

Former to Future:
Preservation in the U.S. National Parks
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ABSTRACT

For more than 100 years, the United States National Park Service (NPS) has been guided by a mandate to preserve parks and their resources for the enjoyment of present and future generations. But all parks are subject to conditions that may frustrate preservation efforts. Climate change is melting the glaciers. Rising seas are sweeping away protected shorelines. Development projects, accompanied by air, water, light, and noise pollution, edge closer to parks and fragment habitats. The number of visitors and vested interests are swelling and diversifying. Resources for preservation, such as funds and staff, seem to be continuously shrinking, at least relative to demand.

Still, the NPS remains committed to the preservation of our natural and cultural heritage. Yet the practice of that promise is evolving, slowly and iteratively, but detectably. Through explorations of legal and scholarly literature, as well as interviews across the government, non-profit, and academic sectors, I've tracked the evolution of preservation in parks. How is preservation shifting to address socio-ecological change? How has preservation evolved before? How should the NPS preserve parks moving forward?

The practice of preservation has come to rely on science, including partnerships with academic researchers, as well as inventory and monitoring programs. That shift has in part been guided by goals that have also become more informed by science, like ecological integrity. While some interviewees see science as a solution to the NPS's challenges, others wonder how applying science can get "gnarly," due to uncertainty, lack of clear policies, and the diversity of parks and resources. "Gnarly" questions stem in part from the complexity of the NPS as a socio-ecological system, as well as from

disputed, normative concepts that underpin the broader philosophy of preservation, including naturalness. What's natural in the context of pervasive anthropogenic change? Further, I describe how parks hold deep, sometimes conflicting, cultural and symbolic significance for their local and historical communities and for our nation. Understanding and considering those values is part of the gnarly task park managers face in their mission to preserve parks. I explain why this type of conceptual and values-based uncertainty cannot be reduced through science.

DEDICATION

For Kush, who did everything else while I did this.

I persevere because of you. I love you.

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1. INTRODUCTION

“I write... to find out what I am thinking, what I am looking at, what I see, and what it means.” –Joan Didion, “Why I Write,” *New York Times Magazine*, 1976

We’re from Phoenix, not originally, but with enough valley summers in memory that heat shouldn’t be a bother. And from the car, I guess it wasn’t. In our red, Nissan Rogue, AC blasting, we rolled east along the winding Pinto Basin Road through Joshua Tree National Park, California, without a tree in sight. Cumulus clouds drifted through the blue above—enough to fill the sky without blocking the sun. Boulders were piled high on both sides of the road, all in shades of cream and grey. Their rounded formations seemed to fuse with the clouds at the horizon. The earth felt very still, but the sky was moving. The clouds floated north, shifting, swelling, and shrinking to the soundtrack of my then-fiancé Kush’s current Twin Shadow obsession.

A valley opened before us—the vast wilderness area that engulfs much of the eastern portion of the park. From a distance the valley appeared polka dotted, and as we approached, scattered creosote and cacti crystalized into view. We veered south into a field of cholla cactus and stepped out of the AC to explore the densely-clustered cacti. Signs warned us to keep a safe distance—funny, given that the cholla didn’t look friendly to touch. Named for their deceptive appearance from afar, these were teddy bear cholla. Their limbs look soft and fuzzy until you get close enough to see the golden spines that extend several centimeters beyond their dark brown, almost rust colored trunks, as well as their light green, multi-limbed stems, contorting in all directions.

I've heard teddy bear cholla more often called by a nickname, "jumping cholla." Their segmented limbs are detachable, latching on to whoever or whatever has the misfortune to brush—even slightly—the cholla spines while passing by. Jumping cholla also drop their limbs, littering the ground with spiny segments, some of which take root and sprout cholla clones. According to park biologists, it's possible that the cholla cacti across those ten acres in Joshua Tree National Park are all clones of one original plant.

It had only been minutes, but the sun was at its peak and the 109 °F heat was wearing us down. We headed back toward the Nissan, just as the buzzing began. Honey bees darted toward us, our car, and the few other tourists who had since arrived. Desperate from drought, they thirsted for drops of condensation on water bottles and from cars' AC systems. We hurried to jump in the car without a stinging stow-away.

We next made our way northwest toward Jumbo Rocks, at any other time of year an overflowing campsite. But that day, only two spots were occupied—one by a dusty, oversized RV with a purring HVAC, another with a tent, a truck, and (despite the heat and moderate wildfire risk) a burning campfire. Bees were present here too. Someone had left a red, gooey, melted pile of trash in the middle of our path to the area's popular rock formations. The swarm of bees pushed us back, cutting our hike short. It was too hot to move forward anyway.

At only four in the afternoon, we were ready for our last stop: Keys View, an overlook on the edge of the San Bernardino Mountains. Even during the park's slowest month, the U-shaped parking lot was packed. And the bees were overwhelming. People had left their cars running with ACs on high, and someone had dumped the ice from his cooler all over the sidewalk. He slouched on the concrete curb in a swarm of bees, either

remarkably unfazed or pretending. Kush and I refused to be thwarted by bees again. Faces shielded, we made our way to the overlook. The valley rested under a thick layer of haze hanging low beneath the clouds. We took a picture anyway.

As we drove away from Keys View, into the heart of the park, scattered Joshua trees began to dot the landscape. I'd heard of wilting, faltering trees, lacking water and melting in the heat as if made of wax. But these still stood tall. Their spiked arms reached higher into the moving clouds, the further inward we traveled.

Parks in Crisis

A week after our 2016 visit to Joshua Tree, the National Park Service (NPS) turned 100 years old. The occasion spurred op-eds, fundraisers, legislative drives, and social-media campaigns in not only that year, but also the several years leading up to August 25th, 2016, the centennial anniversary of the National Park Service Organic Act (the NPS's founding legislation). The spotlight that comes with a nationally celebrated birthday highlighted the diversity and the beauty of the U.S. National Parks, but it also shed light on deep scars and revealed fresh blemishes—many of which were described in the media featuring Joshua Tree National Park as a kind of poster child for the parks' vulnerability in a rapidly changing world.

According to the *LA Times*, you'd better visit the park's magnificent trees before they disappear. The headline read, "Drought hastens decline of the Joshua tree, California's desert symbol," based on a University of California Riverside researcher's prediction that 90% of the tree's range within the park will be gone by the end of the

century.¹ *National Geographic* reported that “iconic Joshua trees may disappear, but scientists are fighting back.”² And *NPR* asked us to plan “for the future of a park where the trees have one name.”³ Average annual temperatures are projected to climb, while drought continues to affect the area, as in most parks in the southwest region.⁴ Joshua Tree is also susceptible to air pollution—mostly nitrogen and ozone—that affects visibility and harms resources in the park.⁵ For example, excess nitrogen leads to changes in the park’s soil chemistry, creating a favorable environment for invasive grasses that outcompete native plants and increase the risk for fire.⁶

The challenges don’t stop with natural resources. The park is more and more popular, year after year. In 2018, Joshua Tree hosted more than 2.9 million visitors, placing it within the top fifteen of most visited national parks.⁷ Though harboring economic benefits for the surrounding communities, the crowds contribute to long wait lines at park entrances, sanitation issues, costly wear and tear on facilities and infrastructure, as well as possible damage to natural and cultural resources.⁸

¹ Louis Sahagun, “Drought hastens the decline of the Joshua tree,” *Los Angeles Times*, June 6, 2015.

² Philip Kiefer, “Iconic Joshua tree may disappear,” *National Geographic*, October 15, 2018.

³ Lauren Sommer, “Planning for the Future of a Park,” *NPR*, August 2, 2016.

⁴ P. Gonzalez et al., “Disproportionate magnitude of climate change,” *Environmental Research Letters* 13 (2018): 10400a.8.

⁵ National Park Service, “Park Air Profiles,” last modified June 18, 2018, <https://www.nps.gov/articles/airprofiles-jotr.htm>.

⁶ E. B. Allen et al., “Impact of atmospheric nitrogen,” in *The Mojave Desert: Ecosystem Processes and Sustainability*, ed. R. H. Webb et al. (Las Vegas: University of Nevada Press, 2009). L. E. Rao et al., “Risk-based determination of critical nitrogen deposition.”

⁷ P.S. Ziesler, “Statistical Abstract,” *Ecological Applications* 20 (2010): 33.

⁸ National Park Service, “Visitor Spending Effects,” last modified June 18, 2018, <https://www.nps.gov/articles/airprofiles-jotr.htm>. Thomas et al., “2018 National Park Visitor Spending,”

At times, the park is at the center of political battles instigated 2500 miles away in Washington, D.C. For instance, almost a year into the Trump Administration, the *LA Times* raised alarm: “Interior Secretary Zinke reportedly dressed down Joshua Tree superintendent over climate change tweets,” just one of many actions taken by the Department of Interior to curb communications on climate change system-wide.⁹ In February 2019, after the longest government shutdown in U.S. history, *The Guardian* wondered, “Can Joshua Tree Recover?,” echoing similar worries expressed in *The New York Times*, *The Washington Post*, and *Slate*.¹⁰ Of course, the shutdown resulted in chaos across the park system, but it was the impact on Joshua Tree National Park that captured the spotlight on the national stage, including illegal off-roading, overflowing trash bins, polluted campsites, and irreversible damage to Joshua trees.

The challenges in Joshua Tree are part of a pattern seen throughout the U.S. National Parks. Despite their protected nature, all are subject to conditions that may frustrate preservation efforts. Climate change is melting the glaciers. Rising sea levels are drowning the Everglades and wiping away protected shorelines. Development projects, accompanied by air, water, light, and noise pollution, edge closer to park boundaries and

Natural Resource Report, (Fort Collins, Colorado: National Park Service, 2019), 28. George Land, “Joshua Tree National Park Experiencing Record Numbers,” last modified December 29, 2016, <https://www.nps.gov/jotr/learn/news/jtnp-experiencing-record-visitation.htm>. Land, “New Campground Procedures,” last modified December 19, 2018, <https://www.nps.gov/jotr/learn/news/new-campground-procedures.htm>. Land, “Park Sees Record Numbers,” last modified December 3, 2018, <https://www.nps.gov/jotr/learn/news/park-sees-record-numbers-over-thanksgiving-week.htm>.

⁹ Scott Martelle, “Opinion: Interior Secretary Zinke reportedly dressed down Joshua Tree superintendent,” *Los Angeles Times*, December 15, 2017.

¹⁰ Katherine Gammon, “The Shutdown is over,” *The Guardian*, February 4, 2019. Liam Stack, “Joshua Tree National Park’s Signature Trees,” *The New York Times*, January 11, 2019. Allyson Chiu, “A travesty to this nation,” *The Washington Post*, January 11, 2019. Michelle Sullivan Govani, “Close the National Parks Now,” *Slate*, January 15, 2019.

fragment habitats and migration corridors. The number of visitors and vested interests are swelling and diversifying. Resources for preservation, such as funds and staff, seem to be continuously shrinking, at least relative to demand. Even that which seems most steady—engraved into law—is dynamic: The National Park Service remains committed to the preservation of our natural and cultural heritage, but the practice of that promise is evolving, slowly and iteratively, but detectably.

In an ever-changing world, parks are still meant to preserve. How is the NPS changing the practice and philosophy of preservation, or not, to simultaneously address environmental and social change? How has preservation evolved before? Where can parks take it from here? How should the NPS preserve parks moving forward?

Discovering the Project

I'm guessing most visitors to Joshua Tree National Park in August have no prior experience with the deadly summer heat. The tourists we met that day in 2016 were mostly from Europe, a few from Asia, with a couple of conditioned Californians in the mix. Many, including Kush and me, practiced drive thru tourism: an AC-facilitated tour of the park's most popular spots, not leaving the car for more than five minutes at a time. It was just too hot, and there were too many bees. But I'd intentionally timed our visit during this brutal, slow season. Park staff would be less busy attending to tourists, leaving them more time to participate in a conversation with me—the first stage of my research regarding environmental and social change at Joshua Tree National Park.

Though I didn't get there until 2016, my journey to Joshua Tree had actually started back in 2014: the beginning of my PhD in Biology and Society at Arizona State

University, with a concentration in “Ecology, Economics, and Ethics of the Environment,” or “4E.” As I initiated the hunt for a dissertation project, my PhD mentor, Ben Minter, filled my inbox and my mind with scholarly work on the past, present, and future of human-nature relationships. It was one of these pieces that captivated my imagination and concern—a *Nature* editorial by the science writer, Emma Marris:

“Imagine Montana's Glacier National Park without glaciers; California's Joshua Tree National Park with no Joshua trees; or the state's Sequoia National Park with no sequoias. In 50 years' time, climate change will have altered some U.S. parks so profoundly that their very names will be anachronisms.”¹¹

Marris discussed climate change in her editorial, but her work led me to others who detailed development, pollution, and invasive species plaguing parks across the country. How could parks preserve glaciers, Joshua trees, and sequoias against climate change and other environmental challenges? How would they navigate changes to features and landscapes that have longstanding meaning for many different people in as many different ways?

Riveted by the headlines about disappearing trees, I selected Joshua Tree National Park as a case study. If I was going to explore the future of national parks in the Anthropocene, it seemed prudent that I focus my work on the site of all the action. At the time, the park had a graduate research fellowship available. Plus, the park is only about a four hours' drive from Phoenix, AZ. Within Joshua Tree, I would track the evolution of preservation as a guiding philosophy for the NPS, calling on the perspectives of park visitors, managers, and policy-makers.

¹¹ Marris, “Conservation biology: The end of the wild,” *Nature* 469(2011): 150.

The initial outline of my project perhaps took the name of my 4E program a little too literally. I developed components fitting each of the “E’s.” First, ecology: I would undertake a survey of the environmental and climatic challenges within Joshua Tree, including an analysis of how those challenges intersect with, compound, and complicate each other. Next, economics: Via surveys, I would understand how visitors to Joshua Tree National Park make tradeoffs among the costs of proposed management plans and the resulting changes to the environment or the visitor experience. And finally, ethics: I would perform textual analysis of management documents, as well as interviews with administrators, managers, and other staff to describe the values influencing decisions and trace the outlines of a shifting environmental ethic for park management. As I imagined it, these three analyses combined would light the way forward for the park, and perhaps for the park service more generally.

But despite my crisp outline, I found myself making little headway. The project began to overwhelm me. I’d ignored the advice of essentially everyone who knew better than me, including Ben, and developed a dissertation the size of at least two and a half dissertations. It’s not a unique occurrence; most PhD students start that way (now it’s *my* advice that goes ignored by younger cohorts). Luckily, it’s easy to adjust the size and scope of a project, especially relative to my second road-block—though I was motivated by a desire to expand my education and expertise, I found myself grasping tightly to my science background, halting progress.

I’d spent my entire life longing to follow many paths at once but feeling obligated to prioritize the science and math. When you’re a girl who excels in those subjects, everyone pushes you toward them, even people who don’t know you. In high school, for

example, my best friend Rachel was warming up at soccer practice, jogging the bright blue track circling the pitch, when a teammate fell into step beside her. Having observed that I often “distracted myself from my destiny” with dance, choir, art, and student government, Rachel’s teammate expressed urgent concern for my soul. If I did not focus on my God-given talents and pursue a scientific career in medicine, hell awaited.

I laughed later, as Rachel shared the encounter. It was a parody of the pressure I felt from everyone, all the time, to be a scientist, or a physician, or a veterinarian—a weight on my shoulders that I could laugh at but not shrug off. I carried it to college where I spent my early mornings and late nights in the dance studio, while throughout the day I oscillated among the math, biology, and environmental science departments. It’s not that I didn’t enjoy those subjects; it’s kind of hard not to enjoy something you’re good at. And I generally love learning about everything and anything. But it was primarily my sense of duty that directed me through the halls of the University of Iowa Department of Biology, as opposed to any other department, searching for a lab for my honors-thesis research. All of this to say, I didn’t grow up hoping to become a snail-sex researcher.

I recall exiting the elevator onto the third floor and immediately facing a heavy, oak door with various stickers and comics posted all over—science humor. The halls outside Professor Maurine Neiman’s laboratory were adorned with research posters filled with images of snails, mountains, lakes, and maps of New Zealand. I knocked once, then twice, to no answer. But I had an appointment, so I yanked the door open to the immediate sound of two, deep barks and scurrying toenails on the concrete floor—my first introduction to Maurine’s live-in mascots, an aging basset hound and a young

German shepherd mix. Maurine appeared from within her embedded office, her curly, brown hair hanging to her shoulders, framing a broad, squinty smile. The space was bustling with doctoral, masters, undergraduate, and high school students, sitting at computers and microscopes, cracking jokes about the number of cups of coffee they'd each consumed since morning.

Maurine's research asks questions about the evolution of sexual reproduction, using snails as a model organism—work once condemned on Fox News as a waste of federal research funding. Her Twitter bio reads: “Fox News called me a snail pornographer.” Bursting with vivid contrast to the quiet, sterile labs I'd passed through earlier, I knew I'd found home. My time spent there would shape my frame of mind for years to come.

I began spending hours in the lab most days of every week engaged in the rigorous and specialized training required of a lab scientist. I embarked to study a set of genes in a single species of snail to determine how genetic information evolves differently between those that reproduce asexually (female snails who have only genetically identical daughters) and those that reproduce sexually (female and male snails whose genetic information recombines to produce genetically diverse sons and daughters). I had a specific research question: how do these genes, in this controlled context, evolve? And all the research happening around me instilled a singular goal: so long as I labored in the lab for the requisite number of hours, following the scientific method, an answer was possible.

I didn't love the lab work so much as I loved the lab community. Even my strong sense of duty would start to fade after hours staring at a computer screen filled with

endless patterns of A's, T's, G's, and C's, the letters representing the organic molecules that compose genes. It was my simultaneous education in the *applications of science* that kept me energized, which I suppose makes sense given that my earliest interests in science had always related to the ways in which I could use it to answer my questions.

Throughout my training with Maurine, she challenged me to see science as a both a toolbox and a story to be shared. I was encouraged, along with all her graduate and undergraduate students, to take turns teaching biology classes at the local high school—an expectation set by her own example. I also worked part-time as a docent for the University of Iowa Museum of Natural History. For a few hours, every week I led elementary and middle school students on tours through the geologic, natural, and cultural history of Iowa, as well as helped with preservation of artifacts like mammoth fossils. I presented at conferences across the country and studied abroad to apply my training to environmental challenges in the Costa Rican cloud forests and the Belize Barrier Reef.

These experiences left me eager to take science where it was needed, in pursuit of solving a “real world” problem, preferably of paramount importance to “society.” In search of my next steps, I took a break from A's, T's, G's and C's to Google “Biology and Society graduate programs.” Arizona State University has a center and a graduate program named exactly that. As a rational scientist-in-training, I tried not to confuse coincidence with fate, so I applied to eight other programs. But from the start, the distinctly creative and interdisciplinary nature of the people, their projects, and their passions, was calling me to the Center for Biology and Society. It instantly felt right. So I guess I'm more superstitious than I thought.

Two years into my PhD, struggling to make progress on my dissertation research, I began to realize that I was clinging to the comforts of the laboratory approach even though I'd intentionally left the lab behind. I'd been taught to systematically answer controlled-context questions; naturally, I managed my dissertation's "real world" questions in the same light. I had distilled "How do we preserve U.S. National Parks in the Anthropocene?" into a set of themed experiments to be performed in the laboratory known as Joshua Tree National Park. Even my economic component possessed a comfortable familiarity: I could understand and compare changing human values in the language of statistics, like understanding evolving genes.

But as I was gearing up to carry out my research, I was also taking courses and reading up on the history and philosophy of science, as well as science policy, and what I learned made science feel a little less sacred as a guiding light. For example, I'd noticed that disagreements over issues like climate change, including within the park service, are often argued in terms of lacking or contested knowledge, as well as conflicting notions of risk. But increasing the quality and amount of evidence doesn't seem to reduce that conflict as much as you might expect. Why is that?

I also reflected on the field experiences I'd had in Central America during my undergraduate education, which I'll expand upon in chapter five. I'd noticed that our team's ecological measurements and models weren't driving ecosystem-management solutions the way I thought they should. Until those experiences, science had typically been a reliable source of answers to my questions. So why wasn't science driving action to protect the reef or the forest? I'd in part sought out "Biology and Society" graduate

programs to pursue my surprising, emerging awareness of these problems for which the ability of science to drive or derive solutions was limited.

I didn't have to wait too long before facing these and many other related questions head-on in my research. During my 2016 conversations with Joshua Tree staff, we spent hours deliberating on science as a process and a toolkit—how were they were using it, interpreting it, understanding it in balance with other commitments, like values, budgets, and laws—all amounting to a discussion of the powers and limits of science in the process of decision making. (Originally the plan was just to get staff input on my ecological and economic surveys.) I realized I wasn't *so* surprised with this reality; in my own life, I'd always felt a strong desire to complement science with education through the arts, humanities, and travel.

I found myself expanding my “ethics” chapter into explorations of science policy, public affairs, and park service history. And for every hour I spent working on my economic survey, I'd spend another hour reading about how surveys are used or not used, how they are perceived by visitors, how they are interpreted by managers, and so on. As this process wore on, I became less invested in my earlier and more conventional scientific pursuits, and more interested in understanding how park managers were performing, understanding, and using science—or rather, sciences, with many forms, traditions, and complexities—to inform and empower their mission to preserve parks. I decided I wanted to have more of the types of conversations I'd had in Joshua Tree, so I scheduled interviews with managers and others related to the NPS.¹² From Joshua Tree in 2016 to Washington, D.C. in 2017, and in phone calls to parks across the country, I

¹² The details of my methods can be found in Appendices A-D.

became fascinated with asking questions like: What do you believe the parks are preserving and why? What are your biggest hopes and fears for the parks, moving forward? Where does the balance lie among sciences, values, economics, histories, and laws? How do you know? And how do you act on it?

Meaning and Memories

The night before our drive-thru tour of Joshua Tree, the skies were clear. Kush and I made the brief, uphill walk from Spin and Margie's to the stargazing garden, just past the rusty spring mattress labeled, "Desert Sculpture." We assigned ourselves to a pair of brightly painted lawn chairs—the metal kind with horizontal slats that leave marks on your back and legs. The sun had set. The grounds were still and silent.

And then the stars began to move. Kush never sees them, shooting stars. I would spot one, racing across the sky for a few seconds, sometimes less, and yell, "look, to the left!" He always turned a moment too late. Kush played the sore loser, brandishing our empty wine bottle at the sky. I was shaking, breathless with laughter. He'd had me giddy all afternoon, from the moment at lunch when he'd accidentally salted his French fries with sugar.

We'd later learn we were witnessing the annual Perseid meteor shower, on its way out of town. Every August, for several nights at a time, meteors dart through the skies. They're called the "Perseids" because they seem to originate from the constellation Perseus. At the peak of the meteor shower, hundreds of shooting stars appear every hour.

When we were ready to turn in, the meteor shower had yet to cease. We were still alone outside; only one or two other apartments were occupied, another symptom of the

slow season. The dim string lights that traced the pathways just barely illuminated the outlines of the burnt-orange buildings and the somewhat kitschy décor, including license plates, garden tools, and rusty machine parts, placed throughout the surrounding cactus gardens.

Spin and Margie's Desert Hideaway lies just outside the town of Joshua Tree, which the state of California doesn't even define as a city, but rather "a census designated place." It's one of three communities on the northern outskirts of Joshua Tree National Park, framed by Yucca Valley to the west and 29 Palms to the east. They're all connected by the 62, known locally as the Twenty Nine Palms Highway.

The interiors of our apartment were just as spunky as the exterior and gardens—lime-green walls, patterned lampshades, a canary-yellow teapot on the stove. A basket of old DVD's and CD's sat on the shelf underneath the TV. We had a patio facing the 62, but the highway was kept out of sight by the trees and the brush. Every so often, we'd hear the soft "whoosshhhh" of a car passing by.

I imagine my mother must have called around this point. She calls me for two reasons only. The first category of "calls from mom" are accidental; she forgets to turn off her touch screen before pocketing her phone or throwing it in her purse. The other calls are the ones I'd rather not answer—bad news. There's a range from, "I can't remember the login for my Gmail," to... well, anything worse. Whenever I see her name across my screen, my heart drops from my chest, just a little, in expectation. I remember the feeling, so the call must have come. Grandpa Bob was gone.

He'd been dying for a while, on his third or fourth bout with cancer, which I guess is supposed to mean I thought it would make sense. I'd talked to him on the phone only

days before. He'd joked that the weather patterns on the TV resembled the tumors in his abdomen, and I'd faked a laugh. Many times before I'd raced to Chattanooga to be there, just in case. He'd roll his eyes, "I ain't going yet. And if I was, I wouldn't want you here." Now the moment had come and gone, and I was stuck. I'd come to Joshua Tree to do a job—a research stage that had been carefully planned, scheduled, and paid for by the park and my graduate program. I would just barely make it to Tennessee in time for whiskey shots at the funeral—an Irish good-bye.

Truthfully, I don't remember much about the moment. I don't recall how Kush reacted. I don't know if I slept well after. I don't even remember if I actually slept through the night and found out in the morning. I do recall that the next day I couldn't stop staring at the clouds moving through the sky like shooting stars.

An Overview

The story of the parks is written in laws, sciences, politics, local tensions, visitor demands, manager concerns, as well as meanings and memories—those of millions of people, including myself. At the start of this project, as a “scientist,” it was unfathomable that I would admit to having a biased, personal relationship with parks, but it's impossible to ignore the ways in which parks have been part of my life, before and throughout this research. Further, the evolution of my research interests has been inseparable from reflections on my own meaning-making, all informed by the books I've read, classes I've taken, places I've visited, concepts and methods I've trialed and erred, and the people I've spoken with. I've attempted to embed those reflections and memories throughout, in ways that hopefully complement the research.

For the last five, almost six years, I've listened as people and groups in the government, non-profit, and academic worlds shared their stories of how U.S. National Parks have evolved and are evolving. Through explorations of laws and literature, in addition to interviewee accounts, I've tracked the historical and real time evolution of preservation as it's practiced in our more than 400 national park units. I tried to understand my research at all scales, from the local park setting to the broader context of the park system and the park idea.

This research project was executed neither swiftly nor smoothly. And it certainly wasn't linear. I clung, for example, to my economic study for probably nine months longer than I should have before cutting it, re-opening it, and cutting it again. Many realizations and actions were motivated by embarrassing mistakes, frustrating stagnations, and insightful, not always gentle, characters along the way. It's probably been organized at least a dozen different ways. I owe that in part to the shifting style and focus of my project as my interests changed and I (apprehensively) allowed myself to pursue them. But it was also necessary to the process of working through what kind of narrative I wanted this project to follow—which I'm aware is only half-way (if that) to where I'd like it to be in terms of presenting a cohesive style and story. I should also admit that I procrastinate writing by organizing and reorganizing for writing, again and again. And when I finally sat down to write, I discovered that I was often wrong about my outline anyway.

Though the project wasn't completed in a linear way, I used time as a guide. U.S. National Parks have been around for more than a century guided by the mandate that parks should be preserved for the enjoyment of present and future generations. But

throughout the decades, parks have evolved in form and meaning. In addition, the philosophy and practice of preservation have endured hundreds of years of evolution, dating long before and throughout the history of the parks. In chapters two and three I ask, how has the concept of preservation evolved? Throughout most of the parks' early history, preservation was equated to the protection of scenery—mesmerizing landscapes, artifacts, and wonders that drew tourists (and continue to draw them today). Along the way, as parks, and types and numbers of park units, evolved, so has preservation. What's been dynamic? What's been steadfast? Where did the concept of preservation begin? And as it collided with the park service, how did it change or not? For early history, I rely on the work of park historians, but I've also done my own digging into the original documents, including a legislative history of the 1916 National Park Service Organic Act.

Most park employees, historians, and academics generally agree that the 1960s presented a paradigm shift for the practice of preservation in parks, moving toward protection of historical *ecosystems* as opposed to—though really, in addition to—*scenery*. In chapter three, I cover the aftermath of two 1963 reports: *The Leopold Report* and *The Robbins Report*. Science begins to weave itself, a little more firmly, into the story of park management. Concepts like invasive species and predator-prey ecology begin to more consistently guide management strategies. And through the 1970s and 1980s, laws such as the National Environmental Policy Act, the Endangered Species Act, and the Clean Air Act codified environmentalist and ecological principles. The chapter ends with an examination of the policies from the Obama years to better understand how preservation came to revolve around ecological integrity, in contrast to previous guideposts like scenery or “vignettes of primitive America.” In chapter three, interviews come into play.

Several retired or longer-serving NPS employees experienced this time first hand, and their memories lend context and depth to my review of policies and literature from this period through today.

In chapter four, we come to the present—how and why is preservation continuing to evolve? I review the challenges of the moment, in the literature, in my experience, and in the experiences of NPS employees across the country. I ask my interviewees to consider and describe change through their own experiences—including environmental, social, political, and conceptual challenges. What’s it like to live and work through the changes—those in climate, ecosystems, resources, publics, and politics, as well as policies and tools? How do you assign baselines to things that aren’t standing still? Notably, we understand ourselves as part of and even driving change. Anthropogenic environmental and climatic changes complicate how the park service defines “naturalness,” the baseline they typically pursue when working to preserve natural resources. How do you preserve naturalness if the systems you’re charged with protecting are dominated by human-caused impacts? Interviewees reflect deeply on the concept of “naturalness,” and I discover that I’ve caught many of them, as well as myself, in the process of thinking the matter through.

