflection. To the extent these immersive nature-based experiences do indeed engage and refresh our brains' higher order prefrontal cortex processes, they are arguably one of the most important sources of benefits derived from outdoor recreation. Yet nature, with all of its restorative benefits, may now be in competition with smartphones for hikers' attention.

Distracted Nature-Based Experiences

What makes the Atchley and colleagues (2012) study particularly intriguing is that the four-day wilderness experience was, by design, absent of smartphones. This was significant because smartphones are known to drain focused attention, resulting in what Strayer and Drews (2007) call "inattention blindness." In other words, smartphones distract our attention from the immediacy of our surroundings to the smartphone itself, and we miss much of what is going on around us while ensconced in our smartphone technology. As a demonstration of this, Hyman and colleagues (2010) hired a brightly colored clown to unicycle about their university's quad. Students crossing the quad while using their smartphone were less likely to notice this conspicuous feature than their smartphone-free peers. For our purposes, it is important to consider that in wilderness settings, far more important features may go unnoticed by hikers preoccupied with their smartphones.

Much of this "distraction" research has been carried out in the context of people talking on cell phones while driving a car (Strayer and Drews 2007; Strayer, Drews and Johnston 2003; Strayer and Johnston 2001). This may be because the costs of distracted driving are obviously high. But researchers have also investigated the costs of distracted walking. Walking while using a smartphone has demonstrable costs, including a significantly slower gait (Barkley and Lepp 2016; Parr, Hass and Tillman 2014) and a greater risk of injury – even walking into traffic – when distracted by a smartphone (Nasar, Hecht, and Wener 2008; Neider et al. 2010; Schwebel et al. 2012; Stravrinos, Byington, and Schwebel 2011). Consequently, it is interesting to ponder the possible implications for people talking or texting on smartphones while hiking a trail, listening to music with earbuds, searching their apps for the next water source or campsite, taking a snapshot of a panoramic view, identifying unknown flora and fauna, or any number of other related outdoor activities. (Remember Amerson et al. [2019] found that PCT thru-hikers reported being on their smartphones an astounding 3 hours and 23 minutes a day, with smartphone use increasing with each additional day on the trail.) If smartphones

distract and distance drivers from the road they are speeding along, and pedestrians from sidewalks they are walking along, it is reasonable to suggest that smartphones may well distract and distance hikers from the natural environment they are trekking through. It is further possible that smartphone use, because of its demands on directed attention, diminishes recreationists' ability to engage their higher order executive faculties with the natural world enveloping them.

The Cognitive Costs of Distracted Hiking

A review of the literature on the perceived impact of smartphone use in the out-of-doors reveals both costs and benefits. The benefits are typically related to perceived safety, convenience, and comfort (Martin 2017; Martin and Pope 2012; Moreira 2017; Noble 2017; Pope and Martin 2011). Smartphones are perceived to make it easier to call for help when needed, pinpoint nearby water sources and camping spots, look up and learn about unknown flora and fauna, communicate with others up and down the trail, check in with those back home, and otherwise eliminate many of the question marks that Aldo Leopold (1949) once characterized as "blank spots on the map." Global positioning systems, Spot Locator Beacons, and navigation apps are all perceived to make it easier for a wider range of outdoor recreationists to venture into the wild with less trepidation (Martin and Blackwell 2016). Given our nation's general obsession with safety (McAvoy and Dustin 1990), and recreation land managers' corresponding sense of responsibility to ensure safety (McAvoy, Dustin, Rankin, and Frakt 1985), it is hard to imagine smartphones ever being outlawed in outdoor recreation settings. Having said that, some protected areas, such as Yellowstone National Park, have approved cell phone management plans in hopes of limiting the intrusion of this technology into backcountry settings. Such plans typically attempt to limit cell phone service to developed areas within parks and protected areas. It is telling, however, that despite a cell phone management plan, Yellowstone is finding the spread of smartphone technology difficult to contain – due, in part, to congressional pressure to expand cell phone service throughout the country via the Public Lands Communication Act (Brown 2016).

At the same time, ART has taught us much about nature's restorative power, and recent research has alerted us to the potential deleterious effects smartphones might have on that restorative power. In addition to its distracting effects, heavy reliance on technology in the backcountry has been shown to threaten other aspects of higher order cognitive functioning.

Javadi and colleagues (2017), for example, found that relying on GPSs for navigation purposes diminishes the brain's hippocalmic function, an important process in memory creation (Konishi and Bohbot 2013). Relying on technology to make our way in the backcountry means our brains do not have to do the work of creating our own internal cognitive maps. Offloading cognitive function to our smartphones is appealing to some, particularly those less inclined to effortful thinking (Barr, Pennycook, Stolz, and Fugelsang 2015). This may help explain the negative relationship between smartphone use and preference for leisure challenge (Lepp, Li, Barkley, and Salehi-Esfahani 2015). Yet challenging leisure pursuits such as backcountry navigation are a source of great benefits. Quoting O'Connor (2019), "Practicing navigation is a powerful form of engagement with the environment that can inspire a greater sense of stewardship. Finding our way on our own – using perception, empirical observation and problem-solving skills – forces us to attune ourselves to the world. And by turning our attention to the physical landscape that sustains and connects us, we can nourish "topophilia," a sense of attachment and love for place" (n.p.). Substituting "the brain in our pocket" (Barr, Pennycook, Stolz, and Fugelsang 2015) for our own cognitive functioning may well affect our memories of the experience (Sparrow, Liu, and Wegner 2011; Tamir, Templeton, Ward, and Zaki 2018). As Resnick (2015) speculates (quoting Templeton), "It could just be that we're using these devices, distracting ourselves from the experience, and because of that distraction, we don't remember the thing we're supposed to be paying attention to" (n.p.) In sum, relying less and less on our own cognitive abilities in outdoor recreation environments by supplanting them with quick and easy technological answers to our pathfinding questions may fundamentally diminish both our experience of nature and our memories of those nature-based experiences.

Whether the 'good' of smartphone technology for perceived safety, convenience, and comfort reasons outweighs its 'bad' effects on higher order cognitive functioning as well as creating 'inattention blindness' raises an important policy question for outdoor recreationists and wilderness land managers to consider…what is the appropriate balance between smartphones' costs and benefits in wilderness recreation?

Whether the "good" of smartphone technology for perceived safety, convenience, and comfort reasons outweighs its "bad" effects on higher order cognitive functioning as well as creating "inattention blindness" raises an important policy question for outdoor recreationists and wilderness land managers to consider. That question is: What is the appropriate balance between smartphones' costs and benefits in wilderness recreation? And if we cannot adequately manage smartphone technology in wilderness, are we not at least obliged to educate outdoor recreationists about the potential negative impact of smartphones on higher order cognitive functioning and the potential hazards associated with smartphone-induced "inattention blindness"?

Conclusion

Joseph Sax (1980) proposed that the highest use of the United States' "crown jewels," the national parks, is to "exercise the contemplative faculty," a form of engagement with the natural world that requires higher order cognitive functioning. Extend that logic to the spectrum of outdoor recreation opportunities available in the United States, and you begin to better understand why smartphones do not bode well for this essential aspect of wilderness recreation. Wilderness has always been an antidote to modernity, a place, as Henry David Thoreau (1992) described it, "to live deliberately, to front only the essential facts of life, and see if [we] could not learn what it had to teach, and not, when [we] came to die, discover that [we] had not lived" (p. 86). Wilderness is that place where we take refuge from the relentless advance of civilization. Smartphones are part of that advance.

Recall as well that Sax (1980) viewed anything that distanced recreationists from nature as unwelcome. He argued against concessions and cars and anything else that buffered people from experiencing the closeness of the natural environment surrounding them. Like Thoreau (1992), Sax, too, wanted to "live deep and suck out all the marrow of life, to live so sturdily and Spartan-like as to put to rout all that is not life, to cut a broad swath and shave close, to drive life into a corner, and reduce it to its lowest terms" (p. 86). Unfettered, untrammeled, primeval nature does that for people. A smartphone does not.

In the end, the larger question to ponder is whether we will allow advancing technology to fundamentally alter our relationship with the natural world (Pergams and Zaradic 2008, 2006). What do smartphones, global positioning systems, Spot Locator Beacons, navigation apps, and other technological innovations mean for the future of outdoor recreation, and, especially, the future of wilderness (Pohl 2006)? Should we embrace advancing technology uncritically

and accept the inevitable changes it will bring about to our very conception of wilderness? Or should we pledge allegiance to what the Wilderness Act's framers had in mind more than 50 years ago when they described wilderness as a place for "primitive" and "unconfined" types of recreation (Dustin, Beck, and Rose 2018)? Roderick Nash (2002) reasoned that the existence of wilderness in America is an expression of our species' ability to exercise restraint, to not do something we can do. Wendell Berry (2003) questioned, in turn, whether we have it within ourselves to actually do that over time. Given the smartphone's potential for distancing recreationists from nature, and thereby diminishing their sense of stewardship, how we deal with smartphones in outdoor recreation in general, and wilderness in particular, is a good test of both Nash and Berry's propositions.

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Haze shrouds the Oquirrh Mountains and the Salt Lake Valley, which borders popular urban-proximate wilderness and nonwilderness areas. **photo credit** © Chris Zajchowski

STEWARDSHIP

Second Class Wilderness: Separate but Unequal Air Resources in American Wilderness

by CHRIS ZAJCHOWSKI, ANTHONY DESOCIO, and N. QWYNNE LACKEY

Chris Zajchowski

Anthony Desocio

Qwynne Lackey

> "The national narrative is always evolving, and its arc must bend toward a fuller truth."
>
> **Gary Machlis and Jonathan Jarvis,** *The Future of Conservation in America: A Chart for Rough Water*

The United States has a long history throughout which equitable access to resources has been denied to segments of the population along racial, ethnic, and socioeconomic distinctions through informal, legal, and sometimes violent means. For instance, in 1954, the landmark US Supreme Court case, Brown vs. Board of Education, ended 58 years of federally supported racial segregation within our nation's public school system based on the "separate but equal" doctrine. The arc of American park and protected area management has followed a similar pattern. The first US parks and protected areas established late in the 19th and early in the 20th century were accessible largely to affluent, white, and predominantly

male visitors. Barriers to access existed for those lacking economic means, adequate leisure time, and those of minority racial and ethnic status. Perhaps most egregious were the legal restrictions on American Indians, many of whom were legally prohibited during the latter half of the 19th century from leaving reservations and utilizing parks and protected areas established on lands from which they were forcibly removed (Keller and Turek 1998; Marks 1999; Prucha 2000; Spence 1996).

As the automobile provided greater mobility across socioeconomic status, parks diversified, leading to greater mixing across groups (Young 2009). However, barriers to equitable outdoor recreation resources remained. In the 1930s, managers in the emerging Shenandoah and Great Smoky Mountain National Parks deferred to the regulations and laws of the southern states of Virginia, North Carolina, and Tennessee by developing "separate but equal facilities" at picnic areas and campgrounds, which effectively barred African American visitors from most park amenities (Young 2009, p. 652). Moreover, while National Park Service (NPS) Director Newton Drury ordered the end of segregation in the NPS in 1942, 21st-century scholars have continued to argue that the wilderness ethos developed and imbued in many federal land management agency policies continues to reflect and reinforce white and affluent stakeholders' values and interests (e.g., Davis 2019; Smith 2005; Weber and Sultana 2013).

In this article, we explore how the US legal landscape governing air resource management leads to a similar separate and unequal provision of wilderness opportunities for a diverse American public. Specifically, while we recognize the many benefits of the Clean Air Act Amendments of 1977 for air resources nationwide, here we review the adverse implications of the creation of Class I and Class II wilderness areas for visitors and wilderness-proximate communities. We acknowledge that drawing a parallel between wilderness management and the "separate but equal" legal doctrine may raise eyebrows, as the latter is certainly a more explicit and egregious injustice forced upon minority groups, specifically communities of color. Yet, with air pollution considered one of the greatest environmental health risks worldwide (e.g., Ebenstein, Fan, Greenstone, He, and Zhou 2017; Tessum et al. 2019), we believe it is appropriate for our field to discuss how the tiered protections of air resources may expose visitors, unbeknownst to them, to increased health risks (i.e., cardiac, reproductive, respiratory) and unequal visitor experiences (e.g., Zajchowski, Brownlee, and Rose 2018). Using the example of the urban-proximate wilderness areas of Utah's Wasatch Front – Lone Peak, Mount Olympus, Timpanogos, and Twin Peaks Wilderness Areas – we suggest that these health risks related to air pollution may be disproportionately borne by wilderness visitors from nearby urban areas, many of whom bear a similar burden of air pollution at home (e.g., Collins and Grineski 2019; Zajchowski and Rose 2018). Furthermore, we suggest that these urban-proximate wilderness visitors may be more diverse than visitors to more remote, Class I wilderness areas, begging the question of whether equitable access to air resources across wilderness designations is prevented as a result of cur-

rent air resource policy. In closing, we present research and policy-relevant suggestions to explore the provision of equal air quality protections across all wilderness areas in the United States.

Air Resource Classification

Legal protections for wilderness areas have historically been a contentious subject. From the signing of the US National Wilderness Preservation Act of 1964 onward (16 U.S.C. 1131-1136, 78 Stat. 890), defining and managing for "untrammeled" and "primeval" wilderness experiences has involved constant review, negotiation, litigation, and legislation (e.g., Dustin, Beck, and Rose 2018; Mace, Bell, and Loomis 2004). With regards to air quality, guiding directives for air resource management in wilderness areas has evolved from the Air Quality Act of 1967 through multiple amendments to the Clean Air Act (1970, 1977, 1990) and the implementation of the Environmental Protection Agency's (EPA) Regional Haze Program (EPA 2019c).

Perhaps the most substantial air resource protections for wilderness areas are codified in the Clean Air Act Amendments of 1977 (Zajchowski, Lackey, and McNay 2019). This act established three tiers of air quality control across lands managed by federal agencies, specifically the US Bureau of Land Management (BLM), Fish and Wildlife Service (FWS), Forest Service (USFS), and National Park Service (NPS). That said, the amendments primarily focused on wilderness areas and national parks. Class I areas were given the most stringent protections, available under 42 U.S.C. 7473. All areas designated as wilderness larger than 5,000 acres (2023 ha) and national parks larger than 6,000 acres (2,428 ha) that existed prior to 1977 were automatically given Class I protections (NPS 2019) due to their "natural, scenic, recreational, or historic" worth (EPA 2019b). These protections were designed to prevent significant deterioration (PSD) of existing clean air resources through limitations on nearby stationary sources (e.g., power plants) using the best available control technology (BACT)(Branagan 1977). Any wilderness areas designated after August 7, 1977, were given a Class II designation, allowing for controlled growth. Class III designations were reserved for areas of high industrial output that would be severely impacted by restrictions on air quality (Adams et al. 1991). There are currently no Class III areas in the United States.

As of 2019, 803 wilderness areas, comprising more that 111 million acres (44,920,106 ha) of US federal land, represent the National Wilderness Preservation System (Wilderness Connect 2019). Of these, 108 designated wilderness areas and 48 national parks have a Class I designation (EPA 2019a). These 108 areas comprise 14% of all designated wilderness areas, meaning that the vast majority of all US wilderness areas (86%) are designated as Class II (Figure 1). On the surface, this distinction would seem primarily semantic; however, the implications for monitoring and management of air quality between different classifications is striking.

Federal Land Managers (FLMs) assigned to Class I wilderness areas are responsible for protecting Air Quality Related Values (AQRVs), such as vegetation, soils, water, fish, wildlife,

and visibility, within the lands in their purview (NPS 2002). FLMs establish criteria to determine impacts to AQVRs and can ultimately recommend that permitting agencies deny permits to new stationary sources of air pollution or modifications to exiting sources due to forecasted impacts (EPA 2019a). Analysis occurs regularly to determine the impacts on AQRVs within Class I wilderness areas. Any facility located within 50 kilometers (31 miles) of a Class I area will be required to submit to analysis of emissions; outside 50 kilometers, an emissions-to-distance ratio based on proximity to the Class I area determines whether an analysis is required (Missouri Department of Natural Resources 2013). In addition to more localized reductions of air pollution, the EPA has attempted to limit the effect of interstate pollution by requiring states to address facilities that contribute to air pollution in other states (Malm 2016). The Clean Air Interstate Rule uses a "cap and trade" system to reduce target emissions that impact adjacent states' air quality standards. Any state or tribal organization that manages a Class I area may invoke interstate dispute resolution under the EPA to protect the air quality of that Class I area (EPA 2013). In sum, Class I areas enjoy the protections from the EPA under the PSD permit program, where permit applicants must prove that the proposed construction or modification of an emissions source will not cause or contribute to the degradation of air quality (EPA 2013).

