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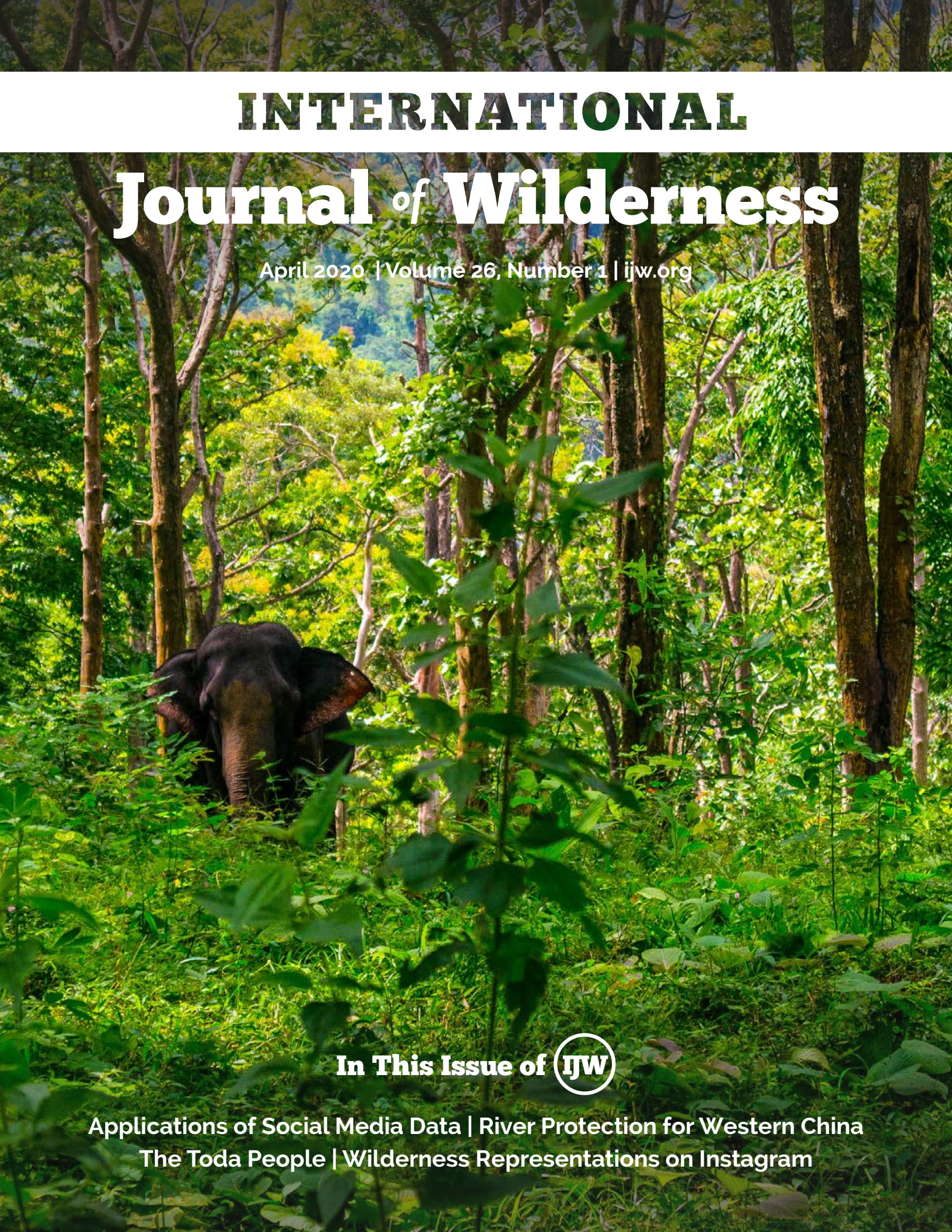

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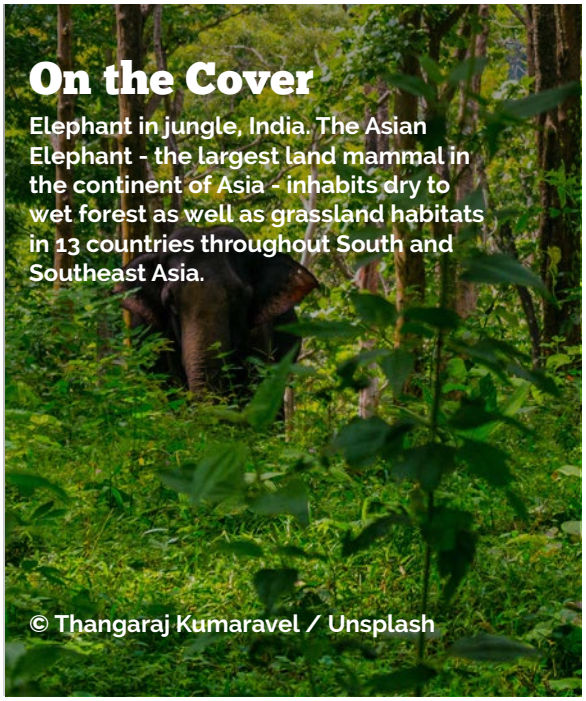

On the Cover

Elephant in jungle, India. The Asian Elephant - the largest land mammal in the continent of Asia - inhabits dry to wet forest as well as grassland habitats in 13 countries throughout South and Southeast Asia.

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MANUSCRIPTS TO: Robert Dvorak, Dept. of Recreation, Parks and Leisure Services, Central Michigan University, Room 108 Finch Hall, Mount Pleasant, MI 48859; Telephone: (989) 774-7269. E-mail: dvora1rg@cmich.edu.

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EDITORIAL PERSPECTIVES

Of Global Concern: Reliance upon Resilience

by ROBERT DVORAK

Robert Dvorak

With the beginning of 2020, we move into a new decade for global conservation and wilderness protection. Each year brings the opportunity to revitalize efforts to grow a constituency that advocates for the preservation of vital global resources. For such a constituency to exist and thrive, it is crucial that we address those incidents and events that occur on a scale that warrant the world taking notice.

Recently, we saw the conclusion of 240 days of bushfires in New South Wales, Australia. As these fires burned in late 2019 through early 2020, more than 18 million acres were affected. Professor Chris Dickman from the University of Sydney has conservatively estimated that 800 million animals were killed in these bushfires, with a national impact to more than 1 billion animals (University of Sydney 2020). These events certainly made the world take notice. From Instagram photos and Twitter posts of injured koalas, to media coverage and GoFundMe fund-raising efforts, citizens across the globe focused their attention on New South Wales.

"There is no argument that the Australia bushfires are of global concern, but what may be of more concern is the lack of a greater resonance across the globe. If nature can no longer react and response to threats, then nature must rely upon us."

Many indicators and drivers can be identified to help understand the scale and magnitude of the Australia bushfires. Habitat fragmentation across Australia has weakened ecosystems and natural processes. Invasive species have outcompeted endemic species and threaten biodiversity. And global climate change has fundamentally altered how Australian landscapes and its species can resist, respond to, and recover from such events. But what may be most concerning is whether we have reached a critical tipping point where we can no longer rely upon the resilience of nature. Previously, ecosystem adaptation, resistance, and resilience buffered natural fires, droughts, and other events. However, that is not the reality of our ecosystems today. Human manipulation and modification now fundamentality influence how nature can react.

There is no argument that the Australia bushfires are of global concern, but what may be of more concern is the lack of a greater resonance across the globe. If nature can no longer react and respond to threats, then nature must rely upon us. Just as nature can be resilient, so too can we as advocates for global conservation and preservation. We must adapt to change, resist and overcome challenges, and be resilient in the face of adversity. We must seize upon the attention and global concern over events such as the Australia bushfires to further make the argument that responses to climate change and ecological threats need to happen now. Because we can no longer rely upon nature's resilience or wait until another decade passes to act.

In this issue of IJW, we explore the influence of trails on wilderness perceptions. Tarun Chhabra examines the Toda people as stewards of wilderness and biodiversity. Dani Dagan, Ryan Sharp, Matthew Brownlee, and Emily Wilkins investigate the uses of social media data in remote wilderness settings. And Kathryn Sutcliffe discusses the implications of Instagram representations for wilderness management. IJW

ROBERT DVORAK is editor in chief of IJW and professor in the Department of Recreation, Parks, and Leisure Services Administration at Central Michigan University; email: dvora1rg@cmich.edu.

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Reflections and clarity in the Sierra Nevadas. **Photo credit** © Brian Peterson

Wilderness Trails: Influences of Perceptions

by BRIAN PETERSON

Brian Peterson

Trails don't have a voice, but they tell numerous stories as they guide recreationists through wilderness. But, trails may influence unrealistic wilderness perceptions and may decrease autonomy, which could affect wilderness values. The purpose of this article is to draw attention to the effect trail usage may have on recreationists' wilderness perspectives and to explore how these perspectives may affect perceptions of autonomy, and possible relations to societal benefits.

This inquiry developed while conducting research to investigate how trail conditions along the Appalachian Trail (AT) affected experiences of long-distance hikers (Peterson, Brownlee, and Marion 2018). Although that research was insightful about relationships between trail conditions and experiential elements, it didn't investigate how trails affected recreationists' wilderness perspectives. Of specific interest were the following questions: How do trails shape recreationists' experiences? How do trails

"Wilderness areas may not be perfect, and there may be some rules, but without a doubt they benefit society, and it is imperative that society can access those benefits. Trails are a perfect guide leading people to those benefits."

affect the "unconfined" values of wilderness? And how do trails affect perceptions of autonomy?

To gain an understanding into the complexities of these questions I investigated my perceptions of on-trail backpacking versus off-trail backpacking during an extended trip in the Sierra Nevada mountain range in California. This area is home to Yosemite National Park, Kings Canyon National Park, Sequoia National Park, Devils Postpile National Monument, and 20 designated wilderness areas. Elevations range from 1,360 feet (415 m) to 14,494 (4,418 m) feet at the top of Mount Whitney, the highest peak in the contiguous United States (National Park Service 2018).

The Trip

One year after conducting research along the AT, I engaged in a personal trek in which I backpacked from Yosemite National Park to Kings Canyon National Park. Before this trip, all of my backpacking experiences had been on trails. My goals were to stay within federally designated wilderness, primarily travel away from trails (where permitted and appropriate), and to also use trails at irregular intervals to see how they influenced my experiences. By backpacking both on trails and off trails within the same trip I would be able to immediately make comparisons of my experiences.

My route covered about 200 (322 km) miles with approximately 150 miles (241 km) of off-trail backpacking. The 50 miles (80 km) of trails were sprinkled into my itinerary at sporadic intervals. For the entirety of the 200 miles I navigated using maps and a compass. I carried a GPS unit but never used it. It was important to not use the GPS unit as a constant guide in

Figure 1 - Protected areas of the Sierra Nevadas, California. Image by Brian Peterson.

Figure 2 - Not a soul in sight. Photo by Brian Peterson.

which I would follow a digital trail. I wanted to immerse myself into off-trail backpacking to understand on-trail backpacking. I felt that the contrasting experiences of hiking on trails and off trails would help me understand how trails influence my perceptions.

The following sections describe significant experiences and perceptions I had while backpacking on trails and off trails. These experiences and perceptions are then discussed in relation to autonomy. Autonomy is seen in actions that are freely undertaken. These actions don't feel pressured by external forces and are rationally endorsed by the individual (Deci and Ryan 2013).

Figure 3 - Feeling unconfined above the tree line. Photo by Brian Peterson.

Perspectives

As the trip approached, I could feel anxiety pulsating through my blood any time I thought about backpacking off trail. This wasn't a small step into off-trail backpacking, I was leaping into 150 miles (80 km) of off-trail backpacking. Naturally my pretrip cognitions were in overdrive. I had never felt these sensations when an on-trail backpacking trip was due soon to commence. Going backpacking off trail already felt like going into the unknown. I assumed that off-trail backpacking would be harder, deliver more solitude, and affect a multitude of my wilderness perceptions. Thank goodness we are lucky enough to have places to do this, a place where I could conduct a personal study to understand my perceptions of on trail versus off trail. Once the trip was under way, I noticed immediate differences.

After miles of slogging off trail, there was a noticeable shift in my experience when I cruised on trail. Trails provide easier passage not nearly as frustrating as backpacking off trail. Backpacking off trail is an extremely tedious task, especially when it involves backpacking 150 miles (80 km) through terrain with constant obstacles such as boulders, trees, bushes, and dangerous river crossings. Each step of backpacking off trail required immense focus, which was extremely exhausting both physically and mentally. This high level of challenge and the required focus exhausted my mental state and prevented me from fully enjoying the surrounding wilderness. I felt that my mind was constantly depleted due to the mental focus needed to traverse technical off-trail terrain. My mental exhaustion was further exacerbated because of the cognitive energy needed to navigate with maps and a compass. The combination of these two took a lot out of me mentally. Using a GPS would have certainly made things easier, but it wouldn't have been as pure a personal study had I followed a digital trail. In comparison, backpacking on trail felt glorious, providing less resistance, allowing more time to look around, and my sense of belonging felt heightened because I wasn't as drained. Trails grounded me by showing me that I was exactly where I wanted to be while being able to enjoy the wilderness surroundings.

On-trail backpacking was less exhausting. I found that my mind was more receptive to awe-inspiring experiences because it wasn't constantly fatigued. When I was exhausted, I felt confined and less autonomous, and instead of feeling like I was freely making choices, I instead felt confined. This exhausted and confined mental state was certainly a bit at odds with the unconfined aspect of wilderness values. For example, I noticed that at beautiful on-trail vistas there was a harmonious camaraderie amongst hikers reveling in awe. People were happy, conversational, and amiable. In contrast, while backpacking off trail my mind felt

Figure 4 - Learning from wilderness wisdom. Photo by Brian Peterson.

unreceptive to awe; I was just too exhausted to process my surroundings. Oddly, while off trail I took less advantage of the enjoyment of vistas. I became more focused on getting myself recovered for the next few miles instead of absorbing the benefits of wilderness.

Although on-trail backpacking felt less confining because the same level of exhaustion wasn't a factor, my autonomy concurrently also felt diminished. This was an interesting conflict: exhaustion wasn't confining my mind while on trail, yet trails had aspects too that made me feel less autonomous. While on trail I felt like I had lost my off-trail freedom; I felt my freedom of choice was gone. Until these off-trail experiences, I had never thought about how uncompromising trails are: trails told me exactly where to go! While backpacking on trails, I no longer could creatively choose where to go, as I was now confined to a narrow corridor. This recognition immediately affected my perceptions of autonomy.

It soon became apparent that this personal investigation of trail perceptions

had more complexity than what I had anticipated: trails boosted my autonomy (less mental fatigue) while simultaneously diminishing my autonomy (trails uncompromisingly told me where to go). This complexity prompted me to compare the magnitude of these factors. When I had less mental exhaustion, my autonomy felt high. When trails told me where to go, I barely noticed any effect on my autonomy. I wondered – why did this differential matter? It seemed to me that trails are a normalized attribute of wilderness, and most wilderness users rationally endorse using them and thus don't notice any diminishment in autonomy. Thus far, I had analyzed mental exhaustion, and the uncompromising nature of trails. But I felt that I was missing connections between trails and societal effects.

I was surprised to find that trails boosted social relations. Happy groups of people at vistas appeared connected and were enjoying being around others – a satisfaction that trails provided access to. The more I thought about it, the more I concluded that it seemed people didn't care at all about trails telling them where to go. Trails are so normalized that the slight extrinsic factor of being guided to locations didn't appear to matter. And as groups at vistas showed me, having a connection to others felt good. However, on the contrary, I was surprised to find that I had become sensitive toward crowded conditions while backpacking on trail. After trekking for miles off trail without seeing another person, the social conditions of backpacking on trail felt overwhelming. I was surprised to feel crowded! Rarely in the past had I felt crowded while backpacking on trail. My on-trail experiences were additionally devalued thanks to my off-trail experiences. I was now seeing trailside impacts with a fresh set of eyes recalibrated from traveling off trail. But again I was feeling conflicted. Trails impressed me with their ability to boost social relations. Yet off-trail experiences retrained me to become pedantic toward crowding and trailside impacts. To understand how trails affected my wilderness perceptions, I continued along on my physical (and mental) trek.

My perceptions of safety were also different when I backpacked on trails. There I felt safer because I knew I was connected along a cleared path to services outside of the wilderness. To understand safety, I questioned why I liked to backpack. One of those answers was to get away from the comforts of society, and to cherish time away from societal pressures and influences. The ideal of being safe is great, but when I thought about it, it actually felt nice to introduce aspects of risk into my life – in fact it was invigorating. I recognized that I often put a lot of value in safety nets, but they can have a confining effect, diminishing

autonomy because I feel compelled to maintain proximity to them. Maybe safety nets make my life a bit too sanitized, maybe too comfortable and less wild. Maybe this perception of safety associated with trails had helped entice me in the past to backpack on trails, but it was actually a confining perception.

I was feeling as if I was trekking deeper into a mental off-trail zone where my maps and compass provided no navigational help. I put my focus into the history of wilderness. All trails have a historical component and were created for a reason. A trail I trekked along during this trip was the iconic John Muir Trail (JMT), which weaves through Yosemite National Park, Kings Canyon National Park, and Sequoia National Park. The JMT has roots in early exploration of the area and is now one of the most popular trails to backpack in the United States. During my trek I had hiked over Muir Pass, which is the location of the famous John Muir Hut, an emergency shelter at 11,955 feet (3,644 m). The Muir Hut is a beautiful octagonal granite dome that blends into the above-tree-line vast granite landscape. This shelter is also a popular location to take a hiking break that provides the opportunity to revel in the history emanating from the shelter. Within the shelter a historical plaque commemorating John Muir connects backpackers to Muir's conservation efforts that helped get the area designated as wilderness. The Muir Hut explicitly showed me that trails have a strong historical connection.

Figure 5 - A tributary flowing into a bigger river. Photo by Brian Peterson.

At the Muir Hut I enjoyed an immediate connection to John Muir and the many gracious others who contributed to making this area a designated wilderness. I was then prompted to recognize the arduous efforts so many people have made to ensure wilderness designations. The Muir Hut was humbling and richly reminded me how lucky I am to partake in my adventure of privileged exploration in a protected wilderness area. It also concretely signified that I am connected to others and to society.

Seeing the Muir Hut blend into the landscape along with feeling the historical component of wilderness shook up my perceptions of autonomy. Up until this point I had failed to make the connection between personal autonomy and social responsibility. Thanks to the Muir Hut I now realized that for the whole trip I had been unknowingly submerged in social responsibility and social values; they had just been blending into the landscape. After all, I had been hiking through socially constructed areas featuring socially constructed values without recognizing the historical component of trails and their societal benefit. Just as the Muir Hut had a plaque commemorating John Muir, wilderness trails are a plaque commemorating wilderness access, the benefits wilderness has to offer, and the efforts of countless people who have graciously contributed to wilderness areas. It became obvious to me that others had reveled in these areas, and that they wanted others to also have access to the benefits of wilderness. As I began to process the social aspects of these areas, my gratitude quickly rose up, and I felt astonished that others offered their assurance that (when willing) I could benefit from these areas as well.

Figure 6 - Entering the Muir Wilderness. Photo by Cory Schmelzer.

Figure 7 - The historic Muir Hut. Photo by Cory Schmelzer.

Journey's End

Perceptions shape how wilderness is viewed, and trails definitely are an influential factor. Trails told me where to go and made wilderness travel easier. However, trails minimized options of places to explore and reduced the possibility to creatively travel through the landscape. Trails often promote crowded conditions and can disengage people from tangibly understanding how frustrating wilder-

Figure 8 - Isolated lakes part of the greater system. Photo by Brian Peterson.

ness travel can be. But trails also taught me about social responsibility. Trails may slightly diminish my personal autonomy, but this is fine with me because it's for the greater good. Wilderness areas may not be perfect, and there may be some rules, but without a doubt they benefit society, and it is imperative that society can access those benefits. Trails are a perfect guide leading people to those benefits. The stories trails tell are not limited to ease of travel, guidance, and history. Trails provide access into wilderness resulting in a plethora of benefits for recreationists, which extend to societal benefits. These benefits are a significant part of the core reason why wilderness areas exist. Wilderness areas are a social responsibility and trails are the linkage to the benefits wilderness holds.

Returning home from my trip, I nostalgically thought about the new stories that trails had told me. Trails will always have a place in my heart. Depending on what type of experiential outcome I am seeking, I choose whether to use trails or to go off trail. Similarly, people enter wilderness with desired experiential outcomes, and typically those experiences involve trails. Most wilderness users seek to get to a destination by trails, and trails provide access to that experience. Using

trails feels satisfying because they are the means to achieving an experiential goal. And along the way people just may get a boost in social relations when a group falls silent to revel in awe. It is easy to find a picture on social media of someone in wilderness standing on a trail with a big smile. It is that awareness of other people's benefits that boosts my happiness, which leaves me wondering how far-reaching the benefits of wilderness are on society. It would be unfair if wilderness was trail-less, because these benefits would be too difficult for most to access. Trails do just that: provide access. As simplistic as that statement is, it is embedded with a network of connections and experiential outcomes that without trails would be too difficult to access, which contradicts the social responsibility of wilderness. Thanks to trails, I've now been influenced to see the social responsibility of wilderness. Once again, trails provided access. ijw

BRIAN PETERSON is a project coordinator and doctoral research assistant in the Park Solutions Lab at Clemson University; email: bpeter6@g.clemson.edu.

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A remote Toda hamlet, Kwehh(r)shy. **Photo credit** © Tarun Chhabra.

