The Dual Mandate

Helping park rangers balance access with conservation in America's public lands.

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Executive Summary

The United States' National Park Service was formed around the basis of a dual mandate to promote preservation of natural environments, and to enable access, use, and enjoyment of these environments by people. However, this also presents the challenge of reconciling the contradiction of preservation and use. National, as well as sub-national, parks face the challenge of dealing with their ever-increasing popularity, while decreased resources exacerbate the situation. Visitors expect pristine, serene places isolated from the problems of modern, urbanized life. It is understandable that they become frustrated when they arrive at a park, only to wait in traffic and find that every campsite is full.

Park rangers are the face our park infrastructure. They enable the experiences people have in nature, and are directly responsible for sharing the importance of conservation-minded behaviors and appropriate use of the outdoors. However, rangers also bear the brunt of visitor frustrations when things don't go as expected, restricting their ability to fulfill broader objectives.

Our research has revealed the complexity of rangers' jobs; people's attitudes and behaviors regarding outdoor activities; and the nuances of the nature–technology and conservation–recreation dichotomies. We aim to use technology to help park rangers better fulfill their duties, thus enabling enjoyable outdoor experiences for everyone, and furthering the larger goal of balancing conservation with access. The following document outlines our research processes, the salient insights, and their implications for developing an appropriate design response.

Design Opportunities

Provide contextual and actionable information to rangers and trail users.

Enable knowledge-sharing opportunities for visitors to support conservation-minded behavior.

Improve collection and sharing of visitor-usage data between rangers and land managers.

Leverage storytelling to help rangers advocate for their work and connect with the public and policy makers.

Contents

Our nation's parks are being loved to death.

Visitors are unaware of their potential to cause harm.

Rangers embody and mediate our experience of parks.

CLOSED FOR RESTORATION

Do not walk or camp in this area.

Conservation
+
Access

Dual Mandate

CHAP. 408.—An Act To establish a National Park Service, and for other purposes.

Be it enacted by the Senate and House ofRepresentatives of the United States of America in Congress assembled, That there is hereby created in the Department of the Interior a service to be called the National Park Service, which shall be under the charge of a director, who shall be appointed by the Secretary and who shall receive a salary of $4,500 per annum. There shall also be appointed by the Secretary the following assistants and other employees at the salaries designated: One assistant director, at $2,500 per annum; one chief clerk, at $2,000 per annum; one draftsman, at $1,800 per annum; one messenger, at $600 per annum; and, in addition thereto, such other employees as the Secretary of the Interior shall deem necessary: Provided, That not more than $8,100 annually shall be expended for salaries of experts, assistants, and employees within the District of Columbia not herein specifically enumerated unless previously authorized by law. The service thus established shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations hereinafter specified by such means and measures as conform to the fundamental purpose of the said parks, monuments, and reservations, which purpose is to **conserve the scenery and the natural and historic objects and the wild life therein** and to provide for the enjoyment of the same in such manner and **by such means as will leave them unimpaired for the enjoyment of future generations.**

Sec. 2 That the director shall, under the direction of the Secretary of the Interior, have the supervision, management, and control of the several national parks and national monuments which are now under the jurisdiction of the Department of the Interior, and of the Hot Springs Reservation in the State of Arkansas, and of such other national parks and reservations of like character as may be hereafter created by Congress:

Research Questions

◆ What role do rangers play in contributing to the goal of balancing conservation with access to protected lands?

◆ How aware are visitors of their impact on the nation's protected lands?

◆ What are the attitudes and behaviors toward technology in the outdoors; how is technology actually used outdoors?

◆ What are visitors' expectations and aspirations for their outdoor experiences? How well are they met?

We aim to help park rangers better fulfill their duties of balancing conservation and access.

Insights

As park visitation increases, rangers' interactions with the public have become more and more transactional, which rangers resent.

"The entry kiosk feels like a fast food approach."

State Park Ranger

Many rangers' responsibilities involve interacting directly with the public. From collecting entry fees and making campsite reservations, to leading interpretive programs and even dealing with problematic users, rangers feel their work has lost the personal quality that drew them to the job in the first place. Increase in park use has introduced the perception that rangers must provide their services more efficiently. Some park managers even discourage rangers from spending more time with visitors and taking initiative to be proactive in their interactions with the public. Rangers enjoy developing genuine relationships with the public and helping people understand and enjoy the outdoors through one-on-one interactions.