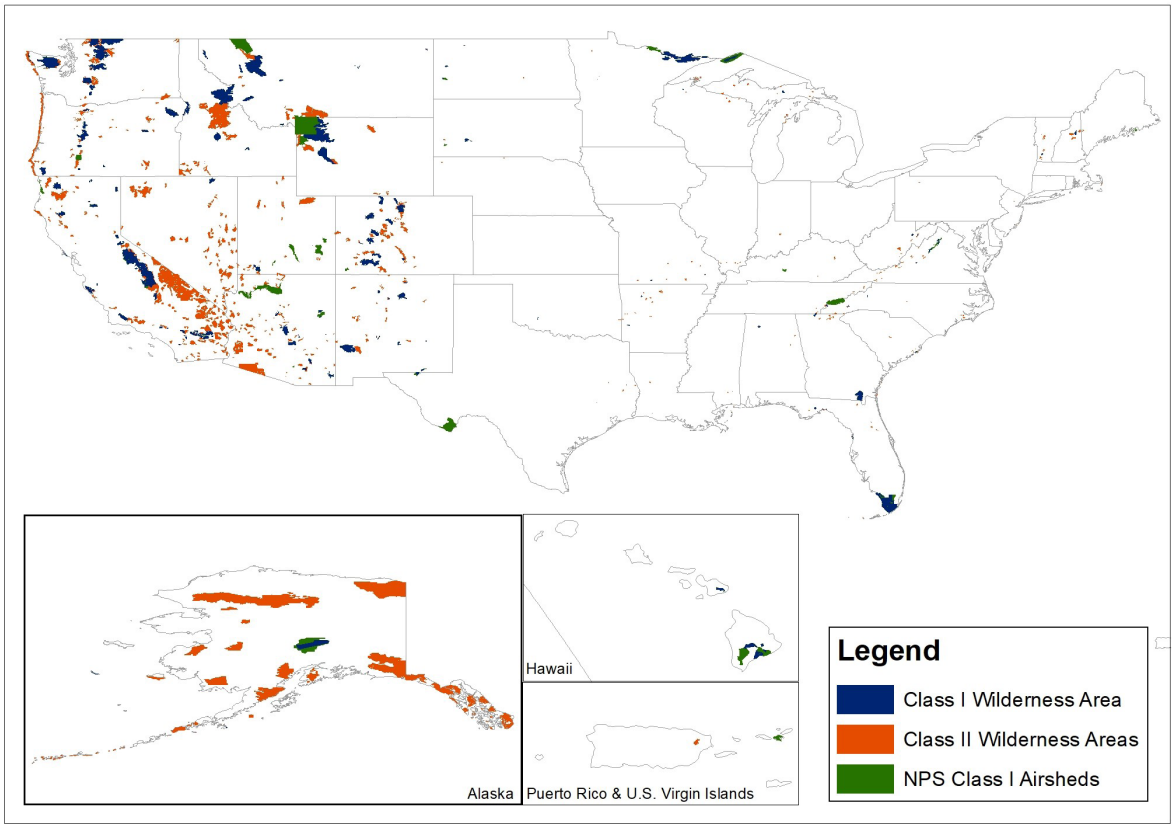

Figure 1 - Wilderness areas in the United States.

The remaining three-quarters of wilderness area acreage in the United States is classified as Class II. As Branagan (1977) describes, this second tier of air quality control allows for "reasonable" growth where decisions regarding land use are not dictated primarily by air quality concerns. In other words, the air resources of Class II wilderness areas may be influenced by the social or economic priorities of neighboring communities or those decided at the state level. PSD and AQRV-related legal mandates for analysis and review are lacking for these Class II areas, which, in turn, provides a disincentive for other parties, such as states, to curb the impacts of new or existing sources of air degradation on wilderness air resources. In turn, this Class II status often leaves managers without the proper legal mandates to address degradation of wilderness resources (Zajchowski et al. 2019). In a recent policy analysis of the impact of federal air quality policy on the work of US park and protected area professionals, one participant commented:

> *When we would try to fight the big fight against the State for a particular thing, we were always shot down because we weren't a Class I park or a Class I preserve. So, if you fall under the protection that the CAA gives you or that we get by being Class I park—that's great—it makes my job easy because the law gives me that ability to engage. If I'm in a location that has no air quality station, and I'm using data from far away or I'm relying on the [permit] applicant to provide the data, or I'm begging and borrowing for information that they are never going to give me. It's a world of difference (Zajchowski, Lackey, and McNay 2019, p. 1013).*

This sentiment was shared by other park professionals, who illuminated that the Class II designation did not allow them to manage wilderness areas and protect wilderness resources in an equivalent manner as Class I areas.

The State of Air

Under the provisions of the Clean Air Act Amendments of 1977, states are able to change the designation of Class II areas to Class I (Adams et al. 1991). That said, as states balance many legal and social mandates, they regularly default to standards codified with the National Ambient Air Quality Standards (NAAQS; EPA 2019a). The NAAQS dictate national thresholds for criteria pollutants – carbon monoxide, lead, nitrogen dioxide, ozone, particle pollution, sulfur dioxide – that can affect public health and welfare. When specific pollutants regularly exceed these thresholds (e.g., 70 ppb ozone), states are required to create a State Implementation Plan (EPA 2019a), in which they outline how they plan to improve ambient air pollutants to regain compliance with the NAAQS. Importantly, these standards allow for higher thresholds for pollutants than in Class I wilderness areas. In other words, while wilderness managers attempt to retain or achieve "pristine" conditions far below the NAAQS, states without Class I areas can allow for pollutant dispersion up to the NAAQS thresholds (Branagan 1977). And, some states, such as Utah, are in nonattainment with NAAQS surrounding specific criteria pollutants (i.e., ozone [UDEQ 2018], particulate matter [UDEQ 2019]), which creates cascading effects for air resources in their Class II wilderness areas.

The example of Utah helps to further illustrate the results of the bifurcation of wilderness designations into Class I and Class II. Many exceedances of the NAAQS within Utah occur at the doorsteps of designated Class II wilderness areas (Figure 2). Each of the four wilderness areas managed by the USFS – Lone Peak, Mount Olympus, Timpanogos, and Twin Peaks – sit adjacent to Utah's main population center, the Wasatch Front. As a result, the emissions from cars, homes, businesses, and factories all contribute to local air pollution challenges and degrade air quality near and within urban-proximate wilderness areas. As Horel and colleagues (2016) observed, ozone values can exceed the NAAQS proximal to Twin Peaks and Lone Peak Wilderness Areas of the Wasatch Front. Additionally, particulate matter deposition from anthropogenic emissions has been documented in the snowpack in the Wasatch Mountains (Hall, Maurer, Hoch, Taylor, and Bowling 2014), making it logical to infer similar impacts from particulate matter in Wasatch wilderness areas. So, while impacts to AQRVs are present (e.g., vegetation [Wager and Baker 2006], visibility [Zajchowski et al. 2019]), the Class II status for each of these wilderness areas prevents the same level of monitoring, modeling, and management that is afforded to their Class I peers.

Interestingly, these Class II areas of the Wasatch Front were established between 1978 and 1984. The timing of the designation of these areas, after the Clean Air Act Amendments of 1977, forced them to join the National Wilderness Preservation System without the air resource protections afforded to Class I areas in southern Utah (e.g., Zion Wilderness; Figure 3). In short, the state of Utah remains largely in control of the fate of air resources within these Class II wilderness areas, which calls into question the "pristine" and "untrammeled" air resources wilderness areas are established to afford.

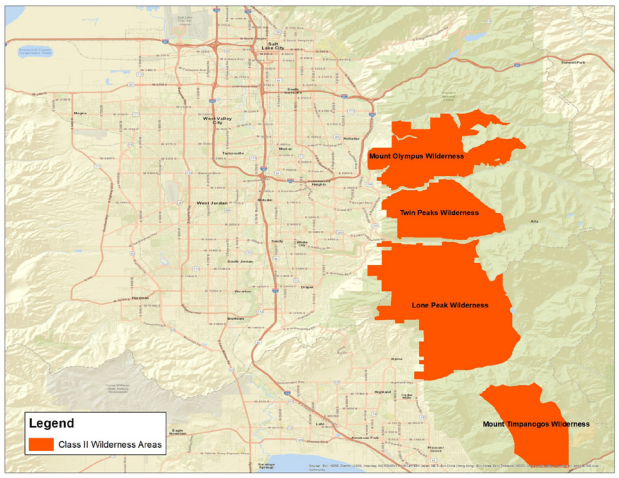

Figure 2 - Wilderness areas of the Wasatch Front.

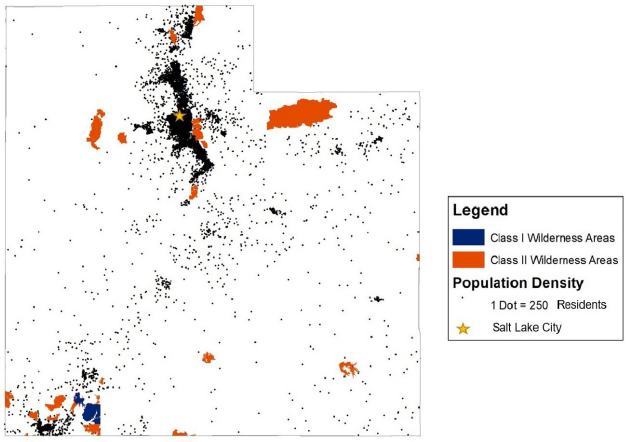

Figure 3 - Wilderness areas and Utah population distribution.

The unequal protection for air resources across Class I and Class II wilderness areas has a variety of implications for wilderness management, ranging from the accumulation of critical loads of criteria pollutants that impact fragile ecosystems to the philosophical challenge to idea of wilderness itself.

Air Resources for Whom?

The unequal protection for air resources across Class I and Class II wilderness areas has a variety of implications for wilderness management, ranging from the accumulation of critical loads of criteria pollutants that impact fragile ecosystems to the philosophical challenge to idea of wilderness itself. In this final section, however, we focus on the implications of tiered protections on wilderness visitors. While previous park and protected area research has explored attitudes, values, and behaviors related to clean air and scenic views in various federal land management agency contexts (e.g., Keiser, Lade, and Rudik 2018; Kulesza, Le, Littlejohn, and Hollenhorst 2013; Zajchowski, Brownlee, and Rose 2018), there is currently no empirical research that documents visitor perceptions surrounding differential air resource policies across wilderness distinctions. In other words, we do not know if visitors are aware of the tiered protections afforded to wilderness, if these distinctions matter to them, or if visitor awareness (or lack thereof) leads to different behaviors. For example, would visitors be less likely to visit a Class II wilderness, once they are informed of its "second class" status? Would they engage in different recreation behaviors due to health risks related to exposure to specific pollutants (e.g., particulate matter)? Would they value Class II wilderness resources differently or engage in fewer sustainability practices (e.g., Leave No Trace) in these spaces due to their knowledge of lower federal and state protections? In sum, there are a variety of questions that can be asked by managers and researchers to ascertain the multiple impacts of air resource distinctions on visitor populations.

Additionally, we suggest that it is also prudent to evaluate which types of wilderness air resources are readily available to whom. To revisit the case of Utah, the Class II wilderness areas of the Wasatch Front are relatively accessible to over 80% of Utahns living nearby (e.g., Lindley, Blevins, and William 2018). More specifically, these Class II wilderness areas are perhaps the most accessible wilderness areas for a substantial portion of Utah's low-income residents and minority communities. Approximately one of every three Utah residents who live below the poverty line reside in Salt Lake County (US Census Bureau 2018). Additionally, Salt Lake County is home to about half (approximately 49%) of individuals who identify as a member of a racial and/or ethnic minority groups living in the state (Kem C. Gardner Policy Institute 2017). Furthermore, the LGBTQIA+ community is another minority community that continues to experience additional

barriers to outdoor recreation participation (e.g., Barnfield and Humberstone 2008; Dignan 2002; Parris 2017), and Salt Lake City has the seventh highest percentage of individuals identifying as lesbian, gay, bisexual, or transgender in a list of the largest US metropolitan areas (Newport and Gates 2015). In sum, for members of all these marginalized groups, their closest and most affordable access to wilderness is offered with "second class" air quality protections. For those willing and able to travel across Utah to access first class air resources, this may be less of the concern; however, we imagine the spatial distance between Class I resources and the Wasatch Front is a barrier for many visitors, particularly those of low socioeconomic status. Spatial analysis of visitation patterns across demographic indicators may help to illustrate who is accessing Utah's Class I and Class II wilderness resources and if disparities between demographics exist that can be attributed the location of Class I wilderness resources.

Nationally, the placement of Class I and Class II wilderness areas begs for a similar analysis. Weber and Sultana's (2013) work addressing the future of the NPS in a racially diverse America highlighted a 2010 Park Studies Institute survey, which showed low visitation from racial minorities throughout the NPS system. The authors, in part, attribute this to the location of many iconic park units outside of the southeast, where the largest concentration of African Americans reside. We hypothesize that future spatial analysis that evaluates the proximity of Class I and Class II wilderness areas across the United States to different racial groups will illustrate similar findings. In other words, this begs the question of who Class I air resources benefit, and, conversely, who misses out on "pristine" and "untrammeled" air quality. As a case and point, Davis (2019) highlights the limitations placed on black anglers, who visit and reside near Congaree National Park, which gained a Class II wilderness designation in 1988. The author documents that the wilderness designation prevents anglers from engaging in their traditional fishing practices, while allowing for

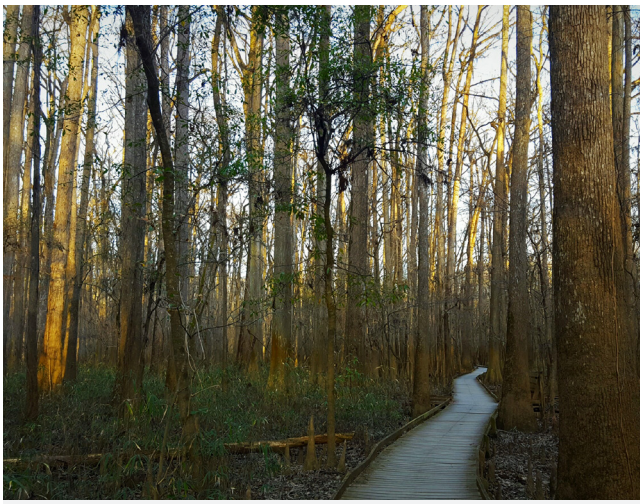

Figure 4 - Congaree Wilderness Area is managed with a Class II distinction. Photo by Caitlin Henry.

Figure 5 - Wildfire smoke blankets river rafters on the Middle Fork of the Salmon River at Indian Creek in the Frank Church-River of No Return Wilderness. Photo by Bethany Craig.

commercial use by predominantly white concessionaires and patrons. Equally problematic is that these anglers, who live near the park, do not benefit from the same air quality protections as visitors to Class I wilderness areas. In other words, not only are they disenfranchised from their traditional fishing practices due to wilderness designation, but they are doubly harmed by not receiving any of air resource benefits that come with a Class I wilderness designation. This case of Congaree highlights the paradoxical results of wilderness designation for local visitors and wilderness-proximate communities.

Conclusion

Federal policy creating Class I and Class II wilderness areas pragmatically sought to provide additional resources, protection, and oversight to flagship wilderness areas and national parks across the United States (e.g., Grand Canyon, Shenandoah, Great Smoky Mountains National Parks). However, the separation of Class I and Class II wilderness areas in existing policies deprives Class II wilderness areas of the equivalent resources, protections, and oversight as Class I wilderness. In addition, this two-tiered distinction benefits those able to access clean air resources but may prevent certain populations from similar access. We suggested that second class wilderness areas may be disproportionately situated nearest to urban and minority populations, who bear a greater burden for the health costs of air pollution (Collins and Grineski, 2019). In turn, a change in policy that allows for equal access to Class I resources or affords Class I status to all wilderness areas, regardless of size or date of creation, is worthy of debate.

Finally, we would be remiss to say that, although we call for more research and policy solutions to address these issues, we emphasize the need for critical, action-oriented, and collaborative work on the topic of unequal provisioning of wilderness air resources across lines of class, race, ethnicity, gender, and sexuality. Scholarship should not only aim to understand inequities but also to examine realistic and applicable solutions, especially policy solutions, to rectify these inequities. Additionally, we acknowledge that our multiple identities and geographies as authors afford us with various privileges, including white privilege and the economic means to visit and recreate in both Class I and II wilderness areas. Our lack of authors from multiple identities who may be more adversely affected by tiered air resource policies is a limitation in our argument. In sum, we suggest future scholarship in this area will be most beneficial if it is done in collaboration with individuals and communities that are adversely affected by the policies guiding the management of second-class wilderness areas. ijw

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Cutoff Mountain in Montana's Absaroka-Beartooth Wilderness Area, lies less than 1 km from the northern boundary of Yellowstone National Park.
Photo courtesy of David Kallenbach.

STEWARDSHIP

Yellowstone and Grand Teton National Parks: A Case Study of Mining Claim History in Four Adjacent National Forest Wilderness Areas

by CRAIG L. SHAFER

According to the Wilderness Act of 1964 (16 U.S.C. § 1131 2(c), wilderness is "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain." Roadbuilding, off-road vehicles, use of mechanized machinery, and the construction of most buildings are banned from wilderness areas. Therefore, in some respects, wilderness has more restrictive land-use protections than national parks. Currently, the US Wilderness System comprises over 111 million acres (44,920,106 ha) in more than 803 units administered by four federal land management agencies (Wilderness Connect 2019).

The Wilderness Act was a result of political compromise (Allin 1982, 60–101). The congressional debate lasted nine years and the draft legislation underwent 65 revisions (Hubbard et al. 1998–1999). The final version banned the construction of permanent roads in wilderness areas, but the areas remained "subject to existing private rights" (16 U.S.C. §1133[c]). For example, preexisting mining claims and oil/gas leases could be exploited in national forest wilderness, although they were still subject to agency "reasonable stipulations" (16 U.S.C. §1133[d] [3]) (Glickman and Coggins 1998–1999). The act also allowed the president to authorize water and power develop-

Craig L. Shafer

"However, the reality was that the 1964 Wilderness Act, despite its many concessions to the mining industry, severely limited mining in wilderness areas due to a series of specific mandates."

ment, including road construction (16 U.S.C. § 1133 [d] [4]), and to control fire and pests (16 U.S.C. § 1133 [d] [1]).

There was also the specification in the act that mining claims could be filed until December 31, 1983, with some exceptions (Toffenetti 1985). Mineral claims located by the end of 1983 could be worked until fully exploited under applicable bureau regulations (Hammond 1967–1968, cited in Stofko 1983). For wilderness areas, the ability to establish new mineral rights was withdrawn after 1983 (Getches 1982; Hubbard et al. 1998–1999). Such wilderness "exceptions," whether concerning mining, roads, or development, for example, have been summarized under the category of "non-conforming but allowable uses" (Anonymous 2011, based on Gorte 1998).