STEWARDSHIP

The Toda People: Stewards of Wilderness and Biodiversity

by TARUN CHHABRA

Tarun Chhabra
Photo by MC Tobias

The Todas are the oldest inhabitants of the Upper Nilgiris plateau in south India, having lived there since ancient times. With their quaint barrel-vaulted temples and houses, their richly embellished cloaks, and their splendid long-horned buffalo, the Todas have fascinated the world ever since "civilization" stepped into the Nilgiris two centuries ago.

Both the Todas and their beloved breed of buffaloes are restricted to the Nilgiris. Their culture revolves around these herds, with each of the six grades of dairy-temple having its corresponding herd of sacred buffaloes. Only a man who has become a dairyman-priest, following the elaborate ordination ceremonies specific to each grade, may milk the corresponding grade of sacred buffaloes and, incorporating an array of rituals, process it into butter, buttermilk, curd, and clarified butter. Although they have been coerced to take up farming quite recently, these people are buffalo-herding pastoralists traditionally.

"At a period when humankind appears to be so disconnected with nature that they assume their species can survive without respecting other forms of life, it might be pertinent to see how a traditional Toda mind is trained to interact with nature."

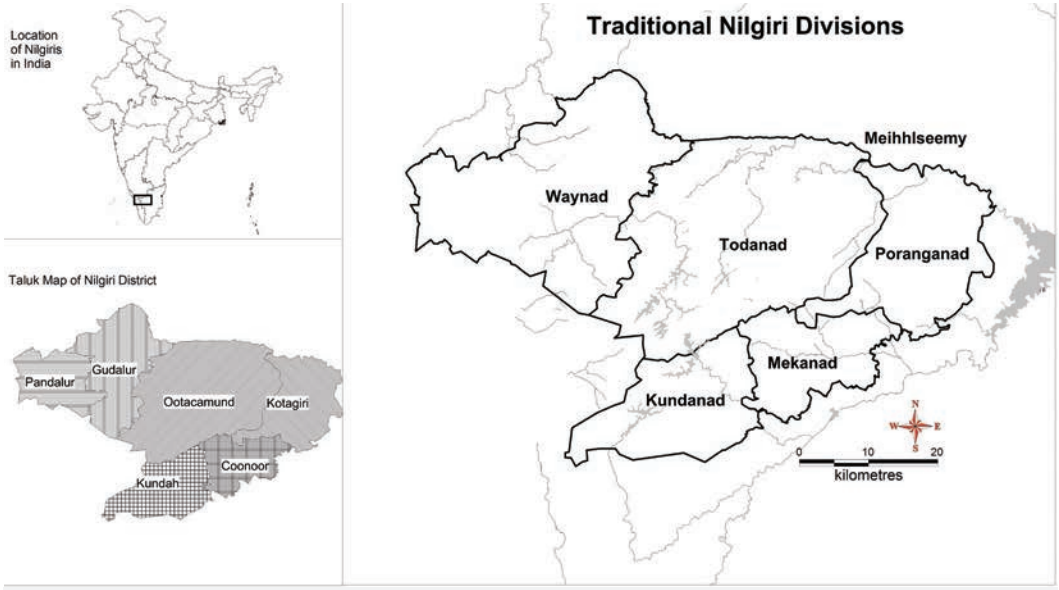

Figure 1 - Location of the Nilgiris in India. Photo by Tarun Chhabra.

Figure 2 - Dairyman-priest at temple. Photo by Tarun Chhabra.

The Todas are one of the very few indigenous cultures who chose to tread the path of vegetarianism. Undoubtedly, this has added a unique dimension to the way they relate to their natural surroundings. Their pastoral way of life, low population (1,450 orthodox community members), combined with their nonmartial, nonhunting, pacifist, and vegetarian lifestyle has surely played a significant role in ensuring the survival and prospering of the flora and fauna that surround their settlements. The Todas' intimate link with nature is one of the factors that has endowed the Nilgiris with such a high degree of biocultural diversity. It is a fine tribute to this people and to the values they espouse that their homeland in the Nilgiris has become the heart of India's first biosphere reserve.

Naturalistic People

At a period when humankind appears to be so disconnected with nature that they assume their species can survive without respecting other forms of life, it might be pertinent to see how a traditional Toda mind is trained to interact with nature. Not surprisingly, the Toda relationship with surrounding nature begins with their birth rituals. The neonate is a passive participant, but the mother is required to handle several specific plant species to validate the ritual activity. A few weeks thereafter, during the infant's naming ceremony, the grandfather uncovers the child's face outdoors for the first time, pointing out to the child various elements of the natural environment: the rising sun, the birds, the buffaloes, bodies of water, sacred rocks, hills, and so on. In all likelihood, the child will be named after one or another of these surrounding natural phenomena: for a girl, perhaps it will be a flower, a bird's feather, or a precious metal; for a boy, the name might incorporate the sacred name of a specific rock, water course, swamp, hill, or shola forest within the vicinity of the child's natal hamlet.

A Toda learns several regulations related to her/his sacred environment from an early age. For instance, there may be a flat rock at ground level along the path to their hamlet that they must scrupulously avoid treading upon every day. There are other pathways they know that only a priest may traverse. They come to understand that some freshwater sources are reserved for dairy-temple-related use only by the priest, others for the ordination rites of a priest-elect, some for drawing water specifically for the salt-pouring rites that occur periodically for the buffaloes, and yet others for cooking festive food during temple-related ceremonies. They discover that some plant species can only be handled by a dairyman-priest associated with a corresponding grade of temple, while others are meant only for certain sacred rituals. They know that after incurring the polluting effects associated with a funeral, they must not venture toward any sacred area in that landscape.

They are told that some peaks are the abodes of gods who are the ruling deities of their clan and that they must salute them with reverence. They know that any alteration in the ecosystem around a deity hill is an indication of profound sickness of the environment. They realize that the sacred rivers must be treated with reverence and should only be crossed in a state of ritual purity. They also come to know that there are some temple complexes of such sanctity that the entire ecosystem in its immediate vicinity is treated as inviolate. Beside the temple, the surrounding thicket, grassland, waters, flora, specific rocks, pathways, buffalo pens, hills, and other landmarks are all considered sacred. One must approach such an area in a state of purity and walk barefoot. Even answering nature's call is prohibited. Even today, sacred Toda areas maintain a healthy ecosystem and resultant microclimate, insulating them from extraneous effects such as those of global climate change. As an example, when we were searching for one of the rarest of endemic Nilgiri orchids, *Liparis biloba*, it was a pleasant surprise to rediscover it growing at a remote Toda hamlet, Kwehh(r)shy.

Before becoming a dairyman-priest, a man is informed of the rules associated with that

temple grade. He knows the specified thorny species that an ordained must collect on the day he becomes a priest, along with the bark of an exceptionally sacred tree that no lay Toda is allowed to handle. He has observed that fire is to be made only by friction, by twirling the sticks of another sacred tree, and this is used to light the temple lamp. The firewood used for the dairying and cooking activities within the temple is collected only from specified species. Even the kinds of plants used to sweep the sacred areas are stipulated. When he partakes of his sacred fare around the temple complex, specific leaf plates and a bamboo vessel are to be used. It is advantageous to have all such floral species available in close vicinity so that his valuable time is utilized in performing priestly duties. One of these might involve a specific rock on which he has to pour freshly drawn sacred milk. The list goes on. At every level, the connection with nature is inseparable for a Toda, and what is essential and sanctified must be protected.

The Toda relationship with nature continues until death, as all rites of passage entail the use of numerous species of flora that cannot be substituted. Therefore, it is expedient to have all these scores of species growing naturally around all hamlets so that the lifetime ceremonies may proceed unhindered. For example, the rituals of pregnancy and those for determining the paternity of a woman's offspring entail the use of the following plants: *waadr (Arundinaria wightiana var. hispida), kawkwehdd (Nothapodytes nimmoniana), peh(r)shk (Rhododendron arboreum subsp. nilagiricum), pell(zh)koddc mhill(zh)y (Rubus ellipticus), kwaddky (Myrsine wightiana), kaihh(r)sh (Syzygium densiflorum), pudhoorr (Sophora glauca), narrkh (Cymbopogon polyneuros), and paw(r)sh kwehdry (Pentapanax leschenaultii).*

Figure 3 - Drinking from special leaf cups at pregnancy rites. Photo by Tarun Chhabra.

It is worth mentioning that the pregnancy rites occur during the darkness of a new moon night and thus a long walk to a distant forest to collect the required plants is not practical.

The Todas produce marvels of architectural beauty and robustness. Among first societies of the world, the Toda people have been recognized as architects par excellence. It has been hypothesized that the Toda conical temples could represent the prototype of the *vimana* (the conical or pyramidal tower built on Indian temples, just above the sanctum) of ancient south Indian temples. Both their barrel-vaulted and conical structures can last for well over half a century, requiring only periodic rethatching (not a single nail is used).When they decide to rebuild a dairy-temple, only specific kinds of natural raw materials may be employed for building the barrel-vaulted and conical temples. This has meant not only protecting such vital resources but also understanding their unique properties. Thus, they understood that the thin *tef (Pseudoxytenanthera monadelpha)* bamboo has high tensile strength and used fresh bent bunches to give the structure its characteristic barrel-vaulted shape. Similarly, they realized the unique properties of the rare and endemic wetland grass, *avful (Eriochrysis rangacharii)*, and used it to thatch their dairy-temples. These structures can last for decades provided the occupant has lit the fire within the building regularly, thus exposing it to smoke. This causes the natural constituents to bind into a single cohesive unit, and it is observed that traditional structures emit minimal smoke into the atmosphere.

Figure 4 - Priest at Konawsh conical temple. Photo by Tarun Chhabra.

Figure 5 - Lashing bunches of tef. Photo by Tarun Chhabra.

Since the natural materials used in the construction of dairy-temples cannot be substituted, the Todas learned how to maintain them. The rattan ties used to bind each layer of the roof to its higher zone are conserved by allowing the

mother plants to regenerate before being harvested next, and the thatch grass is propagated by understanding its resistance to fire, and thus ritually firing the wetland periodically to allow this vital species to regenerate rapidly. Ever since this activity has been proscribed by the government, this grass that is endemic to only the western Upper Nilgiris, has become endangered, and the Todas now have to journey to distant corners of the plateau searching for it. If it disappears in the future, not only will they be unable to thatch their temples, but a vital grass species will become extinct. A study that was commissioned to determine the causes for decline of this species found that firing of such wetlands, that were unlikely to catch fire naturally, greatly reduced the number of competing genera, especially forbs, which tend to dominate in disturbed swamps (Chhabra, Mohandass, and Puyravaud 2002). Ironically, it also showed that the more disturbed swamps had the highest levels of biodiversity, with more than 70 different species present in some bogs. But in this case, the increase in diversity did not indicate a better health of the wetland but rather the converse. The problem has been compounded by the planting of exotic trees such as eucalypts and wattle from Australia on adjacent hillsides.

Since the Todas have proven botanical and ecosystem management skills, it seems apparent that sound environmental policies for the Nilgiris should rest at least partly on Toda traditional ecological knowledge. The Convention on Biological Diversity, to which India is a signatory, specifically declares in Article 8: "respect, preserve and maintain the knowledge, innovations and practices of indigenous communities."

For example, when a study on *avful* was initiated, flowering specimens were sent to an expert in the Royal Botanic Gardens at Kew for necessary identification. Todas, on the other hand, can readily distinguish specimens from other similar-looking species even at a distance, whatever may be the phenological condition. Therefore, traditional Toda plant taxonomy clearly does not require plants to be in a flowering condition for identification. Elders can identify and name close to 400 floral species in the hinterland.

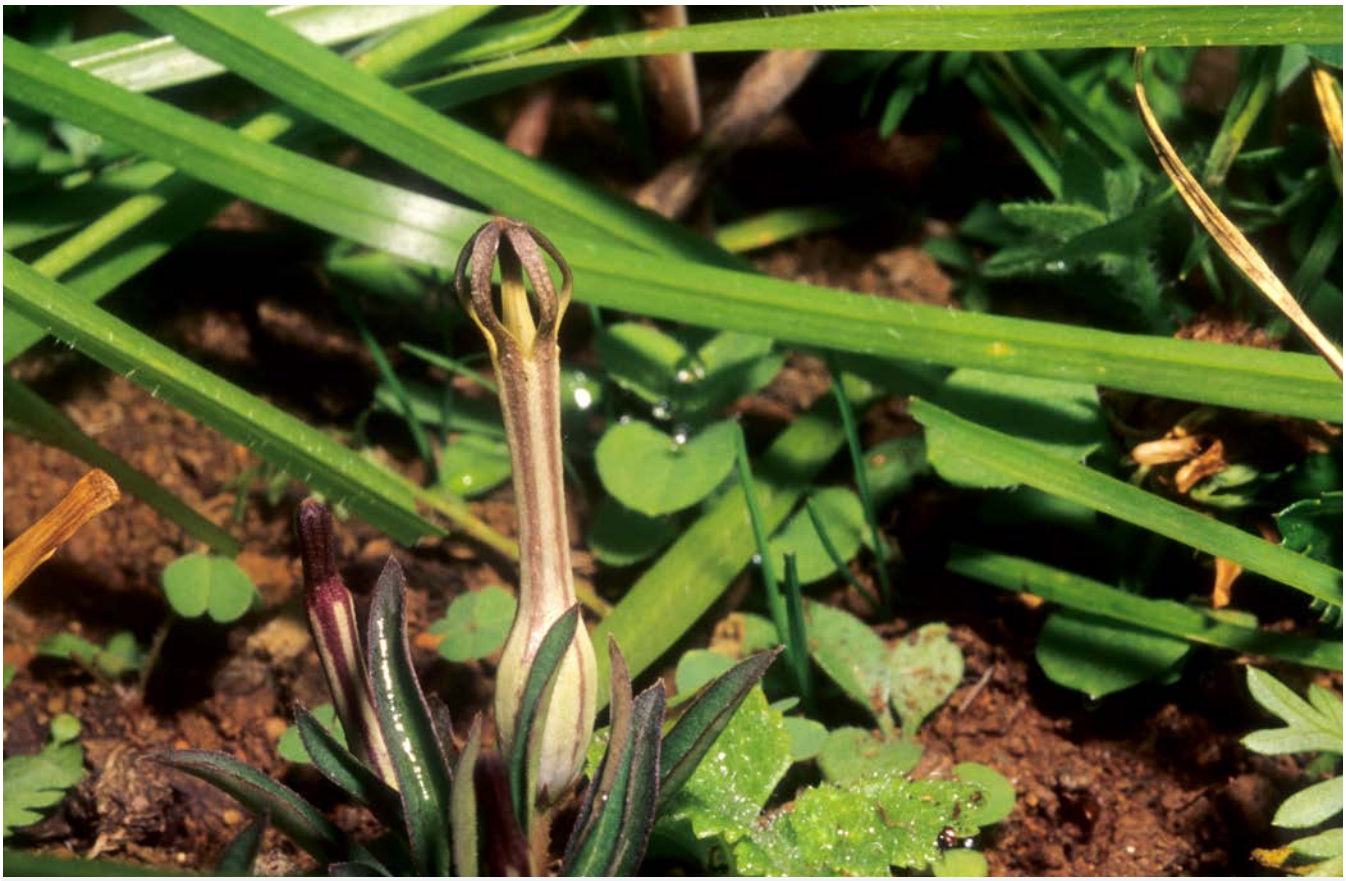

Figure 6 - The churning-stick flower. Photo by Tarun Chhabra.

Sacred Nature as Inspiration

The Todas have used nature as inspiration for their daily life. Their barrel-vaulted houses and temples are said to have been inspired by the shape of the unusual miniature rainbows seen here, their buffalo pens by the circular pattern of a clump of *eihhmehr* bushes *(Gaultheria fragrantissima)*, and even their unique cane milk-churning stick is modeled on the *kafehll(zh)* flower *(Ceropegia pusilla)* that has an uncanny resemblance to a miniature churn stick. They also recognize a flower called *arkilpoof*, the "worry flower" *(Gentiana pedicellata)*, which can indicate a person's anxiety level. If this flower is held by the stem, it closes only if one has worries, faster for more anxious people.

Todas have used flowers to denote not only the season of the year, but every stage of it. For example, they can predict the impending end of the southwesterly monsoon by the mass flowering in the shola forests of the fragrant white *maw(r)sh* flowers *(Michelia nilagirica)*. Similarly, all the different seasons are indicated by the flowering cycles of different plants, certain of them being linked to climatic conditions and the position of heavenly bodies. For example, there is a single name for the most prominent star/planet in the night at a particular period, an herb that is in flower at that time, and the weather of that season.

The Three Ancient Links with Nature

Since ancient times, three irrevocable bonds have linked Todas to their natural environment. The first of these was established when the Toda gods – deified men and women – chose to reside in certain prominent Nilgiri peaks, ever afterward furnishing Todas with potent reminders of the unity of nature and divinity. During those early times, it is said, gods and Todas lived side by side. Natural landmarks still exist that are associated with divine exploits, testimonies to their life stories that Todas even now remember. These deities, after their time in human form, went on to occupy various hill summits where they are believed to reside. In addition, there are numerous other sacred hills that are of paramount importance to specific clans and hamlets, and their sacred prayer names are chanted by the priest regularly. Toda sacred hills lie at the very core of this people's cultural ethos, and they have assiduously protected them since ancient times.

The second great bond with nature is that instituted by the Todas' preeminent deity, Goddess Taihhki(r)shy, when she miraculously brought forth their unique breed of buffaloes, dividing the animals into secular and sacred herds. The goddess afterward also allocated *k̠wa(r)shm* (sacred names) to numerous natural phenomena amidst which the Todas live, and this, over a period of time, resulted in their sanctification. She thus established a sacred relationship with numerous aspects of surrounding nature, and gave them prayer names. Both the sacred buffaloes and the sanctification of nature went on to form the core of Toda cultural heritage.

Figure 7 - The hill deity Kawllvoy is believed to reside in this cliff. Photo by Tarun Chhabra.

For example, a Toda prayer consists of chant words addressed to major locally sacred and minor mountain gods, along with other natural landmarks, such as nearby peaks, slopes, valleys, ridges, and shola thickets, as well as specific sacred trees, rocks, swamps, meadows, pools, and streams. There are *kwa(r)shm* also for the dairy-temple, buffalo pen, pen posts, pen-post bars and other dairy-temple items. If we analyze Toda prayers, we find a corpus of sacred names for several hundred natural features, and if we map all the named features that have survived the ravages of the recent march of civilization, then we have one important aspect of Toda sacred geography in place.

Another aspect of Toda sacred geography is their waters. The two major river systems, Kawl-lykeen (Mukurti-Pykara) and Kinatthill(zh)y (Avalanche-Emerald), represent sacred entities on the same level as that of the deity peaks. There is also a smaller river known as Taihh-vahh, or "river of the gods."

As is also the case with the deity hills, mortal Todas do not consider themselves capable of enhancing the sanctity of the sacred rivers. They do, however, understand that the crossing of such holy rivers in a state of purity and in accordance with prescribed regulations can lead to their own spiritual uplifting. They take great care to ensure that these "deity rivers" are not defiled in any manner. To prevent such defilement, Todas have established several ritually acceptable crossing points all along the course of these waterways. These crossings are often associated with the myths that tell of the origins of these river systems. Different crossing points have differing levels of sanctity, and there used to be specified fords for different categories, priests and laypeople, and always on the premise of ritual purity.

Figure 8 - Taihb-wa(r)shy vah- a sacred crossing. Photo by Tarun Chhabra

Interestingly, even today, an Indian who is out on a pilgrimage of the sacred sites of ancient India often uses the term *teertha-yaatra* for this journey. Few might be aware that the word *teertha* in Sanskrit is literally, "crossing place"

of a sacred river, and this is how it was in ancient days, a physical place to ford a sacred river. Over a period of time, however, this term came to denote not only other places of religious significance, but also to signify places of spiritual crossing. Besides, most of these holy places were flanked by sacred rivers anyway. The ancient Upanishad texts refer to this as a "crossing over" marking the soul's spiritual transformation from this world to the world of the Supreme, the world illuminated by light of knowledge (Eck 2012). When we look at various elements of Toda sacred geography and culture, we are continuously reminded of those early days of the Indian civilization.

There is another category of locally sacred waters that are streams, pools, and springs associated with specific hamlets and dairy-temples. These are numerous and the mainstay of Toda culture, in the sense that their heritage cannot exist without them. Although the larger Indian population is unaware that the bountiful water that flows downstream from the Nilgiri Hills, and upon which millions of lives depend, is largely due to the management and sanctity accorded to the catchment areas by the Toda people. Since ancient times, many of the river systems originating around the Toda heartland have been venerated by Todas as deities. Because of such reverence, these river systems have been protected, thus providing the surrounding plains and hills of three Indian states with their principal sources of fresh water. By according sacred status to several hundreds of smaller freshwater sources situated in the vicinity of each hamlet and associating several of these with their dairy-temples and rituals, the Toda people have ensured that the surrounding ecosystem – including the hydrology-conserving species of plants – has been preserved.

Todas commonly attribute the drying up of their sacred water sources to disturbances in the ecosystem; for example, of constructing reservoirs, establishing plantation trees and crops, and due to climatic changes. By according sacred status to several wetlands, from which they harvest culturally important plant species, the Todas have managed their swampland ecology remarkably well, employing a combination of ritualism and expediency.

The Todas' third great bond to nature may have begun when Goddess Taihhki(r)shy's father Aihhn, presiding deity of the Toda afterworld, proclaimed that the only Todas who would qualify to reside, after death, in his realm were those who, during their lifetimes, had diligently performed all the rites of passage required of their gender – rites involving the use of many different kinds of plant material. This, in one stroke, resulted in the sanctification and protection of well over a hundred plant species. We saw earlier that the rituals related to pregnancy and paternity entail the use of nine floral species. If one adds the essential plants used not only for lifetime ceremonies but also for other cultural purposes, including those to be used to construct dairy-temples, the list of protected species comes closer to 200.