People view visiting a national park through the same lens as any other vacation. However, parks are a government service, not a business that can meet market demands.

"Visitors get angry when they get here and the park is full. Rangers have been bribed, spat on, etc."

State Park Ranger

There are communication breakdowns between parks and visitors, resulting in unmeetable expectations and misconceptions about how to engage with the park. Division of services between government agencies and third party companies cause confusion for people trying to reserve campsites and acquire permits. Often, users are not aware of the different types of passes and permits when they are needed. When uninformed or misinformed visitors arrive at parks, little can be done to alleviate their frustration. As government agencies, national parks lack the resources and organizational flexibility to scale to meet the needs of higher usage rates, and of ever more demanding users.

Because frontcountry trails are seen as safe, and providing catered experiences, visitors are lax on their planning.

"I've had people cry before when they realized they had to pay per vehicle… lots of little things like that go wrong."

State Park Ranger

National parks hold a special status in the minds of users. These parks are seen as the source of uniquely valuable experiences that set them apart from other parks and environments. National parks themselves enable this perception through their infrastructure and media presence. The services and facilities now available at national parks—such as hotels and franchise restaurants—make them accessible and welcoming to a broad audience. However, this also lets people get by without properly planning their trip or preparing for being in the outdoors; "just show up" is a viable strategy. When people visit sub-national parks or venture into the wilderness, lack of preparation can put them in dire situations. The responsibility to resolve these issues ultimately falls to park rangers.

People will behave in accordance with their environmental values when they have the knowledge to do so.

"It's a lot of education of ignorant users—people want to do the right thing."

"The public isn't aware of the balance problem."

National Park Ranger

People participating in outdoor recreation are more likely to be environmentally conscious and strive to practice appropriate behaviors in the outdoors. However, many people are ignorant as to what the proper behaviors are, and to the consequences of misuse. As a result, rangers must perform a great deal of corrective education, often only after finding that a visitor has done something wrong. The rangers we have spoken with indicate that most people are receptive to being taught best practices for reducing their environmental impact, and that they generally follow low-impact behaviors once they are aware of how to do so.

Secondary Research

Literature Review

We conducted a literature review to build foundational knowledge of current approaches to human-computer interaction in outdoor contexts; the historical and contemporary framing of conservation and access; and the relationships between park rangers, park visitors, and the environment itself.

HCI + Outdoors

Does technology have a role in the outdoor space at all? It's not as simple as it looks. People's attitudes toward technology outdoors is explicitly negative, yet in the United States, an estimated 95% of hikers bring their cell phone with them while hiking [1]. Additionally, what constitutes "acceptable" technology in the outdoor space is a moving target. Cheverst, Bodker, & Daiber [2] show how technologies once considered "cheating" in the realm of outdoor activity (e.g. handheld GPS), can later be accepted through common practice. Various factors are at play in driving people's technology use and attitudes in the outdoor space such as unwritten rules of recreation sports, a prevailing Western philosophy of man's "mastery over nature", as well as practical considerations like expanding cell coverage and improved battery life on consumer goods.

While consumers hold complex emotions about the role of technology in the outdoors, the academic research surrounding the application of technology in the outdoor space is expanding. Nicholas and Sterman [3] show a variety of scenarios that acknowledge and transcend the artificial divisions we give between the "natural world" and "technology," such as an e-ink display trail marker that automatically updates a hiker's map when tapped against a trail sign. The authors posit a path forward that can, "leverage the benefits of both nature and technology in useful, engaging, appropriate, unique, respectful ways."

In the same vein, Anderson, Lusk, & Jones [1] argue that, when used appropriately, technology is able to enhance, engage, and enable people's outdoor experiences. We see these three opportunity spaces reflected in much of the technology being developed in the HCI and the outdoors research space. For example, Kiefer, Adams, & Raubal [4] show how technology, in the form of gaze-guided verbal narratives to explore the history of an area, allow for an increased engagement of the outdoor experience. Wearables that use vibrotactile feedback can enhance a rock climber's understanding of their own movements and their ability to climb outdoors [5]. A variety of hiking apps enable people to get outside and hike safely through the use of GPS, maps, and even pathfinding with drones [6][7].

Fenicio, Calvary, and Laurillau [8] put forth an additional classification of the role of HCI in the outdoors: technologies that serve a learning purpose (augmenting nature with information), and those that serve a guiding purpose (assisting explorers along the way).