The purpose of this article is to examine the Wilderness Act's 20-year window of opportunity to create mining claims relative to four wilderness areas in the Greater Yellowstone Ecosystem. One can ask whether these four US Forest Service (USFS) wilderness areas may have made it more awkward to mine any claims on these lands despite the windfall of having a 20-year window of opportunity in the Wilderness Act and the existing ability to grandfather in active claims.

Greater Yellowstone Ecosystem

The area of the Greater Yellowstone Ecosystem (GYE), more recently called Greater Yellowstone Area, was first delineated by Craighead (1977) as representing the continuous essential habitat for the grizzly bear (Ursus arctos horribilis). The spatial delimitation of the GYE varies based on the source. This examination utilized 73,000 square kilometers (28,185 sq. miles) as described by Glick et al. 1991 (Figure 1). This area contains two national parks (Yellowstone and Grand Teton); one national parkway (John D. Rockefeller Memorial Parkway); parts of six national forests (Bridger-Teton, Shoshone, Caribou-Targhee, Gallatin, Custer, and Beaverhead-Deerlodge); three units of the National Wildlife Refuge System (National Elk Refuge, Red Rock Lakes NWR, and Gray's Lake NWR); one Indian Reservation (Wind River); the Bureau of Land Management (BLM), Bureau of Reclamation; and state, municipal, and private lands in Wyoming, Montana, and Idaho. Fully 81.7% of the land is federally owned (Glick et al. 1991) The federal agencies have given the GYE de facto recognition (Keiter 1989).

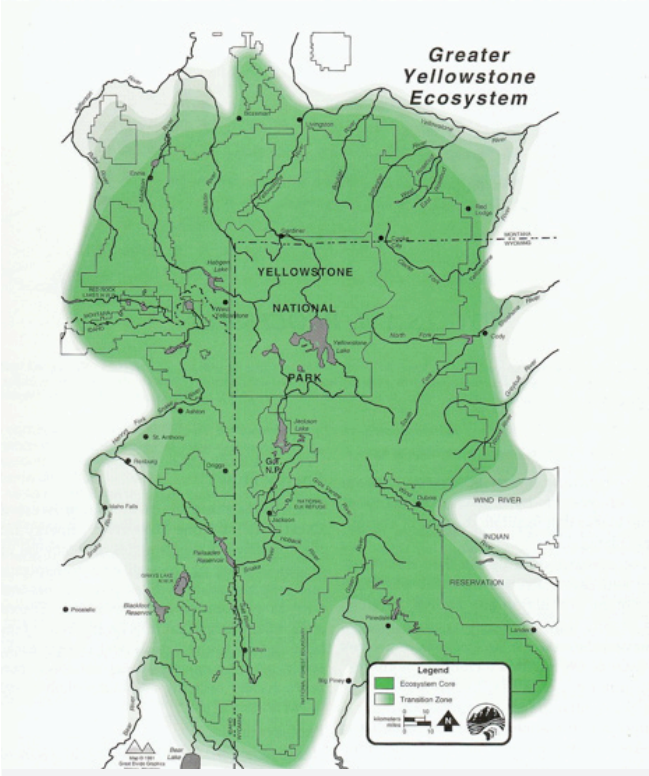

Figure 1 - The GYE (from Glick et al. 1991; used with permission).

Wilderness and Mining

There are three forms of minerals on federal land: locatable (governed by the General Mining Law of 1872, as amended [30 U.S.C. §§ 22-54 and §§ 601-604]); leasable (governed by several mineral leasing acts); and salable (governed by the Material Act of 1947, 61 Stat. 681, as amended). Locatable or "hard rock" (=metallic) minerals are available to the public via claims. The locator (claimant) maintains the claim by paying an annual maintenance fee and can exploit the mineral resources after complying with the surface land management agency's regulations. The Federal Land Protection and Management Act of 1976 (FLPMA) (43 U.S.C. §§ 1701-1787) required the recordation of all federal mining claims with the BLM (Shanahan and Joscelyn 1988). It also reaffirmed the mandates in the General Mining Act of 1872 (30 U.S.C. §§ 22-42).

When first established, a claim is "unpatented," which means that the claimant holds possessory interest in the locatable minerals. The claimant can also secure legal title by "patenting" the claim, which provides ownership of the surface land and/or the underground minerals (but in some cases, the patent may not confer full ownership of the surface). When a claim is patented, it becomes private property, but there is no federal oversight. However, the BLM has some oversight responsibility for unpatented claims (BLM, pers. comm.). When a claim has been properly located, it has a valid existing right. Except for valid claims, a periodic review by BLM determines whether the claim still has a valuable mineral deposit at the site (Ziemer 1998).

An active claim is not the same as a valuable mineral deposit (BLM, pers. comm.). An active claim is one that was approved by BLM. A valid right was properly located and maintained and has undergone a mineral evaluation indicating that an economically valuable deposit exists that could be exploited using ordinary prudence. A closed claim means that the claim has not been maintained. A closed claim is not the same as a withdrawn claim (BLM, pers. comm.). Only an active mining claim in a wilderness area can be exploited, but it need not be patented to withdraw minerals (BLM, pers. comm.). However, the most common reason for a mining claim becoming inactivated is that the owner does not renew the paperwork (BLM, pers. comm.). Fewer than 1% of claims ever become a mine (BLM, pers. comm.).

Locating a claim (i.e., location) consisted of four steps: (1) find a potentially valid claim, (2) monument the claim, (3) record it in the county courthouse, and (4) file notice with BLM (Toffenetti 1985). Generally, the USFS field offices have the authority under law and regulation to approve or disapprove the mining "plan of operations" for national forests, as well as how access is achieved (Thompson 1996; Hubbard et al. 1998–1999). USFS mining and other surface management regulations were promulgated to implement the laws governing the national forests. The USFS also actively assesses whether claims are still active. If the USFS wishes to secure a patented claim, they can offer land purchase or trades. NGOs on their own initiative may purchase them as well.

Some commentators complain that some regulations aggravate a mining initiative by making it difficult and time consuming to acquire the needed permits (Ferguson and Haggard 1973). This opinion does not stress the fact that agency resource specialists for both the BLM and USFS do

all they can to present the facts, issues, and mitigation options in an unbiased fashion. Nevertheless, NGOs and others may challenge whether a claim is still active (Elliott and Metcalf 1975–1976). For more details about the BLM mining policies, see BLM (2018).

GYE Wilderness

In 1972, the Secretary of the Interior Rogers Morton recommended that 8,163 square kilometers (3,152 sq. miles) of Yellowstone National Park be designated as wilderness, or approximately 90% of the park, but Congress never acted on that initiative (Yellowstone National Park 2011). Regardless, due to the mandates of National Park Service (NPS) Director's Order 41, about 95% of the park is reportedly managed as "unofficial wilderness" (White et al. 2013, 265). Official federal wilderness (USFS, US Fish and Wildlife Service [USFWS], and NPS) in the GYE constitutes 2,017,039 acres (8,600 sq. km) (USFWS 2011, 73). There are nine GYE wilderness areas, not including multiple units for one wilderness area, but the current analysis includes four that abut the two park boundaries (Figure 2). These four national forest wilderness areas abutting Yellowstone and Grand Teton National Parks were created from September 1964 to November 1983 (Table 1). Note that the Jedediah Smith Wilderness Area was not included because it was created in 1984 after the 20- year window closed. The Lee Metcalf Wilderness Area was not included because it was created in November 1983, one month before the 20-year window closed.

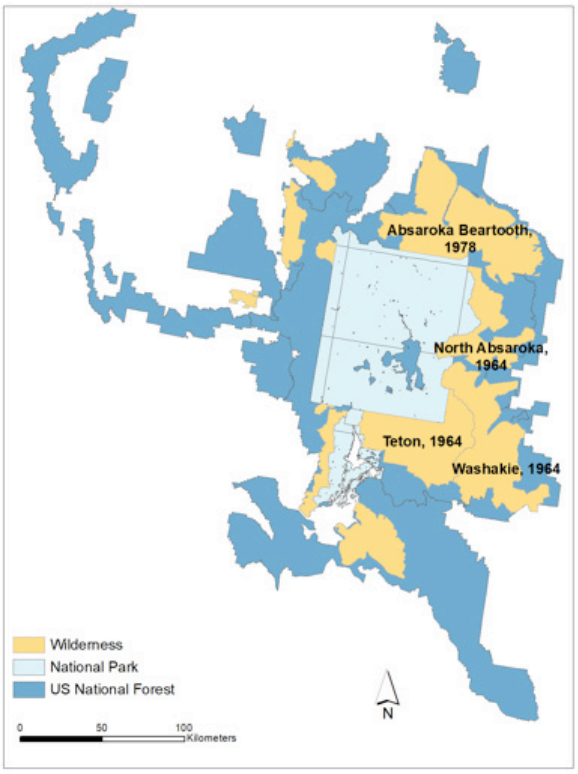

Figure 2 - The four selected GYE wilderness areas.

	YEAR CREATED	AREA
Absaroka-Beartooth, MT	1978	382,034 acres 154,604 ha
North Absaroka, WY	1964	350,634 acres 141,897 ha
Teton, WY	1964	585,486 acres 236,938 ha
Washakie, WY	1964	704,572 acres 285,131 ha

[1]http://www.wilderness.net

Table 1 - Four GYE US Forest Service wilderness areas created from 1964 to 1983

National forest nonwilderness areas are managed under a multiple-use philosophy, where mining, timber harvesting, livestock grazing, and motorized recreation is often permitted (Keiter and Froelicher 1993). Thus, mining was allowed to occur in some federal non-GYE wilderness areas (Toffenetti 1985; Ziemer 1998; Gorte 2010). The Frank Church-River of No Return Wilderness, Idaho, is one example (Matthews et al. 1985). However, the reality was that the 1964 Wilderness Act, despite its many concessions to the mining industry, severely limited mining in wilderness areas due to a series of specific mandates. This generated land-use and access restrictions, surface restoration demands, and if the environmentally conscious public was aware of potential mining, negative publicity often followed (Hubbard et al. 1998–1999). The requirements of federal, state, and local pollution laws generated more restrictions (Elliott and Metcalf 1975–1976).

Approach

The distribution and influence of mining claims in the GYE was investigated using Geographic Information System (GIS) technology. The ArcGIS Desktop 10.1 (ESRI) was used to process and map data. The data on mining claims were obtained from the nondigitized BLM database LR 2000. The current analysis did not include mineral, oil, or gas leases. Data runs were made between July 2014 and May 2017. Mining claims were not determined more precisely than by the section in which they occurred. However, in the case of the Absaroka-Beartooth Wilderness Area, quarter sections were used. This approach is not precise enough to be certain whether some claims were inside or outside a wilderness boundary. To discover precise claim locations, one must first obtain the County Recorder Location Notice and amendments and then study the mapped location (BLM 2018)., A visit to the county courthouses is required, where master title plots can be examined. This task was not performed due to the large amount of time needed to do the search. Additional insights were obtained from staff mineral specialists in each national forest, BLM land law examiners, mining claims specialists, USFS and BLM geologists, GIS practitioners, and others.

	TOTAL CLAIMS HISTORICALLY	*ACTIVE*	*PRE-WILDERNESS*
Absaroka-Beartooth, MT	600+	11	350+
North Absaroka, WY	31+	0	2
Teton, WY	27+	0	0
Washakie, WY	800+	0	58+

Table 2 - Hard-Rock Mining Claims Verified Inside Wilderness

Findings

The current analysis involving the BLM LR2000 data revealed 11 active hard-rock mining claims as of May 18, 2017, all inside the boundaries of the Absaroka-Beartooth Wilderness Area (Figure 3) The specifics for hard-rock mining claims follow (Table 2):

This analysis indicated that the four wilderness areas harbored a minimum of hundreds of hard-rock mining claims from the early part of the 20th century until 2017. As well, at least 400 hard-rock mining claims (prewilderness claims) had the potential to be grandfathered into these four wilderness areas. Further, no prewilderness mining claims were closed before the wilderness designation.

Effect of the 20-Year Window

As a result of grandfathering, or the Wilderness Act 20-year window of opportunity, such rights remain in some US wilderness areas today. During the 20-year window of opportunity to stake mining claims, hundreds of claims were filed in the four GYE wilderness areas selected for this case study. Today, the number of active claims is 11, all inside the Absaroka-Beartooth Wilderness Area. All claims are owned or controlled by one private company seeking palladium and platinum deposits. During 2018, the company was acquired by another mining company. All 11 claims were filed during the 20-year window. Further, there has been no hard-rock mining in any of these four wilderness areas, or any other wilderness areas in the GYE. The New World Mine (Dykstra 1997), although located 0.5 mile (0.8 km) from the nearest wilderness

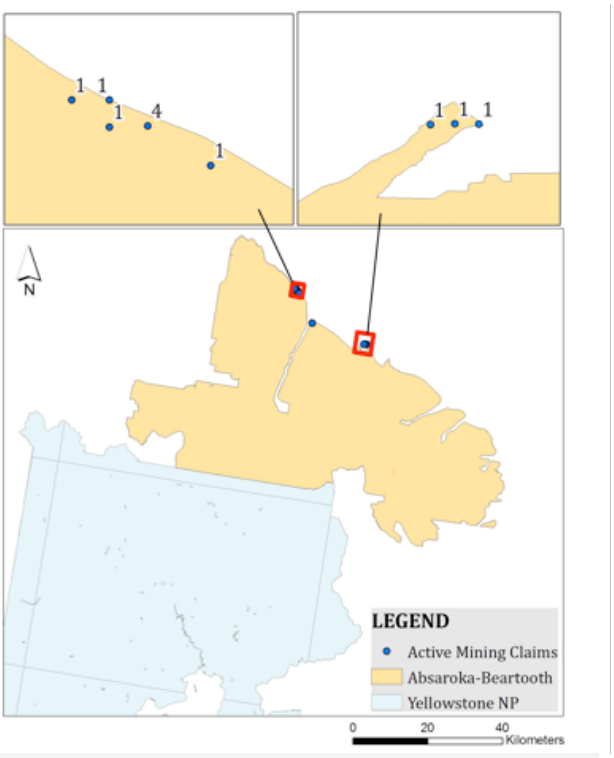

Figure 3 - The location of active mining claims in the Absaroka-Beartooth Wilderness Area as of May 18, 2017.

Figure 4 - Mining operations (background) were under way in 1999 at the McLaren Mine, New World Mining District. Heavy metal mining waste is seen in a tributary of Soda Butte Creek (foreground), 3.75 miles (6 km) northeast of Yellowstone National Park. Photo from Nimick and Cleasby 1999.

area (Figure 4) on mostly private land within the Custer National Forest, warrants mention. An NGO in 2010 purchased 772 acres (312 ha) of mining claims in the New World Mining District, the last remaining land in the district needing landscape restoration due to past mining activity.

In the Absaroka-Beartooth Wilderness Area, 260 claims were filed during 1982 and 1983. In the last three months of 1983, approximately 70 claims were filed in all four of these GYE wilderness areas. But this number does not represent a huge increase in new claims due to the waning 20-year window of opportunity While the opportunity to grandfather in existing mining claims should have been a benefit to claims holders, and the Absaroka-Beartooth Wilderness Area alone had roughly 350-plus claims with grandfathering potential, but claimants did not heavily utilize this window of opportunity before it expired.

After December 31, 1983, wilderness areas were no longer subject to earlier mining laws (Cwik 1983; Edwards 1986). In the case of the GYE and its USFS wilderness areas, the situation was not one of widespread claims being filed and subsequent resource extraction due to the 20-year window provided in the Wilderness Act. But this conclusion may not hold for other wilderness areas in the region or across the US Wilderness Preservation System. For example, the mining claims currently in the Cabinet Mountains Wilderness of western Montana were established during the 20-year window of opportunity, and their potential utilization and extraction has resulted in litigation (Ziemer 1998).

The US National Park System

The NPS currently has 1,010 mining claims in 15 units across the system (NPS 2017). In many of these cases, the existence of claims has been due to the grandfathering of rights. There were 6,330 active mining sites in 2004 within 20 miles of Yellowstone National Park. In this case, sites included mining claims, oil/gas leases, and geothermal locations (Napoli et al. 2004). These oil/gas and geothermal claims are arguably more threatening than hard-rock mining claims. As minerals become more valuable, the filing of claims can accelerate near park and wilderness boundaries (Pew Environment Group 2011). To thwart potential new mining claim exploitation on national forests, on October 18, 2018, then-secretary of the interior Ryan Zinke extended a 2016 2-year mineral withdrawal for another 20 years for 30, 370 acres (75,047 ha) in the Custer and Gallatin National Forests north of Yellowstone National Park. However, this will not affect existing claims on national forests or those on private land.

Conclusion

Toffenetti (1985, 65) said, "We will probably not know for some time whether the mining exception [the 20-year window] benefited the mining industry." However, we know more now for some wilderness areas in the GYE, such as the Absaroka-Beartooth Wilderness Area. Its 11 active claims were all derived from the 20-year window; none were derived from grandfathering of rights for claims existing prior to the window. But the end result of these claims has been that mining has never occurred in these four wilderness areas since

designation. The New World Mine was not in a wilderness area, although it was very close to one. Future investigations could study and determine what has happened to oil and gas, and geothermal leases in these same wilderness areas. Still other studies could determine the status of wilderness hard-rock mining claims in other areas of the country (Figure 5).

Hubbard et al. (1998–1999, 599–600), has stated:

> *In practicality the Act severely restricted hard-rock mining activities on wilderness areas within national forests… then developing those valid claims after that date [December 31, 1983] was severely hampered by other restrictions contained in 4(d)(3) (Wilderness Act of 1964)… despite the mining industry's hard-fought battle to win special treatment from Congress, the real issue became the extent to which regulatory agencies and courts would recognize mining rights within Wilderness Act lands. Thus it became apparent that the commercial mining interests' hard-fought victory existed primarily on paper.*

The results of this case study of the Greater Yellowstone Ecosystem, Yellowstone, and Grand Teton National Parks, and four USFS wilderness areas that abut park boundaries, support this argument.

