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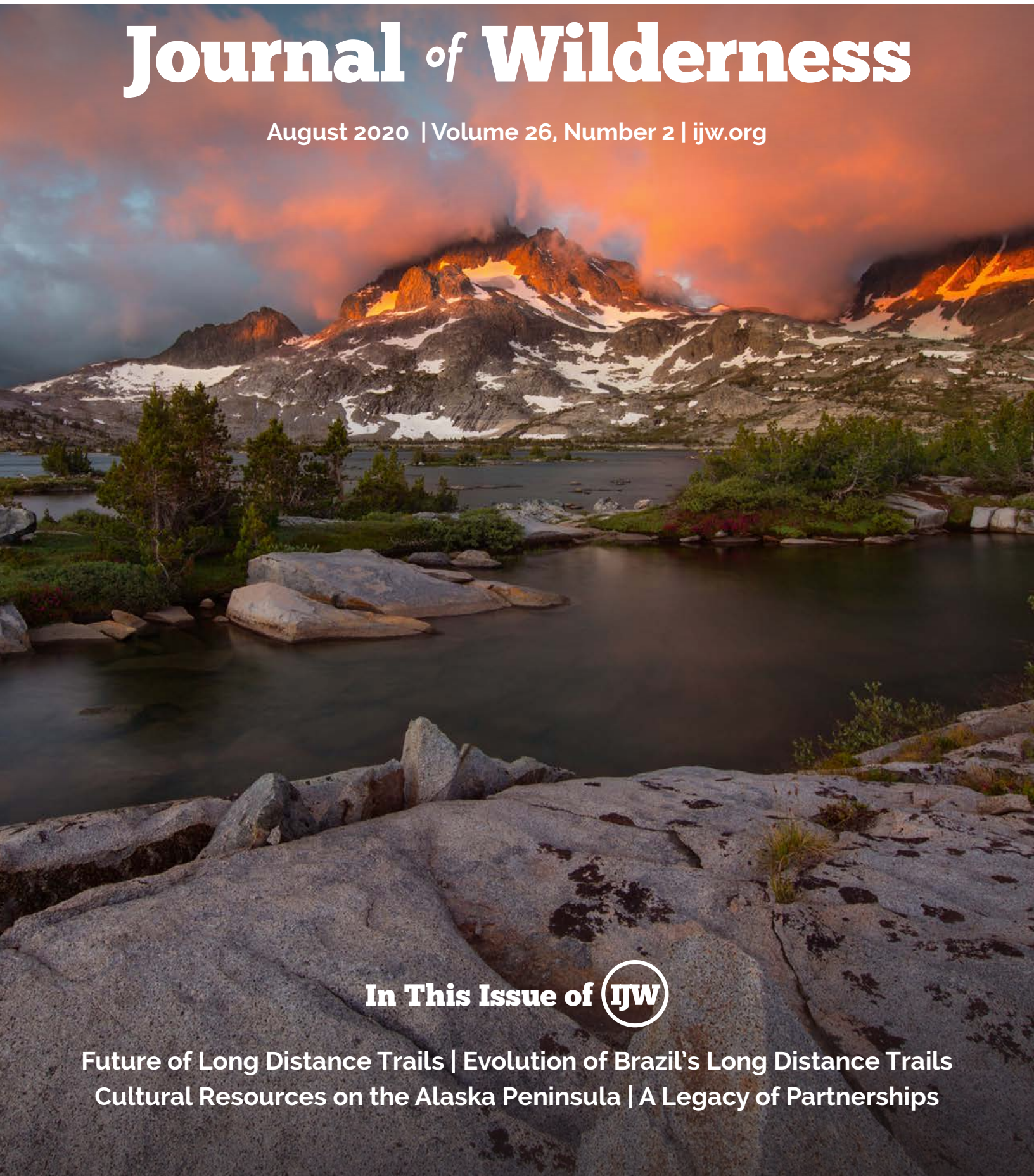

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MANUSCRIPTS TO: Robert Dvorak, Dept. of Recreation, Parks and Leisure Services, Central Michigan University, Room 108 Finch Hall, Mount Pleasant, MI 48859; Telephone: (989) 774-7269. E-mail: dvora1rg@cmich.edu.

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View of the Three Sisters. **Photo credit** © Alexander Kingsbery

EDITORIAL PERSPECTIVES

Foundation and Future of Long Distance Trails

by JENNIFER THOMSEN, JEREMY WIMPEY, and NATHAN REIGNER

"In order to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition, it is hereby declared to be the policy of the Congress to secure for the American people of present and future generations the benefits of an enduring resource of wilderness… for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character" **Wilderness Act, 1964**

"In order to provide for the ever-increasing outdoor recreation needs of an expanding population and in order to promote the preservation of, public access to, travel within, and enjoyment and appreciation of the open-air, outdoor areas and historic resources of the Nation, trails should be established…to provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas through which such trails may pass." **National Trails System Act, 1968**

Jennifer Thomsen

Jeremy Wimpey

Nathan Reigner

We begin this special edition of the International Journal of Wilderness with references to the U.S. Wilderness and National Trails System Acts to illustrate the significance and interconnectedness of wilderness areas and long-distance trails. Wilderness areas preserve places in an undeveloped, natural, and untrammeled state to provide primitive and unconfined recreation opportunities. National Scenic Trails provide recreation opportunities, including opportunities for long-distance

travel, and protect the natural, scenic, cultural, and historic characteristics of the lands they traverse. In philosophy and legislative intent, these designations are similar, emphasizing high-quality resource protection and provision of unique recreation opportunities. In application, they are administered by the US federal agencies and often share common geographies (i.e., national scenic trails often travel through designated wilderness areas).

Difficulties in the management of resources and recreation along national scenic trails in wilderness areas have, however, arisen. These difficulties, often ignited by increases or changes in visitor use have revealed tensions, inconsistencies, and disconnects between wilderness and National Scenic Trail management. The purpose of this special edition is to both highlight the issues particular to resource and recreation management when wilderness and National Scenic Trails overlap and to advance dialogue, collaboration, and science-informed management of these special places.

National Scenic Trails

National Scenic Trails (NST), along with National Historic Trails (NHT) and National Recreational Trails (RHT), were established by the National Trails System Act of 1968 (Figure 1). The basic criteria, as specified by the Act (16 USC 1241-51), is minimum length of 100 miles, continuity along an established route (although the route need not physically exist in its entirety), primarily non-motorized use, and the presence of outstanding recreational opportunities. Currently, 11 trails hold the National Scenic Trail designation in the United States, totaling nearly 20,000 miles

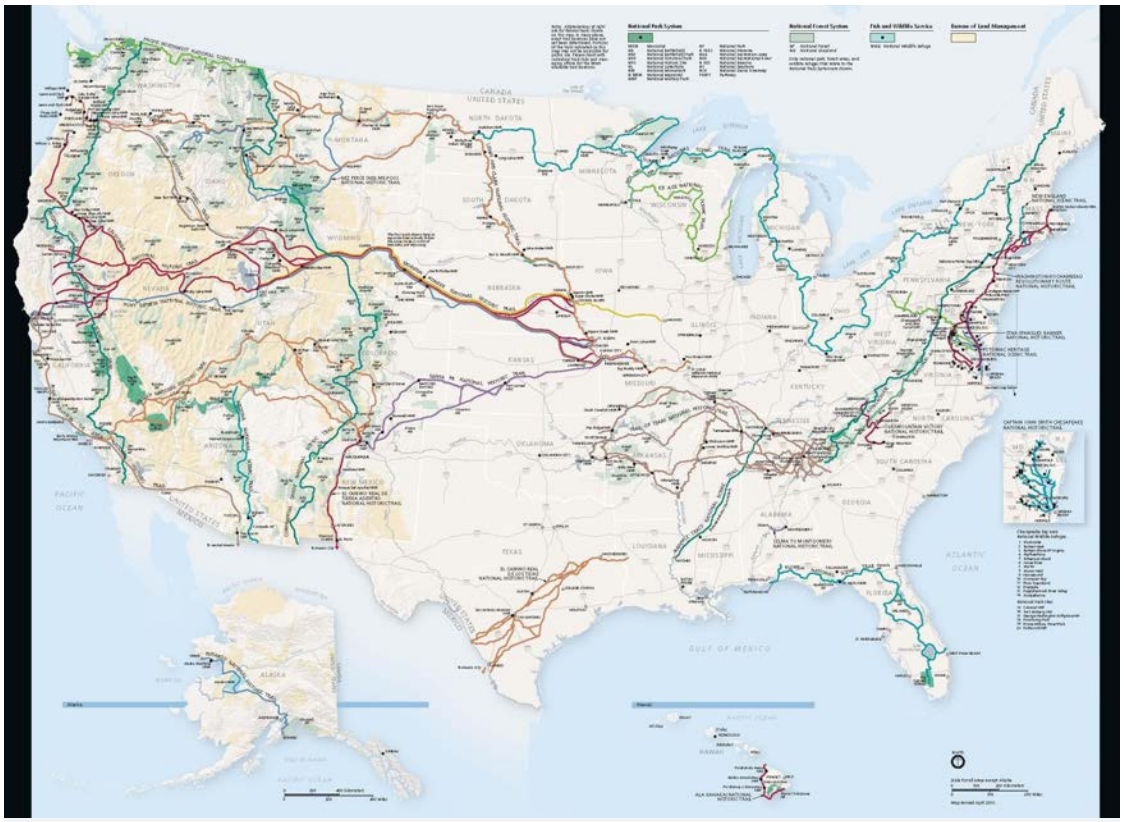

Figure 1 - Map of US National Trails System.

Trail Name	Year Established	Length Authorized (miles)
Pacific Crest National Scenic Trail	1968	2,650
Appalachian National Scenic Trail	1968	2,181
Continental Divide National Scenic Trail	1978	3,100
North Country National Scenic Trail	1980	4,600
Ice Age National Scenic Trail	1980	1,200
Florida National Scenic Trail	1983	1,300
Potomac Heritage National Scenic Trail	1983	700
Natchez Trace National Scenic Trail	1983	695
Pacific Northwest National Scenic Trail	2009	1,200
Arizona National Scenic Trail	2009	807
New England National Scenic Trail	2009	220
	Total:	**18,734**

Table 1 - Length and Age of US National Scenic Trails.

(Table 1). NHTs commemorate historic (and prehistoric) routes of travel that are of significance to the entire United States. They must meet all three criteria listed in Section 5(b)(11) of the National Trails System Act. NHTs are established by an act of the US Congress. NRTs are existing regional and local trails recognized by either the US Secretary of Agriculture or the US Secretary of the Interior upon application.

Given the growing popularity of thru-hiking and extended trails, there is a critical need for in-depth research and discussion to strengthen the understanding and management of this unique recreational activity and the diverse and transboundary resources that are encompassed by long-distance trails. Currently, there are limited studies on long-distance trail use and extended trail management and most studies focus on a select few trails, such as the Appalachian or Pacific Crest Trail, revealing a gap in the literature and coordinated approaches to management. Growing popularity and limited available science is not limited to US long-distance trails and their use, it is also critical research and management gap for similar trails around the world.

This special edition in the International Journal of Wilderness will address these gaps and expand the research and discussion on thru-hiking and extended trails to the academic and professional community. We include research and perspectives on a variety of extended trails in the U.S. and international settings as well as a diversity of types of trails from highly populated to more remote. Further, we address a vast amount of critical and relevant topics to provide readers with conceptual content and practical implications.

The special edition starts with the Soul of the Wilderness where Beth Boyst shares the opportunities and benefits of collaboration and a shared vision and stewardship for National Scenic Trails (NSTs) and wilderness Areas. Next, Cerveny, Derrien, and Miller provide a foundation for

understanding the evolving role of partners in the shared stewardship of National Scenic Trails. Reigner and Wimpey discuss key insights on how collaboration can inform multi-jurisdictional management through examples of the Pacific Crest National Scenic and John Muir Trails. Then, Cole and Thomsen provide findings of social aspects of the thru-hiker experience before, during, and after the completion of the Pacific Northwest National Scenic Trail and how this social experience influences hike preparation, response to challenges during the hike, and the transition back to everyday life.

Stelson, Rice, and Taff share findings from a culturally significant trail through the Katmai Wilderness to discuss the importance of considering cultural resources in long-distance trail planning and management. Then, Rogers and Leung provide findings for how emerging technologies create opportunities and challenges for managers and recreationists of the Appalachian Trail and how this information can inform spatial decisions. Finally, Cunha et al. offer an international perspective on the growth and evolution of the Brazilian long-distance trail system, the involvement of diverse groups, and challenges facing the future.

Bigart's book review of a recently published The Unlikely Thru-Hiker by Derick Lugo highlights the unique perspective of the author as an African-American thru-hiker with no previous outdoor experience on his Appalachian Trail journey. The review offers key insights to how thru-hiking can be a more inclusive and diverse type of recreation and the impacts of these immersive experiences.

As editors of this special edition, it is our hope that the articles can serve as a catalyst for future research and management discussions. In particular, we propose the following calls to action: (1) longitudinal studies to better understand the thru-hiker experience and long-term impacts; (2) focus on cultural resource impacts and management; (3) system-wide studies that can assess trends and unique aspects of National Scenic Trails; (4) coordination and communication across agency and international contexts; (5) expansion of studies to less-frequented trails and trails with unique attributes; (6) studies and experimentation of technology use and social media for thru-hikers and managers; (7) diversification of participation and perspectives of thru-hiking; (8) understanding role of trail towns and communities in management, stewardship, and hiker experience. jjw

JENNIFER THOMSEN is an assistant professor in the Parks, Tourism, Recreation Management Program at the University of Montana; email: jennifer.thomsen@mso.umt.edu

JEREMY WIMPEY, PhD, is Principal of Applied Trails Research and an adjunct faculty member in the Forest Resources and Environmental Conservation Department at the Virginia Polytechnic Institute and State University; email: jeremyw@appliedtrailsresearch.com.

NATHAN REIGNER, PhD, is a research assistant professor in the Recreation, Park, and Tourism Management Department at the Pennsylvania State University; email: npr5097@psu.edu.

The Kelso Valley on the Pacific Crest Trail. **Photo credit** © Ryan Weidert

With Collaboration We Can Overcome Challenges Together

by BETH BOYST

In my thirty years working in the wilderness and trails community, I have seen some of the best examples of wilderness stewardship and collaboration. At the heart of this, are core values of protection for special places, including National Scenic Trails (NSTs) and wilderness areas through which they run, and shared stewardship based on collaboration, science, and the complimentary purposes of NSTs and wilderness preservation. These values shape the missions and responsibilities of land managers, scientists, volunteers, and partners in order to create a robust community that will ensure that these lands, and their natural and cultural resources, are protected in perpetuity.

The Pacific Crest National Scenic Trail (PCT) travels through 48 US federally designated wilderness areas. With over half the mileage of the PCT traversing designated wilderness, Clinton Clarke (Figure 1), founder of the Pacific Crest Trail Conference in1932, shared that the conference's mission was "to maintain and defend for the benefit and enjoyment of nature lovers the Pacific Crest Trailway as a primitive wilderness pathway in an environment of solitude, free from the sights and sounds of a mechanically disturbed nature" (Clark, 1945).

The concepts of "shared stewardship" or "collaborative management" can be challenging. They require shared vision, definition of clear roles and responsibilities, and commitment

Beth Boyst

"The concepts of "shared stewardship" or "collaborative management" can be challenging. They require shared vision, definition of clear roles and responsibilities, and commitment to the collaborative process"

to the collaborative process. Efforts can quickly dissolve if trust is broken or if partners are asked to contribute in ways that do not meet their core interest. Collaboration takes more time than independent management. That's worth repeating – to successfully collaborate, it takes a lot more time! Brian O'Neill, Park Superintendent for the Golden Gate National Recreation Area (deceased), set the gold standard for partnerships. His twenty-one best practices (O'Neill n.d.) (Figure 2 are sprinkled with jewels such as "Find Ways through Red Tape" and "Strive for Excellence."

Superintendent O'Neil's partnership work articulates the guiding principles of a California-based collaborative effort I'm currently facilitating in the southern Sierra Nevada Mountains where the Pacific Crest Trail and John Muir Trail overlap (PCT/JMT). The PCT/JMT collaborative is an ad hoc group of NST and wilderness agency managers, researchers, and management partners who have joined together to realize a shared vision - "The Pacific Crest National Scenic Trail and the John Muir Trail, while preserving and protecting the Wilderness lands they traverse, provide outstanding long-distance hiking and equestrian opportunities across multiple agency boundaries through the iconic high Sierra." The collaborative group started meeting in Fall 2016 in response to unprecedented increases in backcountry travel along the 170-mile coincident path of the PCT and JMT. The trail provides a route along the wilderness heartland of the high Sierra through Yosemite, Sequoia-Kings-Canyon, South Sierra, Golden Trout, Ansel Adams, and John Muir Wildernesses (Figure 3). Visitor use management in this region is very complex due to the high levels of visitor use, multiple access points to the trail, and multiple land unit- based (i.e., national park, national forest) permit systems for managing overnight users. Without thoughtful integrated management, individual park or forest decisions can quickly result in unintended impacts to other units connected by the trail – sometimes referred

Figure 1 - Clinton Clarke, founder of the Pacific Crest Trail Conference.

Figure 2 - Brian O'Neill, Park Superintendent for the Golden Gate National Recreation Area.

metaphorically as "squeezing the toothpaste tube" to reflect that an action taken in one place (i.e., a squeeze of the tube) generates sometimes messy effects elsewhere.

Our collaborative work to create a shared vision and coordinated management requires patient cooperation that accommodates each participants' different missions, concerns, capacities, and capabilities. Our initial work started with a facilitator, name tags, and table name tents. Over time our work has grown into a system of collaborative and coordinated engagements that have resulted in real improvement for trail and wilderness management in the Southern Sierra. To that end, the group has identified the following areas of common interest: 1) establish a collaborative partnership and shared vision; 2) manage visitor experiences/protect resource values and conditions; 3) coordinate a systematic approach to wilderness permits and quotas; and 4) develop and deliver common and effective education messages and materials. Deliberation on practical topics such as alignment of food storage requirements to protect wildlife, collection of wilderness monitoring data to provide greater benefit across units and agencies, and management consideration for locations that do not require permits but access areas that do, have led

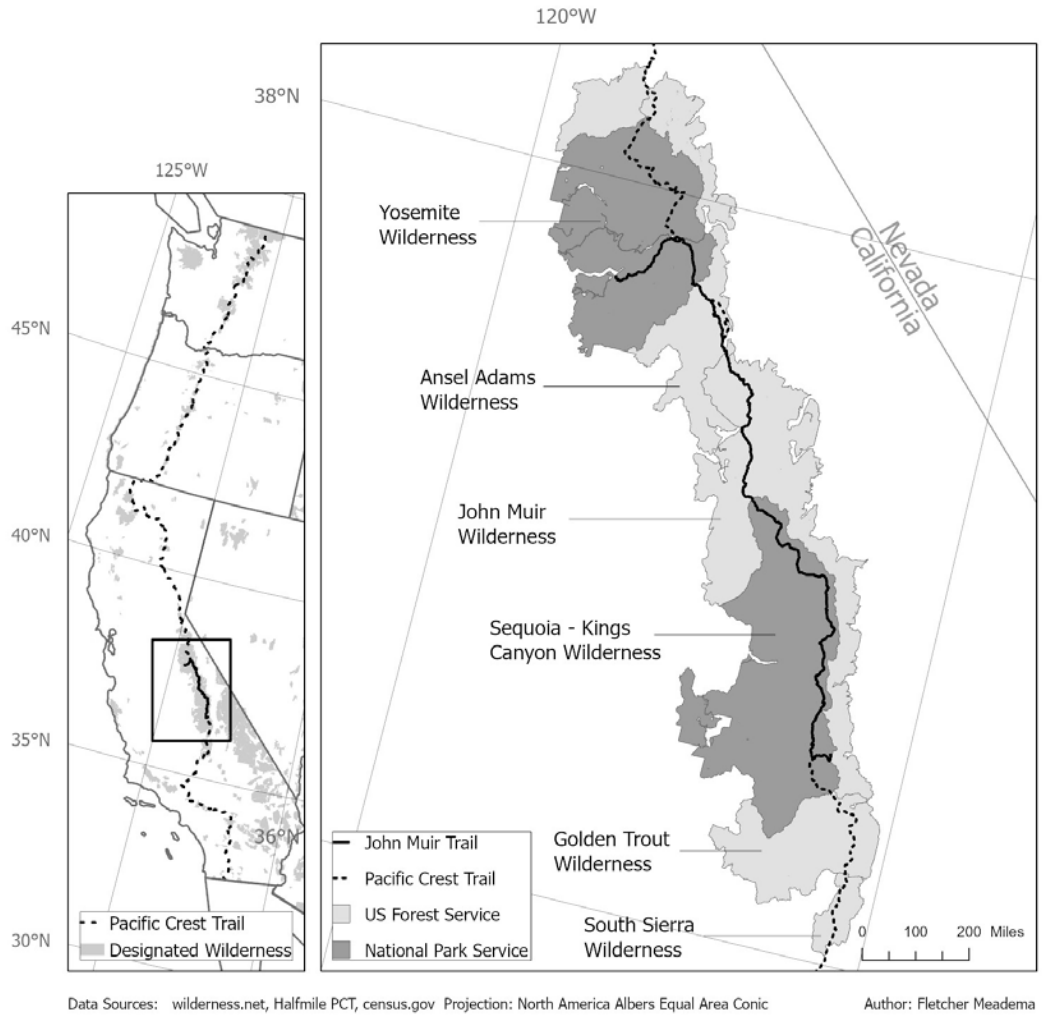

Figure 3 - The Pacific Crest Trial, John Muir Trail, and Wilderness Areas of the Sierra Nevada

to spirited discussions, which in turn have strengthened the collaborative group and improved management at the unit, regional, and trail-wide levels.

Perhaps the greatest success of our collaborative has been to build opportunities and support systems for science-based decision making through collaborations with social scientists, recreation ecologists, and trails experts from multiple universities. Their research, leveraged through the collaborative group's diverse experience and knowledge, provides current and near real-time information to inform discussion and management decisions. The team's research and data focus primarily on who our visitors are, and where, when, and how visitors travel and camp. The outputs provide diverse and dynamic insights into existing conditions, trends, and knowledge gaps. The research and analysis process and engagement help to focus our management strategies to achieve our shared vision – to protect these special places and provide outstanding opportunities for long-distance travel. Many thanks to the Aldo Leopold Wilderness Research Institute and faculty at Virginia Tech, Penn State, Humboldt State, and the University of California-Merced for their insightful collaborations.

I hope you'll be inspired by the opportunities and benefits of these type of collaborations. Our team has evolved from being a collection of strangers to a team of close-knit players who use each other's strengths to accomplish real and good work. The tangible benefits of this collaboration are the integrated transboundary patrols (agency staff and volunteers), monitoring, mapping, and educational efforts. The conundrum of how to allocate limited staff time to this "outside" influence is a challenge we all share, but none-the-less are also called to consider in order to protect and preserve these special places. Benton Mackaye, founder of the Appalachian National Scenic Trail (Figure 4), recognized the intangible benefits of both trails and wilderness by offering: "A period recourse into the wilds is not a retreat into secret silent sanctums to escape a wicked world, it is to take breath amid effort to forge a better world." Gratefully, with national scenic and historic trails in all fifty of the United States, we have a remarkable opportunity to link our stewardship of wild places and to create relevant and enduring partnerships across the nation. ijw

BETH BOYST is the Pacific Crest Trail administrator for the US Forest Service; email: beth.boyst@usda.gov

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Glacier Peak on the Pacific Crest Trail

STEWARDSHIP

Shared Stewardship and National Scenic Trails: Building on a Legacy of Partnerships

by LEE K. CERVENY, MONIKA M. DERRIEN, and ANNA B. MILLER

Lee K. Cerveny

Monika M. Derrien

Anna B. Miller

PEER REVIEWED

National Scenic Trails (NSTs) connect people with the natural and cultural heritage of the United States. Theses trails also provide important opportunities for agencies to engage partners in trail stewardship and sponsorship. Partnership engagement ultimately promotes trails that provide outdoor experiences and learning opportunities for visitors and trail users. In the founding legislation of the National Trails System Act of 1968, Congress acknowledged the integral role of volunteers and trail groups and set out "to encourage and assist volunteer citizen involvement in the planning, development, maintenance, and management… of trails" (P.L. 90-543). Early partners played a critical role in encouraging Congress to embrace the concept of national trails and identifying trail routes. Today, the National Trails System includes 11 NSTs, as well as 19 National Historic Trails, and nearly 1,300 National Recreation Trails in 50 states. The entire system engages hundreds of stewardship partners working at local, regional, and national scales. Federal agencies and trail organizations work together to plan and maintain the trails, develop outreach programs, and connect with the public.

Trail administrators in public agencies have a dual commitment to encourage trail use and provide quality experiences to visitors while also conserving natural resources along trail corridors (P.L. 90-543).

Over the past several years, NSTs have experienced increased use. Expanded media coverage and popularity of published memoirs and motion pictures featuring long-distance thru-hiking have coincided with an uptick in visitation. With increasing trail use, diminished trail conditions have occurred along trail corridors. In designated wilderness areas, congestion and high-density use may conflict with wilderness values which emphasize solitude (Landres et al. 2008). In addition, landscape-scale environmental changes and extreme weather events (e.g., wildfires, floods, or droughts) have raised new concerns for trail safety and conditions (Brown 2018). Meanwhile, all agencies, federal, state, local and non-profit, face growing capacity challenges in recreation management, an aging public sector workforce, and declines in volunteerism nationally (Cerveny et al. 2020; Lewis and Cho 2011; Grimm and Dietz 2018). New partnership approaches may be needed to support trails and promote conservation along trail corridors because of these dynamic processes.

The purpose of this article is to understand the evolving role of partners in the shared stewardship of NSTs and to consider implications for trail and wilderness management. Shared stewardship approaches are motivated by a common vision for how lands might be managed to achieve shared benefits. The approach is implemented through partnerships and capitalizes on shared interests and values, encouraging the engagement of long-standing partners as well as new and diverse groups (Derrien et al. 2019). To frame our discussion, we examined popular and academic literature on natural resource partnerships and conducted semi-structured interviews with 14 key informants with in-depth knowledge of NST management and partner relations. We begin by providing background on NSTs and the role of partners in co-management of natural resources. We then explore the role of partners in the development and management of NSTs and identify benefits and challenges of NST partnerships. Throughout conversations we also identified nine priority issues related to overall trails management and in designated wilderness areas. We conclude with a future vision for shared stewardship for the National Trails System.