National Park Data Collection

The National Parks System rely on visitor statistics to best allocate resources like staff and funds, as well as using data to plan, design, and manage park infrastructure. Traditionally, this data is collected through surveys deployed to park visitors. The surveys are concerned with the number of visitors to a park, what they do during their visit, how long they stay, and characteristics of a "typical" visitor [9]. The survey data is compiled into Visitor Use Statistics and this process takes a significant amount of staff time to deploy and analyze. There is a lack of consistency as to how visitors are counted across parks. Various methods are used to estimate total numbers, such as manual counts of people done by rangers, vehicle counts multiplied by a "persons-per-vehicle ratio," or automatic traffic counters coupled with regression formulas [10].

Over the past five years, there has been an uptick in works exploring the use of geolocation services and social media to enable tracking and understanding of park audiences and usage. Multiple groups of researchers have explored how to successfully use visitor-generated geographic information to provide real-time data on people's activities in parks, bypassing the expensive and time-intensive practice of monthly or annual surveys that park services currently use [11][12][13][14]. However, this research has yet to be implemented beyond academia.

National Park Visitation & Full-Time Employees

DATA COURTESY NATIONAL PARK CONSERVATION ASSOCIATION

■ PARK VISITORS   ■ FULL-TIME PARK EMPLOYEES
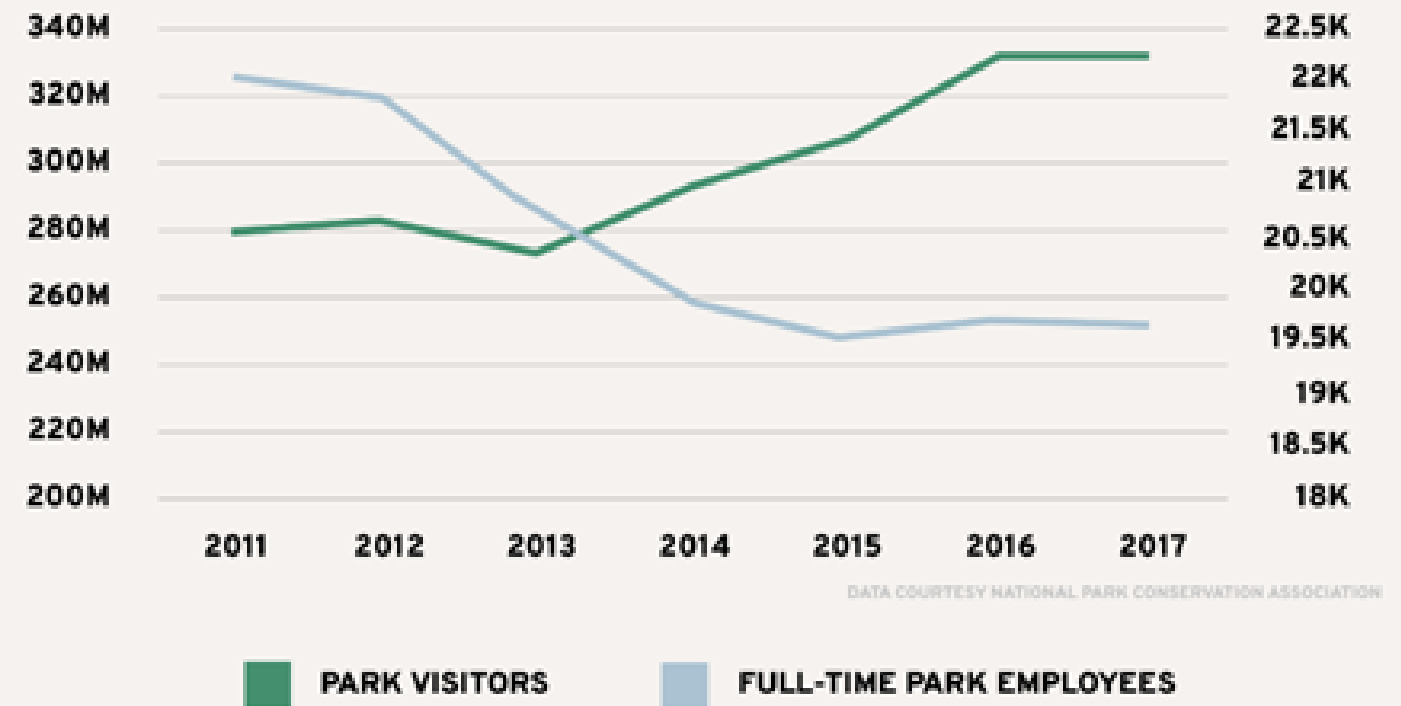
Conservation and Recreation

America's national parks were founded on the principles of preserving the environment while also enabling access and use: "which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." [15]. This "dual mandate" is a mission shared across the nation's parks and land management agencies, as well as by numerous recreation businesses and nonprofit organizations. The environmental movement has historically suggested a relationship between conservation and recreation. Aldo Leopold formalized the concept of a land ethic, by which humans have an obligation to care for the environment and the interconnected relationships between people, society, and nature [16].