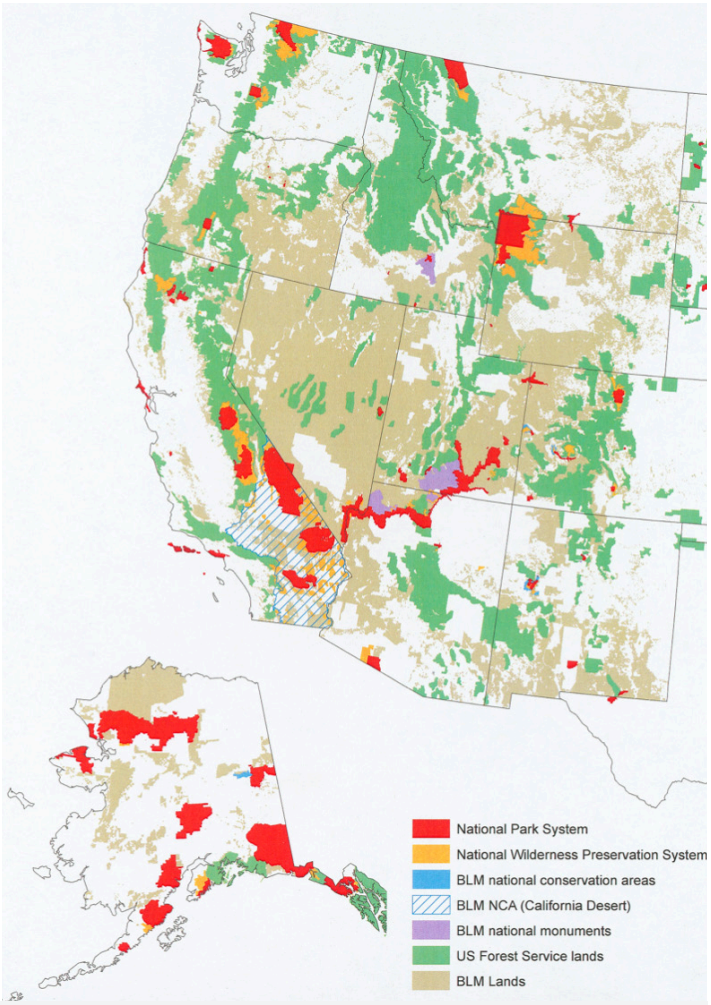

Figure 5 – Wilderness areas (orange) adjacent to major western US natural area units of the National Park System.

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Photo credit: Steven Kamenar

SCIENCE & RESEARCH

Community and Fire Ecologists, Park Biologists, and Recreation Scientists: The Antecedents of Wilderness Science

by DAVID N. COLE

David N. Cole

In the United States, the management objectives for designated wilderness were not codified in law until passage of the Wilderness Act in 1964. Consequently, wilderness science, in the strict sense of science undertaken to understand, protect and effectively manage the lands of the National Wilderness Preservation System, dates from about that time. Nevertheless, prior to the 1960s, there were scientists interested in and studying lands with relatively undisturbed, natural ecosystems, the ecological processes that operate there, and the visitors who recreate there. Many of these places were eventually designated as wilderness, national parks, and other types of protected area. Although these scientists would not have thought of themselves as wilderness scientists, the work they did contributed substantially to our knowledge of wilderness ecosystems and how they might be protected and managed. This article explores some of the scientists and research themes that were antecedent to those scientists who pioneered the emerging field of wilderness science.

Although these scientists would not have thought of themselves as wilderness scientists, the work they did contributed substantially to our knowledge of wilderness ecosystems and how they might be protected and managed.

Community Ecologists: Henry Cowles and the University of Chicago

Early ecologists in the United States contributed substantially to both information about and protection of natural ecosystems. One of the most influential was Henry Chandler Cowles, who trained at the University of Chicago under John Merle Coulter. Coulter was familiar with the vegetation of wildlands, having served as botanist to F. V. Hayden's geological survey of the Yellowstone region in 1872. In 1899, Cowles finished a dissertation on vegetation of the sand dunes of Lake Michigan, since preserved in the Indiana Dunes National Park – widely considered the classic study of the succession of biotic communities (Cowles 1899). Although Cowles published little after 1901, he introduced European plant ecology to American students, developed perhaps the first highly influential curriculum in ecology, and introduced the concept of climax communities. At the University of Chicago, he taught and mentored students in the study of community ecology, a subject best studied in natural areas – places where the composition, structure, and function of ecosystems was little influenced by human activity and development (Mitman 1992). Consequently, Cowles's students and their students in turn contributed much to our knowledge of natural plant and animal communities in North America.

One of Cowles's early students, Charles C. Adams, completed the first ecological survey of what is now the wilderness of Isle Royale National Park (Adams 1908). In 1919, Adams became the first director of the Roosevelt Wildlife Forest Experiment Station in the Adirondacks. During his time there, he was an instrumental force in protection of Allegheny State Park in western New York. In 1925, Adams wrote an early critique of National Park Service (NPS) policy, concluding that the service was not fulfilling its mandate to preserve natural conditions (Adams 1925). To do so, the NPS would need to better align itself with the emerging field of ecology and develop an ecological understanding of its natural resources (Sellars 1997).

Another student of Cowles, William S. Cooper, did further work on the climax forests of Isle Royale (Cooper 1913). His studies in Glacier Bay, Alaska (Cooper 1923) – where in 1916 he established the oldest permanent plot network in postglacial areas in the world – compelled him to lead scientists to nominate it as a national monument. Cooper's students at the University of Minnesota included Rexford Daubenmire and Henry Oosting, prolific students of natural areas and authors of community ecology textbooks. Dwight Billings, a student of Oosting's at Duke University, made major early contributions to desert and alpine ecology. Jerry Franklin, a student of Daubenmire's at Washington State University, coauthored a report on the natural vegetation of Oregon and Washington (Franklin and Dyrness 1969), was instrumental in establishment of natural areas in the Pacific Northwest, and wrote the chapter on wilderness ecosystems in the first textbook on wilderness management (Hendee et al. 1978).

Another early student of Cowles, Victor Shelford, has been referred to as the father of animal ecology (Kendeigh 1968). He was cofounder and first president of the Ecological Society of America. Shelford's work was diverse, involving both experimentation and description, working with individual species and entire communities of plants and animals (Croker 1991). His book,

The Ecology of North America (Shelford 1963), described all the biomes and major seral communities in North and Central America, reconstructing, "so far as existing remnants permit, the character of biological communities as they must have been before European invasion" (Sears 1964, p. 401). From 1917 to 1938, he chaired the Committee on the Preservation of Natural Conditions of the Ecological Society of America. In 1926, with help from other organizations and individuals, this committee prepared a detailed description of the ecology of various parts of North and Central America, natural preserves already set aside, and those being planned (Committee on the Preservation of Natural Conditions 1926).

Shelford became a strong advocate for the preservation of representative examples of all major types of biotic community in as near a natural condition as possible and was one of the first to insist that whole communities must be preserved – not just single species (Kendeigh 1968). This effort for scientific preservation of natural conditions was a complementary but different effort from those of Aldo Leopold and others to protect wilderness for its aesthetic and recreational values (Sutter 2002). But by the 1930s, the leadership of the Ecological Society of America had focused the society's activities on basic research and removed both political and financial support from environmental advocacy and land protection. With his committee disbanded, in 1946 Shelford founded the Ecologist's Union to continue political advocacy for natural areas. Reorganized and renamed in 1950, The Nature Conservancy has become the largest environmental nonprofit in the Americas. For these efforts, Noss (1999) considers Shelford to be among the first conservation biologists in the modern sense.

Figure 1– Victor Shelford was an early proponent of wilderness as a means of preserving representative examples of different biotic communities. Photo courtesy of the Ecological Society of America.

One of Shelford's students at the University of Illinois, Charles Kendeigh, also combined advocacy for the preservation of natural areas with being a pioneering ecologist (Muller et al. 1978). He served as president of the Ecological Society of America, chairman of The Nature Conservancy, and mentor to such prominent ecologists as Eugene Odum and Robert Whittaker. Whittaker went on to conduct studies of natural vegetation patterns in such places as the Great Smoky Mountains, the Siskiyous, Santa Catalinas, and San Jacinto; to write an influential textbook on communities and ecosystems; and to mentor more students of community ecology.

Another Cowles student, Stanley Cain, founded the Department of Conservation at the University of Michigan, the first academic

department of its kind. He was also a president of the Ecological Society of America and, in 1965, became the first ecologist appointed to a powerful job in the federal government, assistant director of the interior for Fish, Wildlife and Parks. In 1964, he earned the Department of Interior's Conservation Award for his work on the Leopold Committee Report on Wildlife Management in National Parks.

National Park Biologists: George Wright and Joseph Grinnell

Of the biologists who have made major contributions to our understanding of the relatively undisturbed ecosystems typical of wilderness, it is remarkable how many can be traced to Cowles and his students at the University of Chicago. Nevertheless, important work was also being conducted elsewhere. One influential institution was the Museum of Vertebrate Zoology, established in 1908 at the University of California, Berkeley, with Joseph Grinnell as director. Grinnell was a field biologist who developed the concept of the niche and wrote numerous scientific publications as well as books, including Distribution of the Birds of California and Animal Life in the Yosemite. Grinnell's goal for the museum was to build a collection primarily of California species, with comparative examples from outside the state. To do this, he surveyed representative sample areas of California, starting with the Colorado Desert in April 1908. His study of the Mount Whitney area, called the Whitney transect, was conducted in 1911; the San Jacinto Mountains in 1913; and from 1914 to 1920, a cross-section of the Sierra Nevada Mountains, including Yosemite, was surveyed. The Lassen Peak area was studied from 1924 to 1929. Refer to Grinnell (1940) for an engaging account of his life.

In 1916, Grinnell coauthored a paper in Science arguing for more scientific and ecological management of national parks (Grinnell and Storer 1916). He argued that national parks should be examples of pristine nature and were valuable to both science and the public. He also criticized several NPS management policies, including the predator control program. Grinnell argued, "As a rule, predaceous animals should be left unmolested and allowed to retain their primitive relation to the rest of the fauna… as their number is already kept within proper limits by the available food supply, nothing is to be gained by reducing it still fur-

Figure 2 – Joseph Grinnell mentored many early National Park Service biologists. Photo courtesy of the Bancroft Library, University of California, Berkeley.

ther" (Grinnell and Storer 1916, p. 378). Grinnell's ideas about resource management in national parks are perhaps best captured in one of the concluding paragraphs to a report on vertebrate animals of Point Lobos Preserve:

> *Administrators of parks need, we think, to convince themselves and then to help visitors in the parks learn that natural processes are capable of maintaining an area with all the desirable qualities just to the extent they are allowed to do so by not interfering with them. Artificial help is not required; indeed, it is not beneficial, but it is positively a hindrance to the natural and hence desirable expression of a truly primeval area. We cannot make such an area, but we may so treat land by bona fide protection that its primeval qualities come to predominate. Again, we need to make no special plans for the benefit of the animals, the plants, or the rocks. What we need to do is to conduct ourselves in such a manner that these objects may exist according to normal process on a long-time schedule. (Grinnell and Linsdale 1936, p. 16)*

Although Grinnell's ideas were initially resisted by the NPS (Sellars 1997), Grinnell had a profound impact on a number of students who went on to conduct biological work there. In 1914, at the University of California, Berkeley, he developed a new course, Natural History of the Vertebrates, which is still offered to this day. The most influential of Grinnell's vertebrate zoology students was George Wright, who spent the summer of 1926 collecting birds and mammals and doing life history studies in Mount McKinley National Park (Thompson 1987). Wright joined the NPS in 1927 and was assigned to work as a naturalist in Yosemite National Park. Independently wealthy, Wright proposed establishment of a wildlife survey program within the NPS that he would personally fund. Wight's proposal was accepted, and wildlife survey work began in the summer of 1930, from an office in Berkeley near the University of California campus. The science staff consisted of Wright and two more former students of Grinnell, Ben Thompson and Joseph Dixon. Their stated purpose was as follows: "In addition to treating of the vertebrate natural history of the parks still needing basic surveys, (it) will cover research in one branch of science that is the very foundation on which the National Park Service is built, namely the preservation of native values of wilderness life. For it is this ideal above all else which differentiates this service from its sister services in government" (Wright et al. 1933, p. iv).

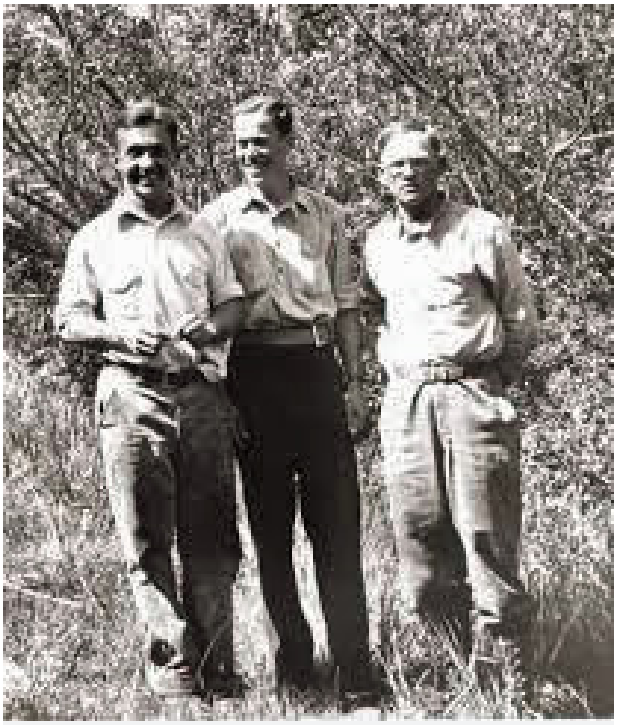

Figure 3 – George Wright, Ben Thompson, and Joe Dixon, shown here around 1930, were the first biologists to survey the fauna of the national parks and make wildlife management recommendations. Photo courtesy of National Park Service.

In 1933, results of the first in a series of proposed studies were published under the title Fauna of the National Parks of the

United States: A Preliminary Survey of Faunal Relations in National Parks (referred to as Fauna 1). Beyond reporting on the status of large mammals in major national parks, the document provided a vision for natural resource management policies that departed greatly from traditional policy. Expanding on some of the principles of Grinnell and Storer (1916), the report argued that the NPS should "perpetuate existing natural conditions and, where necessary and feasible, to restore park fauna to a pristine state" (Sellars 1997, p. 96). It explored the tension between perpetuating natural conditions and providing for public use, suggesting the need to restore disturbed habitat and populations and minimize disturbance caused by development of infrastructure. It recommended that natural resource management be based on scientific research and "each species should be left to carry on its struggle for existence unaided, unless threatened with extinction in a park" and offered specific recommendations regarding "protection of predators, artificial feeding of threatened ungulates, preservation of ungulate range, removal of exotic species and restoration of extirpated native species" (Sellars 1997, p. 98).

The work and capacity of the biological survey group expanded slowly but steadily. The staff moved into offices on the University of California campus and, in 1932, was formally established as a Wildlife Division within the NPS's Branch of Research and Education, with George Wright as division chief. By that time, it was largely financed as a function of the NPS (Sumner 1983). In 1935, a second volume of the Fauna series was published, Wildlife Management in the National Parks, a progress report on improved wildlife administration in the national parks. That year, George Wright was moved to Washington, D.C., where he could be more effective in promoting national parks as wildlife sanctuaries. But the NPS's wildlife biology program was dealt a serious blow in 1936, when George Wright tragically died in a car accident.

While George Wright's death caused the Wildlife Division to lose the momentum it was building, many projects in the works continued to completion. By 1937, administrative policies in Yellowstone National Park increasingly asserted the need for coyote control to protect other wildlife species. In response, Wildlife Division scientist Adolph Murie was sent to study the park's ecological situation. Murie's (1940) Fauna 4 report, Ecology of the Coyote in the Yellowstone, a seminal study of wildlife management, upheld the policy of protecting predators in parks (Sumner 1983). Similarly, in response to a bill to require wolf control in Mt. McKinley National Park, Murie was dispatched there. His Fauna 5 report (Murie 1944), The Wolves of Mount McKinley, was effective in reducing pressure for wolf control (Sumner 1983).

After Fauna 5 and the start of World War II, the biological program of the NPS declined dramatically. The Fauna series was not continued until the publication of The Bighorns of Death Valley in 1961 (Welles and Welles 1961). However, during the latter half of the 1930s, the biological staff, largely funded by the Civilian Conservation Corps, reached a high of 27 biologists, who spent about half their time reviewing proposals for development and half their time working on wildlife management issues and doing research (Sumner 1983).

Of those biologists, one who substantially influenced wilderness science was Lowell Sumner, another mentee of Joseph Grinnell. Sumner joined the NPS in 1935 as a research and management biologist in San Francisco, where among other things he began a series of studies in the parks of the Sierra Nevada. Sumner became a frequent critic of development, particularly of roads in parks, "expressing concern that true wilderness in the parks would soon vanish if the Service did not halt development" (Sellars 1997, p. 105). He was concerned about the impacts of wilderness recreation use, reporting on degradation of mountain meadows caused by pack stock use (Sumner and Leonard 1947). His concern for overuse and impact led him to what is considered the first articulation of the recreational carrying capacity concept. In a 1938 paper, Losing the Wilderness Which We Set Out to Preserve, he warned about exceeding the "recreational saturation point" in parks. He expressed concern about recreation impacting even minute soil organisms that maintain porosity and nutrients, illustrating that park biologists "had moved well beyond management's traditional preoccupation with scenic landscapes and large mammals" (Sellars 1997, p. 105). Sumner's work on pack stock impact on meadows and the impacts of recreation congestion were among the first to make it clear that, even in wilderness, recreation impacts were a concern. This had a tremendous effect on the subsequent development of wilderness visitor management programs.

Figure 4 – Lowell Sumner was a long-serving NPS biologist who wrote about the need to manage recreation use to avoid impairment, particularly in the backcountry. Photo courtesy of National Park Service.