National Scenic Trails

The National Trails System Act of 1968 established the National Trails System to "provide for the ever-increasing outdoor recreation needs of an expanding population and in order to promote the preservation of, public access to, travel within, and enjoyment and appreciation of the open-air, outdoor areas and historic resources of the Nation." (P.L. 90-543). The Act designated two trails, the Pacific Crest Trail and the Appalachian Trail, and established the process by which other trails could be designated. NSTs extend across multiple land jurisdictions managed by different federal agencies, tribes, state agencies, and private landowners. Each NST is assigned an administering federal agency responsible for coordination among local

management entities, ensuring that the Act's legislative requirements are met, and providing standards and technical assistance (USDA Forest Service 2014). Designations reach beyond the physical tread of trail, and include the trail corridor and associated natural, recreational, scenery, and cultural resources.

The National Trails System Act encourages the engagement of non-profit trail organizations and volunteers in many aspects of trail planning and management (P.L. 90-543). These partnerships demonstrate an early institutionalization of a public-private cooperative management system. Pre-existing trails were built and maintained by trail organizations and volunteers on the local level, and in many cases, these local organizations championed their trails for NST designation. Today, dozens of organizations at the local, regional, and national level support NSTs, as an integral component to their management (USDA FS 2014). The designation of NSTs has expanded public awareness of these vital trails and created opportunities for new ventures.

Many NSTs pass through federally designated wilderness areas and NST establishment has occurred in parallel fashion to the designation of wilderness along the trail corridor. Thus, wilderness is a frequent companion to the NST distance hiker. The Pacific Crest Trail passes through 48 federally designated wilderness areas, compared to 25 along the Appalachian Trail and 21 along the Continental Divide Trail. Trail segments in designated wilderness areas require different strategies for trail maintenance (e.g., the use of pack animals and cross-cut saws, and multiple-day trips led by individuals with special training). Maintaining these trail segments also requires consideration of wilderness values and addressing questions about how to preserve solitude in areas with rapidly increasing trail use. Trail administrators managing sections of the trail in wilderness seek to balance Wilderness Act goals to provide primitive experiences and the goals of the National Trails System Act to promote trail use and enjoyment.

Natural Resource Partnerships and Collaboration

Public land management agencies increasingly rely on partnerships to achieve mission-critical goals and to engage in shared stewardship of public lands and natural resources (Koontz et al. 2004). Co-management practices that share power and responsibility among federal and local partners are increasingly becoming important in governance and are useful for building trust, enhancing capacity, and sharing knowledge (Berkes 2009). When talking about partnerships, we refer to the US Forest Service Partnership Handbook, which describes a partnership as "relationships between the people, organizations, agencies, and communities that work together and share interests" (National Forest Foundation 2005, p. 3). A partnership can be formal, (e.g., agreement, memorandum of understanding, or contract), or informal. They also can involve multiple parties and include governmental, nonprofit, or private entities (Seekamp and Cerveny 2010). Partnerships are widely recognized as an important way to share responsibility for management across multiple organizations and expand public involvement in resource conservation (Absher 2010; Koehler and Koontz 2008). Many factors have been identified as elements of successful partnerships among

federal and non-federal partners, including: shared vision, clear pathway for achieving this vision, leadership, resources, organizational commitment, formal agreements, and concrete accomplishments (McPadden and Margerum 2014; Ansell and Gash 2009).

Shared stewardship requires building social capital, nurturing nascent partnerships, and sharing leadership and decision-making space (Derrien et al., 2019). While partnerships are an inherent part of the way public land management agencies accomplish work, partnering requires agency investment and a commitment to new ways of working. Collaborative partnerships build trust and enduring relations between agencies and communities (Coleman et al. 2018). Partnering enables natural resource agencies and the communities they serve to develop flexible, innovative strategies to address shared conservation concerns (Armitage et al. 2009). Collaborative governance is a critical component of sustainable recreation management on public lands (Selin et al. 2020).

Partner organizations bring both volunteer labor and technical expertise to projects that can complement or enhance federal agency capacity (Seekamp et al. 2011). Trail organizations with a healthy volunteer base are essential to the long-term success of NSTs. In 2019, 29 trail organizations engaged 22,224 volunteers who collectively contributed nearly 1 million hours. Trail organizations also raised $14.3 million in private monetary contributions (Partnership for the National Trails System 2019). Trail organizations rely on a cadre of committed volunteers with a wide range of skills. Volunteers may be motivated by a desire to enhance natural resource management, to contribute to society, to connect with a treasured place, or to interact with like-minded people (Lu and Schuett 2014; Bruyere and Rappe 2007; Martinez and McMullin 2004).

Environmental volunteers gain many benefits, including physical activity, stress reduction, social integration, nature connection, and bonding with place. Nationally, volunteer rates have declined steadily since the early 2000s. In 2003, 28.8 percent of Americans volunteered compared to 24.9 percent in 2015, though the number of volunteer hours held steady (Grimm and Dietz 2018). For some NST partners, volunteerism is flat or declining. The Appalachian Trail Conservancy reported 6,827 volunteers (272,477 hours) in 2015, compared to 5,967 volunteers (210,923 hours) in 2019 (Joyner 2019). With these trends in mind, understanding the long-term viability of the volunteer workforce will be critical to the success of NSTs (McPadden and Margerum 2014).

Understanding Partnerships

We conducted semi-structured interviews with 14 key informants to learn more about the role of partners in NST stewardship. Included in our group of experts were NST trail administrators (7), representatives of NST partner organizations (3), national trail organizations (1), and other federal agency employees (3). We asked key informants to describe the historic role of trail partners, current issues and challenges on NSTs, specific concerns related to NSTs in wilderness areas, the current role of trail partnerships, benefits and challenges of trail partnerships, and ideal models of NST stewardship.

Relationships and Roles among NST Partners

Partners have played a significant role in the development and management of trails throughout the United States and federal agencies increasingly rely on partners for aspects of trail maintenance, management, and operations (McPadden and Margerum 2014; Shaffer 2016). The Partnership for the National Trails System (PNTS) connects 34 member trail organizations supporting each of the NSTs to further the protection, completion, and stewardship of national trails. Federal agency administrators rely on the PNTS and its member trail organizations (e.g., trail conservancies, trail coalitions) for all aspects of trail planning, management, and maintenance. These NST organizations coordinate with regional trail organizations and their local chapters to maintain trails in their region. NST organizations also work with (and sometimes function as) land trusts - acquiring lands and conservation or trail easements that connect missing trail links, or that otherwise protect the trail corridor. National service organizations like the Student Conservation Association, Job Corp, or Veterans Conservation Corp, conduct trail work while also achieving goals like job training or leadership development. Local trail-based groups also maintain trail segments in their area (e.g., adopt-a-trail programs, outing clubs, or "friends of" groups) and may work with community-based organizations on an ad hoc basis (e.g., scouting groups, schools, religious organizations). Some groups offer specialized trail expertise, such as the Back Country Horsemen of America, whose members provide support for trail building in remote areas using pack animals (particularly in designated wilderness areas). Many other entities play a critical role in the management of NSTs in the system, including tribes and state agencies. Figure 1 depicts partners at the national, regional and local level oriented toward stewardship of NSTs.

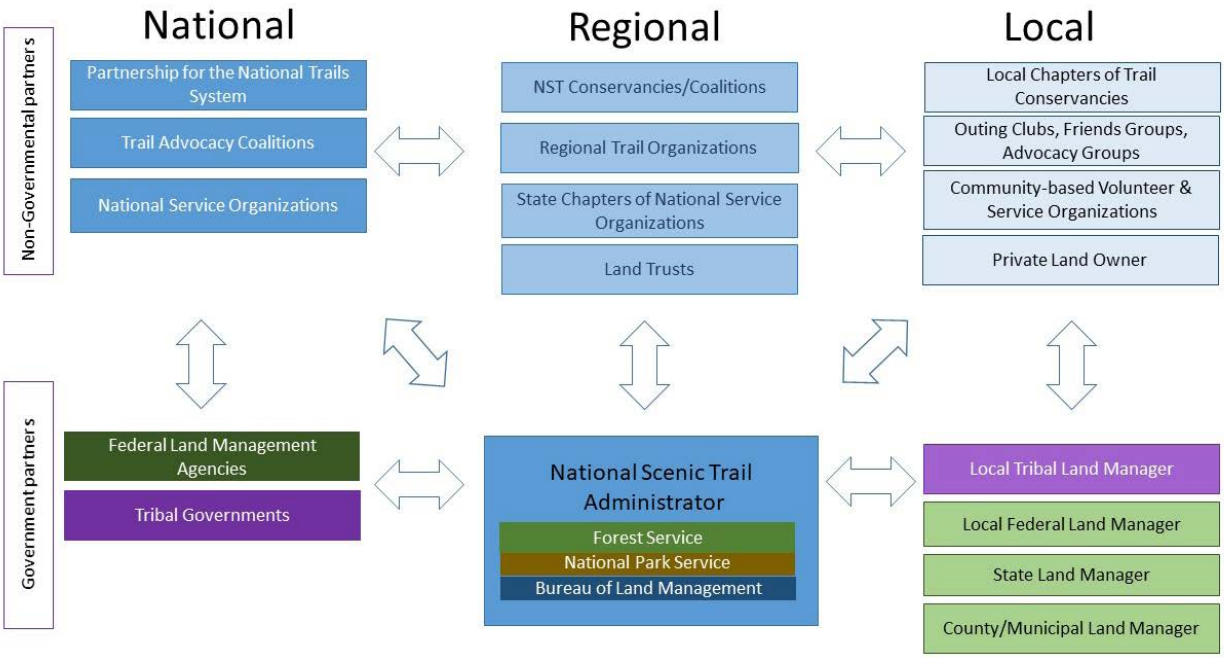

Figure 1 - Depiction of governmental and NGO trail partners at the national, regional, and local scale for National Scenic Trails. (Note: This is meant to be representational and not exhaustive of the full array of trail partners and their interactions.)

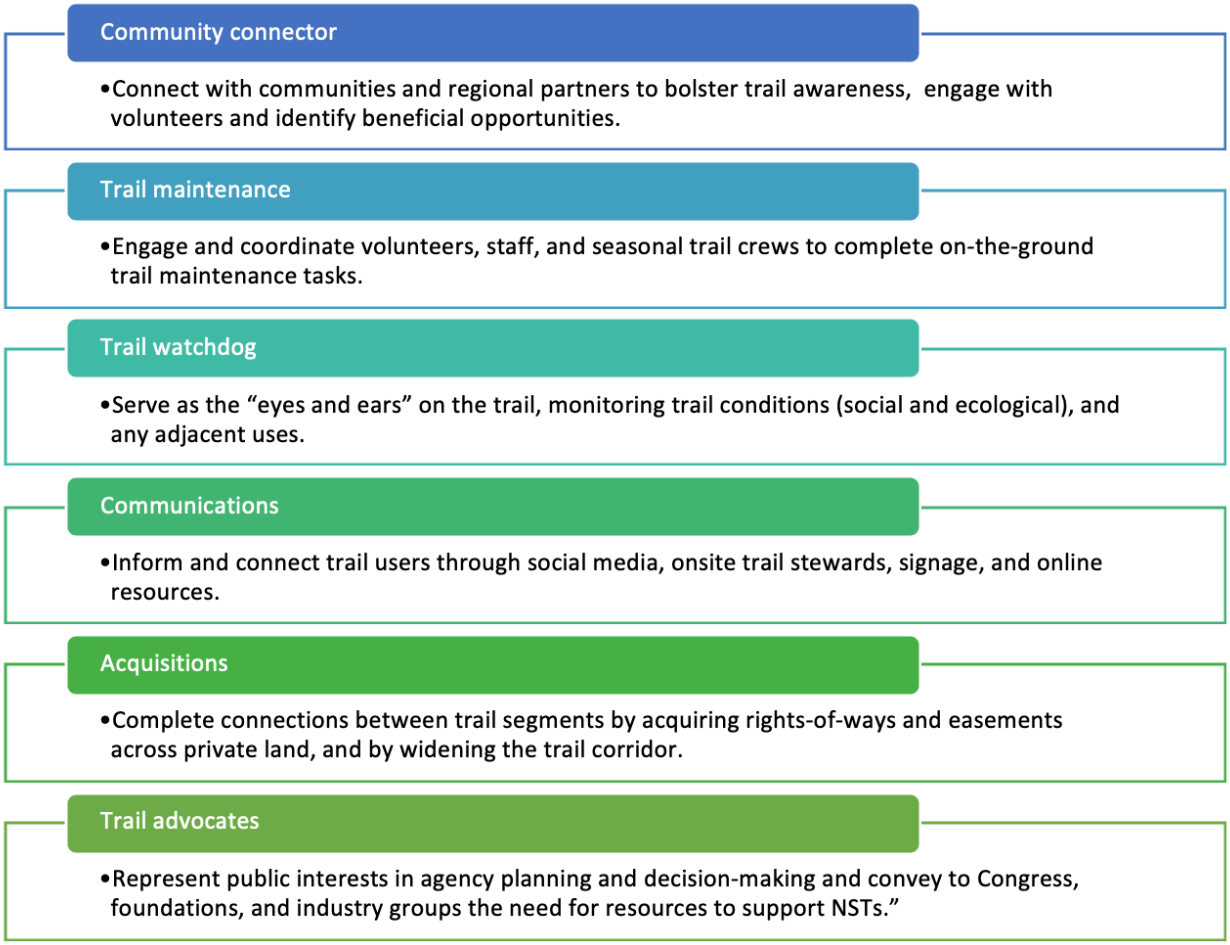

Figure 2 - Trail partners assume a variety of roles in National Scenic Trails

NST designation can prompt new or existing organizations to coalesce and formalize their roles around trail management. Our interviews with trail administrators and trail partners revealed a variety of roles for trail partners, many of which are overlapping and ever-evolving (Figure 2). We identified six critical roles for NST partners: community connector, trail maintenance, trail watchdog, communication, acquisitions, and trail advocates.

Balancing these various roles, while navigating relationships among trail administrators, other state and federal agencies and cooperating partners can prove challenging for trail partners.

Benefits and Challenges of Partnering

Shared stewardship is an approach that recognizes that the collective capacity of multiple organizations with shared interests can be a powerful influence on our ability to care for our natural and cultural heritage (Derrien et al. 2019). Previous studies about the benefits of natural resource partnerships have noted the ability to leverage resources, add new skills and expertise, and provide opportunities for citizen engagement (Seekamp et al. 2013; Absher 2010). We asked our key informants to describe the benefits of NST partnerships (Table 1). NST partnerships provide a number of important benefits from the perspective

Benefits	Examples of Important Roles and Benefits
Connect and convene partners	• Building alliances in support of trails and outdoor activity • Leveraging relations with a wide range of partners and political officials • Convening partners and mediating conflict around trail activities
Provide customer service	• Ability to provide real-time trail information to trail users • One-stop shopping for trail activities (permits, information, conditions) • Public outreach about trail events (websites, social media)
Monitor local trail conditions	• Sharing trail conditions, safety hazards, congestion, or use conflicts with federal partners • Fostering strong place attachments between trail volunteers and trails
Acquire and leverage resources	• Quick turn-around for hiring and volunteer recruitment for work on projects • Fundraising, grant-writing, and access to different funding sources • Activating donors and sponsors for projects – large member base • Providing equipment and tools for trail maintenance
Provide technical expertise	• Providing technical skills in trail design, trail building, or analytical skills (GIS) • Training volunteers and staff in trail construction and maintenance
Foster community connections	• Building support and community pride for trails ("Trail Towns") in gateway communities • Considering economic development opportunities with local businesses
Provide educational opportunities	• Conveying environmental ethics and values to trail visitors and users • Offering educational programs for trail users during special events

Table 1 - Important roles and benefits of trail partnerships.

of federal partners. They can build alliances and connect with local partners, provide customer service, monitor real-time trail conditions, mobilize resources efficiently, offer technical expertise, foster community relations, and provide educational opportunities.

Partnerships also can present challenges, particularly as organizations change or expand their mission and agencies face shifts in capacity. Like any relationship, partnerships take work and require resources. Some of the greatest challenges associated with natural resource partnerships include burnout, severed relationships from employee turnover, lack of staff to maintain partnerships, administrative barriers, and a mismatch of goals (Seekamp et al. 2013). Our key informants identified some of the challenges of partnerships for NSTs (Table 2). Many of these challenges identified echoed previous studies, particularly related to declines in capacity, shift-

Challenges	Examples of Partnership Challenges
Manage competing needs	• Trail partners' priorities may not always align with public land managers, requiring negotiation and expectation-setting • Ensuring that trail group priorities are not overshadowing the interests of other critical stakeholders or the public
Balance types of trail use	• Balancing multiple user types on trails (e.g., human-powered, equestrian, mechanized) • Catering to diverse trail users: thru-hikers, backpackers, weekenders, day-hikers, and trailhead visitors
Shifting resource needs	• Dealing with changing levels of funding, personnel declines, employee turnover, and other shifts in resources. • Recruiting volunteers and shifting volunteer values.
Bureaucratic barriers	• Working within and alongside a bureaucratic system • Creating and managing agreements and MOUs
Administrative leadership	• Building skills in administrative leadership, including managerial, and finance, strategic planning, fundraising, and development
Advocacy roles	• Balancing goals of trail advocacy and trail management when working in concert with public land management agencies
Consistency across jurisdictions	• Ensuring consistency among agency jurisdictions, districts, trail chapters, and trail segments in terms of signage, communications, build infrastructure, and conditions
Building trust	• Maintaining transparency, fostering relationships, and building trust among federal and trail partners and volunteers

Table 2 - Important challenges for trail partnerships.

ing resources, and overcoming bureaucratic barriers (Seekamp et al. 2013; Absher 2010). One element unique to NST partnerships is the transformation of trail organizations associated with trail designation. NSTs often are promted by passionate trail enthusiasts whose early work has led to trail designation. As visibility expands and use grows, trail organizations must grow accordingly and develop new skills in administrative leadership and finances to maintain a critical role.

As our key informants described, challenges emerge when trail organizations have different values or priorities for trail use from federal partners. For example, a trail organization may cater to a constituency of hikers or a sub-group of thru-hikers, while federal trail administrators are concerned with a full range of trail uses. Negotiating various interests and being transparent about intent are both critical to shared stewardship enterprises.

Emerging and Ongoing Issues in NST Stewardship

Environmental Changes

Changes in climate and forest conditions have created challenges for management of NSTs. Wildfire, particularly in the US's western states, has led to temporary trail closures due to fire risk and smoke, creating safety concerns and causing hikers to re-route. Trail organizations have served an important role alerting hikers to fire danger through social media applications and other services. Changing weather and climate patterns also have resulted in storm damage leading to washouts, flooding, landslides, avalanches and other effects that have caused damage to trails and trail infrastructure, such as bridges. These conditions are often exacerbated in post-fire environments (Brown 2018). Trail organizations have been critical in organizing volunteers to assess, document, and share trail condition data immediately following these events, to inform appropriate agency responses. Public agencies managing the trail are taxed by these events, and they often contribute to growing backlog in maintenance. Trail organizations and federal agencies work together to prioritize repair to damaged trail sections, address safety concerns, and mobilize resources to repair trail resources.

Increasing trail use and ecological effects

Some NSTs have experienced a steady increase in visitors as evidenced by trip reports and statistics gathered by trail organizations and administrators. The uptick in trail use has been documented on the "Triple Crown" Trails (Reigner and Wimpey 2020). The increased use of NSTs by long-distance "thru-hikers" and other trail users raises questions about social-ecological conditions along the trail. Heavy use on trails designed for lower levels of use can result in erosion or trail damage, trampling of vegetation, increased human waste, and greater frequency of human-wildlife interactions (Oliver 2018). Side-by-side walking and passing slower hikers can lead to trail widening, as can trampling caused by camping close to trails (Wimpey and Marion 2010). However, contrary to generalizations, visitors have been found to disperse more at low levels of visitor use, rather than when use is high (D'Antonio and Monz 2016). Additionally, activity type and trail design have been found to best predict trail impacts rather than the amount of use (Beeco et al., 2013). Growth in NST visitation puts pressure on trail organizations, administrating agencies, and volunteers to maintain healthy trail conditions to keep up with demand.

Technology and behavior altering use patterns

Use of mobile applications, GPS devices, and social media sites is changing the way some hikers interact with NSTs and with each other (Dustin et al. 2019; Martin and Blackwell 2016; Pohl 2016). Notably, interviewees revealed an emerging phenomenon for thru-hikers who coalesce in large groups, potentially concentrating camping impacts along the trail. Arrendondo (2018) referred to this as the 'bubble effect'. Mobile phone applications and social media sites designed to help trail hikers may inadvertently concentrate visitors along a string of high-use sites with desired amenities like flat ground, fresh water, or natural shelter. According to informants, clustering can occur

because of social benefits (company along the trail), perceived safety concerns (desire to camp in groups), or the timed visits of "trail angels" who provide rides or other services. This behavior can alter the social character of NSTs and decrease opportunities for solitude.

New trends in thru-hiking may also exacerbate these conditions. Ultra-lite or fast-paced hikers and trail runners may travel from pre-dawn hours to late evening. Some are known to camp close to the trail's edge, in contrast to the footprint of the traditional backpacker. Finally, GPS devices may alter patterns of trail use, potentially encouraging off-trail travel, particularly in snow-covered conditions or in areas lacking dense vegetation, dispersing trail users across a wider swath along the trail corridor. Visitor behavior, such as the bubble effect or off-trail travel, may intensify human impacts more so than the sheer volume of visitation.

Balancing wilderness values

Our respondents described challenges in balancing increased trail use in wilderness areas with the need to preserve wilderness character. The National Trail System is managed for purposes of expanding opportunities for people to connect with nature, scenery, and heritage (P.L. 90-543). However, an essential tenet of wilderness management is to preserve opportunities for solitude and primitive recreation (Landres et al. 2008; Engebretson and Hall 2019) and large group use is regulated in designated wilderness areas. One public official we interviewed had observed groups of up to 50 hikers camped together in a wilderness area along one NST. The clustering of hikers raises questions about whether wilderness values are being diminished by the NST. Rising visitor volumes on some NSTs can present challenges for management of designated wilderness areas that lie along these trails. Research has shown that low visitation density is an important attribute associated with wilderness character (Watson et al. 2015). Encountering large groups along the trail can negatively impact hikers seeking solitude, especially in wilderness areas, although this effect was found to be small on some of the most highly used wilderness trails (Cole and Hall 2010).

Declining agency capacity

The increasing reliance on the technical skills, coordination, and availability of contracted and volunteer workforces to construct and maintain trails is a major trend in shared stewardship for NSTs. When the National Trails System Act was passed, it was common for federal land management units to employ year-round or seasonal trail crews with highly specialized skills in trail design, construction, and maintenance. Public agency declines in the budgetary, personnel, and technical capacity for outdoor recreation management have contributed to reductions in skilled workers and equipment for trail work (Cerveny et al. 2020). Trail organizations, partners, and volunteers have filled important roles to attenuate these changes in agency capacity.

Additionally, there is a need for training and certifications in advanced trail skills, which partner organizations can fill if federal agency requirements can be navigated. Some efficiencies can be achieved through agreements to recognize safety certifications across different agencies, such as sawyer certifications.

According to key informants, this shift in responsibility of trail maintenance from federal agencies to trail organizations has put added pressure on these groups, which rely on volunteer hours and donations. Trail organizations also face capacity challenges with greater needs for funding and access to volunteers. Some interviewees described concerns about the aging of their members and volunteers and the need to attract new donors and volunteers to their ranks. Research has shown that volunteer burnout, aging of the volunteer base, and lack of succession planning can affect long-term partner relations (Hvenegaard and Perkins 2019; Absher 2010). Thus, land management agencies and partners benefit from leveraging existing capacity and expertise to ensure new generations of trail stewards (McPadden and Margerum 2014).

Stewardship Challenges in Wilderness

Trail design, construction, and maintenance of NSTs in wilderness areas can be challenging, especially when trails were built prior to the creation of modern sustainable trail construction guidelines (Marion et al. 2011). Several key informants noted that wilderness areas and other remote trail sections can be difficult for trail crews to access and require more costly and complicated solutions. Trail crews must be available for multiple days or weeks to make efficient use of time and sometimes require special training or means of travel (pack animals, canoe access). The prohibition of motorized equipment (required for wilderness and other special areas) can make work more difficult, especially when trail crews have not been adequately trained in use of cross-cut saws. Sections of NSTs that pass through wilderness areas can be challenging to build and maintain and damages from landslides, floods, or windfall can pose safety hazards when not addressed promptly. Improvements might be made through increased trail crew capacity, trail crew training, and education programming for visitors.

Managing Multiple User Types across Jurisdictions

Managing uses along the length of an NST can be difficult, as different uses are permitted based on land ownership, the agency's management approach, special land use designations, or other factors. Several interviewees raised the issue of consistency of management over sections of NSTs crossing multiple jurisdictions. Some NSTs (and trail sections) are open to various uses, including equestrian or bicycles; and, some trail sections are along public roads allowing motorized vehicles. Some trail segments traverse sections hosting incompatible activities, such as logging or target shooting. Although not every trail is open to every use in all segments, local land managers aim to balance use consistent with their individual management objectives and work with trail organizations and other partners to provide opportunities for different types of trail uses. Multiple uses can also result in social issues when a user group's values come in conflict, or when groups compete for the same space (Manning et al. 2017).

NSTs are designed to welcome a variety of trail users and are managed to encourage visitor connection to our nation's natural and cultural heritage. While motorized use on NSTs is typically prohibited, with the exception of trail segments that exist along public roads, equestrian trail

use does provide access to NSTs that may not be otherwise possible for some trail users. Thus, equity, access and inclusion are important considerations for federal trail administrators.

Partnerships to Complete Trails

While some NSTs are complete, others include segments that are unfinished or are adjacent to lands that are not protected from development or uses that threaten the character of the trail. Trail organizations and agency administrators are actively working to engage with public and private landowners to create easements, purchase land, or develop agreements to provide a trail experience that is safe and that maximizes the trail opportunities. For many trails, there are substantial sections that exist along roads and highways that present safety concerns. Meanwhile, despite the inevitable need to cross motorized roads, motorized use is in conflict with the National Trails System Act. Trail partners serve an important role in raising awareness of the trail and its value to the region in areas with unfinished trail segments. Cultivating relationships with tribal, county, state and private entities who may become trail supporters, can help foster local support toward trail connection and completion. Sharing resources in outreach and communication is an important element in trail stewardship.