However, the traditional means of adhering to these principles are showing their age as recreational use intensifies, and we are faced with unforeseen consequences [17][18]. The United States is seeing more and more people spend time outside. In 2017, 146 million Americans—nearly half of the population—participated in outdoor recreation, an increase of 1.7 million participants since 2016 [19][20]. While this growth has been a boon to the outdoor recreation industry, the same can not be said about the places where these activities take place [21]. From 2008 to 2018, National Parks saw a 16% increase in recreation visits, with a peak of over 330 million visitors in 2016 [22]. Few studies have examined the factors contributing to this increase in visitation, although anecdotally they may be tied to the price of gas and social media exposure [23][24].

All outdoor recreation implies a use of nature by humans, and this use results in environmental impacts and alterations. As more people participate in outdoor activities, the individual impacts they have on the environment become immediately apparent. Coupled with the effects of global climate change, the need for conservation becomes paramount [25]. Land managers contend with minimizing "adverse effects of the impact and influence of human use on the environment, while still allowing for recreational use" [26]. As crowds grow, land management agencies and park rangers must now address the consequences of overuse [27].

Two avenues for improving conservation present themselves: expansion and creation of new protected areas, and improved management of existing protected areas. Ideally both should be pursued, but in reality, funds are limited. Studies suggest we should prioritize management of existing lands over expansion [28][29].

Rangers and Parks

Park rangers are the face of a park—they are responsible for giving visitors enjoyable, meaningful, and memorable experiences [30][31][32]. The term ranger applies to people with a variety of job responsibilities, who work for one of the nation's land management agencies. The system of federal agencies include the Forest Service, Bureau of Land Management, National Park Service, Fish and Wildlife Service, Bureau of Indian Affairs, and Bureau of Reclamation [33]. At the state level, the system of organizations is similarly complex. Each land management agency, whether state or federal, has different structures and follows different procedures, and thus the spectrum of ranger job duties varies greatly across the country. There are numerous types of rangers, from park interpreters, law enforcement rangers, to firefighters. However, rangers must also take on additional responsibilities as situations demand, complicating their responsibilities [34].

Becoming a ranger is a difficult and time-consuming process. Navigating the requirements and understanding the necessary qualifications for a government job is notoriously complex within the ranger community, and there are several platforms dedicated to knowledge sharing and professional networking [35][36][37][38][39]. Even once the path is understood, aspiring rangers must work their way up from serving as volunteers or interns, to seasonal workers, before gaining adequate experience and personal connections to serve as full time rangers [40]. Because parks are often understaffed and underfunded, competition for these roles are very high. Rangers are invaluable to both parks and visitors, and the rigorous process they must go through implies they are passionate, hard-working people who are dedicated to promoting conservation and access to our lands.

"As a wilderness ranger you have a unique opportunity to help preserve our planetary environment and maintain healthy ecosystems. You will influence people to further this preservation effort by fulfilling management policies.

You are essential."

Skykomish Wilderness
Ranger Handbook

Encouraging Conservation

Outdoor recreationists play an integral role in helping achieve the balance of conservation and access. Following environmentally responsible behavior while outdoors minimizes the impact on the environment while enjoying access. Minimizing environmental impact creates better experiences for all visitors, while reducing the strain on park services to rectify issues caused from overcrowding or misuse. This accentuates the importance for park visitors to practice conservation-minded behaviors and to enjoy the outdoors responsibly.

Studies have shown that direct experiences with the outdoors are more effective at shaping people's pro-conservation behaviors than indirect experiences [41]. Direct experiences create first-hand learning opportunities in context, while indirect experiences provide education in a secondary manner, for example, through written literature. While learning from books or newspapers can create awareness and promote pro-conservation attitudes, doing so may not lead to actual behavioral change [42].