Fire Ecologists

The third group of scientists whose work had a substantial impact on wilderness stewardship were the fire ecologists. For much of the 20th century, most fire science had been concerned with improving the effectiveness of efforts to suppress fires. The work of these scientists and the managers who used their findings was highly successful, particularly given that it is impossible to suppress all fires. Indeed, as the success of suppression efforts increased, so did the difficulty of managing fire through suppression. This irony, the fact that fire management would require more than suppression, and that fire actually played an important and valuable role in ecosystems, were conclusions arrived at by early fire ecologists.

In reviews of wilderness fire science and of fire use in the national parks, Kilgore (1987,

2007) describes the gradual evolution of fire science from an exclusive focus on fire suppression to a more balanced view in which fire is recognized to be beneficial in some situations. He gives initial credit for this change to early plant ecologists, including Cowles and students from the University of Chicago, as well as scientists in the southern United States, known as the "Dixie Pioneers." This group, which included a forester (Chapman 1912), a botanist (Harper 1913), an animal husbandman (Greene 1931), several Forest Service (FS) scientists (Heyward and Barnette 1934), and a wildlife scientist (Stoddard 1935), showed that prescribed burning could be beneficial to longleaf pine, cattle, and quail without damaging the chemical composition of forest soils (Kilgore 1987). In 1958, the wildlife scientist Herbert Stoddard and several colleagues founded the Tall Timbers Research Station near Tallahassee, Florida. Ed Komarek, who Stoddard hired as field assistant in 1934 became director of Tall Timbers, a position he held for 21 years. Tall Timbers was the first research institution devoted to the study of fire ecology, and its annual Fire Ecology Conference, first organized by Komarek in 1962, was the primary outlet for research on the ecological effects of fire for many years (Carle 2002). As such, Komarek is one of a handful of pioneers of fire ecology and, consequently, was highly influential in changes in fire management that had profound effects on wilderness. The earliest attempt to apply these ideas in a wilderness-like environment occurred in Everglades National Park, where Robertson (1953) had studied the effects of fire in slash pine forest, work that supported management decisions to use prescribed fire to maintain pineland forest in the national park.

In the western United States, the primary advocates of a more nuanced view of fire and natural resources were Harold Weaver, a forester with the Bureau of Indian Affairs and Harold Biswell, a forestry professor who arrived at the University of California at Berkeley in 1947 (Kilgore 2007). Working in ponderosa pine forests, they concluded (1) that frequent low-intensity fires are the norm in ponderosa pine forests, (2) that fire suppression efforts have increased the risk of more extreme fires in these forests, and (3) that prescribed fire at low intensities can reduce fuel loadings and provide other ecological benefits (Weaver 1943; Biswell 1967).

Biswell was a graduate of the University of Nebraska and student of Frederic Clements, who was a contemporary of Cowles and an equally important pioneer of community ecology. At Berkeley, Biswell was a particularly enthusiastic advocate for reintroducing fire in natural systems and a highly influential mentor of a new generation of scholars and practitioners with new ideas about fire and its management. Two of his graduate students,

Figure 5 – Harold Biswell demonstrating the use of prescribed fire in Whitaker's forest in 1969. Photo courtesy of Bruce Kilgore, National Park Service.

Bruce Kilgore and Jan van Wagtendonk, were hired to be the first scientists at Sequoia-Kings Canyon and Yosemite National Parks, respectively. They were able to apply many of Biswell's ideas in the national parks – starting in 1965 with the application of prescribed burns in sequoia groves (Kilgore 1972) and, in 1968, with the first lightning-ignited fire allowed to burn in a national park (Rothman 2007). Other NPS scientists, such as Don Despain at Yellowstone National Park, also made significant contributions to the knowledge base used to manage fire in wilderness.

Jan van Wagtendonk, the Biswell student and fire ecologist at Yosemite, tells a story about the advice he got from Harold Weaver when he first met him. "Before you begin to study the ecological role of fire in an area, be sure to gather information on fire history," he admonished. "Without a solid fire history, you cannot make the case that fire has a role" (van Wagtendonk 2014, p. 1). Among the earliest and best-documented fire history studies was Bud Heinselman's work in the Boundary Waters Canoe Area (BWCA). In that study, Heinselman (1973) reconstructed the fire history of the 1-million-acre (404,686-ha) wilderness, going back to 1595, with detailed stand origins, fire maps, and individual fire year dates. He developed the concept of a natural fire rotation (Kilgore 1987) and classified ecosystems according to their fire regime – the kind of fire activity that characterizes a specific region, most notably in terms of the intensity and frequency of fires. These concepts have been enormously influential in the organization of fire information and fire planning and management, particularly in wilderness.

Figure 6 - Bud Heinselman, taking a tree core sample in the late 1960s, devoted much of his career to exploring the fire history of the Boundary Waters Canoe Area. Photo courtesy of Bob Lucas, Forest Service.

With the NPS leading the way, the fire management programs of the public land management agencies slowly absorbed the implications of fire ecology science, and their programs very gradually moved away from an exclusive focus on suppression. Bruce Kilgore promoted the need for a three-part total fire program. "Allowing fires was part of it, suppression was part of it, and prescribed burns [were] a part of it," he stated (Rothman 2007, p. 143).

The Forest Service was more reluctant to change, but a band of heretics in the northern Rocky Mountains changed that (Smith 2014). In the early 1970s, the FS approved its first wilderness fire management plan, allowing naturally occurring fires to burn in an area of the Selway-Bitterroot Wilderness in Idaho. This was the FS's first approved exception to the 10 a.m. (total suppression) rule. This controversial

effort was initiated under the leadership of Bud Moore, who had recently been named head of Fire and Aviation Management for Region 1 of the FS. Moore had grown up traipsing across the Selway-Bitterroot country, spent 40 years fighting fire, and had come to see fire as a natural and necessary part of the wilderness landscape. In 1970, Moore and Bitterroot National Forest supervisor Orville Daniels decided to establish a fire management test area, the 66,000-acre (26,709-ha) White Cap drainage in the Selway-Bitterroot Wilderness. Forester Dave Aldrich and fire researcher Bob Mutch were selected to write the plan with a goal of restoring ecological processes to fire-dependent wilderness lands. Importantly, they took several years to develop the plan, conduct reconnaissance, and research and develop a monitoring program.

Dave Aldrich was a seasoned fire control expert. Bob Mutch, employed at the FS's Northern Forest Fire Laboratory in Missoula, had published an influential paper hypothesizing that "fire-dependent plant communities burn more readily than nonfire-dependent communities because natural selection has favored development of characteristics that make them more flammable" (Mutch 1970, p. 1046). In addition to their own work, they contracted with University of Montana ecologist Jim Habeck to study the fire-dependent forest of the Selway-Bitterroot (Habeck and Mutch 1973) and enlisted fellow FS fire scientist Jim Brown to collect fuels data in the study area. In 1972, the first lightning-ignited fire was allowed to burn in the White Cap drainage, followed by several more fires in 1973, including the 1,200-acre (486-ha) Fitz Creek Fire. As Smith (2014, p. 11) notes, "The in-depth field evaluations of fuel and vegetation before and after fire exclusion, followed by inventories of conditions on the ground after fires were allowed to burn, provided researchers with some of the earliest detailed documentation of the effects of wildland fires in fire-dependent wilderness ecosystems. And that, in turn, helped influence both public opinion and public policy. Fires burned in the approved area without suppression and, contrary to the worst fears of many, the wilderness survived. Indeed, as vegetation and other studies documented over the years, the burned areas showed robust rejuvenation."

Recreation and Social Science

In the years after the Wilderness Act passed, most of the scientists who specialized in wilderness, attended conferences, and wrote papers and books on the subject, were social scientists interested in recreation. However, prior to 1964, few social scientists had done research with implications for wilderness and its management. This at least partially reflects the fact that prior to passage of the Wilderness Act, social aspects of wilderness, including the type of experience it does and should provide, were undefined. In addition, the field of recreation science did not exist until the 1960s, when the problems associated with growing recreation use on public lands became widely recognized. Nevertheless, a few individuals and institutions deserve to be recognized as antecedents of wilderness recreation and social science.

Pioneering recreation ecologist Emilio P. "Doc" Meinecke, a Bureau of Plant Industry pathologist, was asked in 1925 by the National Park Service to advise its employees on potential

Figure 7 - "Doc" Meinecke, shown here around 1928, studied recreation impacts and devised campground management policies still in use today. Photo courtesy of National Park Service Historic Photograph Collection.

adverse impacts of camping and recreation on big trees in Sequoia National Park (Young 2014). Meinecke documented soil compaction and damage to tree roots that he felt would kill the big old trees. Following additional work on redwoods in the California state park system, Meinecke offered four recommendations for reducing the impacts of recreation –recommendations that have become fundamental tenets of good recreation management (Meinecke 1928). First, he advocated spatial segregation of conflicting park functions. The redwood and sequoia groves, iconic, symbolic, and of central interest to tourists, should be managed differently from other parts of the parks, free of commercial concessions and other artifacts. As Young (2014) notes, Meinecke felt this was at least as important to protecting the visitor experience and sense of place as it was to minimizing ecological impact. Second, he suggested locating the most impactful activities, notably camping, away from primary park attractions. Third, he recommended that use be concentrated on routes and sites designed to handle use, using naturalistic structures as much as possible, rather than fences and signs. Fourth, he recommended that trampled areas be restored to as natural a state as soon as possible (Young 2014). Meinecke's observations and insights led him to write A Camp Ground Policy (Meinecke 1932), which promoted the need to confine most camping to planned campgrounds, carefully designed to concentrate use and impact and provide the illusion of a wild experience ¬ recommendations that remain fundamental to facility design today.

By the end of the 1930s, the Forest Service became increasingly concerned about proper management of burgeoning recreation use. In a progress report on recreation research, Lincoln Ellison, head of range research in the FS, recommended research in campground deterioration, roadside vegetation, and recreation economics (Ellison 1942). In a prescient essay, a forester noted the complexity of recreation research needs, stating that "Research must be pushed: research over the fields of economics, sociology, psychology, botany, ecology, pathology, and forestry; research to the end that people may use the forest for recreation permanently without hurting the forests and, ultimately, ourselves" (Lord 1940, p. 276).

Although it took another decade, the research branch of the FS became the first institution to devote significant resources to recreation research. In 1954, Assistant Forest Chief V. L. Harper, and Samuel Dana, dean emeritus of the School of Natural Resources at the University of Michigan, convinced the prestigious Forestry Research Advisory Committee to recommend development of a recreation research program within the FS. The program's work was to be guided by a problem analysis written by Dana (Camp 1983). Two of the four highest-priority needs that Dana identified became major themes of early wilderness research: surveys of visitor attitudes and preferences and determination of the recreational carrying capacity (Dana 1957). The program was initiated in 1958, with most effort initially going into physical and biological concerns. However, George Jemison, deputy chief for research, was someone who "felt we ought to get into people-oriented research studies in recreation resource management rather than research only into physical resources" (Camp 1983, p. 6).

By the close of 1962, the FS recreation research program consisted of 15 full-time scientists and their summer field assistants. In addition, between 1962 and 1966, FS recreation research programs were co-located at five universities to promote the training of recreation researchers and managers (Camp 1983). Many of those involved in the establishment of a recreation research program worked primarily as facilitators and administrators, hiring scientists, planning research, and distributing funds to cooperating scientists. However, a number of the scientists first hired by the FS between 1959 and 1963 made major contributions to knowledge about recreation. Foremost among these, in terms of influence on wilderness science, was Bob Lucas. Hired in 1960 to work on recreation issues in the Great Lakes states, Lucas pioneered visitor survey research and became the founding project leader of the Wilderness Management Research Unit in 1967 (Cole 2019).

Equally significant were the conceptual and theoretical contributions of Al Wagar, hired in 1959 as the FS's first recreation researcher in the first Forest Recreation Research Center, Warren, Pennsylvania. Wagar's first assignment was to study soil compaction in heavily used recreation areas and the success or failure of nine 20-year-old recreation facilities. Wagar made significant contributions to the field of recreation ecology, being among the first to conduct trampling experiments and to assess the efficacy of recreation site restoration efforts. However, it was his work on carrying capacity – one of Dana's high priority research themes – and ultimately managing for quality in recreation, that make him such an important pioneer of recreation research. Among the ideas that came from his 1961 dissertation work (Wagar 1964) are: (1) carrying capacity is not an inherent property of a place or an absolute value, (2) it depends on the needs and values of people and can only be defined in relation to some management objective, and (3) carrying capacity can be increased through management actions such as zoning, engineering, persuasion, and the management of biotic communities (Cole 2001). He was among the first to stress the importance of providing for a diversity of recreation tastes (Wagar 1963) and that decisions about appropriate management – such as the need for use limits – must be made in a

regional context. His argument was that the difference in quality between low- and high-density recreation would never be substantial and, therefore, "mass use would always appear to be justified (in terms of maximizing human benefits) if we examine one area at a time (Wagar 1974, p. 276). These ideas were the precursors for development of the Recreation Opportunity Spectrum (ROS) planning framework by Bev Driver, Perry Brown, Roger Clark, and George Stankey, some of them pioneering wilderness scientists.

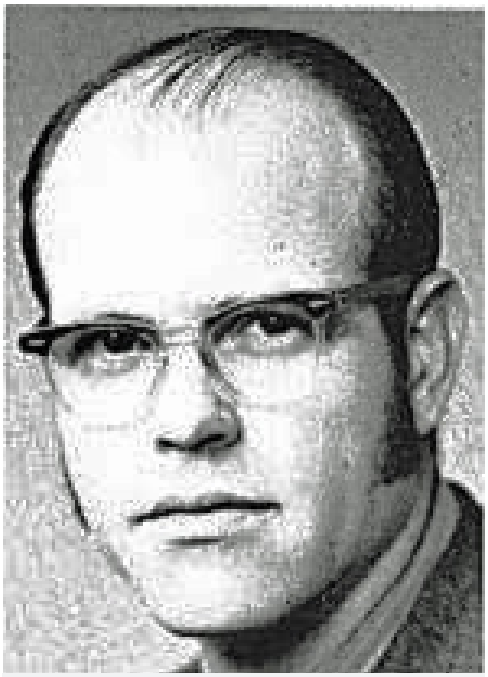

Figure 8 - Al Wagar, shown here around 1970 and one of the first FS recreation scientists, offered early insights into many fundamental recreation management concepts, from carrying capacity to the Recreation Opportunity Spectrum. Photo courtesy of the Forest Service.

Other early FS recreation scientists who did pioneering work include Elwood "Dick" Shafer whose exploration of diversity in tastes resulted in the classic The Average Camper Who Doesn't Exist (Shafer 1969). Art Magill was among the first to measure campground impacts and trends (Magill 1970). Wiley Wenger (1964) did early work on effective ways to monitor visitor use, particularly in remote locations. Will LaPage did some recreation ecology work (1962). He also wrote about carrying capacity (LaPage 1963), anticipating subsequent empirical research and the Limits of Acceptable Change (LAC) planning framework, noting that the issue is one of quality vs. quantity, that the relation between use and experience quality may not be linear, and that managers must develop indicators and identify "critical levels" of satisfaction for the experience to be considered acceptable.

Cooperative units located at universities motivated those universities to augment their training efforts, recruit good students, and conduct significant research. Ross Tocher, for example, was a young professor at Utah State University where Al Wagar was located. With FS funding, Tocher began research projects there, some in wilderness, which he handed off to Perry Brown when he moved to the University of Michigan in 1965. Although Tocher's published work is limited, he was an influential teacher and mentor. Two of the pioneering wilderness scientists of the 1970s, Perry Brown and Joe Roggenbuck specifically mention Tocher as guiding them toward a career in wilderness science. Another individual whose early written works on recreation were highly influential was Marion Clawson of Resources for the Future. In an early articulation of important recreation research needs, Clawson and Knetsch (1963) comment on the link between crowding and carrying capacity and observe that five phases of the recreation experience must be considered: (1) anticipation, (2) travel to, (3) on-site, (4) travel back, and (5) recollection.

Another important impetus to wilderness and recreation research was the work of the Outdoor Recreation Resources Review Commission (ORRRC). Established in 1958, ORRRC produced a

main summary report in 1962, accompanied by 27 special study volumes, one devoted to wilderness. The Wildland Research Center at the University of California at Berkeley produced the wilderness report under the direction of James Gilligan, who had written a dissertation in 1954 on the evolution of FS wilderness policy. The report contains the results of surveys of visitors to seven wilderness areas in 1960, some of the earliest available information about wilderness visitors, the nature of their wilderness visits, psychological appeals and benefits of the wilderness experience, and attitudes toward wilderness management policies. Larry Merriam, one of the pioneering wilderness scientists of the 1960s, was involved with the survey conducted in the Bob Marshall Wilderness (Merriam 1986).

Conclusions

The first wilderness in the United States, the Gila, was established by the FS in 1924, and by the 1930s, the NPS was beginning to move toward conscientiously protecting wilderness-like qualities on many of their lands. However, it was not until the 1960s when burgeoning recreation use and passage of the Wilderness Act in the United States made it clear how unique wilderness qualities were and how challenging they would be to protect. This spurred a small cadre of scientists, first in government agencies and then in academia, to focus their research on wilderness – what it is, what benefits it provides, what threatens it, and how it might best be stewarded. A group of 12 scientists – each having received PhDs and beginning their wilderness work in the 1960s and 1970s – pioneered the scientific study of wilderness, as defined in the United States by the Wilderness Act. Each of these scientists was strongly influenced by pioneering community ecologists, NPS biologists, fire ecologists and/or recreation scientists. Biographical and bibliographic details, as well as oral interviews for most of them are available at Aldo Leopold Wilderness Research Institute (2019).