In chapter five, I shift gears somewhat to explore the increasing applications of science to park management. In doing so, I zoom in on preservation as a practice and a goal (means and ends) in park strategy or NPS policy. The chapter is divided into two parts. First, I review how science informs (or not) decisions in complex, socio ecological systems. This is important because parks and the NPS are complex systems in which predictability is low, uncertainty soars, and targeted management interventions are prone

to cause unintended consequences. In the second section, I draw on interview data to describe how the NPS applies science to the practice and goals of preservation. I find that NPS employees and researchers are focused on ensuring that science is contextual to the unique purpose, challenges, and leadership of each park. In addition, interviewees agree that science does not drive decisions, even though it should inform them.

I find that most interviewees provide logistical and legal justifications for how they use science in park management, as well as when and why its use might be limited. For example, science has to be one of *many* inputs to decision making because the law mandates public input and the budget is an ever-present logistical constraint. In chapter six, I go beyond those legal and logistical justifications to examine the limitations of science to solve problems in complex, socio-ecological systems like the NPS. While some interviewees see science as a solution to the NPS's challenges, others wonder how applying science can get "gnarly," due to uncertainty, lack of clear policies, and the diversity of parks and resources. "Gnarly" questions stem in part from the diversity and complexity of the NPS, its units, and its resources, as well as from disputed, normative concepts that underpin the broader philosophy of preservation, including naturalness. I describe how parks hold deep, sometimes conflicting, cultural and symbolic significance for their local and historical communities and for our nation. Understanding and considering those values and concepts is part of the gnarly task park managers face in their mission to preserve parks. I explain why this type of conceptual and values-based uncertainty cannot be reduced through science. And then I zoom out to consider, though the practice and goals of preservation have evolved, what aspects of preservation as an idea have remained steadfast throughout the years? And where does that leave science?

An important note: by the end of my interview process, it was clear that I'd collected perspectives primarily from individuals with science backgrounds or roles related to science in the NPS.¹³ A key limitation of this work is thus that the perspectives of educators, law enforcement officers, interpreters, rangers, facilities managers, and others from diverse backgrounds are not fully represented in this text (though some of my interviewees have at various points held such roles in the past). This happened in part because my sampling was purposeful—I desired to speak with those who had been involved with or strong voices in the most recent or historically impactful policies and practices related to the growing role of science in preservation. I asked for and pursued their recommendations for further conversations, probably resulting in an even more related group of individuals—a somewhat homogenous, distinct group within a broad, decentralized institution. I mention this because I know that important counter-perspectives are likely missing (as some of my interviewees even noted), and I look forward to learning more about those perspectives in future work and in response to this dissertation.

First, History

William Tweed's *Uncertain Path* was in my Amazon “save for later” cart for years.¹⁴ Browsing the cart in 2019, I found it at the very bottom of my long list. I'm not sure what spurred me to purchase it then, but I recall I bought and read it during an early bout of writing inertia. I was feeling stuck in the process of blending my personal and

¹³ For a full list of study limitations, see Appendix A.

¹⁴ William Tweed, *Uncertain Path* (Berkeley and Los Angeles, CA: University of California Press, 2010).

research experiences into one story. Tweed quite masterfully brings his own narrative to inform his academic pursuits, declaring that his understanding of how parks have evolved had to be personal—it's personal to everyone, granted the public nature of parks.

Tweed is a former employee of the park service, including several years serving as Chief Park Naturalist at Sequoia and Kings Canyon National Parks. In *Uncertain Path*, Tweed journals his way through a “walking meditation,” traversing national park, national forest, and wilderness lands, “to explore the question of what the twenty-first century’s powerful currents of change will mean for national parks and wilderness.”¹⁵ Landmarks spur reflections on the past, present, and future of the National Park Service and public lands, drawn primarily from his own remembered experiences as a visitor to, advocate for, critic of, and employee with the park service. He reflects on questions quite like my own—how do we preserve U.S. National Parks in the context of continuous, compounding socio-ecological changes?

Tweed’s main concern: The National Park Service can no longer—could never, I would add—promise the public that national parks will be maintained into perpetuity. A new set of goals, perhaps even a new mission, are needed, and they should be considerate of and endorsed by the public. He acknowledges that the agency has evolved, albeit sometimes with great resistance, “redefining its goals in light of scientific discoveries.” But the main leading documents, such as the NPS *Management Policies*, lack specific guidance on how to deal with change, as well as how to communicate change to the public. Even to the limited extent that goals and policies have evolved internally, Tweed

¹⁵ Tweed, *Uncertain Path*, 13.

asserts that in the public eye they've changed very little, if at all.¹⁶ This could be problematic for meeting or managing public expectations of parks. He thus presents a new challenge: As part of the overall mission of striving for the dual goals of preservation and enjoyment, the NPS will need to acknowledge and manage for change while continuing to earn public support.¹⁷

Greater awareness of historical changes to the practice and philosophy of preservation could contextualize and perhaps guide the NPS and the public through the changes of the present day. But building awareness, internally and externally, has been a hurdle, despite countless revelatory books, essays, and studies of the past, present, and future of parks. Tweed even notes that many before him have written similar books, with little to no impact.¹⁸ Further, academic approaches to studying the evolution of the national park system can at times become self-referential and disengaged from the legislation and policies that park professionals live and work by. And practitioners can sometimes lack an understanding of how their profession and institution have evolved and how that evolution connects to other currents.

That's why I've asked the park professionals, researchers, and advocates themselves: What does it mean to preserve parks? What does the future of preservation look or feel like? How do we get there? Whose voice matters? These are the questions we'll need to answer to continue preserving U.S National Parks. The parks, the public, and the academy must come together to understand, navigate, and, in many cases,

¹⁶ Tweed, *Uncertain Path*, 2.

¹⁷ Tweed, *Uncertain Path*, 200.

¹⁸ Tweed, *Uncertain Path*, 185.

embrace change. And that starts with an exploration of how preservation and national parks have changed before.

2. HISTORY, PART 1

Re-Education

I first contacted John Dennis, Deputy Chief Scientist of the U.S. National Park Service, via email on Thursday, September 21, 2017, 2:21pm, MST. Would he be willing to spare an hour to answer some questions about his decades of public service with the NPS? Less than 24 hours later, my stomach churned as I read his reply:

“...please note that the name of the organization is "National Park Service" and that "parks" (plural) is embodied in the concept *National Park System*.” (September 22, 2018, 11:27am)

Frantically, I scrolled to my original email, words I had copied and pasted across more than a dozen emails to top park officials. There it was, “the National Parks Service,” a glaring typo. Dennis continued:

“...The major concern is that I fear you may not have done enough background reading and so some of your thoughts may be naïve.”

My palms were sweating now. He must think me prescribing answers to problems I didn't understand, and worse, for an organization I couldn't even name correctly. So I was relieved he still agreed to meet me in Washington, D.C., at the Department of Interior, his office, on Tuesday, October 10, 2017, 10:00 AM.

Dennis saw right to the heart of my intellectual weakness. I'd spent all my time reviewing academic literature on the parks without, as mentioned before, “sufficiently [delving] into the law and the writings of the federal government.” He challenged me to review several federal publications, including the National Park Service's *Management Policies* edition-to-edition, cover-to-cover (something I'd been planning to do, but hadn't had the fortitude to complete by that time).

Reading law is unbearable for me. I can't tell you how many times in the last five years I've fallen asleep over Dilsaver's *America's National Park System: The Critical Documents*, or caught myself suddenly browsing the web for adoptable dogs. But Dennis alerted me that it was time to cuddle up to my new mid-sized mutt with Dilsaver in one hand and the NPS's *Management Policies* in the other: one hundred years of government records in eighteen days. I didn't get much further than reviewing the basics: The Organic Act, the latest *Management Policies* (2006), recent Director's Orders, and popular reports. I spent most of my time laboring to reclaim my focus from anxieties over the pending trip. Dennis wasn't the only distinguished interviewee I had to prepare for and impress.

On October 9, 2017, the morning after a sleepless red-eye from Phoenix and the day before my dreaded appointment, I sat in the drafty first floor dining room-turned-conference room of Arizona State University's former DuPont Circle residence. I'd done one smart thing and arranged a meeting with a committee member, Dan, before the first of my interviews. As I waited, I caught a cringe-worthy glimpse of my hair in the window reflection. That morning I'd attempted to look more put together than I felt by twisting my brown hair into a chignon (thanks, YouTube!), but during my 20 minute walk from Foggy Bottom, the morning rain had undone my efforts. That was enough to put me over the edge. I'm not typically a dramatic person, but I was blinking back tears as the creaking floorboards alerted me to the arrival of Dan Sarewitz, ASU professor of science and society and co-director of the Consortium for Science, Policy, and Outcomes.

I had not intended for our meeting to be a therapy session, but I spilled my anxieties while Dan listened thoughtfully and said, "well, of course." Of course, I was

“naïve.” Of course, I didn’t have all the knowledge I should. Of course, I was missing something key in my current understanding. And of course, I would revise, revise, revise the questions, assumptions, and motivations driving my dissertation research. Dennis—who had worked with the NPS since 1971—could be pointing out a very real disconnect that I should see as an opportunity. Now was my chance to listen.

The next morning was crisp and clear; the rain had rolled out overnight. I walked to the Department of Interior from my micro-hotel on George Washington University’s campus, wearing my new flats. Upon my arrival, less than 20 minutes later, my heels were raw—bleeding into my shoes. But I kept faux confidence pasted on my face, smiling wide. John greeted me at the North door, right past the security check-point. He slowly led me down the wide, bright hall to the right. Large windows let the warm October sunshine in through the open office doors lining the hall. The Department of Interior building was expansive and enduring, but with some cracked ceilings and squeaky doors. Dennis shared an office on the first floor, with a window looking out over a courtyard. Towers of paper and books waited on his grey desk, all for me—my re-education.

A Century of Stability and Change

The history of the U.S. National Park Service has been told countless times, including in essays, books, NPS interpretive programs, and a famous 12-hour-long Ken Burns documentary. Thus, I don’t plan a full retelling of that history here. Still, I am interested in the former, just as I am in the future. What came prior, especially for a

bureau as steeped in tradition and layers of historical legislation as the park service, influences what comes next.

While accommodating various values, politics, and management practices within and across different time-periods, the Park Service has remained steadfastly committed to a mandate that most—I might even dare to say *all*—park service employees can recite from memory. Signed by President Woodrow Wilson on August 25, 1916, the Organic Act created the National Park Service with a mandate:

“...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.”¹⁹

Based on this mandate, and more than one hundred years later, the Park Service continues to manage for two broad goals: (1) preservation of our iconic landscapes, historical sites, and natural and cultural resources and (2) enjoyment of the parks by an adoring American public. In 1916, it was this dual commitment to preservation and enjoyment that made the brand new NPS unique from other land management agencies, such as the U.S. Forest Service. The parks, instead of existing for consumptive purposes, would embody the *preservationist* idea. Thus, key to understanding the parks will be tracing the history of preservation, a concept with origins dating prior to the creation of the first parks and the NPS. How have the concepts and practice of “preservation” and “enjoyment” evolved and why? What are parks preserving and how? What’s been dynamic? What’s remained resolute? And what contributes to stability or change across the years?

¹⁹ National Park Service Organic Act, 16 U.S.C. § 1 (1916).

I will explore what's been or appeared to be steadfast, including values, legal commitments, management processes, and key players, detailing both obvious and underlying evolution. Information and ideas have been sourced from the esteemed work of others,²⁰ as well as from original analyses of interviews and primary resources, including those stacks of paper John Dennis shared with me on that sunny October day in Washington, D.C.

Ensuring Nature Finds Its Way

I grew up admiring nature from the backseat. My family was the type that stayed in the Motel 6 closest to the National-Park-of-the-summer. From our home in Iowa we always drove, and thus I never got as far as say, the Everglades, until I was old enough to go myself. Our earliest trips were made in a black Ford Taurus my sister and I called "Black Beauty," after the starring horse in the 1994 film²¹, and in later years, a black 1998 Toyota Sienna that never earned a name.

My parents aren't rugged, outdoors-people. As a family we don't camp, unless invited to stay in someone's RV. We never backpacked, though my parents will proudly tell you about that one time they hiked the Appalachian Trail, long before kids were in the picture. And my sister and I were never Girl Scouts. But our auto-tours were enough for me to develop a deep fondness for nature.

²⁰Though I've read many original historical documents myself, I do not consider myself a historian. Most of this chapter relies on the work of historians Richard Sellars, Alfred Runte, and Roderick F. Nash. Each is praised from within and beyond the NPS for their critical and comprehensive histories of preservation, wilderness, and/or the parks.

²¹ The film is based on the 1877 novel *Black Beauty*, by Anna Sewell.

I had a habit of sitting in the middle or to the side but with my spine bent sideways so that I could see out the front window. I'd track the oncoming views, blinking as little as possible. (I do this today as well, but now it's called back-seat-driving). One summer, we were on a typical road trip to Badlands National Park. Golden fields of tall, swaying grasses spread across rolling hills, and then the plush landscape broke into harsh angles and spires, eroded from sedimentary rock by the dry wind and sun.

My eyes were on the gravel path ahead when a brown, heaving lump came into view, settled to the side of the dusty road. "Dad STOP!!!!!!!!!" We rolled to a stop beside what I decided must be a very lost, very frightened bison calf. I cannot forget the eyes—wide, brown, glassy.

I begged my parents to sacrifice our luggage so that we could offer the bison a ride home to his herd. I was sure he would fit; "Black Beauty" had come with a trunk-space upgrade. My parents would not comply, but over the years I'd forced them through enough wildlife-saving experiences that they knew the alternative. We drove to the nearest ranger station to share the bison-sighting. I imagined the park rangers airlifting him home, having located the worried mother bison a few hills away, wondering where she'd misplaced her baby. The rangers would ensure that nature found its way, even if it needed a little help.

I'll never know what really happened, though I'm not sure that I'd want to. If I'd been seventeen instead of seven I might have realized that the calf was probably left behind because he was ill or injured and a risk to the herd. The "natural course"? Let it be. Or perhaps the bison had been hit by a car? Was it nature's way that we should be driving through these landscapes, presenting such a threat? But I *was* seven, and what I

felt in that moment was that the baby bison should be reunited with mother bison. I wouldn't have named it then, and I'm not sure I would define it or feel it in the same way today, but that was *preservation* in my mind.

What's Preservation?

Preservation, in the minds of park service founders, leaders, and employees, evades singular definition, in part because it's at once a policy in (context-specific) practice and a system-wide, legal mandate. There are practical definitions—preservation applied—such as “Preservation as a Treatment” for protecting historical sites and artifacts:

“... the act or process of applying measures necessary to sustain the existing form, integrity, and materials of an historic property... focuses upon the ongoing maintenance and repair of historic materials and features rather than extensive replacement and new construction...”²²

In another example, as a park-specific goal, the 1872 Yellowstone Act operationalizes preservation as protection “from injury or spoliation, of all timber, mineral deposits, natural curiosities, or wonders, within the park, and their retention in their natural condition.”²³

The Wilderness Act of 1964, part of the preservationist policy record impacting many national parks, national forests, and other public lands, declares that wilderness areas are to be preserved “for the use and enjoyment of the American people in such

²² U.S. Dept. of Interior, National Park Service, Technical Preservation Services, *Standards for Treatment of Historic Properties*.

²³ An Act to Set Apart a Certain Tract of Land Lying Near the Headwaters of the Yellowstone River as a Public Park, 17 Stat. 32 (1872).

manner as will leave them unimpaired for future use and enjoyment as wilderness.”

Though echoing the language founding the National Park Service, the Wilderness Act applies preservation in its strictest sense, retaining a landscape in its “primeval character,” without the developments, facilities, and visitor amenities characteristic of parks.

Wilderness would be a place “where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain.”²⁴

Even more broadly, preservation’s call is “to shield nature from human manipulation, intrusion, and above all, destruction,” as summarized by Ben Minteer and Stephen Pyne in their introduction to *After Preservation*, an edited volume featuring academics, philosophers, practitioners, and environmentalists who each take turns contributing to the debate around “saving American nature in the Age of Humans.”²⁵ This view of preservation has become a rallying cry in recent years as defenders of wilderness and public lands have come to grips with some of the challenges to the preservationist idea, including more interventionist and anthropocentric approaches to park and wilderness management.²⁶

Notable in any of these definitions, including my own original intuition regarding bison in the Badlands, is the presence of a defined “natural condition,” “primeval character,” or knowable historical “integrity,” directing the desired ends of preservation

²⁴ Wilderness Act, 16 U.S.C. § 1131 (c) (1964). NPS leadership at the time (especially Director Wirth) wasn’t too thrilled about the passage of the Wilderness Act. They felt that a new statute would hamper their management discretion. This tension is discussed well in John C. Miles, *Wilderness in the National Parks* (Seattle: University of Washington Press, 2009).

²⁵ Ben Minteer and Stephen Pyne, “Writing on Stone, Writing in the Wind,” in *After Preservation*, eds. Ben Minteer and Stephen Pyne (Chicago: University of Chicago Press, 2015), 1.

²⁶ As exemplified by the authors in the collection George Wuerthner, Eileen Crist, and Tom Butler, eds., *Protecting the Wild* (Washington, D.C.: Island Press, 2015).

in practice. But central to the evolution of preservation, have been shifting definitions and interpretations of “naturalness” and other objectives (particularly, for natural resources).²⁷

Within parks, preservation as both a mandate and a practice was originally driven by a desire to protect spectacular, scenic, large-scale landscapes. Through almost one hundred and fifty years of history in parks, new ways of interpreting and practicing preservation would be tested, debated, abandoned, and (re)embraced. Emphasis on “visual integrity” would repeatedly be challenged by emerging understandings of ecosystems, ecological processes, as well as natural and cultural history from the 1930s through today, such as the historical relationships of Native Americans to park landscapes.²⁸ As former NPS historian Richard Sellars argues, “Nature preservation—especially that requiring a thorough scientific understanding of the resources intended for preservation—is an aspect of park operations in which the Service has advanced in a reluctant, vacillating way.”²⁹

Though closely related (and co-evolving) concepts for more than ten decades, the origins of “preservation” and “national park” are less directly related. The aesthetic, spiritual, and literary tradition of nature preservationism emerged before the first parks, though both parks and preservation have roots in Romanticism, landscape art, and previous failures to moderate development on landscapes such as Niagara Falls.³⁰

²⁷ This is something I will address in more depth in chapter four.

²⁸ Tweed, *Uncertain Path*, 65. Robert B. Keiter, “Ancestral Lands,” in *To Conserve Unimpaired*, Robert Keiter (Washington, D.C.: Island Press, 2013).

²⁹ Richard West Sellars, *Preserving Nature in the National Parks* (New Haven: Yale University Press, 2009), xvii.

³⁰ Larry M. Dilsaver, *America’s National Park System* (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), 7.

Throughout the 19th century, the concepts would diverge as many times as they would *briefly* intersect. It wasn't until around the turn of the 20th century that John Muir and others would seek to justify parks like Yosemite on preservationist grounds, and a great debate over a wilderness valley, Hetch Hetchy in Yosemite National Park, would cement the twentieth century association between parks and preservation.

Preservation Before Parks, Parks Before Preservation

Some of the earliest writings regarding preservation of nature come from Henry David Thoreau, an American naturalist, essayist and philosopher. Thoreau is best known for *Walden*, a reflection on his spiritual and philosophical growth following two years, two months, and two days of solitude and self-reliance at Walden Pond.³¹ In other writings, he was one of the first to suggest preservation of nature: “why should not we...have our national preserves... in which the bear and panther, and some even of the hunter race, may still exist and not be ‘civilized off the face of the earth’—our forests...not for idle sport or food, but for inspiration, and our own true recreation?”³² Though in his time Thoreau struggled to sell books and fill lecture halls, his work would later come to bear on similar minds of the next generation, including those who would be responsible for the birth of the National Park Service.³³

³¹ Henry David Thoreau, *Walden; or, Life in the Woods* (Cambridge, Massachusetts: The Riverside Press, 1854).

³² Roderick Frazier Nash, *Wilderness and the American Mind* (New Haven: Yale University Press, 2014). Henry David Thoreau, *The Maine Woods*, (Cambridge, Massachusetts: The Riverside Press, 1892), 160.

³³ Nash, *Wilderness and the American Mind*, 160, 317.

Perhaps no intellectual descendant of Thoreau is better known than John Muir, a champion of the wild and national parks advocate, especially for Yosemite National Park at the heart of his beloved Sierra Nevada Mountains in CA. Though inspired by Thoreau, Muir's version of preservation was more focused on wild landscapes, and was often expressed in more radical terms, not just in prose but in action, including stormy nights spent in the tree tops³⁴ and close encounters with bears.³⁵ His writings and famous feats of wilderness survival inspired and influenced a wide cast of characters, from fellow wilderness enthusiasts to U.S. Presidents. Thoreau, on the other hand, was more pastoral and enamored of the middle landscape between the true wild and the city (Walden Pond was just outside of Concord, Massachusetts). Still, Roderick Nash, historian and author of *Wilderness and the American Mind*—which some reviewers have called the “Book of Genesis for environmentalists,”³⁶—notes that Muir's ideas were not *so* different from Thoreau's: “The context rather than the content of the respective philosophies determined their popularity.”³⁷ Around the time of Muir's budding fame, the country was seeing three trends in Americans' relationship with nature, contributing to the rise of a “Wilderness Cult”:³⁸

³⁴ John Muir, “A wind-storm in the forests,” in *The Mountains of California*, John Muir (New York: The Century Company, 1894).

³⁵ John Muir, “Among the Animals,” in *Our National Parks*, John Muir (Cambridge: The Riverside Press, 1901).

³⁶ Nash, *Wilderness and the American Mind*, front cover review by Dave Foreman, American environmentalist and founder of Earth First!.

³⁷ Nash, *Wilderness and the American Mind*, 160.

³⁸ Nash, *Wilderness and the American Mind*, 145.

1. An inclination to associate wilderness with America's disappearing frontier and pioneer past.
2. A growing tendency to see wilderness as a source for virility, toughness, and fitness.
3. Assignment of aesthetic and ethical value to wild places, as well as believing them ideal places for contemplation and worship.

Muir's popularity and wide readership contributed to and benefited from the Wilderness Cult. His views of preservation, shared in prolific and intense essays, combined with the rise of the Wilderness Cult, would eventually help ignite a campaign for more national parks, starting with the designation of Yosemite National Park in 1890.³⁹ Members of the movement believed too much civilization to be unhealthy. Parks and preserved wilderness were the antidotes.

But the national park story begins before 1890. Some ascribe the original park idea to American painter George Catlin, who traveled the American continent, particularly the west, painting portraits of Native Americans.⁴⁰ While on an 1832 trip to the Dakotas, Catlin wrote of his concerns over the natural and social impact of the United States' westward expansion. He wondered if Native American civilization and wilderness could be saved by "...some great protecting policy of government... in a magnificent

³⁹ For a complete portrait of John Muir, see Donald Worster, *A Passion for Nature* (Oxford: Oxford University Press, 2008).

⁴⁰ Alfred Runte, *National Parks, The American Experience* (Lanham, Maryland: Taylor Trade Publishing, 2010), 22. Nash, *Wilderness and the American Mind*, 100-107.

park.... A nation's park, containing man and beast, in all the wild and freshness of their nature's beauty!"⁴¹

The first version of a "nation's park," Yosemite Valley and Mariposa Big Tree Grove, would fall short of Catlin's vision. The area had first been entered by European Americans in the mid-seventeenth, and within a few years development for tourism began to inundate the valley floor, impacting "nature's beauty."⁴² Concerned that the valley must remain available to all, Congress turned Yosemite Valley and the Mariposa Big Tree Grove (including giant sequoias) over to the state of California in 1864, to be set aside as a public park.⁴³ But in the process, "man and beast" as together in Catlin's mind, were divided; Native Americans whose ancestors had lived in the areas for thousands of years were pushed from the park's boundaries, in many instances with violence,⁴⁴ to make way for a state park meant for "public use, resort, and recreation."⁴⁵

Though technically a state park, Yosemite Valley and the Mariposa Big Tree Grove did represent the first known instance of a nation granting land to be set aside for use as a public park. And among the first plans to manage the park, emerged a report which the National Park Service's preservationist mandate would later come to resemble.

⁴¹ George Catlin, *Illustrations of the Manners, Customs, and Conditions of the North American Indian* (London: H. G. Bohn, 1851), as cited in Runte, *National Parks*.

⁴² National Park Service, "People," last modified September 20, 2017, <https://www.nps.gov/yose/learn/historyculture/people.htm>.

⁴³ Dilsaver, *America's National Park System*, 8.

⁴⁴ M. Spence, "Dispossessing the Wilderness: Yosemite Indians and the National Park Idea, 1864-1930," *Pacific Historical Review* 65 (1996): 27-59.

⁴⁵ An Act Authorizing a Grant to the State of California of the Yosemite Valley and of the Land Embracing the Mariposa Big Tree Grove, 13 Stat. 325 (1864).

Shortly after the park's designation, the Governor of California appointed a commission to develop a management plan. At the time, Frederick Law Olmsted—often hailed as the father of landscape architecture—was living in CA. He was appointed to the commission and developed a report that went beyond a basic management plan to provide an “intellectual framework” for managing the park.⁴⁶ Published in 1865, the report proposed the “preservation and maintenance as exactly as is possible of the natural scenery” of the valley and tree grove.⁴⁷ To do so, Olmsted warned that the park should avoid any development “inharmonious with the scenery,” which was to be the paramount resource preserved. In the report, Olmsted took his time, describing the scenic value of the landscape at length, concluding: “It is the will of the nation as embodied in the act of Congress that this scenery shall never be private property, but that like certain defensive points upon our coast it shall be held solely for public purposes.”⁴⁸

However, Olmsted also outlined the clear utilitarian value of that scenery. Olmsted compared the park's potential for tourism to that of the lands of Switzerland, noting the valley would become a source of wealth for the local and state communities. In addition to providing economic value, Olmsted felt that the United States Government was fulfilling a democratic duty to its people in designating the park: “It is the main duty of the government, if it is not the sole duty of the government, to provide means of protection for all its citizens in the pursuit of happiness against the obstacles, otherwise

⁴⁶ Ethan Carr, “Olmsted and Scenic Preservation,” last modified 2014, <http://www.pbs.org/wned/frederick-law-olmsted/learn-more/olmsted-and-scenic-preservation/>.

⁴⁷ Frederick Law Olmsted, “The Yosemite Valley and the Mariposa Big Tree Grove,” in *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994.), 22.

⁴⁸ Olmsted, “The Yosemite Valley,” 16.

insurmountable, which the selfishness of individuals or combinations of individuals is liable to interpose to that pursuit.”⁴⁹ Central to a citizen’s pursuit of happiness, in Olmsted’s mind, was the opportunity to interact with nature for its soothing effect on one’s mental condition. Without government protection, the opportunity to heal oneself in nature would be available to only the wealthy few (as is historically the case), but it was the duty of Congress to provide the opportunity to all.

Olmsted’s report also contained prose similar to what would one day be written by his own son, Frederick Law Olmsted, Jr., in the 1916 Organic Act’s NPS dual mandate:

“For the same reason that the water of rivers should be guarded against private appropriation and the use of it for the purpose of navigation and otherwise protected against obstruction, portions of natural scenery may therefore properly be guarded and cared for by government. To simply reserve them from monopoly by individuals, however, it will be obvious, is not all that is necessary. It is necessary that they should be laid open to the use of the body of the people.”⁵⁰

Scenery should be preserved, but it should also be available for use. And further, the landscape should be available, in preserved form, to account for the “interest of the uncounted millions” in future generations.⁵¹ Olmsted called for wise and moderated development of roads, trails, cabins, and campsites. And he implored that the state employ experts (principally, landscape architects) to minimize the impact of development.

⁴⁹ Olmsted, “The Yosemite Valley,” 18.

⁵⁰ Olmsted, “The Yosemite Valley,” 21.

⁵¹ Olmsted, “The Yosemite Valley,” 23.

Olmsted's report was among the first documents to clearly link preservation and parks. A half-century later, Olmsted, Jr. would draft the statement of purpose for the National Park Service, embracing the same call to balance preservation and use. Before there would be a National Park Service, there had to be a national park (or twelve). As well, Olmsted's suggestion that the state of California employ landscape architects anticipated the later expansion of landscape architecture in the parks during the 20th century.⁵²

Another origins myth dates the national park idea to a September 19, 1870, discussion among the members of the Washburn-Doane Expedition, as they sat around a campfire in present-day Yellowstone National Park.⁵³ After investigating and mapping the area, they collectively dreamt of a National Park that would protect the wonders and scenery that had so impressed them. They published the results of their expedition, and less than two years later, their dreams would come to fruition.⁵⁴

But in Sellars' telling of the story he is quick to point out an oft glossed-over detail. One member of the expedition, Nathaniel P. Langford, was well connected to Jay Cooke, financier for the Northern Pacific Railroad. Cooke was interested in expanding the railroad into the area, and knew that government lands would be easier to traverse than private lands. And noting the tourism-potential of the scenic wonders in Yellowstone, Cooke (and the railroad industry in general)

⁵² Ethan Carr, *Wilderness by Design* (Lincoln, Nebraska: University of Nebraska Press, 1998).

⁵³ Runte, *National Parks*, 32, 35. Sellars, *Preserving Nature*, 8-10.