Having environmental knowledge and awareness is fundamental to pro-conservation behavior, but this knowledge is often difficult to build [43]. The non-immediacy of most environmental issues presents a cognitive barrier to understanding those issues [42]. Change to the environment is gradual and may not be tangibly felt for many years, by which point damage becomes irreversible [42]. This highlights the importance of presenting information in compelling ways to create an emotional connection with the audience and support knowledge building.

A significant gap also exists between conservation-related attitudes and behaviors while outdoors [43]. This gap describes that the way people behave may not actually be in accordance with their attitudes pertaining to conservation. A multitude of external factors play into this gap.

Kollmuss and Agyeman argue that simply obtaining more knowledge isn't wholly responsible for increased pro-conservation behavior. Factors such as economic incentives, affordances to act responsibly while outdoors, and perceived feedback all contribute to pro-conservation behavior. People generally exhibit more pro-conservation behaviors if it is convenient for them to do so, and positive feedback is received [43].

Ajzen and Fishbein also present a set of variables that can be attributed to the attitude and behavior gap. The most influential variable is the knowledge that people need to attain to have a solid understanding of the environmental problems. The second is understanding the pro-conservation behaviors people should follow in support of those environmental issues. Other highly influential factors that impact behaviors include their perception of their ability to bring about change in addition to how personally responsible they feel to the issue at hand. The model presented by Ajzen and Fishbein highlights the complexity of encouraging outdoor participants to act and behave in accordance to their attitudes [44].

Research presents the importance of direct experiences with the outdoors to promoting conservation-minded behavior. However, the sheer number and complexity of different factors that influence pro-conservation behaviors provide challenges. Chawla has suggested that creating emotional responses to environmental degradation is more likely to promote pro-conservation behavior change [45]. This leads to suggest that there are opportunities to encourage behavior change by creating emotional connections.

Competitive Analysis

We conducted a competitive analysis across three broad themes that all touched upon a different aspect of a ranger's job: ranger communication tools; reservations systems for parks to track overnight usage; and realtime crowd data collection. We evaluated these against the following criteria:

This is what we learned:

Value How much value does it add for the user?

Stability How much maintenance is required to keep the product in an operational state during its lifecycle?

Usability How easy is the product to use, and what is the initial learning curve like to become proficient?

Resilience How well is the product able to serve its purpose in evolving usage contexts?

- ◆ It's difficult to communicate the current status of a park to the outside world, creating frustrations for both rangers and park visitors.

- ◆ Rangers do not have full ownership of communication channels, but are responsible for resolving problems arising from communication breakdowns. Ultimately, rangers are responsible for park visitors' experiences.

- ◆ Rangers must interface with a lot of different stakeholders yet none of their tools account for this; communication is siloed.

- ◆ Data collection capabilities have yet to lead to meaningful improvements for parks or rangers. Current usage of the data collected are also not utilized in a way that is useful for visitors.

Reservation Systems

Astra Campground Manager

The most widely used campsite reservation software in America and also contracts with private campgrounds like KOA and RV parks.

Paper Tag System

Piece of paper that is then clipped onto a wooden post at one's campsite to track reservation dates and license plate numbers.

Real-Time Data Collection

Google Maps Live Usage

Provides usage trends of an area by the hour for each day of the week.

Eco-Counter

Provides turnkey systems for pedestrian and cyclist traffic counting.

Waze

A crowdsourced platform for gathering and sharing navigation, traffic, and road conditions.

Ranger Communication

Radios

Primary method of ranger communication across long distances.

Trimble Juno 3B

A handheld device used to identify and log campsite data and issues.

Primary
Research

Participants

We conducted two phases of interviews: one with outdoor recreationists; one with park rangers. Initial interviews with recreationists focused on their barriers to engagement with the outdoors, and the role of identity in their desire to participate. Several participants noted positive interactions with park rangers and the National Park Service. We felt this avenue warranted further research, so we reached out to rangers working in a variety of settings to better understand their work and expose opportunities for design responses.

We recruited participants with social media, personal networks, and snowballing. Participants were screened by an online survey. We intercepted rangers at the ranger station located within REI Co-op's Seattle store, Mount Rainier National Park, and Dash Point State Park.

5

Hikers and Campers

6

Park Rangers

3

Experts

Hikers and Campers

We began by researching users of the outdoors, specifically targeting people who participate in hiking and camping, as these activities have relatively low barriers to entry. We broke our participant population into two groups, frequent users and non-users.