The earliest and, arguably, most influential pioneer of wilderness science was Bob Lucas, who began studying visitors to the wilderness of the BWCA around 1960 (Cole 2019). Lucas and his scientific contributions were a direct result of the FS effort to facilitate scientific input to recreation management on public lands. Another pioneer from the 1960s who came out of the nascent FS recreation research program was John Hendee. Hendee's dissertation compared visitors to Pacific Northwest wilderness in the mid-1960s to car campers and national park, national forest, and state park visitors. He worked on wilderness issues for his entire career and, along with Bob Lucas and George Stankey, wrote the first textbook on wilderness management (Hendee et al. 1978).

As leader of an FS research group affiliated with the University of Minnesota, Bob Lucas financially supported early academic research on ecological impacts of recreation in wilderness by fellow wilderness scientists of the 1960s, Sid Frissell and Larry Merriam. Lucas hired Dave Lime to continue his work on BWCA wilderness visitors when he moved to Missoula in 1967 to lead the FS's Wilderness Management Research Unit, the first research institution devoted exclusively to wilderness

research (Cole 2019). There he facilitated the work of 1970s wilderness scientists, hiring George Stankey and David Cole at the Wilderness Management Research Unit and financially supporting academic research by Steve McCool, Perry Brown, and Joe Roggenbuck.

The careers and scientific contributions of NPS wilderness science pioneers Jan van Wagtendonk and Dave Parsons are a result of reinvigoration of NPS biology in the late 1960s. Each was hired in the early 1970s as research scientists at Yosemite and Sequoia and Kings Canyon National Parks, respectively, to improve the scientific basis for wilderness management. They were also strongly influenced by early fire ecologists and, to a lesser degree, early community ecologists.

The names of many of these wilderness pioneers – John Hendee, Bob Lucas, George Stankey, and others, as well as succeeding generations of wilderness scientists – are familiar to many in the wilderness community. Their studies and writings have profoundly influenced wilderness thinking and management. However, it is important to also recognize the contributions of those who laid the foundation for wilderness science, names less familiar to many—Victor Shelford, Joseph Grinnell, George Wright, Lowell Sumner, Harold Weaver, Harold Biswell, Bud Heinselman, Doc Meinecke, Al Wagar, and many others.

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The Oostvaardeplassen in April 2018. **Photo courtesy:** Stichting Annemieke (https://www.facebook.com/groups/609452909390002/).

Learning to Rewild: Examining the Failed Case of the Dutch "New Wilderness" Oostvaardersplassen

by HELEN N. KOPNINA, SIMON R. B. LEADBEATER, and PAUL CRYER

The Dutch conservation area Oostvaardersplassen was initiated as a rewilding project within the Netherlands' protected area network. It came under the spotlight when management strategies and practices were criticized by scientists, conservation practitioners, and the public, from a number of perspectives – not all of which were compatible. This article reviews the origin, evolution, and application of the rewilding concept and examines the Oostvaardersplassen project as a case study. Our assessment demonstrates that the area was never an appropriate site for rewilding, and beset by rudderless management, and led to a situation that was ecologically and ethically untenable. The case study is used to illustrate humanity's evolving role in environmental protection where advances in the understanding of ecological complexity, animal behavior, and sentience, cannot be ignored when addressing environmental protection, problem solving, and management. Finally, it lays out options for the future in the absence of the three Cs of rewilding, the Cores, Corridors, Carnivores, and introduces the concept of the fourth C, Compassion.

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Introduction

As accounted by the Millennium Ecosystem Assessment (MEA n.d.), and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report (United Nations 2019), the human-dominated era, informally termed the Anthropocene, is driving mass extinctions (Lewis and Maslin 2015). MEA and IPBES have as their objective the assessment of the consequences of ecosystem change as a scientific basis for action needed to enhance conservation. The MEA and IPBES work has resulted in a scientific appraisal of the conditions and trends in the world's ecosystems, noting a sharp decline in biodiversity. Likewise, the International Union for Conservation of Nature (IUCN 2013, n.d.) has highlighted alarming trends in terrestrial ecosystems, notably in most industrially developed countries. Megafauna, the largest of terrestrial herbivores and carnivores, are experiencing severe declines (IUCN n.d). One of the strategies proposed by the Ecosystem Management division of the IUCN (n.d.) to address this decline is that of rewilding.

Not all rewilding programs, however, are well received. For example, the Dutch nature reservation area called Oostvaardersplassen (OVP) has experienced numerous demonstrations against its management strategies. Around the area, numerous placards stating "stop rewilding" are on display. In addition, protest platforms against the OVP have been active for a number of years now, including Facebook groups (https://www.facebook.com/antiovp) and Twitter accounts, which have focused on animal suffering and biodiversity conservation. What went wrong?

This article addresses three overlapping issues pertaining to this complex situation. First, it examines the history and evolution of the rewilding concept (Foreman 1998; Soulé and Noss 1998) to show that the term has been diluted and transformed such that it is at risk of losing both meaning and purpose. Second, it shows that OVP was never a suitable site for rewilding, not in its original forms nor any of its subsequent evolutions. Third, following the animal welfare and animal rights movement (Singer 1977; Aaltola 2012) and the emerging field of animal rights law (Sykes 2016), this article stresses the importance of compassion in conservation (Bekoff 2013, 2014; Wallach et al. 2018). In this article we argue that we need to address both scientific evidence and ethical considerations when dealing with sentient and highly social animals.

Rewilding

The primary driver behind the rewilding concept was the awareness of environmental degradation, not only at local and species levels but also on a continental scale due to the disruption of ecological processes (Noss 1985, 2019; Soulé and Noss 1998). These processes were being threatened by large-scale habitat alteration and fragmentation due to industrial production and economic development, which externalizes the detrimental costs of perpetual growth.

There have been many competing concepts of rewilding since the 1980s, following emerging scientific insights in ecology, with ecological engineers restoring areas depleted by industrial or agricultural activity in order to "bring nature back." David Foreman (1998) is

credited with first coining the term "rewilding" to refer to the process of restoring populations of apex predators, because they often regulate the "cascades" – ecosystem food webs. Trophic rewilding (Soulé and Noss 1998) refers to an ecological restoration strategy that aims to restore top-down trophic interactions and associated trophic cascades to promote self-regulating biodiverse ecosystems (Svenning et al. 2016). Foreman introduced the three Ws acronym – Wilderness, Wildways, and Wildeors, because the word "wilderness" incorporates philosophical and ethical components in addition to the geographical ones. Foreman (1998) had a fourth W within his acronym – Wardens, signifying the need for regulation and enforcement.

Complications can arise because the terms "wild," "wildness," and "wilderness" each have biophysical, philosophical, and political components and different interpretations (Callicott and Nelson 1998). In this regard two points should be acknowledged. The first is that while the concepts wild and wildness can be applied to individual components of a system and any geographical scale, the IUCN definition maintains that wilderness areas are usually large (Dudley et al. 2008). The IUCN, in recognizing conflicting issues associated with scale, relies on protected area planners applying the whole suite of interchangeable wildness and wilderness characteristics to determine a fitting designation (Dudley et al. 2008).

The second point is that the term "wilderness" does not receive universal acceptance across the globe (Callicott and Nelson 1998; Zealand 2007). We propose here that acceptance of the wilderness concept is dependent upon it shifting beyond the preservation of an idealized time-trapped landscape to instead recognizing its ecological necessity, ethical applicability, and broad cultural relevance (Cryer 2009).

Based on evidence that the efficacy of conservation was positively correlated with the size of the protected area, Soulé and Noss (1998, p. 2) emphasized the "restoration and protection of big wilderness and wide-ranging, large animals – particularly carnivores." Brown et al. (2011) define rewilding as a strategy for the conservation of complete, self-sustaining ecosystems, primarily involving the protection and, where necessary, reintroduction, of keystone species in large, connected reserve networks. These keystone species include megafauna, with their large home ranges (strictly protected core reserves), large migration routes (connectivity), and large predators (keystone species). These three Cs, the Cores, Corridors, and Carnivores (Noss and Cooperrider 1994; Soulé and Noss 1998; Fraser 2009) entail the goal of reestablishing certain ideals of "natural ecosystem processes" and reducing the need to manage landscapes. Rewilding helps "contribute to converting altered ecosystems back into their natural composition, either by letting nature take its course or by introducing missing elements – such as native species" (Promberger and Promberger 2015, p. 249). The restoration and protection of natural processes and wilderness areas involves connecting these areas to one another and reintroducing apex predators and keystone species to their original habitats (Brown et al. 2011).

While rewilding programs in Europe began to develop at the turn of the 20th century in response to the displacement of large carnivores and herbivores, the protected territories tended to be small and not well monitored or coordinated (e.g., Ceauşu et al. 2015; Jepson 2016). There have been several projects in Europe that have been identified as examples of rewilding, including parts of the European Green Belt, along east European border areas (Fraser 2009). The Rewilding Europe network stresses "even our wilderness areas need to be rewilded, because there is hardly even one large area in all of Europe, which is allowed to function naturally by itself, without detailed human 'management'" (http://www.rewildingeurope.com).

Paleo-Rewilding

In instances where extinction prevents the reintroduction of megafauna, ecologists consider introducing near-relatives of the extinct species. Such paleo-rewilding was the subject of a controversial essay in Nature (Donlan et al. 2005). As discussed by Noss (2019), Donlan et al. (2005) used the term "rewilding" to refer to the experimental introduction to North America of elephants, which represented the closest living relatives of animals that became extinct in that locale during the late Pleistocene, approximately 13,000 years ago. Such rewilding then became associated with the restoration of prehistoric landscapes; for example through the introduction of the predomesticated ancestor of the dromedary camel (Camelus dromedarius), which was driven into extinction from the wild 4,000 to 5,000 years ago (Root-Bernstein and Svenning 2016). Subsequently, rewilding became synonymous with Pleistocene rewilding, associated with conservation programs in which animals are bred in captivity or captured in the wild, and reintroduced to new regions.

This approach, however, was considered impractical and dangerous, due to the uncertain impacts of the introduced species (Nogués-Bravo et al. 2016). In addition to this, it creates a misperception that current conservation strategies aim to return areas of the Earth to an idealized version of an earlier and perhaps static condition, denying the dynamic nature of ecological systems, especially those associated with biodiversity/habitat loss and climate change. The appreciation of global environmental change has led to the realization that restoration to historical benchmarks or modern equivalents may no longer be a viable option (Pettorelli et al. 2018).

A shift from the use of Foreman's "wilderness" to the concept of rewilding Cores perhaps opened the door to shrinking the geographical context of rewilding and was adopted and entrenched by European importers of the concept. Clive Hambler, who defined "rewilding," independent of scale, as the "restoration towards greater naturalness" (Hambler 2015a, p. 7), emphasizes that the central rational reason for rewilding was to reduce "extinction rates" (Hambler 2015b, p. 23). The word "rewilding" denotes recovery, and this applies not only to corridors that receive protection between Cores, but to the Cores themselves, as they respond to the advantages of connectivity.

The concept of paleo-rewilding thus shifted between the practice of reintroducing and pro-

tecting "any" wild or domesticated species to the creation of historical landscapes. Below, two intertwined concepts will be discussed. One is the idea that scale matters in determining the necessity of intervention, and the second concept pertains to what is being restored and how it is achieved.

Scale, Intervention, and Management

In some contexts, rewilding entails the passive management (basically, human noninvolvement) of ecological succession with the goal of reestablishing natural ecosystem processes and reducing human control of landscapes (Gillson et al. 2011; Navarro and Pereira 2012). In other contexts, rewilding attempts to actively restore ecological self-regulation through the replacement of missing or dysfunctional ecological processes or components (Seddon et al. 2014).

Noninterventionists imply that biodiversity depends on ecosystems formed through natural processes and interactions in which human beings have historically played a proportionally modest role (Schenck 2015). Interventionist strategies apply in instances where natural systems are restored on a limited scale, and where natural processes are not sufficient to provide regulation and resilience (Gillson et al. 2011; Navarro and Pereira 2012; Schenck 2015). As a general principle, the larger the area the greater its capacity for self-regulation and the more resilient the ecosystem is to change (Gillson et al. 2011; Navarro and Pereira 2012; Noss 2019).

However, the size of an area alone cannot determine the appropriateness of interventionist or noninterventionist strategies, for which context is also required. We could hypothesize, for example, that in an area where fauna is characterized by rabbits, foxes, and hawks, 50,000 hectares (123,553 acres) may be sufficient for extensive self-regulation. However, a similar-sized area populated with leopards, hyenas, rhinos, and elephants would in contrast require extensive management. What happens on the fringes of a rewilded area is also significant. Under stressful conditions, animals will move away, and surroundings that are conducive to that offer additional resilience. In instances where there are species that, to protect human safety, require containment, this resilience diminishes, exacerbating debates around human/wildlife conflict (Demarais et al. 2012).

The Case of Rewilding in Oostvaardersplassen

The Netherlands is a densely populated country with a total land area of 33,720 square kilometers (13,019 sq. miles), populated by more than 17 million people, with a population density of 507 inhabitants per square kilometer (http://www.worldometers.info/world-population/netherlands-population/). Because of this high population, density-conservation efforts in the Netherlands occur in small and controlled or managed territories (Shoreman-Ouimet and Kopnina 2016). The prevailing view in the Netherlands is that nature was something to be managed, like a farm (Shoreman-Ouimet and Kopnina 2016), which served to justify nature organizations' funding for "project management" rather than nonintervention and allowing nature to take its course (Van Dinther 2019).

The key authority behind the creation of OVP is Frans Vera (2009), who supported "precivilized nature rewilding" or paleo-rewilding, only without considering the large scale required for this model of rewilding. Vera's work on prehistoric landscapes justified local rewilding initiatives based on the assumption that large herbivores were instrumental in maintaining a more open landscape and hence prevented the dominance of closed canopy forest (Vera 2009). However, some researchers have questioned paleoecological data that suggested a permanently open landscape (Hambler and Canney 2013, p. 154). The counterargument is that trees used to dominate landscapes, but in an evolving way, with some open woodland giving way to more of a closed canopy later on (Whitehouse and Smith 2010, p. 551). While there would have been temporary and permanent glades, most of the land was covered with high forest (Kirby et al. 2005, p. 169). In what is now the territory of the Netherlands, its open landscapes are in fact the result of medieval agricultural activities and intensified grazing and thus "cultural" rather than "natural" landscapes (Van Dinther 2019). Despite evidence that open landscapes with grazers had a predominantly cultural basis, the restoration of the prehistoric landscape in OVP was seen as natural, according to Staatsbosbeheer (n.d.), the state forestry service and official manager of this area.

Nonnative grazers were introduced to a 56-square (22-sq. miles) kilometer area situated in the reclaimed land area called Flevopolder. Red deer (Cervus elaphus) from Scotland, Konik horses (or ponies) (Equus ferus) from Poland, and Heck cattle (Bos taurus) from Germany were introduced because they had undergone very little selective breeding and were assumed to have many of the characteristics of their wild ancestors (Vera 2009). The Heck cattle were the result of a controversial German breeding program in which modern aurochs were selectively bred with Spanish fighting bulls to resemble the "prehistoric" European aurochs (de Bruxelles 2009; Izadi 2015). Reportedly, the farmers found the Heck cattle too aggressive (Morris 2015; Izadi 2015) as they were always "trying to kill everyone" (Crew 2015). Introduced species included birds that had become rare, such as the kingfisher (Alcedo atthis), common spoonbill (Platalea leucorodia), Eurasian bittern (Botaurus stellaris), marsh harrier (Circus aeruginosus), bearded tit (Panurus biarmicus), foxes (Vulpes vulpes), and hares (Lepus europaeus). Additional species that had almost or entirely disappeared from the Netherlands now occur there, including the greylag goose (Anser anser), great cormorant (Phalacrocorax carbo), great white egret (Ardea alba), white-tailed eagle (Haliaeetus albicilla), and sanderling (Calidris alba) amongst others, were also introduced (Vera 2009; Lorimer and Driessen 2014). Smaller mammals such as red foxes and hares, as well as amphibians and reptiles, are also found in the area (Lorimer and Driessen 2014; Shoreman-Ouimet and Kopnina 2016).

The assumption of ecosystem function was premised on the Netherland's "historical landscape," which was presumed to be an open grazing area. When the planners of the OVP project set up a small park, the overpopulation of herbivores was inevitable, demanding an intensively managed interventionist strategy.

The herbivore overpopulation was caused directly by poor, inappropriate ecological planning and management, of which animal cruelty was the inexorable outcome.

The small size of the area was mitigated by the possibility of connectivity through the promise of potential corridors. The development of the so-called green infrastructure was announced by the Dutch government as part of the combined "nature and sustainability" vision supported by a number of political parties and ministries in 2009 (EMA 2015). The corridors, however, were never introduced and grazers remained landlocked (see Figure 1).

OVP's Development

At first, the OVP initiative was well received, not only by Dutch nature organizations but also by the policy makers involved in local landscape restoration initiatives (Kuil et al. 2000) and the Natura 2000 program, the EU's largest coordinated network of protected areas stretching over 18% of the EU's land area. However, a few years after its designation as a nature area, OVP started to attract skepticism. While visiting the area during the filming of the Dutch nature documentary De Nieuwe Wildernis (The New Wilderness), Elizabeth Kolbert reflected: "A few members of the French crew had brought along video cameras…. I wondered what they would do with the high-voltage power lines in the background. It occurred to me that, like so many post-modern projects, the Oostvaardersplassen was faintly ridiculous." More pointedly, a popular talk-show host, Lubach (2016), referred to the "OVP safari lodge" where excited disaster tourists can gorge on the sights of starving animals.