⁵⁴ Sellars, *Preserving Nature*, 8. Runte, *National Parks*, 35.

would become among the strongest advocates for the park's designation as a national park. Although appreciation for Yellowstone was at times phrased in the romantic terms of Thoreau and Muir, or lauded for its scenery, such as in the paintings of Thomas Moran, action ultimately stemmed from more economic and political concerns.⁵⁵ Early interest from Cooke persuaded members of Congress to prevent private acquisition of the unusual resources.

In addition, the area overlapped multiple western territories, meaning it would make more sense to retain the land within the jurisdiction of the federal government, as opposed to creating another state park like Yosemite.⁵⁶ During the 1871 legislative debate, advocates emphasized the area's uselessness to society for mining, agriculture, and other development.⁵⁷ So long as it could not be developed for consumptive use, President Ulysses Grant was free to sign off on Yellowstone National Park on March 1, 1872, setting aside more than two million acres of land from private acquisition. The land would be a "public park or pleasuring-ground,"⁵⁸ open to tourism and serviced solely by the Northern Pacific Railroad. Sellars characterizes the Yellowstone Act as a declaration that tourism would be paramount to the budding economy of the West.⁵⁹ And Runte reminds us that "[e]ven with those larger boundaries, the motive was still

⁵⁵ Nash, *Wilderness and the American Mind*. Runte, *National Parks*, 34. Sellars, *Preserving Nature*, 8-11.

⁵⁶ Runte, *National Parks*, 29.

⁵⁷ Nash, *Wilderness and the American Mind*, 112. Runte, *National Parks*, 43-55.

⁵⁸ An Act to Set Apart a Certain Tract of Land Lying Near the Headwaters of the Yellowstone River as a Public Park, 16 U.S.C. § 22 (1872).

⁵⁹ Sellars, *Preserving Nature*, 8.

monumentalism.”⁶⁰ The parks would be managed to support tourism, and not as nature reserves.

Confirming this, each of the early parks, including Yellowstone, Mackinac Island, Mount Rainer, and Yosemite, were developed with resorts and spas, restaurants and luxury hotels. Yosemite Valley even hosted pastures and agriculture.⁶¹ Further, “invariably, park boundaries conformed to economic rather than ecological dictates,” demonstrating that the priority was on scenic features and not ecosystems.⁶² (Though it is worth pointing out that ecology was barely an emerging science at the time—something I’ll discuss in detail in chapter three). Regardless, in setting aside an area almost three times the size of Rhode Island to protect a few known areas containing scenic wonders, the first national parks, especially Yellowstone, would preserve millions of acres of wilderness, even if only “protected by implication” in service of the utilitarian values of the tourism industry.⁶³ In no small part, visuals such as landscape paintings, park photographs (think, Ansel Adams), and coffee-table books would play a role in publicizing and promoting parks—generating tourism to and political support for parks.⁶⁴

⁶⁰ Runte, *National Parks*, 41.

⁶¹ Sellars, *Preserving Nature*, 18.

⁶² Runte, *National Parks*, 48.

⁶³ Sellars, *Preserving Nature*, 7. Runte, *National Parks*, 40-41.

⁶⁴ Finis Dunaway, *Natural Visions* (Chicago: University of Chicago Press, 2008), 3, 23-30.

The Lost Valley

In 1890, during the campaign for Yosemite National Park, the preservationist vision of parks had grown in influence. As we know, Yosemite was home-turf for John Muir, and his involvement would ensure that wilderness and preservation played more of a role in motivations. In fact, Muir was directly involved with specifications for the Yosemite bill that would pass Congress and be signed into law by President Harrison in 1890. Thus, Yosemite again became a site for the intersection of preservation and parks. While other early parks had been driven by recreational tourism, “Muir’s thinking regarding Yosemite and other parks stands out as the most prominent juncture between the park movement and intellectual concerns for nature’s intrinsic values and meanings, as typified by the writings of Ralph Waldo Emerson and Henry David Thoreau.”⁶⁵

Following the designation of Yosemite National Park in 1890, Muir founded the Sierra Club in 1892 for continued stewardship of both Yosemite and Yellowstone. He also continued to build relationships with influential characters, such as Presidents T. Roosevelt and President Taft. In 1906, for example, Muir was directly involved in campaigning for Grand Canyon National Monument, designated by President Roosevelt. The preservationist drive for and relationship to parks, it seemed, had finally emerged in full force—though that’s not to say Muir’s intentions mirrored exactly the intentions of those with whom he collaborated and kept company, nor that preservation truly was the primary driving force behind the preservationist decisions and actions that would result from those relationships.

⁶⁵ Sellars, *Preserving Nature*, 15.

For example, environmental ethicist (and my PhD advisor) Ben Minteer and environmental historian Stephen Pyne point out that the relationship between Muir and Roosevelt was more complicated than the former persuading the latter to preserve American nature during an “inspired campout” in the Sierra Nevada Mountains.⁶⁶ In 1903, Roosevelt visited Yosemite National Park with Muir—a famous photograph shows the pair standing on Glacier Point—and the story, perhaps more myth, goes that it was on that trip that Muir, “convinced Roosevelt to commit the federal government to the protection of the nation’s natural heritage.”⁶⁷ Preservation takes center stage. But Minteer and Pyne recognize that the trip can also be characterized as a political event—one among many brief visits and events Roosevelt undertook to “advance the cause of state-sponsored conservation.” Further, they note that “the politics of state-sponsored conservation was itself intertwined with political and economic reform, the enlargement of American nationalism, and the projection of the United States as a global power.”⁶⁸ In another image from the 1903 trip, Muir, Roosevelt and several other men—the Surgeon General, two University Presidents, the Governor of California, the Secretary of the Navy, as well as Secret Service agents and soldiers—stand in front of an old sequoia tree, called the Grizzly Giant. Minteer and Pyne argue, if you draw the narrative of the trip, and preservation more broadly, from this second photo, you’ll see the pluralism that drove the creation and preservation of parks:

⁶⁶ Ben Minteer and Stephen Pyne, “Restoring the Narrative of American Environmentalism,” *Restoration Ecology* 21 (2013): 7.

⁶⁷ Minteer and Pyne, “Restoring the Narrative of American Environmentalism,” 6.

⁶⁸ Minteer and Pyne, “Restoring the Narrative of American Environmentalism,” 7.

A commitment to patches of preservation does not lie outside of (or in defiance to) American experience any more than religion does. Instead, it thrives as part of American pluralism, as testimony to the abundance that made such practices possible, and as part of a national epic, the frontier, that threw the wild and the wrecked into stark confrontation. All the pieces did not mesh smoothly, any more than any other American experience did, but they were all part of what Roosevelt called a Square Deal.⁶⁹

Still, for better or for worse, the popular story of preservation—and the associated principles of deep ecology, intrinsic values, and nonanthropocentric values—situates it in contrast or competition to other ways of valuing and understanding protection of public lands. As Minter and Pyne put it, preservation and these informing principles were set apart from “the larger cultural and political enterprise,” when in fact “environmental concerns have always been connected with everything else in society.”⁷⁰

Still the narrative of preservation vs. use (or perhaps, vs. everyone) persisted, and to some degree, still persists. And it’s a narrative that was largely established in the turn-of-the-century debate surrounding Hetch Hetchy Valley in Yosemite National Park that would both challenge and crystalize the meaning and practice of preservation in parks by exposing a rift between those who concerned themselves with a version of preservation that stands apart from society, desiring parks to be protected in perpetuity from development and other human impacts, and those who believed in the wise use of public lands, balancing recreation, resource use, and protection.

Muir called Hetch Hetchy Valley, “a grand landscape garden, one of Nature’s rarest and most precious mountain mansions.” In his typical, spiritual prose, Muir described the valley in an essay for the *Sierra Club Bulletin*:

⁶⁹ Minter and Pyne, “Restoring the Narrative of American Environmentalism,” 8.

⁷⁰ Minter and Pyne, “Restoring the Narrative of American Environmentalism,” 9.

As in Yosemite, the sublime rocks of its walls seem to the nature-lover to glow with life, whether leaning back in repose or standing erect in thoughtful attitudes, giving welcome to storms and calms alike. And how softly these mountain rocks are adorned, and how fine and reassuring the company they keep --their brows in the sky, their feet set in groves and gay emerald meadows, a thousand flowers leaning confidently against their adamant bosses, while birds, bees, and butterflies help the river and waterfalls to stir all the air into music -- things frail and fleeting and types of permanence meeting here and blending, as if into this glorious mountain temple Nature had gathered here choices treasures, whether great or small, to draw her lovers into close confiding communion with her.⁷¹

Muir's hope, in describing the valley to the masses, was that the "few cunning drivers" of a plan to build a dam in the valley would be overwhelmed by the continued support of his fellow "mountaineers, nature-lovers, naturalists," and members of his Sierra Club.⁷²

The valley had been considered a potential dam and reservoir of water supply for San Francisco, CA, as early as in 1882, but in 1890 became preserved wilderness as part of Yosemite National Park.⁷³ In 1906, however, a devastating fire and earthquake leveled San Francisco, changing the scope of need and the political context.⁷⁴ Still, President Roosevelt expressed his ambivalence about the reservoir, and he openly sought alternative sites. When none could be found, he ultimately felt it his duty to support the city's request. John Muir wrote to Roosevelt in 1907 calling back to their 1903 trip to Yosemite (including Hetch Hetchy), but—perhaps confirming Minter and Pyne's interpretation of the 1903 trip—Roosevelt replied that national parks should not stand in

⁷¹ John Muir, "The Hetch Hetchy Valley," *Sierra Club Bulletin* 6 (1908): 211-220.

⁷² Muir, "The Hetch Hetchy Valley."

⁷³ Nash, *Wilderness and the American Mind*.

⁷⁴ Runte, *National Parks*, 71.

the way of material development with such obvious need if parks expect to maintain public support in the long term.⁷⁵

In 1908, Interior Secretary Garfield approved the city's request. The municipal application would move to Congress, and Muir would organize the resistance. Over the next several years, Muir and his supporters criticized commercialism and described the valley as one of nature's great temples. They believed they were fighting for more than just the valley; theirs was an effort to stall the destruction and undoing of the national parks. Editorials and op-eds in favor of preservation, including the one I cited from Muir above, were spread across the pages of important publications such as the *New York Times* and *Outlook Magazine*.⁷⁶ Powerful interests joined and bolstered the effort—for example, the American Civic Association (ACA), a professional organization of urban planners and developers with a fondness for the attractive qualities of natural areas and parks. The ACA President, J. Horace McFarland (from 1904-1925) held influential governmental contacts, as high as the President, that helped the ACA garner political support for their own agenda items. McFarland argued that instead of turning the valley over for its consumptive value, it could be developed to provide more recreational value. Eventually combined efforts became so powerful that even Roosevelt was swayed to change his mind (1908). And the House of Representatives killed the city's application in the 60th Congress.⁷⁷

⁷⁵ Nash, *Wilderness and the American Mind*, 163-164.

⁷⁶ Nash, *Wilderness and the American Mind*. For example, the Sierra Club keeps a “vault” of op-eds published in the *New York Times* throughout 1913: “*New York Times* 1913 Editorials Opposing Damming of Hetch Hetchy,” accessed September 21, 2019, https://vault.sierraclub.org/ca/hetchhetchy/ny_times_1913_editorials.html.

⁷⁷ Nash, *Wilderness and the American Mind*.

The tides changed in 1913 with the election of Woodrow Wilson. His Secretary of Interior, Franklin Lane, was a native of San Francisco and sympathetic to plans for a reservoir. Lane upheld previous secretaries' policy that Congress has final say in matters of changing National Parks, but San Francisco was fortunate this time with a mix of more supportive legislators as well. The first of those, Representative John E. Raker (D-CA) introduced the bill for a permit and garnered unanimous support for the reservoir. The legislators agreed that conservation of nature should yield to conservation of human health and need.⁷⁸

The debate around the bill showcased a growing divide among those concerned with the protection of nature. At one hearing, Gifford Pinchot, then Chief of the brand-new U.S Forest Service, testified: To him, it made the most sense to find the purpose for the land that would serve the greatest good for the greatest number.⁷⁹ San Francisco would benefit far more than the mere thousands who visited the wilderness valley.

Pinchot, a forester and efficiency expert, had not always stood so obviously opposed to John Muir and the preservationists. Not long before, Muir had advocated for Pinchot during his campaign to create the U.S. Forest Service within the Department of Agriculture, believing Pinchot would manage the lands with minimal unnecessary destruction.⁸⁰ Even then, their differences were obvious, but their common ground lay in the improved management of forest lands. Muir acknowledged that not all landscapes

⁷⁸ Nash, *Wilderness and the American Mind*.

⁷⁹ Nash, *Wilderness and the American Mind*, 170-171.

⁸⁰ Runte, *National Parks*, 79. This was something the Sierra Club would later hold against Pinchot. When Pinchot expressed his support of the Hetch Hetchy dam, William Colby, Secretary of the Sierra Club wrote to Pinchot: granted the Sierra Club's earlier support of Pinchot's USFS, how could he take a stand against preservation?

could be preserved as wilderness. A growing country needed to use its natural resources, as well, and Pinchot would be the right man for the job, ensuring that only what was needed was taken.⁸¹ Pinchot eventually came to call his brand of land management “conservation.” In contrast to Muir’s “preservation,” “conservation” stood for the wise use of natural resources, to support the needs of a growing nation.⁸²

Pinchot’s “conservation” directed the use of Hetch Hetchy as a reservoir. In response, preservationists began to make concessions, hoping to find compromise. Even John Muir suggested the valley be developed with roads to allow for better access by tourists. According to Runte, “Simply, given a choice in 1910, preservationists preferred roads, trails, and new hotels to reservoirs, power lines, and conduits.”⁸³ Concurring, Sellars believed the reason the Tuolumne River was eventually dammed was the valley’s lack of recreational facilities.⁸⁴

In Congress, preservationists hoped Representative William Kent (I-CA) would be their champion. He had previously been sympathetic to the preservationist cause, and even donated his private land for Muir Woods National Monument.⁸⁵ But perhaps again demonstrating the broader pluralistic, political context in which preservation existed (and

⁸¹ Tweed, *Uncertain Path*. Nash, *Wilderness and the American Mind*. Runte, *National Parks*.

⁸² Nash notes that although Pinchot claimed to coin the term, there is evidence of earlier use by others (note 55), Nash, *Wilderness and the American Mind*, 139. Also, though Pinchot has long been painted as an economic, development-oriented utilitarian with little regard for the aesthetic, moral, and spiritual values of nature that propelled Muir, his reputation experienced a bit of a reassessment in the wake of Char Miller’s book, *Gifford Pinchot and the Making of Modern Environmentalism* (Washington, D.C.: Island Press, 2001).

⁸³ Runte, *National Parks*, 81.

⁸⁴ Sellars, *Preserving Nature*, 16.

⁸⁵ National Park Service, “Muir Woods, People,” last modified February 2, 2016, <https://www.nps.gov/muwo/learn/historyculture/people.htm>.

exists), Kent also wanted to protect public ownership over utilities. Municipal control through the reservoir would prevent Pacific Gas and Electric Company control later. Kent would even call on his previous support of preservationists as evidence that his support of the reservoir should not be taken lightly. With Kent's support, the bill passed the House, and would go on to pass the Senate as well, both by wide margins. By December 19, 1913, the bill was signed into law by President Woodrow Wilson.⁸⁶

Though the battle was lost, Muir relished in the fact that “the conscience of the whole country [had] been aroused from sleep.”⁸⁷ And as we'll see, the publicity and political strategies that preservationists had honed during the campaign would become indispensable on the road to the NPS. Nash also notes this episode as a turning point: the preservationist message was officially mainstream. One hundred and fifty years earlier—even only twenty years earlier—a similar proposal would have encountered a much smaller, meeker protest, if at all: “Traditional American assumptions about the use of undeveloped country did not include reserving it in national parks for its recreational, aesthetic, and inspirational values.”⁸⁸ But at the turn of the century, Muir, McFarland, and others could stir protest because Americans were ready for it. The extent and long-term vigor of their efforts exemplified this new state of thought. Also, very few legislators favored the dam because they opposed wilderness. In fact they felt compelled to proclaim their love of nature during Congressional sessions, even though through their votes they were placing the needs of people first. Previously, legislators would not have felt the need

⁸⁶ The Raker Act, 38 Stat. 242 (1913).

⁸⁷ Nash, *Wilderness and the American Mind*, 180.

⁸⁸ Nash, *Wilderness and the American Mind*, 181.

to rationalize a decision in the name of development “For three centuries [Americans] had chosen civilization without any hesitation. By 1913 they were no longer so sure.”⁸⁹

And yet, Hetch Hetchy was gone, leaving preservationists to wonder: if Yosemite wasn’t safe, could any park ever be?

The Long and Winding (Rail-)Road to a U.S. National Park Service

Even before the conservationists claimed victory in 1913, McFarland had wondered if the parks would be better protected from such threats under a more unified front: a government agency of their own.⁹⁰ Indeed, the drowning of Hetch Hetchy and the concerns it raised would, in part, fuel the campaign for a U.S. National Park Service, led by many of the same cast of characters with a similar vision of preservation.⁹¹ Parks, as scenic wonders, would be safer if they could be united and better developed for use by a supportive public for generations to come. A look back on the act’s legislative history can inform questions of park purpose and management, as well as inform a definition of park preservation for the period—and identify the broader cultural and political context within which the idea of preservation continued to evolve. What values bore on the intentions and actions of advocates and opponents lobbying for and against the NPS?

Preservationists, policy-makers, railroad executives, and many others were involved in crafting and lobbying the Organic Act, each with different motives.

⁸⁹ Nash, *Wilderness and the American Mind*, 181.

⁹⁰ Sellars, *Preserving Nature*, 30. This was uncovered in a letter from McFarland to Pinchot in which McFarland had suggested the agency to Sect. Ballinger. Ballinger would go on to suggest it to President Taft.

⁹¹ Tweed, *National Parks*, 92-93.

The idea for a National Park “Service” or “Bureau” entered the legislative agenda sometime between 1910 and 1912, when the problems associated with uncoordinated management coincided with a politically receptive climate (à la Hetch Hetchy and a mostly sympathetic Congress, complemented by powerful executive branch and interest group advocates, such as McFarland’s ACA). As national park historian Richard Sellars observed, “The legislative history of the Organic Act provides no evidence that either Congress or those who lobbied for the act sought a mandate for an exacting preservation of natural conditions.”⁹² Driving home the point that a pluralism of values and intentions contributed to the preservation of national parks, my review of hearings and congressional records highlights the economic and administrative concerns and drivers associated with creating the new bureau. Muir’s and the preservationists’ impact can still be seen in the Congressional record; his name and authority are mentioned throughout hearings and in committee reports. Though he passed away in 1914, before the passage of the Organic Act, he was a prominent advocate whose influence continued after his death through his relationships with key characters in the legislative history.

In 1872, Yellowstone became the first landscape to be christened as a national park. And in the next four decades, eleven more “crown-jewels” were designated, including Mount Rainier, Glacier, Mesa Verde, and Rocky Mountain National Parks, each under independent legislation with different guiding rules for appropriations and administration. Contributing to the number and diversity of protected public lands, the Antiquities Act of 1906 gave the U.S. President the power to set aside public lands to protect “historic landmarks, historic and prehistoric structures, and other objects of

⁹² Sellars, *Preserving Nature*, 29.

historic or scientific interest...”⁹³ According to Sellars, the Antiquities Act was the result of “political pressure brought mainly by anthropologists seeking to prevent vandalism to the nation’s prehistoric treasures...”⁹⁴ Though the act was stimulated by cultural resource preservation, Theodore Roosevelt set an instant precedent for interpreting the act broadly, setting aside several monuments within the year to protect the historical, geologic, and scenic wonders in Devils Tower, Petrified Forest, Montezuma Castle, and El Morro National Monuments, and later Grand Canyon and Mount Olympus—officially expanding the meaning of “historic” or “scientific” objects to include entire landscapes.⁹⁵

By 1912, financial and legal inefficiencies began to accumulate, to the dismay of then Secretary of Interior, Walter L. Fisher. Though all the parks and some of the monuments were the legal responsibility of Secretary Fisher, the uncoordinated legislation and management impeded his ability to develop and implement a comprehensive management plan. The spread of wealth was uneven among the parks, leaving some more developed and better managed—often “local tensions and whims” determined appropriations, as opposed to real need.⁹⁶ And there was not enough engineering or natural history expertise to go around, necessitating dependence on other agencies to lend “detail” so that work on roads, facilities, and landscaping could be completed (e.g. U.S. Forest Service, Army Core of Engineers, War Department, etc.).

⁹³ American Antiquities Act of 1906, 16 U.S.C. § 432 (1906).

⁹⁴ Sellars, *Preserving Nature*, 13.

⁹⁵ Runte, *National Parks*, 67. Sellars, *Preserving Nature*, 13.

⁹⁶ Secretary Fisher speaking, U.S. Congress, House of Representatives, Committee on the Public Lands, *Establishment of a National Park Service: Hearing before the Committee on the Public Lands*, 62nd Cong., 2nd sess., 1912, 6-9.

Plus, there were also the 28 National Monuments managed under three different agencies: 17 in the Department of Interior, ten in the Department of Agriculture (USFS), and one in the War Department. It follows that there was an even greater lack of consistency in the development and management of National Monuments.⁹⁷

Secretary Fisher recognized the needs of a growing and uncoordinated park system, and he argued that improved development and management were required to support increasing visitor numbers and demands. A new bureau dedicated solely to the U.S. National Parks would foster a necessary systematic approach to park management.⁹⁸ Although Secretary Fisher played an influential administrative role in pushing national parks onto the legislative agenda, it would be a mistake to ascribe him sole responsibility. For example, he was appointed by and served under President William Howard Taft (from 1911 until 1913), whose own presidential agenda likely influenced the attention Fisher gave to the parks. President Taft, who had enjoyed a tour of the parks led by none other than John Muir, submitted his own personal statement in support of a National Parks Bureau in 1911.⁹⁹ He spoke of the beauty of national parks and the need to invest in a bureau: "...utility involves expense...It is going to add to the expense of the Interior Department, and it is going to swell those estimates, but it is essential that we should use what the Lord has given us in this way and make it available for the people."¹⁰⁰

⁹⁷ U.S. Congress, House, Committee, *Establishment of a National Park Service*.

⁹⁸ U.S. Congress, House, Committee, *Establishment of a National Park Service*.

⁹⁹ William O. Douglas, "John Muir's Public Service," last modified 2019, http://vault.sierraclub.org/john_muir_exhibit/life/muir_publicservice_douglas.aspx.

¹⁰⁰ U.S. Congress, House of Representatives, Committee on the Public Lands, *National Park Service: Hearing before the Committee on the Public Lands*, 63rd Cong., 2nd sess., 1914, 6.

Interest groups external to the government supported and shaped the administrative agenda put forth by President Taft and Secretary Fisher. These groups became particularly important (as seen in the congressional record and in presence at congressional hearings) because of their powerful, unified message that the bureau would enable better preservation of spectacles and scenery for enjoyment by the people. As mentioned, The American Civic Association had supported a National Park Bureau as early as 1910, when McFarland provided a statement to then Secretary of Interior Richard Ballinger arguing that a bureau could protect other parks from meeting the same fate as Yosemite's Hetch Hetchy Valley.¹⁰¹ Between 1911-1912, three bills to create a "Bureau of National Parks" were introduced, two in House of Representatives and one in the Senate.¹⁰² The ACA became the leading interest group lobbying in support of each of these.¹⁰³ McFarland was also responsible for recruiting Harvard alum and landscape architect, Frederick Law Olmstead, Jr., to the campaign. Olmstead, Jr., would go on to draft the significant statement of purpose that still guides park management today.¹⁰⁴

¹⁰¹ Sellars, *Preserving Nature*. Runte, *National Parks*.

¹⁰² U.S. Congress, Senate, *To establish a Bureau of National Parks, and for other purposes*, S 3463, 62nd Cong., 2nd sess., introduced in the Senate December 7, 1911, https://congressional-proquest-com.ezproxy1.lib.asu.edu/legisinsight?id=62%20S.%203463&type=BILL_DOC. U.S. Congress, House, *To establish a Bureau of National Parks, and for other purposes*, HR 16090, 62nd Cong., 2nd sess., introduced in the House December 16, 1911, https://congressional-proquest-com.ezproxy1.lib.asu.edu/legisinsight?id=62%20H.R.%2016090&type=BILL_DOC. U.S. Congress, House, *To establish a National Park Service, and for other purposes*, HR 22995, 62nd Cong., 2nd sess., introduced in the House April 8, 1912, https://congressional-proquest-com.ezproxy1.lib.asu.edu/legisinsight?id=62%20H.R.%2022995&type=BILL_DOC.

¹⁰³ Sellars, *Preserving Nature*.

¹⁰⁴ Sellars, *Preserving Nature*.

Tracking the ACA's role in this legislative history also reveals some of the external events that added to the pressure to create a bureau for the national parks. First, as detailed above, the ACA had been involved in the long and ultimately failed campaign to prevent construction of a dam in the Sierra Nevada Mountains that flooded Hetch Hetchy Valley. Failure was in part ascribed to the lack of organized resistance across the parks, which was not possible without coordinated, systemic leadership.¹⁰⁵ The ACA had also tasted disappointment at Niagara Falls decades before. Despite an ACA campaign, the Falls fell to development—the unseemly industrial kind—and the ACA lost the opportunity to develop an aesthetically appealing and economically lucrative tourist destination.¹⁰⁶ The ACA vowed to stop this from occurring in the national parks and believed that supporting the creation of a bureau would bolster national parks against such ends.¹⁰⁷

Running on tracks laid down decades earlier through Jay Cooke's involvement in the establishment of Yellowstone National Park, railroad executives became the most powerful of the business interests advocating for a National Parks Bureau. They supported the parks idea because the lands were most useful (and lucrative) to them as public lands; Americans would ideally ride the rails to visit the magnificent public landscapes in the west.¹⁰⁸ Indeed, the railroads became the major mode of transport for

¹⁰⁵ Runte, *National Parks*. Sellars, *Preserving Nature*.

¹⁰⁶ Runte, *National Parks*.

¹⁰⁷ Sellars, *Preserving Nature*. Runte, *National Parks*, 78-79.

¹⁰⁸ Nash, *Wilderness and the American Mind*. Runte, *National Parks*. Sellars, *Preserving Nature*. U.S. Congress, House of Representatives, Committee on the Public Lands, *National Park Service: Hearing before the Committee on the Public Lands*, 64th Cong., 1st sess., 1916.

early visitors to the parks. They also played a role in promoting the parks; they spent many advertising dollars on campaigns to bring visitors to the great western parks via the railways.¹⁰⁹ In addition to the railroads, visitors also boosted the hotel, spa, and concessionary industries in Yellowstone, Yosemite, and other early national parks. Thus, the interests of the industrial tourism sector were at the center of lobbying efforts to create a National Park Service, marking the continuation of a relationship of convenience between preservationists and the tourism industry.

Between 1910 and 1916, park leaders and interest groups from within and outside of the government convened in several National Parks Conferences, facilitating the unification of an administrative agenda.¹¹⁰ Organized by the Department of Interior, these conferences were recognized in the congressional record as important supporting evidence for an NPS.¹¹¹ The conferences importantly brought together the powerful voices of the ACA, the railroads, supportive bureaucrats, and park leaders to develop a coherent and cohesive message for Congress: The national parks require centralized control. A bureau would facilitate coordinated management and allow the fair disbursement of appropriations so that all parks could be equally developed for tourism. The overwhelming majority of participants were from the business sector, particularly railroads and concessionaires, and thus the meeting message emphasized economic justifications for creating an NPS, rather than preservation.¹¹²

¹⁰⁹ Alfred Runte, *Trains of Discovery: Railroads and the Legacy of Our National Parks* (Lanham, Maryland: Roberts Rinehart Publishers, 2011, rev. 5th ed.).

¹¹⁰ Sellars, *Preserving Nature*, 32-33.

¹¹¹ U.S. Congress, House, Committee, *Establishment of a National Park Service*.

¹¹² Sellars, *Preserving Nature*, 32.

Despite strong support and messaging, the first bills to establish a “Bureau of National Parks” were not successful.¹¹³ The united front and executive support for a National Parks Bureau could not quell financial and administrative concerns throughout Congress. For example, Representative Franklin Mondell (R-UT) argued that the management of the National Parks was surely too simple a task to require the expense and oversight of its own bureau. He proposed designating a simple “division” instead, with very minimal financial support. He also believed there would not be additional parks, and there was thus no need for expansion of management capacity.¹¹⁴ Further, a familiar foe, the USFS opposed the transfer of National Monuments to the Park Service because “large bodies of timber” within such monuments should be for commercial purposes.¹¹⁵ Though not as steadfastly opposed to an NPS as his predecessor, Pinchot, USFS Chief Henry S. Graves, made it clear that there should be no overlap between forests and parks. Sellars characterizes the USDA/USFS resistance as “bureaucratic territorialism.”¹¹⁶ Ultimately and with most effect, the Appropriations Committee in both chambers of Congress could not be convinced that a new bureau would be fiscally

¹¹³ The first bill to establish a “Bureau of National Parks” was presented in the U.S. Senate by Utah Senator Reed Smoot (R) (S. 3463, 1911). Very similar bills were likewise introduced in the House of Representatives (H.R. 16090, 1911, introduced by James H. Davidson (R-WI); and H.R. 22995, 1912, introduced by John E. Raker, (D-CA), a familiar face. Raker had supported the dam in Hetch Hetchy. In all instances, the bills were read and referred to the Committee on Public Lands (which existed in both chambers of Congress, except that in the House is was officially called the “Committee on *the* Public Lands”). Ultimately, the bills were not fruitful.