Community Connections

While thru-hikers may hold a place in the popular imagination, the majority of NST visitors are day visitors, short-term backpackers (who may utilize trail segments), and trail section hikers seeking to complete a portion of the trail. The Appalachian Trail, for example, receives an estimated 3 million trail visitors annually, compared to 3,000 who attempt the entire 2,190 miles (Appalachian Trail Conservancy 2020). For some, visiting the trailhead provides a meaningful experience to connect with the legacy of an iconic trail. NSTs and trail connectors provide an important means for nearby communities to connect with the outdoors, enhancing health benefits associated with being outdoors. Trail administrators and partners increasingly recognize the importance of connecting with community leaders, business owners, and economic development entities in gateway communities. In recent years, "trail town" programs have emerged, which link communities with NSTs and emphasize the importance of community awareness and pride. Partnerships with gateway communities can help build community support for the trail, related projects and events, marketing, and fundraising for trail management. Many trails connect with local communities through youth corps programs, providing opportunities for youth to experience and engage with public lands. Stewardship is being understood as a form of recreation that strengthens ties between communities and special places (Miller et al. 2020).

Future Visions

"There is something special that comes from the language in the Act and the history that it draws… the idea of true shared stewardship and co-management and that notion that everyone is trying to partner."
-- Trail Administrator (paraphrase)

Many land managers and partners view NST partnerships as the original and ideal model for shared stewardship. From the conception of trails to their designation and management, these national trails build on a public passion for trails that is channeled and orchestrated into effective working partnerships among private and public institutions. While these partnerships vary in how they are organized and staffed, they all demonstrate a joint investment in stewarding shared public resources. This idea of shared stewardship is at the heart of current land management agency approaches to stewarding natural and cultural resources. The partnership structures, investments, and networks for NSTs deserve agency attention as an effective case study and model for engaging in meaningful work with others. They offer important insights for shared stewardship for other recreation resources, as well as in other management areas, such as wildfire and cultural landscapes. We asked each interviewee to describe their vision of the ideal NST stewardship model. There was a consensus among interviewees, who described a governance model with a central, primary trail organization with ties to dozens of stakeholders and partners, akin to the umbrella organization model described earlier (Seekamp et al. 2011). In this model, the central partner has a high capacity for administrative functioning and the flexibility to develop and manage websites, maintain a social media presence, keep maps updated and available, and communicate directly with trail visitors. This central partner creates a network with its local chapters to share local, on-the-ground knowledge, which it imparted to trail users in a timely manner and used to identify and prioritize maintenance needs. And, it is connected with nearby communities to build relationships and encourage local engagement. In this suggested ideal model, strong working relationships among agency staff and NGO partners are critical, and maintaining sufficient agency staff with local knowledge is necessary, particularly during planning periods. As shown in Figure 2, these multiple roles are important for trail organizations, and they cannot perform these functions without sufficient agency engagement and support, as well as engagement from other trail partners.

Partnerships draw on organizational strengths (such as nimbleness and efficiencies with funding, staffing, and volunteers), and on the strength of networks that are deeply attuned to local conditions. While challenges persist for these partnerships, and adjustments and refinements are needed to improve the model, many are champions of the model itself. The National Trail System was the original model for shared stewardship. Because it is legislated that partnerships are integral to trail management, NSTs can be laboratories for trying new ways to partner and showcasing partnership success. As natural resource agencies lean toward greater emphasis on co-management and shared stewardship of our treasures in natural and cultural heritage, we can learn from the lessons of NSTs. ijw

LEE CERVENY is a research social scientist and Team Leader for the People and Natural Resources Team, USDA Forest Service, Pacific Northwest Research Station; email: lee.cerveny@usda.gov

MONIKA DERRIEN is a research social scientist with the USDA Forest Service, Pacific Northwest Research Station.

ANNA MILLER is the assistant director of Research and Operations at the Institute of Outdoor Recreation and Tourism at Utah State University.

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Hiking the PCT in Southern California **Photo credit** © Justin Helmkamp

SCIENCE + RESEARCH

Multi-jurisdictional collaborative management of the Pacific Crest, National Scenic, and John Muir Trails

by NATHAN REIGNER and JEREMY WIMPEY

Nathan Reigner

Jeremy Wimpey

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). The Pacific Crest Trail (PCT) runs 2,650 miles along the mountain ranges of California, Oregon, and Washington, connecting America's borders with Mexico and Canada. It is designated as a National Scenic Trail (NST) and along

with the Appalachian and Continental Divide National Scenic Trails, is considered one of the "Triple Crown" long-distance trails in the United States. The PCT runs through numerous public land units (e.g., seven National Parks, twenty-six National Forests, four Units of BLM land, five State Parks, and forty-eight federally designated Wilderness areas) and overlaps with other trails and routes (e.g., John Muir Trail [JMT] and the Tahoe Rim Trail). Therefore, the PCT is both a stand-alone NST and a part of the trail networks of many other areas and designations.

Over the past decade, long-distance use (i.e., trips that are 500 miles long or longer) of the PCT has increased dramatically. In 2019, approximately 8,000 long distance PCT permits were issued, and nearly 1,000 users reported a completed thru-hike (PCTA, 2020). Thru-hike completion numbers have risen by an order of magnitude in the past decade. The increases in PCT use align with increases in use of the national parks and forests through which the PCT runs. Combined, the national park and forest systems received nearly 500 million visits in 2018, which is approximately 15% higher than use levels from a decade before (US Forest Service, 2018; US National Park Service, 2020). While this recreation provides numerous health and economic benefits, the volume of use and its rapid growth is placing management pressures related to crowding, conflict, environmental damage, and administrative burden and coordination on the region's public land managers and neighboring communities.

Use pressure within the Central Sierra has been particularly high between Mount Whitney and Tuolumne Meadows where the PCT and JMT are coincident. In this area, the trails cross through eight unique federally managed public land units. These include the National Park Service administered units of Yosemite National Park, Devils Postpile National Monument, and Sequoia and Kings Canyon National Parks. Additionally, the trails cross through US Forest Service administered units including the Inyo, Sequoia, Humboldt-Toiyabe, Eldorado and Sierra National Forests. Together these public lands encompass over two-million acres, 176 miles of the PCT and the entirety of the 211-mile JMT. Federally designated Wilderness areas account for approximately 95% of this land area. In addition to direct federal management of recreation along the PCT in these units, several non-profit and NGO partners including the Pacific Crest Trail Association (PCTA) contribute to the region's collaborative management system. Boundaries of each land unit are porous as visitors travel and recreate utilizing hundreds of miles of trails that allow for relatively seamless backcountry experiences.

With high visitation levels throughout the summer, permit systems are used throughout the region to balance recreational access with resource protection and conservation mandates. These systems limit the number of overnight users accessing wilderness lands to protect environmental and experiential character from use-created impacts. Acquiring these unit-level permits to enable a long-distance trip along the PCT can be challenging. To ease this challenge and facilitate the experiences for which the PCT was designated as an NST, a long-distance travel

permit, administered by the PCTA on behalf of the USFS, allows PCT travelers on trips of greater than 500 miles to travel and camp on the PCT without the need to secure individual unit-level permits.

Together, these permit systems create a mosaic that simultaneously created diverse recreation opportunities and ever shifting management challenges. As units adapt their own permit systems to address unit-specific issues, their actions influence the conditions and permit system operations of surrounding units, which often adapt in response. The overlay of the PCT long-distance permit creates complexity as PCT users travel through land management units in ways that are unaccounted for by unit-level permitting and management systems. The ad hoc nature of responses and interaction effects have highlighted a need for collaboration among trail and land managers to coordinate their actions. This article documents this collaborative process and how research and analyses are being leveraged to support informed adaptive management of the PCT and JMT.

Methods

The research and analyses we describe here were guided by, and conducted in direct response to, prioritized needs expressed by PCT and JMT managers. The process began with review and organizing of existing information, identifying critical gaps, and analysis and synthesis of the available information to inform collaborative discourse on visitor use management across the region. The process resulted in three areas of research and analysis: 1) compilation of wilderness permit data; 2) synthesis of permit systems in the central Sierra Nevada; and 3) analysis of annual surveys of PCT long-distance permit holders.

Compilation of Wilderness permit data

Each federal land unit in the PCT/JMT area uses overnight permit systems to manage wilderness camping. These unit-administered wilderness camping permit systems generate a wealth of information about visitor use along the PCT/JMT including group and trip characteristics, use estimates along trails and in camping areas, and changing patterns of visitor use. In 2017, researchers and land managers compiled this permit-derived information from individual units and assessed: 1) the potential for integrating the data into an area-wide dataset; and 2) its suitability for modeling visitor use along the PCT/JMT. Compilation was based on identifying common variables and data formats within the multiple unit-level permit datasets. Examples of these variables included the start and end dates and locations of trips, group sizes and types, and planned itineraries.

Synthesis of permit systems: the Central Sierra Nevada

To better understand the administrative operations and constraints that shape each unit-level permit system, the research team conducted structured interviews with wilderness permit managers from the Eldorado, Humboldt-Toiyabe, Inyo, Sierra, and Stanislaus National Forests and Sequoia, Kings Canyon, and Yosemite National Parks. The interviews elicited information about

Question Area
Permit System Structure & Operation ▪ What PCT/JMT-related uses require permits for your unit? ▪ What behavior is regulated via permit? (e.g., trailhead entries, overnight use at destinations, travel through zones, etc.) ▪ What is the valid duration of your permit? ▪ How do visitors get permits? ▪ Does your unit ration permits or have quotas? If so, how are rations/quotas set and allocated? ▪ What conditions is your permit system designed to manage and how does it operationalize them? ▪ Are there known "gaps" in or "work arounds" for your permit system?
The Movement of Permit Holding Visitors ▪ Where can your permit holders go within your unit? ▪ What other unit can your permit holders visit/where else is your permit valid? ▪ What other units issue permits that give visitors permission to engaged in permitted activities in your unit/who else's permit do you honor?
Permit Information & Data ▪ Do you share information with other units when issuing a permit? If so, what information do you share, with whom do you share it, and how? ▪ Do other units share information with you when they issue permits? If so, what information do they share, who shares it with you, and how? ▪ Are there known gaps in the information that you have about your permit system?

Table 1 - Permit System Interviews & Synthesis

the structure and operations of permit systems, any limits to visitor use that are imposed by the permits and the underlying rationale for limits, and the methods used by units to coordinate permits that cross jurisdictional boundaries. Table 1 presents the question areas addressed in the interviews. Results from the interviews were synthesized to document the characteristics of each permit system and their interactions.

Analysis of PCT long-distance permit holders

To better understand the travel patterns and behaviors of long-distance permit holders, the PCTA administered a survey to every adult PCT long-distance permit holder between 2016 and 2019. Long-distance permit holders were recruited to participate at the end of the travel season (i.e., late autumn) by email and data was collected using an online questionnaire. This survey gathered information on each long-distance traveler's prior long-distance trail experience, group characteristics, travel patterns (i.e., trip and trip-segment starting and ending dates and locations), visitation to key locations in the PCT/JMT areas (e.g., Mount Whitney, Yosemite Valley), and time spent off the trail during long-distance trips. Based on results from the 2016 and 2017 surveys, the questionnaire was revised in 2018 to better collect information on the travel patterns

Long-distance Permit Year	Survey Administration Year[1]	Permits Issued[2]	Survey Responses	Valid Responses[3]
2016	2017	6,027	780	725
		N/A	13%	12%
2017	2017	6,572 (+9%)	1,128	1,031
		N/A	17%	16%
2018	2018	7,313 (+11%)	2,180	2,105
		N/A	30%	29%
2019	2019	8,934 (+22%)	2,413	2,306
		N/A	27%	26%

[1] Surveys of 2016 and 2017 permit holder "classes" were conducted in 2017.
[2] Number of permits issued to adults.
[3] Valid responses are survey responses for which an exact match could be made between the Permit ID provided by respondents and an issued Permit ID.

Table 2 - PCT Long-distance Permit Holder Survey Population & Responses

of trips with multiple major segments (i.e., "flip-flop" or discontinuous trips) and resupply behaviors in the PCT/JMT area. Table 2 presents details about PCTA's survey responses.

Primary analysis sought to distill information on actual travel patterns and behaviors of PCT long-distance travelers to answer questions about how actual travel patterns differ from those implied in permit applications. To explore these topics, trip and trip-segment starting and ending dates and locations from the survey were analyzed to create computational models of visitor travel for each year of the survey. The models use the reported start and end time and location information to estimate average travel speeds for each respondent. These travel speeds are applied to the reported start dates, start locations, and durations of each segment of each respondent's trip to estimate how many respondents are expected to have camped on any given section of the PCT on each night of the travel season. These expected use levels were weighted by survey response rates to represent the full population of long-distance permit holders and to calculate estimated daily densities of long-distance permit holders along the PCT.

Results

Compilation of Wilderness permit data

Efforts to compile data collected by area units' permit systems into a comprehensive and coherent dataset revealed disparities in detail, quality, and accessibility among the various permit systems. Each system collects different variables (i.e., some systems collect full itineraries while others have only trip state date and location), store data in different formats (e.g., paper forms, local databases, web-hosted databases), and has different data extents (i.e., years and seasons covered). These differences highlight two challenges to leveraging this information for management. First, the task of creating a single, consistently formatted dataset for common analysis of all historic permit data would take significant time and effort and the resulting database would have substantial gaps and caveats. Second, managers were collaborating based on incomplete and assumed knowledge about the nature of and relationship among the different permit systems.

Synthesis of permit systems: the Central Sierra Nevada

The difficulties encountered compiling and using permit data revealed a need for a systematic documentation and understanding of the area's unit-level permit systems. Interviews with permit system managers provided insights about the permits' operations, administrative constraints, and the ways the systems integrate beyond each unit's boundary.

The scientific and management rationale for the permit systems were established and revised at different times (i.e., from the 1970s until the present) and in response to different pressures (e.g., crowding, conflict, environmental damage). Following their establishment, most of the systems have adapted at an operational level in response to changing conditions and circumstances. Some of these adaptations have been motivated by changing visitor use patterns, others have been in response to the consequences of management actions implemented by other units in the region. For example, as individual units implement unit-level permit actions (e.g., Inyo National Forest's Whitney Portal exit permit, Yosemite National Park's Donahue Pass exit permit), PCT and JMT users quickly adapted their travel patterns in ways that created new management issues elsewhere (e.g., beginning trips at low-use locations, increasing popularity of northbound JMT trips).

Wilderness permitting in the PCT/JMT overlap area is variable at the operational level. The methods used to apply for and receive permits and the types of information that must be provided when applying for a permit differ by unit. Some permits are available online and others only by an in-person visit to a ranger station. Some require specification of a planned itinerary, while others do not. Some limit lengths of stay in particular areas, while others allow groups to overnight wherever they please. Additionally, there are not standardized or codified systems for recognizing the validity of permits across the region. Although all land management units in the PCT/JMT overlap area are seamlessly connected by trails, all units do not recognize the validity

of each other's permits. Although a great deal of difference and diversity was found among permit systems, the interviews also confirmed a commitment to communication and collaboration among units. Permit managers in the area regularly communicate with each other, and informal or ad hoc communication has matured into regular and organized collaboration.

"Significant differences emerged in the data between wilderness and trail conditions based on the intended behaviors reported at the time of permit application and the actual behaviors of long-distance travelers reported through the PCTA survey."

Analysis of PCT long-distance permit holders

Significant differences emerged in the data between wilderness and trail conditions based on the intended behaviors reported at the time of permit application and the actual behaviors of long-distance travelers reported through the PCTA survey. Much of the divergence between intended behaviors and actual behaviors was legitimate and common (e.g., hikers ending their trips early because of injury, illness, or changing motivations; planned timing and routing

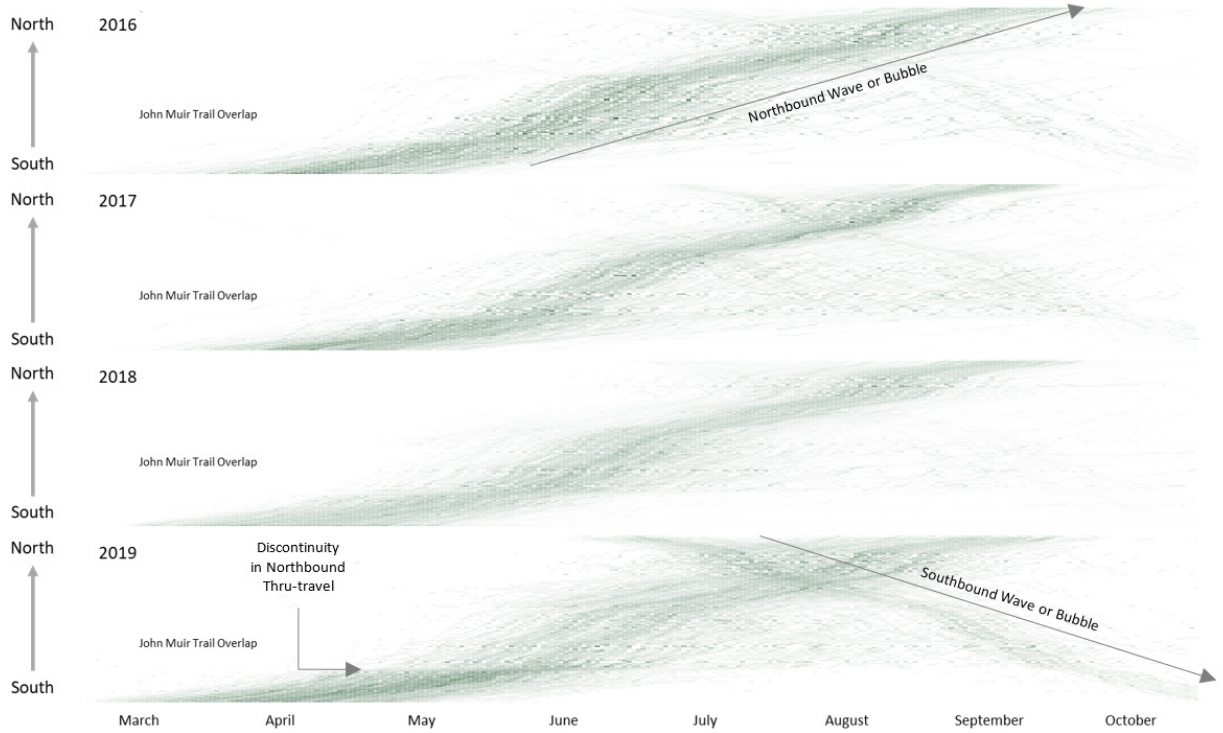


Figure 1 - Estimated Density of PCT Long-distance Permit Holders along the PCT: 2016 - 2019

changing in response to safety concerns related to snow and fire). However, some of it was not legitimate (e.g., using PCT long-distance permits for trips of less than 500 miles) or was unexpected (e.g., permit holders taking long periods of time off the trail during their trips).

Survey derived travel pattern models highlighted times and locations where long distance travel use was high, patterns of attrition for the seasonal northbound thru-hike "bubble" (i.e., northbound thru-trips that end earlier than planned), and how travel patterns changed from year to year in response to environmental conditions (e.g., snow and fire), management actions (e.g., permit regulations), and social conditions (e.g., crowding, trail culture). Modeling and estimation of the density of PCT long-distance permit holders revealed trail-wide travel patterns and changes in these patterns over time. Figure 1 depicts four years (2016-2019) of modeled travel patterns. For each year, days of the long-distance permit holder season are arrayed along the X-axis and sections of the PCT between trail access points are arrayed along the Y-axis. The darkness of each cell (i.e., each day and section combination) increases as the estimated number of permit holders increases, from a minimum of zero to a maximum of approximately 20 permit holders per mile.

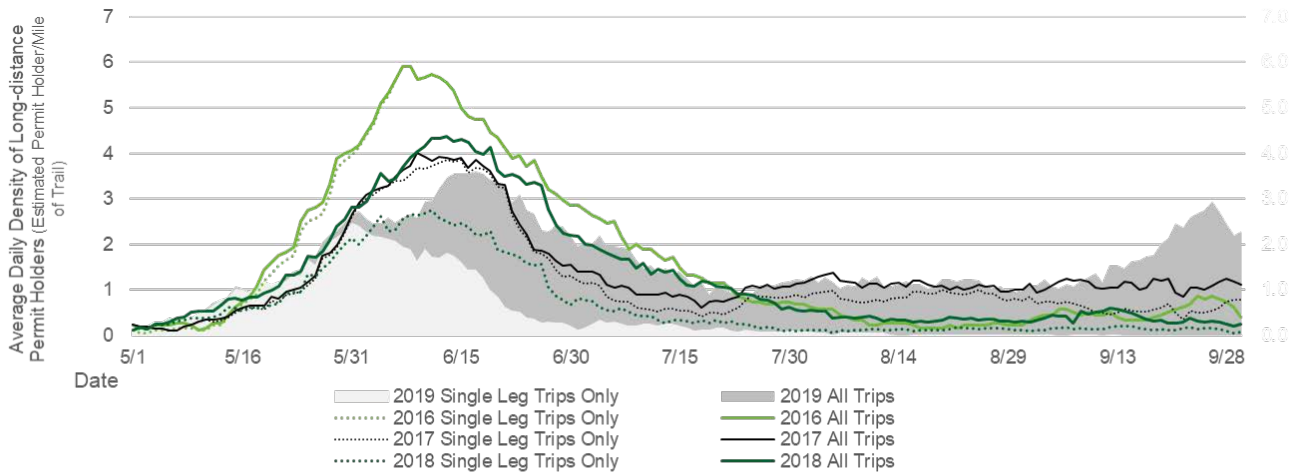
Examination of these model estimates yield the following insights about PCT long-distance traveler behavior.

1. *A primary northbound wave of long-distance travelers passes along the PCT beginning at the southern terminus in April and ending at the northern terminus in September. In the early season (i.e., March, April, and May), northbound long-distance permitted thru-trips typically seek to balance passing through the southern California desert early in the season before summer heat begins while also allowing adequate time for mountain snows to melt and associated flooded watercourses to calm. A limit of 50 trip starts per day at the southern terminus prevents the number of northbound travelers from growing too large and seeks to spread use evenly throughout the period. Late in the season, travelers seek to reach the northern terminus before autumn storms begin and temperatures drop in the northern Cascades.*

2. *In years with high snow levels (e.g., 2017 and 2019), there is a greater amount of long-distance permit holder use of the Central Sierra region of the trail in July, August, and September. This use pattern is the result, in large part, of northbound travelers initially bypassing sections of the trail to avoid lingering snow and associated flooding in the Sierra Nevada and returning to the area later in the summer and autumn when trail conditions are more favorable for travel. This is seen in the discontinuity in the primary northbound wave just south of the PCT/JMT overlap, particularly in years with heavy spring snowpack. The discontinuity is evidence that the northbound traveler wave or bubble is disturbed and broken-up by heavy or late-season snow in the Sierra Nevada mountains.*

3. *In 2019, a distinctly concentrated wave of southbound hikers emerged. The strengthened southbound wave is likely the result of several factors including, among others, saturation of northbound thru-permits, which are limited at 50 per day during the primary trip start season. Additionally, anecdotal evidence suggests a response among some thru-travelers to changing experiential conditions along the PCT, in which travelers who are seeking greater levels of solitude are choosing to make southbound trips to avoid traveling within the prominent northbound traffic.*

Understanding the interactions between these trail-wide travel patterns and federal land management units was one of the core objectives of the permit holder survey. Figure 2 displays the travel pattern data provided by survey respondents specifically for the PCT/JMT overlap. The line graph presents expected average daily density of long-distance permit holders per mile for 2016 through 2019. For each year, the proportion of total permit holder density attributable to single leg trips (i.e., conventional continuous thru-trips) is depicted. The table presents the estimated daily average number of long-distance permit holders present in the PCT/JMT area for each week of the primary travel season. These analyses highlight significant changes in PCT traveler behavior in this area over the past four years. Since 2016, the peak density of PCT long-distance permit holders expected to be in the PCT/JMT area at one time had steadily decreased, a nearly 50% decline between 2016 and 2019. This reduction in peak pressure when the northbound bubble or wave of PCT long-distance travelers passes through the area may be positive news for managers. However, this reduction in peak pressure is accompanied by increased long-distance permit holder presence later in the year during the primary unit-level visitor use season. This increases the functional pressure (i.e., direct interaction between PCT long-distance travelers and unit-level users) placed on units by long-distance travelers. It is the product of increasing numbers of PCT long-distance travelers breaking their trips into multiple segments, with northbound thru-hikers skipping the Sierra Nevada mountains in the early summer and returning later when travel conditions are more favorable. Ultimately, although the maximum number of PCT long-distance travelers present along the PCT/JMT at one time has declined, more long-distance travelers are using the trail each year.



Estimated Number of PCT Long Distance Permit Holders on the JMT

Year	May					June				July				August					September			
2016	15	28	138	324	578	774	700	553	414	317	229	154	100	81	41	29	31	42	69	54	80	96
2017	28	42	92	170	398	544	594	468	238	146	91	79	128	144	120	142	149	128	109	82	87	101
2018	35	81	143	241	440	636	755	662	494	335	261	201	151	100	72	57	64	57	72	94	58	52
2019	32	70	161	233	405	447	560	596	450	360	285	207	172	210	203	201	207	183	194	239	336	465

Figure 2 - Estimated PCT Long-distance Permit holder Use in the John Muir Trail Area

Discussion and Conclusion

Collaborative Research Strengthens Management

We have presented diverse analyses conducted in direct response to a priority need collaboratively identified and expressed by the trail and land managers. Together, the analyses have documented visitor use conditions and tracked changes from year to year, informed collaborative adaptive management, and strengthened the capacity of the management community of practice along the PCT. Long-distance and national scenic trails, including the PCT, are dynamic recreational settings. Environmental conditions, especially those related to snow and fire, vary from year to year. They influence when and where long-distance travelers are present on the trail and, consequently, when and where long-distance travel interacts with unit-level visitor use and resource management. Social conditions also vary from year to year. Some of this social variation is responsive to management actions (e.g., changes in permit requirements) and some is the product of forces outside the control of trail and land managers (e.g., social media, third-party information sources, global travel and experience trends). Regardless of the source, trail and land managers benefit from accurate and up-to-date understanding of long-distance traveler behavior and how these traveler characteristics relate to environmental and management conditions.

By collaborating with each other and their stewardship partners, trail and land managers of the PCT/JMT have systematically leveraged existing data, new data, and scientific analysis to document changing trends in use of the PCT and PCT traveler behavior over a critical four-year

period. Specific examples of these trends include understanding the influence of snow levels in the Sierra Nevada mountains have on delaying the northbound wave or bubble of thru-travelers and stimulating multi-segment trips and the emergence of a distinct southbound bubble as quotas for northbound travel become exhausted.