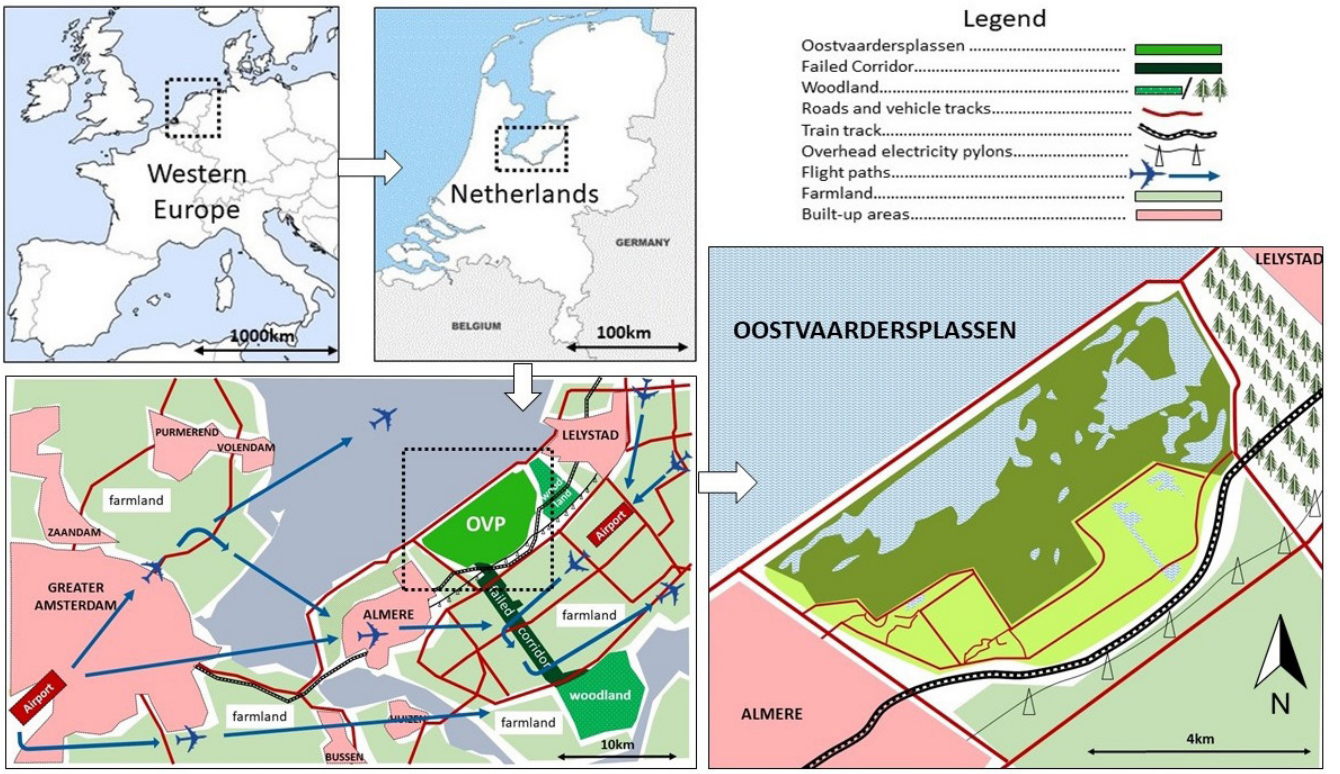

Figure 1 – Maps showing the position of OVP in western Europe as well as surrounding land uses and basic vegetation types

With its fence limiting food availability and emigration, the OVP project had the unavoidable outcome of needing population control, either through starvation or regular culls. The introduction of megafauna in OVP was approved without the possibility of natural regulation (Shoreman-Ouimet and Kopnina 2016) and the lack of any legal framework protecting (wild) animals (Kopnina 2016a). Responses to this emerging situation fell into three camps: those believing that the OVP should be seen as a wild and self-regulating, advocated animal starvation. Those following conventional wildlife management practices advocated culling. Many members of the public, who perceived the suffering of OVP animals as a human-constructed error, demanded that the animals should be fed and cared for.

Mass starvation, the result of too many herbivores multiplying on a small and closed territory, was inevitable and wholly predictable. In the winter of 2011–2012 the total number of dead animals stood at 941 on March 1 (Griekspoor 2018). According to the Staatsbosbeheer, more than 90% of the deaths in 2014 were animals that were shot to prevent starvation. The Staatsbosbeheer (2014), however, remained optimistic about "the natural life where nature has a say in it."

Mortality statistics varied widely when it came to how many animals were shot (according to eyewitness reports by protestors or official numbers), died of starvation, or experienced "natural deaths." By December 2017 there were nearly 5,300 red deer, Heck cattle, and Konik horses in the nature reserve, 700 more than in 2016 (Kuypers 2017). The total head count of dead animals in 2018 stood at 1,755 on March 1. That is approximately one-third of the total population comprising 1,478 red deer, 26 heck cattle, and 251 Konik horses (Griekspoor 2018). Another source suggested of the more than 5,200 red deer, horses, and cattle, almost 3,000 died (Paauwe 2018). The Staatsbosbeheer reported that 2,684 red deer, 75 cattle, and 467 horses died in the five months from December 2016 to April 2017 (NOS 2018). According to official reports from Staatsbosbeheer, from December 2018 to April 2019, 1,800 deer were shot (NOS 2019).

Figure 2 – This Tom Janssen cartoon first appeared in the Trouw newspaper in March 2010. Caption (translated from Dutch): "Look, free nature!"

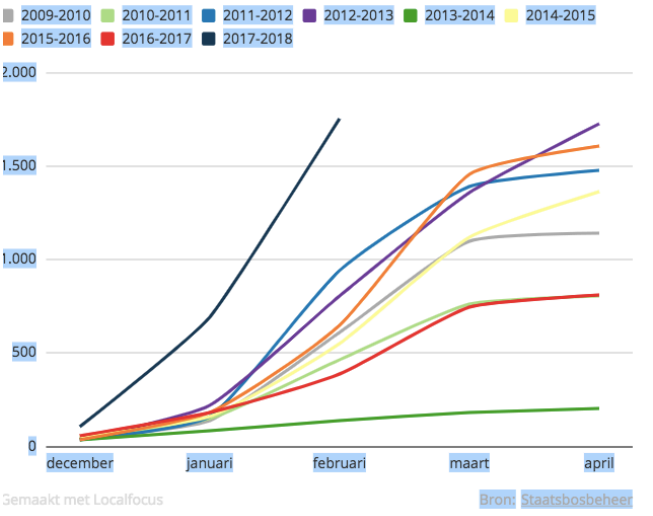

Figure 3 – Mortality of large grazers – Oostvaardersplassen. Source: Staatsbosbeheer.

The ensuing controversy surrounding OVP reached the European Union (European Parliament 2018) when on July 20, 2018, deputy Harold Hofstra of the Province of Flevoland, and director Sylvo Thijsen of Staatsbosbeheer, signed the Van Geel Covenant to shape OVP's future development. The covenant sets out plans for the development of National Park New Land, with the aim of increasing accessibility to the area for visitors, and providing recreational opportunities and associated facilities, such as cafés and shops. In the short term, investments are proposed in the areas of creating more water habitats, increasing shelter, and reducing grazing pressure. In the long term, the number of large grazers will be maintained at a maximum of 1,500 animals, by shooting them (https://www.staatsbosbeheer.nl/over-staatsbosbeheer/dossiers/oostvaarders-plassen-beheer). That Dutch nature organizations only receive subsidies for intervening through environmental management, a rather perverse economic stimulant, complicates matters (Berendse in Van Dinther 2019).

The shift to prioritizing recreational opportunities in OVP signals the relinquishment of any rewilding principles, even under the most diluted forms of the term. Increased human activity within a very restricted area can only ever negatively affect wildlife (Hambler and Canney 2013, pp. 83–84; Bötsch et al. 2018), as increasing numbers of studies are discovering the "negative effects of recreation on animals" (Larson et al. 2016). Simply put, wild areas "will not remain natural if too many people have access" (Peterken 1996, p. 378).

Discussion

While rewilding can be seen as scientific, biological, or even technocratic action to support ecological sustainability, it also has ethical implications. Ethically, ecocentric supporters of rewilding emphasize that wild ecosystems with intact food webs, including apex predators, have intrinsic value, and humanity has a moral obligation to restore such ecosystems wherever possible (Noss 2019). The inclusion of intrinsic value to reflect ecological complexity makes rewilding and ecocentricity inseparable (Kopnina 2016a, 2016b; Cafaro et al. 2017; Kopnina et al. 2018; Piccolo et al. 2018). But it is important to note that the semantic migration of rewilding has diluted it conceptually such that some of its originally implicit aspects, including ethics and scale, require specification or clarification. Without undermining the advantage and applicability of the Cores, Carnivores, and Corridors (not to mention Compassion) concepts to European rewilding in general and OVP in particular, the use of the word "wilderness" is either a stretch or a dilution of the concept.

In sum, according to Noss (2019), rewilding must begin with two fundamental actions: (1) enlargement by adding areas to small nature reserves and restoring native vegetation assemblages, and (2) restoration of functional connectivity among patches. Restoring connectivity can create a whole greater than the sum of its parts, in that small reserves by themselves cannot maintain viable populations of area-demanding species, but a network of connected sites might provide enough habitat to support metapopulation or viable populations (Noss 2019).

Both the Foreman concept, and Soulé and Noss's (1998), refer to geography on a continental scale. More subtly, the differences between the original Foreman concept and that of Soulé and Noss (1998) are significant (Rewilding Institute, 2018). To Foreman, rewilding was an ethical conservation plan that made use of science. Perhaps to accelerate gaining traction, Noss and Soulé defined it as a scientific conservation plan, which was subject to ethical scrutiny. Within Foreman's interpretation, ecocentricity was implicit, along with the concept of respect and compassion for nonhuman community members by human community members. This is critical in determining a fundamental question in rewilding: Should a fourth C be added to "Cores, Corridors, Carnivores," that of Compassion?

To address this question, the rewilding term was reevaluated by Marc Bekoff (2013; 2014), who added a moral dimension to the purpose of rewilding. To Bekoff, our modern relationship with the Earth has suffered a disconnect through a series of social, agricultural, and economic revolutions that deluded humanity into believing it now occupies an elevated position within the greater Earth community. Our relationship with nature is consequently characterized by alienation and fragmentation, unnatural to a consciousness that includes kindness and empathy in addition to greed and self-interest. Bekoff points out that the initiating force is interspecific compassion, care, and empathy directed at individual community members, plants, and animals. Bekoff proposes that solution-seeking must be more than a purely cerebral process, one that validates both head and heart (Bekoff 2014, p. 5). In this view, rewilding extends beyond the biophysical and carries the alleviation of suffering as an inherent component.

This addition to the rewilding concept has a number of ramifications. Bekoff's interpretation adds depth to the inclusion of Compassion as the fourth C. His emphasis on the individual is more akin to the thinking behind the compassionate conservation movement (Baker 2013; Wallach et al. 2018). This movement seeks to acknowledge and incorporate individual animals within the purview of conservation decision-making. This is in direct contrast to approaches that focus on attaining healthy ecological systems, and which consider the fate of individuals or groups of animals of little consequence so long as they contribute to the health of the ecosystem (Wallach et al. 2018). Within this discussion it is necessary to differentiate between suffering in natural systems (e.g., predation, starvation, disease) and "terminal (or artificial) suffering" caused by habitat loss or other anthropogenic drivers of extinction. This has particular significance within the OVP case study, which demonstrates that neither the imperatives of animal ethics, nor practical requirements of biological conservation, are met in a proper manner.

As some activist groups, and more recently European legislators, have stressed, the shift in OVP's management strategy from creating a nature reserve to prioritizing recreation, where heavy management turning the area into a free-range farm, cannot go unmarked. It is another occurrence where, in spite of the global need for biodiversity conservation and the allocation of protected areas, the Netherlands is choosing to convert an area intended

for biodiversity protection into an area demarcated for people to enjoy "historical landscape" fantasy. OVP's mismanagement can be viewed from a number of differing and valid perspectives: flaws in ecological thinking, the inhumane treatment of animals, and the poor application of interventionist or noninterventionist strategies. From our point of view, the underlying idea is not whether precivilization landscapes can be re-created, apart from the questionable applicability of paleo-rewilding relevant to OVP, but whether the planning of OVP can be ethically and pragmatically justified.

Figure 4 – The Oostvaardeplassen desertland. Courtesy of Stichting Annemieke; https://www.facebook.com/groups/609452909390002/.

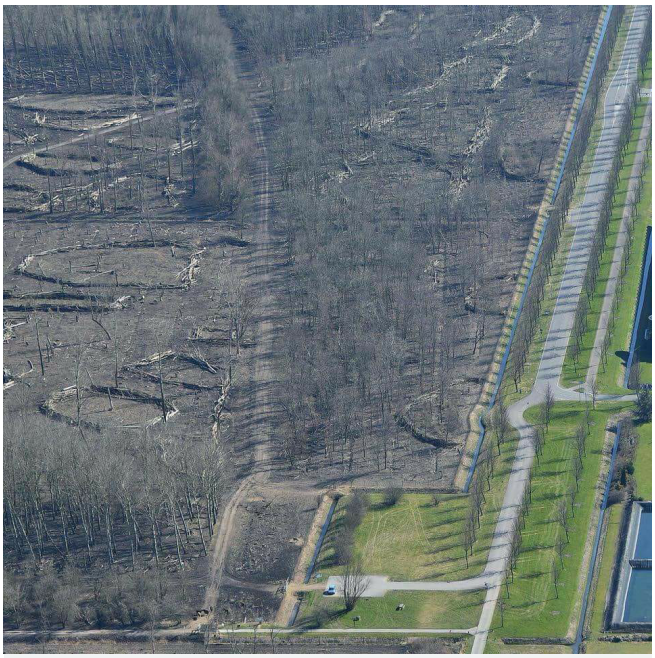

Figure 5 – The Oostvaardeplassen as viewed from a helicopter. Courtesy of Shutterstock – (free images).

Figure 6 – The Oostvaardeplassen: Truck with Antlers. Courtesy of Stichting; Annemieke https://www.facebook.com/groups/609452909390002/).

Future Direction of OVP

OVP's management authority has abandoned use of the term "rewilding" and seamlessly transitioned the reserve into a meat-producing recreational area. While relinquishing the rewilding concept may be appropriate, the lack of accountability for the egregious mismanagement of a protected area and its introduced large herbivores is not. The scientific community and conservation managers must define and articulate this accountability, if only to prevent its recurrence. As OVP has been used as a template for at least one other rewilding project (Tree 2018), the potential for history to repeat itself is real.

In light of this accountability, these options were or are available to current decision makers:

- The Staatsbosbeer authorities could recognize the ecological and humanitarian blunder and move the large animals to more suitable areas. This could be conducted purely to reduce numbers, or it could be deployed to intentionally breed animals for other areas within a coordinated metapopulation strategy.
- They could explore contraception (Cohn and Kirkpatrick 2015) to maintain populations once they were reduced to ecologically acceptable levels.
- The numbers of large mammals within OVP could, as proposed, be controlled by regular culling, utilizing the meat for human consumption.

None of these options offer a "hands-off" management model that might actually be preferred in natural systems, and none are without controversy. They each highlight the reality of managing a small area and the choices that are made determine the commitment of the decision makers to the environment and animal welfare. The authorities seem to have taken the cheapest option in correcting the high numbers of large herbivores: culling animals and selling the meat. Yet, if the authorities are worried about the costs involved in live removals compared to the fallout of international condemnation, they are being shortsighted.

The proposed management revisions of the OVP conservation area continue to rely on simplistic conservation management rather than developing the necessary understanding of complex ecological interactions, and appear to be driven by expediency rather than ethical concerns. The revised vision for OVP does not include consideration of the biodiversity value of large mammals, the densities set for these animals, and the manner in which those numbers are to be maintained in the future. Effectively this means that OVP will become a recreational area characterized by some novelty viewing and meat production. Its remaining value to small mammals, birds, and other fauna would require scrutiny, but its contribution to the local or European protected area network would certainly be less than the planners of the original conservation area envisioned.

As discussed, the concept of rewilding (with the component parts of the term, "re" and "wild" having their own meanings) has evolved and changed as it has been applied to different circum-

stances. And as stated in our Introduction, in relation to the concept of wilderness, no part of OVP fits within a wilderness designation; to apply the term inappropriately will only undermine efforts in larger areas by deeming high levels of human impact acceptable. The replacement of Foreman's four Ws – Wilderness, Wildways, Wildeors, and Wardens with the three Cs – Cores, Corridors, and Carnivores, opened the door for rewilding to evolve rapidly without the inherent constraints of size or the ecocentric land ethic. Without the expanse of wilderness, small rewilding projects required increased management intervention, and without the ecocentric land ethic, those increased interventions could become ethically nihilistic.

The addition of the fourth C, Compassion, is an example of an ethic being re-added to the rewilding concept after being stripped of it through the evolution of the term. Does the inclusion of Compassion restore the meaning of rewilding to its original form? Perhaps. Within the range of ecocentric outlooks, the wilderness land ethic acknowledges the well-being of the collective and the members who make up the collective as a radically interconnected whole. Proponents of compassionate conservation react against mechanistic ecological strategies in which ecosystem integrity must be maintained even at the calculated expense of individual animals (Bekoff 2013). It is not that compassionate conservationists ignore ecosystem maintenance, nor do they shy away from the hard decisions associated with ecosystem management. But they do apply the well-being of all components of an ecosystem (individual animals) as well as the whole, within their decision-making (Bekoff 2013). For interventions to be ethically justifiable, compassion, for individuals and species, must be inherent within management decision making (Wallach et al. 2018).

Conclusion

We have argued that there are limitations in the currently applied system of land management at OVP, which have become evident with advances in science and ethics. As our analysis has indicated, in many ways OVP's inappropriate application of rewilding illustrates how the project has failed to keep pace with developments in science and ethics. The term "rewilding" (including selected parts of its original definition and processes) has been useful to smaller initiatives in Europe, right down to the scale of rewilding previously farmed land. But in order to do this effectively, the term "rewilding" had to be reworked to deal with the management issues of small areas. In doing this, the term came to include aspects of planning and intervention that the original term was designed to specifically circumvent – namely, high human impact and management intervention. Compensatory mechanisms and alternative strategies are debated to the point that, without details, context, and clarification, they render the term "rewilding" meaningless.