¹¹⁴ U.S. Congress, House, Committee, *Establishment of a National Park Service*, 22.

¹¹⁵ U.S. Congress, House, Committee, *Establishment of a National Park Service*.

¹¹⁶ Sellars, *Preserving Nature*, 35.

responsible for the U.S. government.¹¹⁷ Thus, the bills between 1911 and 1912 were not passed, but the campaign for an NPS was not erased from the agenda.

Many in Congress shared Representative Mondell’s concerns about the unnecessary spending and bureaucratic growth that would result from creation of a National Parks “Bureau.” Although it did not pass, the Senate bill (S. 3463, 1911) was successfully amended such that instead of a separate Bureau, the bill sought to establish a “National Park Service.” Subsequent bills would each adopt similar language, largely because it was thought that a “Service” within the Department of Interior would require less spending and simplify the appropriations process (as opposed to the complicated process that could result from the designation of an entirely new bureau). So, in part to ease concerns over a redundant and expensive new bureau, the Senate agreed to “downgrade” to a “service,” thus coining what would become the “National Park Service.”¹¹⁸

In addition to discovering that a “Service” was more acceptable than a “Bureau,” largely for fiscal reasons, support for the cause between 1913 and 1916 was more effective due to the emergence of a powerful group of advocates composed of congressional committees, bureaucrats, and interest groups.¹¹⁹ In both houses of

¹¹⁷ U.S. Congress, House, Committee, *National Park Service*, 1914. U.S. Congress, House, Committee, *National Park Service*, 1916.

¹¹⁸ U.S. Congress, House, Committee, *Establishment of a National Park Service*. U.S. Congress, Senate, Committee on Public Lands, *Bureau of National Parks: Report (to Accompany S. 3463)*, 62nd Cong., 2^d sess., 1912, S. Rep. 676-62). U.S. Congress, Senate, Committee on Public Lands, *Bureau of National Parks: Hearing before the Committee on Public Lands*, 62nd Cong., 2nd sess., 1912.

¹¹⁹ Between 1913 and 1916 (across the 63rd and 64th Congress), four bills were introduced: three in the House of Representatives (H. R.104, 1913; H.R. 434, 1915, both introduced by Representative John E. Raker (D-CA); H.R. 8668, 1916 introduced by Representative Kent (I-CA))—who you’ll also recognize from the Hetch Hetchy campaign—and one in the Senate (S. 826, 1913), again introduced by Senator Reed. Smoot, Chairman of the Committee on Public Lands). Components of two (H.R. 434 and H.R. 8668)

Congress, sympathetic congressmen populated the Committee on (the) Public Lands and congressional staff worked hard to craft a bill that could appease the Appropriations Committee and garner broad appeal with Congressmen. These committees also hosted hearings in which Congressmen and others could advocate.

Perhaps surprisingly, two of the strongest congressional advocates for an NPS had previously supported the campaign to flood Hetch Hetchy. Representatives John E. Raker (D-CA) and Willam Kent (I-CA)) acted as chief sponsors to several of the bills that were put before Congress to create an National Park Bureau or Service. Representative Kent, sometimes called the “Father of the National Park System,” even sponsored the bill that would eventually become the 1916 Organic Act.¹²⁰ During the Hetch Hetchy debate, preservation had fallen to utility, in large part because of Kent’s and Raker’s support of the dam. Their support of the National Park Service demonstrates that they believed preservation was still an admirable and worthwhile goal, just not when human needs were in conflict. It follows that they saw no competing human needs that would create obstacles for the NPS; this time utility and preservation aligned.

In addition, there was executive support; both President Wilson and Secretary Lane supported creation of a NPS, so the matter remained on the administrative agenda. Most influential was Secretary Lane’s choice of Mather to head the latest lobbying

were combined into H.R. 15522, which would lead to the Organic Act of 1916 through hearings with the Committee on Public Lands.

¹²⁰ R. Winks, “Robin Winks on the Evolution and Meaning of the Organic Act,” *The George Wright Forum* 24 (2007), 6-21. Congressman Kent is often called “father of the National Park System.”

campaign and to manage the parks (and eventually, to direct the National Park Service).¹²¹

Mather was a self-made borax industry executive who had always personally appreciated nature for its healing and inspiring qualities. He came to be passionate about the national parks idea after meeting John Muir on a visit to Yosemite when it was still a state park.¹²² Upon seeing its poor condition and deficient management in the park, he became inspired to take on the challenge of advocating for a government agency that would systematically govern national parks and protect them from such degradation.¹²³ He abandoned his own business ventures to move to D.C., and he spent a considerable portion of his own wealth supporting the National Park Service through its origins and infancy.¹²⁴ His great wealth and political know-how helped bring the national parks idea to life, especially with his influence on politicians and railroad industry executives.¹²⁵ In addition, Mather was a “marketing genius,” who believed that “if the parks were to be used, they had to be publicized.”¹²⁶ And he went straight to work doing so.

Mather recognized that “[t]he opportunity for publicity [was] ripe”¹²⁷ and he hired essayist Robert Sterling Yard, as well as developed relationships with other members of

¹²¹ U.S. Congress, House, Committee, *National Park Service*, 1914. U.S. Congress, House, Committee, *National Park Service*, 1916.

¹²² Tweed, *Uncertain Path*, 82.

¹²³ The Sierra Club, “*Stephen T. Mather*,” last modified 2019, accessed April 30, 2015, http://vault.sierraclub.org/john_muir_exhibit/people/mather.aspx.

¹²⁴ U.S. Congress, House, Committee, *National Park Service*, 1916.

¹²⁵ Sellars, *Preserving Nature*.

¹²⁶ Tweed, *Uncertain Path*, 82.

¹²⁷ U.S. Congress, House, Committee, *National Park Service*, 1916, 30.

the media, to publicize the parks and to demonstrate public popularity to Congress. Yard played up the successful tourism industries of Switzerland and Canada asking Congress in one hearing why we wouldn't foster the same economic benefits here in the US? (National Park Service 1916; Sellars 2009).

In Congress, Mather appealed as the best choice to lead the nascent NPS. During a hearing before Congress on April 5, 1916, Mather subdued Congressional fears that money might be mismanaged; his friendly relationship with railroad industry executives and his successful record as a businessman made him an appealing person to lead a new penny-pinching "service" in the Department of Interior.¹²⁸ For example, Representative Kent said of Mather:

"I feel that we are going to be able to show, as a result of these hearings, that our park system, under the management not only of one of the most public-spirited men in America, but one who is a remarkably able businessman, is going to be self-supporting without extortion from the traveling public."¹²⁹

Mather preferred developing the parks so that they could better handle hordes of visitors and provide revenue: "Without facilities to accommodate the public, a national park would be 'merely wilderness, not serving the purpose for which it was set aside, not benefitting the general public.'"¹³⁰ Like Kent, Mather's brand of preservationism, though initially inspired by his adventures with Muir, was distinctively more practical. Parks

¹²⁸ U.S. Congress, House, Committee, *National Park Service*, 1916. Runte, *National Parks*. Sellars, *Preserving Nature*.

¹²⁹ U.S. Congress, House, Committee, *National Park Service*, 1916, 76.

¹³⁰ Mather quoted in Sellars, *Preserving Nature*, 63.

would not be parks without development, and the alternative, “merely wilderness,” would not satisfy the needs of the nation for outdoor recreation and natural encounters.

Finally, interest groups like the ACA (still led by McFarland) and railroad executives continued to voice their support of any efforts to establish a centralized agency governing the parks. Mather’s relationship with railroad executives maintained and cultivated their support, including a \$40,000 investment by the industry into joint-advertisements for the parks and the railroads.¹³¹

Each of these advocates can be connected to John Muir. Of course, his preservationist message was not touted in front of the entirety of Congress to justify a National Park Service, but he maintained key relationships with many of the political advocates, including Congressmen like Kent, bureaucrats such as Mather, and Muir’s past work in cooperation with the ACA. So although the justification to Congress was mostly fiscal and administrative, Muir’s preservationist fingerprints were all over the institutionalization of parks.

Despite the powerful advocates, Congressional support for H.R. 15522 was not unanimous (or without strings attached). Representative Kent introduced H.R. 15522 into the 64th Congress on May 10, 1916, and the bill subsequently went through a four-month process of committees, amendments, and conference before coming into its final iteration. After passing the House on July 1, 1916, the bill was introduced into the Senate and referred to their Committee on Public Lands. Feeling that the Secretary of Interior should have more personal jurisdiction over personnel in the NPS, the Senate introduced an amendment to allow the Secretary of Interior to create new employee positions as

¹³¹ U.S. Congress, House, Committee, *National Park Service*, 1916.

deemed necessary (as opposed to the inefficient process of Congress appointing and appropriating for new positions each time).

Senate members also voted to remove the provision for the Secretary of the Interior to allow grazing and livestock within parks and monuments. Members of the House argued, however, that there were too many benefits of grazing to ban it. For example, at the time it was thought that grazing could help protect the NPS from catastrophic fire.¹³² They contended that grazing should be allowed in areas not frequented by tourists, and that allowing grazing would also generate revenue. Representative Kent, who owned a ranch in Nevada, was sympathetic to the interests of ranchers, and he may have had an influence on the decision by the House of Representatives to allow for the grazing provision. And though Mather personally disagreed with the provision, he recognized that Kent's influence was politically necessary and thus publically advocated for the provision during congressional hearings.¹³³

Scenic preservation would be the leading purpose of parks, but ultimately, consumptive use could not be entirely avoided. After several days of deliberation in the Conference Committee, H. R. 15522 passed with the first amendment accepted and the second (denying grazing privileges) discarded but with the compromise that Yellowstone would be exempt from grazing.

¹³² A theory that holds up today; grazing reduces the fuel load. Joel M. Diamond, Christopher A. Call, and Nora Devoe, "Effects of targeted cattle grazing on fire behavior of cheatgrass-dominate rangeland in the norther Great Basin, USA," *International Journal of Wildland Fire* 18 (2009): 944-950. Adam C. Liedloff et al., "Modelling the trade-off between fire and grazing in a tropical savanna landscape, northern Australia," *Environment International* 27 (2001): 173-180.

¹³³ Sellars, *Preserving Nature*.

On August 25, 1916, U.S. President Woodrow Wilson signed The National Park Service Organic Act.¹³⁴ Congressional support for the bill was bipartisan, as the main concerns for the bill had been fiscal as opposed to ideological. With strong support from the Committee on Public Lands, Secretary Lane, Stephen Mather, and the ACA and the railroad industry, the bill became public law. The law gives power to the Department of Interior of the executive branch. The President appoints the Director of the National Park Service (Mather would be the first), and the Secretary of Interior (also a Presidential appointee) appoints all other administrative positions. The funding would come from Congressional appropriations, as well as park entrance fees (as few as possible to maintain accessibility to the entire public).

As mentioned earlier, another notable voice in the creation story of the National Park Service was that of landscape architect and proud preservationist, Frederick Law Olmsted, Jr., who wrote part of the Organic Act, including the statement of purpose. True to his disciplinary roots, and similar to his father, Olmsted, Jr., pushed the value of the parks as places of scenic appeal.¹³⁵ He saw the creation of national parks as an opportunity to protect remarkable landscapes from the detriment of commercial and consumptive use, and thus parks should be kept “unimpaired” for generations to come (the preservation mandate).

“Unimpaired” is not specifically defined in the legislation. Sellars argued that at the time it most likely referred to scenery as opposed to ecology because (1) the field of ecology had not fully formed and (2) unimpaired scenery was the draw for tourists who

¹³⁴ National Park Service Organic Act, 16 U.S.C. § 1 (1916).

¹³⁵ Nash, *Wilderness and the American Mind*. Carr, *Wilderness by Design*.

would deliver the promised economic benefits of the NPS.¹³⁶ Another parks historian and Yale professor, Robin Winks concurs, noting that later publications by Olmstead, Jr., including a list of criteria for approving various uses of parks, clarify his meaning and demonstrate that his priority was the protection of scenery.¹³⁷ Winks also contends that if you examine evidence beyond the Congressional record (meetings, writings, speeches, social circles, etc.) it becomes clear that Olmstead's intention for the Organic Act was to prioritize preservation over use.¹³⁸ In my reading, different advocates, from the ACA to the Railroads, from Mather to Muir, had different motives—again, preservationist action was underwritten by pluralistic values. The original *Congressional* intent for preservation *appears* to have been strictly in the scenic sense to encourage tourism and the associated economic benefits. But the flexible language in the act allowed stakeholders to find common ground at the time, and it would also allow for later evolution of meaning in future legislation and policy. Especially, the door was left open for later ecological and environmental perspectives to influence the interpretation and implementation of preservation, with a growing focus on ecological methods of achieving an “unimpaired” state.

¹³⁶ Sellars, *Preserving Nature*.

¹³⁷ Winks, “Robin Winks on the Evolution.” Olmstead's five criteria for approved park “use”: (1) burden of proof must rest on those who advocate for non-park purposes/uses; (2) enterprise must be of social importance on a national scale and not practicably attainable elsewhere; (3) must not endanger the original purpose of the park; (4) danger must be slight enough not to endanger the status of the park as a park; and (5) purpose of non-park use must be nationally more important than the park's original intended purpose.

¹³⁸ Winks, “Robin Winks on the Evolution.”

Mather and his Men

Such change would not occur immediately or quickly. Almost all historians agree that the first decade of the park service is instead defined by stability, conferred by the consistent leadership of Mather and his men. Having been closely involved with the passage of the Organic Act, they did not question how to interpret and act upon it. Some historians even extend the era of “perpetuating tradition” close to a second decade, given that Mather’s right hand man and protégé, Horace Albright, would eventually take over for Mather as the second director of the park service in 1929.¹³⁹ Mather and Albright also handpicked their superintendents, embedding their philosophies across time and space, beyond Washington and throughout the parks.¹⁴⁰ Together, they led with policies fitting their utilitarian vision of preservation: parks were to be preserved for the scenery that made them attractive as tourism destinations, and development would lend to parks’ accessibility and promise to uphold the highest American ideal, democracy.¹⁴¹

The first major policy document for the park service, the 1918 Lane Letter, detailed and confirmed Mather’s philosophy for parks. Written by Albright for Interior Secretary Franklin Lane, the letter leads with three principles that reiterate the Organic Act and re-appear in policy documents to the present day:

“First that the national parks must be maintained in absolutely unimpaired form for the use of future generations as well as those of our own time;

¹³⁹ Stephenson goes further, grouping the entire first five decades of park service history together as the “Era of Spectacles.” During this time, the utilitarian values that guided park service officials were rooted in their desire to pull guests to the parks, but it seems to have been the aesthetic value of the park landscapes (the natural spectacles) that motivated Americans to visit and explore their national parks. N. L. Stephenson, “Making the Transition to the Third Era of Natural Resources Management,” *The George Wright Forum* 31 (2014): 227-235. “Perpetuating tradition” comes from Sellars, *Preserving Nature*.

¹⁴⁰ Dilsaver, *America’s National Park System*, 53.

¹⁴¹ Sellars, *Preserving Nature*.

second, that they are set apart for the use, observation, health, and pleasure of the people; and third, that the national interest must dictate all decisions affecting public or private enterprise in the parks.”¹⁴²

Preservation was to be prioritized, and use would be secondary. But the letter continues with a utilitarian vision, emphasizing the recreational value of parks. The letter addresses concession policies, provides rules for leasing, authorizes some tree cutting and grazing, and encourages cooperation with other government agencies to achieve tourism goals and raise awareness of the parks as destinations.¹⁴³ Reflecting Mather’s and Albright’s values, “the parks [would] be kept accessible by any means practicable.”¹⁴⁴

Parks had to be accessible as part of their justification for existence.¹⁴⁵ With Hetch Hetchy fresh in memory and well-connected political rivals at the USFS making moves on potential park lands, Mather and his men knew that parks must be developed to demonstrate their recreational value.¹⁴⁶ Accordingly, the parks were in the business of employing landscape architects responsible for the development of roads, trails, and visitor facilities. Further, it was believed a democratic duty to ensure access to parks. The western landscape parks, however, were remote from larger population centers in the eastern US, and thus railroads were necessary to transport visitors and concessionaires.¹⁴⁷

¹⁴² Franklin Lane, “Secretary Lane’s Letter on National Park Management,” in *America’s National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 48-52 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), Originally published in 1918.

¹⁴³ Sellars, *Preserving Nature*.

¹⁴⁴ Lane, “Secretary Lane’s Letter,” 50.

¹⁴⁵ Carr, *Wilderness by Design*.

¹⁴⁶ Dilsaver, *America’s National Park System*, 53.

¹⁴⁷ Dilsaver, *America’s National Park System*, 53.

One of the first tests for the young NPS and Mather's utilitarian management philosophy would be confronting the Federal Power Act of 1920, an act that authorized dam construction on public lands.¹⁴⁸ Hetch Hetchy on their minds, NPS advocates launched into action and successfully fought for an amendment (1921) excluding national parks from dam construction without specific further Congressional approval. This is particularly interesting granted that McFarland and the ACA in part conceived of the NPS as a preventative measure against future dams (or similar destructive development) in national parks.

Though development for enjoyment and use was a priority under Mather, there are also internal documents dating to this period that showcase efforts to carefully balance the needs of tourism and enjoyment with preservation. For example, in 1922 superintendents gathered at a NPS Conference in Yosemite National Park passed a resolution encouraging development but warning against *over-development*.¹⁴⁹ The greatest good in parks would be achieved by building roads and facilities in parks, but the superintendents also realized that development in parks should not be uniform: "...in a mountainous region, the principle roads may be best located in the valleys, leading to the principal scenic points. Trails may be built up the tributary streams. The greater portion of the area, including the high regions, the ridges and the peaks will be left untouched,

¹⁴⁸ Dilsaver, *America's National Park System*, 53-54.

¹⁴⁹ U.S. Department of Interior, National Park Service, "Superintendents' Resolution on Overdevelopment," in *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 57-61 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), Originally published in 1922.

but still accessible to those with sufficient vigor and enthusiasm”¹⁵⁰ Acknowledging the limits of development, they argue that although roads and structures set parks properly apart from wilderness, development must be “properly directed,” a challenging, undefined task for the “best judgment and active work of all concerned.”

In addition to more nuanced views of development in parks, new visions of preservation were also starting to sprout toward the end of the park service’s early years. Policies alluded to an evolving understanding of preservation as not only geared toward scenery, but (in a fuller, more legally adequate reading of the Organic Act) also other important (valued) processes, features, and natural resources in parks that contributed to the full park experience for visitors.¹⁵¹ For example, Director Albright released a 1931 memo revising several years of predator policy. In national parks, he declared, predators would have a place in nature. His policy made it an NPS duty to “maintain examples of the various interesting North American mammals under natural conditions.”¹⁵² In addition, Albright approved a 1931 forestry and fire policy, seemingly informed by the NPS’s first fire control expert.¹⁵³ The list goes on, including a 1933 statement on the importance of parks being open to research. In the document, Albright admits that data for managing parks was inadequate, and he notes that opening the parks to more science,

¹⁵⁰ U.S. Department of Interior, National Park Service, “Superintendents’ Resolution on Overdevelopment,” 59.

¹⁵¹ Dilsaver, *America’s National Park System*, 2. He calls it “object preservation.”

¹⁵² Horace M. Albright, “The National Park Service’s Policy on Predatory Mammals,” in *America’s National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 87-88 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), originally published in 1931, 88.

¹⁵³ Horace M. Albright, “A Forestry Policy for the National Parks,” in *America’s National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 89-98 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), originally published in 1931.

primarily through strategic partnerships with other agencies, could aid in determining causes of adverse conditions in parks.¹⁵⁴

Sellars, however, noting the timing of this and other statements, believes that many of Albright's memos and policies were actually drafted, or at least heavily influenced, by a new cadre of park wildlife biologists.¹⁵⁵ Around the same time, biologists, most from institutions outside of the park service, had begun to argue that the National Park Service needed to incorporate the growing body of natural history and biological knowledge into management practices.¹⁵⁶ Biologist George Wright was a particularly famous critic of the park service. In 1928, he wrote a letter to Director Albright urging him to develop in-house biological expertise. To Sellars' point, Albright ignored Wright's request, but in 1929 Wright succeeded in self-funding the first scientific report on the parks (published in 1932).¹⁵⁷

In Wright's report, *Fauna of the National Parks*, he argues for more active, ecologically informed management of national parks.¹⁵⁸ Wright details a new management philosophy, informed by an awareness of habitats, species extinctions, native vs. exotic species, and employee training in wild life problems. He acknowledges

¹⁵⁴ Horace M. Albright, "Research in the National Parks," in *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 122-131 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), originally published in 1933.

¹⁵⁵ Sellars, *Preserving Nature*, 98.

¹⁵⁶ Sellars, *Preserving Nature*.

¹⁵⁷ George M. Wright, Joseph Dixon, and Ben Thompson, "Fauna of the National Parks of the United States, a Preliminary Survey of Faunal Relations in National Parks," in *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 104-110 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), originally published in 1932. (Also called "Fauna No 1.")

¹⁵⁸ Wright, Dixon, and Thompson, "Fauna," 105.

that his recommendations are based only on the “present state of knowledge,” meaning further future investigations may lead to further or revised recommendations. He also notes that the double mandate complicates his interpretation of preservation: “The unique feature of the case is that perpetuation of natural conditions will have to be forever reconciled with the presence of large numbers of people on the scene, a seeming anomaly.”¹⁵⁹ Still, the NPS must assume more ecologically informed policies and strategies, or there could be no scene to see.

The report resulted in a short-lived Wildlife Division, led by Wright until his 1936 death in a car accident. After his passing, the Wildlife Division never achieved enough status to encourage a long-term shift in the management of the parks from scenic and object preservation to ecological preservation, and the division was eventually transferred to the Biological Survey (today, known as the U.S. Fish and Wildlife Service) in 1940.¹⁶⁰ The image of a serene, natural landscape would continue to guide park stewardship. Sellars describes “façade management,” in which the management practices enforced by landscape architects clashed with the goals of early park biologists. For example, managers were asked to spray pesticides to stop the natural process of herbivory that was too “ugly” for park visitors to witness.¹⁶¹ In another example, Wright advised that dead trees in Yosemite should be left in place for proper nutrient cycling. A tree does not have to be beautiful to be protected, he argued. However, the park service continued to remove

¹⁵⁹ Wright, Dixon, and Thompson, “Fauna,” 106.

¹⁶⁰ Sellars, *Preserving Nature*, 101.

¹⁶¹ Sellars, *Preserving Nature*, 84.

dead or burned trees and debris from Yosemite to keep up appearances for park guests.¹⁶² Sellars offers an overall more pessimistic view of the NPS at the time, believing that this first wildlife report would have not even occurred had Wright not provided his own fortune to fund it.¹⁶³ Sellars also characterizes the wildlife division as “insurgents in a traditional bound realm.”¹⁶⁴ The NPS’s longtime commitment to scenic preservation stood strong against new ideas.

Wright’s Wildlife Division may have been temporary, but (1) emerging scientific understandings, (2) criticisms of the NPS by internal and external experts, and (3) even the small changes the NPS did make during Wright’s time, were all signals of larger changes to come. Overall, preservation was still defined by a focus on scenery and objects, but these agents of change would continue to challenge the NPS. But first, the country would attend to WWII.

Drury-Wirth Era

The next substantial challenge to scenic preservation would not be made for almost a quarter of a century. The decades between the 1940’s and 1960’s, were instead defined by two very different NPS Directors: Newton B. Drury led the NPS through WWII, and Conrad Wirth took over for the post-war years.¹⁶⁵ The New Deal years prior to the war brought expansion and facilities construction to the parks, especially due to the

¹⁶² Sellars, *Preserving Nature*, 128.

¹⁶³ Sellars, *Preserving Nature*.

¹⁶⁴ Sellars, *Preserving Nature*, 148.

¹⁶⁵ Between them, was Director Demaray. His less than one year appointment was honorary, given his decades long stint as Associate Director. Sellars, *Preserving Nature*, 149.

impact of President F. Roosevelt's Civilian Conservation Corps (CCC).¹⁶⁶ Throughout the 1930's young men in the CCC built roads, trails, and visitor facilities through the parks that would eventually pave the way for continued development and growth in tourism in the 1950's.¹⁶⁷ But in the time between, the war years halted development, especially under the leadership of Drury, whose conservative mindset complemented the limited resources of wartime.

Though he discouraged expansion of the park system, Drury was steadfastly protective of the existing parks from consumptive use for war purposes, and he demonstrated a (relatively) heightened ecological awareness.¹⁶⁸ Drury differed from his predecessors especially in his choice to deemphasize recreation and growth of other types of park units (such as recreational areas). Instead, he preferred that national parks be limited to the traditional, premiere, scenic landscapes. Though generally preservation in practice and as policy continued to equate to protection of scenery, Drury also implemented ecologically informed policies, including his decision to control Yellowstone's bison herds,¹⁶⁹ as well as his decision to cancel the Yellowstone bear

¹⁶⁶ An Act for the Relief of Unemployment Through the Performance of Useful Public Work, and for Other Purposes, 16 U.S.C. §§ 585-590 (1933).

¹⁶⁷ Sellars, *Preserving Nature*, 130-134.

¹⁶⁸ Newton B. Drury, "The National Parks in Wartime," in *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 167-173 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), originally published in 1943.

¹⁶⁹ Sellars, *Preserving Nature*, 155.

shows.¹⁷⁰ However, his refusal to bolster and support internal biological staff left further efforts to incorporate an ecological worldview into park management out of reach.¹⁷¹

Conservation groups outside the NPS were also beginning to speak more loudly, critiquing the NPS's brand of tourism-driven preservation. For example, the National Parks Association published a 1945 call for each park to become a "sanctuary for the scientific study and preservation of all animal and plant life originally within its limits..."¹⁷² They go on the call for a "scientific administration" applied to all preservation practices in all parks.¹⁷³

Toward the end of Drury's tenure, the parks were clearly suffering from wartime neglect and underfunding. In a 1953 Harper's essay, "Let's Close the National Parks," American historian Bernard DeVoto argued that the public shouldn't be allowed in the parks until Congress could adequately restore them. His words captured the nation's attention and raised public support for action:

Let us ... close Yellowstone, Yosemite, Rocky Mountain, and Grand Canyon National Parks—close and seal them ... and so hold them secure till they can be reopened. ... Meanwhile letters from constituents unable to visit Old Faithful, Half Dome, the Great White Throne, and Bright Angel Trail would bring a nationally disgraceful situation to the really serious attention of the Congress which is responsible for it.¹⁷⁴

¹⁷⁰ Sellars, *Preserving Nature*, 160-161. Though Sellars contended it's possible that the limited staff in war time also impacted his decision to cut the shows.

¹⁷¹ Sellars, *Preserving Nature*, 167-168.

¹⁷² National Parks Association, "National Primeval Park Standards, A Declaration of Policy," in *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 174-177 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), originally published in 1945, 174.

¹⁷³ National Parks Association, "National Primeval Park Standards," 176.

¹⁷⁴ Bernard DeVoto, "Let's Close the National Parks," in *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 183-189 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), originally published in 1953 in *Harper's Magazine*, 183.

Around this time, the NPS also barely managed to avoid reservoir construction in Dinosaur National Monument, an important event that signaled the growth of a politically powerful wilderness activist movement—stepping in to advocate where the Park Service was not or could not—and a broader societal regard for nature preservation. For example, with David Brower as Executive Director, the Sierra Club played a key advocacy role in protecting Dinosaur National Monument, including the production of coffee table books that the Sierra Club would become known for across the next two decades.¹⁷⁵ The first of those was *This is Dinosaur*, which played an important role in the defense of the monument by raising visual awareness of what was at stake: at the close of the book, the reader is asked “whether, in the end, we may not be in danger of engineering out of existence some of the things that make existence precious.”¹⁷⁶ Reminiscent of Hetch Hetchy, the fight against the reservoir also demonstrated that development of visitor facilities and roads was still necessary to protect parks from other types of development.¹⁷⁷ It seemed still the case that “strong utilitarian threats needed strong utilitarian responses.”¹⁷⁸ Though Drury did not act accordingly, his successor Wirth (after Demaray) would.

In the mid-1950s, Conrad Wirth became the NPS Director and set in motion what would become a billion-dollar development program called Mission 66, named for the

¹⁷⁵ Mark Harvey, *A Symbol of Wilderness: Echo Park and the American Conservation Movement* (Albuquerque: University of New Mexico Press, 1994).

¹⁷⁶ Dunaway, *Natural Visions*, 123-126. Quote from Wallace Stegner, ed., *This is Dinosaur: Echo Park Country and Its Magic Rivers* (New York: Knopf, 1955). (not paginated)

¹⁷⁷ Sellars, *Preserving Nature*, 180-181.