Synthesizing data along the PCT, particularly in the JMT area, have informed adaptive management of the PCT and its interaction with the federal land units the trail traverses. Adaptive management of the PCT and adjacent lands begins by developing an operational understanding of user behavior on the trail and the broader regional system of public lands. The research and analysis presented above helped to build this understanding from both an administrative (e.g., permit data compilation, permit system synthesis) and visitor use (e.g., long-distance permit holder survey) perspective. PCT/JMT trail and land managers' understanding of existing conditions is used to identify, plan for, and implement necessary management actions through a collaborative process. Examples of the resulting management actions include enhancement and coordination of safety and impact-reduction information, education, and communication; revision of long-distance permitting quotas and regulations; and expansion and consistency data collection including ranger and volunteer patrols, trail registers and counters, and permit holder surveys. The effects of these actions on trail use and users were then monitored and evaluated during successive years of data collection and analysis (e.g., annual permit holder surveys, collaborative management deliberation). The results of these multi-year analyses support PCT and JMT trail and land managers to further refine and adapt their management approaches and generate insights into how trail use and conditions may change in the future.

Along with the technical contributions made by the research and analysis described, it has also been a key to growing the collaborative community of management practitioners along in the PCT. Through their collaborative activities, PCT and JMT trail and land managers have grown both the body of knowledge available for management and their capacity for using knowledge to improve management. This capacity building includes the extension and strengthening of professional relationships the enable collaboration and the expansion of processes for integrating science, data, and analysis in management.

In this article we have illustrated the ways that applied science and data analysis can inform long-distance and national scenic trail management in responsive and collaborative ways. The research and analytical activities we discussed leveraged existing information and partnerships. Support responded directly to the expressed needs of managers and help managers adapt to changes in visitor use and administrative constraints. Additionally, science and data supported collaboration and development of a cohesive management community in the PCT/JMT area. ijw

NATHAN REIGNER, PhD, is a research assistant professor in the Recreation, Park, and Tourism Management Department at the Pennsylvania State University; email: npr5097@psu.edu.

JEREMY WIMPEY, PhD, is Principal of Applied Trails Research and an adjunct faculty member in the Forest Resources and Environmental Conservation Department at the Virginia Polytechnic Institute and State University; email: jeremyw@appliedtrailsresearch.com.

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Following the route of the Pacific Northwest National Scenic Trail

SCIENCE & RESEARCH

Understanding the Role of Social Interactions During Different Phases of the Thru-Hiker Experience

by TAYLOR COLE and JENNIFER THOMSEN

PEER REVIEWED

ABSTRACT

Thru-hiking has been on a dramatic rise, spurring hikers to venture onto increasingly remote and challenging trails over extended periods of time. Despite the recent popularity of thru-hiking, there is little known about how social interactions across the different phases of the recreational experience. This study addressed these gaps by investigating the thru-hiker experience of the Pacific Northwest National Scenic Trail (PNNST), a trail best known for its remoteness, rugged features, and solitude. Multi-phase semi-structured interviews were conducted with 42 of the 2017 PNNST thru-hikers before their hike (anticipation phase), directly after completion (on-site phase), and two months after completion (recollection phase). The results illuminate that while the PNNST is a relatively low-usage trail, the feeling and desire for community was prevalent during different stages of the thru-hike and social relationships contributed to hikers' ability to cope with challenges during the hike. Additionally, the research suggests that social media platforms contribute to the preparation prior to the hike and maintaining relationships during the transition back to everyday life after the thru-hike. This study's findings contribute to the conceptual understanding of how the social experience is integral and diverse to various phases of the thru-hiking experience.

Taylor Cole

Jennifer Thomsen

Figure 1 – The high alpine ecosystem of the Pacific Northwest National Scenic Trail

Thru-hiking has grown rapidly over the past decades (Berg 2015) and can be defined as an individual hiking the entire length of an extended trail in a continuous journey, departing from one terminus of the trail, and hiking unaided to the other terminus (Mills & Butler 2005; Bruce 1995). In the United States, there are eleven National Scenic Trails including the popular Appalachian Trail and the Pacific Crest Trail. These trails were established through the National Trails System Act [NTSA] (2009) with the aim to provide the greatest opportunity for outdoor recreation and conservation of scenic, natural, historical, or cultural qualities along the trails. The variety of geographic locations and other experiential characteristics contribute to diverse opportunities and challenges for thru-hikers and managers on these trails. There has been research addressing the experience of popular long-distance trails (Peterson, Brownlee, and Marion 2018; Hitchner, Schelhas, Brosius, and Nibbelink 2019; Robertson and Goetz 2017); however, there has been limited research exploring how the social interactions within the thru-hiking community impact the preparation and response to challenges before and during the thru-hike and how these social interactions can support transition of hikers back to everyday life after this immersive experience. To address this gap, our study investigated the social aspects of the thru-hiker experience before the hike, reflections on during the hike, and after the hike on the Pacific Northwest National Scenic Trail (PNNST).

The Pacific Northwest National Scenic Trail

The PNNST became a National Scenic Trail in 2009 and stretches 1,200 miles from western Montana on the eastern border of Glacier National Park to the Olympic Peninsula of Washington. The PNNST passes through six designated wilderness areas, three national parks, seven national forests, and through over twenty towns along the route (PNTA 2020). Traversing through diverse ecosystems, including high alpine, high desert, and rainforest, PNNST thru-hikers often have opportunities to encounter grizzly and black bears, wolves, moose, mountain goats, and other wildlife species unique to the region (Figure 1).

The overall management of the PNNST is overseen by the U.S. Forest Service and is also supported by the Pacific Northwest Trail Association (PNTA) that defines their mission as "to protect and promote the Pacific Northwest National Scenic Trail, and to enhance recreation and educational opportunities for the enjoyment of present and future generations" (PNTA 2020). Thru-hiking has been increasing in popularity each year and the number of thru-hikers on the PNNST is also estimated to increase in usage in the coming years. The majority of hikers who attempt the trail start from Chief Mountain, Montana in late June or early July and take 60-75 days to arrive at Cape Alava, Washington (PNTA 2020). Based on visitor use monitoring during the 2018 field season, there have been slight increases in thru-hikers, but not to the level of growth experienced by the Appalachian Trail or the Pacific Crest Trail, two of the most popular thru-hiking trails in the United States.

Social Aspects across Phases of the Recreational Experience

Outdoor recreation encompasses multiple phases (Clawson and Knetch 1966; Hammitt 1980) and involves dynamic interactions through a lived, personal experience (Stewart 1998; Borrie and Roggenbuck 2001). The phases include anticipation phase, travel to phase, the actual on-site experience phase, the travel-back phase, and the recollection phase (Clawson and Knetch 1966). Social interactions occur at various phases and can influence the short and long-term impacts of recreation. In the anticipation phase, individuals need to prepare for a safe and enjoyable experience. This phase is particularly important for individuals who do not have prior experience with the recreation activity and for recreational activities that require in-depth preparation and specialization. The level of specialization is influenced by required equipment, skillset, and amount of previous experience (Bryan 1977; Tsaur and Liang 2008). Thru-hiking requires adequate preparation as an immersive and specialized recreation activity. The anticipation stage can support interactions between experienced and non-experienced recreationists to prepare for the on-site phase and support the successful completion of the thru-hike.

In the actual on-site experience, the social component can be a central part of the overall experience (Peters, Elands, and Buijs 2010; Lu and Schuett 2014). Individuals can recreate with others (e.g. hiking with a friend) or meet new recreationists during the activity (e.g. meeting an individual on the trail). Some recreationists seek limited social interactions; while social

exchanges can be a motivator for others to participate in the recreation activity (Whiting, Larson, Green, and Kralowec 2017; Chang, Wray, and Lin 2014). For thru-hiking, many individuals set out on the trail without other hikers or a hiking group; yet, there is an underlying supportive and welcoming community aspect to thru-hiking that contributes to social interactions (Littlefield and Siudzinski 2012). There has been more recent research exploring the social worlds of thru-hikers with particular emphasis on the segmentation of different types of hikers on the trail based on their motivations and social interactions (Lum, Keith, and Scott 2020). In addition to the social interactions with other recreationists, thru-hikers frequently visit trail towns and engage with local communities, other hikers, or trail angels (Rush 2002). Many of these non-hikers provide support and a sense of community to thru-hikers as they travel through the area (Bratton 2012; Lum et al. 2020).

The social aspects of recreation can persist in the recollection phase after the activity is completed. Recreationists share their experience with others who were directly involved with the activity (e.g. other recreationists) or with others in their life who were not involved in the recreation activity (e.g. friends and family). For thru-hiking and other types of recreation that are immersive and take place over extended periods of time, there can be difficulty when transitioning back to everyday life. Turley (2011) found that thru-hikers experience a sense of loss of the intimate sense of community on the trail. This period of reflection after the completion of the recreational activity is important to the overall experience and can inspire deeper and long-term impacts from recreation (Duerden, Witt, and Taniguchi 2012). However, there are very few studies that explore the role of long-term social connections in the thru-hiking community.

Solitude, Social Cohesion, and Thru-Hiking

Wilderness areas are managed for a solitude experience and many recreationists seek these areas specifically for solitude (Hall 2001; Dawson 2004). Long distance trails often encompass wilderness areas; thus, solitude is a key aspect of the thru-hiking experience. Thru-hiking is often portrayed as a personal journey (Zealand 2007; Robertson and Goetz 2017; Robinson 2013) and has been compared to a spiritual "pilgrimage that is done alone, but also communally" (Hitchner et al. 2019 p. 88). However, solitude does not equate to an absence of all social interactions (Dawson 2004).

Recent studies indicate the emergence of hiking subcultures and a unique social element for long-distance trails (Fondren and Brinkman 2019). This subculture is often associated with the specific long-distance trail and hikers have a shared language, behaviors, and attitudes towards their activities on and off the trail (Fondren and Brinkman 2019). Relatedness, "the need to feel belongingness and connectedness with others" (Ryan and Deci 2000 p. 73), has overlap with subculture characteristics; however, it is important to note that hikers can be autonomous while also having a social community. The general emphasis on independence and solitude in the thru-hiking experience may underestimate

the role of social interactions, relatedness , and social cohesion to the phases of the thru-hiking experience.

Social cohesion refers to how individuals in a social system identify with values, norms, and beliefs (Durkheim 1972). Positive relationships, acceptance, and belonging are key aspects of social cohesion (Forrest and Kearns 2001; Jennings and Bamkole 2019) in addition to place attachment and empowerment (Jennings and Bamkole 2019). Social cohesion exists when individuals are experiencing positive outcomes from group membership and there are interpersonal interactions that support these conditions (Friedkin 2004). The level of social cohesion within a group is influenced by the attractiveness of group membership, the structural conditions among the group, and the extent to which individuals' identity is associated with a particular group (Friedkin 2004).

The sociological concepts of social cohesion can occur during recreational experiences (Peters et al. 2010; Jostad, Paisley, Sibthorp, and Gookin 2013). Social cohesion has been examined in outdoor recreation; however, findings have been mixed. For example, some studies have found a positive relationship between social cohesion and mental health in recreational settings (Maas, Van Dillen, Verheij, and Groenewegen 2009; de Vries, Van Dillen, Groenwegen, and Spreeuwenberg 2013); while other studies found no relationship between social interaction and emotional wellbeing (Korpela, Borodulin, Neuvonen, Paronen, and Tyrvainen 2014). In the context of urban parks, most social interactions were considered cursory, but that may be attributed to the characteristics of an urban park experience (Peters et al. 2010). To expand the understanding of social interactions of thru-hiking on a long-distance trail, this study interviewed thru-hikers on the Pacific Northwest National Scenic Trail during different phases of their recreational experience.

Methods

Semi-structured interviews were used to collect data from thru-hikers on their social experience during the anticipation, on-site, and recollection phases (Siedman 2006). The three phases of interviews included: 1) before individuals begin their thru-hike (anticipation), 2) after thru-hikers finished their hike (on-site), and 3) two months after the hiker finished their time on the trail (recollection).

The anticipation interview phase took place prior to thru-hikers beginning their journey. This interview focused on demographic information and previous hiking experience, attractive qualities of the trail, motivations for thru-hiking, social expectations of the trail experience, preparation for the thru-hike, and information about plans to hike solo or in a group. The second on-site phase of interviews took place directly after participants finished the thru-hike. Researchers asked hikers about the most rewarding and challenging parts of the experience, overcoming challenges during the hike, and the social experience on the trail and in the trail towns. The third and final recollection interview took place two months following the second interview. This timing was chosen to represent a time that allowed for some reflection and readjustment to off-trail life, but also was within a feasible time to

retain participation. The third interview asked about the challenges and ease of adjustment back into everyday life, skills gained from the experience, most memorable portions of their PNNST experience, sustained contact with others they met on-trail, and trail-related social media and online communication. It is important to note that are often differences between how individuals actually experience leisure compared to a reflection on the experience (Zajchowski, Schwab, and Dustin 2017).

Interview participants were recruited through the support of the Pacific Northwest Trail Association (PNTA). The Facebook group "PNT Class of 2017" included 79 members of thru-hikers for the 2017 hiking season, However, there was no ability for the researchers to confirm that these members all completed the hike. According to the PNTA, approximately 65-75 hikers attempted to complete the entirety of the trail in 2019 (PNTA 2020). The PNTA manages the Facebook page and included multiple posts on the Facebook page encouraging voluntary participation in the study with the researcher's contact information to setup an initial interview. A second recruiting strategy for the study included the voluntary registration of thru-hikers through the PNTA's webpage. Once hikers were registered, they were presented with a message to voluntarily participate in the study through an email message. USFS and PNTA publicly endorsed and supported participation in the interviews. In addition to recruitment via Facebook and PNTA webpage, interview participants were recruited during trail-related encounters with thru-hikers during the thru-hiking season when the research was conducting monitoring on the trail. If hikers agreed to participate in the study, they were asked to provide an email to be contacted at a later time by the researcher to setup an interview.

Interviews from 42 participants are included in this study. Interviews were conducted primarily by phone although some in-person interviews took place if the participants lived in close proximity. All interviews were recorded and transcribed and all responses remained anonymous in the analysis (Siedman 2006). Interviews were transcribed and coded using NVivo. Six researchers independently coded three interview transcriptions and developed their own list of codes (Berg 1989). Independent coding was synthesized to create a standard code list with strong intercoder reliability (Siedman 2006). This standard code list was applied by a single coder to the remainder of the interviews. Coded data from across the three phases of interviews were pooled and thematically analyzed. Themes were arrayed along the same temporal experience spectrum as the interviews.

Results

Table 1 presents the interview respondents by gender, age, and where they traveled from to hike the PNNST. Half of the respondents had previous thru-hiking experience, 43% were from the west, 64% were male, and 60% were ages 18-35.

Results below are discussed in order of their appearance in the anticipation, on-site, and recollection phases of the thru-hike experience. In each section, the relative frequency of themes and ideas being expressed by respondents is reported.

Region of Respondents' Residency	Participants (N)	Gender	Participants (N)
West	18	Male	27
Midwest	8	Female	15
Northeast	6	Age	Participants (N)
Alaska/Canada	6	18-35	25
Southeast	4	36-55	9
		56+	8

Table 1 – Demographics of respondents

Preparation tool	Reported use	Identified as most useful
Guidebooks	44%	16%
Maps	41%	3%
Online Forums	34%	6%
Facebook page	31%	3%
Personal contact	22%	9%
PNTA website	22%	16%
Combination of sources		22%

Table 2 – Preparation tools used by PNNST thru-hikers.

Anticipation Phase (pre-hike)

Motivations and social connections

Before hikers began the trek, they shared motivations for why they chose to thru-hike many of which were connected to individual goals and desires for escape from society. The PNNST has a reputation as rugged, remote, and relatively untraveled compared to other long distance trails. One hiker shared, "I've been told it's more of a wild feeling. It's really remote." Self-drive (i.e. self-determination, the desire to live life to the fullest, always wanting to do a thru-hike) was prevalent among thru-hikers (56%) and this was particularly a popular motivator for respondents 18-35 years old. One thru-hiker said: "overall I kind of want to do this for myself."

Many other hikers (40%) were motivated by the aspect of escape (i.e. escape from consumerism, daily life, society, technology). This idea of escape was particularly prevalent in thru-hikers over 56 years old. One of the thru- hikers expresses their motivation to thru-hike as: "I'm hoping this will kind of shake me up a little bit, and help me to put one foot forward in that aspect too. One foot in front of the other as far looking for what's next." A third theme focused on how participants were motivated by personal connections with others to the PNNST (25%). This theme included personal connections with people who had previously hiked the trail. For example, a hiker shared: "I've known about it [the PNNST] my entire life … so I took that book that my grandpa had 11 years ago of the trail and decided that that's what I wanted to do to kind of honor him…"

Preparation and social connections

Preparing for a 1,200 mile expedition entails many aspects and requires a multitude of sources to gather that information (Table 2). While guidebooks and maps are commonly thought of as the most useful for planning a thru-hike, social platforms such as online forums (34%) and Facebook (31%) are being utilized in the planning process as well. For the PNNST, there are Facebook pages where hikers, potential hikers, and PNTA members can share ideas and ask questions. One hiker described the Facebook page as an opportunity to get information from knowledgeable hikers: "just talking to those trail experts and people who've done it before doing their advisement bit. It's probably been the single most helpful thing." Personal contact with former thru-hikers and the use of the PNTA webpage was also recognized as a resource prior to the hike. While these were the most commonly used resources by hikers, guidebook and the PNTA website were the most useful sources with recognition that most hikers use a combination of these resources. One hiker explains "I don't think I can point to any one thing just because everything is kind of spread out, so you can get little bits of information from all over in different places."

Anticipation Phase (pre-hike) expectations vs. On-Site Phase (post-hike) experience

The PNNST has a reputation as a low-use trail with very little known about social interactions before, during, and after the thru-hike. Fifty-three percent of pre-hike interviewees were planning to hike the trail alone. Many hikers (65%) cited that that they could not find anyone to join them. One hiker shared, "I figured if I waited to try to find somebody to do it [hike the trail] with, then I might never get around to it, so I just decided to do it myself." Other hikers (35%) found that they are comfortable or prefer to hike by themselves, described as: "I enjoy going solo. It [hiking alone] kind of opens up your experiences when you're solo." Twenty-three percent of those hiking alone also noted that they prefer their own hiking style to those of a group. A hiker described the choice as: "I don't like to have to be tied down to someone else's plans, so if I hike and I find people who are compatible, then I'll hike with them, but I never want to go into a hike with the expectation that I'll stay with someone for the whole thing."

Despite the large amount of pre-hike interviewees that planned on hiking alone, 46% of pre-hike interviewees planned on hiking with a group. Many of these group hikers (33%) had a fear of being alone or hiked in groups for safety reason. In particular, one PNNST hiker described their apprehension of hiking alone in grizzly habitat: "I'm really afraid of grizzly bears, really afraid. Yeah, so I wouldn't even consider hiking through grizzly country by myself. It just wouldn't be enjoyable for me." Other notable reasons for choosing to hike with others were that they enjoy hiking with their partner (13%) and that their friends wanted to join them (20%). Within pre-hike interviewees, 7% more men were choosing to hike alone than women.

Since the PNNST is significantly less travelled than other National Scenic Trails like the AT and the PCT, thru-hikers have a variety of expectations about the social experience during the hike. During pre-hike interviews, 44% of individuals thought that they would not see many other people on the trail. However, 53% of interviewees reported that they also wanted to meet people or form hiking groups during the hike. Many interviewees (21%) also stated that they thought the PNNST would be a different social experience than other thru-hikes: "I don't feel like in my head it's going to be the same as the PCT where you're walking with groups of people that you meet along the way." There was a small percentage (9%) who expressed their desire to not have a social experience: "We're hoping to minimize social experience...mostly we're wanting to enjoy nature on our own." Because of its reputation as a low-use trail, 28% of thru-hikers expected to experience solitude: "I'm definitely expecting it to be more solitary than the past couple [thru] hikes." Another 19% of participants expected to have a reflective experience on the PNNST. One hiker shared their desire for: "...that really deep inner reflection. I'm definitely expecting to get that and more from this hike".

Despite many hikers planning to hike alone, 73% of post-interview respondents stated that they joined with others during the hike. Reflecting back on the hike, many hikers found their expectations were surpassed when it came to social interactions with

people. For example, one hiker shared, "I didn't have expectation for the people that we would meet or like the trail angels, but they were all phenomenal. We met some really amazing people and that was really cool". When asked about the most rewarding aspects of the thru-hike, 32% of hikers identified the social experience: "I think the friends that I made along the trail. That was hugely rewarding. I just had a fantastic time with other hikers". The rewarding social experience for PNNST thru-hikers not only includes other hikers, but also the interactions within trail towns and with trail angels: "the community support was much more extensive in breadth and depth than I expected."

On-Site Phase (post-hike): Coping with challenges

Thru-hikers on the PNNST faced a myriad of challenges during their time on the trail and hikers identified a variety of coping strategies. Loneliness emerged as a challenge in 8% of post-hike interviews. One hiker described their struggles during the thru-hike as: "There was a lot of feeling of loneliness on the trail for me personally and it's something new for me coming from the PCT last year where there's a lot of people on the trail." Fifty-one percent of post-hike interviewees stated social aspects as one of their mechanisms to cope with challenges on the trail. One thru-hiker describes utilizing social tools to succeed: "When things were hard, it was never like I was thinking, 'Uh, I quit.' I think it's good having a partner." Reliance on hiking partners was one of the most frequently referenced (39%) coping strategies during the hike. According to many hikers, their hiking partner made it easier to tackle the challenges that they encountered:

I think having people with me was a big deal this time around going through. If I didn't have somebody else hiking with me on some of these bushwhacks, I would have just lost it you know? I'd have been so pissed off, but you go with somebody and it's not as bad. You can laugh about it a little bit more. For me, that's big.

The social component of the thru-hike was mentioned by 51% of hikers during the interviews two-month after completion of the hike. One hiker stated "it's always so much easier to suffer with other people." Additionally, support from the PNTA and locals in trail towns were cited by 14% of hikers as a strategy to cope with challenges, with one hiker noting that they were "super helpful" in dealing with struggles on the trail. Trail towns were noted by several thru-hikers in their two-month post-hike interviews as an aspect that was especially memorable about their PNNST experience: "I talk a lot about the small little towns and the great people that I've met along the way." While thru-hiking the PNNST includes many beautiful landscapes, the social aspect of trail life appears to also leave a lasting impact on those who undertake this journey.

Recollection Phase: Social relationships

In the interviews with hikers two months after completion of the trail, thru-hikers were asked about their transition back to everyday life. Individuals who had prior experience with thru-hikes reported an easier transition back to routines of daily life than those who had not previously completed a thru-hike. Thru-hikers with previous experience had 56% reporting challenges in

readjustment compared to 83% of hikers with no previous thru-hike experiencing challenges in readjustment. One hiker reflected on the difficulty in transitioning from the way of life on the trail as "when you're in the wilderness a lot, you appreciate people on their individual basis, you know each person. But when I'm in the city around big groups of people, I have noticed it's almost like a post-traumatic syndrome."

In the two-month post-hike interviews, 93% of respondents indicated that they were still in contact with people that they met on the PNNST. Eighteen percent of hikers only maintained contact with the individuals with whom they hiked with on the PNNST while 14% of hikers also maintained contact with trail angels two months after the trail. Thru-hikers varied in their modes of communication. Facebook was the most popular contact method with 46% of respondents noting that they used the site to keep in touch and when combined with Instagram (10%), the majority of respondents used social media for post-hike communication. For example, a hiker explained "so far it's mainly with Facebook. I have called and checked in on a couple of people just to see how they were doing. The PNT hikers Facebook page has been a good place for all of us to stay connected." Texting (39%), phone calls (21%), and email (11%) were also common methods of communication.

Social media usage related to the PNNST was also asked about in post-hike interviews. Fourteen percent of participants reported using social media strictly for sharing photos of their experience: "I kind of blogged throughout the trip, used my Facebook to promote it . . . I think I pretty much have wrapped everything up with that. I don't think I'll really be posting anything more going forward." Many thru-hikers (24%) used social media to reach a broader audience and to keep in touch with other hikers and trail angels (14%). Finally, there were 24% of interviewees who reported that they were not engaging on social media about their experience on the PNNST. One hiker stated: "I don't know, I may post another photo or two. But I don't think I'll keep talking about it for my whole life".

Discussion

Importance of social cohesion on low-use trails

This study explored the social aspects of the thru-hiker experience before (anticipation phase), during (on-site phase), and after the completion (recollection phase) of the PNNST hike. While PNNST hikers were drawn to the trail for its reputation of low use and the opportunity for solitude in a unique and dynamic landscape, the social aspect of thru-hiking was identified as the most rewarding part of their experience. Compared to popular, high-use trails like the Appalachian Trail and the Pacific Crest Trail, the PNNST offers a distinctly different type of long-distance trail experience for thru-hikers (Figure 2). Although the majority of interviewees had expectations or desires of hiking alone, most of these solo hikers joined other hikers on the trail. This study emphasized the importance of social components to helping hikers overcome challenges and have a positive, transformative experience.

Figure 2 – The PNNST offers a distinctly different type of long-distance trail experience for thru-hikers

The findings demonstrated the robust and tight-knit nature of the PNNST hiking community. Many aspects of social cohesion such as positive relationships, belonging and identity with a group, and place attachment (Forrest and Kearns 2001; Jennings and Bamkole 2019; Friedkin 2004) were present for PNNST hikers. Additionally, the findings showed a relationship between social connections and the ability to cope with challenges and transitions back to everyday life. Thus, mental wellbeing was enhanced through social cohesion which has been found in other recreational settings (Maas et al. 2009; de Vries et al. 2013).

This study revealed that social cohesion and social interactions are not just part of high-use long distance trails like the Appalachian and Pacific Crest Trails, but are also integral to the thru-hiking experience on low-use long distance trails.

Shared experiences create bonds and aspects of community (Arnold 2007) which was evident by how many PNNST hikers reported extended stays in trail towns specifically to socialize with

other hikers, trail angels, or others in the community. The subculture of the PNNST thru-hikers illustrated the importance of relatedness (Ryan and Deci 2000) and the unique connections that form in association with the recreational activity and the trail (Fondren and Brinkman 2019). This study revealed that social cohesion and social interactions are not just part of high-use long distance trails like the Appalachian and Pacific Crest Trails, but are also integral to the thru-hiking experience on low-use long distance trails.

Social interactions across recreational phases

Outdoor recreation encompasses multiple phases (Clawson and Knetch 1966; Hammitt 1980) and this study focused on the anticipation, on-site, and recollection phases of the PNNST thru-hiking experience. The findings suggested distinct roles for social interactions across recreational phases. In the anticipation phase, interviewees reported using a combination of sources including online forums, social media, and personal contact with potential or experienced hikers. This pre-hike engagement was largely focused on information exchange and logistical planning which is common for experiences such as RV trips (Fjelstul and Severt 2011) and tourism (Xiang, Wang, O'Leary, and Fesenmaier 2015; Amaro, Duarte, and Henriques 2016). PNNST hikers required ample time for planning especially for inexperienced hikers that are not familiar with the geographic area; thus, the distinct equipment and skills required of thru-hiking highlighted the role of previous experience and external support for this specialized recreation activity (Bryan 1977; Tsaur and Liang 2008).