Frequent Users

Frequent users are those who had hiked/camped ten times in the last two years. We were particularly interested in interviewing users who had picked up hiking or camping within the last five years as they could help us understand how they explicitly overcame barriers to participation. Interviewing frequent users would help us understand how people made the transition to these activities and overcame their barriers to participation.

Non-Users

Non-users are people who have not engaged in hiking or camping but aspire to become more involved. Interviewing non-users would help identify barriers that they perceive to prevent them from engaging in the activity. Talking to these two sub-groups helped uncover complex identity issues and cost-issues that were barriers to participation.

Park Rangers

Our second set of participants were United States park rangers. Park rangers were not part of our initial research plan but our interviews with hikers and campers identified them as a group of interest. Outdoor participants frequently mentioned their positive interactions with park rangers during their time spent outdoors. They spoke on their importance in enabling memorable outdoor experiences for visitors at national parks and state parks.

Secondary research and interviews also uncovered issues with funding that inhibits their ability to effectively do their jobs. We sought out park rangers to understand their goals, scope of work, job-related issues, and how they saw their work in relation to the outdoors and the public using it.

Ranger responsibilities are very diverse and highly dependent on the type of park and location. This stressed the importance of recruiting a diverse pool of rangers from state parks, national parks, and national forests from different regions across the United States.

Ranger Locations

Mount Baker-Snoqualmie National Forest
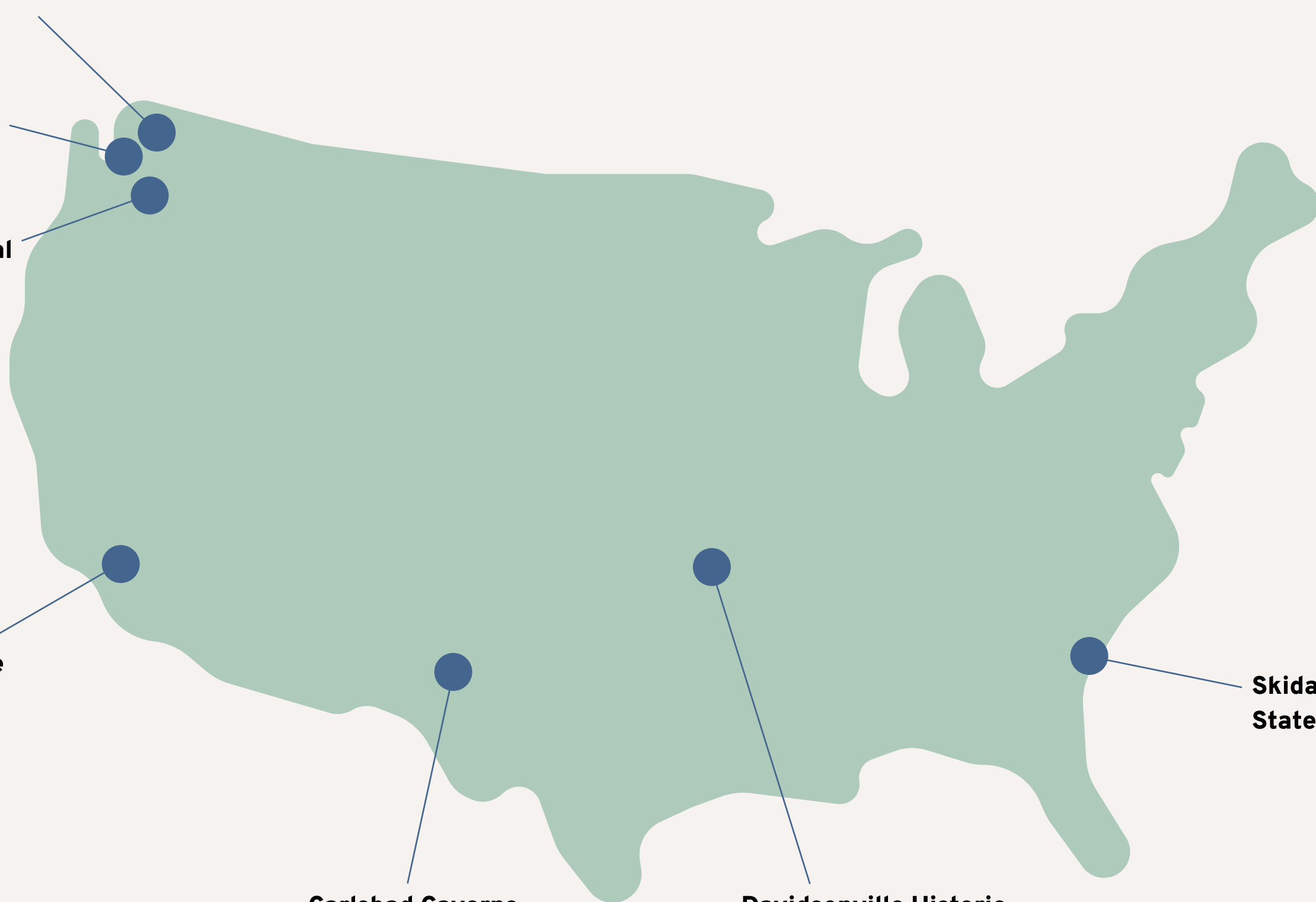
The Ranger Station at REI