¹⁷⁸ Sellars, *Preserving Nature*, 188.

program's targeted end-year, 1966—also the 50th anniversary of NPS.¹⁷⁹ In a special presentation to President Eisenhower and his cabinet, Wirth expressed that parks were “being loved to death.” He continued, “They are neither equipped nor staffed to protect their irreplaceable resources, nor to take care of their increasing millions of visitors.”¹⁸⁰ In part funded by the American Auto Association, within the first seven years of the program 578 miles of road and 1,080 parking lots were added to the parks.¹⁸¹ Wirth advocated for “accessible wilderness” in the parks: views of “pristine” nature that could be viewed after a 10 minute walk from the car.¹⁸² Like Mather, Albright, and other directors before him, to Wirth, “the more a national park was used, ‘the less vulnerable [were] its lands to threats of commercial exploitation.’”¹⁸³ By the end of Wirth's term, preservation certainly meant scenery, and scenery was meant to be seen; Thus preservation drove development, and development was believed to enable preservation.

Not all who worked in the parks were pleased with this approach. Probably most famously, author and then-park ranger Edward Abbey presented a thorough, disparaging critique in this essay, “Industrial Tourism.” He laments the roads, parking lots, and motor traffic crisscrossing parks, and worries for the fate of new units: “Lee's Ferry has not

¹⁷⁹ M. F. Anderson, *Polishing the Jewel: an Administrative History of Grand Canyon National Park* (Grand Canyon, AZ: Grand Canyon Association, 2000). Sellars, *Preserving Nature*. Nash, *Wilderness and the American Mind*. Tweed, *Uncertain Path*.

¹⁸⁰ Conrad Wirth, “Mission 66 Special Presentation to President Eisenhower and the Cabinet,” in *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 193-196 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), originally published in 1956, 194.

¹⁸¹ Anderson, *Polishing the Jewel*.

¹⁸² Sellars, *Preserving Nature*.

¹⁸³ Wirth quoted in Sellars, *Preserving Nature*, 188.

fallen under the protection of the Park Service. And who can protect it against the Park Service?”¹⁸⁴ But I should note that concerns over development in parks had been growing long before Abbey’s 1968 publication of *Desert Solitaire*. For example, Bob Marshall, Benton MacKaye, Robert Sterling Yard, Aldo Leopold, and others founded the Wilderness Society in 1935—the first organization focused solely on the defense of the wilderness, not just in the face of resource extraction but increasingly road building and the impacts of mass tourism.¹⁸⁵

And in hindsight, some have critiqued the fact that throughout Mission 66 biologists were ignored, if not vehemently excluded, during decision-making.¹⁸⁶ Wirth worked to keep the role of the biologists small: scientists would “not make decisions or give order pursuant to putting recommendations into effect.”¹⁸⁷ Tweed concurs, seeing the Mission 66 campaign as a missed opportunity for the NPS (and Wirth) to orient the 50th anniversary celebrations around updating the mission to a more ecological worldview.¹⁸⁸ Instead, however, the parks were “entangled in [their] own history” and caught up in the momentum of growing tourism and accelerating park expansion.

¹⁸⁴ Edward Abbey, *Desert Solitaire* (New York: Ballantine Books, 1968), 57.

¹⁸⁵ Paul Sutter, *Driven Wild: How the Fight against Automobiles Launched the Modern Wilderness Movement* (Seattle: University of Washington Press, 2002).

¹⁸⁶ Tweed, *Uncertain Path*. Sellars, *Preserving Nature*.

¹⁸⁷ Wirth quoted in Sellars, *Preserving Nature*, 222.

¹⁸⁸ Tweed, *Uncertain Path*.

Transforming Preservation

Shortly before the culmination of Mission 66, two major external reports were released, each critical of the NPS's lacking support and use of science. These externally funded reports were the first of their kind, but they harkened to previous smaller, internal efforts to redefine the preservation of parks in ecological terms.¹⁸⁹

The first, *Wildlife Management in the National Parks*, came at the request of Interior Secretary Udall, who established an external advisory board to advise the parks on overgrazing by Yellowstone elk and other specific wildlife issues.¹⁹⁰ Chaired by and named for A. Starker Leopold, from the University of California, Berkeley, the *Leopold Report* went far beyond Udall's targeted request to argue that the primary purpose of all parks should be to maintain the complex biotic associations protected within. Addressing ecological complexity required that the NPS support research and hire scientific staff for each park.¹⁹¹ Most famously, the report called for the use of historical baselines to determine the aims of ecological management, specifically the time of the first European

¹⁸⁹ Sellars, *Preserving Nature*, 214. Runte, *National Parks*, 187. For example: U.S. Department of Interior, National Park Service, "A Back Country Management Plan for Sequoia and Kings Canyon National Parks," in *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 211-216 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), originally published in 1963, 211. This was one of the first internal reports to discuss the *scientific value* of wilderness, i.e., its use for scientific research: "Science needs these environments as a point of reference and as a yardstick with which to measure man's success or failure in the countless land-management programs that he carries out in the rest of his environment." Another example: U.S. Department of Interior, National Park Service, "Wildlife Management in National Parks," in *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 217-223 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), originally published in 1962, 217. Also known as the Stagner Report, this one echoed Wright's report, published three decades earlier. In a refrain that now sounds similar today, Stagner argues that "former preservation measures applied to the management of wildlife have in many instances become obsolete."

¹⁹⁰ A. S. Leopold et al., "Wildlife Management in the National Parks," in *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 237-252 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), originally published in 1963.

¹⁹¹ Runte, *National Parks*, 137.

settlers' encounter with park landscapes: national parks should be "illusions of primitive America."¹⁹² Dynamics would be preserved, but they would be centuries-old dynamics. Leopold and the committee viewed Europeans as the troublesome change agents, ignoring the impacts of indigenous peoples who had lived on park lands for thousands of years prior.¹⁹³ Thus, the cause of preservation was to protect *original* landscapes as natural landscapes; and parks should guard natural (original) processes, not just natural scenes.¹⁹⁴ In fact, if natural processes were protected, then natural scenes would naturally persist.¹⁹⁵

The report acknowledges that the philosophy that governed the NPS at the time of the Organic Act did make sense for that time: "In implementing this Act, the newly formed Park Service developed a philosophy of wildlife *protection*, which in that era was indeed the most obvious and immediate need in wildlife conservation." Then, parks were refuges protecting scenery. In 1963, refuges were insufficient for preservation because habitats were increasingly recognized as dynamic due to both natural and man-made processes: "...habitat is not a fixed or stable entity that can be set aside and preserved behind a fence, like a cliff dwelling or a petrified tree."¹⁹⁶ Recognizing that it would take a diversity of management strategies to manage complex and dynamic ecological processes, the report committee stressed the need for employee training in skills and

¹⁹² Leopold et al., "Wildlife Management in the National Parks."

¹⁹³ Runte, *National Parks*, 179.

¹⁹⁴ Runte, *National Parks*.

¹⁹⁵ Tweed, *Uncertain Path*, 66-67.

¹⁹⁶ Leopold et al., "Wildlife Management in the National Parks," 237.

knowledge not yet developed within the NPS. Thus, parks required greatly expanded research programs. Eventually, Leopold went on to direct the new scientific division for a year, but after his resignation the scientific division was reorganized and decentralized to the regions.¹⁹⁷

The U.S. National Academies also published a report at the request of Secretary Udall. Released five months after the *Leopold Report*, the *Robbins Report* (named for the chair of the report committee), corroborated the findings of the *Leopold Report*, declaring the parks to be complex natural systems: “Each park should be regarded as a system of interrelated plants, animals, and habitat (an ecosystem) in which evolutionary processes will occur under such control and guidance as seems necessary to preserve its unique features.”¹⁹⁸ The report asks the NPS to become more “research-minded” to aid in the transformation of management philosophy and practice, arguing that each park should have its own independently funded research unit to conduct “mission oriented” research. Though the *Robbins Report* was similar to the *Leopold Report* in many ways, it was much longer and provided many more specific recommendations that had an unprecedented influence over many park service officials.¹⁹⁹ I will dive deeper into the details and aftermath of the each of these reports in later chapters, but I want to note now that these reports are often seen as marking an important shift from the preservation of scenery to the preservation of historical ecological processes through diverse, active, science-informed management strategies. In Sellars words:

¹⁹⁷ Sellars, *Preserving Nature*.

¹⁹⁸ Leopold et al., “Wildlife Management in the National Parks,” 253-254.

¹⁹⁹ Sellars, *Preserving Nature*, 216.

...written by scientists (mostly biologists), both the Leopold and National Academy reports gave a *scientific* perspective to national park management—a kind of ecological countermanifesto that marked the beginning of renewed efforts to redefine the basic purpose of national parks...Much of National Park Service history since 1963 may be viewed as a continuing struggle by scientists and others in the environmental movement to change the direction of national park management, particularly as it affects natural resources.²⁰⁰

And it is to that “history since 1963” that I turn to in chapter three.

What’s a National Park?

Like preservation, the concept of “National Park” has been dynamic over time. While not the central focus of this dissertation, it’s still important to note the radical changes to the system that have occurred since 1916. It’s something I’ve only referred to tangentially to this point, but the expanding types of park units from NPS origins through the 1960’s had a growing influence on the practice and definition of preservation, so I’d like to address it before going any further.²⁰¹

Sometimes expansion in the types and numbers of NPS units was the result of departmental reorganization or consolidation. For example, when the NPS was created in 1916, the service took over not only the large, landscape parks, but also some national monuments that had been established under the 1906 Antiquities Act.²⁰² As well, despite parks being known most broadly as the likes of Yellowstone and Yosemite, many of the

²⁰⁰ Sellars, *Preserving Nature*, 217.

²⁰¹ For a complete review of how the structure of the Park Service and its units have evolved, see: Barry Mackintosh, Janet A McDonnell, and John H Sprinkly, Jr., *The National Parks: Shaping the System* (Hancock, Michigan: George Wright Society, 2018), published as a special issue of *The George Wright Forum* 35 (2018): 1-132.

²⁰² American Antiquities Act of 1906, 16 U.S.C. § 432 (1906).

earliest federally protected sites were historic sites and battlefields (the latter managed under the War Department). These included Casa Grande Ruin, the country's first historic site, established in Arizona in 1889,²⁰³ as well as the first national battlefield park on Lookout Mountain in Chattanooga, Tennessee, established in 1890.²⁰⁴ These types of sites would eventually be incorporated into the NPS in a 1933 Executive Order by President F.D. Roosevelt, reorganizing the executive branch agencies and moving all remaining national monuments, battlefields, and memorials to the NPS.²⁰⁵ Two years later, the Historic Sites Act was signed, legally defining the goals of preservation as pertains to historic and archeological sites and buildings protected by the NPS.²⁰⁶

At other times, park leaders' expansion efforts justified the NPS's existence and expanded the types of values and services that parks could offer. Such is the case with the long—and not wholly welcomed—process of creating and expanding recreational areas between 1936 and the 1960s (and beyond). It started innocently enough, with an “Act to Authorize a Study of the Park, Parkway, and Recreational Area Programs in the United States.”²⁰⁷ The study explored potential sites like parkways and recreational areas for future addition to the NPS. As a result, Congress authorized Cape Hatteras National

²⁰³ U.S. Congress, “Protection of Casa Grande Ruin,” in *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 30 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), originally published in 1889.

²⁰⁴ An Act to Establish a National Military Park at the Battlefield of Chickamauga, 16 U.S.C. § 424 (1890).

²⁰⁵ “Excerpts from Executive Order No. 6166 of June 10, 1933 and Executive Order No. 6228 of July 28, 1933,” in *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 116-121 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), originally published in 1933.

²⁰⁶ An Act to Provide for the Preservation of Historic American Sites, Buildings, Objects, and Antiquities of National Significance, and for other purposes, 16 U.S.C. §§ 461 et seq. (1935).

²⁰⁷ An Act to Authorize a Study of the Park, Parkway, and Recreational Area Programs in the United States, and for other purposes, 16 U.S.C. §§ 1700 et seq. (1936).

Seashore as the first of these recreation-focused parks.²⁰⁸ Demonstrating internal resistance to these new types of units, a similar study took place within the U.S. Department of Interior in 1941, and it found that state and local governments should take responsibility for recreational sites, in part because such areas have a different “atmosphere” from that of traditional national parks.²⁰⁹ This finding aligns with Director Drury’s view that the parks should not be expanded beyond the traditional western landscape sort. But the reality, according to others who came before and after Drury (i.e., Albright and Wirth), was that the recreational needs of America were expanding, and the parks were the logical agency to take command of new sites. Albright, for example, believed that every state deserved access to recreation in the great outdoors and taking responsibility for providing such access would grant the NPS broad and enduring public support.²¹⁰

While most of the literature I have reviewed in this chapter focuses on the larger, landscape parks like Grand Canyon and Rocky Mountain, the reality is that parks have expanded to include many different types of sites, with distinct purposes, and yet all managed under one Organic Act.²¹¹ Preservation and enjoyment must still be balanced, but to differing degrees and by different means depending on the unit. And from the

²⁰⁸ Dilsaver, *America’s National Park System*, 113. Though authorized in 1937, the park was not officially established until 1953.

²⁰⁹ U.S. Department of Interior, National Park Service, “A Study on the Park and Recreation Problem of the United States,” in *America’s National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 151-164 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), Originally published in 1941.

²¹⁰ Runte, *National Parks*, 195.

²¹¹ An Act to Facilitate the Management of the National Park System and Miscellaneous Areas Administered in Connection with that System, and for Other Purposes, 67 Stat. 495 (1953).

1960s, the definition and practice of preservation would and will continue to expand in consideration of new types of resources throughout hundreds of diverse sites (400+ today), while at the same time responding to (or, at times, resisting) the recommendations of the *Leopold* and *Robbins Reports*. Recent, current, and future park leaders and publics would and will be forced to ask, how do we preserve *natural and cultural* resources? What is the role of science in these different types of units? How do we balance the desire to preserve with the reality of change?

3. HISTORY, PART 2

“Start with Sellars.” That was the advice my PhD advisor, Ben Minter, gave me when I first brought him my dissertation ideas in 2014. Anyone interested in National Parks should start with Sellars’ *Preserving Nature in the National Parks, a History*.

The late Richard West Sellars spent his life devoted to the national parks, first as a seasonal ranger, then a Regional Chief of Historic Preservation, Architecture, and Archaeology, and later, as a revered author, historian and lecturer. In *Preserving Nature in the National Parks*, he presented a critical history of NPS natural resource management, and described decades of tension around the “central dilemma” of park management: “the question of exactly what in a park should be preserved.”²¹²

Ben had in part suggested Sellars’ book to inform my first term paper on the values shaping park stewardship. Throughout the book, I marked various values with multi-colored sticky-tabs: yellow for aesthetic values; pink for utilitarian; green for ecocentric; and blue for anything else. More than 125 tabs later I had a rainbow sticking out the side of the 308-page book, illustrating the decades of clashing values Sellars describes. Ecological concepts competed with management for scenery and tourism, despite “pressure from within and without [the NPS] to become a more scientifically informed and ecologically aware manager of public lands.”²¹³ Sellars clearly believed that science was foundational to the NPS’s ability to preserve parks. He called upon the

²¹² Sellars, *Preserving Nature*, 4.

²¹³ Sellars, *Preserving Nature*, 290.

institution to rise above history and “[attune] land management and organizational attitudes to ecological principles.” Only then could the NPS establish itself as a 21st century leader in nature preservation.²¹⁴

Each evening, I’d curl up on the second-hand couch in my first apartment in Tempe, AZ, eager to jump back into the book where I’d left off the night before. It was a page-turner to me, following science and scientists through the journey from being ignored (or worse) as “insurgents in a tradition bound realm,”²¹⁵ to the triumph of the 1999 Natural Resource Challenge—the multi-million-dollar science-initiative resulting from the book. This is clear in the pithy notes with which I filled the volume’s margins. I debated sharing those here because most are shallow and embarrassing, but I’m game for some self-deprecation. Where science bowed to tourism or scenery, I wrote “seriously?!” and “astonishing!” On page 110, I drew a sad-face next the failure of the NPS to act on the recommendations within *Fauna No. 1*. By the time the book gets to 1991 you could tell I was fed up with the back and forth; next to the *Vail Agenda* (a 1992 report resulting from the NPS’s 75th Anniversary Symposium) I wrote, “so, what would make this time different?” In the epilogue to the 2009 edition of his book, when Sellars shared the fruitful response to the original 1997 publication, I wrote “YAY!”

I first read Sellars before I had even an inkling of my research plans. All I knew was that I wanted to apply science to the preservation of parks. It’s no wonder I was excited to see science’s more prominent role by the end of Sellars’ history; I was a science cheerleader.

²¹⁴ Sellars, *Preserving Nature*, 290.

²¹⁵ Sellars, *Preserving Nature*, 148.

Transitioning Toward Science?

Apparently, one embarrassing typo—emailed to important people across the U.S. National Park Service—is not enough. In early 2019, I circulated an email referring to the *Vail Agenda*, as the “Vali Agenda.” I had proofread at least seven times; I guess next time I’ll have to go for eight.

I’d sent the email in preparation for round two of interviews. I was interested in NPS employee perspectives on various documents, policies, and reports throughout the years (like the *Vail Agenda*). Without direct prodding, round-one interviewees had reflected on *The Leopold Report*, *State of the Parks*, *Revisiting Leopold*, and others. To continue the conversation in round two, I shared example documents and asked, “Do you have any thoughts about the impact of any of [these] reports, and why they had the impact (or lack thereof) that they did? Have any of them impacted your approach to your role with the NPS?”

When I’d read through such documents before, I’d noticed the recurring calls for science-based decision-making that Sellars had first alerted me to. *Fauna No. 1* echoed in *The Leopold Report*, echoed in *State of the Parks*, echoed in the *Management Policies* from across the decades, and so on. Each had distinct elements, but the repetition was impossible to ignore. This isn’t breaking news, but it stirred in me the urge to ask, what did NPS employees think of the broken record? And was it finally spinning smoothly?

Beyond interviewee perspectives on history, I was curious about the impact of the latest additions to that series, which seemed definitive wins to me. For example, in recognition of *The Leopold Report’s* enduring effect into the 21st century, NPS Director

Jonathan Jarvis charged his Science Committee with “Revisiting Leopold.” The resulting report simultaneously honored the legacy of the *Leopold Report’s* “cogent principles, philosophy, and recommendations,”²¹⁶ and re-examined resource management in light of “new knowledge and emerging conditions—including accelerating environmental change, a growing and more diverse population of Americans, and extraordinary advances in science...”²¹⁷ All the above, the committee argued, required abandoning historical baselines that Leopold *et al.* had once endorsed. But other findings from the original report, they claimed, “remain valid and significant,” including recognition of biological complexity, endorsement of active management strategies, and the recommendation for an elevated role of science in park management.²¹⁸ The 2012 report thus builds upon *The Leopold Report*—the “foundation” from which they would launch the NPS into a future of stewarding “for continuous change that is not yet fully understood.” In 2016, Director Jarvis drew directly from *Revisiting Leopold* for the final policy act of his term, Director’s Order-100. DO-100 advanced ecological (as well as historical and cultural) integrity as the goals for park management, and required reliance on science as a basis for understanding and managing resources in the context of continuous, uncertain change.²¹⁹

²¹⁶ National Park System Advisory Board, *Revisiting Leopold: Resource Stewardship in the National Parks* (Washington, D.C.: National Park System Advisory Board, 2012), 23. The report was funded in part by the National Park Foundation.

²¹⁷ National Park System Advisory Board, *Revisiting Leopold*, 4.

²¹⁸ National Park System Advisory Board, *Revisiting Leopold*, 8.

²¹⁹ Director’s Order 100 of December 20, 2016, “Resource Stewardship for the 21st Century,” *Rescinded (no longer in the code and no longer in effect)*, https://www.nps.gov/policy/DOrders/DO_100.htm, 3.

In this chapter as well as the next, the voices of NPS employees, past and present, add color, depth, and nuance to my understanding of this long-awaited win—the transition to science-informed park management goals and practices.²²⁰ Is it complete? Is it what they had hoped for? In what ways, through this period and into the next, do interviewees feel concepts and mandates guiding preservation are settled *vs.* still a work in progress? And backing up a few steps, what makes this a “win”? I came to the project as a science cheerleader—but along the way, I started to wonder, is science really the solution to these complex challenges? I look to documents published from 1963 up through the Obama administration to understand how preservation came to revolve around ecological integrity, in contrast to previous guideposts like scenery or “vignettes of primitive America.” How did the NPS get *from The Leopold Report to Revisiting Leopold?* As Sellars demonstrated, that leap was a collection of many small steps throughout the twentieth century—a few of them backwards.

The Ecological Revolution?

The year 1963 is considered a turning point in NPS history. Dilsaver deems it the start of the “The Ecological Revolution.”²²¹ Runte refers to *The Leopold Report* as “an instant classic,” for its recognition of ecological complexity and endorsement of diverse, active management strategies.²²² Tweed notes that both *The Leopold Report* and *The*

²²⁰ For an overview of my qualitative methods and data, see Appendices A-D.

²²¹ Larry M. Dilsaver, “The Ecological Revolution, 1964-1969,” in *America’s National Park System: The Critical Documents*, ed. Larry M. Dilsaver (Lanham, Maryland: Rowman and Littlefield Publishers, 1994), 269-370.

²²² Runte, *National Parks*, 137.

Robbins Report, “challenged the service to make significant changes in its worldview.” Each report advocated that natural processes should dictate management strategy—if natural processes were protected in their historical state, then, Tweed says, “the integrity of the landscape could be expected to endure.”²²³ Many current NPS employees I spoke with admired the shift towards intentional management of natural resources, as well as the importance of seeing, understanding, and managing the whole ecosystem, not just the notable parts. Interviewees declared *The Leopold Report* as: “A massive impact.” “Foundational.” “Quite impactful.” “A recalibration.”²²⁴

That shift was not sudden, however. Sellars characterized the period from the 1963 publication of *The Leopold Report* until the late 1990’s, “as a continuing struggle by scientists and others in the environmental movement to change the direction of national park management, particularly as it affects natural resources.”²²⁵ In that time, a series of reports from within and outside the government, including Sellars’ book, criticized the glacial pace with which preservation was transforming. Though the ideals and recommendations within the *Leopold Report* may have been “impactful,” “foundational,” and “recalibrating,” it would take decades before they were bolstered with the necessary financial, personnel, and policy support of the NPS and the U.S. Government.²²⁶ Beyond questions of resources or capacity, some elements of the report were ambiguous—or at least open to interpretation, like naturalness—and included some

²²³ Tweed, *Uncertain Path*, 67.

²²⁴ Including two superintendents and two park scientists (one now an administrator).

²²⁵ Sellars, *Preserving Nature*, 217.

²²⁶ Some, no doubt, would argue support was never and even still isn’t adequate.

directives that would prove impossible to pull off, such as preserving historical landscapes and ecological processes. In Sellars' words: "Easily decreed, it was not easily enforced."²²⁷ To elevate science and scientists, the NPS needed more staff and funds for natural resource management, and most challenging, required a "redistribution of power."²²⁸ Scientists brought into the NPS would need to learn to navigate bureaucracy and integrate with an institutional culture they had long been excluded from.

Drawing from his review of countless communications, documents, and policies, Sellars noted that the longest standing purpose of parks—as scenic destinations for tourism—was entrenched. The associated "deeply imbedded assumptions [were] far more difficult and slower to change than the organizational structure,"²²⁹ as evidenced by the many structural shifts and policy documents throughout the 20th century that failed to create lasting change. In addition, while some superintendents were eager to host responsive research capabilities in their parks, others saw it as a threat to their leadership and decision-making power.²³⁰

Based on my experience, I would also guess the varied reactions in part resulted from how decentralized the Park Service was and still is. Within the bounds of the law, superintendents have fairly independent rule over their parks. Perhaps that's why the

²²⁷ Sellars, *Preserving Nature*, 219.

²²⁸ Sellars, *Preserving Nature*, 217. This was called for by both 1963 reports. The *Leopold Report* desired all natural resource management to be under the care of biologically trained personnel and the NAS report called for Directorate level scientific positions, as well as 10 scientists in WASO and an additional 10% of funding for science in the NPS. Sellars, *Preserving Nature*, 218.

²²⁹ Sellars, *Preserving Nature*, 290.

²³⁰ Sellars, *Preserving Nature*, 221, 229.

Robbins Report proposed a directorate level position to oversee park science, instead of having scientists report to superintendents.²³¹ Alluding to the impact of individuals in a decentralized institution, Sellars noted that the earlier NPS research centers depended almost entirely on the support of regional and park leadership, as opposed to a system-wide review or mandate.²³² In other words, their success was the “result of personalities and chance.”²³³ For example, the Uplands Field Research Laboratory, established in 1975 in Great Smoky Mountains National Park, benefitted from a “sympathetic superintendent,” as well as the consistent financial and logistical support of the regional director.²³⁴ A similar center in the Everglades struggled under a series of unsupportive superintendents.²³⁵

Anxieties about the independence of park science accompanied questions of power balance and organization. This was part of the purpose of the *Robbins Report* suggesting that scientists be managed under their own directorate.²³⁶ Somewhat accordingly, NPS Director Hartzog created the Division of Natural Science Studies in

²³¹ National Academy of Sciences, National Research Council, “A Report by the Advisory Committee to the National Park Service of Research,” in *America’s National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 253-262 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), originally published in 1963. Although, as Sellars noted, that may have fed superintendents’ fears that an independent force was coming into their parks to take over. Sellars, *Preserving Nature*.

²³² Sellars, *Preserving Nature*, 236.

²³³ Sellars, *Preserving Nature*, 237.

²³⁴ Sellars, *Preserving Nature*, 237. It’s also worth noting that the park was one of the first to be designated (in 1934) in part because of its ecological components (seen by some as a wildlife and botanical preserve at a time when most other parks were still being designated on scenic grounds alone). Though without the monumental mountains, the ecological qualities alone may not have qualified the area as a park, according to Runte, *National Parks*, 107.

²³⁵ Sellars, *Preserving Nature*, 237.

²³⁶ Sellars, *Preserving Nature*, 219.

1964. The Division's Chief Scientist reported to an assistant director (as opposed to *being* an assistant director), but they supervised all park scientists, as called for in the *Robbins Report*. The Division was short lived, however. After A. Starker Leopold's 1968 resignation as Chief Scientist, it was reorganized and ultimately transferred out to regional leadership where science and scientists were supported with varying enthusiasm and funds (or lack thereof).²³⁷

The concern over scientific independence continued throughout the 20th century. For example, in 1993 Secretary of Interior Bruce Babbitt created the National Biological Survey (NBS) by bringing together research scientists formerly placed with the USFWS, and BLM, and the NPS. The move was in part an effort to ensure independence for science. For many years prior, the department had been caught up in court regarding a decision not to list the spotted owl as an endangered species; advocacy groups claimed the decision lacked scientific justification.²³⁸ Babbitt saw the opportunity to create an objective, non-advocacy research agency that could be responsible for conducting endangered species surveys, among other projects.²³⁹ As one former administrator I spoke with put it, Secretary Babbitt wanted to “make it clear that park managers were not only funding research that would support their policies or their positions but that the science was really objective and independent.”

²³⁷ Sellars, *Preserving Nature*, 221- 232. (The story appears within that range of pages).

²³⁸ Sellars, *Preserving Nature*, 288. The move was made to enhance “non-advocacy research” and better address issues at scale. Frederic H. Wagner, “Whatever happened to the National Biological Survey?” *BioScience* 49(1999): 219-222.

²³⁹ Wagner, “Whatever happened to the National Biological Survey?”

But another interviewee—also a former leader in the NPS—recalled that the new agency was “spectacularly unsuccessful.” The NBS did not survive the 1994 turnover of Congress to Republicans; lawmakers in the new majority feared that NBS biologists were trespassing private land to protect endangered species.²⁴⁰ When the NBS was eventually defunded, biologists were moved over to the U.S. Geological Survey within the new Biological Resources Division, still separate from the National Park Service.²⁴¹ A few interviewees—mostly retired or longtime park leaders—who worked with the NPS through the 1990s recalled the impact of the move: “broken relationships” with academic researchers, lost personal connections, and research results with less direct applicability. Sellars also summarized the division of science from park needs, “Science [had] at last achieved independence—but it was through removal, rather than by remaining in the Service and gaining independence from ‘operational management,’ as advocated beginning in the 1960s...”²⁴²

Also complicating the elevation of science in park management, the legal landscape evolved throughout the second half of the 20th century. As I noted in chapter two, some laws added sites and resources, demanding attention to more than natural resource management. With the passage of several pieces of legislation like the Land and Water Conservation Fund Act of 1965²⁴³ and the National Historic Preservation Act of

²⁴⁰ Wagner, “Whatever happened to the National Biological Survey?”

²⁴¹ Sellars, *Preserving Nature*. Wagner, “Whatever happened to the National Biological Survey?”

²⁴² Sellars, *Preserving Nature*, 289.

²⁴³ Land and Water Conservation Fund Act of 1965, Pub. L. No. 88-578, 78 Stat. 897 (1965).

1966,²⁴⁴ the NPS acquired responsibility for recreational, as well as additional cultural and historical parks, respectively. And then in 1968, the NPS became responsible for two new types of units with the passage of the Wild and Scenic Rivers Act and the National Trails System Act.²⁴⁵

The Wilderness Act of 1964²⁴⁶ added yet another type of classification by zoning “the national parks into conservation first and other recreation first areas.”²⁴⁷ At the time, the Park Service resisted passage of the new law. The NPS, especially Director Wirth, saw the Wilderness Act as counter to their development programs under Mission 66.²⁴⁸ The NPS was allotted the highest acreage of wilderness lands of any public lands agency, but most of those lands were “left overs,” those parts of the landscape that were not deemed useful or beautiful enough for tourism.²⁴⁹ The NPS also worried that the Wilderness Act would reduce their management discretion, and they thought they were already managing wilderness just fine without it.²⁵⁰

²⁴⁴ National Historic Preservation Act of 1966, 16 U.S.C. § 470 (1966).