Thru-hikers also stated how their social relationships provided support to cope and overcome physical and mental challenges experienced during the hike or on-site phase of the thru-hiking experience. While social groups are identified as a coping mechanism (Coble, Selin, and Erickson 2003), there has been limited application to the specific challenges of thru-hikes. Immersive outdoor wilderness courses, such as Outward Bound and the National Outdoor Leadership School, have emphasized the role of group dynamics in knowledge transfer and coping with challenges in a wilderness setting (Sibthorp, Furman, Paisley, Gookin, and Schumann 2011; Goldenberg and Pronsolino 2008). The core concepts from these programs may be applicable to the thru-hiking experience especially to navigate the plethora of mental and physical challenges during the hike.

The study findings indicated that the social experience for PNNST thru-hikers extended into the recollection phase. The continuity of group membership has been noted as an important aspect of social cohesion research (Friedkin 2004). Nearly all hikers reported that they maintained thru-hike contacts and relationships several months after they completed the trail. Many PNNST thru-hikers shared the challenges of transitioning back to everyday life off the trail, similar to Turley's (2011) study, and how their connections with the trail community helped to cope with these challenges particularly for novice hikers. Findings suggest a unique subculture of PNNST nested within the broader thru-hiking sub-culture. This idea of nested subcultures connected to geographic landscapes underlined the unique aspects of thru-hiking that occur

in diverse long-distance trail settings (Fondren and Brinkman 2019). Unfortunately, many thru-hikers are distanced geographically and have limited in-person contact after completion of the hike. Online forums play a critical role in engaging recreation communities (Cong et al., 2008; Ziegler et al., 2014) and may be particularly important to the thru-hiking community for maintaining relationships in months and years beyond the hike's completion.

Social media as a tool for social interactions

Many hikers want to escape the use of technology when on the trail due to its proliferation in modern society (Ptasnik 2015). However, technology is changing the relationship between recreationists and the landscape (Martin 2017; Dustin, Beck, and Rose 2017; Dustin, Amerson, Rose, and Lepp 2019). Social media has become an avenue for creating and maintaining community during the different phases of thru-hiking. Millions of individuals engage in social media and the numbers continue to rise (Correa, Hinsley, and De Zuniga 2010). Thru-hikers travel from all over the country and world and often do not have opportunities to meet another hiker in-person before they start the hike. Online forums and sharing networks are helpful for sharing in-depth information including recreation groups like thru-hikers (Cong, Wang, Lin, Song, and Sun 2008).

Thru-hiking has many social media sites that are being used regularly by potential, current, or former thru-hikers. For example, "WhiteBlaze.net", is a site focused on Appalachian Trail hiking, and has thousands of members with millions of posts from both thru-hikers and people interested in the trail (Ziegler, Paulus, and Woodside 2013). Additionally, there are Facebook pages dedicated to the specific years of a thru-hike (e.g. PNNST Class of 2019). As social media and the internet become more prolific, they increase access of information to individuals exploring new recreational opportunities (Jacoby-Garrett 2019). Hikers typically utilize social media for planning purposes (i.e. gear, scheduling, finances) in the anticipation phase, in the on-site phase for updates in the on-site phase, and for memories of the trail and anecdotes about the experience in the recollection phase (Kotut, Horning, Steltard, and McCrickard 2020). Additional studies demonstrated hikers' use of cell phones and other forms of technology when on the trail (Dustin et al. 2017; Dustin et al. 2019). Although this PNNST study did not specifically focus on the use of technology on and off the trail, PNNST thru-hikers did share their use of social media before and after the hike. However, there is a need for future research on the social media use for PNNST thru-hikers across the phases of the recreational experience.

Managers and other supporting organizations of long-distance trails can utilize social media and internet forums to provide information, engage with potential and current hikers, and promote stewardship of trails and other key issues beyond the hike. The PNTA currently uses their online forums and social media sites to provide updates and information (e.g. trail closures, wildfires, etc.), but there could be additional opportunities for stewardship and continued engagement with the trail community. This strategy has been utilized by other types of recreation (Landon, Kyle, Van Riper, Schuett, and Park 2018; Larson, Cooper, Stedman, Decker, and Gagnon 2018a; Larson, Usher, and Chapmon 2018b) and can be applied to stewardship of

long-distance trails. The transboundary nature of long-distance trails may require a variety of pro-environmental behaviors that can promote stewardship ranging from local trail maintenance, support of trail associations, advocacy for establishment of trails, to spreading awareness on various ecological issues associated with the trail and respective region; however, there is a need for further research to better understand this relationship (Thapa, 2010).

Conclusions

The purpose of this research was to better understand the role of social interactions through various phases of the thru-hiking experience. First, the study's findings illuminate that thru-hiking is a community, even on the PNNST where the usage is relatively low and hikers expected minimal social interactions. Second, the social experiences are integral to different phases of the recreational experience including planning, coping with physical and mental challenges during the hike, and transition back to everyday life after the hike. Third, social media is a useful tool to support social interactions across the phases of the thru-hike.

As with all research studies, there are limitations and recommendations for future research. The recruitment process of this study may have limited some of the hiker participation as it was largely targeted to online forums and websites. A number of individuals did not respond to requests for a post-hike interview due to email complications, possibly not finishing the trail, or deciding that they no longer wished to participate in the study. Additionally, hikers were asked to reflect on their experience on the trail which may influence the findings (Zajchowski, et al. 2017). A final limitation is the study's primary focus on the PNNST as other extended trails have differing characteristics that may limit the generalizability of the findings. This study offers the potential for development of a survey and scale focused on social aspects of the thru-hiking experience, which can provide insight to broader trends if applied to diverse thru-hiking audiences and contexts.

This research contributes valuable information to understanding the social aspects of thru-hiking. While there is ample research looking at social aspects of other types of recreation, there is limited application to the thru-hiking context which is unique from many other types of experiences due to the immersive and longitudinal qualities of the experience and the transboundary geographic context. The study's findings provide a foundation for future research to expand various lines of inquiry and provide insight for long-distance trail managers and trail associations to utilize the thru-hiking social community to (1) strengthen hiker preparation in the anticipation phase; (2) help hikers cope with challenges on-site during the hike and supporting social cohesion; and (3) maintain relationships with the hiking subculture in the recollection phase to facilitate future stewardship behavior and long-term connections to the trail and the trail community.

TAYLOR COLE is an outdoor recreation coordinator at Idaho State University, Program of Outdoor Education; email: coletay2@isu.edu

JENNIFER THOMSEN is an Assistant Professor at University of Montana, Parks, Tourism, and Recreation Management Program; email: Jennifer.thomsen@umontana.edu

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SCIENCE & RESEARCH

Managing Cultural Resources On The Alaska Peninsula

by LAURA STELSON, WILLIAM L. RICE, and B. DERRICK TAFF

Laura Stelson

William L. Rice

B. Derrick Taff

PEER REVIEWED

ABSTRACT

Twentieth-century cultural resources provide physical evidence of human relationships with a landscape that has shaped the wilderness areas we know today. These cultural resources enrich the meaning of an area as wilderness, but also present multiple management challenges surrounding visitor use in designated wilderness areas. The National Geographic Society Katmai Expeditions of the 1910s present a case study of how historic trails and their associated artifacts interact not only with present issues toward the dual-enforcement of the National Historic Preservation Act and Wilderness Act, but also with the management of visitor use along a corridor containing relatively recent traces of historically significant activities and events. This study draws on the findings of a 2018 expedition identifying convergence of a historically significant trail with a popular path for backpackers through the Katmai Wilderness and explores the importance of cultural resources in long-distance trail planning and cultural resource management in designated wilderness.

Across the Wilderness Preservation System, there is an increasing interest by federal agencies in the management of contemporary cultural resources—those left behind "by hunters, traders, miners, settlers, and travelers" (Cowley et al., 2012 p. 29). However, of the innumerable paradoxes that exist in federal land management policy, perhaps none is more confounding than the competing resource preservation goals of the Wilderness Act and the National Historic Preservation Act (NHPA). Both pieces of legislation seek to preserve areas and objects from humankind's fervor to develop, yet the Wilderness Act largely excludes the preservation of human-made objects—the primary goal of the NHPA. Thus, land managers are left with a choice in the management of cultural resources in wilderness areas: ignore the strict provisions of the Wilderness Act and preserve cultural resources or ignore the provisions of the NHPA and disregard cultural resources altogether.

This study examines the policy and management complexities of preserving twentieth century cultural resources in wilderness areas that intersect long-distance trails by providing an example from Katmai National Park and Preserve, Alaska. Following the format of qualitative, exploratory case-study research, we address how legislation and recent debates about the dual-enforcement of the NHPA and Wilderness Act might inform future management decisions surrounding the protection of cultural resources along long-distance trails extending through protected wilderness areas (Yin 2003).

This examination provides examples of decisions regarding the management of a growing class of cultural resources (twentieth century materials) that have only recently become part of the archaeological record. Often, the recency of significant events and phenomena associated with such cultural materials has precluded them from inclusion in the designation of wilderness character on U.S. public lands, limiting their protection in the management plans of specific protected areas. The case of a recently rediscovered historic trail through Katmai National Park was selected to examine how current national and region-specific legislation may be used in the development of new wilderness narratives and mitigation strategies for the protection of significant cultural resources and history previously omitted from this national park's management plan. This representative case study about the management of historic resources at Katmai National Park and Preserve provides a significant contribution to the limited pool of available literature on the dual-enforcement conflict that is currently available to resource managers seeking to address similar issues elsewhere.

Relevant Legislation

The relevant legislation outlined here refers specifically to laws protecting cultural resources and wilderness character in the context of national park lands (NPS-specific policies) and federally-owned lands in Alaska (Alaska National Interest Lands Conservation Act) that are specifically relevant to our case study. For further discussion of designations of historic and cultural resources and policies intended to protect wilderness character refer to DeSantis (2020) and Landres et al. (2015)

Antiquities Act of 1906

In response to acts of vandalism seen at archaeological sites across the U.S. Southwest, Congress provided the first official measure of protection to cultural resources on public lands by enacting the Antiquities Act of 1906. This act prohibits the excavation of antiquities on all U.S. public lands without a permit from the Secretary of the Interior (King 2008). This was the first piece of major legislation to firmly establish research and education as valid goals of public land management in the United States. In addition, the Act authorized the creation of National Monuments on public lands that are especially significant to science (Sellars 2007).

Organic Act of 1916

The Organic Act of 1916 created the National Park Service (NPS) to mandate the protection of scenery, natural history, cultural history, and wildlife in public park lands for future generations. As such, the NPS was the first federal agency to be charged with maintaining the integrity of both natural and cultural resources on public lands, setting a precedent that other federal land-management agencies would subsequently follow (Ross 2013). The Act calls for the setting aside of public lands for both recreation and conservation purposes, with the caveat that current enjoyment should not impair that potential for generations to come. As cultural resources are nearly always non-renewable, it is this policy that managers consider when weighing the informative potential or educational value of a given resource against the potential risk of its destruction (National Park Service 1998).

Wilderness Act

In 1964, President Lyndon Johnson signed the Wilderness Act—defining parameters public lands must meet for inclusion in the National Wilderness Preservation System. The first of these requires that a Wilderness area "generally appears to have been affected primarily by the forces of nature, with the imprint of [hu]man's work substantially unnoticeable." The fourth—and last parameter—concedes, however, that lands may also contain "historical value." This fourth parameter provides the basis for much of the cultural resource preservation in Wilderness, as will be discussed.

The Alaska National Interest Lands Conservation Act (ANILCA)

While the policies set forth by the Wilderness Act are generally still applicable in Alaska, they are occasionally superseded by regulations proposed in the Alaska National Interest Lands Conservation Act, established in 1980. This complex piece of legislation was primarily intended to provide rural residents with access to subsistence resources and permit the continuance of traditional activities, but has inadvertently provided further protection to archaeological resources and standing structures within wilderness areas (see ANILCA , Subchapter I and Section 1315). Specifically, ANILCA conflicts with the protection afforded to wilderness areas elsewhere in the United States by allowing for the use of motorized boats and planes in designated wilderness, as well as the construction and maintenance of hard-sided structures for overnight shelter (Landres 2017).

National Historic Preservation Act

In 1966, President Johnson signed the National Historic Preservation Act (NHPA)—expanding the National Park Service's (NPS) ability to catalog and preserve "places that represented historical events, archaeological sites, and historic buildings" (Kirn 2013, p. 53). The NHPA also established the National Register of Historic Places (NRHP), which gives the NPS the authority to establish and preserve historic "districts, sites, buildings, structures and objects that are significant in American history, architecture, archeology, engineering, and culture" (NPS 1988, p. 2). To be eligible for listing on the NRHP, a resource must meet two basic criteria: 1) be significant (through a relationship with an important event or person, their embodiment of a particular type, period, or method of construction, or in their potential to yield further information about history and prehistory); and 2) have enough integrity to continue communicating its significance (in other words, the site or structure cannot be too damaged to demonstrate its own significance or potential) (36 CFR 60.4).

In 1972, President Nixon signed executive order 11593, extending the same degree of protection to any cultural resource found on federal lands that were merely deemed eligible for listing on the National Historic Register (even if the resource was not yet listed on the register). This order has been critical to ensuring a legally protected status to sites immediately after their assessment by a qualified professional—potentially years ahead of an official acceptance of a nomination to the National Historic Register (King 2008). A further revision made to the NHPA in 1980 expanded the same policy of protection to encompass all cultural resources—those attributes of a place relating to social identity—beyond legally defined districts or sites to include the preservation of ethnographic resources and cultural landscapes in addition to archeological resources, structures, and museum objects (National Park Service 1998).

These two revisions have had a few significant consequences for the way that most public agencies now protect cultural resources.First, nomination to the NRHP generally contributes little additional protection to sites on federal lands already maintaining sufficient integrity and informative potential to be considered for nomination (Sebatian 2009). For example, Fannie Quigley's House, located in Denali National Park, was only added to the NRHP in late 2019 (NRHP Ref # 100004765). Built around 1907, the structure is only slightly older than Denali National Park itself and has been maintained and protected by the NPS for the better part of a century (Norris 2006). Secondly, it has elevated cultural resources on the register to holding a sort of 'honorary' status by establishing a public record articulating why a place, phenomenon, or history is so important that the public really should know about it (King 2008). This honorary status may confer the benefit of additional funding for preservation purposes through federal programs and grants (Sebastian, 2009). Lastly, this approach also has the occasional drawback of subjecting many sites to unintentional damage by users of public lands who have no knowledge of their existence or significance (Ryan 1999). Often, those responsible for their preservation see the safest option as steering people away from them. In the case of a trail that is itself a resource,

strategies implemented by park managers might focus on limiting the damage inflicted upon adjacent and associated archaeological sites through trampling, erosion, climbing on structures or moving artifacts (Wildesen 1982). Effective strategies used by cultural resource managers include restricting traffic around archaeological sites to pedestrian use only and developing and maintaining a clear footpath with signage and amenities nearby (Palumbo 2002). However, when not executed carefully, such additional developments and amenities have the potential to detract from an area's wilderness character.

National Trails System Act

Finally, in 1968, President Johnson signed the National Trails System Act (NTSA) "to provide for the ever-increasing outdoor recreation needs of an expanding population and in order to promote the preservation of, public access to, travel within, and enjoyment and appreciation of the open-air, outdoor areas and historic resources of the Nation." This legislation includes elements of both the Wilderness Act and the NHPA. For instance, designated National Scenic Trails are to "provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas through which such trails may pass." Since this time, archaeologists have increasingly adopted the perspective that, while trails do lead people to cultural resources, their strategic placement may also function as an effective tool for minimizing impact to a site (Lipe 2009).

Relevant Case Studies

Previous attempts to balance the Wilderness Act, the NHPA, and—in some cases—the NTSA have ended with mixed results. The management of the Phillip Burton Wilderness of Point Reyes National Seashore provides perhaps the most controversial example. Watt's (2002) analysis of the area's contentious 1976 wilderness designation concludes that a purposeful erasure of the land's relatively recent history of ranching and dairy production was required for the area to meet wilderness eligibility. Existing ranch buildings and barns were removed or burned and the NPS reported to Congress that the area had been left "unaltered by the hand of man" (Watt 2002, p. 60). More recently, the wilderness garnered national attention after a 2013 federal court ruling upheld an NPS decision to not renew the historic oyster farming lease adjacent to the wilderness on the basis that it did not conform to the area's wilderness character (Nagle 2014).

Cultural resource management along the Appalachian National Scenic Trail within the Shenandoah Wilderness provides another contentious example. Human impacts on the landscape are evident throughout the Shenandoah Wilderness (Cowley et al. 2012); as noted by Shaffer (2016), the Appalachian Trail through Shenandoah provides access to its abundance of cultural landscapes and resources. In fact, the trail's significant standing in American lore as a uniquely American pilgrimage has transformed it into cultural landscape unto itself, where the trail and its accompanying structures and viewscapes purvey and preserve an important experience (Shaffer 2016). Until recently, however, the NPS largely ignored the presence of contemporary "mountain

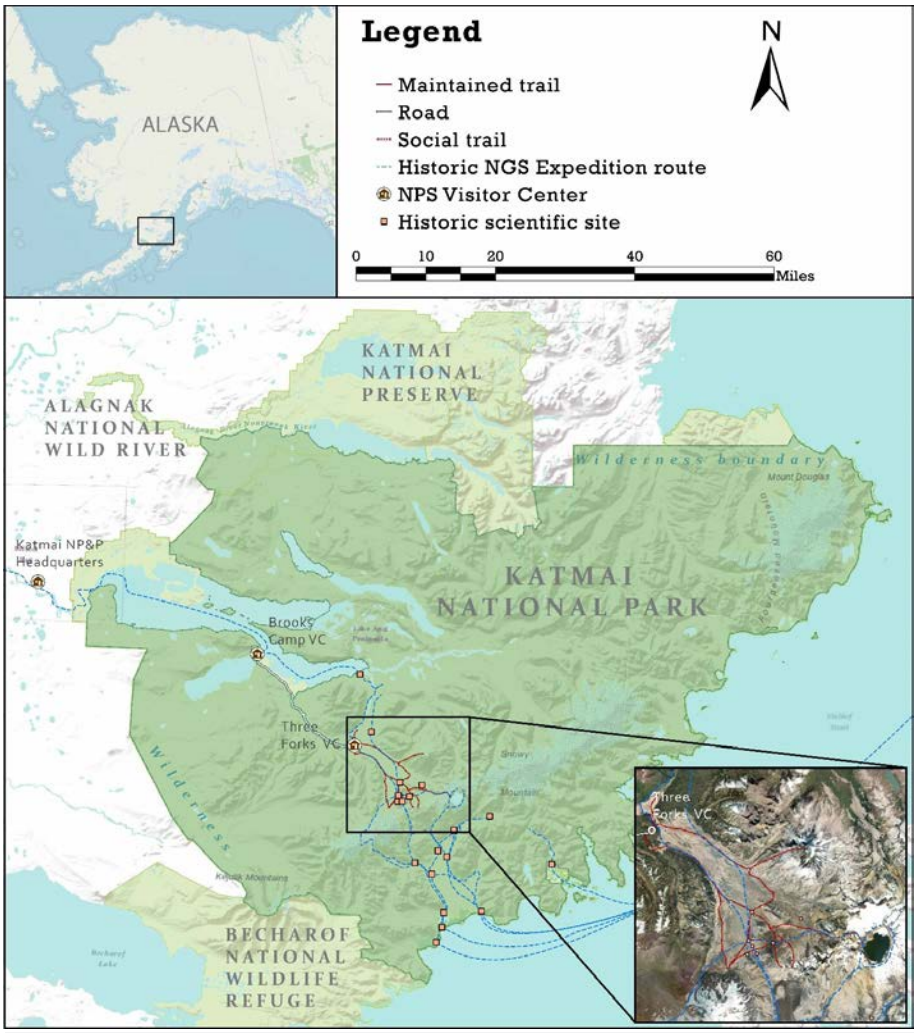

Figure 1 – Map of Katmai National Park showing historic National Geographic Society expedition routes, historic base camp and scientific site locations, park facilities and wilderness boundaries.instagram.com/p/BJNxxOQguqK/.

culture" artifacts along the Appalachian Trail through the Shenandoah Wilderness and the other areas of the national park to ensure compliance with the Wilderness Act—in spite of the high density of nineteenth and early-twentieth century homesites in the area (Gourley 2017). The NPS has now moved to catalog the "mountain culture" artifacts throughout the park and comply with all relevant policies (Gourley 2017).

Examples of cultural resource inclusion under the "historical value" clause of the Wilderness Act can be found in the Chiricahua and Death Valley Wilderness areas (Crowley et al. 2012). The Chiricahua Wilderness—which is completely enveloped by the NHPA-protected Chiricahua National Monument Historic Designed Landscape—preserves retaining walls and historic structures related to the history of the Civilian Conservation Corps (Crowley et al., 2012). In Death Valley, artifacts including "mill sites, claim markers, aerial tramways, mine shafts…town sites… aircraft wreckage, abandoned roads, cabins (some still in use), rock walls, fences, gravesites, graffiti, survey markers, bearing trees, and many other things" (p. 116) are preserved and included in the

wilderness character qualities of the park's Wilderness Stewardship Plan (Death Valley National Park 2012).

The Death Valley Wilderness also provides a prominent example of how visitor trip planning can be influenced by relatively contemporary cultural resources. A recent study found that the trips of Death Valley hikers were—in part—motivated by an eagerness to engage with historical sites and learn about the cultural history of the area (Rice et al. 2019). Additionally, public input to the area's 2012 Wilderness Stewardship plan revealed that "visitors value historic mining sites [and] there is concern that the park needs to provide access to historic mining sites and other historical mining remains" (Death Valley National Park 2012, p. 12).

The Case of Katmai Wilderness

In 1918, President Woodrow Wilson established Katmai National Monument on just over one million acres of the Upper Alaska Peninsula for the protection of the unique and highly active volcanic landscape created by the Mt. Katmai-Novarupta volcanic event of 1912 (Presidential Proclamation #1487). In spite of the Valley's long pre-eruption history of use as a travel corridor by Alaska Native peoples and Euroamericans, the Monument's original boundaries were drawn close to the edges of the volcanic devastation, as the primary resources to be protected were the scenic beauty and geologic resources of its famed Valley of 10,000 Smokes. Central to the efforts to explore and protect this area were the National Geographic Society (NGS) and their well-known leader of four expeditions to Katmai, Robert F. Griggs.

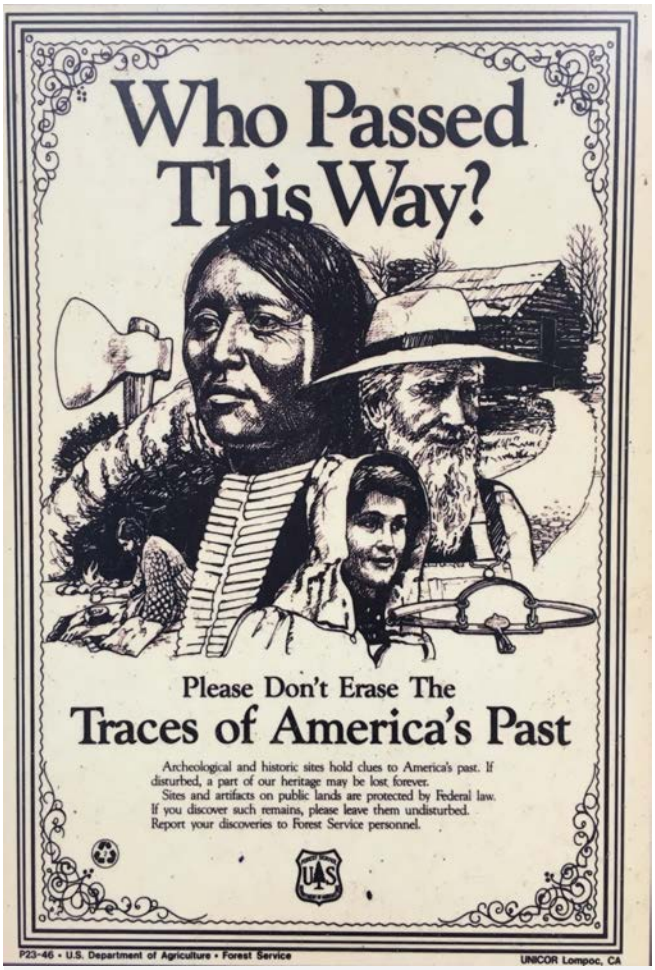

Figure 2 – Signage has been used by protected area managers to preserve contemporary cultural resources. Photo by Will Rice.