Mount Rainier National Park

Silverwood Lake State Recreation Area

Carlsbad Caverns National Park

Davidsonville Historic State Park

Skidaway Island State Park

Expert Interviews

Experts were selected based on their domain knowledge and ability to fill remaining knowledge gaps after conducting primary and secondary research. In particular, we sought greater understanding of the current landscape of HCI in the outdoors, and of organizational challenges of outdoor education and outreach. We interviewed two leading academic experts whose work focuses on technology use in the outdoors, and a senior program manager at an outdoor recreation nonprofit organization.

Michael Jones

Associate Professor of Computer Science
Brigham Young University

Scott McCrickard

Associate Professor of Computer Science
Virginia Tech

Becca Polglase

Education Director
The Mountaineers

Michael Jones

Associate Professor of Computer Science
Brigham Young University

Michael Jones' research expertise lies at the cross section of HCI, ubiquitous computing, and the outdoors. He has researched hikers' technology preferences, ubiquitous computing in the mountains, and the role of HCI in the outdoor recreation space. We identified Jones as a resource we could lean on to glean insight on the current landscape of HCI in the outdoor space.

"Human-computer interaction should never win out over human-nature interaction."

Jones believes that successful use of technology in nature should be both seamlessly integrated and non-permanent. Human-computer interaction should never win out over human-nature interaction. His guiding philosophy when designing technology in this space was that technology's place is in a backpack (out of sight), and that interactions should be as simple as possible. In regards to conservation and technology, Jones found that people use technology to support their goals and values, and people who participate in outdoor recreation are generally conservation minded. However, sometimes they simply lack the knowledge of how to act to achieve those goals.

Scott McCrickard

Associate Professor of Computer Science
Virginia Tech

Scott McCrickard leads the Technology on the Trail initiative at Virginia Tech, a research project investigating people's relationship with technology in the outdoors. His work focuses on understanding and developing ways of using technology in context to enable better outdoor experiences. McCrickard also teaches two HCI and outdoors related courses at Virginia Tech which explore the challenges of designing technology for the outdoors. He has published research papers examining the varying needs of different groups of outdoor recreationists. We sought out McCrickard to understand how people currently use technology outdoors and to identify the challenges and opportunities in implementing it in this space.

"People quickly react with horror when talking about using tech in the outdoors, but their actions speak otherwise."

McCrickard identified the contrast between people's attitudes toward technology in the outdoors, and their actual use of technology. People view others' use of technology in the outdoors negatively, yet still use it themselves. He outlined three phases technology could support in the outdoors which were preparation, experience and reflection. McCrickard found that technology use on the trail enables the sharing of experience with others through photography and blogging. Technology should be enablers of better outdoor experiences and not disruptors. He noted scientists as drivers for technological innovation in the outdoor space. McCrickard also spoke on the integration of technology into citizen science as an example of a successful method of using technology in the outdoors harmoniously.

Becca Polglase

Education Director
The Mountaineers

Becca Polglase has 20 years of experience working in outdoor education, and has been with The Mountaineers since 2010. The Mountaineers is a Seattle-based nonprofit organization whose mission is to "enrich the community by helping people explore, conserve, learn about, and enjoy the lands and waters of the Pacific Northwest and beyond." Polglase is responsible for leading the development of both youth and adult education programs, as well as strategies to support the volunteers working in these programs. We found Polglase to be a great resource to understand the challenges education leaders face in teaching outdoor recreationists.

"Conservation causes will be lost unless we have outdoor recreation."