Toda Management of Ecosystems

Until two centuries ago, the Todas people had complete control over the management of their sacred sites. The sites were maintained in a pristine condition, as proved by the establishment of the Nilgiri Biosphere Reserve (NBR) in 1986, and this area is considered to be the most important area for plant speciation in southern India. Thereafter, despite the establishment of protected reserve forests, national parks, and the NBR, the biodiversity of this sacred landscape has been steadily undermined. Vast stretches of pristine grasslands were planted with exotic trees brought in from Australia, the most biodiverse and water-generating wetlands were either farmed or flooded by hydroelectric reservoirs, and sholas (referred to as "living fossils") dating back to the time of the continental drift, were decimated.

The Toda people have ritualized the concept of ecosystem management, much as they have done to many facets of life. Until some decades ago, the priest of the highest grade of dairy-temple would usher in the onset of the frosty winter months by using firesticks to set fire to selected portions of grassland at the foot of deity hills. Although the process of selective burning of grasslands has been scientifically proven to be beneficial for the ecology, this ritual, as mentioned earlier, has been proscribed The Todas continue to make fire for other ritual purposes and perform a variety of other indirect ecosystem management practices.

Figure 9 - These pristine shola grassland ecotypes form the core of the NBR. Photo by Tarun Chhabra.

The most important among these are the salt-giving rites for the Todas' endemic breed of buffalo during different seasons. In addition to the utilitarian function of periodically providing salt to the buffaloes, this rite is so important that a failure to perform it is deemed an invitation to ecological ill-health. For example, the Todas believe that a failure to perform this ritual during the winter season would mean an absence of frost, resulting in a failure of the proper flowering cycle of some plants, thus making the impending honey and wild fruit season erratic.

Figure 10 - The salt-giving rites are a form of indirect ecosystem management. Photo by Tarun Chhabra.

A similar omission during summer is believed to result in the failure of the Southwest Monsoon, thus causing a shortage of pasture with resultant meager milk yields, along with a depletion of water.

Todas perform an annual pilgrimage to the deity hill Kawnttaihh where they pray to the major natural sacred sites in the vicinity for general and ecological well-being. It was on the slopes of this hill that the priest would ritually fire the grassland to herald the onset of winter. They also conduct a ceremony atop Paw(r)sh hill, where they pray for benediction and environmental health to the Kawllykeen (Pykara) river deity that flows just below.

Conclusion

The most noteworthy of Toda values are the imperative to treat their homeland as a sacred, worshipped entity and the requirement to act upon the deeply rooted belief in the myriad ways by which the community is linked to Mother Nature. In the clash of values brought about in the outside world with lucre and violence being all too common, it is the traditional value system of indigenous peoples such as the Todas that is most likely to take a back seat.

Even today, Todas meet with introspection, rather than anger and a desire for retaliation, the loss of a buffalo to a predatory tiger residing near their hamlets. Amazingly, they can accept their loss as being a kind of godsend. Not long ago a Toda council was held to discuss the issue of tigers straying into their hamlets. The opinion was that this was happening because Todas themselves were moving away from their heritage, and thus, the protector was becoming the aggressor.

A traditional Toda mind does not register his environment as just a series of natural sites. When

a Toda looks at certain hills, he sees them as the abodes of deities whose sacred names he has chanted. Indeed, when he looks at many a rock, or rock formation, tree, pathway, or body of water, they are seen as manifestations of divinity, integral parts of the sacred world of the hamlet, clan, and community.

When I first interacted with the Todas in the early 1990s, it appeared their culture was at a crossroads. The government had succeeded in making this buffalo-oriented community into unwilling farmers. Although that changeover now appears permanent, Todas have demonstrated remarkable alacrity in rebuilding long-abandoned dairy-temples and seasonal hamlets, often after a hiatus of several decades. Fortunately, the Toda value system remains strong, with these people continuing to hold on to many of their traditional ideals.

Modern developmental activities must recognize that all indigenous people have an ancient heritage, and that their value systems have evolved and endured over the centuries. Therefore, the need of the day is for holistic development that incorporates the traditional knowledge and value systems of such people, as well as the most important aspects of their traditional ways of life. For instance, if the government had promoted the age-old pastoral ways of the Todas rather than making them into reluctant farmers, these people would have continued with a vocation they love and at the same time drawn economic benefits from the traditional dairying activity that is most ecofriendly.

Since the Toda people are no more allowed to manage their sacred homeland, the best way of preserving this valuable legacy would be to declare these deity hills and their surrounding ecosystem as a Toda World Heritage Site and protect them accordingly.

TARUN CHHABRA is a dentist and founder of the Toda Nalavaazhvu Sangam (Toda Welfare Society) and the Edhkwehlynawd Botanical Refuge (EBR) Trust. The author of numerous articles, papers and chapters, his magnum opus is The Toda Landscape: Explorations in Cultural Ecology, Harvard University Press, 2015, Harvard Oriental Series, vol. 79. He has also discovered many new species of plants from the Nilgiris, including three wild balsams that were all given Toda-related nomenclature; e-mail: kwattein@bsnl.in.

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Super Cub

Upper Twin Lakes. Lake Clark National Park.

SCIENCE + RESEARCH

Social Media Data in Remote and Low-Use Backcountry Areas: Applications and Limitations

by DANI T. DAGAN, RYAN L. SHARP, MATTHEW T. J. BROWNLEE, and EMILY J. WILKINS

Dani T. Dagan

Ryan L. Sharp

Matthew T.J. Brownlee

Emily J. Wilkins

PEER REVIEWED

ABSTRACT

This article evaluates data from user-generated content related to two national parks in Alaska. One season of Twitter and Flickr posts was collected, coded for content, and mapped if geographic data was available. The dataset was assessed for quality and compared with information reported by commercial operators. Of 4,008 social media users who referenced the parks, 223 were on-site visitors and 144 visited the backcountry. Results suggested that social media overrepresented bear-viewing behaviors, and that spatial data was limited. Using social media data to understand low-use, remote backcountry settings can be useful, but more research is needed to understand limitations related to setting, media platform, and spatiotemporal scales.

Information about visitor use in parks and protected areas is an essential component of effective management (Cessford and Muhar 2003). Data about recreation users has long been recognized as important for several reasons, including the ability to manage budgets, personnel, protect resources, and to provide visitors with enjoyable experiences (Manning 2010). Useful visitor information for managers includes data

on visitor counts, type of visitor use (e.g., primary activity), timing of use (e.g., season), indicators and thresholds of quality, and rule compliance (Manning 2010; Marion, 2016; Cahill et al. 2018). Previous studies also indicate that it is beneficial for managers to understand characteristics of users, including activity type (Manning 2010). Activity type can influence visitors' temporal and spatial distributions, impacts on natural resources, or user conflicts (Jacob and Schreyer 1980; Kyle, Graefe, Manning, and Bacon 2003).

Commonly used methods for collecting this data include infrared sensors and cameras, on-site observations, permit systems, and questionnaires (Cessford and Muhar 2003; Manning 2010). These methods can be costly, in both monetary and human capital resources (Fay et al. 2010). Questionnaires are commonly used to understand park visitors, including their demographics, behaviors, normative standards for natural or social conditions, values, and satisfaction (Vaske 2008). However, surveys are expensive to conduct, especially in remote areas, and while on-site survey response rates for specific stakeholder groups remain relatively high, survey response rates are declining broadly (Vaske 2008), so there is a need to better understand alternative or supplemental methods to collect data on visitor use.

In the United States, remote areas comprise both backcountry and federally designated wilderness. Federally designated wilderness is a legal classification in the United States that refers to a high level of protection of biophysical and social resources (Hendee and Dawson 2002). The US National Park Service (NPS) uses the term "backcountry" to refer generically to "primitive" or "undeveloped" areas (NPS 1991). While all designated wilderness is considered backcountry, not all backcountry is designated wilderness. Visitor use monitoring in backcountry and wilderness is uniquely challenging, especially in terms of cost (Hollenhorst et al. 1992). For example, without a concentrated area of visitor use, a location through which all or most visitors pass, or a permit system, survey distribution becomes extremely expensive. Fay et al. (2010) write that managers describe survey distribution in dispersed backcountry settings that receive little use as "cost-prohibitive," stating that combining multiple data sources can significantly improve the sample.

In light of these challenges, researchers have begun investigating methods for utilizing user-generated online content, such as social media posts, to assess visitor use in parks and protected areas (e.g., Sessions et al. 2016; Fisher et al. 2018; Levin, Lechner, and Brown 2017; Mancini et al. 2018; Hausman et al. 2018; Hamstead et al. 2018; Tenkanen et al. 2017).

Social Media Studies

Social scientists began exploring online data sources as early as 1997, with the emergence of web blogs (Khang et al. 2012). By 2007, geographers were utilizing web data to understand populations on a landscape scale and coined the term "volunteered geographic information" (VGI) (Goodchild 2007). Studies using VGI have utilized a range of internet sources (e.g., Twitter, OpenStreetMap, Strava fitness mobile app) to address a variety of social and natural research topics, fitness activities, urban planning, natural disaster relief, and more (Arapostathis et al. 2018;

Haworth and Bruce 2015; Griffin and Jiao 2015). Recently, researchers have begun applying these concepts to visitor use in parks and protected areas, albeit less commonly in backcountry or wilderness settings. NPS planners have considered volunteered geographic information, specifically mobile fitness tracker data, when identifying visitor capacity (NPS 2018a).

An early application of social media data for visitor use research by Wood and colleagues (2013) evaluated Flickr data from tourism sites globally and determined that it could serve as a proxy for visitation. Several studies have since used social media data to identify geographic hotspots for cultural ecosystem services by using shared photos to map areas of value and identify salient characteristics of these areas across landscape scales (e.g., Pastur et al. 2016; Richards and Friess 2015; van Zanten et al. 2016), and on finer scales (e.g., Tenerelli et al. 2016). Others have used photos and Twitter to understand how travel patterns (e.g., Chua, et al. 2016; Heikinheimo et al. 2017). However, few studies have utilized social media data to analyze recreation use by activity type to understand visitor behaviors, as opposed to their preferences or locations.

Wood and colleagues (2013) describe possible limitations to using social media data in the context of parks and protected areas, including possible biases because certain activities are more photogenic or easy to photograph, due to perceived value affecting posting behavior, or because local visitors may be less inclined to share their experience online. Users may be tailoring shared content on social media to elicit a positive response from social media followers, which may influence the data (Boley et al. 2018). Biases and limitations to user-generated data have indeed been demonstrated. Tweets and other VGI data sources have been shown to have an urban bias (Hecht and Stephens 2014). Additionally, social media is not used equally by all demographics. In Kruger National Park, Hausmann et al. (2018) asked visitors about their social media use. They found that older and higher-income tourists were less likely to use social media, and that Flickr photos showed more biodiversity relative to Instagram, which showed more photos of people.

Previous studies were primarily conducted in urban-proximate areas, relatively densely used areas, or conservation areas with cellular signal (e.g., Heikinhemo et al. 2017; Hamstead et al. 2018; Fisher et al. 2018; Hausmann et al. 2018), while fewer studies were conducted in more remote or sparsely used areas or on a fine spatiotemporal scale. Tenkanen et al. (2017) compared social media data and official park visitation statistics in national parks in Finland and South Africa and showed that while social media was a good proxy for visitation in heavily populated parks, it may underestimate popularity of less-visited parks. Mancini et al. (2018) analyzed spatial data from the relatively low-visitation Cairngorms National Park in Scotland but used six years of data. Similarly, Walden-Schreiner and colleagues (2018b) evaluated geotagged Flickr photos in low-use protected areas and on a site-specific scale but included seven years of data. This manuscript assesses the usefulness of these data by applying similar methods in a sparsely visited backcountry and wilderness setting, and in both fine spatial and temporal scales.

Specifically, this study aims to:

1. Understand to what degree social media users who share content related to the parks are in-person visitors

2. Examine whether social media data can be used to understand the recreation activity type of on-site visitors on a site- and season-specific scale

3. Examine the limitations of using social media data to understand visitors, specifically whether it overrepresents certain populations of users

Methods

Study Area

Katmai and Lake Clark National Parks and Preserves (KATM and LACL), located in southwest Alaska, are two of the least-visited US National Parks. The two parks have a combined 8 million acres (33,000 km2), nearly three-quarters of which is federally designated Wilderness (NPS 2016). All of LACL can be considered backcountry, while in KATM, the only area that is not considered backcountry is Brooks Camp, which is a relatively small area renowned for its brown bear viewing opportunities, and contains a visitor center, picnic area, and lodge. Brooks Camp is also well-known for its "bear cams," which livestream brown bears throughout their active season (Explore n.d.). Neither park is accessible by road and both are typically accessed by small fixed-wing aircrafts or boats. There is little to no cellular connectivity in the park, although some visitors who stay in backcountry lodges have access to WiFi. While the commercial use authorized (CUA) pilots and guides report data to the parks, there is currently no reservation system that the parks utilize to monitor backcountry use.

The National Park Service Southwest Alaska Inventory and Monitoring Network (SWAN) compiles data reported by CUAs for each park (SWAN 2018a, 2018b). CUA data can be useful for counting visitors and have been used in similar remote parks, such as Kenai Fjords National Park and Gates of the Arctic National Park and Preserve (Fay et al., 2010). According to these reports, visitor use days reported by CUAs to KATM fluctuated between 25,000 and 30,000 between 2008 and 2017, while the number of visitor use days reported to LACL grew from 4,000 days to more than 15,300 days during the same time period. The NPS, whose counting methods count visitors rather than use days and includes non-CUA visitors, reports 37,818 and 22,755 visitors in 2017 in KATM and LACL, respectively.

The KATM report shows that the area with the highest number of visitor use days is Brooks Camp, the only front country area in both parks. It also appears that the sum of visitor use days in the remaining areas in KATM approximates the number at Brooks Camp alone. Furthermore, because all of LACL is considered backcountry, when these parks are combined there are more backcountry visitor use days than front country days (SWAN 2018a, 2018b).

Visitor activities are also reported by SWAN (2018a, 2018b). For both parks, bear viewing and sport fishing were the most frequently reported activities by a significant margin. In Lake Clark, photography was also a very highly reported activity, although not as commonly reported as bear viewing or fishing.

Activities are not mutually exclusive. At both parks, bear viewing use has been increasing in recent years relative to sport fishing. In 2016, the most recent year of data reported, there were approximately 42% more bear viewing days than sport fishing days in LACL (~3,600 fishing; 5,100 bear viewing), while there were similar numbers of each reported at KATM.

Data Collection

Researchers commonly use Twitter, Flickr, and Instagram as social media data sources for a variety of reasons, including their popularity and ease of data access (Tenkanen et al. 2017). However, this study evaluated only Twitter and Flickr since Instagram limited their data access in 2018. Data from both platforms was collected using their respective application programming interfaces (API). Generally, an API provides a way for two platforms to communicate with one another; in this case, it allows a coder to access and specify information from the social media platform. Twitter data was collected through the Twitter API in real time between June 15, 2018, and October 24, 2018, which approximates the peak visitation season at both parks (SWAN 2018a, 2018b). Additionally, tweets continued to download for two months after peak season, until October 24, 2018, to account for a possible lag time between visiting and posting. All tweets were saved into a database in real time. The database includes tweet text, photo URLs, profile information, and geographic data.

Flickr data posted during the same time frame was collected through the Flickr API using Python. This script created a database with the unique photo identifier, user name, any caption text, tags, date and time the photo was taken, date and time it was posted, and geographic information if available. The Flickr API allows researchers to collect photos and corresponding metadata by specifying a time frame and bounding box, which is a geographic area defined by two latitudes and two longitudes (Hausmann et al 2018). Additionally, photos were queried by manually inputted tags (e.g., Mancini 2018).

Due to concerns that low overall visitation would result in too few posts for meaningful analysis, the initial data collection was executed with very liberal search queries in order to capture as many posts as possible. To evaluate data collection methods in remote areas with little-to-no cellular connectivity, this wide query "net" was combined with detailed cleaning and coding methods.

Both Twitter and Flickr posts were queried using key words and a geographic bounding box. If a post contained any individual keyword, or was geotagged within the bounding box, it was downloaded into a raw dataset. The bounding box includes a range of latitudes and longitudes that make up an imaginary rectangle on the map (e.g., Hausmann et al. 2018), and the one used in this study encompassed both KATM and LACL. For both Flickr and Twitter, the bounding box for geotags was set at [-156.713358, 57.681894, -153.00000, 61.586310]. Twitter keywords queried included park names as both regular post text and hashtags (searchable phrases beginning with #), account handles (Twitter account names beginning with @), and names of two key locations as both tweet text and hashtags. The resulting query list included "katmai," "#katmai," "lake clark,"

"#lakeclark," "hallo bay," "#hallobay," "proenneke's cabin," "#proennekescabin," "@katmainps," and "@lakeclarknps." However, queries related to these locations, Hallo Bay and Proenneke's Cabin, were later discarded because of low return upon initial examination of results, leaving queries for the park names as tweet text and hashtags, as well as the park account handles. Because users on Flickr cannot tag other accounts, and do not typically use hashtags, Flickr was queried for posts including tags "katmai" or "lake clark."

Data Cleaning and Analysis

Data was cleaned for duplicates, and each post was manually inspected to code for content (Richards and Friess 2015). Retweets and replies were removed from the dataset, and posts in a language that the reviewer did not understand were assessed using Google Translate and by inspecting media attachments. Each post was coded according to content using a visual inspection of both textual content and attached media, such as photos, videos, or links to external websites, and done by a person familiar with the area. Posts were coded as unrelated to the parks, nonvisit (posts about the parks but not indicating a visit; e.g., news stories), by location if the post was in Brooks Camp, or in an unclear location. Posts that were in backcountry and wilderness were coded by activity (Figure 1).

In order to limit bias resulting from a small number of active users, users' posts were evaluated collectively, but each user was coded only once. If they appeared to engage in both fishing and bear viewing, they were coded as engaging in both. If none of the user's posts indicated a bear viewing or fishing activity, it was coded as other (Table 1). In cases where the user shared content that fell into multiple categories, they were coded according to the activity closest to a

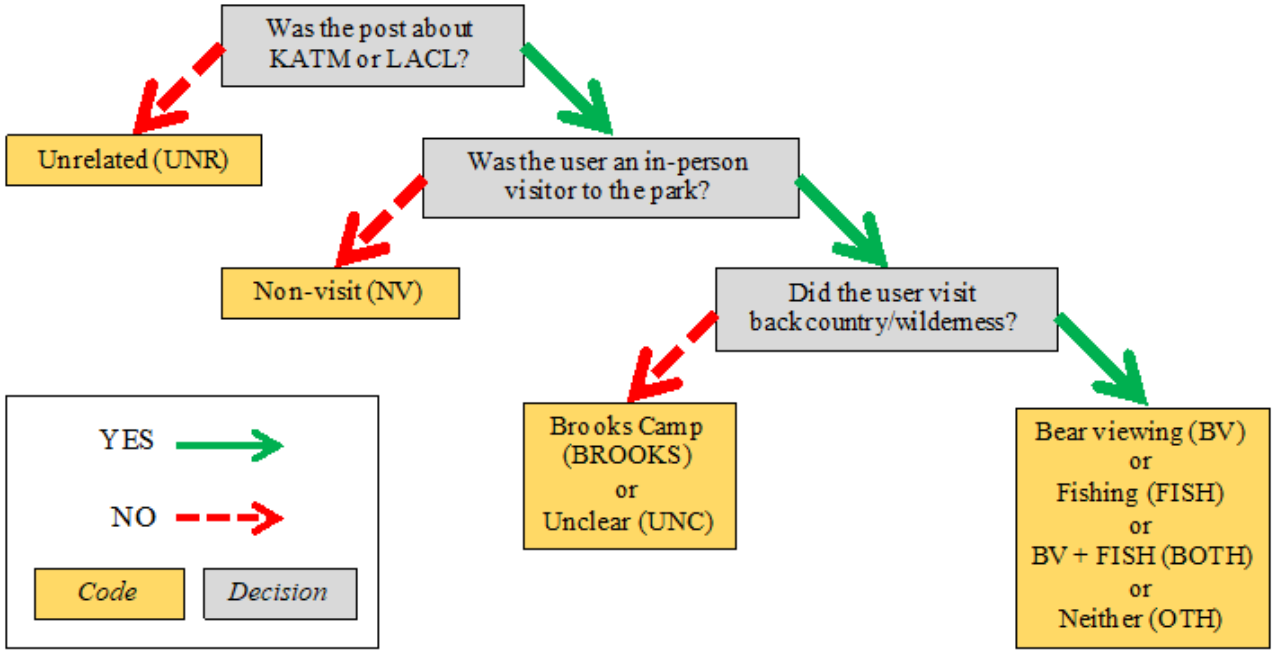

Figure 1 - Decision tree used to determine code for social media users through a visual inspection. Users' posts were evaluated collectively, and the user was coded according to the category furthest to the right in this table (for example, if a user shared nonvisit content and backcountry bear viewing, they were coded as bear viewing). Table 1 includes detailed descriptions of each decision point.