The four years Griggs years spent documenting the fumarole-ridden desert left behind by the Novarupta event resulted in numerous National Geographic publications recounting the expedition teams' fantastic adventures and important scientific discoveries and directly influenced Wilson's decision to protect Katmai's landscape (Griggs 1917, 1918, 1921, 1922). For many, Griggs' widely-distributed photographs and narrative of an 'authentic' discovery served to provide a more personal connection to this strange and far-away place (see Figure 3 for example). One century later, Katmai is still expensive, with guided tours, dining, and lodging drawing

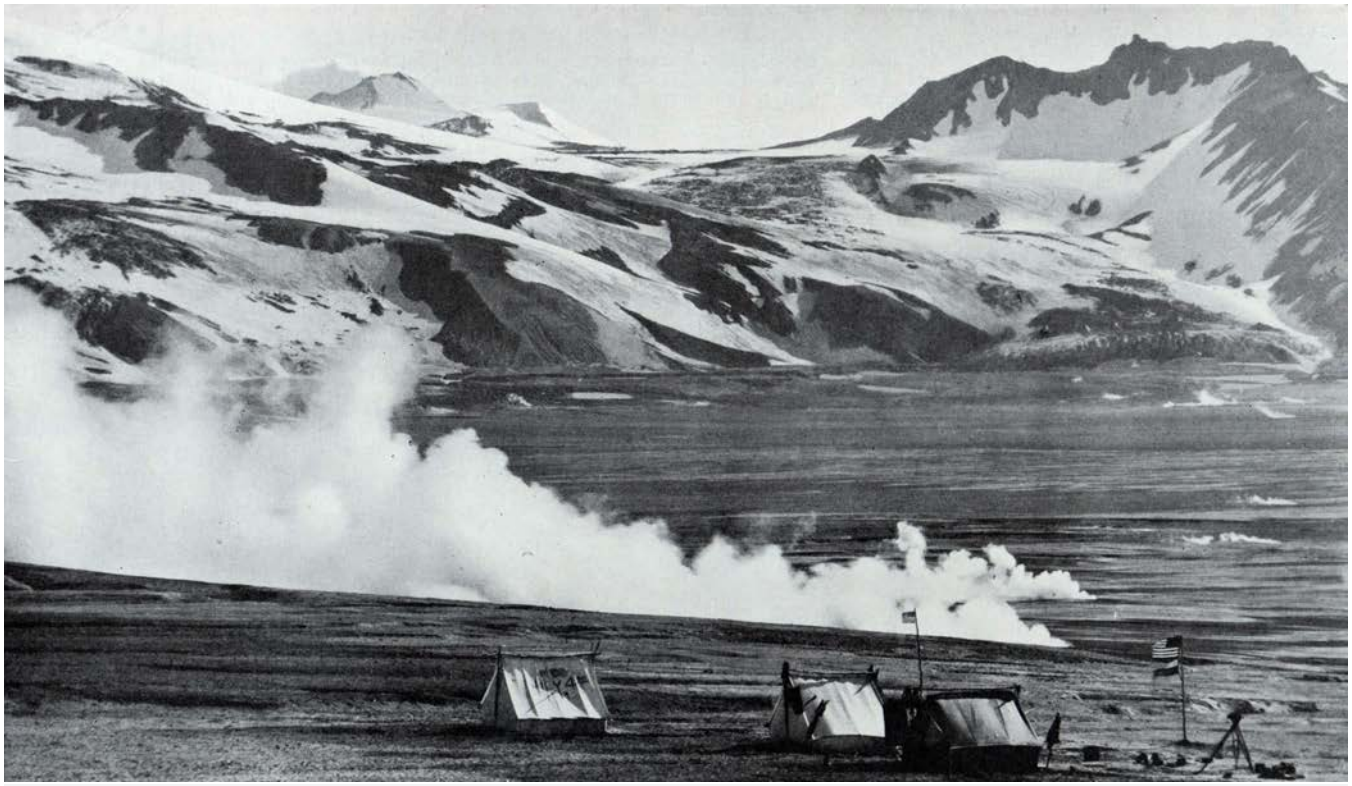

Figure 3 – Historic photo of the active fumeroles in Katmai's Valley of 10,000 Smokes published in a 1921 edition of National Geographic Magazine; original caption reads: "The headquarters of the National Geographic Society's latest Katmai expedition during its stay in the Valley of 10,000 Smokes" (Credit: National Geographic Society/Emory Kolb)

visitors from around the world—with approximately one quarter of visitors hailing from outside of the U.S. (Strawn & Le 2014).

Recognition of the area's important cultural history, diverse wildlife, and pristine habitats prompted the boundaries of the Park and Preserve to expand to what they are today. All combined, protected lands at Katmai span an area larger than the entire state of Connecticut – nearly 5 million acres. Together with this tremendous growth in size came a host of management concerns. While Katmai is best known today as a sanctuary for Alaska Brown Bears or as a world-class destination for anglers and sportfishermen, the park also boasts an archaeological record amongst the richest in all of Alaska (Norris 2004). Over 240 archaeological sites have been documented within its boundaries, several of which represent large villages once occupied by hundreds of historic Alutiiq and ancestral Sugpiaq people (Dumond 2011). These concerns, and many others, converge most acutely at the Brooks River Archaeological District National Historic Landmark; also Katmai's primary destination for bear viewing (Ringsmuth 2013).

Outside of Brooks Camp, Katmai has only six miles of maintained trails, and, as a result of sweeping changes and expansions by ANILCA, over 95% of the park's land lies in designated or eligible wilderness (Morris & Evison 1986). The majority of this wilderness is only accessible to the public by watercraft or small fixed-wing aircraft on floats or specialized landing gear, significantly limiting the range of places where visitors might go. Nevertheless, all of the cultural and natural resources found within the park's wilderness areas are managed by a very small

core staff working remotely from King Salmon, AK. The park's enormous size and abundance of resources, combined with the arrival of visitors on planes departing from numerous airports in Southern Alaska make it impossible for this small staff to educate all visitors about potential encounters in advance of their visit, or even closely monitor adverse impacts to all of these sites on a regular basis.

Methodological Process

It was this history of early scientific exploration and conservation that our multidisciplinary team of scientists and storytellers sought to explore in 2018. In spite of the historical significance of these expeditions, the precise routes which these early explorers followed as well as the exact locations of their base camps remained unknown (Clemens & Norris 2008). By delving into the maps printed in various century-old editions of National Geographic Magazine, our team pieced together the approximate locations of the various base camps these expeditions used from 1915 through 1919, as well as the routes that they would have followed from Katmai's Pacific Coast all the way across the Aleutian Mountains, through the Valley of to 10,000 Smokes and down to the Iliuk Arm of Naknek Lake—a waterway leading directly out to the Bering Sea (see Figure 2). Our goal was to identify the archaeological remains of their associated camp sites. Over the course of 34 days of backpacking, our team retraced the routes of these historic expeditions, visiting the sites of twelve different historic NGS expedition camps. Incidentally, the majority of the expedition's travels were found by our project to overlay an extant historic trail known as the "Katmai Pass Route", which had already been in use for hundreds, if not thousands, of years prior to its concealment by Novarupta's massive ashfall.

Findings and Discoveries

Katmai's primary destination for backpackers remains the Valley of 10,000 Smokes, which contains an extensive network of social trails that visitors manage to navigate on their own without direct guidance or amenities (Norris 1996). Included in this trail network are large sections of the historic Katmai Pass Route, along with numerous spurs leading to nearby mountains and geologic features once navigated by the NGS's expedition teams. How many visitors to Katmai choose to follow these historic trails, how far they go, and what historic sites they interact with has yet to be investigated. "Backcountry" use of Katmai's wilderness areas is facilitated through numerous commercial-use authorized (CUA) guiding services, not all of whom report their activities to the park. Unreported CUA visits have been estimated to raise the number of annual visitors by 16,000 people or more (Fay & Chistensen 2012). In 2014, 15% of park visitors stated that they visited the Valley of 10,000 Smokes, and 13% stated that they camped overnight in the Park's backcountry (Strawn & Le 2014). If these percentages are transposed onto the number of visitors in 2019 (84,167 people), then the number of visitors taking extended backpacking trips in this area may be as many as 11,000 annually (NPS Visitor Use Statistics 2019). However, based on the authors' own observations, the actual number of backpackers at Katmai is likely not this

high and has not increased at the same rate as day-trip visitation to the park. Backpackers and hikers who follow the course of a well-worn social trail down from Katmai's Three Forks visitors center, located near the northern boundary of the Valley of 10,000 Smokes are not informed that they are literally following in the footsteps of famous NGS explorers, trail-blazers and prominent scientists who came before and after them.

Two century-old base camp locations documented along the historic NGS routes were found to contain archaeological features and artifacts scattered on their surface. Findings included a roll of film, portable chemistry equipment, a shell casing, camping gear, and many personal effects, such as socks and a hat pin—all scattered in clusters over a 100m area, as if they came from different tents (Figure 4). Beyond the NGS-associated findings, the 2018 expedition documented even more sites within the Valley of 10,000 Smokes linking this location to an era of scientific exploration that the NGS had spurred at Katmai (Stelson & Walton 2019). The expedition team also found evidence of researchers attracted by Griggs. For instance, two members of the NGS expedition of 1919 that later went on to become prominent geologists, carved their initials on stone at the base of the Novarupta volcano (Hildreth & Fierstein 2012; Figure 7). Inspired by Grigg's original scientific work, Smithsonian Institute biologist Victor Cahalane established his own permanent vegetation monitoring plots around the valley in 1954 and the rebar stakes delineating their corners can still be seen today (Cahalane 1959). Taken in isolation, each of

Figure 4 – The site of a National Geographic Society base camp used in 1917 and 1919. Findings such as the base of a scientific flask stand and crushed gaslight in the foreground provide clues to its antiquity and research-oriented purpose. Each pink flag marks an artifact. Photo by Laura Stelson.

Figure 5 – A historic USGS geologic research station known as "the Baked Mountain Huts" used as a hard-sided shelter by backpackers traveling through the Valley of 10,000 Smokes. Public use of the huts is currently discouraged due to their deteriorating state. Photo by Will Rice.

these features might appear to look like old garbage, graffiti, or dilapidated shacks, but together they are part of a long scientific legacy—the continuation of which can be seen in the occasional encounter of seismographs now maintained by the Alaska Volcano Observatory.

Many visitors who choose to stay in the Valley of 10,000 Smokes overnight wind up having a very personal encounter with this scientific legacy by taking shelter in the now historic-age USGS research station known as the Baked Mountain huts—situated in the core of Katmai Wilderness (Figure 5). Constructed by USGS in 1965, and used by various geological projects for administrative purposes until 1982, these structures have served as a temporary shelter for those caught off guard by the valley's powerful windstorms (Hildreth & Fierstein 2012). To be sure, these strange, musty shacks have always stood out against the natural landscape as functional rather than beautiful—complaints about their "unkempt" appearance, have been on record since 1969 (Norris 1996). Nevertheless, protection through their usefulness as the only form of shelter within a twelve-mile radius kept them standing for 52 years, and they might now even be considered an essential part of the Valley of 10,000 Smokes experience. In spite of their historic nature, the future of the Baked Mountain Huts (and the possibility of finding a hard-walled shelter beside the Katmai Pass trail) became significantly less certain after a storm caused two of the structures to collapse. As the most tangible and functional remnants of Katmai's history of scientific exploration, their fate now rests in the managerial interpretation of the NPS wilderness and cultural resources management legislation outlined above.

Implications for Management

Katmai staff have the unique challenge of managing designated wilderness under ANILCA policies, while also balancing the preservation of abundant cultural resources under the NHPA. In its intent to preserve traditional Alaskan subsistence strategies, ANILCA protects the practices of travel by motorized vehicles and the construction of hard-sided structures in Alaska's designated wilderness areas. These stipulations present park managers in Alaska with additional challenges in defining wilderness character and assessing visitor impacts to sites in this region.

Evaluating the potential for damage to these relatively ephemeral cultural resources has become increasingly urgent as growing demand for adventure tourism drives ever more backpackers to remote and undeveloped locations such as Katmai's wilderness (Huddart & Stott 2020). In 2019, visitor numbers at Katmai more than doubled from what was typical some five years earlier (NPS Visitor Use Statistics 2015-2019). The lack of guidance and amenities for visitors seeking to navigate the network of historic and informal tails throughout the Valley of 10,000 Smokes increases the vulnerability of the natural and cultural resources of this wilderness to accidental damage by visitors seeking to access 'off-trail' locations. To effectively combat such threats, an approach of mixed direct (i.e. physical barrier) and indirect (i.e. informative) methods for managing visitor impacts to cultural resources is recommended. Realization of this area's significant history and cultural resources opens new possibilities for developing such a comprehensive strategy. Connecting with Katmai's history of scientific exploration and tales of epic adventure by being guided along this known route may well enhance the adventure experience for long-distance trail hikers, while simultaneously discouraging them from unintentionally disturbing other vulnerable resources. In this particular case, the justification for maintaining a hard-sided shelter that is specifically afforded by ANILCA may be used to justify the rehabilitation of a historic amenity affording access to Katmai's backcountry wilderness for many visitors.

A trail as rich in history as Katmai Pass might have much more to offer the informed hiker than the scenic beauty of wilderness alone.

With regard to the cultural resources explored during this study's expedition, many of the artifacts directly aligned spatially, with the Katmai Pass Route. In spite of its millennia long history, large sections of the Katmai Pass Route that might provide visitors with this historic experience (if officially established as a historic long-distance trail) have fallen into virtual disuse. Some experts contend that "undeveloped" backcountry sites may be particularly effective in helping people to reflect on the past and construct their own views of history (Lipe 2009). If so, a trail as rich in history as Katmai Pass might have much more to offer the informed hiker than the scenic beauty of wilderness alone. At present, the chance of visitors encountering more than one of the historic sites along the route

without prior knowledge of their existence is fairly low and the advance knowledge that would place these encounters in their historic context is difficult to come by—as the only known maps and related descriptions are found in now-rare editions of 100-year old books and magazines. However, in an age where technology allows for real-time connectivity and knowledge sharing, amidst the ever-increasing demands for more recreational opportunities, this area has the potential to be a hotspot for visitor use. Research suggests that long-distance hikers are continually seeking new challenges, varying in levels of remoteness, social connectedness, and cultural significance (Lum et al. 2019; Sheldon 2019; Yuh & Peden 2018), and the Katmai Pass Route would certainly offer a unique long-distance hiking challenge and experience. If funding and associated staffing and maintenance were to be improved, (which is the opposite of current park trends where permanent positions have been phased out, and frequent government shutdowns have complicated consistent seasonal hiring), the revival of this trail and its legendary history yields much potential for providing visitors to Southwest Alaska with a meaningful connection to both the people and the Wilderness of these lands.

Whether the new knowledge and significance of these unusual remnants of historic scientific activity will spark a greater visitor appreciation of and access to these resources, remains to be seen. While access to Katmai remains fairly difficult compared to other large wilderness areas in Alaska (e.g., Denali; Wrangell-St. Elias), the potential for increased use, and associated risks to the wilderness and cultural resources is always of concern. Given the discoveries of this examination, the growing popularity of long-distance hiking, the relative easy travel on much of the Katmai Pass Route (i.e., approximately 40 miles of flat, accessible terrain), and the ever-increasing effect of social media on visitor use trends (Donahue et al. 2018; Miller et al. 2019), these numbers could increase. Finally, we would be remiss not to acknowledge the potential unintended consequences associated with this National Geographic-sponsored expedition. For example, the expedition's findings could induce increased visitation, and therefore associated need for more direct and indirect management along the Katmai Pass Route, and Katmai as a whole. Continued monitoring and future research are merited, to document the media presence and dissemination of the expedition's findings, and potential correlations with use increases as well as resource conditions. In a landscape defined by rapid change, these possibilities are difficult to discount. ijw

LAURA STELSON is an archaeologist and Ph.D. candidate at the Pennsylvania State University, Department of Anthropology and Human Dimensions of Natural Resources and the Environment Program; email: lfs20@psu.edu

WILLIAM L. RICE is an assistant professor at University of Montana, Parks, Tourism and Recreation Management Program; email: will.rice@mso.umt.edu

DERRICK TAFF is an assistant professor at the Pennsylvania State University, Department of Recreation, Park and Tourism Management; email: bdt3@psu.edu

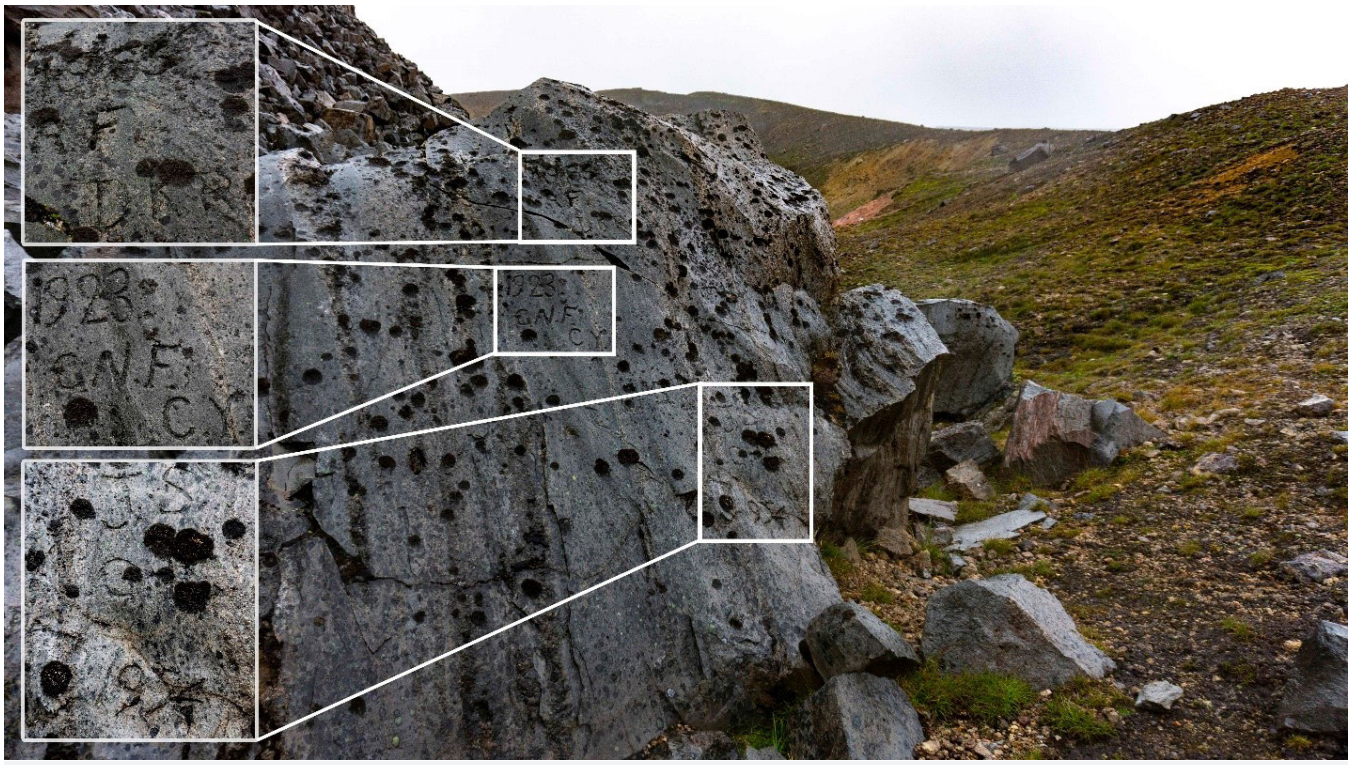

Figure 6 – Carved graffiti found on the south side of the Novarupta volcano lava plug. The initials and dates (1923/1953/1954/1955) indicate that these carvings were made by research teams from Carnegie Institute and the Katmai Project Photo by Laura Stelson.

Figure 7 – Backpackers descend into the Valley of 10,000 Smokes from Baked Mountain. Photo by Mark Melham.

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View of the Great Gulf Wilderness, New Hampshire with Mt. Washington in the background.

Smarter Long-Distance Hike: How Smartphones Shape Information Use and Spatial Decisions on the Appalachian Trail

by ANDREW G. ROGERS and YU-FAI LEUNG

PEER REVIEWED

ABSTRACT

Smartphones create new opportunities and challenges for managers and recreationists by facilitating novel communications. Through semi-structured, in-depth interviews with 20 Appalachian Trail (AT) long-distance hikers, we explored hikers' use of information sources, including smartphone-based sources, and spatial decisions. While GPS seemed to be a reassurance tool, user-generated content appeared to play a greater role in decisions related to camping, points of interest, and water sources. Results provide insights on AT long-distance hikers' experiences and perceptions about smartphones. Findings may also aid mangers and researchers in evaluating the appropriateness of smartphones in protected areas.

Andrew G. Rogers

Yu-Fai Leung

Participation in overnight backpacking has been steadily growing in the United States (Outdoor Foundation 2018), and national scenic trails have seen recent surges in popularity. Since the Appalachian Trail's (AT) completion in the 1930s, nearly 20,000 people have reported hiking at least 2,000 miles (or 3,219 km) of it, but nearly 14,000 of these hikes have been reported since the year 2000 (Appalachian Trail Conservancy [ATC] 2019a). While some of these 2,000-milers are section hikers (i.e., they hiked the whole trail in sections over multiple

Figure 1 – Long-distance and day hikers overlooking the Blood Mountain Wilderness, Appalachian Trail, Georgia, USA.

years), a majority are thru-hikers (i.e., they hiked the entire trail in one year). This growth in long-distance hiking has prompted Fondren and Brinkman (2019) to suggest that "long-distance hiking has captured the zeitgeist or cultural climate of the time" (Figure 1).

As recreation on national scenic trails increases, impacts on environmental and social conditions require more attention. Recreational use causes biophysical impacts, which can have substantial consequences on ecological integrity and the visitor experience in natural areas and wilderness (Hammit, Cole, & Monz 2015; Manning, Ballinger, Marion, & Roggenbuck 1996). Long-distance hiking is no exception, especially when one considers the amount of time spent in wilderness and protected areas over the course of a long hike. Long-distance hikers may camp 100 or more times on the AT in a single journey. Even when practicing low-impact techniques, camping can be a very impactful activity (Cole & Monz 2004). Different strategies can aid managers in concentrating or dispersing impacts associated with camping (Marion, Arredondo, Wimpey, & Meadema 2018), but their success typically hinges on recreationists following management guidance and locating appropriate campsites.

Managing the areas through which these trails pass involves balancing social and environmental objectives (Daniels & Marion 2006). Land management is complicated on long-distance trails, which often traverse multiple distinct protected areas while also connecting towns or developed rural areas. In the case of the AT, the route traverses 24 wilderness areas in addition to numerous other federal, state, and local protected areas (National Park Service [NPS] 2014). Management of the trail corridor is shared among the various land owners and managers, the ATC, and a fed-

eration of 31 volunteer-led trail maintenance organizations (NPS 2014). Managers are faced with the classic conundrum of providing recreational opportunities for today's visitors while also protecting the natural resources for generations to come, and emerging technologies change the management landscape.

More than two decades ago our colleagues wondered, "Will we be able to feel assured that the next person coming down the trail won't have a cell phone stashed away in their pack and be able to contact the outside world if an emergency arises? Will people still elect not to bring their cell phones along?" (Freimund & Borrie 1997). The reality is that handheld information and communication technologies are almost ubiquitous now. Emerging technologies create new opportunities but also new challenges for managers of protected areas, especially wilderness (Martin 2017; Valenzuela 2020).

While GPS has been available through certain devices (e.g., personal locator beacons, recreation-grade GPS units) for decades, the system is now easily accessed through smartphones, which are owned by a majority of U.S. adults (Vogels 2019). Smartphones also grant users access to the internet through an increasingly robust mobile network, and mobile applications (apps) allow smartphone users to focus their devices on specific tasks or activities. Websites and apps often create space for user-generated content (UGC), such as through comment sections, reviews, or media uploads; it is content generated by users instead of publishers or site managers. UGC "disrupts" established communication channels and is "fast becoming the most important and widely used source of travel information" (Salem & Twining-Ward 2018, p. 3). While the use of information has long been considered an appropriate management strategy in the outdoor recreation and protected area management contexts (Roggenbuck & Watson 1985), UGC may undermine traditional approaches to applying this strategy. There are also smartphone-based information sources that are not interactive, such as PDF documents. These are static information sources, like paper books or maps, in that they are not GPS-enabled and they do not facilitate UGC. However, when mobile service is available, they may be updated more readily than paper sources.

The ubiquity of smartphones also extends to long-distance trail corridors. Recent work on the Pacific Crest Trail showed that 97% of long-distance hikers carried smartphones and used them daily (Amerson, Rose, Lepp, & Dustin 2020), and this work has fueled important discourse surrounding the "cognitive costs" of smartphones in wild places (Dustin, Amerson, Rose, & Lepp 2019). Martin (2017) provided a comprehensive overview of the influences of information technology on outdoor recreation and wilderness experiences and management, noting several potential benefits and issues associated with technology. More recently, Valenzuela (2020) argued for researchers to embrace and leverage technology to achieve management objectives. Smartphones and other technologies (e.g., virtual reality and social media platforms) are either already ingrained in society or on the verge of integration such that a paradigm shift among managers is necessary to achieve manage-

ment goals, and this is especially true for managers of wilderness or natural areas that emphasize primitive experiences (Valenzuela 2020). An understanding of recreationists' use of smartphones and associated tools can aid managers in responding to them or even leveraging them to achieve management objectives.

Long-distance hiking may represent a valuable activity to explore recreational smartphone use since long-distance hikers rely heavily on external information sources to guide their journeys along the way. Also, when one considers the surge in long-distance hikers and the number of nights spent on trail, the increase in recreational impacts could be significant. This study explored long-distance hikers' use of information sources with attention to smartphone-based information. One focus was on avenues of communication: how do hikers receive information and from who? The other focus was on what the authors have termed spatial decisions, such as selecting a campsite or deciding where to stop for water, as they have immediate and tangible ramifications for the natural resources. Long-distance trail managers who stay abreast of emerging trends and understand hikers' use of information sources will have a better understanding of the causes and distribution of recreation impacts, which strengthens their ability to promote low-impact behaviors and sustain the natural resources for future generations. Understanding long-distance hikers' smartphone use and spatial decisions may also inform future research on long-distance trails, recreational smartphone use, or spatial decisions.

Methods

On-site semi-structured interviews were employed to generate data related to decision-making and the use of information sources by long-distance hikers. This method was chosen for its ability to focus on pre-determined topics while avoiding a fixed set of responses (Given 2008). Open-ended questions and probing questions allow researchers to explore phenomena with participants and uncover new insights. The first author acted as a participant-researcher to facilitate interviews in a "natural" setting (Lincoln & Guba 1985). Conducting interviews on-site as a participant-researcher allowed for quick rapport between the researcher and the other participants, minimized issues of recall, and allowed the phenomena to be discussed in their context.

The semi-structured interview protocol followed an extensive review of literature and was developed to capture hiker characteristics and demographics (e.g., how many miles have you come so far, how experienced would you describe yourself as a backpacker before this hike), information use (e.g., what information sources are you using, how do you use each source, how does GPS impact your hiking experience), and spatial decisions while on trail (e.g., how do you decide where to camp, how do you decide where to stop for water). The interviews were conducted with hikers encountered on the AT in New Hampshire, USA in the last week of July and the first week of August 2019, which allowed for interaction with northbound and southbound thru-hikers as well as with section hikers.

Out of the twenty-three hikers contacted and informed of the project, one individual rejected

the offer to participate citing a lack of desire to participate, and two individuals rejected due to time constraints. In total, seventeen interviews were conducted with twenty long-distance hikers participating. Interviews ranged from 26 to 121 minutes, averaging 57 minutes. Interviews were digitally recorded and transcribed verbatim on a smartphone. Transcripts were analyzed and coded following Tracy's (2013) guidance on iterative analysis while keeping in mind the goal of understanding long-distance hiker avenues of communication and spatial decision-making on long-distance trails. Primary- and second-cycle coding led to the identification and description of salient themes, which are summarized and represented through key invivo quotes. Trustworthiness of themes was checked through a process like Birt et al.'s (2016) synthesized member-checking process. A list of preliminary themes was sent to thirteen participants who provided email addresses, and nine responded with comments. Most feedback was affirmative, but some wording was adjusted according to member-check input to reflect the range of responses more accurately.

Results

Description of the Participants

Participants ranged in age from 22 to 56 years old. Participants had been on-trail between 28 and 150 days and had hiked between 295 to 1,880 miles (475 to 3,025 km) at the time of the interview. Hikers traveling northbound (n=14) and southbound (n=6) were interviewed. While most were attempting thru-hikes (n=17), three participants were undertaking section hikes. Four of the thru-hikers were flip-flopping the trail, a practice where the entire trail is hiked in non-consecutive segments within one year.