According to Polglase, the work done by The Mountaineers to promote outdoor recreation is necessary, because doing so leads to greater conservation awareness and investment. People will be more involved in conservation causes related to their own outdoor interests, because they can see tangible benefits for themselves. Polglase also highlighted the communication difficulties she faces when collaborating with government agencies such as the National Park Service. These challenges were mainly the byproduct of understaffing due to funding issues.

Methods

Methods

Our primary research method was semi-structured interviews with park rangers, hikers, and campers. We developed interview guides for each participant profile to guide our conversation. We also interweaved directed storytelling into each session. Sessions were 45 minutes and were conducted either over the phone, or in-person depending on the geographic location of the participant.

◆ Semi-structured Interviews

◆ Directed Storytelling

◆ Contextual Inquiry

Semi-Structured Interviews & Directed Storytelling

Sessions with Hikers & Campers

Sessions with recreationists centered around understanding current and past barriers to participation, how they overcame barriers, and their outdoor experiences. We sought to understand participant's motivations for going outdoors. We used directed storytelling as a method to elicit rich, personal and qualitative insights from people's experiences outdoors. This helped us gather insights on behaviors outdoors, technology use, and motivations.

Sessions with Park Rangers

Semi-structured interviews were conducted with park rangers for 30-minute sessions either on-site or over the phone. These interviews were focused on learning more about park ranger responsibilities, job difficulties, and technology use on the job.

Contextual Inquiry

We conducted a contextual inquiry with a park ranger in the Skykomish district as a way to gain insight into a ranger's day-to-day activities. The session included going on a routine hike with a ranger and a visit to a nearby ranger station. We utilized this method to help identify aspects of their work that weren't externalized over interviews. Questions were asked throughout the hike as we observed the ranger during the hike and at the station.

"People only care about the end-result, not the process to get there."

"It can take ten years for data to turn into action."

"This is my least favorite part of the job."
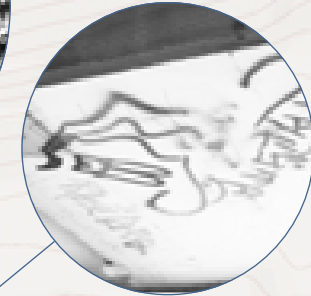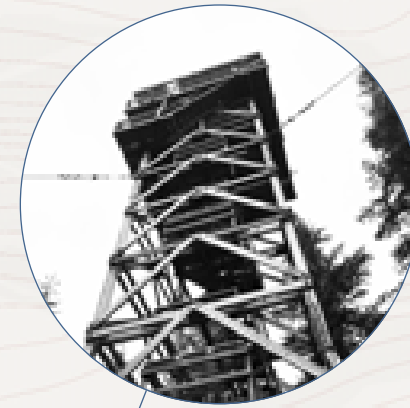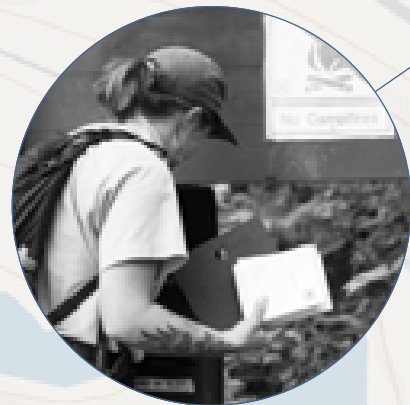
Design Opportunities

Provide contextual and actionable information to rangers and trail users.

The information available to trail users is insufficient when unexpected situations arise. Providing meaningful and actionable information in these moments can help trail users make better decisions, enabling better experiences in the outdoors.

Enable knowledge-sharing opportunities for visitors to support conservation-minded behavior.

When people practice conservation-minded behavior outdoors, conservation and access are more naturally balanced. People generally have the right intentions, but may lack the knowledge to act accordingly in the outdoors. Improving knowledge-sharing can enable visitors to act in support of their values.

Leverage storytelling to help rangers advocate for their work and connect with the public and policy makers.

Rangers' contributions to furthering the Dual Mandate rely on a multitude of external stakeholders. Stories allow rangers to successfully communicate the importance of their work, which is paramount to rallying their audience and winning support.

Improve collection and sharing of visitor-usage data between rangers and land managers.

Current data collection and sharing methods are inefficient and opaque. Improving dataflow can provide more actionable information for rangers, land managers, and the public.

Guiding Principles

Ease communication and knowledge sharing for rangers and the public.

Value human–nature interaction over human–technology interaction.

Design to maximize both conservation and access.

Support ranger agency to act on their first-hand knowledge.

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