Was the post about KATM or LACL?	**Yes if at least one of the user's posts:** • refers to the at least one of the parks by name • refers to at least one location in the parks • refers to a commercial entity that operates exclusively in the parks **No if none of the above**
Was the user an in-person park visitor?	**Yes if at least one of the user's posts:** • specifies that the user was in a park or a specific park location **No if all of the user's posts fall into these categories, AND no posts qualify as "yes" using the criteria above:** • indicate that the user was watching KATM's bear cameras, include content watermarked with the explore.org name and logo (i.e., screenshots of KATM's bear cameras) • share a news story • discuss KATM's fat bear week contest, make reference to contentious current events (e.g., Pebble Mine controversy) • text suggests that post content belongs to another user (e.g., sharing a famous photographer's photo) • or if user account belongs to a news outlet, guide company, a park, a nonprofit, or similar organization
Did the user visit backcountry or wilderness?	**Yes if at least one of the user's posts:** • specifies that the user was at LACL • specifies that the use was in a specific backcountry location (including the coast, broadly) • includes both indication that they were in one or both parks AND content of a feature that does not exist at Brooks Camp (e.g., bears eating clams) in the same post **No if all of the user's posts include images or describe features that only exist at Brooks Camp (see below)**
Did the user visit Brooks Camp, or was their location in the park unclear?	**Brooks Camp if posts:** • include platforms, Brooks Falls, Brooks Lodge • include photo angles that can only be taken from Brooks platforms (i.e., photos taken from above a bear) **Unclear if posts:** • include content that indicate the user was in LACL and/or KATM, but information is insufficient to confirm a backcountry/wilderness or Brooks Camp location
Was the user bear viewing, fishing, both, or neither?	**Bear viewing if no posts that indicated sport fishing activity, AND at least one of the user's posts include:** • photos of bears • photos of people photographing bears • description of bear viewing • indication of a guide company that only provides bear viewing tours **Fishing if there were no posts that indicated bear viewing activity, AND at least one of the user's posts include:** • photos of casting fishing line or holding a fish • description of fishing activities **Both if:** • the user shared at least one post that indicates each fishing and bear viewing **Neither if:** • none of the user's posts indicated either bear viewing or fishing

Table 1 – Codebook, which was used in combination with the decision tree in Figure 5 to evaluate user activities and locations

backcountry visit (e.g., if posts were both unrelated and nonvisit, the user was coded as nonvisit; if they shared nonvisit and Brooks Camp content, they were coded as Brooks Camp; if posts shared both Brooks Camp and backcountry activities, they were coded by their backcountry activity).

Descriptive statistics were used to evaluate the volume of social media users that were in-person visitors, as well as the frequencies of activity types. Geographic information was mapped using Google Earth and categorized based on location.

Results

Twitter and Flickr Content

In all, 46,768 Tweets were collected. After discarding retweets and replies, 11,795 Tweets representing 6,086 Twitter users remained. Of these users, 3,973 (65.3%) referenced the parks, as opposed to unrelated content (e.g., Tweets about the Clark/Lake transit station in Chicago, IL). Of the users who shared content about the parks, only 189 (3.1%) of these users were visitors (Table 2). A total of 789 Flickr posts were collected, and only one post did not reference the parks. In all, 34 unique Flickr users represented park visitors with one nonvisitor removed.

Unless otherwise noted, nonvisitors are excluded from all further analysis. Additionally, datasets were combined and social media users are evaluated as one group for the remainder of this article, unless otherwise noted. Of the 223 Twitter and Flickr users coded as in-person visitors, 144 were in backcountry locations, 54 at Brooks Camp, and 25 in locations that were unidentified (Table 3). The majority of backcountry users (73.6%) shared content related to bear viewing (Table 4).

Spatial Results

The majority of users with associated geographic information did not share content related to an in-person visit. A total of 1,834 social media posts, representing 158 unique users, contained associated geographic information. Only 31 of these users were in-person visitors, including 27 Twitter users and 4 Flickr users. This ratio closely reflects the ratio of total Twitter and Flickr visitors (189 and 34, respectively). A total of 31 observations is not sufficient for statistical analysis to have adequate power, but observational analysis can suggest potential characteristics of spatial data in this remote, low-visitation park.

Of the 31 total users with associated geographic data, 16 points were outside the parks (Table 5). Of those, 14 were associated with towns outside of the parks, one in Alaska Wilderness over 200 miles (322 km) northeast of LACL, and one was in Alagnak Wild River (an NPS unit that geographically connects to KATM). Of the 15 points that lay in the parks, three were in Brooks Camp, three were in the frequently visited backcountry areas of Chinitna Bay and Hallo Bay (SWAN 2017a, 2017b), one was along a river near the KATM coast, and eight were clustered in one point in KATM. These eight points were all derived from Twitter cross-posts of Instagram content that was manually tagged with Katmai National Park as the location. Because posts with a manual tag on

	Twitter	Flickr	Total
Total posts collected	11,795	789	12,584
Total unique users	6,086	35	6,121
Total users referencing the parks	3,973	34	4,007
Total visitors (users)	189	34	223
Total backcountry visitors (users)	122	22	144
Total users with spatial data	27	4	31
Total users with spatial data in the parks	11	4	15

Table 2 – Summary of Twitter and Flickr content with text referencing the parks' names or social media accounts, or geotagged in the parks, between June and October 2018

	Twitter	Flickr	Total
Backcountry visit	122 (3.07%)	22 (62.86%)	144 (3.59%)
Brooks Camp	47 (1.18%)	7 (20.00%)	54 (1.35%)
Location within park unclear	20 (0.51%)	5 (14.29%)	25 (0.62%)
Non-visit park content	3,784 (95.2%)	1 (2.86%)	3,785 (94.4%)
Total	*3,973 (100%)*	*35 (100%)*	***4,008 (100%)***

Table 3 – Frequencies of unique user locations of social media users who shared content related to Katmai and Lake Clark National Parks and Preserve, June–October 2018

	Twitter	Flickr	Total
Bear viewing	88 (72.13%)	18 (81.82%)	106 (73.61%)
Neither	25 (20.49%)	3 (13.64%)	28 (19.44%)
Fishing	9 (7.38%)	0 (0%)	9 (6.25%)
Bear viewing and fishing	0 (0%)	1 (4.55%)	1 (0.69%)
Total	*122 (100%)*	*22 (100%)*	***144 (100%)***

Table 4 – Frequencies (percentages) of unique user backcountry activities of social media users who shared content related to Katmai and Lake Clark National Parks and Preserve, June–October 2018

Instagram select the same random point in the area to associate with, it is highly unlikely that the users actually visited this location (Figure 2).

Discussion

While past studies have shown correlations between visitation, visitor activities, and spatial density in parks and protected areas, many studies note that these correlations are weaker in lower-use, more remote areas (e.g., Heikinheimo et al. 2017; Tenkanen et al. 2017; Sessions et al. 2016; Fisher et al. 2018; Walden-Schreiner et al. 2018a; Levin et al. 2017). By evaluating the content of posts related to two remote, low-visitation parks, this study investigates how well social media content in these areas represents in-person visitors. Capturing data using a wide net and manually identifying Tweets from actual visitors revealed that only 189 Twitter users who post about the parks are actual in-person visi-

	Number of users
LACL or KATM	**15**
Instagram point (KATM)	*8*
Chinitna Bay (LACL)	*1*
Hallo Bay (KATM)	*2*
Coastal river (KATM)	*1*
Brooks Camp (KATM)	*3*
City or town	**14**
Port Alsworth	*11*
Seward	*2*
Anchorage airport	*1*
Other undeveloped area	**2**
Alagnak Wild River	*1*
Interior Alaska, on edge of Denali NP	*1*
Total	**31**

Table 5 – Visitor locations based on volunteered geographic information of users coded as in-person visitors to Katmai and Lake Clark National Parks and Preserves

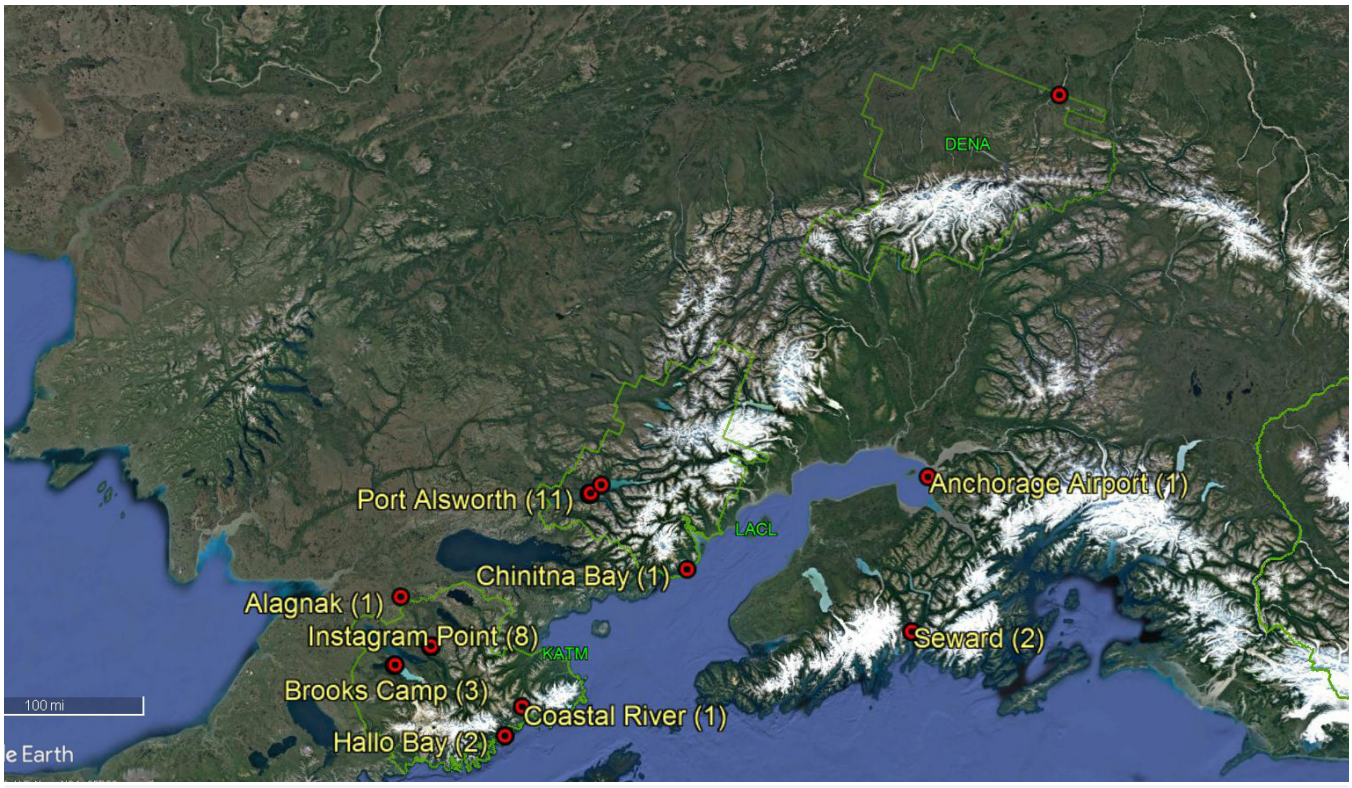

Figure 2 – Map of geographic information associated with in-person visitors. Labels and frequencies correspond with table 5.

tors, compared with 3,784 users who shared content related to the parks but not related to an in-person visit. This suggests that while Twitter can be used to understand public perceptions of the park or media chatter about a park, it may not be as useful a tool for understanding visitors. The Flickr data revealed that while there were more than 700 posts from the parks, there were only 35 users sharing photos. In short, while there were 117 times more overall users on Twitter discussing the park and 6 times more Twitter users who visited the park compared with Flickr users, all of the Flickr users who shared content about the park were in-person visitors.

During the summer of 2018 there were 37,018 visitors to KATM and 12,952 visitors to LACL according to park statistics (NPS 2018b). When combining both parks, a sample size of 381 would be required for a +/- 5% margin of error (Vaske 2008). The total volume of users who were in-person visitors, 223 overall and 144 in the backcountry, is not a generalizable sample. This limitation is especially important to consider in the context of previous research, which has shown social media to overrepresent and underrepresent certain groups. It should be noted that previous studies in remote and sparsely used settings use larger spatiotemporal scales, which allows for more data to be collected. This suggests that scale is a primary consideration when using these data to understand visitors in such locations.

Additionally, these results suggest significant differences between platforms when using keywords to query for posts. While nearly all Flickr users were in-person visitors, Flickr yielded a very small sample. Twitter's sample was significantly larger, but the amount of time required to identify users who were in-person visitors is likely too great to be of any managerial value.

Overall, there were enough social media users who were in-person visitors to make limited conclusions about social media use by visitors to KATM and LACL. However, 95% of Twitter users who posted about the parks were not visitors. While this does not suggest that social media content can never be used to estimate visitor volume in site- or season-specific contexts, it does highlight the need to explore in what cases it can be and how to do so. Future research may explore using multipliers or automating content evaluation. The majority of research uses geographic bounding boxes to query for posts in order to prevent the inclusion of non-visitors. In this study, which evaluates only one season of data at only two remote parks, that method would have only yielded 15 posts from visitors, 12 of which were in the backcountry or wilderness.

The distribution of activity types shared by social media users, compared with data reported by CUAs, relatively overestimates bear viewers relative to sport fishers (SWAN 2018a, 2018b). There are several possible reasons for this. For one, photography is more often combined with bear viewing than fishing in these parks (Sharp et al. 2019a, 2019b). This may also be because bear viewing is a more charismatic activity (i.e., users may perceive that it will return more positive feedback on social media). Future research may benefit from using the primary CUA data to make

statistical comparisons between frequencies of CUA-reported activities and activities shared on social media.

While the distribution of activity types reported by CUAs and shared on social media may not align, the ratio of Brooks Camp versus backcountry visitors seems to align between CUA-reported data and social media content. It is not possible to quantify the similarity using just the reports generated by SWAN (2018a, 2018b); however, it appears that in 2017 there were approximately 13,500 user days at Brooks Camp and 25,000 user days at the remaining areas of KATM and all of LACL (numbers approximated from graphs in SWAN 2018a, 2018b); in other words, ~35% of CUA reported visitor use days were in Brooks Camp. Social media analysis revealed 54 Brooks Camp visitors and 144 backcountry visitors, or 27.2% Brooks Camp. Future research may also use primary CUA data to evaluate whether significant similarities or differences in locations exist.

Limitations

This is an in-depth study of just one season at just two parks; therefore, it is not necessarily generalizable to all wilderness areas. Rather, it serves to draw attention to possible applications and limitations related to using social media data to understand visitors in very remote contexts and at a fine spatial scale.

Additionally, technological barriers to social media data collection continue to limit researchers' and managers' ability to use it. While the data in this study was collected prior to March 2019, Flickr now severely restricts the number of photos they host for free users. Users who do not pay for their accounts will only be allowed to host 1,000 photos, and photos above that limit will be deleted from their site (Austin 2019). While only 3% of free users have shared more than 1,000 photos on Flickr, it is important to recognize that social media companies are private entities that can, and do, change what data is available at any time. This has already impacted researchers' ability to use Instagram, a platform that arguably works best for understanding park visitors (Tenkanen et al., 2017; Heikinheimo at al., 2017). Instagram has, in the past, suddenly shut down access to its API and thus data (Volpicelli 2018).

Implications

Despite the limitations in using social media to understand in-person visitors, high social media attention from nonvisitors may be useful for the park in terms of extending the reach of their education or conservation messages (Skibins and Sharp 2018). In this sense, online users who share content related to parks can be considered a demographic of "digital" park visitor. In KATM, it is especially relevant to consider engagement with nonvisiting online users, as the park's bear-viewing livestream reaches more than 10 million people. Given the difficulty in reaching this remote site, when evaluating livestream viewers, these online-only "digital visitors" are economically valued at more than twice that of in-person visitors (Loomis et al. 2018).

Overall, the results of this study suggest that using social media data at a fine scale in a remote, low-visitation area has limited use. Additionally, the vast majority of social media users who share content about parks on Twitter were not in-person park visitors. Overall, consideration of methods and scale should be used when collecting and interpreting user-generated content. Additionally, the analysis of post content took an extraordinary amount of time and effort. While in this case using just a geographic bounding box would have yielded very few observations, the added value of the additional observations obtained by querying and evaluating post content must be weighed against the cost to the researcher.

"Overall, the results of this study suggest that using social media data at a fine scale in a remote, low-visitation area has limited use. Additionally, the vast majority of social media users who share content about parks on Twitter were not in-person park visitors."

This study does not conflict with the work that other researchers have done, evaluating whether there is a correlation between reported visitation and social media volume when comparing many sites or over many years. Rather, it suggests that consideration needs to be paid to the scale and interpretation of results. Additionally, this study affirms that queries using spatial data to search for posts, as opposed to post content, is indeed filtering out a large number of nonvisitors. This was especially clear with regards to studies using Twitter data. So, the application of this data in this context is limited; to have sufficient data, questions should be asked on larger spatial and/or temporal scales.

Qualitatively understanding user-generated content can enhance other metrics and can contribute to a well-rounded understanding of what visitors do in parks and protected areas. However, there may be a bias toward certain activities, perhaps those that more naturally include photography or are more photogenic. Future research may further investigate how visitors' perceptions of social media likability influences what they choose to share. Additionally, future research may adapt the visual inspection methods used in this analysis to investigate whether automated content analysis or machine learning can identify posts shared by in-person visitors. Finally, future research may explore how proximity to cellular signal or internet influences the volume of user-generated content created and shared by in-person visitors, or whether backcountry and wilderness users have different behaviors related to technology than front country or urban-proximate visitors, and how these constraints affect the representativeness of social media samples in these settings. ijw

DANI T. DAGAN is a PhD student at Clemson University, Department of Parks, Recreation, & Tourism Management; email: ddagan@clemson.edu.

RYAN L. SHARP is an associate professor in the Applied Park Science Lab within the Department of Horticulture and Natural Resources at Kansas State University; email: ryansharp@ksu.edu.

MATTHEWT. J. BROWNLEE is an associate professor of Parks and Conservation Management and director of the Park Solutions Lab at Clemson University, Department of Parks, Recreation, & Tourism Management; email: mbrownl@clemson.edu.

EMILY J. WILKINS is a PhD candidate at Utah State University, Department of Environment and Society; email: emily.wilkins@aggiemail.usu.

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Wenaha Wild and Scenic River: **Photo credit** © Robert Burns.

COMMUNICATION & EDUCATION

Monitoring Outdoor Recreation Use: The Umatilla National Forest, Wenaha Wild and Scenic River Corridor

by ROBERT C. BURNS, DAVID SMALDONE, MARY E. ALLEN, and ASHLEY R. POPHAM

Robert C. Burns

David Smaldone

Mary E. Allen

Ashley R. Popham

ABSTRACT

This case study sought to determine if current Weneha Wild and Scenic River Corridor recreation use is appropriate and compatible with the numerous applicable legislation and regulations. The study was conducted following a 2013 capacity analysis for the Wenaha River Comprehensive River Management Plan. The capacity analysis examined several items related to social carrying capacity, including parking at trailheads, campsite use, and group size, as well as information about recreationists' characteristics and experiences. Quantitative data were collected in the form of vehicle counts, and field observational data were used to supplement the quantitative results. A document analysis was also performed using relevant documents, including federal legislation, Forest Service management plans and policies, and other federal, state, and county documents. Results confirmed that virtually all recreation use in the setting was appropriate and within established thresholds. With anticipated growth in recreation visitation, resource managers can focus on better cooperation and coordination with other agencies to improve management of the setting.

The political environment of the United States during the 1960s and 1970s quickly and drastically shaped the future of land management. This period gave rise to the Clean Water Act (1972), Endangered Species Act (1973), and Forest and Rangeland Renewable Resources Planning Act (1974) in just three short years (USDA Forest Service 2005). Two key legislative actions from this period were important for this study: The Wilderness Act of 1964 and the Wild and Scenic Rivers Act of 1968.

The Wilderness Act, arguably the most significant piece of legislation to federal land managers in the United States, defines wilderness, in part, as "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain" (Wilderness Act section 2 [c]). These lands are the most highly protected lands in the United States, as use of these areas is the most restricted and the terms of the Wilderness Act supersede those of other land management laws. Policy development, management plans, and day-to-day decisions are guided by the act for all federally designated wilderness lands.

The Wild and Scenic Rivers Act (WSRA) was signed into law in 1968, just four years after the Wilderness Act. The WSRA states that designated rivers "shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations" (WSRA section 1[b]). To be designated, a river must possess at least one "outstandingly remarkable value" (ORV), which has been defined as "a unique, rare, or exemplary feature that is significant at a comparative regional or national scale" (USDA Forest Service 2015a). Whether a river possesses such a value is to be determined by the federal land management agency that manages that river.

The Oregon Omnibus National Wild and Scenic Rivers Act of 1988 amended the WSRA of 1968, granting federally protected status to dozens of Oregon rivers and river segments including the Wenaha Wild and Scenic River (WSR). The Forest Service was named as responsible for the protection of the Wenaha WSR (section 102), and the Forest Service also determined it to possess four outstandingly remarkable values: recreation, scenery, wildlife, and fisheries (USDA Forest Service 1992). The Umatilla National Forest (NF) was thereby required to develop a Comprehensive River Management Plan (CRMP) for the river. The Wenaha WSR CRMP (USDA Forest Service 2015b) outlines goals and standards to protect and enhance the ORVs for which the river was designated into the WSR system, while providing for public use and enjoyment of the WSR (USDA Forest Service 2015b).

There are also lands and natural resources within and adjacent to the WSR that are administered by other federal, state, and local agencies. Although the Forest Service has jurisdiction over areas within the WSR, it may not enforce its rules outside of its boundaries. Thus, interagency cooperation is necessary to achieve management objectives and to ensure consistency in management and enforcement. This means the Forest Service must collaborate with other agencies and stakeholders to ensure that river values are protected on the 2.9 river miles (4.7 km) that extend beyond the forest boundary.