One participant was on the final leg of a three-year section hike of the AT, one participant had never backpacked overnight before this journey, and the

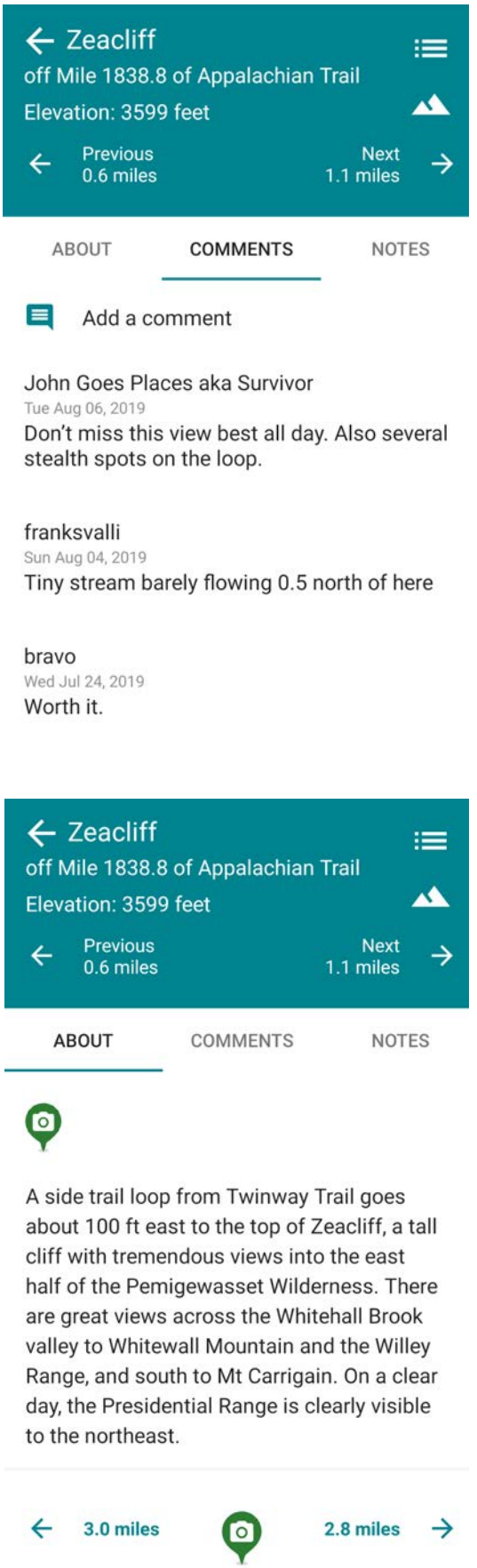

Figure 2a/b – Examples of the Guthook app interface.

rest had backpacked between two and ten days. Two participants had formal experience leading backpacking trips but considered themselves inexperienced before this trip. As one explained, "I knew like textbook the way you're supposed to do things. But that's a lot different when you're on a thru-hike." When asked to describe their level of experience at the time of the interview, participants offered a range of responses from expert to novice. However, the majority indicated they were experienced but still learning.

Avenues of Communication

All participants carried a smartphone with them, and all used at least one of three AT-specific guides: The A.T. Guide (better known as "AWOL's guide," theatguide.com), Guthook's Guide to the A.T. (an offline smartphone application known as "Guthook," https://atlasguides.com/appalachian-trail/), and the Appalachian Trail Thru-Hikers Companion (the "official guide" according to the ATC, https://aldha.org/companion)(Figure 2a-b). A PDF version of AWOL's guide was used by six participants. As mentioned earlier, although PDFs are smartphone-based, they are static sources of information in that they are not GPS-enabled and they do not facilitate user-generated content. While thirteen participants used Guthook, twelve of them also had a supplementary static source of information. Only one participant used Guthook alone. All participants used their phones for taking photos (Figure 3).

Figure 3 – Thru-hiker taking photo with smartphone from Zeacliff Overlook, Pemigewasset Wilderness, Appalachian Trail, New Hampshire, USA.

GPS

Many participants valued their smartphones' ability to verify their location and help them stay on trail. The majority of GPS use was through the Guthook application, but hikers also used Google maps and other apps to check their location.

> *"Guthooks is also, like kind of gratifying. Like you can… hit your location and see how close you are like exactly on-trail." (7)*

But many hikers also mentioned reservations about GPS effect on the experience.

> *"Sometimes it makes it just seem like you're trying to get something over with." (6)*

Of the seven hikers who carried only static sources, four reported accessing GPS through other means.

> *"There is an application called iHealth, and you can see how many miles you hike during the day." (8)*

> *"I use Google quite a bit, Google Maps all the time, to try and-- sometimes I'm like, 'am I on the trail?' Haven't seen any blazes in a while. Sometimes I'll be able to pull it up, and like it has little green dashes" (12)*

Only three participants, each of whom carried paper guides, did not use GPS for navigating on the trail, although one of them did carry a personal locator beacon.

User-Generated Content

Mobile application users had overwhelmingly positive statements regarding the user-generated content, which they referred to as "comments."

> *"Guthooks is nice. You can find like little secret gems along the trail… because of a random Guthook comment that somebody finds" (2)*

> *"Seeing some people's comments lets you know that you should really make the trip off-trail to go see this vista or campsite or whatever it is. I think that the comments enhance my experience by sharing other people's experiences and letting me know if it's something worthwhile or something that I want to skip." (3)*

Although participants pointed out that the comments were not entirely reliable, the solution seemed to be more comments.

> *"You can't take just one comment, because those are just people like you or I just commenting, sometimes in a bad mood. I try to read a few of the comments and get the gist." (9)*

> *"The more they're completely crowdsourcing everything, and the more people that use it, eventually, you get a critical mass and the cream would rise to the top." (13)*

Hikers who did not download Guthook still reported benefitting from the comments.

"Although we don't have Guthook, we definitely have the advantage of information from Guthook through other hikers. That's been nice on occasion." (17)

Communication with Managers

The ATC encourages thru-hikers to register their hikes "so they can plan their itinerary in order to avoid the social and ecological impacts of overcrowding" (ATC 2019b). Fifteen participants (all but two of the thru-hikers) registered, citing desires to help the ATC, to be recognized and documented, or to receive a hang tag (a commemorative tag with Leave No Trace information designed to hang on a pack).

"I thought it was the proper thing to do. And also it could help keep track of people coming in and out. And also I would like to have my name on the database so that you know that I hiked the AT! " (1)

"I just thought it'd be fun to register. Get a tag. That was maybe the main thing. I wanted a tag." (19)

However, these motivations did not resonate to the same extent with section hikers or the thru-hikers who did not start at one of the ATC's Visitor Centers.

"Since I'm only out here for like a month, just doing two states, pretty much, I was like, 'Ah, it's not a big deal. They don't need to know I'm out here.' And it'd be weird having the badge and people would ask me about it, and I'd be like, 'Oh well I'm just section hiking.'" (10)

Many of those who registered were set on a particular date, but some thru-hikers decided to shift their start date after visiting the ATC website. They also benefitted from the education provided at the visitor center at the southern terminus.

"I did look on the site... I was going to start on [a particular day but] it was super full. I backed it up a day and went [the day before]." (19)

"They give you some tips, and they show you how to hang your bear bag as well, and they ask you to be really careful with your trash and with your food." (8)

Spatial Decisions

Acknowledging that trails intend to concentrate recreation impacts to a narrow linear corridor, the semi-structured interview protocol sought to elucidate participants' decisions to step off the trail and the role that their information sources play in those decisions. Camping, visiting points of interest, and stopping for water appeared to be strongly influenced by information sources while the other spatial decisions examined (where to break and where to dispose of human waste) were less clearly linked to trail guide information, user-generated or otherwise.

Camping

Although campsite distribution strategies have been described in the literature (Marion, Arredondo, Wimpey, & Meadema 2018), participants tended to simply view campsites as either

Figure 4 – Heavily trampled unofficial camping area where the AT crosses Mink Brook, White Mountain National Forest, New Hampshire, USA. A mobile app had an entry for the stream, and many user-generated comments mentioned camping (e.g., "Great place for lunch or camping" and "Tent island, fit 7 tents on the island by the fire ring. Great spot").

"official" or "stealth." Official sites are those published in guidebooks. Stealth sites are not formally mentioned in guidebooks, although they may be noted by other hikers via mobile app comment feature (Figure 4). Guthook comments were valuable for some hikers to locate "stealth" sites that aligned with their preferred distance for the day. However, participants who used only static sources still knew where to look for existing stealth sites.

> *"A lot of the Guthook-- it's mostly official campsites. But with comments, a lot of hikers can tell you where to go, how far, and then give you more information about it." (1)*

> *"I'll only look for a stealth site if there isn't a campsite or a shelter within the miles, plus or minus a couple of miles of what I plan on doing. Then I'll start clicking on other icons in the Guthook's app where I do want to stay and see if anyone is mentioning a stealth site." (13)*

> *"It's a good guess, when there's a stream or whatever, there's usually a stealth site somewhere close by within 0.2." (20)*

Only one participant reported true dispersed campsite selection.

> *"When… it's really late, and I haven't found a spot, sometimes I just start wandering in the woods to find a spot. Cause you're like, 'Something's gonna be flat somewhere around here.'… I don't think anyone will ever find some of those spots that I do." (12)*

Points of Interest

Participants wanted to enrich their hikes by exploring points of interest, but they were also conscientious of doing "sideways miles." Word of mouth, Guthook comments, and distance often determined if a hiker chose to go to a point of interest or not (Figure 5).

> *"It's usually about word of mouth that I'm like 'I'm going to go through a blue blaze.' Not much else takes me off." (2)*

> *"Is it worth going up there? Well, the last comment was that the trees have grown up. 'You can't see anything.' Well, I'm not going there. Thanks to Guthooks, I was able to learn not to waste an hour going half a mile out of the way." (9)*

> *"Something that's not too far off the path-- a lake or a pond that I might go swimming in or an exceptional view that everyone is raving about… Unless it's one of those two things, I'm not really getting off the trail. I try not to do too many sideways miles." (13)*

Water

Some participants closely managed water stops based on the quality and reliability of sources, while others simply tried to carry as little as possible. Comments provided enough information that Guthook users could be very selective except in the driest times. Hikers who carried only static information sources used word of mouth to learn about unreliable sources, but sometimes they ended up with suboptimal water.

> *"There was a really bad water source that we had a couple days ago, and we were just like 'Nah, like let's push on to get a little bit better water,'… I don't really prefer to dig it out of a bog." (5)*

> *"I try to stop where there is a good spring, but sometimes, yeah you don't really have the choice, so yeah. Many times I had to stop and like use some frog water." (8)*

Figure 5 – Some points of interest, like the summit of Mount Lafayette in White Mountain National Forest and adjacent to the Pemigewasset Wilderness, New Hampshire, USA, are more popular than others.

"We'll try and look for something three to five miles from where we're at… And then using Guthook's too just to figure out what are good water sources. If it's like three miles out and it says 'This water's shitty,' and there's another one five miles out, we'll go to the five mile one." (15)

"I ask other hikers a lot. Like now especially with water sources, especially as it gets later into the season, like the sources AWOL is listing as unreliable, asking other hikers 'Hey, did you see water here?" (18)

Discussion and Implications

This inquiry further substantiates a phenomenon recently documented by Amerson et al. (2020)—smartphones are part of the long-distance hiking world. In this small sample, all hikers carried smartphones, but they engaged with them to different degrees. The mobile app essentially adds GPS and user-generated content to the same base information as the static guides. For hikers with access to GPS, the primary use was simply to confirm one's location. While increasing use of GPS in backcountry or protected natural areas certainly warrants investigation into potential experiential and biophysical impacts (Martin & Blackwell 2016), it appears that GPS did not guide spatial decision-making for the participants in this research. As GPS has become more accessible and mobile networks become more robust, future research should explore the impacts of this connectedness on the wilderness experience.

On the other hand, user-generated content does appear to influence spatial decision-making, at least for some decisions. Even those hikers who made a point to "disconnect" reported that they received crowd-sourced information via word of mouth. User-generated content allowed hikers to plan around stealth sites with certainty and told hikers which points of interest and springs to visit and which to hike past. While water sources are critical to survival on the trail, the motivations that underpin visiting points of interest are less clear. While these stops could be entirely hedonistic, a better understanding of what motivates hikers to stop or venture off-trail could be valuable information for managers seeking to steer use or for researchers seeking to understand leisure behavior. Future research should also account for the reality that accessing technology can be convoluted. Participants who initially indicated that they do not use GPS, following probing questions, revealed that they did access GPS but through less apparent means, such as a smart watch or health app. Similarly, participants without Guthook revealed through discussion that they still received information from Guthook comments via word of mouth. Thus, research instruments that attempt to capture technology use among recreationists must consider alternative means of using technology or accessing information and communication networks.

Given that resource impacts are inextricably linked to recreationists' physical presence, an information source that determines the spatial distribution of hikers must, to some extent, determine the spatial distribution of impacts (Cole 2009). This is true for any trail guide, but the UGC of mobile apps sets them apart from more traditional guides. The lack of land manager input, the ease of contributing content, and the complacence with which some users post increases the likelihood that sensitive or problematic information could be shared. For example, a well-inten-

tioned comment may indicate the existence of a campsite that managers have attempted to inconspicuously close. While the speed with which UGC is shared has some benefits for recreationists (e.g., up-to-date information on water sources), it could also be problematic. For example, app users who share the location of trail magic (well-intentioned offerings of food or other displays of care for hikers) could contribute to crowding at those locations. Thus, managers should be aware of the influence of UGC on protected area visitors and respond where necessary. For example, managers should check "stealth" sites indicated by UGC for proximity to sensitive resources and potential for expansion. When better sites exist nearby, managers could close the site and request that the comments be removed, and the appropriate site indicated in the app. In longer stretches of trail without sustainable campsite options, UGC could aid managers in identifying where new campsites should be located to minimize unconfined camping and concentrate resource impacts (Marion et al. 2018). Researchers could use content analysis of comments or leverage geographic information systems to better understand the establishment of stealth sites or to inform where managers should designate new sites or close redundant ones.

If managers intend to guide long-distance hikers toward preferred behaviors, they must work proactively with app developers and users. Based on conversations about registering their hikes, participants in this research appeared willing to follow the guidance of trail managers to minimize their impacts, such as hanging their food to protect wildlife or shifting their start dates to minimize crowding. The ATC's web-based registration system paired with education sessions at the southern terminus helped many hikers make "good" decisions. More interventions acknowledging the prevalence of user-generated content should be developed as the scene continues to unfold, and researchers should evaluate the efficacy of these interventions and connect their findings to similar research (e.g., Hockett, Marion, & Leung 2017; Marion & Reid 2007) to aid in a greater collective understanding of recreation behavior and low impact ethics.

If managers intend to foster specific behaviors, norm activation (Heberlein 2012; Schwartz 1977) may offer valuable guidance. Since AT hikers "are relatively well-informed about a variety of minimum impact skills" (Newman, Manning, Bacon, Graefe, & Gerard 2003, p. 37), and since thru-hiker culture prioritizes pro-environmental behaviors (at least in face value) (Redpath 2016; Siudzinksi 2007), activating this norm to promote recently developed minimum impact practices could yield positive behavior change, as it has with distributing thru-hike starts at the southern terminus. Researchers should continue to evaluate the effectiveness of impact-reducing communications as information and communication technologies further permeate the outdoor recreation realm. Technology-related recommendations should be actively associated with other low-impact practices education and communication efforts, which have begun to reflect the prevalence of mobile devices (e.g., wear headphones to listen to music (Leave No Trace Center for Outdoor Ethics 2020)). Similar guidelines could be developed to

guide long-distance hikers' use of information in the digital age. Hikers could be encouraged to use only "official" campsites. App users could be discouraged from posting new camping locations. Manager validation or approval of sustainable campsites could be added to apps to clarify for hikers which sites are appropriate for use. Marion et al. (2018) suggested that GPS could be used to help connect recreationists to appropriate sites, but UGC in GPS-enabled apps helped participants in this research to find and plan their days around inappropriate "stealth" sites. Given the potential impacts associated with camping, future research should help to clarify the "official" versus "stealth" site dichotomy that was prevalent among the participants in this research and increase the likelihood that recreationists choose appropriate sites for overnight use.

While not reported here, each participant in this research discussed the appropriateness of technology on the trail in depth. Some embraced technology fully while others tried to minimize its intrusion into their hikes, but many fell in the middle. They relied on their phones and viewed them as valuable tools, but they also echoed the sentiments articulated by Dustin et al. (2019) that information and communication technologies detract from the trail experience. Despite these concerns, participants found smartphones too convenient and too practical to leave at home. For the participants who were on the two ends of the spectrum, neither group appears likely to be swayed, but both respect the other group's point of view. All the participants shared many key characteristics. They chose to take long walks in nature. They respect other hikers' autonomy, and they want the freedom to choose their own style of adventure. Mirroring Dustin, Beck, and Rose's (2018) charge, managers and planners must find the underlying wilderness values of various user groups and develop palatable policies on the common ground.

While it is a matter of opinion whether these types of technology are inherently incompatible with the wilderness experience, it is clear that connectivity is increasing, and recreationists (including long-distance hikers) are using information and communication technologies to inform their pursuits.

The shift that is occurring boils down to this: previously, people had to actively choose to bring information and communication technologies on the trail. They were clunky, unreliable, and often inconvenient. Now, paper guidebooks are beginning to be considered clunky, unreliable, and often inconvenient. Hikers must now be proactive if they want to avoid information and communication technologies on the trail. While it is a matter of opinion whether these types of technology are inherently incompatible with the wilderness experience, it is clear that connectivity is increasing, and recreationists (including long-distance hikers) are using information and communication

technologies to inform their pursuits. Managers and researchers must evaluate the experiential and biophysical impacts of these emerging technologies. While a recent research agenda-setting document asserts that information and communication technologies are here to stay (Valenzuela 2020), wilderness managers are still charged with providing "outstanding opportunities for solitude or a primitive and unconfined type of recreation" (Wilderness Act, 1964). It is our hope that a better understanding of recreationists' use of smartphones can help managers and researchers as wildland recreation moves into the digital age.

Limitations

This research is based on data generated by a participant-researcher and a small sample of Appalachian Trail long-distance hikers in a natural setting. While the participant-researcher carried a variety of information sources (maps, a paper databook, smartphone-based guide), the use of the smartphone to record the interviews may have influenced the participants' perceptions of the researcher's views and their responses. Although the interview protocol attempted to use neutral language and the semi-structured nature of the interview attempts to allow a broad range of responses, the questions asked still limit the range of possible responses to some extent. While member-checking helps to increase trustworthiness, coding and synthesizing of data were interpretive processes performed exclusively by the first author. Interpretation of the results was shared by the two authors, but other peers (both long-distance hikers and researchers unassociated with this project) aided in the development of these ideas.

While the results reported here reflect the experiences of these participants, more extensive sampling is needed to generalize beyond this group. Continuing this line of research with more hikers, with different levels of experience and at different portions of the AT or on other trails, would likely yield new findings and a better understanding of smartphone use in the outdoor recreation realm.

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ANDREW ROGERS recently received his M.S. in Parks, Recreation and Tourism Management from the College of Natural Resources at North Carolina State University. Andrew's research interests fall in the realms of visitor use management and recreation ecology, and they are inspired by his personal endeavors and interactions with recreationists; email: arogers@ncsu.edu

DR. YU-FAI LEUNG is a professor in the Department of Parks, Recreation and Tourism Management, College of Natural Resources at North Carolina State University (USA). Yu-Fai's research aims to advance the science and practice of sustainable visitor management in parks, protected and wilderness areas globally; email: leung@ncsu.edu

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Transmantiqueira, a thousand-kilometer-Long Distance Trail in southeastern Brazil. Photo by Hugo Castro.

The evolution of long-distance trails in Brazil and future perspectives

by ANDRÉ A. CUNHA, HUGO DE CASTRO PEREIRA , BENARDO ISSA DE SOUZA, JULIO MEYER, and PEDRO CUNHA E MENEZES

André A. Cunha

Hugo de Castro Pereora

Bernardo Issa de Souza

Julio Cesar Meyer Jr.

Pedro da Cunha E. Menezes

Brazil's long-distance trails (LDT) are the descendants of historical routes of travel for indigenous peoples that date back thousands of years. There is evidence of trails that connected the southeastern coast of Brazil to Peru, central Chile, and southern Colombia, totaling nearly 30,000 km. Along the Brazilian coast, indigenous peoples occupied wide regions with millions of inhabitants, who moved along the coast by means of extensive trails, which have now transformed into highways (Dean 1995). Many of these historic trails are being recovered for tourism and recreation through the accelerated expansion of the LDT movement in Brazil.

Brazil's LDT movement started in the 1990s, seventy years later than the United States' proposal of the Appalachian Trail. The first long-distance trail, Transcarioca Trail of Rio de Janeiro, has been expanding with the involvement of trail enthusiasts and protected area managers. LDTs are a form of integration and a tool for the conservation of natural areas (Yahner et al. 1995; Dufour and Crisfield 2008), as well as an excellent opportunity for recreation and promoting place attachment and economic development, particularly in the most remote areas (Pollock et al 2012).

Nature tourism has been growing rapidly in Brazil, especially in national and state parks. In the last decade, some parks have doubled or tripled the number of visitors, but visitation

Figure 1 – Aparados da Serra National Park, where one of the most classic "traverses" in Brazil, the Travessia dos Canyons exist since the 1980s. Photo by Fernando Tatagiba.

is still concentrated in a few areas. In addition, to encouraging visitation, Brazilian LDTs have motivated stewardship and collaboration among hiking groups, protected area managers, tour operators, tourist secretaries from the municipalities, NGOs, and universities to collectively implement and manage the trails in the different regions of the country. Largely, LDTs are a bottom-up movement and now are established in the sphere of public policies at the federal level.

The involvement of various sectors at the local and regional levels through the process of planning, design, and implementation have stimulated place-based connections to the trails and protected areas. Additionally, small towns experiencing economic stagnation and high rates of rural exodus have benefited from LDT visitation, stimulating small businesses in accommodation, transportation, and food services. Thus, local residents and protected area managers tend to cultivate a sense of pride and belonging towards the LDTs and long-term support for conserva-

Figure 2a – Semi-desert beaches in south section

Figure 2b – Central section of the Transcarioca Trail, in the Pedra Branca State Park, municipality of Rio de Janeiro, Brazil. Photos by Pedro da Cunha e Menezes.

tion and nature. This paper presents an overview of the history and the current network of LDTs in Brazil, as well as the network of protected areas and sites of historical and cultural heritage in which they are nested. In addition, the national system and standardization of LDTs is discussed along with perspectives for the future management and development of Brazilian LDTs.

Evolution of Brazilian Long-Distance Trails

The traverses or "travessias," equivalent to local or regional LDTs, have existed for decades within Brazil's national parks (Figure 1). The 1990s jumpstarted the current movement of regional and national LDTs through the birth of the Transcarioca Trail. The network of trails in the city of Rio de Janeiro began to grow (Cunha e Menezes 1996; 1998), connecting semi-deserted beaches to the west of the city to internationally known tourist spots such as Pão de Açúcar and Corcovado (Figure 2). Despite the lack of resources, the head of Tijuca National Park and several partners from different sectors of society implemented the first 45 km of the trail with an intense effort (Cunha e Menezes 2000).

Between 2000 and 2010, without social mobilization and government support, the movement was relatively dormant. In the early 2010s, trail activity resumed with the support of large NGOs, governments, protected area managers and thousands of volunteers that resulted in the expansion of another 100km of the Transcarioca Trail. In the last decade, LDTs movement has grown exponentially in Brazil (Figure 1).

Many protected areas managers realized the potential of increased visitation with the valuation of protected areas and nature conservation that can extend to LDTs. Partnerships with the tourism sector and with hiking groups has also increased throughout Brazil with LDTs as the catalyst.

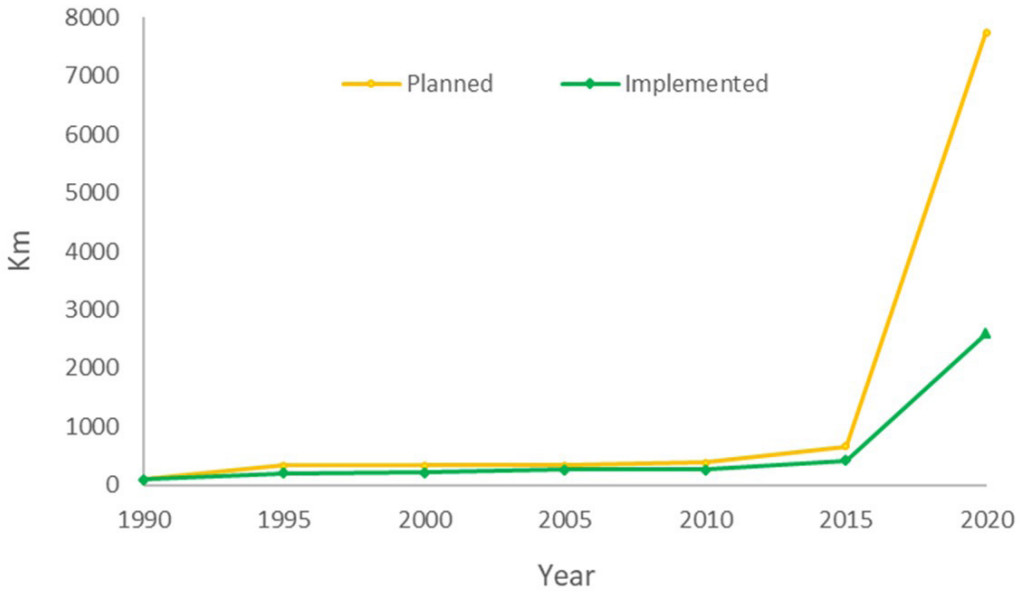

Figure 3 – Evolution of Long-Distance Trails in Brazil. Few local LDTs, called "travessias" or traverses, existed in some National Parks until the second half of the 20th century. In 2010 and mainly after 2015, the movement to create LDTs grew at an accelerated rate, despite the fact that implementation is growing at a slower pace than planning new trails.

There is currently a network that encompasses about 50 regional LDTs, totaling almost 8,000 km of planned trails and more than 2500 km of trail implemented in the different regions and biomes of the country (Figure 3).

Local, Regional and National LDTs

Brazilian LDTs are designed to be nested across three complementary scales (local, regional, national). The different scales of LDTs are based on l length: (1) national LDTs cover a thousand kilometers or more; (2) regional LDTS range from a dozen to hundreds of kilometers; and (3) local LDTs cover tens of kilometers. Many of these first traverses, or local LDTs, are being connected to regional LDTs and together form the national LDTs. These three scales serve short, medium, and long visitation. Local LDTs accommodate multi-day visits, regional LDTs accommodate multi-week visits, and national LDTs accommodate multi-month or a few successive visits.