²⁴⁵ Wild and Scenic Rivers Act, 16 U.S.C. §§ 1271 et seq. (1968); National Trails System Act, 16 U.S.C. §§ 1271 et seq. (1968).

²⁴⁶ Wilderness Act, 16 U.S.C. §§ 1131 et seq. (1964).

²⁴⁷ Denise E. Antolini, “National Park Law in the U.S.: Conservation, Conflict, and Centennial Values,” *William & Mary Environmental Law & Policy Review* 33(2009): 868. Harmony A. Mappes, “National Parks: For Use and ‘Enjoyment’ or for ‘Presevation’? and the Role of the National Park Service Management Policies in That Determination,” *Iowa Law Review* 92(2006-2007): 601-636.

²⁴⁸ Sellars, *Preserving Nature*, 191; Runte, *National Parks*, 211.

²⁴⁹ Sellars, *Preserving Nature*, 192.

²⁵⁰ This response is discussed in detail in John C. Miles, *Wilderness in the National Parks* (Seattle: University of Washington Press, 2009).

Other laws passed throughout this period added further protections to the NPS's natural resources. The 1969 National Environmental Policy Act required all executive agencies to minimize environmental impact and to use the best available science when making decisions. Thus, any park development must be accompanied by studies evaluating environmental impact.²⁵¹ Though the NPS complied to avoid litigation under NEPA, Sellars claims that without the legal requirement, "there would have been far less scientific input" into park planning at the time.²⁵²

Additional protections and responsibilities accompanied the Clean Air Act of 1967, the Federal Water Pollution Control Act of 1972, the Endangered Species Act of 1973, and the Archaeological Resources Protection Act of 1979. Many included provisions that directly or indirectly elevated the role of science—or at least scientific monitoring—in parks, such as required observation and improvement of air quality under the Clean Air Act. Such legislation was sometimes resented for the ways in which it complicated management and added compliance requirements to the existing challenges of preserving parks.²⁵³ But it was undeniable that parks were affected by the environmental challenges this legislation sought to protect them from; air pollution, for example, threatened scenic overlooks throughout the southwest.²⁵⁴

²⁵¹ National Environmental Policy Act, 42 U.S.C. § 4321 et seq. (1970).

²⁵² Sellars, *Preserving Nature*, 240-241.

²⁵³ Sellars, *Preserving Nature*, 233-235.

²⁵⁴ Runte, *National Parks*, 228. Jerome Ostrov, "Visibility Protection under the Clean Air Act: Preserving Scenic and Parkland Areas in the Southwest," *Ecology Law Quarterly* 10 (1982): 397-453. John. J. Kearney, "Is the Air Visibility of Our National Parks Being Adequately Protected?," *EPA Journal* 7(1981): 2-6.

In the 1980s, the NPS officially acknowledged air pollution and other types of threats to parks—though admittedly the recognition was catalyzed by an external report conducted by the National Parks Conservation Association, and a subsequent mandate from Congress.²⁵⁵ The resulting *State of the Parks* report declared “that no parks of the System are immune to external and internal threats,” and recognized that more than half of the threats to the parks were external, e.g., commercial developments, air pollution, urban encroachment, etc.²⁵⁶ Further, *State of the Parks* stated that such threats were not adequately documented. Thus, the NPS required a comprehensive inventory and monitoring, as well as an elevated role for science via increased funds and staff.²⁵⁷ Within the decade, however, the NPS would once again fail to create meaningful change. A 1987 General Accounting Office report, “Limited Progress Made in Documenting and Mitigating Threats to the Parks,” noted that the NPS was not fulfilling the recommendations of *State of the Parks*.²⁵⁸ The report declared that many problems and threats had instead worsened and reiterated calls for increased funds for documenting and addressing threats.²⁵⁹

²⁵⁵ National Park Service, Office of Science and Technology, “State of the Parks, A Report to the Congress,” in *America’s National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 405-410 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), originally published in 1980. Sellars, *Preserving Nature*, 262.

²⁵⁶ National Park Service, “State of the Parks,” 407. Runte, *National Parks*, 229.

²⁵⁷ National Park Service, “State of the Parks,” 407-408.

²⁵⁸ United States General Accounting Office, “Limited Progress Made in Documenting and Mitigating Threats to the Parks,” in *America’s National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 414-417 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), originally published in 1987, 414.

²⁵⁹ United States General Accounting Office, “Limited Progress,” 416-417.

In 1992, two more reports were released, each calling for the NPS to strengthen its research agenda. The first, *Science and the National Parks*, was an external report, composed by the Committee on Improving the Science and Technology Programs of the National Park Service, from the National Academy of Sciences. In some ways, the report mirrored the Robbins Report, released almost three decades earlier. The committee declared that the parks needed stronger inventory and monitoring programs, and science should be a stronger basis for park planning. The science program thus required its own funding and autonomy. They also suggested a stronger role for chief scientists, and stronger support for external research. But the report recognized that its recommendations were not new. To make real change, the NPS needed a culture centered around research that could guide long-term, systematic park planning (as opposed to what Sellars characterized as a culture centered on tourism and management consisting of quick fixes driven by utilitarian values).²⁶⁰

The second report, *National Parks for the 21st Century: The Vail Agenda* was the product of the NPS's 75th Anniversary Conference held in Vail, CO, in 1991. Like the 1987 GAO report, *Vail* reported that the NPS's response to the *State of the Parks* report had been, at best, inconsistent. Employees were still in need of resource training. The research program still required more funds. External and transboundary threats still deserved closer attention. These problems, the report acknowledged, were

²⁶⁰ National Academy of Sciences, Committee on Improving the Science and Technology Programs of the National Park Service, "Limited Progress Made in Documenting and Mitigating Threats to the Parks," in *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 446-449 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), originally published in 1992, 446. Sellars, *Preserving Parks*, 283-284.

longstanding.²⁶¹ Despite open self-critique and reflection, Sellars believed *Vail* “broke little if any new ground.” It over-relied on references to and critiques of previous reports, as opposed to offering a fresh perspective on how to move forward from past failures.²⁶²

When Sellars published *Preserving Nature in the National Parks* in 1997, he believed the Park Service still lacked a sufficient response despite small triumphs like research centers.²⁶³ As he put it, the NPS was a “house divided” over science, “pressured from within and without to become a more scientifically informed and ecologically aware manager of public lands, yet remaining profoundly loyal to its traditions,” a focus on scenery and tourism above ecology.²⁶⁴

Finally, Action

Interviewees offered mixed reactions when asked about the series of reports and critiques published throughout the twentieth century. None saw the reports in completely negative light; there was more so a candid recognition that although they may have been inspiring, they failed to create lasting change.²⁶⁵ Still, each report represented an important step, even if small or later walked back. One superintendent, also a former NPS

²⁶¹ Dilsaver, *America's National Park System*, 410.

²⁶² Sellars, *Preserving Nature*, 279.

²⁶³ Sellars, *Preserving Nature*.

²⁶⁴ Later in this chapter—and in detail in chapter five—I’ll question what “ecology” and “science” mean for park preservation, including how they’ve evolved and how park managers balance science with different values and models of nature. It’s far from a straightforward prospect, though these reports may have made it seem so.

²⁶⁵ This viewpoint is shared, for example, by a few superintendents and a few park leaders with science backgrounds.

administrator, even saw repetition as necessary: “They do echo each other, that's for sure, and the reason for that is we have to keep on fighting for and evolving... So it's like "The Vail Agenda" didn't say anything different, but we have to make the case [for science and for parks] over again.” Whether the interviewee felt she was making that case to the public, the government, interest groups, or the NPS, she didn’t specify. Perhaps, all the above.

Whatever their mixed reactions on the reports leading up to 1997, interviewees overwhelmingly agreed on the positive impact of Sellars’ book.²⁶⁶ *Preserving Nature* spurred almost instant action, including a multi-million-dollar investment for park science.²⁶⁷ As a longtime employee and scholar of the NPS, Sellars was an insider, and he knew how to shape the effect of his book. Leadership—administrators and superintendents—had to be engaged and invested in the process. In the epilogue to the 2009 edition of his book, Sellars recalled Michael Soukup, then Associate Director for Natural Resource Stewardship and Science, leading the charge for change, with the full support of NPS Director Robert Stanton and Deputy Director Denis Galvin.²⁶⁸ As well, task forces were co-chaired by natural resource experts *and* superintendents, bringing scientific-expertise and local leadership to the table together. The result of their collective efforts was the 1999 Natural Resource Challenge and a Congressional appropriation of

²⁶⁶ That interviewees saw it as a triumph could also speak to their support of Sellars’ view of the rightful place of science in decision making (includes a handful of park and NPS leaders, current and former).

²⁶⁷ McDonnell notes that of the repeated calls since the 1930s, Sellars was the only to inspire a substantial increase in funds for science. Janet A. McDonnell, “Reassessing the National Park Service and the National Park System,” *The George Wright Forum* 25(2008): 6-14.

²⁶⁸ Sellars, *Preserving Nature*, 291-293.

\$14.3 million of additional annual funding. The multi-part initiative elevated the role of science in park management, opened the parks to academic collaborations through research learning centers, as well as strengthened inventory and monitoring programs.²⁶⁹

Interviewees also referenced the 1998 National Parks Omnibus Management Act—a “mandate for science.”²⁷⁰ Section 202 of the Act contains a simple but powerful directive: “The Secretary is authorized and directed to assure that management of units of the National Park System is enhanced by the availability and utilization of a broad program of the highest quality science and information.” As well, the Act provides the legal basis for the Inventory and Monitoring Program and the Cooperative Ecosystem Studies Units (CESU) Network, launched in 1999.²⁷¹ Based in universities, CESUs bring together academics, non-profits, research organizations, and a large consortium of federal agencies with the goal of preserving natural and cultural resources.²⁷² In part, CESU’s replaced the loss of Cooperative Park Studies Units (CPSUs) to the National Biological Survey; CPSUs were similar units that had run from the 1970s until 1993.²⁷³

Of the Omnibus Act, one interviewee explained, “science was now something that was legitimate to spend money on. Although money had been spent... it was always in

²⁶⁹ Sellars, *Preserving Nature*, 295.

²⁷⁰ National Parks Omnibus Management Act of 1998, 16 U.S.C. §§ 5911 et seq. (1998). “Mandate for science,” quoted from a former high-level NPS leader. Sellars, *Preserving Nature*, 294.

²⁷¹ National Parks Omnibus Management Act of 1998, 16 U.S.C. §§ 5933-34. (1998).

²⁷² Sellars, *Preserving Nature*, 235. “Cooperative Ecosystem Studies Units,” accessed September 24, 2019, <http://www.cesu.psu.edu/default.htm>. Confirmed as well by an interviewee who was involved with CESU.

²⁷³ J.K. Agee, D.R. Field, and E.F. Starkey, “Cooperative Park Study Units: university based science programs in the National Park Service,” *Journal of Environmental Education* 14 (1982): 24-28. Steven R. Beissinger and David D. Ackerly, “Science, Parks, and Conservation in a Rapidly Changing World,” in *Science, Conservation, and National Parks*, eds. Steven R. Beissinger et al. (Chicago: University of Chicago Press, 2017), 372.

the back of the superintendent's mind, 'Well, somebody else should do that. It's not the Park Service's role to be a research organization.'" Finally, it was the NPS's legislated responsibility, and they had resources from the Natural Resource Challenge to carry it out.

A Closer Look at the *Leopold Report's* Legacy

On the phone...

...Sitting before my expansive, oak desk at home. Through the piles of paperbacks cluttering my workspace, I can just barely glimpse our backyard garden of dandelions and rocks. I hear my dog, Torrey, body slamming the sliding-glass door downstairs, and I pray she'll hold her bladder for just 10 more minutes until I can end the call.

...On the floor of my friend's 500 square-foot apartment within D.C.'s rapidly developing (gentrifying) Navy Yard neighborhood. The new high-rises feel mere inches apart; I see across the narrow divide to the neighbors sitting down to cereal as the sky lightens from grey to blue.

...Parked by a random office building in the middle of Tempe, AZ, alternating between the sweltering heat and short blasts of AC. Even on a 70 degrees F, March afternoon, the car can reach more than 100 degrees F within minutes. I've backed my seat as far as it will go to fit my MacBook and notebook both across my lap.

...At my kitchen table: "Sorry. I'm distracted because my cat's jumping on my computer. Get away! Okay. Let me start over."

Not all my interviews took place in-person, though that would have been ideal. It's exciting to tread through the offices and conferences rooms where decisions are drafted. Certainly, as sophisticated as technologies for voice and video conversations have become, nothing replaced presence for discerning non-verbal communication: Sarcasm conveyed in a slightly raised eyebrow; enthusiasm bursting from two raised hands; a pause in the conversation marked by a chin upon a hand, an elbow upon a desk, an index finger tapping upon pursed lips. And of course, if I hadn't visited him in person Dennis would not have gifted me a stack of documents, every one of which I have appreciated in researching and writing this dissertation. But it would have been expensive,²⁷⁴ so I made time whenever and wherever I could to accommodate calls from across several different time zones and dizzying schedules. And I eventually learned to anticipate my cat's habit of intercepting the webcam at the best (worst) moments in a conversation.

It was during these calls that I had the privilege of speaking with a handful of notable NPS retirees, including those who'd once held offices in the D.C. headquarters (WASO), as well as leadership roles in various units. Many have since settled into an idyllic lifestyle of traveling the world's protected areas, enjoying grandchildren, and of course, keeping a close eye on the institution they've helped shape. Like John Dennis, they worked through the decades following *The Leopold Report*—most throughout the

²⁷⁴ The system includes 419 areas covering more than 85 million acres in every state, the District of Columbia, American Samoa, Guam, Puerto Rico, and the Virgin Islands. National Park Service, "Frequently Asked Questions," last modified September 8, 2019, <https://www.nps.gov/aboutus/faqs.htm>.

1980's and 1990's. Also like Dennis, they were eager to share their thoughts on the NPS and its history.

In his first-floor office at the Department of Interior on that sunny, October morning, Dennis had noted: "...People keep coming back to the *Leopold Report* not recognizing that Park Service management policy learned from the *Leopold Report* and then evolved beyond that." In the phone calls to follow, the retirees I spoke with agreed—the NPS had long ago abandoned historical baselines for preservation.²⁷⁵ Their perspectives reminded me, although the *Leopold Report* can be remembered for setting off "The Ecological Revolution,"²⁷⁶ it's probably just as often been critiqued for endorsing a historical standard for preservation—a goal increasingly seen as non-scientific and even unattainable considering the inherent dynamics of ecosystems and the more recent context of climate change.²⁷⁷ One critic, Alston Chase, scorched the *Leopold Report* and the NPS in his 1986 book, *Playing God in Yellowstone*, arguing that the *Leopold Report* and the ecosystem management aims of the NPS were not based in good science. The goals of restoring historical systems was ill-informed, and even impossible:

²⁷⁵ Note, each of them had once occupied influential roles in the NPS, including direct involvement in writing, reviewing, and implementing the policies and laws I've reviewed. Outside of my limited sample of interviewees, there very well may have been some who interpreted and practice historical preservation well into the late 20th century despite the evolution in *Management Policies* and the philosophies of those leading in WASO and in individual parks.

²⁷⁶ Larry M. Dilsaver, "The Ecological Revolution, 1964-1969."

²⁷⁷ Emma Marris, "The Yellowstone Model," in *Rambunctious Garden*, Emma Marris (New York: Bloomsbury, 2011). Monica Turner et al., "Climate Change and Novel Disturbance Regimes in National Park Landscapes," in *Science, Conservation, and National Parks*, eds. Steven R. Beissinger et al., (Chicago: The University of Chicago Press, 2017). D. N. Cole and L. Yung, *Beyond Naturalness: Rethinking Park and Wilderness Stewardship in an Era of Rapid Change* (Washington, D.C.: Island Press, 2011). Steven R. Beissinger and David D. Ackerly, "Science, Parks, and Conservation in a Rapidly Changing World," in *Science, Conservation, and National Parks*, eds. Steven R. Beissinger et al., (Chicago: The University of Chicago Press, 2017), 376.

“The *Leopold Report* had, in short, inadvertently replaced science with nostalgia, subverting the goals it had set out to support.”²⁷⁸ Chase was an outsider: an NPS—and particularly Yellowstone—watchdog. What did the insiders think of such critiques?

Two days after speaking with Dennis, I was laying on my stomach across the floor of that D.C. high-rise with my iPhone wedged between my ear and my shoulder. On my seventh call that week, I had developed a neck cramp, but I needed both hands free for notes. The former WASO administrator on the phone repeated Dennis’s concerns:

“...And that's really quite important... not to freeze [parks] in time, not to try to stifle change. And we haven't done that for decades. People keep saying, ‘Oh, you're still managing under the vignette of primitive America.’ Well, no that's about 20 years late. If you look at the *Management Policies*, if you look at the evolution of *Management Policies*, we started saying that parks manage for dynamic systems, oh back in the late '70s, I think...”

When I later went searching, I could at least pinpoint the year 1988 thanks to the old copies of the NPS’s *Management Policies* Dennis had shared with me (though it might have happened earlier). From *Management Policies 1988*: “The National Park Service will not seek to preserve natural systems in natural zones as though frozen at a given point in time.”²⁷⁹ It made sense then, why the interviewee would grumble: “...people are still throwing rocks at the *Leopold Report*. And come on, let's get—I mean, try to keep up here.”

²⁷⁸ Alston Chase, *Playing God in Yellowstone* (Orlando, FL: First Harvest/Harcourt Brace Jovanovich, 1987), 35. The First Harvest edition I used was published in 1987, though the original copyright was in 1986.

²⁷⁹ U.S. Department of Interior, National Park Service, *Management Policies* (Washington, D.C.: National Park Service, 1988), 4.2. (Pagination in the 1988 edition goes by section (4) and then page within the section (2).

Not quite two years later, I spoke with a former superintendent as I paced through my office in the graduate student government building. I raised the volume of the speaker phone above the sound of an olive tree screeching against my second-story window:

“... we realized in the last 50 years that the *Leopold Report* that we had lived by and the concept of a vignette of early America... is a completely incorrect assessment of what it is we do and why we're doing it. ...we're not trying to sustain a single picture in time, but we are sustaining the whole ecological process.”

So according to *Management Policies 1988*, as well as interviewees, the historical baselines endorsed in the *Leopold Report* had been abandoned at some point during the late twentieth century—in favor of preserving “whole ecological processes.” The last several decades of evolving park management have thus seen not only a shift in how science is applied to the practice of preservation—through academic research partnerships, mandated monitoring programs, citizen science—but also how science is deployed to define the *goals* of preservation. *Means and ends*.

Later the same Tuesday on which I talked with Dennis, I was sitting on the bed in my room at the Hotel Hive on F Street when I spoke with someone—a former division chief—who saw the *Leopold Report* for more than its most famous quote:

“... we're trying to preserve the integrity of those ecosystems. I think that's probably been the goal since the early 1960s but we're just now learning how to articulate that. And people heard Leopold, *et al.*, with their “vignettes of primitive America” and thought “snapshot,” “fixed, static views or scenes,” and I don't think that's what they had in mind at all... [Leopold, *et al.*] knew it was dynamic and that was their intent.”

If you set “vignettes of primitive America” aside, Leopold *et al.* also drew attention to ecosystem dynamics, ecological processes, and biotic associations—management goals with scientific validity to this day. Chase may be right that such goals were “subverted”

by the simultaneous focus on history. But a case could be made that there was a notion of functional integrity fighting to get out in the report, but it was wrestling with the concept of historical integrity.

The principles of ecosystem dynamics, process, and biotic associations would be repeated within reports to follow in the next thirty years. And they would provide the foundation for twenty-first century preservation goals like ecological integrity, defined within *Revisiting Leopold* as sustaining “a full complement of native animal and plant species” as well as “natural functioning ecological processes such as predation.”²⁸⁰ You don’t have to read between the lines to see the similarity to the principles espoused in the *Leopold Report*. This sentiment threads throughout *Revisiting Leopold*: though historical baselines no longer made scientific sense, the committee believed that other intentions of the original *Leopold Report* remained relevant.²⁸¹ In this light, Leopold *et al.*’s chief legacy was science, not historical baselines.

The Historical Context of “Ecological Mistakes” in Park Management

At one point, though, historical baselines may have been considered a scientific end. When the first national parks were founded, boundaries were sufficient protection because the natural world was seen as stable—direct threats to that stability included mining, ranching, poaching, deforestation, and encroachment of urban development. Historical baselines (or historical scenes) would have comported with the prevailing

²⁸⁰ National Park System Advisory Board, *Revisiting Leopold*, 12.

²⁸¹ National Park System Advisory Board, *Revisiting Leopold*, 8.

scientific knowledge of the time, Climax Theory (e.g., Clements 1916),²⁸² which held that all ecosystems either exist at or are evolving toward a climax stage that could go on forever if undisturbed. Park borders, combined with a hands-off management approach, would be enough to allow systems to follow that natural process. Any hands-on practices were either thought to be benign to that evolution, or they were done in the name of balancing preservation with visitor safety and enjoyment, such as introducing exotic fish species to stock lakes²⁸³ or culling predators to protect game species like elk.²⁸⁴

In her book, *Rambunctious Garden*, science writer Emma Marris describes how even as the field of ecology continued to mature, stability remained a core principle:

“While some ecologists... tried to move away from Clementsian ideas in the 1950s, other ecologists hewed to the idea of stable equilibriums, especially the growing “systems ecology” group that studied energy and nutrient flows through ecosystems in the 1960s and 1970s. Such ecologists could model a lake, a forest, or even the whole Earth as a kind of large machine of inputs and outputs.”²⁸⁵

I spent a semester of graduate school drawing out such “models” during my Ecosystem Ecology course; we studied interactions between living organisms and their physical environments, including flows of energy and materials.²⁸⁶ We illustrated those flows as directional arrows to demonstrate where carbon, or nitrogen, or water, etc., were headed

²⁸² F.E. Clements, *Plant Succession: An Analysis of the Development of Vegetation* (Washington, D.C.: Carnegie Institution of Washington Publication 242, 1916). Emma Marris, *Rambunctious Garden* (New York: Bloomsbury, 2011), 28. Marris points out there were those who disagreed with Clements, though his theory remained prominent (e.g. H. A. Gleason, “The Individualistic Concept of Plant Association,” *Bulletin of the Torrey Botanical Club* 53(1926): 7-26.). F. Stuart Chapin III, Pamela A. Matson, and Peter Vitousek, *Principles of Terrestrial Ecosystem Ecology*, 2nd ed. (New York: Springer, 2012), 10.

²⁸³ Sellars, *Preserving Nature*, 123-124.

²⁸⁴ Sellars, *Preserving Nature*, 119-123.

²⁸⁵ Marris, *Rambunctious Garden*, 29.

²⁸⁶ Chapin III, Matson, and Vitousek, *Principles of Terrestrial Ecosystem Ecology*.

in a system, and from which sources. Where there was a source, there was a sink. My professor taught us that such models were our baseline for understanding—in the field, we’d find that flows aren’t in balance, especially given the effects of humans on those systems. But earliest understandings of ecosystem ecology still relied on Clements, especially the analogy between an ecosystem and an organism: “He suggested that a community is like an organism made of interacting parts (species) and that successional development toward a climax community is analogous to the development of an organism to adulthood.”²⁸⁷ In Clements’ view, the climax ecosystem exists at equilibrium, like a healthy, adult organism. (I would guess that understandings of healthy, adult organisms were also over-simplified in the 1960s—or at least only beginning to grasp how complex and at times unpredictable living bodies can be—so the analogy worked then).

The Leopold Report clings to a similar ideal. To continue with Clements’ analogy, the report advances hands-on management to restore prior ecosystem conditions, as a doctor or veterinarian acts to heal a sick or injured organism (which, again, isn’t a perfect analogy given today’s understanding of the varied, complex causes and pathways of diseases like cancer). And yet, the report also references the types of biotic associations studied in systems ecology, as well as a clear understanding that ecosystems are dynamic and humans can impact those dynamics for better or worse.²⁸⁸ Again, that’s why some interviewees considered parts of the report still relevant today. It’s worth noting too, that

²⁸⁷ Chapin III, Matson, and Vitousek, *Principles of Terrestrial Ecosystem Ecology*, 10.

²⁸⁸ Turner et al., “Climate Change and Novel Disturbance Regimes,” 77.

the report admitted its recommendations would require “skills and knowledge not now in existence.”²⁸⁹ This could be interpreted as an acknowledgement that science would evolve. And it did.

By the late twentieth century, “disturbances,” such as fires, hurricanes, and insect outbreaks, became widely recognized as ecologically important.²⁹⁰ In a book chapter on disturbance in parks, lead author and ecologist Monica Turner describes how ecologists began to recognize “that few ecosystems were ever at equilibrium” as they studied disturbances.²⁹¹ Turner’s own work was pivotal in that transition. She led a team that studied one of the largest disturbances in NPS history: the 1988 fires in Yellowstone National Park.²⁹² During that summer, more than a quarter of the park burned—over 600,000 acres—largely due to dry, windy conditions. Turner recalls how the fire captured national attention: “It was reported in the media that the nation’s “crown jewel” was being destroyed.”²⁹³ Though the fire was indeed larger and more intense than any other from the 20th century, Turner describes how subsequent research determined that “large,

²⁸⁹ Leopold et al., *Wildlife Management in the National Parks: The Leopold Report*, 13.

²⁹⁰ Turner et al., “Climate Change and Novel Disturbance Regimes,” 77. This post-equilibrium, flux-of-nature understanding was also popularized in an important book by Daniel Botkin, *Discordant Harmonies: A New Ecology for the Twenty-first Century* (Oxford: Oxford University Press, 1990).

²⁹¹ Turner et al., “Climate Change and Novel Disturbance Regimes,” 78. J. Wu and O. L. Loucks, “From balance of nature to hierarchical patch dynamics: a paradigm shift in ecology,” *Quarterly Review of Biology* 70(1995): 439-466. Monica Turner et al. “A revised concept of landscape equilibrium: disturbance and stability on scaled landscapes,” *Landscape Ecology* 8(1993): 213-227.

²⁹² Monica Turner et al., “Effects of fire on landscape heterogeneity in Yellowstone National Park, Wyoming,” *Journal of Vegetation Sciences* 5(1994): 731-742. Monica Turner et al., “Effects of fire size and pattern on early succession in Yellowstone National Park,” *Ecological Monographs* 67(1997): 411-433.

²⁹³ Monica, Turner, W. H. Romme, and D.B. Tinker, “Surprises and lessons from the 1988 Yellowstone fires,” *Frontier in Ecology and the Environment* 1(2003): 352.

infrequent, severe fires are ‘business as usual,’” and are in fact “functionally important, establishing patterns of stand and landscape structure that sustain ecosystem processes for decades to centuries.”²⁹⁴

The year 1988 also saw publication of the edition of *Management Policies* in which the NPS declared that they would stop managing parks as “frozen at a given point in time.”²⁹⁵ Perhaps aiming to reflect that policy shift, as well as recognition of ecological disturbances, parks adopted the management principle of “historical range of variability” (HRV) in the 1990s.²⁹⁶ Under HRV, parks were expected to vary across time given their natural dynamics and disturbances, but only within historical bounds.²⁹⁷ So instead of frozen at point a time, park were managed across a previous temporal range. But how do you determine that range? Is there agreement on what the historical conditions were and whether they are attainable? And can we assume historical conditions are healthy conditions? I wondered if HRV had motivated the critiques that some of my retired interviewees had protested—HRV didn’t sound *so* different from preserving “vignettes,” or at least not different enough.

²⁹⁴ Turner et al., “Climate Change and Novel Disturbance Regimes,” 85-86.

²⁹⁵ U.S. Department of Interior, National Park Service, *Management Policies*, 4.2.

²⁹⁶ Turner et al., “Climate Change and Novel Disturbance Regimes,” 78. Robert E. Keane et al., “The Use of Historical Range and Variability (HRV) in Landscape Management,” *Forest Ecology and Management* 258(2009): 1025-1037. P. Morgan et al., “Historical Range of Variability: A useful tool for evaluating ecosystem change,” *Journal of Sustainable Forestry* 2(1994): 87-111.

²⁹⁷ For a review of HRV see Morgan et al., “Historical Range of Variability.” Gregory H. Aplet and David N. Cole, “The Trouble with Naturalness: Rethinking Park and Wilderness Goals,” in *Beyond Naturalness*, eds. David N Cole and Laurie Yung (Washington, D.C.: Island Press, 2010).

HRV was promoted into the late 1990s until awareness grew that it may be a “misleading guide for defining desired future conditions.”²⁹⁸ This realization stemmed in part from a growing body of research demonstrating that the past cannot dictate the future in the context of accelerating global change.²⁹⁹ For example, HRV doesn’t apply if climate change is altering ecosystem dynamics and disturbance regimes at unprecedented rates and scales.³⁰⁰ Global change has thus led those within and around the NPS to ponder, if not HRV, then what should be the goals of park stewardship?³⁰¹ And how should those goals be approached? Those were the questions former NPS Director Jonathan Jarvis tasked his Science Committee with “revisiting” in 2012—the same as those raised by Leopold *et al.*, in 1963. What should be the goals of park management? Which policies would help achieve those goals? And what actions would be necessary for policy implementation?³⁰² In other words, what should be the means and ends of park preservation in the twenty-first century?