Purpose of Study

The Wenaha WSR depends on recreation, scenery, wildlife, and fisheries ORVs for its character and the types of recreation opportunities it provides. The Forest Service and collaborating agencies are directed to maintain (and enhance) ORV conditions that are consistent with (or exceed) conditions at the time of designation (USDA 2015b). To accomplish this, the Forest Service and collaborating agencies must balance "appropriate" levels of use and protection of outstanding remarkable values. This task can become challenging, as a river's classifications may also inform decisions regarding user capacities and protection of resources across different river segments. WSR river classifications vary in levels of accessibility, user capacity, and ORV sensitivity to degradation (e.g., erosion, bank trampling, loss of vegetation). Thus, "appropriate" levels of use are those that achieve and maintain the desired conditions established within the CRMP (IWSRCC 2018).

The Forest Service must address user capacities and develop management actions to ensure that use levels stay within the established capacities directed by the CRMP. A visitor capacity analysis was prepared in 2013 for the Wenaha WSR with recommendations for the desired conditions, standards, and guidelines for the recreation ORVs. Managers are required to monitor current use levels and determine if those levels are consistent with, or threaten, the established desired conditions for those resource values (IWSRCC 2018). This requires evaluating visitors and trends over time in the amounts, types, and distribution of recreational use throughout the Wenaha WSR. Assessments of visitor use levels inform management on whether those levels are compatible with the visitor capacity established for a WSR area and help determine the amount of investment needed to support changing visitor capacity decisions (IVUMC 2019).

The Interagency Visitor Use Management Council (IVUMC) recently published a new visitor management framework, developed collaboratively across federal natural resource agencies (IVUMC 2019). This framework offers a flexible, iterative, and responsive process to develop, implement, and monitor visitor use. It describes a sliding scale approach to assess resource impacts that provides guidance in matching the investment in time and money needed to monitor and address impacts, and to commensurate levels of impact, uncertainty, and risk related to the resource (IVUMC 2019). For instance, visitor capacity scenarios in which the levels of impact risk and issue uncertainty are relatively low may indicate that less investment is needed at that time. On the other end of the spectrum, high levels of impact risk and issue uncertainty would warrant a higher amount of investment. The purpose of this case study was to understand if existing recreational use in the Wenaha WSR can be considered appropriate and within established capacities, in accordance with the many different guiding documents, regulations, and legislation.

Study Area

The Wenaha-Tucannon Wilderness (WTW) is in the Umatilla NF, located in the Pacific Northwest of the United States, in northeastern Oregon and southeastern Washington. The specific study area included the 21.5 miles (35 km) of the Wenaha Wild and Scenic River and areas that access the river corridor. The Wenaha WSR study area was segmented into four categories based on their designated segments within the CRMP (2015): (1) Wild River (Wilderness), (2) Wild River (Nonwilderness), (3) Scenic River, and (4) Recreational River sections. These categories vary in accessibility and level of surrounding development. Wild Rivers are primitive without development and are mostly accessible by trail, whereas Recreational Rivers are accessible by road or rail and may have shoreline or watershed developments, and Scenic Rivers fall in between Wild and Recreational Rivers accessibility and development levels.

The Wild River segment consists of 18.7 river miles (30 km) within the Umatilla NF boundary, and 15.2 (24 km) of those miles are also within the Wenaha-Tucannon Wilderness (USDA Forest Service 2013b). The majority of the wilderness corridor is characterized by remote wild landscapes and is not typically used for recreational floating. The remainder of the Wild River (3.5 miles/6 km) is outside of the wilderness (i.e., nonwilderness) but still within the Forest Service boundaries. The

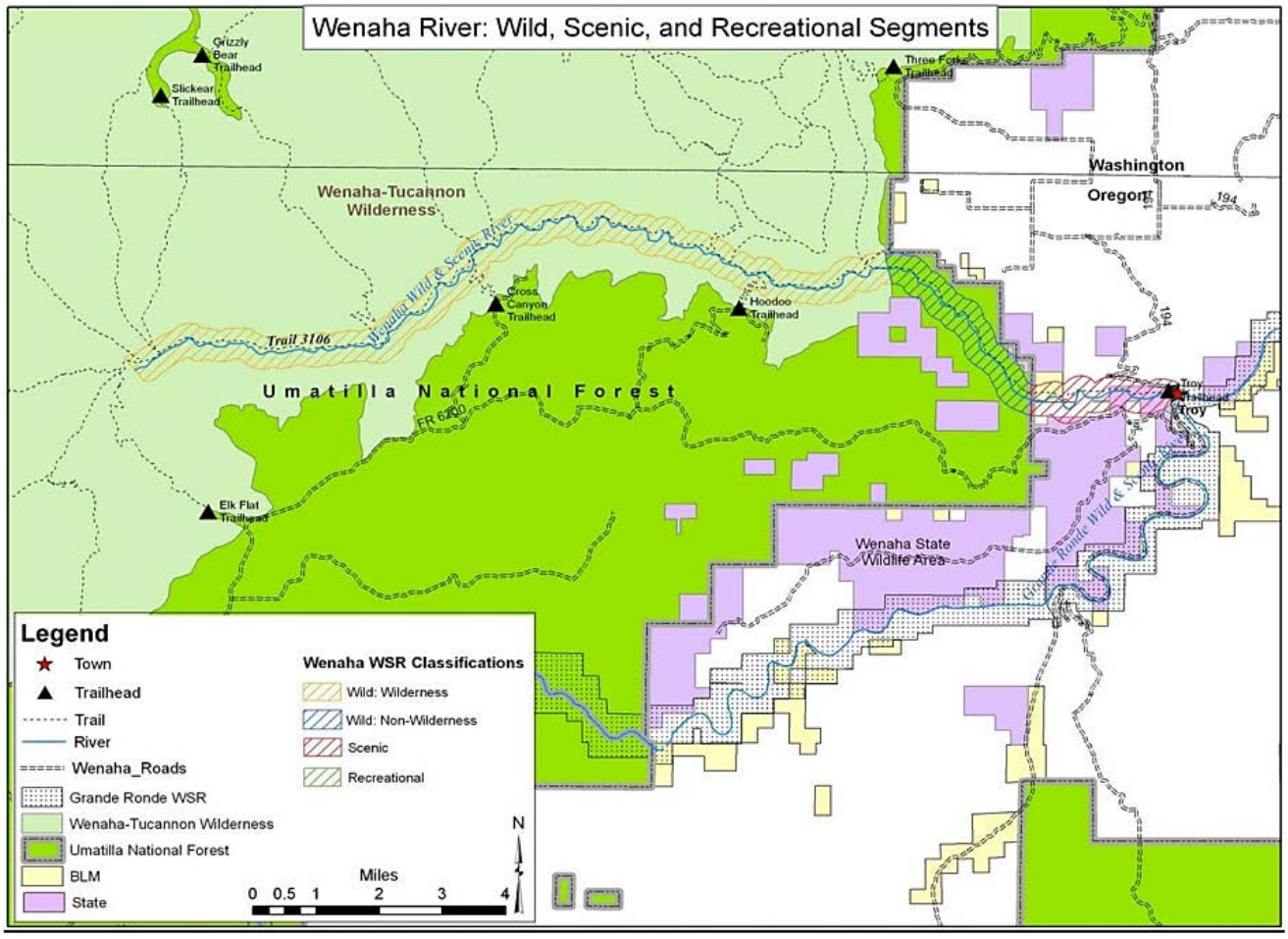

Figure 1 – Map of the Wenaha Wild and Scenic River classifications (USDA Forest Service 2015b).

Scenic and Recreational River sections flow through the Wenaha State Wildlife Area and include a mix of state, private, and federal lands administered by the Bureau of Land Management (BLM). Private and BLM-administered lands in these sections are primarily used as forest or pasture, for residential living, and for private business. The Scenic River section (2.7 miles/4 km) is located outside of the wilderness and Forest Service boundaries. Much of this section is still remote, providing recreation opportunities similar to those provided by the Wild River sections. The Recreational River section (extending only 0.15 mile/.24 km) is found in the last river mile in which the community of Troy, Oregon, greets the mouth of the Wenaha just before its confluence with the Grande Ronde Wild and Scenic River. Recreation visitation is low, and the vast majority of visitors report a high level of satisfaction (Burns, Popham, and Smaldone 2018).

Methods

Four stages of research were utilized to understand existing recreational use in the Wenaha WSR : (1) a review of federal legislation, Forest Service documents, and other regulations; (2) quantitative data collection through surveys and vehicle counts (Burns, Popham, and Smaldone 2018); (3) field observations; and (4) an analysis of existing visitor use compliance with the goals and expectations outlined in the documents. The documents were reviewed to understand the desired levels of use within the Wenaha WSR. The data collection and field observations were conducted to determine the levels of "current rec-

	Recreational section	*Scenic section*	*Wild section (non-wilderness)*	*Wild section (wilderness)*	*Noncorri-dor (non-wilderness)*	*Noncorridor (wilderness)*
US Forest Service	--	--	✓	✓	✓	✓
BLM	✓	✓	--	--	--	--
Oregon Dept. of Fish & Wildlife (ODFW)	✓	✓	✓	✓	--	--
Wallowa County	✓	✓	--	--	--	--
Private residents & business owners	✓	✓	--	--	--	--

Table 1 – – Stakeholders with direct administrative authority within the Wenaha Wild and Scenic River study area.

reational use" in the study area and analyze those levels for consistency with the agency's guidelines. Current recreational use was determined by a series of indicators or social attributes that can be measured to track changes in conditions associated with human use. These indicators are specified within the Wenaha WSR CRMP (USDA Forest Service 2015b). This study focused on four of those recreational use indicators: (1) group size, (2) group encounters, (3) vehicle use, and (4) recreational activity type. These data were analyzed for consistency with the desired use levels outlined in the documents.

Document Review

Documents were obtained through meeting and speaking with natural resource agency managers from several agencies listed and through web searches. Not only were the myriad guiding documents challenging to navigate, but the study area is itself extremely complex because many jurisdictions are involved. Table 1 shows which agencies or other stakeholders have direct administrative authority in different portions of the study area. It is important to note that management efforts should be cooperative and collaborative in planning and regulation, and each stakeholder is involved at different levels with the administration of many parts of the study area.

The second step was to organize all relevant documents into three categories: (1) primary, (2) secondary, and (3) tertiary (Figure 2). Primary documents included federal legislation; those documents are most authoritative. However, not all current use was addressed by these documents – they provide loose direction but also grant agencies authority to manage details. Secondary documents were also analyzed, including Forest Service plans, policies, and directives that provide specific management direction. Tertiary documents included other federal (BLM), state, and county plans and regulations that are important for managing the study areas of the river corridor that lie outside the Forest Service boundary.

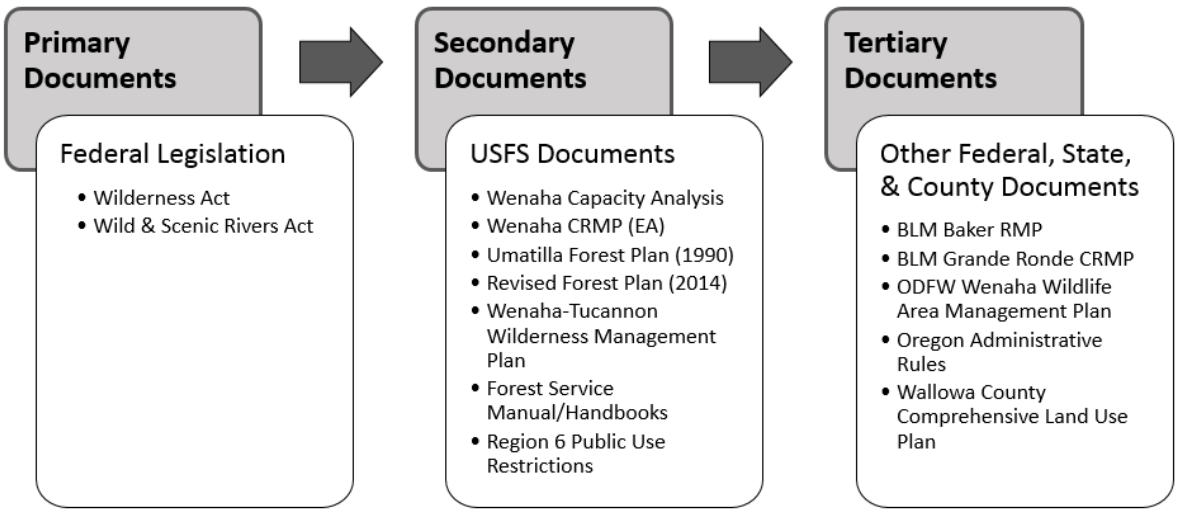

Figure 2 – Document Organization developed during Document Review Analysis.

A variety of documents provide management direction for different portions of the study area (Table 2). Because these documents often complement one another, all are arguably applicable to the entire study area. For example, the Forest Service Manual and Handbooks discuss general management of Wild and Scenic Rivers. However, the documents noted in the following tables provide the most specific and relevant criteria by which to evaluate appropriate use.

	Non-forest Service Areas		Forest Service Areas			
Guiding document	***Recreational* section**	***Scenic* section**	***Wild* section (non-wilderness)**	***Wild* section (wilderness)**	**Noncorri-dor (non-wilderness)**	**Noncorridor (wilderness)**
Wilderness Act	--	--	--	✓	--	✓
Wild & Scenic Rivers Act	✓	✓	✓	✓	--	--
Wenaha Capacity Analysis	✓	✓	✓	✓	✓	✓
Wenaha CRMP	✓	✓	✓	✓	✓	✓
Umatilla Forest Plan	--	--	✓	✓	✓	✓
Revised Forest Plan	--	--	✓	✓	✓	✓
Wenaha-Tucannon Wilderness Management Plan	--	--	--	✓	--	✓
Forest Service Manual & Handbooks	--	--	✓	✓	✓	✓
Region 6 Public Use Restrictions	--	--	✓	✓	✓	✓
BLM Baker Resource Management Plan	✓	✓	--	--	--	--
Wallowa & Grande Ronde River Management Plan	✓	✓	--	--	--	--
State of Oregon Administrative Rules	✓	✓	--	--	--	--
OR Dept. of Forestry Public Use Restrictions	✓	✓	--	--	--	--
ODFW Wenaha Wildlife Area Management Plan	✓	✓	✓	✓	--	--
Wallowa County Comprehensive Land Use Plan	✓	✓	--	--	--	--

Table 2 – Documents used to evaluate appropriate use in the Wenaha Wild and Scenic River study area

Survey

An onsite survey was used to collect visitor data on a variety of topics including demographic and group characteristics; visitor perceptions related to crowding, conflict, and satisfaction; encounters with other visitors; and activity participation. The survey was developed as part of a larger visitor study conducted in the Wenaha WSR from mid-June through early August of 2014 (Burns, Popham, and Smaldone 2018). Survey items of relevance to this study included three of the four recreational use indicators: (1) group size (the number of adults and children in a group), (2) group encounters (the number of times recreationists encounter other groups), and (3) participation in recreational activities (based on a list of 23 potential activities). A total of 74 surveys were collected at trailheads accessible to the Wenaha River corridor and at campsites in Troy.

Vehicle Counts

Vehicle counts can be used to represent people at one time (PAOT) in an area (Lawson, Manning, Valliere, Wang, and Budruk 2002). Vehicle counts were conducted upon arrival and departure from the survey site locations. Following the same method used in the Forest Service capacity analysis (USDA Forest Service 2013a), vehicles at trailheads or other locations with attached trailers (of all types) were counted as one vehicle.

Also following the capacity analysis methodology, vehicles at all 20 campsites were included for the Troy private campground count. For the Elk Flat Trailhead (TH), vehicles or trailers are often parked in a location approximately 0.25 mile (.40 km) from the actual trailhead. These vehicles were included in the Elk Flat TH count. Counts were recorded on paper to be entered into a spreadsheet every time the interviewer arrived at or departed a survey site location.

Field Observations

Reporting field observations is an effective method of supplementing quantitative research (Axinn and Pearce 2006; Onwuegbuzie and Leech 2005). This method provides context and can result in richer explanations than quantitative reporting alone (Sieber 1973). Observational data were collected via field notes and photographs taken at survey locations and on trails within the study area. Observations were determined noteworthy based on knowledge gathered both prior to and during data collection, especially if observations were made related to potential issues that were not addressed by the survey. For example, the presence of campsite litter was noticed, but the survey instrument did not include items related to this issue. This was considered important, as results from the 2011 capacity analysis defined litter as an inappropriate use and a threat to visitor capacity.

Analysis of Existing Use Compliance

The data collected from surveys, vehicle counts, and field observations were evaluated to determine "current recreational use" levels. The amount of recreational use was measured by the visitors' group size, number of encounters with other groups, number of vehicles at the study site, and the types of recreation activities in which the visitors participated. These data were then evaluated for consistency with applicable legislation and regulations.

The method used to determine if current recreational use was appropriate was adapted from the "Appropriate Use Protocol," suggested by the Federal Interagency Task Force on Visitor Capacity on Public Lands (Haas 2002). This method involves completing a worksheet that uses criteria that can help managers decide whether a specific recreational use is appropriate for an area. In the protocol, 21 decision criteria were identified, and examples included: "Does the use comply with applicable statutory requirements? (Yes/No)" and "Will the use significantly impact desired future conditions? (Yes/No)." At the conclusion of the evaluation, the decision maker reports whether use is appropriate or not appropriate.

The protocol's decision criteria were modified for this study to determine appropriate use for the study area. The added questions below reflect the organization of the documents (primary, secondary, and tertiary) used to determine what is considered appropriate use for the Wenaha WSR. (The "Not Applicable" category was added, as Forest Service documents and state/other federal documents often did not apply to the area being evaluated.)

1. *Does the use comply with applicable federal legislation? (Yes/No/N/A)*
2. *Does the use comply with applicable Forest Service documents? (Yes/No/N/A)*
3. *Does the use comply with applicable other federal and/or state policies? (Yes/No/N/A)*

Results

Group Size

Data collected during the sampling period suggested that group sizes were appropriate for the areas evaluated. Group size is regulated in wilderness in order to provide "outstanding opportunities for solitude" (Wilderness Act section 2[c]). Regulating group size also can be used to uphold the WSRA for those rivers that have been identified as possessing recreation as an outstandingly remarkable value, because regulating group size can help protect social carrying capacity (Manning 2011; Whittaker et al. 2011). While federal legislation does not specify group sizes in wilderness, land management agencies do. Therefore, Forest Service (secondary) and other agency (tertiary) documents were used to evaluate appropriate group size for the area.

The Wenaha-Tucannon Wilderness Management Plan (WTWMP) (USDA Forest Service 1989), the Revised Forest Plan (USDA Forest Service 2014), and the CRMP (2015) all specify the maximum group size as 12 persons/18 head of stock for those areas in wilderness. The CRMP also proposed a new standard that would extend this limitation of 12 persons/18 head of stock for that portion of the Wild river segment that is outside of wilderness. While the CRMP cannot enforce group size for lands outside of forest boundaries, another guideline proposed by the CRMP is that those nonforest entities that manage the Scenic river section should incorporate a group size limit that is consistent with these limits within the Wild section. However, this limit

	Non-Forest Service Areas		`Forest Service Areas			
Guiding document	***Recreational* section**	***Scenic* section**	***Wild* section (non-wilderness)**	***Wild* section (wilderness)**	**Non-corridor (non-wilderness)**	**Non-corridor (wilderness)**
Group size evaluation	N/A	N/A	A	A	NE	A
Evaluation of numbers of other groups encountered	N/A	A	A	A	N/A	A

N/A: Not Applicable. Group size or numbers of other groups encountered is not regulated for these areas.

A: Appropriate. Group sizes or numbers of other groups encountered are appropriate for the area specified (CRMP 2015).

NE: Group size was not evaluated in areas outside of the corridor or wilderness. (These parking areas were evaluated in terms of vehicle capacity for which results are provided below.)

Table 3 – Appropriate use: Group size and numbers of other groups encountered in the Wenaha Wild and Scenic River study area (by River Corridor Section)

has yet to be determined. No known state or other document addresses group size limits for the Scenic or Recreational segments, and therefore this measure could not be applied in these areas. The CRMP does recommend a maximum number of PAOT for the entire river corridor, a measure used in tandem with vehicle capacity recommendations.

The mean group size reported by this study was 3.97 (Table 3). Only one group was larger than the 12 persons limit, and there was a party of 30 on the private campground in Troy on a holiday weekend. Parties recreating within those areas with group size regulations included just three separate parties of 11 people. No groups on Forest Service–managed land exceeded the limit of 12 people or 18 head of stock.

Group Encounters

The number of times recreationists encounter other groups is another indicator that managers can investigate in order to protect opportunities for solitude in wilderness and social carrying capacity in general. The CRMP and the Wilderness Plan were the only documents that addressed group encounters for the study area. The CRMP states that encounters of no more than three to six other groups within the river corridor (excluding the recreational section) are appropriate, allowing for more encounters during "peak visitation" (which includes about 10

days per year, such as certain holiday weekends). The mean number of encounters with other groups during the sampling period in the corridor was < 1.00 (0.97). This number excludes those who only used the recreational section and/or that portion of the scenic section which is the state campground. As this mean number of encounters was well below the three to six group encounter threshold identified in the CRMP, existing use was compliant in the corridor according to this measure (Table 3). Use outside of the corridor in wilderness was also appropriate. For those visitors who recreated in non-corridor wilderness areas (n=11) the mean number of other groups encountered was 1.00. This number is appropriate according to the standard set by the Wilderness Plan (USDA Forest Service 1989), which states that this semiprimitive wilderness area should maintain an 80% probability of encountering 10 or fewer other groups per day.

Vehicle Use

Appropriateness of vehicle use was assessed by comparing vehicle counts with thresholds outlined by Forest Service documents. Observational data revealed some inappropriate use regarding the exact locations of where visitors were choosing to park at trailheads and other locations, and also two isolated cases where vehicle use violated specific wilderness restrictions.