Some regional LDTs have emerged and are highly visited, such as the Cora Coralina Trail, in Central Brazil. This trail is an old "bandeirantes" (group of pioneers and explores) path, from the 18th century. Established in 2015, the trail encompasses 300km connecting three state parks, bridging natural and cultural heritage in the experience. Brazilian LDTs have diversified in terms of landscapes, biomes and contexts. Currently, there are even aquatic LDTs, such as the Rota dos Pioneiros, which has been used historically by Indians, Spaniards, Jesuits, Bandeirantes and

Figure 4a&b – Visitors in the Ilha Grande National Park, at the Aquatic LDT Rota dos Pioneiros, in central and southern region of Brazil. Photos by Erick Xavier.

migrants over the centuries. This aquatic trail accessed by canoe or kayak, transcends more than 400 km through three biomes, of which about 100km are already signposted (Figure 4).

The implementation of the LDTs has been carried out by groups of volunteers, who start with an existing trail in a protected area or recovering part of a historic trail. The process often begins with small local trails connected to other protected areas through other parts of the landscape. The scoping phase includes field excursions, intense mapping, and dialogue with private landowners, managers, and the tourist trade. Eventually, the fragments of trails start to form a connected LDT. Although there has been a lot of progress in recent years, there remains a lot of work to build a functioning national LDT network in Brazil.

Standardized Signage and Regional Identity

The recent expansion of the Brazilian LDTs network in the last five years, and the collective work of diverse partners and social networks, has advanced the standardization of the symbols and signage of Brazilian LDTs. The publication of the Trail Signaling Manual (ICMBio 2018a), provided guidelines and best practices for signage. The visual symbol is a yellow footprint on a black background. Each regional LDT designs its own "footprint", according to the regional identity of each trail, valuing some aspect of local, cultural or natural heritage. Many regional footprints highlight charismatic, endemic or endangered species, other cultural attributes, activi-

Figure 4a&b – Visitors in the Ilha Grande National Park, at the Aquatic LDT Rota dos Pioneiros, in central and southern region of Brazil. Photos by Erick Xavier.

ties, or the landscape (Figure 5). The intense voluntary work in the early stages of planning the trail and the definition of the footprint design contributed to the cohesion and sense of belonging for the groups involved in LDTs. This simple and unique symbol has created a sense of group cohesion between the participants and helped to establish a brand of LDT trails in Brazil, that is easily recognizable worldwide.

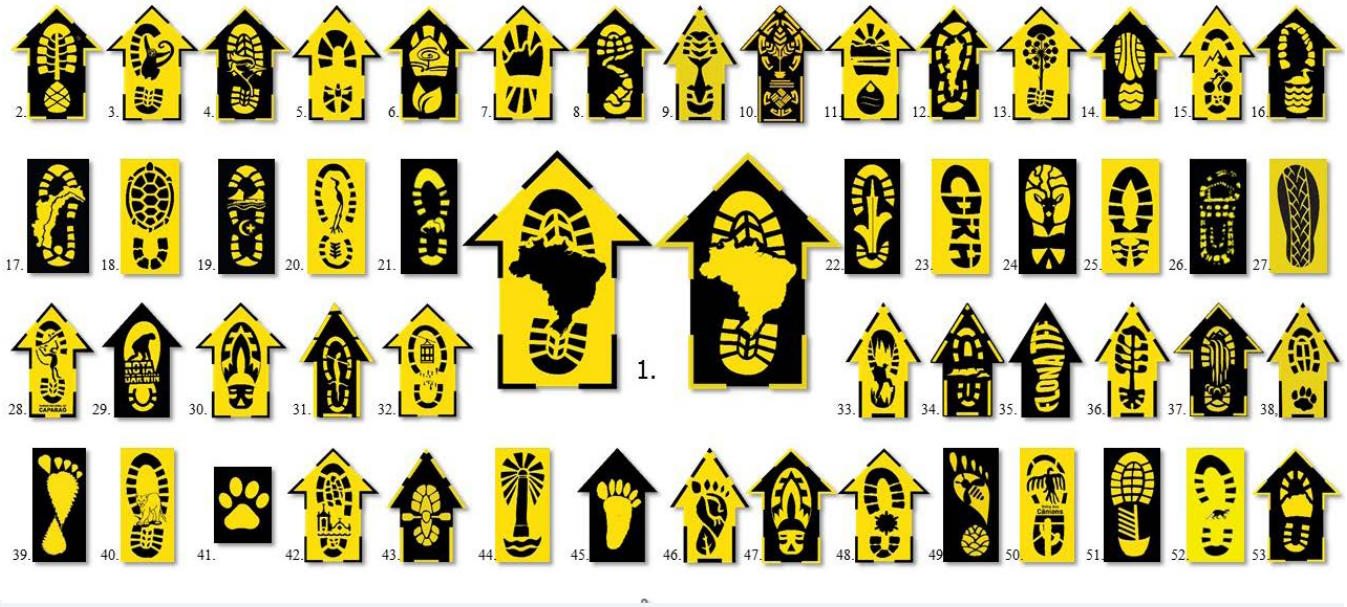

Figure 5 – Standardized signaling from the Brazilian Long Distance Trail Network (LDTs), all LDTs follow the same signaling pattern, although each regional LDTs has its own identity: 1.Rede Brasileira de Trilhas de Longo Curso; 2. Trilha Transmantiqueira; 3. Roteiro de Observação de Primatas; 4. Trilha da Gralha Azul; 5. Trilha Transcarioca; 6. Trilha da Cachoeira Formosa; 7. Caminhos da Serra do Mar; 8. Caminhos de Mambucaba; 9. Caminhos da Baleia Franca; 10. Rota do Guarumã; 11. Trilhas da APA da Baia Negra; 12. Trilha Transfloripa; 13. Trilha Transespinhaço; 14. Rota das 10 Cachoeiras; 15. Travessia dos Estados; 16. Trilha Ovo do Pato; 17. Trilha Velho Chico; 18. Caminhos do Rio Negro; 19. Trilha dos Canoeiros; 20. Trilha do Arco do André; 21. Rota do Rio Areias; 22. Caminhos do Planalto Central; 23. Caminhos de Cora Coralina; 24. Caminho dos Veadeiros; 25. Trilha das UCs do NGI ICMBio Palmas; 26. Caminho Saint Hilaire; 27. Giro dos Povoados; 28. Trilha do Muriqui; 29. Rota Darwin; 30. Caminho dos Canoeiros (Veadeiros); 31. Trilha do Parque Nacional de Sete Cidades; 32. Trilhas do Parque Nacional de Ubajara; 33. TransDiabo; 34. Trilha do Platô do Monte Roraima; 35. Trilhas da Flona Tefé; 36. Caminho das Araucárias; 37. Trilhas Cachoeiras de Macacu; 38. Trilha Interparques; 39. Caminhos da Flona de Brasília; 40. Trilha Grande Sertão; 41. Corredeiras do Uruá; 42. Caminhos da Costa Verde; 43. Trilhas da Ilha Grande e Lagoa Xambre; 44. Rota dos Faróis; 45. Trilha das cachoeiras do PESA; 46. Caminho do Vale das Águas; 47. Rota das Transições; 48. Trilha Pedra dos Amigos; 49. Rota da ARIE das Abelhas; 50. Trilha dos Cânions; 51. Trilha Chico Mendes; 52. Trilhas do Parque Estadual do Ibitipoca; 53. Travessia do Tabuleiro

Brazilian Government and National System

The federal agency for protected areas, the Chico Mendes Institute for Biodiversity Conservation (ICMBio), has been pressured in the past couple of years to implement LDTs in federal protected areas as an important tool for conservation, integration, and generating economic benefits. Thus, the federal government began to structure a National System of LDTs with consideration of other international LDTs to minimize challenges and replicate the successes that can be adapted to the Brazilian context (Souza 2018).

An integrated effort was made between the Ministry of Tourism, Ministry of the Environment, and ICMBio through a Joint Federal Ordinance No. 407 in 2018, which instituted the "National Network of Long-Distance and Connectivity Trails – RedeTrilhas." This network helps to establish and support LDTs through public policy and aims to:

- *promote long-distance trails as an instrument for biodiversity conservation and landscape connectivity;*
- *recognize and protect pedestrian routes and other non-motorized means of travel of natural, historical and cultural interest;*
- *sensitize society about the importance of connecting natural landscapes and ecosystems,*
- *promoting active participation in the implementation of the National System of Protected Areas;*
- *valuing voluntary work in establishing long-distance trails;*
- *expand and diversify the tourist offer, in order to stimulate tourism in natural areas.*

The Ordinance supports the establishment of a governance body for each LDT to be composed of government and civil society entities, taking advantage of existing governance structures such as Biosphere Reserves, Mosaics of Protected Areas, Heritage Sites, Ecological Corridors, Tourist Regions of the Tourism Regionalization Program.

A new guideline, Regulatory Ordinance of RedeTrilhas (MMA 2019), will define the criteria for integrating the trails, the governance model, and the signaling model, among other regulatory measures. The LDTs in Brazil were born from a bottom-up movement; therefore, it is understood that the government's role is to encourage the involvement of civil society and avoid restrictions that could impede initiatives. Therefore, more robust legislation must be established, with defined roles of the entities involved in LDTs and the parameters for the development and implementation of a National System of LDTs.

Linking Landscapes, Biodiversity and Culture

Brazilian LDTs are being designed to integrate historical, cultural, and natural values in their routes. Naturally, the strengths of the trails are the scenic and wild landscapes often within Protected Areas (ICMBio 2018b). Thus, seeking to leverage LDTs as tools for landscape conservation, the LDT route must link the core areas (i.e. protected areas) and serve as an ecological corridor, connecting landscapes across territories.

Since the 1990s, the ecological corridors strategy has been implemented in Brazil with the objective of forming large connected landscapes, including several categories of protected areas and broader landscapes outside protected areas that support nature conservation and flow of biota over vast areas (Ayres et al. 2005; Anderson and Jenkins 2007). However, there has been limited advancement due to the low adherence from different societal sectors. The growth of nature-based tourism worldwide, and particularly in Brazil, offers a strategy for LDTs to combine visitation to promote sustainability and conservation along vast corridors.

Protected areas play a major role in LDTs as they are attractions for recreation and tourism in addition to housing rich and endemic biodiversity. The Brazilian LDT network includes several types of protected areas (Table 1). Parks are the most frequent category with a large contribution from state parks, followed by national and municipal parks. According with IUCN protected

Protected Areas Categories	Federal	State	Municipal	Private
Strictly PAs				
Biological Reserve			1	
Ecological Station	1	2		
National/State/ Municipal Parks	21	36	15	
Natural Monument	1	6	6	
Wildlife Refuge	1	1	1	
Sustainable Use				
Environmental Protected Area	10	22	17	
Area of Ecological Relevance	1	1		
National/ State Forests	5	1		
Extractive Reserve	2			
Sustainable Use Reserve		3	1	
Private Reserves				24
PAs Total	**42**	**72**	**41**	**24**
UNESCO Natural Heritage Site	4			
UNESCO Cultural Heritage Site	7			
UNESCO Natural & Cultural Heritage Site	1			

Table 1 – Protected Ares and UNESCO World Heritage Sites along the Brazilian Long Distance Trails.

Phase 1	Articulation and awareness of actors: bringing together actors interested in collaborate, managers and owners
Phase 2	Mapping and exploration in situ: map existing trails, sensitive areas, access roads and existing infrastructure in the surroundings
Phase 3	Planning and Design: layout, type and class of the trail; types of use and management needs, support points; overnight sites; necessary infrastructure; land properties; scenic beauties; protected areas and communities along the route
Phase 4	Implementation: cleaning old sections; (re) opening of new sections; trail construction and equipment (bridges, slope, erosion control, paving)
Phase 5	Signage: standardization and installation on access roads; trail heads, signs for orientation, interpretation, regulation
Phase 6	Marketing: involvement of the tourist trade and other users
Phase 7	Financing: private sector, governments, tourism, PAs and environment funds
Phase 8	Monitoring of trail conditions, users, services, positive and negative impacts
Phase 9	Trail maintenance: minimizing biophysical impacts, camping sites, infrastructure
Phase 10	Promotion of services and products: means of accommodation, trash and waste management, transport, food, diversification of local trails and activities, gastronomy, stimulating the creative economy and local populations business

Table 2 – Ten phases for implementing LDTs.

areas categories for strict protection, Natural Monuments are also prevalent (Table 1). In the IUCN categories for sustainable use in protected areas, the Environmental Protection Areas (APA) are most frequently found in addition to National and State Forests, Extractive Reserves and Sustainable Development Reserves.

Some LDTs transcend other areas with great cultural and historical populations, such as the Indigenous Lands and Quilombola (Marron) Territories; however, their intersection with LDTs has not yet been mapped. Private Natural Heritage Reserves (RPPNs) contribute to Brazilian LDTs and it is important to highlight that LDTs pass through several other rural properties. Although these areas are not declared as RPPNs, their owners often support the promotion of nature tourism and conservation practices of natural or rural landscapes. It should be noted that the number of protected areas is likely greater than what is displayed in Table 1 considering that the identification of the trail paths and compilation of data is still in progress.

In addition to protected areas, LDTs encompass places of global importance, such as sites recognized as a World Heritage Site by UNESCO. LDTs pass through historical cities, such as Ouro Preto, or modern cities, such as Brasília or Rio de Janeiro. Some LDTs cross country borders and others integrate culture with biodiversity as in Chapada dos Veadeiros in the Brazilian Savanah or Paraty and Ilha Grande, in the Atlantic Forest. Using LDTs as tools for enhancing the natural and cultural values of protected areas and beyond can help support the conservation and celebration of Brazil's cultural and natural wealth.

Brazilian LDTs are still in their infancy, but with collaborative efforts across scales, they are expanding rapidly. This movement has brought together partners from different sectors of society, volunteers, managers and staff from protected areas, associations of different recreationists, tourism entrepreneurs, local, regional and federal governments around a common goal to establish and grow a network of LDTs in Brazil

Management Considerations

Brazilian LDTs are still in their infancy, but with collaborative efforts across scales, they are expanding rapidly. This movement has brought together partners from different sectors of society, volunteers, managers and staff from protected areas, associations of different recreationists, tourism entrepreneurs, local, regional and federal governments around a common goal to establish and grow a network of LDTs in Brazil. Based on US Forest Service (2007) guidelines and our experience, we identify ten different phases for LDT development (Table 2). Development and growth in these different phases represent many of the pressing management challenges for LDT development.

Given the recent movement for expanding LDTs, stakeholders are motivated to plan and define routes. Together with the proliferation of social media use, there is an accelerated rush to establish new LDTs. However, some challenges include financing, maintenance of trails, monitoring of users and impacts, and biophysical conditions of the trails. There is also limited infrastructure for support services such as accommodation, food, and transportation.

Most of these trails pass through remote locations, where the infrastructure to receive visitors is almost nonexistent. The parks have basic facilities for overnight accommodations, such as campgrounds for a limited number of people. However, it is difficult to find appropriate supply points, lodging options, food services, and transportation of hikers to different access points on the trails. Although small businesses are emerging, these communities are lacking resources and capacity. It is critical that governments, trade and tourism organizations, and educational institutions offer support and training for these services. Additionally, there are already reports of problems related to waste management and erosion of trails. Thus, monitoring for impacts needs to be integrated into LDT planning and management to mitigate negative impacts and allow for adaptive management actions.

Perspectives for Future Management of Brazilian LDTs

There are many challenges facing the development of LDTs in Brazil. Due to the transboundary nature of LDTs, it is necessary to strengthen collaboration between sectors of society and the different scales of government. Although it is a bottom-up movement, government support is essential to encourage permits and specific services for LDTs, such as access to areas, waste management, maintenance of trails and infrastructure, and also to facilitate the development of support services and small businesses. Entrepreneurs require stronger capacity to diversify opportunities and increase quality of their services and products. Local associations and user groups should support protected areas and other core areas and help facilitate dialogue among key stakeholders and mobilize more volunteers to support trail stewardship for the trail and resources. Researchers and managers should work together, and with visitors to monitor, understand, inform and engage the society and decision makers about the LDTs and their benefits (Dufour and Crisfield 2008).

Research on nature-based tourism in Brazil is very limited (Cunha et al. 2018) and almost nonexistent for LDTs. There is limited understanding of use for LDTs; therefore, basic research on user counts and demographics, trail use patterns, user motivations and perceptions are greatly needed. There is also a need for understanding volunteers and stewardship activities for LDTs in addition to the economic aspects of businesses and infrastructure for LDTs. There are many key questions to explore:

- *What is the supply and demand for different services and products?*
- *What are the bottlenecks and challenges for socio-productive inclusion?*
- *How do LDTs promote the connection and restoration of habitats for different species of fauna and flora?*
- *What are the social and environmental impacts of LDTs?*
- *How do LDTs influence changes in hikers' health, relationship with nature, attitudes of protected areas, etc.?*

While LDTs can be a powerful tool for the promotion of tourism and for nature conservation, LDTs are also an opportunity for research and training for managers, universities, and professionals from different sectors.

All these actors should pursue the valuation and support of the cultural, historical, and environmental attributes throughout the LDTs, thinking not only of increasing and diversifying the flow and types of visitors, but designing LDTs for transformative experiences and the conservation and celebration of biodiversity and the culture in the diverse Brazilian landscapes. The trail ahead for Brazil's LDTs is long and challenging, but also ripe with opportunity and enthusiasm.

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ANDRÉ A. CUNHA is a professor at University of Brasília, Dept of Ecology; Center for Tourism Studies; and Center for Advanced Studies of the Cerrado; email: cunha.andre@gmail.com

HUGO DE CASTRO PEREIRA is the president of the Brazilian Trails Network Association and General Coordinator of the Transmantiqueira Trail; email: hugodcp@gmail.com

BERNARDO ISSA DE SOUZA is environmental analyst in Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), the Brazilian institute for protected areas; email: bernardo.souza@icmbio.gov.br

JULIO CESAR MEYER JUNIOR is a member of the environmental organization in the state of Pará, Brazil and a member of the Board of Directors of the Brazilian Trail Network Association; email: juliocvet@gmail.com

PEDRO DA CUNHA E MENEZES is a career diplomat and a member of the board of directors of the Brazilian Trails Network Association; email: cunhaemenezes@gmail.com

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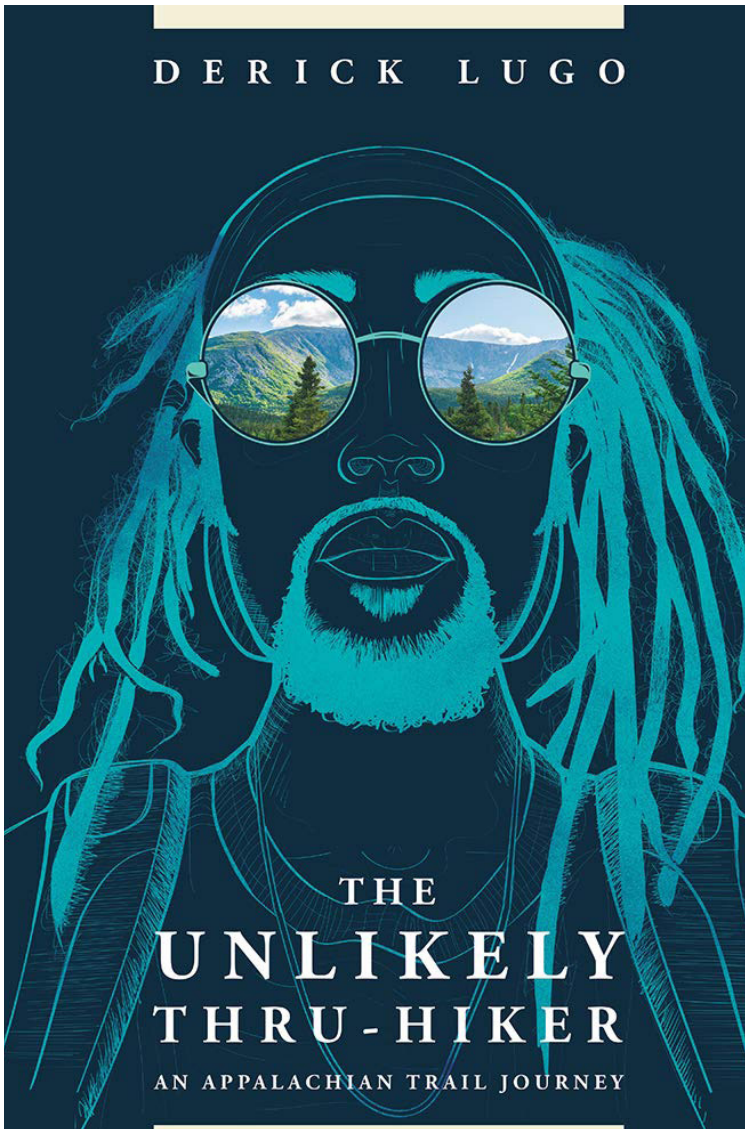
Mt. Baker of the Snoqualmie National Forest. **Photo credit** © Vincent Li

Book Review:

Elena Bigart

THE UNLIKELY THRU-HIKER: AN APPALACHIAN TRAIL JOURNEY.
Derick Lugo. 2019. Appalachian Mountain Club. 209 pp, $19.95



The Unlikely Thru-Hiker is the story of a young African American man from New York City, who despite knowing nothing about the outdoors or hiking, attempted to hike the entire Appalachian Trail (AT). Through Derick's unique and humorous perspective, his readers learn about thru-hiking the AT, the social interactions that happen along the way, coping with challenges and unpredictability, and appreciating the beauty and simplicity of nature.

Several books and documentaries have been written and produced about hiking the AT and other extended trails over the years. Lugo's book provides a unique and non-traditional perspective on hiking that raises questions of diversity and inclusion in outdoor recreation. Lugo is positioned as the "unlikely thru-hiker" as he is from a major urban epicenter, he had neither hiking experience nor spent much time outdoors, and his family and friends did not know anything about the AT prior to his journey. In fact, family and friends tried to talk him out of this adventure and questioned if he would be able to succeed. Additionally, Derick is African American, which is rare in the thru-hiking community. Even the book cover with a sketch of Derick's face and outline of his dreadlocks conveys his unique personality as he views the Appalachian landscape through his sunglasses. In many ways, he begins breaking down the stereotypes about thru-hiking through the title and cover of his book.

As Derick himself notices, "hiking in general is a predominantly white pastime" (p. 69). On his adventure, he discovers that he is "a rare sight out here" (p. 69), and with his subtle sense of humor admits that it makes him stand out from the crowd: "With no other black thru-hikers on the trail, I'm guessing that makes me a celebrity of sorts" (p. 183). But at the same time, he argues that although "diversity had not yet reached the AT", "the trail does seem ready, wide-opened, and with open arms" (p. 69). African Americans comprise only 1 to 1.2 percent of all visitors to public lands, and Hispanic/Latinos – between 3.8 and 6.7 percent, which means that both groups are underrepresented as visitors to public lands relative to their presence in the population at large (Askew and Walls 2019). These observations are thought-provoking and leave us pondering the current and future aspects of inclusion in outdoor recreation on thru-hiking trails, national parks, and other public lands.

Lugo attempts to share his experience with other "unlikely thru-hikers", including those who have never heard about the AT, and advocates for making outdoor recreation comfortable for people of all colors. For example, he shares: "If more individuals like me, the backcountry-challenged and the urbanites, were aware of this astonishing trail, then perhaps there would be more outdoorsy types of all colors – and fewer unlikely thru-hikers" (p. 71). However, the challenge still remains to increase the relevance and inclusion of public lands and outdoor recreation.

Regardless of his lack of knowledge and preparation about backpacking, Lugo's experience on the trail has been quite positive and encouraging. Any long-distance trail constitutes a social world that brings together long-distance hikers, day hikers, and individuals who provide support to them, often referred as "trail angels". Several times in his book, Lugo mentions that he felt loved on the trail, and that so many people were willing to teach him and offer help and support. He made a lot of friends on his six-month journey, and was often surprised by the generosity of strangers through "trail magic". Maybe it is Derick's own kindness, sense of humor and humility that opened the hearts of many people whom he encountered along the way.

Through Lugo's story, we witness a clear respect for the trail, acceptance of challenges ("The most

essential tool that I have is acceptance", p. 46), positive attitude ("With the trail so rough, I'll do anything to keep myself positive", p. 162), and the desire to soak it all in ("I want to experience everything that the A.T. has to offer, right?", p. 182). All this helped him to succeed in completing the epic hike and enjoying the journey. The AT can often get crowded, which may result in frustration and conflict for some people, but not for Derick. Perhaps, coming from one of the most populated cities in the United States, he had a different perception of crowding, and his interactions with other people actually provided comfort. In fact, Derick mentions in his book that he "prefers the company of fellow hikers" (p. 79), but at the same time he admits that "there is something about hiking alone that rejuvenates me […] I can be any hiker I please" (p. 80). His adaptability, humility and great social skills were part of his success.

The AT provided Derick with lessons for on and off the trail. He compares the process of thru-hiking to phases of human growth: "It starts with the innocence of childhood, then moves to the awkward and stubborn teen years, then to the know-it-all twenties before reaching out later years, when we can use the wisdom of our experience to guide us. These phases, which took years to travel through in life, I passed through in my few short months of this journey. This is life in a flash" (p. 203). This comparison leaves us pondering about how nature can help us understand ourselves and what is really important in life. Derick admits that he has "gained a closeness with Mother Nature" (p. 185), and that his "time on the AT has set a course for self-improvement" (p. 200). We see similar revelations about personal growth, finding true self, connection to nature and embracing wilderness in Strayed's "Wild" (2012) and Bryson's "A Walk in the Woods" (1998) – two other popular books about thru-hiking journeys undertaken by novice backpackers.

Indeed, being in nature, in wilderness, without technology and the pressure from the modern world, helps us discover something new about ourselves, provokes deep and long thoughts, and leaves behind the need to race against time. Lugo was able to share these feelings through his story, and his own transformation as a result of a thru-hike. With this epic personal change, the book might have benefited from an added epilogue on Derick's return to New York City, and his transition back to everyday life. It would have been intriguing to read more about Derick's feelings, adjustments, and the longer term impacts of his trail experience.

On his personal website, Derick Lugo says that "there is something special about wilderness that makes you feel alive". His book inspires diverse types of people to challenge themselves, do something that they have been afraid of doing, experience the majestic world of wilderness, and simply be kind to each other. We really need this advice in the troubling and uncertain times we live in, where things are changing rapidly, and the benefits of acceptance and respect seem to be more important than ever.

Reviewed by **ELENA BIGART**, instructor at the University of Montana, Parks, Tourism and Recreation Management Program; email: elena.bigart@umontana.edu

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