Perhaps it is time to define the term "rewilding" from a strategic perspective: to ensure the components of rewilding (either the Ws of Wilderness, Wildways, Wildeors, and Wardens or the Cs of Cores, Carnivores, Corridors and Compassion) become adopted at an international governance level.

Perhaps it is time to define the term "rewilding" from a strategic perspective: to ensure the components of rewilding (either the Ws of Wilderness, Wildways, Wildeors, and Wardens, or the Cs of Cores, Carnivores, Corridors, and Compassion) become adopted at an international governance level. The greatest goal of rewilding is to protect and link large tracts of land where the opportunity remains. If the controlled or gentle rewilding of small areas, as advocated for example by Lorimer (2014), undermines the rewilding of vast landscapes, then the time has come to separate the terminology in order to recognize different scales, so as not to marginalize small "rewilding" sites or dilute the principles associated with large ones. With even the most lenient delineations of size, OVP was too small for a rewilding project on its own, and the promised and necessary connectivity never materialized.

As this article has demonstrated, the protected area design of OVP negated any option for a noninterventionist strategy. In terms of the feasibility of conservation action, the application of rewilding at OVP demonstrates the shortcomings of applying biodiversity conservation principles without appreciating the critical dimensions of scale and interspecies interdependence (Shoreman-Ouimet and Kopnina 2016). In the absence of a large territory where animals can migrate in times of food shortage, and without predators, the herbivores were left to starve. Not unlike confined animals within a large zoo cage, the animals were left there by humans but without human care. Artificially simulating a condition of "terminal suffering" through containment is the antithesis of what any concept or practice of rewilding is purported to be about, namely of saving species from extinction, or the reintroduction of species through unrestricted access to increased natural habitat.

As an alternative for OVP, we suggest here that OVP's herbivores have suffered enough through attempts at "management" and should be allocated a larger territory through the same Dutch and international conservation funding that enabled OVP to be established to begin with. A noninterventionist approach would be more successful if OVP was left to smaller animals and birds, granting great cormorants, egrets, common spoonbills, and white-tailed eagles a large human-free refuge within the human-dominated landscape. IJW

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ACCELERATING
CLIMATE
ACTION

Arab Youth Climate Movement Qatar Executive Director Neeshad with AYCM National Coordinators from Morocco, Bahrain, Kuwait, Lebanon, Qatar and Jordan at COP22 Marrakesh in Morocco in 2016.

Arab Youth Climate Movement Qatar

by NEESHAD SHAFI

This Arab youth group succeeded against odds where most climate advocacy NGO's failed in the Middle East

Neeshad Shafi

People are experiencing the consequences of climate change across the Middle East. From flash floods in Kuwait, Doha, and Jeddah to rising sea levels in the Mediterranean, many coastal modern cities are at risk from increased frequency of extreme weather. We are witnessing heavy rains and flooding in the winter and dangerous heatwaves and droughts in the summer, from which scientists and development specialists agree could do serious damage to many countries around the world, but perhaps especially in the Middle East.

Across dinner tables in Morocco to the Gulf countries, the Arab world's natural leader, Arab intellectual youth ask one another how and why things came to turn out in this unnecessarily bad way. These young activists are calling on their governments to pledge emission cuts and are pressing to secure a strong outcome from international climate talks. Doing so begins the change to the region's current reputation of obstruction when it comes to dealing with climate

In the future, we can expect environmental youth mobilization in the Middle East and North Africa to intensify, as ecological challenges increase alongside constrained development choices, increasing population growth, and resource scarcity.

Figure 1 – Neeshad Shafi of Arab Youth Climate Movement Qatar was listed in the 100 most influential people in climate policy by Apolitical in March 2019.

change. Oil- and gas-rich Saudi Arabia and other Gulf countries have been considered as leading a campaign to sabotage attempts by countries on the front line of climate change. This includes the ambitious 1.5-degree Celsius target for global climate change in the 2015 COP21 (Conference of Parties) Paris agreement. While the world celebrated the successful Paris Agreement where more than 150 heads of state attended the largest gathering of government leaders in history, Heads of State of key Gulf countries did not attend. Even when it came to the signing ceremony of the Paris Agreement, which took place at United Nations headquarters in New York four months after the agreement, the Arabian Gulf countries were among the few countries in the world that did not participate, although they did sign over the course of time. More recently, a major report on 1.5-degree Celsius targets was excluded from formal United Nations climate negotiations, after Saudi Arabia tried to discredit its scientific underpinnings.

The Beginning of AYCM at COP18 Doha

At the United Nations Framework Convention on Climate Change (UNFCCC) 18th COP in Doha, Qatar, from November 26 to December 7, 2012, governments from every country on Earth had an important opportunity to define the way forward for climate action. However, outcomes fell short of the expectations of many who wished to see progress toward a global plan to fight climate change. As the end of the COP18 neared, many challenging political issues remained unresolved. Some feared that the COP would achieve even less than expected and end in collapse. Fortunately, the COP was able to come to agreement on a set of decisions, called the Doha Climate Gateway. Despite reaching agreement, there remained frustrations that the Doha COP failed to rise above the low bar set for it. By delivering few concrete results, the talks

delayed many difficult decisions for later meetings. But there was a silver lining. Not only was this the first time that a UN climate meeting was held in a Gulf country, it was also the first time that Arab youth turned out in full force to protest inaction by the Arab countries. After four decades of civic quietude, Qatar saw its first youth protests over climate change. The December 1. 2012, climate march through Doha, attended by about 800 people, is thought to be the first ever civil demonstration in Qatar. It was notable for the presence of around 100 young activists from the fledgling Arab youth climate movement, who loudly called for Arab leaders to take the lead in the talks. Both of these developments highlighted an exciting step forward for the Arab world.

Another example of youth in action is the Arab Youth Climate Movement Qatar (AYCMQA), which was established in the lead-up to the COP18 Doha negotiations. Young Arab youth sought to actively influence parties to agree on ambitious, legally binding targets to cut greenhouse gas emissions and reach consensus on how to move forward with further commitments for Annex I Parties under the Kyoto Protocol beyond 2012. Furthermore, young people wanted to share their hopes and aspirations for international action addressing climate change issues.

Figure 2 –Arab Youth Climate Movement participating in a climate change march in downtown Doha, Qatar, in 2012. Photo courtesy of Issam Abdallah.

Figure 3 – Arab Youth Climate Movement Qatar executive director Neeshad speaking at COP21 Paris in 2015. Photo courtesy of Arab Youth Climate Movement Qatar.

The role of NGOs in Tackling Climate Change in the Arab World

Many countries in the Middle East are facing the profound environmental, social, and economic impacts of rapid population growth, development, and natural resource constraints. Having a strong NGO community with a clear mandate to engage civil society, businesses, and the public sector can help countries to tackle these issues more successfully.

Environmental NGOs can play a crucial role in the Middle East and Arab world by helping to plug gaps by conducting research to facilitate policy development, build institutional capacity, and facilitate independent dialogue with civil society to help people live more sustainable lifestyles. While some of the barriers are beginning to be lifted, there are still many areas that require further reform and support in order to assist NGOs, such as AYCM, to conduct their work. These areas include the need for a legal framework in the Middle East to recognize NGOs and enable them to access more diverse funding sources, high-level support/endorsement from local figureheads, and engaging NGOs in policy development and implementation.e

A change is apparent since COP21 UNFCCC, where international geopolitical power dynamics have reproduced youth lobby groups that have commanded a great deal of support from various UN and European organizations. The influence of the NGOs on the negotiators has depended greatly on their ability to make themselves heard. This has been attempted by holding side events, exhibitions, mobilizations, or whenever possible, securing an invitation to join the official delegations of their governments in supporting the Arab countries' efforts on climate negotiation and policy advancement.

However, youth NGOs face continued barriers. In particular, the role of youth nonprofits is not well understood or recognized as they pursue their missions, based on lack of understanding about their role in civil society and public perception that the government alone is responsible for the well-being of its citizens and residents. This is aggravated by the lack of faith in the ability of nongovernmental organizations to drive change in most Arab countries. This perception is also exemplified by the fact that there is no framework for nonprofit organizations to establish themselves, which significantly hinders them in working to their full potential. Further, most Arab countries share a semi-authoritarian government, which can exacerbate this tendency.

Figure 4 - Arab Youth Climate Movement representatives from Qatar, Bahrain, Yemen, Jordan, Sudan, and Saudi Arabia at Empower Youth Summit in Qatar, 2017. Photo courtesy of Arab Youth Climate Movement Qatar.

Figure 5 – Arab Youth Climate Movement Qatar executive director Neeshad speaking at an Earth Talks series event in Qatar. Photo courtesy of Arab Youth Climate Movement Qatar.

Lacking Climate Education and Awareness

The issue of a climate crisis seems to be overwhelming, and governments are skeptical and slow to act. Long-running social issues in the region include ongoing security issues, stability issues, mass migration, resource scarcity, and economic dilemmas. Thus climate change is overshadowed by other priorities despite the fact that many of these problems could be a result of an already changing climate. Recent conflicts in the Middle East have pushed climate change down on the agenda of both public opinion and news outlets in most Arab countries. To compound these challenges, many Arab countries share a semi-authoritarian media system. In order to avoid crossing editorial red lines, climate change reporting is mostly copied from international news agencies. Local reporting is sparse, as it may easily touch on sensitive issues concerning inadequate governance. Consequently, climate change has traditionally been covered as foreign news with a focus on international climate change negotiations, with limited relevance for a regional audience.

Road Ahead for Arab Youth

It is easy to despair, but the activism of young people, young Arab citizens and residents in particular, provides hope. The AYCM has groups across the Middle East and North Africa, with most of their activities in Qatar, Bahrain, Jordan, Morocco, and Libya. AYCM Qatar has emerged among the leading NGOs in the field, being active in Qatar and the Arab world.

The Arab Youth Climate Movement has also shown how to get nonprofit youth groups to debate climate action in the Arab world. In the future, we can expect environmental youth mobilization in the Middle East and North Africa to intensify, as ecological challenges increase alongside constrained development choices, increasing population growth, and resource scarcity.

The Arab Youth Climate Movement has also shown how to get nonprofit youth groups to debate climate action in the Arab world. In the future, we can expect environmental youth mobilization in the Middle East and North Africa to intensify, as ecological challenges increase alongside constrained development choices, increasing population growth, and resource scarcity. Modes of environmental activism will continue to evolve, drawing on the actors, discourses, tactics, and forms of engagement already prevalent in the region.

The Arab Youth gathered in Qatar in November 2012 to band together to ensure that climate change issues are brought to the mainstream and that the environment is protected and accessible to our future generations. Since then, the scope has evolved to ensure that we're advocating in protecting the natural and human environment in the Arab world and making a greater call for climate action. Our purpose remains unchanged: to bring young people together to speak for nature and future generations right to enjoy it.

We further endeavor to create a shared vision for a sustained ecological future for the Arab world. Continuing to advocate for behavioral and policy change through sustained grassroots campaigns, policy briefings, and reports will help in developing holistic educational programs to raise awareness about the climate crisis. We will work through green entrepreneurship to engage youth in cocreating solutions to our local environ-

Figure 6 – Arab Youth Climate Movement Qatar calling young people to join the movement for climate action in Doha, Qatar, 2017.

mental problems. Finally, we will keep building local and international partnerships to expand knowledge.

Recently, as Arab Youth Climate Movement Qatar executive director, Neeshad was included on the list of 100 Most Influential People in Climate Policy by Apolitical, representing the only youth from the Arab world to be included in this high-profile list. Those recognized include high-level advocates whose work is indispensable to raising awareness and demanding change. Others are rising stars who are making their mark in local communities and are a driving force behind governmental progress. This represents an important step and recognition moving forward for Arab youth.

We have no time to waste in coming together for new ideas and solutions for our climate and environmental crisis, which is why the Arab Youth Climate Movement is bringing young people together to build the most powerful and effective environmental movement the Arab world has ever seen.

We amplify the power of our youth and supporters as a voice for everyone's right to a healthy and sustainable world. Because we all breathe the same air and share the same land. For more information on AYCM Qatar, visit www.aycmqatar.org. IJW

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Figure 7 – AYCM Qatar participants at the NYC Youth Climate Summit

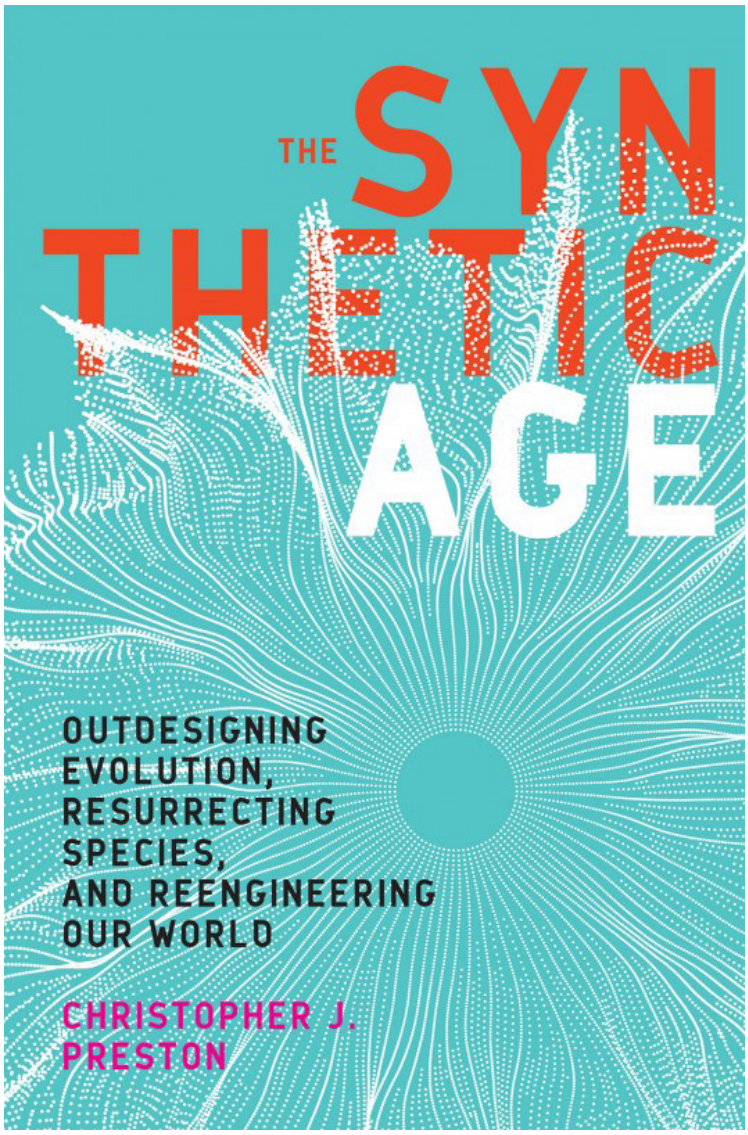
Tiger in Ranthambore National Park, India. **Photo credit** © Annie Spratt

Book Review:

Patrick Kelly, Media and Book Review Editor.

THE SYNTHETIC AGE: OUTDESIGNING EVOLUTION, RESURRECTING SPECIES, AND REENGINEERING OUR WORLD

by Christopher J. Preston. 2018. MIT Press. 224 pp. $15.95 CAD/USD (pb).



In *The Synthetic Age*, philosopher and ethicist Christopher Preston offers readers a glimpse into a rapidly approaching future of unprecedented human control, design, and manipulation of our planet and its natural processes. Preston introduces us to a dizzying array of emerging technologies that promise to fundamentally remake and reorder the natural world. As we leave the Holocene epoch behind and enter the Synthetic Age, the distinction between the artificial and the natural is set to vanish entirely. Preston urges us to recognize that by endeavoring to intentionally remake and reshape the biosphere, we threaten to upend the core assumptions that ground our moral relationship to the natural world. At this pivotal moment of unprecedented transition, we are asked to take a step back and carefully consider how far we ought to go in remaking the Earth.

The book proceeds through 11 well-researched chapters, with each devoted to explaining one of several new technologies and accompanying ideologies poised to subsume the biosphere under the technosphere. Detailing advances in nanotechnology, synthetic biology, de-extinction, and climate engineering, Preston paints a vivid picture of a not-so-distant future that is both awe inspiring and deeply unsettling. In terms of implications for wilderness management, Preston's exploration of ecosystem engineering (Chapter 5) is most directly germane.

After first recounting familiar critiques of the wilderness idea (i.e the pristine myth and the privileging of untouched nature), Preston details a new strain of environmentalism that rejects both the moral and practical relevance of wilderness and wildness in the 21st century. If, as thinkers such as Emma Marris claim, untouched, wild nature no longer exists, then environmentalism has to be "less about *preserving* and more about *shaping*" the natural world, including those areas protected as wilderness (p. 70).

This pushback against the wilderness idea in favor of active management has been well documented by previous authors. What makes Preston's exploration unique is the context within which he discusses it. While detailing a host of technological advancements, Preston is careful to point out that each may have potentially powerful conservation applications that include wilderness management. As a staunch supporter of the wilderness idea, I was surprised to find myself tempted when the prospect of rescuing bull trout or whitebark pine from climate change (via genetic alteration) was dangled before me. While I stopped far short of endorsing such a thing, especially within wilderness, I was forced into the uncomfortable position of trying to balance my deep concern for struggling species with my strong valuation of wild, untrammeled landscapes.

What kinds of new technological tools, if any, will wilderness managers opt for when facing down the one-two punch of an extinction crisis and climate change? Does it make sense to continue with an uncompromising, hands-off approach to wilderness? These are admittedly heretical questions. However, the strength of Preston's book rests precisely in getting us to ask these kinds of questions. He does so not as a provocateur simply looking to ruffle feathers but rather as someone clearly concerned about a coming future where our most cherished environmental values will be seriously challenged. Rather than be left scrambling to find our ethical bearings in a world changing at lightning speed, Preston's book offers us a chance to stop, think, and hopefully decide what sort of future we desire. IJW

Reviewed by **PATRICK KELLY,** IJW media and book review editor; email: patrick1kelly@umconnect.umt.edu.

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