Vehicle count data were compared to the recommended standard set by the CRMP (2015). One method used by the Forest Service to estimate visitor use and to set use limits is through associating numbers of vehicles with numbers of PAOT, where one vehicle represents a count of four PAOT. Specific thresholds were identified in the CRMP and were based on results from the capacity analysis conducted in 2011. The CRMP focused on the total vehicle capacity for only those trailheads that most easily access the corridor and set this standard at 50 vehicles. This standard was not exceeded (Table 4). Even when considering the maximum number recorded for all trailheads simultaneously, the total count (N=26) of vehicles is only half of the set standard (50 vehicles).

The Forest Service did not set a standard for the private campground in Troy and the state campground, as the agency cannot enforce standards on nonforest lands. No known state or other document reports vehicle capacity or sets standards for vehicle capacity for these areas. The Forest Service lists 20 vehicles as the capacity for the private campground in Troy (USDA Forest Service 2013a). The maximum count recorded at one time by this study was 21 vehicles (including trailers), and the mean for the entire sampling period was 1.95 (Table 4). For state lands, capacity is reported as 10 vehicles. This capacity was only exceeded on one high use day, when 12 vehicles were counted. The mean was much lower, 1.03 vehicles. Table 4 compares the maximum vehicle counts recorded on state and private lands with the existing capacity reported in the capacity analysis (USDA Forest Service 2013a). Accordingly, the use of vehicles and parking areas with regard to numbers of vehicles is appropriate for the study area.

Trailhead (TH) Site location	Maximum count recorded (summer 2014)	Recommended capacity (USDA 2015)	
Cross Canyon TH	9	--	
Elk Flat TH	11	--	
Hoodoo TH	4	--	
Three Forks TH	0	N/A	
Grizzly Bear TH	N/A	--	
Troy TH	2	--	
TOTAL	26	50	
Public and Private Lands	**Maximum count recorded (summer 2014)**	**Existing Capacity (USDA Forest Service 2013a)**	**Mean***
Public	12	10	1.03
Private	21	20	1.95

*The mean reported is for the count of vehicles (including trailers) upon arrival and is for the entire sampling period.

Table 4 –Vehicle counts at trailheads, state and private lands compared to recommended and existing capacity levels

Recreational Activities

"Recreational activities" included all recreational activity survey items listed on the survey instrument (Popham 2015). Each activity was evaluated to ensure that the activity was appropriate for all areas of the river corridor and noncorridor areas during the sampling time frame by checking the activity with management documents (Table 2) and the modified "Appropriate Use Protocol" noted earlier (Haas 2002). All activities were deemed appropriate, but observational data supplemented these results and did identify some instances of inappropriate use (Table 5). The most notable pertained to litter in campsites. The 2011 capacity analysis conducted by the Forest Service included an impact assessment of 131 campsites (USDA Forest Service 2013a). Each campsite was rated based on the presence of ground disturbance, tree damage, area disturbance, litter, human waste, weeds, user-created trails, and an overall impact rating (Cole 1983). Results showed a "low" overall impact rating for 128 of the 131 campsites of the corridor, and the remaining 3 showed "moderate" impact.

Some user-developed trails and trail impacts were noted through interviewer observational data (Table 5). According to the capacity analysis (USDA Forest Service 2013a), one inappropriate use identified as having a higher potential impact on visitor capacity is "unmanaged recreation use causing excessive permanent destruction of vegetation or multiple user-developed trails; especially along the banks of the river" (pp. 9, 11). Some evidence of user-developed trails was noted in all sections of the river corridor.

Discussion

In general, the answer to the question of whether recreation use is compliant and appropriate for the Wenaha WSR is "yes." The CRMP (2015) developed for the Wenaha defines what uses (and use levels) are appropriate or inappropriate for the study area. When data collected for this study were compared to these thresholds, recreational use within the study area was determined to be appropriate with very few exceptions. If use remains low and monitoring continues

	Non-Forest Service Areas		Forest Service Areas			
Other recreational activities	***Recreational* section**	***Scenic* section**	***Wild* section (non-wilderness)**	***Wild* section (wilderness)**	**Non-corridor (non-wilderness)**	**Noncorridor (wilderness)**
Recreational activity survey items*	A	A	A	A	A	A
Proximity of campsites to river	N/A	N/A	N/A	I	N/A	N/A
Campsite impacts (observational data)	I	I	N/O	I	I	N/O
User-developed trails or trail impacts (observational data)	I	I	N/O	I	N/O	I
Other observational evidence*	N/O	N/O	N/O	I	I	N/O

*Recreational activity survey items *include all other recreational activity survey items.*

**Other ocular evidence *included two isolated cases of inappropriate use: chainsaw use in violation of fire restrictions (Noncorridor, not in wilderness) and grazing of domestic goats (Wild section, in wilderness).*

N/O: Not observed. No ocular data suggested inappropriate use, though not all areas were assessed.

N/A: Not Applicable. Either proximity of campsites to river was not regulated by any document relevant to the area specified, or the area was outside of the river corridor.

A: Appropriate. Recreational activity items are exclusively appropriate for the area specified.

I: Some inappropriate use – at least one instance of recreational use was inappropriate for the area specified.

Table 5 – Appropriate use: Other recreational activities in the Wenaha Wild and Scenic River study area (by River Corridor Section).

to indicate the CRMP standards are not being exceeded, a sliding scale approach as recommended in the recent IVUMC (2019) framework would indicate that higher levels of investment are not needed. However, the management complexity related to the Wenaha WSR indicates that some issues remain to be addressed.

Group sizes in the study area were appropriate and acceptable as they were well below the thresholds identified by the CRMP (2015). The CRMP proposed a new standard to limit group sizes to 12 people/18 head of stock in the Wild section outside of wilderness. It also proposed a new guideline to work with nonforest entities to incorporate a group size limit in the management of the Scenic section of the river corridor. This is important, as no other federal, state, or county document addresses group size on nonforest lands in the study area. This action would help protect and enhance the recreation ORVs, as these remote areas are comparable to the regulated Wild section. Should recreational use in the study area increase, it is recommended that the Umatilla NF monitors group sizes within the corridor to ensure that visitor capacity is not exceeded.

Regarding group encounters, the numbers of other groups encountered by recreationists are appropriate for the study area. Group encounters are only addressed by Forest Service documents, and although the Scenic section of the river lies outside of Forest Service boundaries, the CRMP suggests three to six should be the maximum number of encounters in this and the Wild section of the corridor. Use levels were well below this threshold during the time of data collection. As with group size data, the number of group encounters currently occurring shows that current management guidelines are being met. The number of encounters of other groups should continue to be monitored to see if recreational use in the study area increases.

The number of vehicles parked at trailheads and other parking areas was appropriate for the study area, as it was well below the threshold proposed by a new guideline in the CRMP (USDA Forest Service 2015). On rare occasions, visitors parked in shaded areas just outside of designated trailhead parking. As parking in vegetation can harm native species and contribute to the spread of invasive species, monitoring trailheads for invasive species and assessing vegetation impacts would be helpful.

The types of recreational activities that occurred in the study area were generally appropriate (as identified within the CRMP), with only a few exceptions, particularly regarding campsite use. Even small numbers of campers can negatively impact the river's outstandingly remarkable values, and litter at some campsites threatens all four of the Wenaha's ORVs (USDA Forest Service 2015). While annual monitoring of all corridor campsites may not be feasible for this area, it is suggested that at least the more convenient campsites located at trail intersections be monitored when possible. These are often, although not always, more popular sites, and have greater potential for increased use. In addition, the location of some campsites in wilderness near the river was inconsistent with the proposed guideline of the Revised Forest Plan (USDA Forest Service 2014). The CRMP guidelines for campsite management advised a reduction in

the number of campsites through resting or closing those sites that are more highly impacted in the corridor. This reduction in campsites is regulated to achieve the "desired future conditions" section of the CRMP, which proposed the reduction of streamside sites.

Observational data also found evidence of user-created trails in the study area. Resource managers are aware of this and have addressed the issue through two proposed guidelines in the CRMP (USDA Forest Service 2015). These focus on user-created trails in riparian areas that have the potential to negatively affect ORVs. According to the CRMP, Leave No Trace (LNT) principles are encouraged in the area. Additional educational materials could focus on two of the seven LNT principles: "Leave what you find" and "Minimize campfire impacts" (Leave No Trace 2015). Posting information and interpretive messages at visitor centers and at wilderness trailheads could be beneficial, along with posting public use restrictions. Research on nonpersonal interpretation shows that simple messages can be one of the most successful delivery methods (Ham 2013).

In cases of areas with overlapping jurisdictions, agencies tend to default to the more specific management plans and policies developed by other agencies for a given area, and rightly so.

Management Implications and Conclusions

Management complexities due to the overlapping jurisdictions within the study area should be addressed, particularly if recreational use increases in the future. The inherent administrative complications that can arise in areas with complex jurisdiction situations have presented challenges for land managers for a long time (Lewis and Marsh 1977). The most specific direction for the study area comes from Forest Service documents. However, the Forest Service cannot enforce regulations outside of its boundaries, and few specific rules and regulations pertaining to recreation in the Wenaha corridor are defined for those portions of the study area that are on non-Forest-Service lands. In cases of areas with overlapping jurisdictions, agencies tend to default to the more specific management plans and policies developed by other agencies for a given area, and rightly so.

Nevertheless, confusion can still occur, and implications can be felt at a micro level. For example, on one occasion during this study a US Forest Service resource manager suggested that on the state-managed campground BLM rules are followed regarding the use of fire pans. On a separate occasion, a BLM employee explained that the BLM has no authority over state land at all, and that the state must regulate its own lands. Thus, two federal employees appear to be contradicting each other regarding specific rules. Regulatory guidance indicated that if the state wished to follow BLM rules, then regulations should have been developed requiring mandatory

fire pans as prescribed by the Wallowa and Grande Ronde Rivers Management Plan (USDI BLM 1993, p. 138). However, if the state were to follow its own Oregon Administrative Rules (OARs), rock fire rings are inappropriate for this area, as they violate the OAR specifying that fire should be contained in fireproof containers (fire pans) within this portion of the Wenaha river corridor.

This is an example that illustrates the difficulties that can arise when multiple agencies are involved in managing an area. Interagency councils have been created in recent years to help coordinate management of complex areas such as wildernesses (e.g. Interagency Wilderness Policy Council) and Wild and Scenic Rivers (Interagency Wild and Scenic Rivers Coordinating Council 2018) and recently, the Interagency Visitor Use Management Council was formed to focus specifically on visitor use management on federal lands (IVUMC 2019). However, all three of these councils are composed of exclusively federal land management agencies. No state or other entities are included. Therefore, it is up to federal agencies to engage these other entities to ensure that the details of management plans are understood and applied. Incorporating state level and private stakeholders into the management process would serve the federal agencies well (Selin and Mendoza 2016).

As previously mentioned, the US Forest Service is very aware of other agency plans and activities in the study area and have incorporated that consideration into Forest Service management plans. Further, the CRMP (2015) proposed a "cooperative management" guideline, which will encourage other agencies to adopt a group size limit on nonforest lands (in the Scenic river corridor section) that is comparable to Forest Service limitations. Cooperative management will be very important for the non-Forest-Service lands of this study area, especially if recreational use increases. Numbers of visitors would likely increase on the more accessible Scenic and Recreational sections of the river corridor that are outside of Forest Service boundaries. Therefore, future collaboration among agencies might be warranted in order to ensure those visitor capacity thresholds defined for the CRMP are not exceeded. Purposeful collaboration between all stakeholders will help to ensure consistency in agency planning, which can and should result in better management of our public lands. ijw

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DR. ROBERT C. BURNS is professor and director of the West Virginia University Division of Forestry and Natural Resources; email: Robert.Burns@mail.wvu.edu.

DR. DAVID SMALDONE is associate professor of Recreation, Parks and Tourism Resources at the West Virginia University Division of Forestry and Natural Resources; email: David.Smaldone@mail.wvu.edu.

DR. MARY E. ALLEN is a postdoctoral research associate at the West Virginia University Division of Forestry and Natural Resources; email: Mary.Allen1@mail.wvu.edu.

ASHLEY R. POPHAM is a resource assistant for the US Forest Service, Mt. Hood National Forest, Oregon; email: apopham@fs.fed.us.

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Images of the Pacific Crest Trail. **Photo credit** © Annie Gencay.

Representations of the Pacific Crest Trail on Instagram: Implications of Social Media for Wilderness Management

by KATHRYN SUTCLIFFE

Kathryn Sutcliffe

The Wilderness Act directs wilderness managers to provide "outstanding opportunities for solitude" (Wilderness Act 1964). By contrast, social media platforms such as Facebook, Instagram, and Twitter are built to share experiences with an audience. Despite their seemingly opposite purposes, wilderness is increasingly represented on social media tools: the Instagram hashtag (a label attached to a photo that allows other users to search for specific content) #wilderness has more than 6 million posts; the hashtag #wildernessculture has 10.6 million posts. Specific wilderness areas have fewer posts but are still represented: Colorado's Weminuche Wilderness (#weminuchewilderness) has 4,500 posts, the Boundary Waters Canoe Area (#boundarywaters) has 45,000 posts, and the John Muir Wilderness has 25,000 posts for the hashtag #johnmuirwilderness and 72,000 posts for the hashtag #johnmuirtrail.

"Even if wilderness managers choose not to investigate Instagram or other social media platforms to inform active management decisions, they should be observing this space to understand how users are portraying wilderness experiences."

Sixty-nine percent of all US adults use Facebook, and 37% use Instagram (Pew Research Center 2019). Social media is particularly dominant among younger age groups with 90% of all 18- to 29-year-olds using at least one social media platform. Sixty-seven percent of 18- to 29-year-olds use Instagram; of those who do, 76% use it daily (Pew Research Center 2019). Of the various social media tools, Instagram is particularly conducive to broadcasting experiences to wide audiences. While Facebook posts are typically restricted to a user's "friends" and unavailable for public viewing and searching, an estimated 72% of Instagram posts are available to anyone on the internet (Byrne 2014). In combination with the high frequency with which wilderness is portrayed on social media, the increasing ubiquity of these platforms suggests representations of wilderness on social media will continue to grow.

These factors have created a massive dataset about wilderness. Social media is primarily shared from a first-person perspective. Typically accompanied by a narrative of the user's preferences, each post of wilderness depicts it as the user has experienced it. Such access to a person's feelings about their wilderness experience provides a resource to rapidly gather data from a large population on their subjective experiences in wilderness. On Instagram, 100% of posts include a photo and thus provide a data point of what wilderness conditions looked like at a specific point in time, offering opportunities for windows into things such as camping density, campsite conditions, and species identification and surveying.

Simultaneously, this use of social media to bring wilderness experiences to a broader audience raises new considerations for wilderness managers. What does the wilderness experience look like, and how does it change, when visitors enter with a specific goal of sharing it? Do wilderness users perceive the presence of social media in the wilderness as a breach of solitude? Is solitude even among their priorities in entering wilderness? Wilderness users are finding answers to these questions, consciously or not, simply through continued use of social media within wilderness. If wilderness managers ignore the social media space, they risk missing full participation in these conversations.

This article explores the potential of Instagram as a source of information for wilderness managers by examining the components of Instagram posts and examining trends that emerge in user narratives and viewer comments. It uses the framework of thru-hikers of the Pacific Crest Trail (PCT) to understand wilderness representations and social media user experiences. Unless otherwise indicated, all referenced posts were found by searching the hashtag #PCTClassof2019. All posts are publicly available and do not require the user to grant permission to be viewed.

The Pacific Crest Trail on Instagram

A unique case study to examine social media as a dataset and to explore current wilderness trends can be found in thru-hikers' representations of the Pacific Crest Trail on Instagram. A 2,650-mile (4265 km) route running from Mexico to Canada, the PCT passes through 48 wilderness areas across three states. Since thru-hikers are walking for several months, they have an extended opportunity to post – and viewers have an extended opportunity to observe – their journey in real time, uploading a photo to Instagram whenever internet access is available. This active use of Instagram while hiking is visible in the growth of PCT-tagged posts over a thru-hiking season. On June 11, 2019, the hashtag #PCT2019 had 32,439 posts and the hashtag #PCTClassof2019 had 5,351 posts. Four months later, on November 11, 2019, the hashtag #PCT2019 had 65,991 posts (a 103% increase) and the hashtag #PCTClassof2019 had 13,785 posts (a 158% increase).

Photos First

As a photo-dominant platform, the photograph component of each Instagram post is the most immediately prominent aspect to the viewer. Indeed, when searching posts, only the photo is at first visible. It portrays a moment the user deemed worthy of sharing with an audience. Photos tagged #PCTClassof2019 overwhelmingly feature some type of wilderness vista, with hikers frequently included both as selfies and portraits. Photos featuring hikers appear to be particularly common at mile markers, summits, notable PCT landmarks (Figure 1), and the north and south terminus of the trail. Also common are photos of "zero days" spent off trail to resupply and take a break in nearby towns.

Figure 1 – Hikers pose by the sign marking the entrance to Kennedy Meadows, denoting the completion of the desert section of the PCT. Well-known landmarks are common celebratory posts. All photos were posted between May 23, 2019, and June 13, 2019.

Figure 2 – While PCT long-distance permits are issued for single individuals, Instagram photos demonstrate high-density camping and clustering of tents. Image posted on April 15, 2019, at https://www.instagram.com/p/BwSxUmslk2S/ by user uphilladventure.

Such images can provide information representative of "on the ground" experiences and conditions, as well as other information relevant to wilderness management decisions. For example:

- *A photo posted April 15, 2019 by uphilladventure (Figure 2) shows upward of 30 tents pitched in the same area, reflecting a high-density usage not communicated by the PCT's individually issued permits.*

- *User thejfiles posted a photo of himself alone at the southern terminus on April 14, 2016. However, his photo of the northern terminus on September 7, 2016, shows him with six other hikers, for a total group size of seven.*

- *User eli.exists posted a starting photo at the southern terminus on April 6, 2018, with one person, but a photo at the northern terminus with six total people.*

By contrasting the photos at the beginning of hikes to those posted at the end, wilderness managers can better establish what a thru-hiker's experience and potential impact on wilderness resources can look like.

Perceptions of Wilderness

Accompanying each photo is a caption written by the user – a real-time, self-narration of their journey that offers a window into how they perceive the wilderness around them. Without prompting by a survey, and before time has increased the likelihood of misremembering or tinged recollection with nostalgia, users share their primary reasons for going into the wilderness and what they find there:

Figure 3 – A hiker narrates her reaction to a section of the PCT affected by wildfire. Image posted June 23, 2019, by user katheleenlovesyoga at https://www.instagram.com/p/BzDoRgslyNG/. At the time of data collection (July 31, 2019), the post had 681 likes and 33 comments.

- *"I haven't much clue as to how I ended up on the PCT this year," wrote thekindofblue on a May 28, 2019, photo. "Here I've found myself a trail family, kindness, and the sheer power of nature… Somehow, it feels like the trail was always an inevitable part of me."*

Captions describe a hiker's emotional highs and lows, their thoughts while hiking, encounters with both nature and people, feelings toward surroundings, reflections on wilderness (Figure 3), and concerns about upcoming sections of the trail.

- *"Since the beginning of trail it has felt as if the only thing on everyone's mind has been the Sierra," wrote Ian.bertram on a June 6, 2019, post. "Due to high snow fall and recent storms the next section of trail will likely be quite the challenge, but I'm excited to explore what's ahead."*

Also illustrated is how a wilderness experience on the PCT continues to affect thru-hikers months or even years later (Figure 4). Reflecting on his one-year anniversary of beginning a PCT thru-hike, on April 25, 2019, user crumbsontrail reposted a photo of himself at the southern terminus and captioned it:

- *Happy trail anniversary to me! The memories are so vivid, so full … we can choose to take a risk, not live the way society wants us to live, and follow our heart. May it be becoming an artist, trying a different job, going back to school, leaving the country or go on a 2650 miles long hike [through] raw, wild nature."*

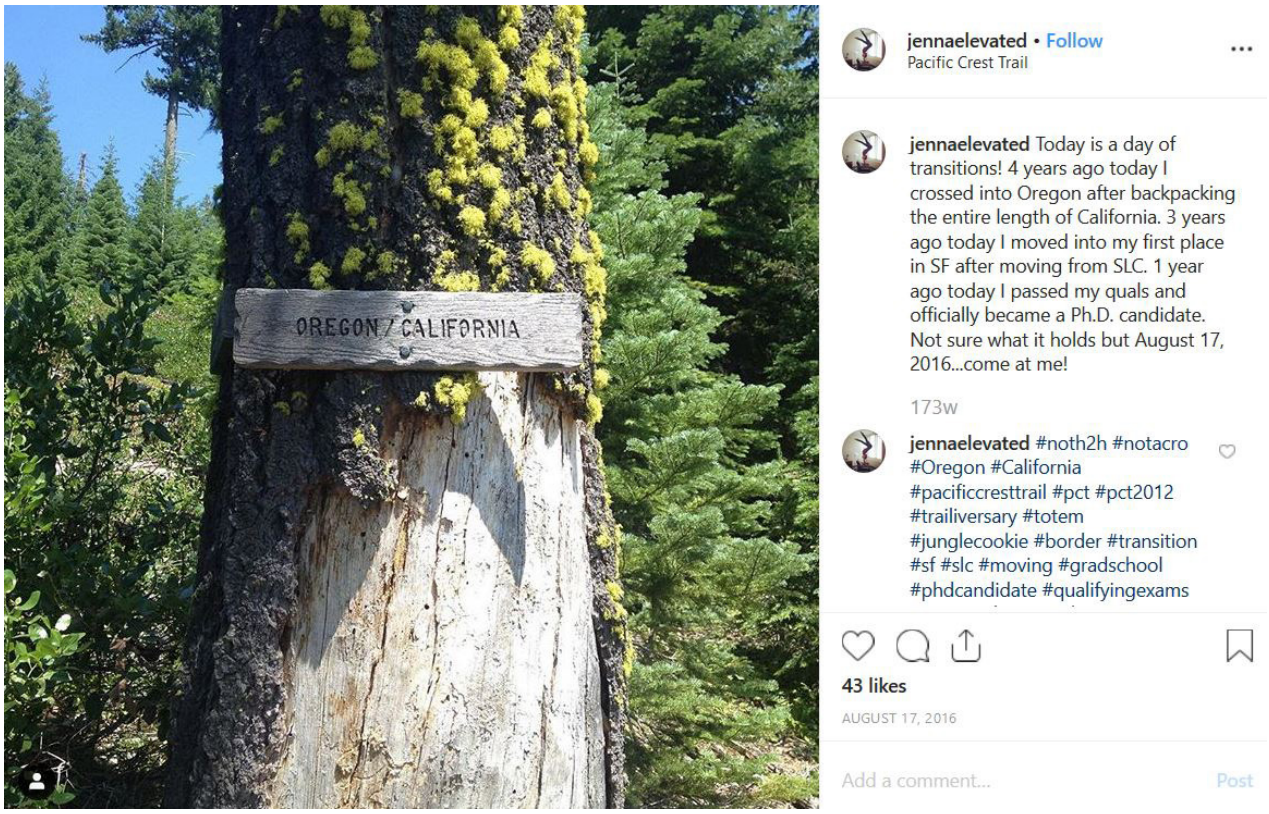

Figure 4 – Completing a thru-hike is portrayed on Instagram as a defining achievement that serves as a milestone against other life events. Image posted August 17, 2019, by user jennaelevated at https://www.instagram.com/p/BJNxxOQguqK/.