²⁹⁸ Aplet and Cole, “The Trouble with Naturalness,” 23). Reviewed in Keane et al., “The Use of Historical Range and Variability (HRV) in Landscape Management.” Constance I. Millar, Nathan L. Stephenson, Scott L. Stephens, “Climate change and forests of the future: managing in the face of uncertainty,” *Ecological Applications* 17(2007): 2145-2151. For a review of climate change in parks, see Patrick Gonzalez, “Climate Change Trends, Impacts and Vulnerabilities in U.S. National Parks,” in *Science, Conservation, and National Parks*, eds. Steven R. Beissinger et al., (Chicago: The University of Chicago Press, 2017).

²⁹⁹ For example, fire: A. L. Westerling et al., “Warming and early spring increase western us forest wildfire activity,” *Science* 313(2006): 940-943. R. Seidl, M. J. Schelhaas, and M. J. Lexer, “Unraveling the drivers of intensifying forest disturbance regimes in Europe,” *Global Change Biology* 17(2011): 2842-2852. M. A. Mortitz et al., “Learning to coexist with wildfire,” *Nature* 515(2014): 10-18.

³⁰⁰ Turner et al., “Climate Change and Novel Disturbance Regimes,” 78. Keane et al., “The Use of Historical Range and Variability (HRV).”

³⁰¹ e.g., Cole and Yung, *Beyond Naturalness*.

³⁰² National Park System Advisory Board, *Revisiting Leopold*, 8.

The Rightful Place of Science

I was seventeen years old when President Barack Obama took his oath on the steps of the United States Capitol Building. Tuesday, January 20, 2009, was a school day. Around the same time that Chief Justice Roberts fumbled the words to the Oath of Office, I imagine I was sitting in my fourth period class, staring out one of the building's large, stationary windows. The grilles were each painted Urbandale J-Hawk Blue, crisscrossing the glass in a contemporary grid of squares and rectangles of all sizes. No matter how nice the weather outdoors—which it wasn't in the middle of an Iowa January—the framing was always sealed shut. Looking out at the snow, I was probably daydreaming about next period: lunch. By the time I was eating my rectangular cheese-pizza in the school cafeteria, President Obama was likely well into his inaugural address. It was during that speech—which I didn't hear, see, or read until many years later—that President Obama declared:

“We'll restore science to its rightful place, and wield technology's wonders to raise health care's quality and lower its cost. We will harness the sun and the winds and the soil to fuel our cars and run our factories. And we will transform our schools and colleges and universities to meet the demands of a new age. All this we can do. All this we will do.”³⁰³

He promised to elevate science in healthcare, climate change, transportation, education, and more. And it was a promise that quickly extended to our U.S. National Parks. On March 9, 2009, President Obama released a Memorandum on Scientific Integrity,

³⁰³ Barack Obama, “Inaugural Address,” January 20, 2009, transcript and mp4, The White House (archive), Washington, D.C., <https://obamawhitehouse.archives.gov/blog/2009/01/21/president-barack-obamas-inaugural-address>.

addressed to each of his executive departments and agencies, including the Department of Interior and the NPS:

“Science and the scientific process must inform and guide decisions of my Administration on a wide range of issues, including improvement of public health, *protection of the environment*, increased efficiency in the use of energy and other resources, *mitigation of the threat of climate change*, and protection of national security.” (emphases added)³⁰⁴

This was a clear directive from the Commander in Chief to apply science towards park stewardship, and leading that charge would be Jonathan Jarvis. Director Jarvis’ formal education and park experience were rooted in biology, and he was among the relatively few graduates of a Natural Resource Training Program focused on scientific literacy that the NPS ran throughout the 1980s.³⁰⁵ In an October 2009 interview with the *National Parks Traveler*, Director Jarvis made his priorities clear: “I have always been an advocate for the procurement and application of excellent science to our decision-making process, that all of our decisions should be informed by and guided by good science, and I think that that is one reason that they asked me to serve.”

Among Jarvis’ first acts, he appointed the first ever Science Advisor to the NPS Director: Gary Machlis. Prior to 2009, Machlis was a professor of conservation science at the University of Idaho with a long history of research and involvement in the parks, especially visitor studies. In addition, he’d previously served as the NPS Visiting Chief Social Scientist, as well as one of the original architects and the National Coordinator of the CESU Network. As Science Advisor, Machlis reported to Director Jarvis for the sole

³⁰⁴ Scientific Integrity: Memorandum for the Heads of Executive Departments and Agencies, 74 Fed. Reg. 10671, (Mar. 11, 2009).

³⁰⁵ Shared by an anonymous, insider interviewee.

purpose of counsel and special projects. He did not oversee programs, park scientists, or a budget and was thus unobligated to protect them and likewise free to constructively critique.³⁰⁶ In a way, Jarvis had finally installed the high-level, independent yet internal voice for science called for in the 1963 *Robbins Report*, excepting that Machlis did not have a cadre of park-level scientists to supervise. They were (are) still housed in the USGS.

I interviewed one former WASO employee who explained Jarvis's logic for establishing the Science Advisor position. First, there was "momentum in the Park Service ... toward more evidence-based decisions." This momentum surely stemmed in part from the tone set by President Obama's administration, as well as the prior decades of reports and critiques that feature in Sellars' history of the parks. In addition, the interviewee noted that science seemed to be "getting more and more complicated." Jarvis recognized he might require expert advice to interpret the latest research relevant to park management. This observation tracks with a historical positive feedback loop—as scientists and NPS employees increasingly recognized the complexities of park resources and ecosystems, they continued to call for more science and scientists in parks (though of course, it took a while to get what they asked for).

And finally, demonstrating the impact of individuals in the Park Service, the interviewee acknowledged that Jarvis' own background in science fed a "desire to visibly elevate it to a high level." And so it was. With Machlis at his right hand, Director Jarvis proceeded to release a series of memos and enact several programs to follow through on

³⁰⁶ Shared by an anonymous, insider interviewee.

his promise to bring the best available science, minds, and scholarly work to bear on park management.

In part taking a cue from the Commander in Chief, climate change would drive much of the early action. President Obama was clear throughout his campaign and the early days of his term that climate change would be a top issue,³⁰⁷ and within the first year, his Secretary of Interior released a corresponding Secretarial Order, “Addressing the Impacts of Climate on America’s Water, Land, and Other Natural and Cultural Resources.”³⁰⁸ Through the Order, Secretary Ken Salazar sought to “establish a Department-wide approach for applying scientific tools to increase understanding of climate change and to coordinate an effective response to its impacts...” The Park Service should thus explore responses to sea-level rise, infrastructure damages, threats to wildlife, and cascading effects on invasive species and fire regimes.³⁰⁹

Climate change was of course a concern before Obama, Salazar, and Jarvis came into leadership. As far back as 1990, Congress passed the Global Change Research Act, requiring a President-appointed committee to submit regular reports on the status of global warming research and related challenges.³¹⁰ Some of that research took place in

³⁰⁷ “The Record: A Historic Commitment to Protecting the Environment and Addressing the Impacts of Climate Change,” Accessed September 26, 2019, <https://obamawhitehouse.archives.gov/the-record/climate>.

³⁰⁸ Ken Salazar, "Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources," Secretarial Order 3289 (Washington, D.C.: U.S. Department of the Interior, Sept. 14, 2009).

³⁰⁹ Ken Salazar, "Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources," Secretarial Order 3289 (Washington, D.C.: U.S. Department of the Interior, Sept. 14, 2009).

³¹⁰ National Globe Change Research Act of 1990, 15 U.S.C. § 2921 et seq (1990).

parks. The Park Service started its own Climate Change Response Program (CCRP) in 2007, largely driven by the efforts of Leigh Welling—a scientist who would become the founding chief of the program—as well as the support of then Associate Director of Natural Resource Science and Stewardship Michael Soukup.³¹¹ Still intact today, the CCRP works system-wide to assist parks and regions with the impacts of climate change, including providing interdisciplinary research and guidelines for adaptive park planning.³¹²

Building on that foundation, the NPS published their *Climate Change Response Strategy* in September 2010. In it, Jarvis declared, “climate change is fundamentally the greatest threat to the integrity of our national parks that we have ever experienced.”³¹³ In response, he created the NPS Climate Change Coordinating Group, composed of several associate directors and advised by Machlis, as well as a regional director and a superintendent. The *Response Strategy* goes on to delineate a set of goals for the NPS, organized among “four integrated components: science, adaptation, mitigation, and communication.”³¹⁴ The influences of *Fauna No. 1*, *The Leopold Report*, and *The Robbins Report* are evident—especially in the goals to strengthen inventory and monitoring efforts and to enter beneficial research partnerships.³¹⁵ Such goals were

³¹¹ Phone conversation with Dr. Welling, July 13, 2019.

³¹² U.S. Department of Interior, National Park Service, *Climate Change Action Plan 2012-2014*, (Washington, D.C.: National Park Service, 2012), 9.

³¹³ U.S. Department of Interior, National Park Service, *Climate Change Response Strategy*, (Washington, D.C.: National Park Service, 2010), 7.

³¹⁴ U.S. Department of Interior, National Park Service, *Climate Change Response Strategy*, 3.

³¹⁵ U.S. Department of Interior, National Park Service, *Climate Change Response Strategy*, 12-13.

further fleshed out in the subsequent *Climate Change Action Plan* of 2012.³¹⁶ Also that year, the NPS released the original *Green Parks Plan* to guide sustainable operations throughout the system, including energy efficiency, recycling, and “greening our rides” through electric vehicles.³¹⁷

Between 2012 and 2016 Director Jarvis published a series of memos to clarify NPS policy in light of climate change and to stress the importance of science to decision making. Each would eventually feed into Director’s Order-100, along with *Revisiting Leopold*.³¹⁸

The first of those memos was released on March 6, 2012, to provide guidelines for preserving natural resources in parks given that the “pervasiveness of climate change requires that we re-examine our approaches...”³¹⁹ In the memo, Jarvis notes that while *MP 2006* states that park managers cannot be held responsible for externally sourced impairment, Jarvis *would* hold them responsible for using the best available science, as well as building partnerships with other agencies, non-profits, universities and local communities—the means for preservation.³²⁰ It’s not all that clear as to what counts as “best available science.” Though, as I’ll discuss in chapter five, “best available science” would need to be specified in a way that would work for the various park contexts and

³¹⁶ U.S. Department of Interior, National Park Service, *Climate Change Action Plan*.

³¹⁷ U.S. Department of Interior, National Park Service, *Green Parks Plan* (Washington, D.C.: National Park Service, 2016).

³¹⁸ Jonathan B. Jarvis, "Addressing Climate Change and Natural Hazards for Facilities," Policy Memorandum 15-01 (Washington D.C.: National Park Service, Jan. 20, 2015).

³¹⁹ Jonathan B. Jarvis, "Applying National Park Service Management Policies in the Context of Climate Change," Policy Memorandum N42 (Washington D.C.: National Park Service, Mar. 6, 2012).

³²⁰ Jarvis, "Applying National Park Service Management Policies in the Context of Climate Change.”

questions that emerge, as well as the reality of plural sciences. That's tricky to do. The memo is also less clear on the goals—which is understandable given its place in the queue of memos to come. Those goals could be articulated later. Where the subject *is* broached, Jarvis acknowledges that natural conditions could become “increasingly difficult to characterize and ineffective as a guide for desired future conditions.” And yet, parks are directed to proceed with “traditional practices targeted to maintain ‘natural conditions’ in parks—such as removing invasive species and other stressors; maintaining natural processes and disturbance regimes; restoring naturally functioning ecosystems; supporting biodiversity and landscape connectivity...etc.”³²¹ The recommendations thus contradicted the parks’ newly realized context, a phenomenon perhaps associated with the state of transition in which the NPS found itself. They could recognize that old goals might no longer apply, but it would take time to redefine those goals and the practices to achieve them.

Reflecting a growing awareness that natural and cultural resources are linked, a 2014 memo noted the challenges of preserving cultural resources with meanings so often tied to the very places that were experiencing rapid climate change.³²² Jarvis emphasized the need for integration of cultural and natural resource management, given the ways in which their meanings can be intertwined. As well, the health of cultural resources is often dependent on the health of the larger ecosystem they’re embedded in—they too are vulnerable to sea level rise, extreme temperatures, and fire. Perhaps most novel, Jarvis

³²¹ Jarvis, "Applying National Park Service Management Policies in the Context of Climate Change."

³²² Jonathan B. Jarvis, "Climate Change and Stewardship of Cultural Resources," Policy Memorandum 14-02 (Washington D.C.: National Park Service, Feb. 10, 2014).

asks his park managers to recognize the potential for loss. Not everything could be saved, and managers would need to make tough choices. When would it make more sense to document and let go of resources that cannot be saved “because of their location or fragility”?³²³ Besides noting the need for such decisions to be informed by research and broad consultation with “an array of stakeholders,” the memo punts on the answer. More specific guidance would instead be forthcoming.³²⁴ Echoing the importance of informed decision making, a 2015 memo emphasized the key role of knowledge in managing for hazards to park facilities and infrastructure.³²⁵ Climate change threats must be understood before proper responses could be developed, and alternative decision pathways should always be explored using “sound science.”

In addition to concerns over climate change, the 100th Anniversary of the Organic Act was rapidly approaching, presenting the perfect moment for overall reflection on park stewardship. Public-facing initiatives were generally focused on the important issues of representation and relevancy, such as the Find Your Park campaign.³²⁶ The centennial also spurred contemplation throughout the parks community, from a series of essays in the *George Wright Forum* to the NPS’s *Call to Action*. The latter represented a shared vision of the future, shaped by NPS employees, advocates, scholars, and partners. It was

³²³ Jarvis, "Climate Change and Stewardship of Cultural Resources."

³²⁴ Jarvis, "Climate Change and Stewardship of Cultural Resources."

³²⁵ Jonathan B. Jarvis, "Addressing Climate Change and Natural Hazards for Facilities," Policy Memorandum 15-01 (Washington D.C.: National Park Service, Jan. 10, 2015).

³²⁶ “Find Your Park,” accessed September 26, 2019, <https://findyourpark.com/>.

released in 2011 as a 39-item checklist, and progress was updated annually through 2015.³²⁷ Of those to-do's, number 21 insisted that the NPS "Revisit Leopold":

Create a new basis for NPS resource management to inform policy, planning, and management decisions and establish the NPS as a leader in addressing the impacts of climate change on protected areas around the world. To accomplish this we will prepare a contemporary version of the 1963 Leopold Report that confronts modern challenges in natural and cultural resource management.³²⁸

That "contemporary version" appeared one year later as *Revisiting Leopold*. As noted above, Director Jarvis decided the task would fall to the NPS Science Committee, a committee of the National Park System Advisory Board.³²⁹ Members of the Board, and thus the Science Committee, serve four year terms upon appointment by the Secretary of Interior.³³⁰ Chaired by Rita Colwell, former Director of the National Science Foundation, the committee consisted of eleven doctorate degree holders, including a Nobel Laureate, several university professors, two museum curators, and a former NPS scientist. Reflecting a committee stacked with scientists, *Revisiting Leopold* emphasized the important role of science in park preservation, especially in the context of "continuous change that is not yet fully understood."³³¹ The "lens of science" reveals the dynamics of

³²⁷ U.S. Department of Interior, National Park Service, *A Call to Action: Preparing for a Second Century of Stewardship and Engagement*, (Washington, D.C.: National Park Service, 2015).

³²⁸ U.S. Department of Interior, National Park Service, *A Call to Action*, 11.

³²⁹ National Park Service, "Science and Natural Resource Management for the National Parks: Milestones, 1916–2016," last modified April 13, 2018, <https://www.nps.gov/articles/parkscience34-1-insert-timeline-hunt-et-al-3883.htm>.

³³⁰ National Park Service, "Advisory Board Members," last modified July 22, 2019, <https://www.nps.gov/resources/advisoryboardmembers.htm>.

³³¹ National Park System Advisory Board, *Revisiting Leopold*, 11.

a system facing climate change, invasive species, development, and more.³³² The committee thus readily acknowledged that in going back to the *Leopold Report* for inspiration, they were not seeking a return to historical baselines. Instead, they sought to return to the questions asked by Leopold, *et al.* back in 1963: What should be the goals of park management? Which policies would help achieve those goals? And what actions would be necessary for policy implementation?³³³ How would the answers to those questions differ in light of new and ongoing challenges, as well as growing knowledge of resources and park systems—including awareness of what we don’t know? Because continuous change was *not yet fully understood*, managers “must rely on science for guidance,” to have any chance at preserving parks despite “novel conditions, threats, and risks.”³³⁴

Science was not the sole focus of the report. The Committee urged parks to manage with the goal of “transformative experiences,” for example. Visitor experiences in park should “educate and inspire” everyone, and that would require “expanding the relevance and benefits of parks to underrepresented minority groups and communities.”³³⁵ Cultural and historical resources should be managed for “authenticity, defined as “accurate representation of a specific cultural time and place, revealing meaning and relevance of the object to its ‘parent’ culture or context, and displaying a genuine and realistic connection to factual historical events.” Science could inform

³³² National Park System Advisory Board, *Revisiting Leopold*, 1.

³³³ National Park System Advisory Board, *Revisiting Leopold*, 8.

³³⁴ National Park System Advisory Board, *Revisiting Leopold*, 12.

³³⁵ National Park System Advisory Board, *Revisiting Leopold*, 13.

historical accuracy, such as through archaeology, geology, or archival research, but “meaning and relevance” are beyond the reaches of science alone. (It’s also notable that multiple “authenticities” could exist for a given cultural or historical resource depending on how inclusive the narrative is—and depending on who’s telling the story.) As well, the Science Committee defined parks as coupled human-natural systems; many aspects of parks that we consider ecological, also hold cultural significance, like bison.³³⁶

Still, science was at the center of the recommendations regarding natural resources. The primary goal should be ecological integrity,³³⁷ defined as:

...the quality of ecosystems that are largely self-sustaining and self-regulating. Such ecosystems may possess complete food webs, a full complement of native animal and plant species maintaining their populations, and naturally functioning ecological processes such as predation, nutrient cycling, disturbance and recovery, succession, and energy flow.³³⁸

I try to recall my first impressions, back to when I initially read the document in 2014. As I noted above, it struck me as a win for science. Concepts like nutrient cycling, disturbances, species life cycles, and food webs would guide natural resource preservation. Likewise, the Science Committee stressed the importance of the “functional qualities of biodiversity, evolutionary potential, and system resilience.”³³⁹ Those

³³⁶ National Park System Advisory Board, *Revisiting Leopold*, 9.

³³⁷ It’s worth noting here that the Science Committee did not invent the goal of ecological integrity. Parks Canada adopted ecological integrity in the 2000 Canada National Parks Act: "...a condition that is determined to be characteristic of its natural region and likely to persist, including abiotic components and the composition and abundance of native species and biological communities, rates of change and supporting processes." Parks Canada, “Ecological Integrity,” last modified May 2, 2018, accessed September 24, 2019, <https://www.pc.gc.ca/en/nature/science/conservation/ie-ei>.

³³⁸ National Park System Advisory Board, *Revisiting Leopold*, 12.

³³⁹ National Park System Advisory Board, *Revisiting Leopold*, 10.

qualities should matter just as much as the “observable” icons; science was finally as important as scenery.³⁴⁰ This was especially evident in the recommended actions: hire more scientists, establish a science advisory board, expand monitoring programs, foster citizen science programs, promote interdisciplinary research, and so on.³⁴¹

And yet, this definition of ecological integrity raises some of the very questions it’s meant to answer. What should be the goals for parks in an era where systems may change so much that native species may no longer be suited to their historical environments? Is the answer really “ecological integrity”—which aims for a “full complement of native animal and plant species maintaining their populations”? And what goals can we set for a natural system that’s overwhelmed by human influences, especially anthropogenic climate change? Is the goal “ecological integrity”—including “naturally functioning ecological processes,” which, as defined by NPS policy, should be free from human dominance?³⁴² “Ecological integrity”—this key, new scientific goal informing natural resource management—is informed by many of the same concepts, like native species and naturalness, that had driven NPS leadership to revisit the means and ends of preservation in the first place. Were those concepts so deeply embedded, or part of how we define, value, and experience national parks that they cannot be left behind? Was the term “ecological integrity” simply dressing up those older ideas in *seemingly* objective and operationalized garb, even though it isn’t ...and perhaps cannot be?

³⁴⁰ National Park System Advisory Board, *Revisiting Leopold*, 10.

³⁴¹ National Park System Advisory Board, *Revisiting Leopold*, 19-21.

³⁴² U.S. Department of Interior, National Park Service, *Management Policies 2006* (Washington, D.C.: National Park Service, 2006).

Learning to Question the “Rightful Place of Science”

Drawing almost word-for-word from *Revisiting Leopold*, Jarvis’ 2016 Director’s Order-100 declares: “The overarching goal of resource stewardship...is to manage NPS resources in a context of continuous change that we do not fully understand...” Also echoing *Revisiting Leopold*, the primary ends of that stewardship would be ecological, historical, and cultural integrity, and that required reliance on science, collaboration with outside partners, and stakeholder engagement. In pursuit of the first, superintendents should be required to “possess scientific literacy,” and leadership should “foster a culture that values scientific and scholarly expertise, and supports scientists and scholars to conduct, publish, and present research of the highest quality.”³⁴³

But perhaps indicating the four years of reflection, review, and revision separating *Revisiting Leopold* and DO-100, the definition of ecological integrity moved a bit farther from the concepts of “native” and “natural.” Instead, ecological integrity should be “comparable” to natural habitats, and could allow for progression “towards novel conditions associated with a changing climate.” And although maintenance of integrity should rely on “scientific and scholarly research,” it should also be informed by “traditional ecological knowledge, and an evolving understanding of the resources and values that are fundamental to the park’s purpose.” The key role of science had been affirmed and so ordered, but it would not be placed above other inputs to preservation.

Around the 2016 release of DO-100 was about the same time I was starting to feel a little less certain of the role of science in park management. With a deeper knowledge

³⁴³ Jonathan B. Jarvis, "Resource Stewardship for the 21st Century," Director's Order 100 (Washington D.C.:National Park Service, Dec. 20, 2016).

of NPS history, I began to understand parks as the public lands they are—lands that would always be subject to the shifting values of the public, and of the people we elect to run them.³⁴⁴

Sellars knew this. Reflecting on the impact of *Preserving Nature in the National Parks*, in the epilogue to the 2009 edition, Sellars peppered triumph with caution. The sustainability of the Natural Resource Challenge, he noted, was dependent on values: “Only through sustained oversight and pressure can an enduring, ecologically sound management of national park lands...be ensured. This is always the people’s choice to make—or not.”³⁴⁵ Part of the “people’s choice” is executive leadership—something that is unlikely to remain stable over the years. In his 2009 epilogue, Sellars recounts how under the Bush Administration, Interior Secretary Gale Norton secretly requested that her team revise the NPS *Management Policies* to emphasize recreation and use, as well as park deregulation; two interviewees recalled this, as well.³⁴⁶ But on the counter-attack, the “people’s choice” could also be expressed through advocacy groups and op-eds. One former NPS administrator recalled reactions to the revisions from within and outside of the NPS:

“...Once we got a clean draft that showed all of the changes ...we could zone in on them and prepare arguments against each one of them. ... When people around the country heard that this had been done, we got a tremendous number of editorials. I think it was like 60 or 70 editorials in major newspapers. And everybody came out of the woodwork to oppose this.”³⁴⁷

³⁴⁴ Runte, *National Parks*.

³⁴⁵ Sellars, *Preserving Nature*, 308.

³⁴⁶ Sellars, *Preserving Nature*, 302.

³⁴⁷ Example media attention: Michael Schnayerson, “Who’s ruining our National Parks?” *Vanity Fair*, June 7, 2006.

The National Parks Conservation Association, George Wright Society, and Coalition of NPS Retirees all played key advocacy roles in preventing edits that would have omitted words like “science,” “ecosystem,” and “human and visitor impacts.” Leaders within the NPS spoke out, too. Sellars recalled a memo prepared by Jarvis—the same Jarvis responsible for DO-100—who was then the Pacific West Regional Director. Jarvis characterized the revisions as the “largest departure from the cores of values of the NPS in its history, posing a threat to the integrity of the entire system.”³⁴⁸ Though Secretary Norton abandoned the revisions, in Sellars’ view she had already demonstrated that the NPS’s progress in natural resource management would always be subject to ideological changes. The parks and their commitment to science thus required “eternal vigilance” against future transgressions.³⁴⁹

Reading about this series of events for the first time in 2015, I sensed my own call to action to be part of that “eternal vigilance”—to understand how parks could better rely on science in decision making and rise above politics to maintain science in its “rightful place.” I would need to help prove science as the key to good decisions, despite what the people or the people’s elected leadership may think or do. I’d been trained as a scientist; I believed that so long as I labored in the lab for the requisite number of hours, following the scientific method, an answer was possible.

But in 2016, I was starting to ask more questions about science. The problems in parks were not the like problems in the lab—one issue, like clear night skies, could cross

³⁴⁸ Sellars, *Preserving Nature*, 303.

³⁴⁹ Sellars, *Preserving Nature*, 308.

scientific, political, economic, and cultural realms. So then why did I feel that science should carry any more weight than the other factors of decision making, especially the voices of the people? Did I believe my voice—and the way I value the role science in preservation—mattered more than the voices and values of others? I was especially troubled by that question when I reflected on the fact that I value parks as more than ecological entities.

My early experiences with nature were the typical stuff of swims in the icy neighborhood creek, horseback rides at summer camp, and family road trips to the western national parks. The latter brewed in me a strong attachment to the wild freedom I experienced in those landscapes, and it's a feeling I've chased through the years in camping trips, study abroad programs, and research projects. I wanted to explore and understand the highest mountain tops and the deepest seas, to go where people didn't go. My curiosity in part inspired my aptitude for and pursuit of science.

In the third decade of my life, parks provided me sanctuary from my toughest times. After my first heartbreak, I booked a trip to the Grand Canyon and spent a week dawdling along the bottomless drop-offs, hoping to fill the fresh void in my heart with the thrill and sense of accomplishment one gets during the twenty-three-mile trek from rim-to-rim. And as I healed from cancer treatments in my last year of college, I sought retreat on the shores of Devil's Lake State Park, Wisconsin. It's not a National Park, but in my struggle up the tallest bluffs I found freedom from the labels of "cancer patient" and "cancer survivor." I hadn't intended to, but I began to grieve the loss of my grandfather on a drive through Joshua Tree National Park. I ran to nature to escape heartbreak, stress,

and disease that threatened my vitality. Surely other people had their own reasons for escaping to nature, too. How should their voices inform preservation?³⁵⁰

The tabs I placed in Sellars' book started to look differently—green wasn't in competition with yellow, pink, and blue. Each had unique and overlapping importance, even if at times competing. As *Revisiting Leopold* notes: "The NPS needs a specific and explicit policy for park stewardship and decision making based on best available sound science, accurate fidelity to the law, and long-term public interest."³⁵¹ Science does not stand alone to inform park management. It exists in a constellation with other inputs to decision making—political, economic, legal, cultural, and personal.

As I say in chapter one, I do not question whether science can do good, be useful, or play a key role in decision making. It's essential. And I acknowledge that there are (and strongly disagree with) those who would like to purge science from informing public lands management and substitute a logic of corporate commercialism and exploitation in favor of pursuing development and de-regulation of those lands. The questions I ask have more to do with the limits of science to answer normative and ethical questions.

In part, I learned that from the very institution I thought I would study and critique on the topic. For example, the NPS's 2010 Climate Change Response Strategy declares that any scientific investigation in parks should be preceded by "questions about what information is needed and why." Science would not be the only informant: "While

³⁵⁰ Text in the two preceding paragraphs slight updated from an essay I published in *Minding Nature*: Michelle Govani, "A Journey to the Place Between Wild and Wrecked," *Minding Nature* 11(2018): 77-83.

³⁵¹ National Park System Advisory Board, *Revisiting Leopold*, 17.

much of the needed knowledge will come from physical and ecological sciences, decision making also involves social, economic, cultural, and political considerations.”³⁵² Perhaps that’s because the NPS sees climate change as more than a scientific problem—response would require all sorts of information and a wide range of interdisciplinary and multi-value partnerships among “disciplines, sectors, and organizations.”³⁵³ Climate change won’t be solved in a lab.

Director’s Order 100 seems to understand that science is not monolithic; there are a “wide variety of scientific and scholarly disciplines,” including Traditional Ecological Knowledge. In acknowledging a diversity of legitimate scientific perspectives—and epistemologies in the case of TEK—the NPS speaks to a plurality of “sciences” that I mentioned earlier. I’ll expand on that point in chapter five but the gist is that sciences can be differentiated by their objects of study, their scales of investigation, as well as their training programs and professional norms. The NPS seems to recognize that “science” and its use in management is not a universal nor a consensus-driven process.

Alongside calls to consider all types of knowledge in resource management, DO-100 also directs park managers to involve “diverse communities in park resource issues, values, and science,” and to start building the infrastructure to better engage with public comments, town halls, partnerships with indigenous communities, citizen science programs, and more.