For user crumbsontrail, a thru-hike of the PCT was a chance to break away from society's expectations about how one should live their life, a perception he continued to portray to his social media followers a year later.

Other users shared retrospective feelings of loss.

- *On a November 6, 2018, post, carlsbest wrote: "After I finished the PCT, I fell into post trail depression and it was difficult for me to transition back to [off-trail] lifestyle.… Depression and lack of energy kept me from doing the things I love. I was using all my energy into work and I am exhausted. I have not had the energy I get outdoors and do what I love. Hike.*

On the same post, prior PCT thru-hiker clareschmidt7 commented,

- *"I worry that the more time between me and the PCT, the lower my energy and excitement about life, I've never felt so alive and in touch as I did on that trail."*

Other captions are primarily logistical, noting the location the photo was taken, trail conditions, and miles hiked. Thru-hikers sometimes note what encounters most detracted from their wilderness experience:

- *wherethehellissteve identified the negative effects of nearby resource extraction, writing on a July 17, 2019, post, "Woke up at 4AM this morning to the sweet sounds of lumberjacks and bulldozers clearcutting the forest in the valley below our campsite."*

These types of observations provide wilderness managers with a snapshot of where management interventions may need to be most prioritized.

#Hashtags

Following each caption are hashtags, labels that allow viewers to search for specific categories of photos. Hikers tag photos with a wide array of hashtags, sometimes placing more than 30 on a single photo (Figure 5). At minimum, photos typically include a hashtag specifying the trail and year attempted. As of December 16, 2019, the hashtag #pct2014 had 3,692 posts, the hashtag #pct2016 had 35,939 posts, and the hashtag #pct2018 had 70,821 posts. This type of logistical hashtag can assist in remedying the challenge that wilderness trends at a specific place over time have been difficult to track (Dvorak et al. 2012). Tools to follow wilderness users, such as self-permitting, aerial photography, direct observation, and surveys can be imprecise, time-consuming, and expensive (Hammitt, Cole, and Monz 2015). Instagram and other social media platforms help fill these voids, allowing observation of the PCT year after year. While such a dataset will bring its own limitations – it is driven by the whims of the user, not a standardized survey, and can go back only to 2010, the year Instagram was founded – it makes assembling large sample sizes of specific cohorts of wilderness users in a specific year a rapid process.

Other hashtags identify resources being used by thru-hikers. The hashtag #withguthook indicates a user is using Guthook, a popular hiking app that provides extensive detail about the PCT, including offline maps, photos of waypoints, real-time information about trail conditions, and water availability provided by other hikers. Counting the use of this hashtag offers some insight into the

Figure 5 – Photos are typically tagged with multiple hashtags. User paigepasquini labeled their post with 33 hashtags, including #guthookguides and #ultralight (resources used on the thru-hike), #womenwhohike and #womenwhoexplore (establishing an identity), and #dirtbagdarling (reclaiming a term of disdain as one of pride). At time of original data collection (July 23, 2019), the post had 294 likes and 10 comments.

frequency of digital app use for wilderness navigation.

A user's hashtag also provides insight into how they perceives themselves and their journey. PCT photos included hashtags such as #womenwhohike, #blackgirlswhohike, #latinaswho-hike, #veganthruhiker, and #plussizehiker, each claiming an identity beyond "thru-hiker." The frequently used #hikertrash transforms the shameful perception of "trashy" into a mark of pride. Other hashtags communicate perceptions and goals of the journey of the thru-hike: #optoutside, #neverstopexploring, #adventurelife, #wanderlust, and #wildernessculture each link thru-hiking with a specific perception of how life should be lived.

Hashtags can extend the audience of PCT photos to audiences not familiar with wilderness. Alongside PCT hashtags are hashtags for seemingly unrelated topics. For example, on July 18, 2019, heparker1 used, in addition to #PCTClassof2019, the popular #dogsofinstagram label, which had 159 million posts as of August 2019. Users without knowledge of the PCT will search for an unrelated topic (dog photos) and find themselves with content about the PCT. Much of wilderness media can be self-selecting; books, articles, and Leave No Trace education consumers will likely have at least minimal awareness of wilderness. With unrelated hashtags, the potential viewing population for the posted wilderness perspectives and practices widens enormously.

Audience Perception

The final component of an Instagram post are comments left by viewers. Sometimes family and friends of the thru-hiker or sometimes strangers ask questions and provide thoughts and opinions on the depicted situation. Most frequently, comments take the form of a torrent of praise and validation of the thru-hiker. Within 14 hours of posting, akuerzdoerfer's August 4, 2019, photo of his thru-hike completion garnered 540 likes and 39 comments, all highly positive:

- *"You are a force of nature."*
- *"Congratulations on such an incredible accomplishment."*
- *"hell yeah!! My deepest respect!!"*

This praise extends to more ordinary moments as well. ludlmama's June 1, 2019, post, which describes struggling through a patch of bad weather, resulted in viewer comments such as:

- *"You are astounding! [Heart emoji] totally crying."*
- *"You are an excellent writer. This was an exhilarating read."*
- *"Woaaaaaah this is an epic post and epic picture."*

In their commentary, viewers hint at their own perceptions of wilderness. On a May 31, 2019,

photo by katiecarp (Figure 1, bottom right), one viewer asked if she was bringing a gun.

Solitude and Instagram

The composition of Instagram posts raises new questions for how persons interact with wilderness. The Wilderness Act directs wilderness to provide "outstanding opportunities for solitude." What does solitude look like in the context of Instagram? Social media posts are intended to share experiences. While the user may be physically isolated, the portrayed moment is intended to include connection with, and allow commentary from, other people.

Is this solitude? Wilderness writing, painting, and photography have always shared personal wilderness experiences, but Instagram enables narration of and reaction to a wilderness journey at a speed and audience size previous artistic expressions do not. The rapidity with which Instagram posts can be created drastically shortens the time between when a hiker experiences the PCT and when they talk about it with an audience. This is particularly true of a thru-hike: the multiple-month time frame means a hiker can receive, and potentially have their experience altered by, viewers' feedback while still in the wilderness.

Instagram has also emerged as a performance-centric platform. It is used to curate the appearance of an attractive lifestyle, often with intentional exclusion of any negative experiences (Pilar, Balcarova, and Rojik 2016; Fox and Vendemia 2016). Users who engage with it do so with a primary motivation of appearing cool and creative to those around them (Sheldon and Bryant 2016). The torrent of praise and validation heaped onto PCT photos – whether from commenters or the volume of "likes" – reflects the success of those motivations. Can the character of a wilderness experience be retained against a potentially dominant desire to cultivate an identity to share via social media? A hiker might be in physical solitude, but social media is designed to share and allow viewers to engage with the experiences of others. While depicting quests of solitude and escape from society, while tagging photos with hashtags such as #WannaBeWhereThePeopleArent, hikers join spaces where people are and bring them along on their journey into wilderness.

Inclusion of this audience in a wilderness journey can even bring financial opportunities for hikers, who can use Instagram to find sponsorship to help pay for their trip. On a March 16, 2016, post that garnered more than 1,700 likes, brandonexplores wrote that MSR would be sharing "some of the work I produced while I was out there in the wilderness for 6 months." He went on to praise the company, writing, "couldn't of [sic] done any of it without the support of great gear companies like @msr_gear." When an outdoor gear company complimented their March 2016 photo, user cachebuster responded with an inquiry about whether they were seeking new gear ambassadors. Opportunities aren't limited to outdoor gear. A June 27, 2019, photo by meredithj7 had comments from three companies (selling lip balm, jewelry, and furniture) offering to "collaborate."

Other hikers request sponsorship directly from their viewers. To fund his 2019 thru-hike, user secondchancehiker set up a Patreon, a website that allows online "patrons" to make monthly financial donations in exchange for

benefits such as exclusive social media content. As of September 15, 2019, secondchancehiker had 278 patrons making financial donations, in addition to more than 12,000 Instagram followers and 26,000 YouTube subscribers. Throughout his journey, he produced multiple types of social media targeted at financially contributing viewers, including footage of being evacuated by helicopter due to a back injury.

The PCT Association found lack of money to be one of the most frequently cited reasons a thru-hikers ends their journey (PCT Association 2019), meaning gear or financial sponsorship may be the enabler of a wilderness experience. A mutually beneficial relationship is formed: hikers earn financial support, while companies gain brand ambassadors who can increase sales by placing their products in the context of adventures in beautiful places. Many thru-hikers also have side projects of their own, generating content for audience consumption throughout their thru-hike. "Read full post by heading to [blog URL] under the "journal tab," urged lupine_hikes on an August 30, 2019, post. "While you're there, subscribe to the mailing list!" User sunshineconsultingllp wrote on August 5, 2019, "The following is a [sneak] peak of my next blog post (link in bio)."

Conclusion

Social media may redefine what solitude and other concepts in wilderness mean. Further implications of this trend remain to be explored, but ignoring the information provided by Instagram and other social media spaces ensures that changes will occur without active discussion. This is particularly relevant when considering the heaviest users of social media: the younger generations still developing their wilderness ethics. They will be the persons setting policies and social norms in wilderness in decades to come. If their wilderness habits include regular use of social media, excluding study of its presence and influence will neglect a large component of the wilderness experience.

Even if wilderness managers choose not to investigate Instagram or other social media platforms to inform active management decisions, they should be observing this space to understand how users are portraying wilderness experiences. In a July 25, 2019, post tagged #threesisterswilderness, user kkferb responded to upcoming use restrictions, writing:

- *"I met a lot of nice people today on the trails and some talked about the limited entry/permit system which takes effect in our area in 2020.… The days of spontaneous trail adventures on many of the wilderness trails will be no longer. I will dearly miss them. I also understand the need to protect those special places negatively impacted by overuse, and sadly, abuse."*

Such responses to management action can provide insight into where more public education or outreach may be needed, or where wilderness users are dissatisfied with decisions.

With social media comes also the potential for observing joy. Contemporary philosophies of wilderness preservation often include spiritual justification, arguing wilderness allows individuals to connect with something greater than the self while cultivating respect for nature and solitude (Adams 2008; Nash and Miller 2014). It portrays wilderness as offering opportunities for personal growth through physical challenges. With the caveat that Instagram experiences are carefully

curated, thus presenting their own type of bias, they also demonstrate the powerful emotional journey of the trail. On August 6, 2019, steplotus_ wrote:

- *"Snoqualmie Pass, WA. BACK ON TRAIL!… Nearly a year ago I stepped up to the same trail head and unbeknown to me, it would be the last time I would hear my mom's voice… Today, I step here with confidence. Is it because I am home? Is it because I am surrounded by trail friends who have made this process gentle and warm? How did I arrive to this space of confidence and bliss, knowing I'd be walking over the same miles I said my goodbyes to my Ma? Celebrate. Tribute. Memory. Before taking our first steps, I call dad, "I am ready. We are going to start walking!" Dad replies "okay, you know Mom is with you, right?" "I know, Dad. She's here." Lets do this."*

Social media changes how wilderness users share and perceive their experiences. Through their posts from the trail, they share anniversaries of sobriety, mourn destruction from wildfires, ponder gratitude and friendship, and celebrate wilderness. With social media, a new platform to examine how wilderness weaves itself into the American experience has emerged.

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KATHRYN SUTCLIFFE, MPH, is based out of Boston, Massachusetts, and is interested in connections between mental health, social media, and the outdoors; e-mail ka.sutcliffe@gmail.com.

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آخر الطوفان

Lancang River ORVs (Culture-Marnyi curve alone the river). **Photo credit** © Hailong Liu.

Natural and Scenic River Protection for Western China

by HAILONG LIU, YUXIA ZHOU, and TRAVIS WINN

Hailong Liu

Yuxia Zhou

Travis Winn

The development and utilization of rivers is important for a nation's economy and the livelihood improvement of its people. However, adequate river protection is also a core component of ecological civilization. Ecological civilization is a new stage in the history of human civilization that has followed industrial civilization. It requires the economic, political, cultural, and social development following the law of harmonious relationship between human and nature, and it reflects the contemporary progress of civilization in a society. A key milestone in the legislation and practice of integrated river protection was the enactment of Wild and Scenic Rivers Act (WSRA) of United States in 1968, followed in turn by New Zealand (1981), Canada (1984), and Queensland, Australia (1990), with their own systems of river protection. WSRA's passage acknowledged the importance of protecting and enhancing select free-flowing rivers for their range of natural, cultural, and recreational values (Chesterton and Watson 2017).

China's rivers are under intensive demand to meet mul-

tiple uses ranging from water resources development to flood control to shipping to pollution prevention. At present, China has the largest number of large dams of any country in the world, and the large-scale development of its rivers will continue for the foreseeable future, A reported 6,539 dams more than 30 meters (98 ft.) high have been completed or are under construction, accounting for 43% of all such dams worldwide)(Jia 2016). According to the Chinese Statistical Yearbook of Water Resources in 2016, investments in water conservancy construction in China maintains an annual growth rate of more than 10%, in which 50% is for water resource projects, 35% for flood control projects, 11% for hydropower projects, and only 4% for water and soil conservation and ecological improvement (Ministry of Water Resources of the PRC 2016).

The country's mountain areas with their outstanding scenic resources are often the hotspots of water resources development. This has created big challenges between dam construction and river ecosystem and landscape protection. For example, the first public interest litigation for the protection of endangered wildlife in China, the Green Peacock Habitat Protection Case, was held in 2018. It pointed out that the construction of Gasajiang Hydropower Station on the mainstream of the Yunnan Red River would submerge the last habitats of the endangered green peacock, which ranked as Endangered on the IUCN Red List of Threatened Species. China's current river management focuses on the development of economic and practical values and often ignores ecological, cultural, and scenic values protection. Therefore, there is an urgent need for comprehensive river management legislation and river protection system.

This article discusses three models of river protection in Western China: a Natural model, a Coexistence model, and a Rehabilitated model. The case of the Angsai Gorge segment of the Lancang River is also explored as an example for preliminary discussion. It acts as a natural and scenic river demonstration project because of its characteristics and values, changes and trends, and research areas that allow for exploration of new conservation strategies.

The Significance of River Protection in Western China

Western China includes 12 provinces and autonomous regions with a total land area of 6.86 million square kilometers (2.86 million sq. miles) and a total population of 380 million people. This accounts for 72% of China's territorial area and 29% of its population. The protection of rivers in Western China is of great significance for the following reasons:

- *The western region is the birthplace of several important international rivers, such as the Yangtze River, Yellow River, Lancang River, Nujiang River, and Yarlung Zangbo River, and it plays a key role as the core area of water resources for both national and international water security strategies.*

- *The western region contains rivers with the most distinct wilderness characteristics in China (Liu and Yang 2014), and some still retain high value of wilderness and primitive landscape character. It is a landscape with ecologically crucial and unique hotspots, very fragile and sensitive ecosystems, and significant biodiversity protection.*

- *The western region is also the origin of diverse cultures, and is inhabited by Tibetan, Han, Qiang, Hui, Tu, Sala, Mongolian, Mumba, Loba, and other ethnic groups that hold unique religious beliefs and lifestyle practices integrating nature and culture. The worship of holy mountains and sacred lakes represents the ecological wisdom of coexistence between human and nature in Qinghai-Tibetan Plateau culture.*

In recent years, scholars have advocated for establishing a natural and scenic rivers protection system in Western China. Efforts have included promoting public participation in rivers protected (Cheng and Li 2006), analyzing stakeholders for river development and protection (Li, D. 2017), and translating the US Wild and Scenic River Act to the Western China context (Liu and Yang 2014). Additionally, national river protection cases in Sichuan Province and analysis of the relationship between China's river protection, China's national park and protected area system have been proposed (Li et al. 2018; Li , D. 2017; Li, P. 2018).

Three Models of River Protection in Western China

Natural Model: River Protection Based on National Park and Protected Area System

At present, China is planning to reform the national park and protected area system, with three main concepts of "ecological protection, national representation, and national public welfare."

Since 2017, 11 pilot national parks have been established. In addition, the plan of building the world's largest, most concentrated and unique World Third Pole National Park Cluster in the Qinghai-Tibetan Plateau has been proposed, relying on the unique natural and cultural landscapes of the western region with the Yarlung Zangbo Grand Canyon, Naqu Selin Lake, Ali Sar Da Lin, Qinghai Three Rivers Source, Mount Everest, and Qiangtang Unpopulated Area as the primary areas (Fan et al. 2017). It follows, therefore, that China should explore more comprehensive protection strategies with the establishment of these new national park and protected area systems. A Natural River is defined as the river or river segment with relatively less human disturbance and with characteristics of wilderness, intact ecosystems, high or unique biodiversity, and national landscape representation. It is derived from the US WSRA but with some differences: it is hard to define a total wild river due to the local population and traditional settlements along even the most remote Chinese rivers. The Natural River protection model aims to include those as part of the national park system with integrated protection of river ecosystems and natural and cultural landscapes.

Based on the above approach, some specific strategies can be implemented:

1. *According to the concept of ecological protection and national representation, identify the Outstandingly Remarkable Values (ORVs) of Western China rivers in terms of hydrology, geology, biology, recreation, and scenic aesthetics*

2. *Analyze the relationship between rivers and protected areas of Western China, such as national parks, scenic areas, geology parks, forest parks, and other types of areas, and clarify the types and spatial boundaries of river-related protected areas;*

3. *Based on the natural watershed (catchment unit), identify the structure and function of rivers and define the width of protected river corridors to ensure the integrity of ecosystem;*

4. *Establish forbidden development zones and implement strict preservation under legislation;*

5. *Moderately develop recreation and education projects with low environmental impact.*

Coexistence Model: River Optimization of Developed Rivers with ORVs

Ancient China left many cases of water conservancy projects that combine perfectly with picturesque landscapes, such as Dujiangyan in Sichuan, West Lake in Hangzhou, and Yiheyuan (Summer Palace) in Beijing. This is reflected in the harmonious coexistence between practical function and ecological aesthetics within ancient water management wisdom. However, in the past decade, several hydropower projects in Western China have aroused great public controversy. Therefore, it is time to change the focus on large water project development to a more balanced attitude that includes the concept of maintaining ecosystem services. Here it is necessary to explore a Coexistence Protection Model of developed rivers with ORVs by respecting natural process and coordinating with hydropower projects. The economy of water conservancy projects can and must be balanced with the regulation of river flow; the protection of fish and bird habitat; the conservation of geology, history, culture, and landscape resources; and the improvement of people's livelihoods.

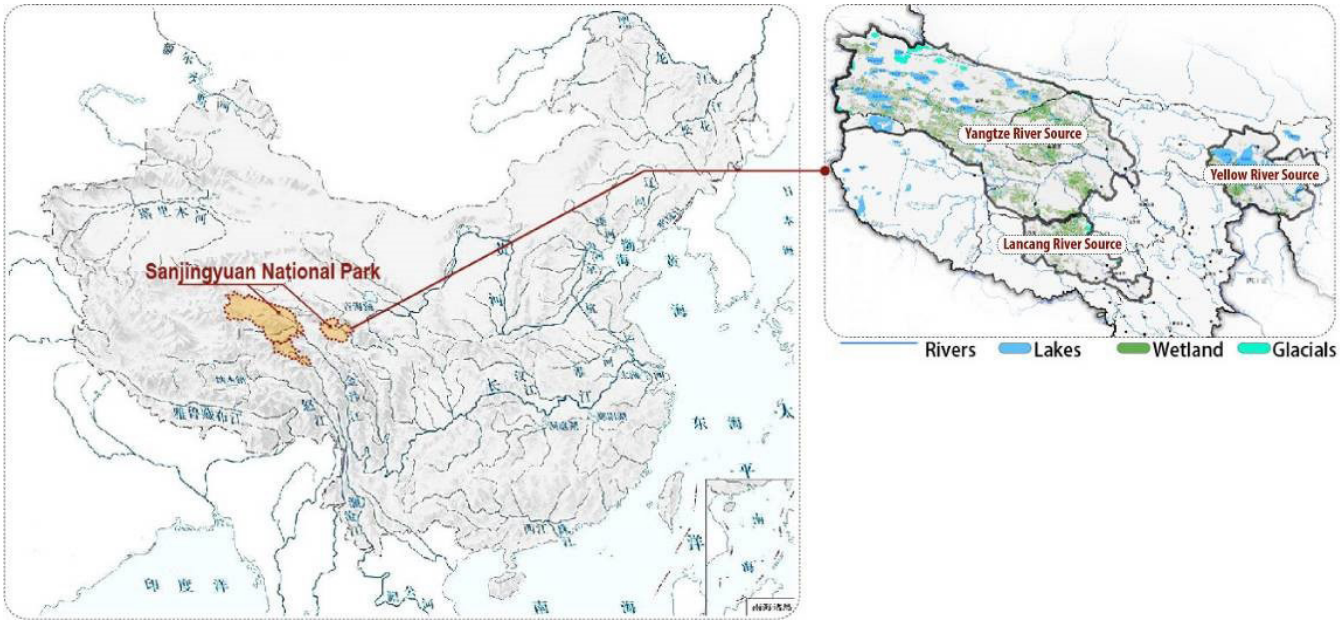

Figure 1 - Location of Three-River-Source National Park. National Development and Reform Commission. Three-River-Source National Park Comprehensive Plan[R]. 2018, pp. 25–26.

Some specific strategies include:

1. *classifying rivers types according to the objectives of socioeconomic development and natural protection needs;*

2. *developing scientific research focused on the relationships between river protection and development, such as fish migration, bird habitat protection, and historical and cultural landscape protection;*

3. *providing solid and sufficient criteria for all parties to evaluate the environmental and economic outcomes before project implementation;*

4. *assessing environmental impacts of various river-related engineering projects in respect to visual landscape, terrestrial and aquatic ecosystems, and local identity; and*

5. *establishing a third-party environmental impact assessment system, legal proceedings based on current river-related law, and a long-term natural and scenic river protection system of laws.*

Rehabilitated Model: River Restoration with Dam Removal Projects

According to The Audit Report of Eco-Environmental Protection in the Yangtze River Economic Zone (2018), by the end of 2017 just over 24,000 small hydropower stations had been built in 10 provinces, with a minimum spacing of only 100 meters (328 ft.), and such extreme exploitation has resulted in 1,017 kilometers (632 miles) of dried-up segments of varying degrees in 333 rivers. Additionally, the illegal and disorderly construction of small hydropower stations causes serious ecological issues. However, the Yangtze River protection proposed by President Xi Jinping has significant possibilities to restore degraded rivers by removing aging dams or dams with low efficiency to restore many sections of rivers. Therefore, the Rehabilitated Model aims to restore developed rivers or river segments with ORVs by dam removal and other possible means. Through rehabilitation the rivers will be restored to their natural and aesthetic values, provide recreation opportunities, and generate new potential social and economic values.

Some specific strategies could be carried out in the future, including:

1. *implementing the rivers' restoration of water quantity, quality, biodiversity, ecosystem, and visual landscape from tributaries to main streams and river basins;*

2. *establishing multidisciplinary research teams or cooperative platforms including experts from hydrology, ecology, geomorphology, landscape architecture, history, archaeology, hydraulic engineering, and dam safety to evaluate and track the process before and after the dam removal;*

3. *promoting public participation, encouraging local people and institutions to take part in river protection and restoration; and*

4. *integrating river and landscape protection into the responsibilities of local leaders and promoting the establishment of full-time professional river manager teams.*

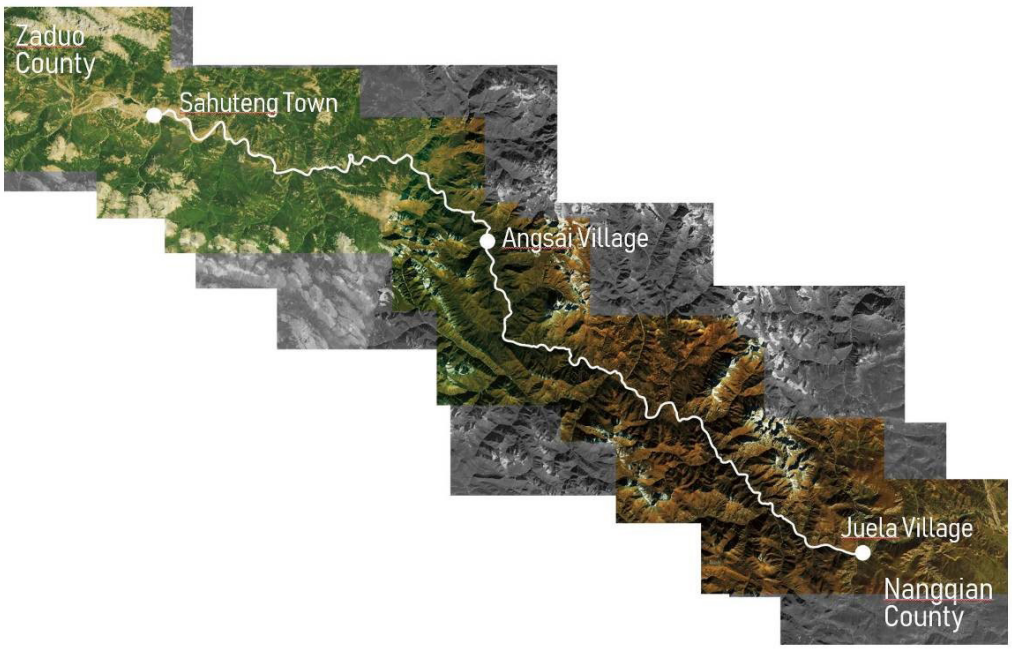

Figure 2 - Range Map for rafting investigation. Data from global mapper database.

Study on Angsai Gorge of Lancang River as a Natural and Scenic River

Characteristics and ORVs

Lancang River originates in the Three-River-Source Area of southern Qinghai province, China. This is also the birthplace of the Yangtze and Yellow Rivers, and is well-known as "China's Water Tower" with the world's highest and largest glacier distribution. The protection goals of Three-River-Source National Park include its unique "glacier-snow mountain-wetland-river-gorge" plateau ecosystem, water source, and biodiversity, and it is also the demonstration area for ecological restoration and preservation of local cultural heritage.

Our research group completed a 122-kilometer (76 mile) field investigation along Angsai Gorge of Lancang River (from Sahuteng Town of Zaduo County to Juela Village of Nangqian County in Three-River-Source Area) during July and August 2018. The preliminary analysis shows that this river segment represents the world-class features of a Wild and Scenic River (as compared to the US Wild and Scenic River Act) and has remarkable values in terms of ecology, geology, hydrology, scenery, and recreation. It is a habitat for wildlife, such as snow leopard, blue sheep, eagle, and other rare species. There remain high natural conditions without massive water conservancy projects and transportation construction. The mainstream and tributaries have free-flow status, high water quality, intact vegetation cover along a riverside canyon, and the unique harmonious relationship with Tibetan culture. Finally, astonishing picturesque views exist of open landscapes and wilderness without human disturbance, with great opportunities for recreation and education.

Changes and Trends

The rivers in the Three-River-Source Area are facing threats from glacier melt and recession, which in turn have a negative impact on water supply for rivers, lakes, and wetlands. The principal threats for the Lancang River along Angsai Gorge are roads, bridges, power lines, signal towers, commercial camping sites, and buildings. Although all of these projects are necessary for improving local living conditions, local transportation, energy, and tourism development, the negative effects from the constructions should be minimized for this world-class Wild and Scenic River.

The Last Descents River Expeditions team has experienced and observed the rivers of Western China for more than 10 years. They discovered a significant reduction of natural and scenic rivers in Western China, which originally possessed remarkable ecological and scenic characteristics. The Lancang River segment in Angsai is one of the rare remaining natural and scenic rivers. The team estimated that, according to US standards, the Angsai segment had 48% that could be classified as wild river, 41% as scenic river, and 11% as recreation river during their first rafting trip in 2010. But by 2017, only 8% remained as wild river and 80% as scenic or recreation , based on the expert judgment of the team.

Many important plans and relevant research on Three-River-Source National Park are currently in progress. Although the Angsai Gorge river segment (78 km/49 miles in Zaduo County) is included in the core area, the quality of some downstream river segments from the national park boundary is even higher than the river segment inside the boundary. However, river segments both inside and outside the boundary are under great threats of riparian infrastructure constructions and are likely to be affected in the near future.

We are now standing at a turning point in the future of China's western rivers, facing enormous challenges and opportunities at the same time. The establishment of the National Park System in 2017 in China is a milestone. And the promulgation of National Park Law and the Law of Protected Area is now driving more stringent legislation management of the environment in the future.

Further Research and Strategy

Many rivers in China have ORVs, but not many could meet the US criteria of Wild and Scenic Rivers due to the large population and rapid development of China. At present, the establishment of policy and plans for Three-River-Source National Park is in the pilot stage. Thus, it will be an opportunity to establish the pioneer river protection mechanism in this area and to classify

Figure 3 – Angsai Gorge of Lancang River segment. Photo by Meredith Meeks.

Figure 4 – Lancang River segment between Zaduo County and Nangqian County (natural river segment outside national park boundary). Photo by Hailong Liu.

Figure 5 – Lancang River ORVs (Geology – Cretaceous Danxia landform). Photo by Yuxia Zhou.

Figure 6 –Lancang River ORVs (Biodiversity – blue sheep). Photo by Hailong Liu.

Lancang and other precious natural rivers as National Natural and Scenic Rivers. In the future, this pilot project could be extended from Three-River-Source Area to rivers in wider Western China, or even the whole country.

For the protection of the Lancang River in Angsai Gorge, the following items warrant further study:

- *Landscape Impact Assessment – The construction of roads, bridges, power lines, residential areas, and tourist facilities are heterogeneous landscape elements that create visual interference points in the natural scenery of the canyon. There are prominent differences in scale, shape, and tone between the engineering characteristics and the surrounding natural settings, which lead to the fragmentation of natural and cultural landscape. A Landscape Impact Assessment should be carried out to measure landscape change.*

- *Stakeholder Analysis – Stakeholders in the negotiation between protection and development of Angsai Gorge include the National Park Service, local governments and departments, local communities and herdsmen, NGOs and related research institutions, eco-experience business companies, and visitors. By analyzing the perspectives and reformation of existing management mechanisms, it is possible to explore the win-win scenarios and optimal management modes for this river segment. There are also potential opportunities to encourage the participation of local herdsmen and organizations in the river recreation business and innovate the management methods in Three-River-Source National Park.*

- *Recreation Assessment – Analyze and predict the ideal visitor experience and visitor capacity via on-site questionnaires and interviews. Evaluate the economic benefits from ecological experiences, including its economic benefits (visitor expenditure) and social benefits (visitor satisfaction, community participation, etc.).*

- *Comprehensive Management Planning – The above analysis and multifaceted assessments need to be implemented into comprehensive and specific spatial planning and river management guidelines that create the protection range of Lancang River and coordinate with the boundary of Three-River-Source National Park. Different river protection levels need to be formulated with compatible management policies that optimize the requirements for infrastructure construction control along the river. Additionally, there should be public broadcasting and environmental education to improve the public understanding of river values.*

Figure 7 – Lancang River ORVs (Culture – prayer flags and Marnyi stone pile on river shore). Photo by Yuxia Zhou.

We are now standing at a turning point in the future of China's western rivers, facing enormous challenges and opportunities at the same time. The establishment of the National Park System in 2017 in China is a milestone. And the promulgation of National Park Law and the Law of Protected Area is now driving more stringent legislation management of the environment in the future. The relationship between river protection and development is particularly complex. On the one hand, it is urgent to establish a top-down management system; on the other hand, it is necessary to analyze the specific protection of different types of rivers according to local conditions. Further research is needed for the three models proposed in this article and the demonstrative case of Lancang River requires further research to provide a reference for natural and scenic river protection in China. IJW

HAILONG LIU is an associate professor in the Department of Landscape Architecture, School of Architecture, Tsinghua University of Beijing. His main research focus is on landscape hydrology, an interdisciplinary field crossing hydrology, ecology, environmental science, and landscape architecture; email: liuhlong@tsinghua.edu.cn.

YUXIA ZHOU is a PhD candidate in the Department of Landscape Architecture, School of Architecture, Tsinghua University of Beijing. Her research interest are wild and scenic rivers, national parks, and protected areas.

TRAVIS WINN is an American rafting expert and founder of Last Descents River Expeditions, which focuses on using river recreation as a tool for river protection and sustainable development.

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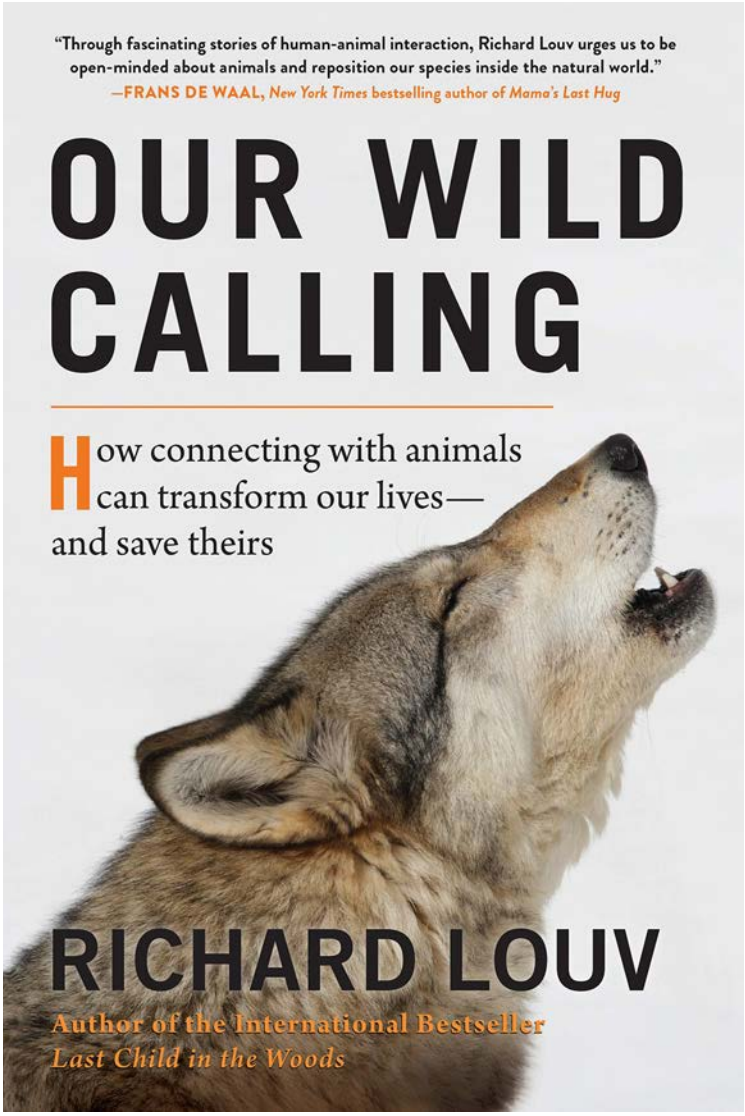
A citizen scientist takes a photo of a Pasqueflower, one of Boulder, Colorado's first spring blooms. The data was uploaded to iNaturalist during the 2019 City Nature Challenge. **Photo credit** © Melanie Hill

Book Review:

Patrick Kelly, Media and Book Review Editor.

OUR WILD CALLING: HOW CONNECTING WITH ANIMALS CAN TRANSFORM OUR LIVES-AND SAVE THEIRS
by Richard Louv. 2019. Algonquin Books. 320 pp. $13.99 CAD/USD (hc)



Our Wild Calling, the newest offering from journalist and author Richard Louv, builds on many of the themes explored in his international bestseller, Last Child in the Woods. In that influential work, Louv coined the term "nature-deficit disorder" to capture the negative consequences that increasing separation from the natural world is having on children's health and well-being. In Our Wild Calling, Louv turns his attention to the human-animal relationship, investigating the potential for this connection to transform our mental, physical, and spiritual lives. Combining the latest research, along with powerful personal stories, Louv offers us a way to challenge and displace human exceptionalism by reestablishing and recognizing our "membership in the family of animals".

Written in an accessible and clear journalistic style, Our Wild Calling begins by showing that humans in the Anthropocene are increasingly caught up in what Louv calls an "epidemic of loneliness". He then highlights a particular subset of this psychologically destructive phenomenon, something he calls "species loneliness". Defined as the "gnawing fear that we are alone in the universe with a desperate hunger for connection with other life", species loneliness points to the need for a deep connection to other animals that will "deliver us from our isolation, both as individuals and as a species"(pg. 17). Though Louv cites current research as supporting evidence, those of us working to protect and preserve wilderness and wildness for the public good in many ways already understand this need.

Demonstrating and reinforcing connection and shared experience with other animals is a primary theme throughout Our Wild Calling. To that end, the book progresses through a series of chapters on the fascinating and rapidly expanding body of scientific research into the human-animal relationship. Scientifically observed similarities between humans and animals in linguistic structure, social organization, and even moral behavior, are all tantalizingly floated. Along the way, Louv sprinkles moving anecdotes and personal stories from researchers, educators, and a wide variety of others who have had life-changing encounters with all manner of creatures, both wild and domesticated.

Driving all of this is Louv's goal of instilling empathy through a realization of our shared membership in the community of life on Earth. Akin to the realization of Aldo Leopold's Land Ethic, Louv hopes to cultivate an "age of connection" wherein humans assume the responsibility of becoming plain members and citizens of our shared biotic community. This cannot be achieved through policy and improved technology alone, but through the cultivation of what Louv calls the "habitat of the heart". By pushing past outdated cultural biases about anthropomorphism, we create the possibility for true emotional connection and care for our living planet. The urgency to do so has never been greater, and Our Wild Calling offers a well-researched, passionately written guide to a wilder, more vibrant future. IJW

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

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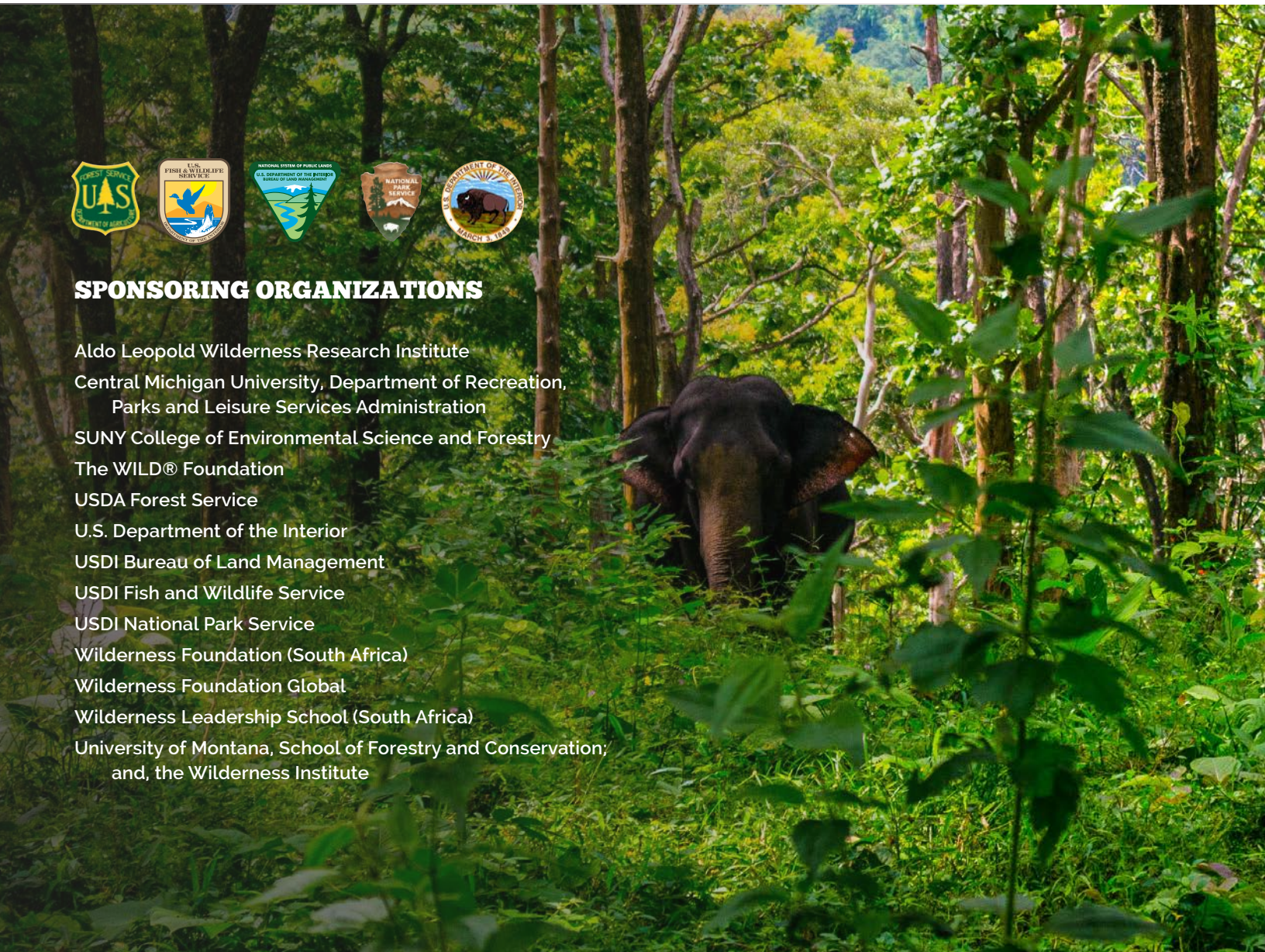

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