At the start of this project, I was ready to fight for science *vs.* everything. But in the parks, science works alongside everything. Moving forward, I knew I wanted to

³⁵² U.S. Department of Interior, National Park Service, *Climate Change Response Strategy*, 8.

³⁵³ U.S. Department of Interior, National Park Service, *Climate Change Response Strategy*, 9.

explore this in more depth. Where does the balance among these inputs to decision making lie? How might different inputs complement one another? What if there's conflict? How do park managers translate all the values, concepts, and information into the means and ends of preservation? Especially when some concepts and information seem to be in states of perpetual change or redefinition?

Further, I wondered if managers felt the elevated role of science was helping them better manage their parks on the ground? In what ways? Even equipped with a full range of inputs to decision making, the challenge remains grand—to preserve parks in the context of continuous change. Regarding climate change, for example, the NPS admitted that many questions remained unanswered: “How quickly and how much will sea level rise on particular coastlines? How much temperature increase can species and ecosystems withstand before widespread and irreversible changes occur? How will the distribution, timing, and intensity of precipitation change in different regions?”³⁵⁴ How would science, in balance with other inputs to understanding and decision making, help answer those questions? And in the process of using science to inform preservation, what assumptions are NPS managers making about how science works and what it can do? Are the questions above, and others like them, even answerable through science?

There's a small, but notable difference in language between *Revisiting Leopold* and Director's Order 100: in the former, continuous change is not “yet” fully understood. In the latter, they omit the word, “yet.” There may be changes, ongoing and yet to come, that are beyond understanding. Which changes and challenges might be so? How do

³⁵⁴ U.S. Department of Interior, National Park Service, *Climate Change Response Strategy*, 5.

managers know which questions to answer through science, as opposed to through other types of knowledge?

Preservation as Policy (or Law)

Above my desk, a little to the left of a framed Joshua Tree poster, and directly above a “timeline to completion” that I didn’t follow, hangs a mind-map I titled, “The Organization of the U.S. National Park Service (w/in the U.S. gov’t).” I’d decided to draw the map after a phone call with Jason (Jay) Theuer, the Cultural Resource Branch Chief at Joshua Tree National Park, and at the time, the most recent member of my dissertation committee. What he taught me then was new information for a PhD student whose last experience with civics was during her senior year of high school. He was calling to address some confusion he’d noticed in the latest draft of my prospectus—what’s the difference between law and policy?

At the very top, in the center, I wrote, “The Constitution.” Jay explained that it underlines all the rest. In the official phrasing of Management Policies, “The property clause of the U.S. Constitution, which is the supreme law of the United States, gives Congress the authority to develop laws governing the management of the national park system. The property clause specifically directs that ‘The Congress will have the Power to dispose of and make all needful Rules and Regulations respecting the Territory or other Property belonging to the United States (article IV, section 3).”³⁵⁵ Anything that

³⁵⁵ U.S. Department of Interior, National Park Service, *Management Policies 2006*, 4.

followed—legislative, executive, or judicial—owed its legality to the U.S. Constitution and the property clause.

As Jay continued, I sketched. The mind-map I ended up with sprawls across four pieces of recycled printer paper taped together, and it's hung above every desk in every home I've had for the last couple of years, pinned to the wall by four pink thumbtacks.

On the far left of the map lies the legislative branch—with arrows and brackets illustrating the several natural resource, science, and appropriations committees and subcommittees that most often sponsor bills relevant to the NPS. Those become statute if passed by the House and the Senate and signed by the President. Jay explained, fidelity to those laws is priority number one. For example, in *Revisiting Leopold*, the NPS Science Committee writes, “NPS decision-making process must adhere with precision to law...”³⁵⁶ And indeed there is a law which could be interpreted as foundational to their policy recommendations: the 1998 National Parks Omnibus Management Act directs the Secretary of Interior to ensure park management is “enhanced” by application of “the highest quality science and information.”³⁵⁷

In the center of my mind map lies the executive branch, headed by the President of the United States. As an executive agency of the U.S. government, the National Park Service falls under the direction of the President's administration. The Secretary of Interior, their deputy and assistant secretaries, and the Director of the NPS are all presidentially appointed. Jay explained that the President, Secretary, and Director each

³⁵⁶ National Park System Advisory Board, *Revisiting Leopold*, 17.

³⁵⁷ National Parks Omnibus Management Act of 1998, 16 U.S.C. §§ 5932 (1998).

have the authority to write and release orders and memos that guide or clarify policy in the U.S. National Parks. As well, they might oversee revisions to the *Management Policies* that direct the National Park Service. But how are each of those different from the law?

Only Executive Orders carry similar legal weight—every federal agency, including the NPS, is required to comply and can be sued in court for violating orders (the courts, by the way, take up the right side of my mind-map; lawsuits filed against the NPS are tried in federal court). Though Executive Orders do not require Congressional approval, they cannot contradict statute or violate the Constitution. If they do, they can be challenged in court. And unlike statutes, Executive Orders can be overturned by future Presidents, again, without permission from Congress. For example, National Monuments, which are products of Executive Orders, can be modified under future administrations. Such was the case when President Trump reduced the size of Bears Ears National Monument, formerly designated by President Obama. In contrast, modification of legislated National Parks requires an act of Congress.

Policies, as well as memos and Secretarial or Director’s Orders, are meant only to guide or “improve the internal management of the National Park Service.” As the NPS Office of Policy notes, “They are not enforceable legal tools.”³⁵⁸ However, they typically

³⁵⁸ National Park Service, “Law, Policies & Regulations,” last modified May 22, 2019, last accessed September 24, 2019. <https://www.nps.gov/aboutus/lawsandpolicies.htm>.

have a legal basis and are sometimes even direct reiterations or restatements of law.³⁵⁹

The real purpose of these policies is to specify how to achieve the ends stated in the law:

“Fortunately, the Organic Act also authorizes the NPS to ‘regulate the use’ of national parks, which means we may develop more detailed policies to implement the overarching policies set by Congress. We have articulated those detailed policies in *Management Policies*, which govern the way NPS managers are to make decisions on a wide range of issues. If or when necessary, Director’s Orders may modify or supplement *Management Policies*.”³⁶⁰

Similar to Director’s Orders, memos are meant to create or clarify policy, but are more often used when the matter is simpler—like to institute recycling programs³⁶¹—or more urgent, such as with the interim memo restricting the use drones in national parks.³⁶² The latter are sometimes later incorporated and formalized into Director’s Orders, such as the case with Director Jarvis’ memos and DO-100. Like Executive Orders, Director’s Orders often reflect the priorities of the current administration, and they are thus subject to rescindment should the administration change.

Expressing that authority, the Trump administration rescinded DO-100 on August 16, 2017. As of July 2019, President Trump is on his second Secretary of Interior, and has yet to appoint and confirm a Director of the National Park Service. The “Deputy Director Exercising the Authority of the Director” has released a few memos regarding

³⁵⁹ National Park Service, “‘Things to Know’...about National Park Service policy and the Directives System,” last modified August 18, 2017, last accessed September 24, 2019, <https://www.nps.gov/policy/DOrders/thingstoknow.htm>.

³⁶⁰ National Park Service, “‘Things to Know.’”

³⁶¹ Jonathan B. Jarvis, "Disposable Plastic Water Bottle Recycling and Reduction," Policy Memorandum 11-03 (Washington D.C.: National Park Service, Dec. 14, 2011).

³⁶² Jonathan B. Jarvis, "Unmanned Aircraft-Interim Policy," Policy Memorandum 14-05 (Washington D.C.: National Park Service, Jun. 19, 2014).

employee uniforms and visitor service animals,³⁶³ but there's been no further guidance on preservation.

Still Evolving

At the start of this research I wondered, are the concepts and mandates guiding preservation settled or still works in progress? I looked at science, naturalness, preservation, native species, and more. I've traced the evolution of the preservation in practice throughout park history: hands off, hands on, best-guess-work, scientific studies, models of future changes. And I've described the changing goals of preservation, too: scenery, tourism, large landscapes, cultural and historical treasures, "vignettes" of historical ecosystems, and lately, cultural authenticity and ecological integrity. But these means and ends, and especially the concepts guiding them, still aren't settled in policy. And in conversations with park managers and administrators, I'd next discover that they likewise aren't settled in their minds either. Though laws, leadership, and external influences like Sellars have driven preservation to draw more on the sciences, the NPS has yet to clarify the *concepts* that preservation centers on, especially naturalness. As I said before, though NPS officials recognize the concept as increasingly challenging, the latest scientific goal—ecological integrity—is by some definitions informed by naturalness. But what is naturalness in the context of the human-driven changes that dominate many parks? And what does it mean to understand the challenges facing parks scientifically if we have yet to settle on how to understand them conceptually?

³⁶³ You can find a list of NPS memos at: National Park Service, "Policy Memoranda," last modified August 30, 2019, last accessed September 24, 2019, <https://www.nps.gov/policy/PolMemos/policymemoranda.htm>.

4. QUESTIONING NATURALNESS

What are Parks Preserving?

In every interview I ask, “what are parks preserving?” Most will answer along the lines of the NPS mission statement; some even quote the Organic Act word for word. David Hallac, Superintendent of the National Park Service’s Outer Banks Group, surprised me: “...I’m not sure anymore.”

Even over the phone, I could picture his dark eyebrows raised, his hands gesturing through the air. “...The reason I said to you, ‘I’m not sure,’ relates to climate change and sea level rise. And because of that, and because change is happening so rapidly, and because the consequences of change are so uncertain, and because our policies have not been able to...we’ve not been able to wrap our minds around what we do for a rapidly evolving situation with an unknown destiny, it’s kind of hard to know what we’re preserving into the future.”

All NPS Superintendents are faced with changing landscapes and resources set within already dynamic systems. Hallac is tasked with managing a “disappearing seashore.”

The Outer Banks Group consists of Cape Hatteras National Seashore, Fort Raleigh National Historic Site, and Wright Brothers National Memorial, each located on one of the many barrier islands that make up North Carolina’s Outer Banks archipelago. The islands stretch north to south in a razor-thin dotted-line of beige sands and green grasses, separating most of northeastern North Carolina from the Atlantic Ocean. Millions visit each year, drawn by the expansive beaches and ocean views, particularly

within Cape Hatteras. Hallac's been Superintendent since 2015, and it's been a challenge from the start.

Climate change is contributing to sea level rise that erodes away the seashores into the Atlantic Ocean at a "rapid" pace. And yet, visitation remains high, with trends of increasing crowds for each of the last five years. As a result, the local economy booms, and the public, in Hallac's perception, remains somewhat hopeful of the NPS's ability to "fight the ocean back, and nourish the beaches, and ward off the change."

But even if Hallac and his team could push back a rising sea and stabilize the eroding coastline, he still wouldn't be sure how to define "what" he's working to preserve. Often, people associate Cape Hatteras National Seashore with a "big, wide open, pristine suite of beaches." Hallac doesn't dispute their beauty, but they are not pristine:

"... All of the dunes, on our 67 miles of beaches, have been constructed by humans. Much of the vegetation was planted, over the decades in the 1900s, to stabilize the dunescape that was developed by humans. The ditches and saltwater marshes that we have on the sound side have largely been drained. ...let's just say, climate change was a non-issue, didn't exist, wasn't on the radar screen, and sea level rise was not either. ... I still might not be able to give you a good idea of what my management target was for the seashore because it's been so fundamentally altered. And because civilization has come to need to support [and] it's being supported by the altered landscape."

Tourism, supported by the "altered landscape," is highly important to the Outer Banks economy. Attending development runs along the entire seashore, some within the parks. The North Carolina Highway 12 routes north and south, parallel to the shore and accompanied by powerline corridors. Pastel colored vacation homes stand on stilts along the neighboring beaches. Hotels, restaurants, and campgrounds surround the parks. How

does Hallac establish preservation goals for a system with a past and present characterized by human impact, as well as human-park interdependence?

“I’m not sure that a traditional management target or restoration target would work here. I don’t think it’s feasible or practical. So now you take your question...which assumes that we actually had a management target to begin with or an ecosystem we were managing towards, and I just told you, we really didn’t have one. And it wasn’t necessarily practical here because of the close proximity of humans and villages embedded in the seashore. ...how did these environmental changes affect where we were? And the answer is, it just further confuses the situation. It makes it hard to take an already highly altered landscape, altered by humans, with an uncertain management target, now being changed so rapidly, and figure out, you know, where we [want to] go in the future.”

Some might argue that Hallac’s circumstance is extraordinary—that the urgent, drastic changes experienced throughout the Outer Banks Group are as unfortunate as they are unique to their combination of history, geography, economy, and climate change. Hallac admits his are “among the most vulnerable parks in the United States.” But his impressive career, spanning from Wyoming’s Mammoth Hot Springs to the Florida Everglades, tells him that the challenges posed by global change—as well as by historical and ongoing human impacts at *local* scales—are system-wide.

I first met Hallac, or rather, became aware of him, at an April 2017 conference for the George Wright Society, the professional association for park and protected area practitioners, advocates, and academics. He was sitting on a panel of more than a dozen NPS personnel, in a cold, crowded conference room at the Norfolk, VA, Waterside Marriott Hotel. A blank projector screen, much larger than average size, took up the entire right side at the front of the room, forcing the panelists to sit hunched together, shoulder-to-shoulder. Despite their obvious prominence, I hadn’t heard of anyone on the panel before as an NPS outsider. Hallac sat up tall. He spoke with volume and emotion,

measured but effective. His posture and passion distinguished him, but the content of his concerns was shared among the diverse panelists. Across their various parks, groups, or regions, they each pondered the significance of rapid socio-ecological change—caused by and impacting a variety of integrated social and ecological features, systems, and relationships. Colonial National Historical Park Superintendent, Kym Hall, shared her concerns about the effects of rising seas on historical structures and artifacts. Mary Foley, former Senior Science Advisor to the NPS’s Northeast Regional Director (for 24 years), expressed her frustration with the slow pace of approval for social science research—parks urgently need to understand public perceptions of and reactions to changes. Joshua Tree National Park’s Chief of Cultural and Natural Resources, Jane Rodgers, highlighted the effects of drought and extreme heat on Joshua trees and other species in the park.

And all of them wondered: how do you preserve parks against overwhelming human-driven influences beyond their control?

These are not new concerns or questions. Director’s Order-100, along with the preceding Director’s memos and reports, aimed to address it. The overarching goal: to manage resources in the context of continuous change that is not fully understood and that originates from influences beyond the NPS’s control. Ecological, historical, and cultural integrity should be prioritized, and managers should rely on science to inform and adopt new conservation concepts and tools. As previously discussed, “ecological integrity” emphasizes species composition, diversity, and function, and allows for conditions ranging from historical to novel, depending on a park’s context of socio-ecological change.

By the time I was holding my first interviews in October 2017, DO-100 had been rescinded by the Trump administration.³⁶⁴ Still, I discovered that it rang through most conversations, so much so, that after the first few interviews I started to officially ask everyone how they felt about it. It's not a point I reached saturation on—meaning I'm sure there are still more perspectives out there that I'm unaware of—but I noticed a pattern that amounts to, "DO-100 was necessary for clarifying the future directions of the NPS, but not sufficient in terms of the details."

Hallac, for example, wasn't shy about sharing his perspective. First, he was supportive: "They were moving the ball...towards the end zone slowly. And without a ton of direction, but yes, they certainly, I believe, were in the right direction." This sentiment was echoed in many other conversations I had; DO-100 marks a shift in understanding, in approach, and in values.³⁶⁵ One interviewee noted that those shifts had been happening in some parks for many years prior. The document thus served more as an important "marker in time" for the ways in which the NPS is and has been evolving, as opposed to a "foundational" point of origin for that evolution. But what does it mean to steward resources for continuous change to preserve ecological integrity, as well as cultural and historical authenticity? Hallac continued:

"I have no idea what that means, and I've been doing this. Like, this is my reason for being on the earth—is to do natural resource management in the park service. I love it. There's nothing I love more. I've studied it. This is why I come to work every day, and I have no idea what it means."

³⁶⁴ DO-100 was rescinded on August 16, 2017, under the Trump administration.

³⁶⁵ The one exception was John Dennis, who generally agreed with the direction of DO-100 but thought it was unnecessary because *MP 2006* sufficiently addressed those concerns already. I don't necessarily have evidence for this, but I would guess that's in part because he wrote *MP 2006*—he understandably defends it as a comprehensive policy document.

Hallac didn't blame Director Jarvis for the lack of clarity (who, Hallac promised me, was already aware of his opinions). He and other interviewees recognized that rapid socio-ecological change is difficult to confront, especially when colliding with a slowly evolving, decentralized, preservationist institution. As another interviewee, an NPS scientist, put it, Jarvis "sort of punted" on the specifics of how parks should move forward. But, he continued, "I don't blame him. I think it was appropriate for the time...that's the stuff we're still working on. And so I see [DO-100] as a transitional document, in a way."

I noticed the implication of an institution in transition upon repetitive references to concepts I thought had been left behind, at least according to DO-100 and other policies from the Obama administration. I never asked anyone about "naturalness," for example, thinking "ecological integrity" had replaced it (despite DO-100 being rescinded). But that was before I had conducted the analysis in chapter three, showing that ecological integrity still relies on the concept of naturalness to some degree. Interviewees spoke about naturalness of their own volition when I prompted them to consider the significance of socio-ecological changes for preserving parks. They pointed out that naturalness still guides management, according to *Management Policies 2006*. They detailed the ways in which anthropogenic changes were making it difficult to understand, define, and apply the concept to managing parks. Sometimes seeming to use the term synonymously with "unimpaired," "pristine," and even "ecological integrity," they demonstrated how different people ascribe different meanings to "natural,"

reflecting the ways in which it has evolved, in value, in practice, and, even in park policy.³⁶⁶

After noticing interviewee upon interviewee identifying “natural” as at once essential and in need of some re-thinking—in addition to noticing the different personal definitions—I went to my book shelf in search of *Beyond Naturalness*, a book I first read when I was barely months into my graduate school journey. At that point, I had glossed over it in favor of course work, term papers, and teaching assignments. Luckily, I thought to pick the book up in that moment for the second time, almost four years later. In the 2010 edited collection, a group of academics, scientists, public-lands managers, and (a few) park service employees gathered to “articulate park purposes in terms that are both more specific and more diverse than naturalness and to adopt a wider array of management approaches to achieve those purposes.”³⁶⁷

In the book, as well as in a 2008 paper the group published in the George Wright Forum, they urge the NPS to question the concept as a philosophical basis for policy. Could naturalness be re-interpreted or more precisely defined? Should other concepts replace naturalness? Or complement it?³⁶⁸ Editors Cole and Yung are careful to note, “We ask for change respectfully, mindful that implementation is challenging and that the burden of the challenge lies with protected area managers rather than us.”³⁶⁹

³⁶⁶ David N. Harmon, “The Heart of the Matter: New essential reading on parks, protected areas, and cultural sites,” *George Wright Forum* 27(2010): 255-259.

³⁶⁷ Cole and Yung, *Beyond Naturalness*, 2.

³⁶⁸ David Cole, Laurie Yung, and Erika Zavaleta, et al., “Naturalness and Beyond: Protected Area Stewardship in an Era of Global Environmental Change,” *The George Wright Forum* 25(2008): 36-56.

³⁶⁹ Cole and Yung, *Beyond Naturalness*, xiii.

I've asked park service staff, administrators, academics, and advocates to reflect on that "burden." What sorts of changes are you experiencing? What's it like to live and work through the transition—changing climate, ecosystems, resources, publics, and politics, not to mention policies and tools? We know how policy responded to some of those changes, but the perspectives of individuals within and around the NPS matter, especially if DO-100 marked an evolution that's already been in process in different stages and at local levels across the system.

There are three primary concepts that feature throughout the conversations detailed in this chapter: preservation, naturalness, and change. It's been a challenge to keep them logically and semantically clear in my own mind, as they often blur together in the interviews. For example, some equate the idea of preservation with naturalness; change is counter to both concepts, then. Other do not believe preservation and naturalness remain tied, and thus change is not as much of a threat to the concept of preservation in general. This gets even more complicated when you consider the fact that people have different definitions for each of the terms, as well. I reflect on my own evolved understandings of "natural" and "preservation," for example. Recall from chapter two, I once thought preservation meant reuniting a baby bison with its mother—it was only natural they should be together and the ranger should intervene to make it so. Now, I look back and wonder if the baby bison was sick and purposefully left behind by the mother and the herd. This is a different, less child-friendly view of the "natural" course. (I could go on—what if the baby bison had become sick from human causes? Then what's natural? Are humans part of the natural system or definition?) You get the idea;

it's complex and different depending on your perspective. I've done my best to give the chapter structure and keep the terms clear.

That said, the central question throughout the interviews was, what is the significance of anthropogenic socio-ecological change for national parks, especially for the philosophy, policy, and practice of preservation? Repeatedly, it comes back to reflections on “naturalness,” and the challenges posed by the scale, complexity, and inevitability of change. Some feel urgency and desperation for new policies, values, or ideas, while others are defensive, less certain of critiques by Cole and Yung, and others. True to the NPS's transitional state, most seem to exist in the space between—which is part of what makes the concepts blurry. All acknowledge how complicated it is to even consider or effect change to the NPS's longstanding commitment to preservation, especially of natural conditions.

Recognizing Change

On the way to understanding the significance of change for the parks and for preservation, I first wanted to understand, “what sorts of changes are parks experiencing?” How would interviewees explain the conditions contributing to the NPS's transition? I knew the literature, so I went in knowing to listen for climate change, fire regime change, land-use change, and so on. The question thus seemed like it would present a simple task: they describe and I document. I'd even pre-meditated on the presentation of the data: a section on climate change, a section on fire, a section on land-use change, and so on. But when I began my analysis, I found it impossible to isolate any one of the changes for study due to their interrelatedness. At one point, I arranged and re-

arranged dozens of yellow sticky-notes atop my kitchen table to diagram all the interactions (a poor graduate student’s dry-erase board). Before I had even finished drawing on the relationships, it looked like my three-year-old nephew had scribbled across my table with a permanent marker.

Though messy, the exercise clearly illustrated interviewees’ perception that climate change is a (and perhaps “the”) central challenge. Not every park experiences crowding, for example, yet in all but one conversation, interviewees referred to the remarkable extent of climate change, stemming from its direct and indirect effects on things like fire regime, coastal erosion, biodiversity, park facilities, and more.³⁷⁰ The pattern of concern reflects former NPS Director Jarvis’s declaration, “climate change is fundamentally the greatest threat to the integrity of our national parks that we have ever experienced.”³⁷¹

Relative to the rest of the United States, national parks tend to be more susceptible to the impacts of climate change, especially because many parks exist in areas prone to extremes like the Arctic, high elevations, and arid desert landscapes.³⁷² Across the NPS, average annual temperatures are increasing and average annual precipitation is decreasing, with the most extreme temperature changes occurring in Alaskan parks and

³⁷⁰ And during the single interview in which climate change was not mentioned explicitly, the interviewee referred to related challenges, such as sea level rise and fire regime change.

³⁷¹ U.S. Department of Interior, National Park Service, *Climate Change Response Strategy*, 1.

³⁷² Patrick Gonzalez et al., “Disproportionate Magnitude of Climate Change in United States National Parks,” *Environmental Research Letters* 13(September 24, 2018): 104001. <https://doi.org/10.1088/1748-9326/aade09>. This one is a study of every single unit in the Park Service compared to the rest of the USA.

the most severe droughts occurring in the southwest.³⁷³ The team responsible for these research findings, led by principal climate change scientist for the NPS, Patrick Gonzalez, predicts that even under models of reduced emissions, climate change exposure will continue to intensify (and even more so if emissions were to hold at current levels or to increase).³⁷⁴

As one NPS retiree, a former natural resource administrator from the Washington headquarters, put it, “You throw into that equation climate change and suddenly all of the things that we have learned over the years become more complicated.” Land managers believe climate change adds complexity and urgency to the already tough challenge of preserving national parks. Another interviewee stressed, “the pot has been stirred.”

Among the possible impacts of climate change, interviewees consistently referred to the threat posed to biodiversity. Flora and fauna across the United States, and especially in the Southeast, have been and continue to be vulnerable to invasive species,³⁷⁵ land-use change, and other threats.³⁷⁶ Climate change is an additional challenge, causing novel temperature and precipitation conditions that may be unsuitable

³⁷³ Gonzalez et al., “Disproportionate Magnitude of Climate Change in United States National Parks.” William B. Monahan and Nicholas A. Fisichelli, “Climate Exposure of U.S. National Parks in a New Era of Change,” *PLoS ONE* 9 (July 2, 2014): e101302, <https://doi.org/10.1371/journal.pone.0101302>. Monahan et al., found similar results for their study of only 289 national park units. Their results showed that parks are “overwhelmingly at the extreme warm end of historical temperature distributions...” while “Precipitation and other moisture patterns are geographically more heterogeneous across parks...” (from the abstract).

³⁷⁴ Gonzalez et al., “Disproportionate Magnitude of Climate Change in United States National Parks.”

³⁷⁵ NPS definition: “Invasive species include terrestrial and aquatic plants, animals, diseases, and other organisms and are defined as “those species that occupy or could occupy park lands directly or indirectly as a result of deliberate or accidental human activities.” U.S. Department of Interior, National Park Service, *Management Policies 2006*, 43.

³⁷⁶ C. Bellard, C. Leclerc, and F. Courchamp, “Combined Impacts of Global Changes on Biodiversity across the USA,” *Scientific Reports* 5(December 2015): 1-11, <https://doi.org/10.1038/srep11828>.

for an area's historical plants and animals.³⁷⁷ In many cases it magnifies the other familiar threats to biodiversity, or interacts with them in particularly challenging ways (e.g., combining with habitat fragmentation to undercut the ability of a population to disperse, etc.). Climate change could also impact native species' ability to compete by creating favorable conditions for invasive species. Hallac notes this:

“...we now have ecosystems where because of changing climate, precipitation patterns, snowfalls, snow park, sea level inundation—you know, whatever—it's becoming harder and harder to control nonnative species. And some of our native species may not even be physically able to tolerate the new systems that they're living in. Temperatures might be too warm. The growing season might be too short or too long. Well, whatever it is, habitat may no longer be suitable.”

In other cases, plants and animals are indirectly threatened by climate change because of its effects on fire regime.³⁷⁸ One NPS scientist shared that “published research has shown that climate change has doubled the wildfire area burned—the wildfire area that would have burned without climate change since the 1980s—and this is continuing.” In addition to climate change, policy also impacts fire regime. Jason Mateljak, Chief of Resource

³⁷⁷ In Yosemite National Park, subalpine forest shifted upslope into subalpine meadow from 1880 to 2002: Constance I. Millar et al., “Response of Subalpine Conifers in the Sierra Nevada, California, U.S.A., to 20th-Century Warming and Decadal Climate Variability,” *Arctic, Antarctic, and Alpine Research* 36, no. 2 (May 2004): 181–200, [https://doi.org/10.1657/1523-0430\(2004\)036\[0181:ROSCIT\]2.0.CO;2](https://doi.org/10.1657/1523-0430(2004)036[0181:ROSCIT]2.0.CO;2). In Joshua Tree National Park, trees may no longer be able to persist in the park due to heat related mortality: Cameron W. Barrows and Michelle L. Murphy-Mariscal, “Modeling Impacts of Climate Change on Joshua Trees at Their Southern Boundary: How Scale Impacts Predictions,” *Biological Conservation* 152 (August 1, 2012): 29–36, <https://doi.org/10.1016/j.biocon.2012.03.028>. Kenneth L. Cole et al., “Past and Ongoing Shifts in Joshua Tree Distribution Support Future Modeled Range Contraction,” *Ecological Applications* 21, no. 1 (January 2011): 137–149, <https://doi.org/10.1890/09-1800.1>. In Lassen Volcanic National Park, American pika (*Ochotona princeps*), a small alpine mammal, is vulnerable to extirpation: Joseph A. E. Stewart et al., “Revisiting the Past to Foretell the Future: Summer Temperature and Habitat Area Predict Pika Extirpations in California,” *Journal of Biogeography* 42(2015): 880–890, <https://doi.org/10.1111/jbi.12466>.

³⁷⁸ For example, in Yellowstone National Park, climate change may increase the area burned by fire up to ten times by the year 2100: Anthony L. Westerling et al., “Continued Warming Could Transform Greater Yellowstone Fire Regimes by Mid-21st Century,” *Proceedings of the National Academy of Sciences* 108, no. 32 (August 9, 2011): 13165–70, <https://doi.org/10.1073/pnas.1110199108>.

Management for Lassen Volcanic National Park in northern California, describes the scenario in Lassen:

“We are a heavily forested park with a long history of fire suppression. So, we have, I'd say, overstocked and unhealthy forest in the park. We have a pretty rigorous and have had a pretty rigorous fire management program for years, but we still are behind where we need to be. So, one of our biggest fears is to be the next big catastrophic fire. . . . What is the health with changing climate, with the conditions of the forest, what happens if we have this landscape level fire in the park, and what will that do to our resources?”

Other park managers and biologists concur: the causes of fire regime change are many, myriad, and often directly or indirectly related, including climate change, the presence of fire-adapted invasive species, as well as historical land-management practices like fire suppression. Mateljak feels it's become more challenging to determine the definition of “health” in the forests he manages—something that has arguably always been a challenge as the understanding of fire regimes has evolved, but of course receives added layers of complexity under conditions of climate change. Interviewees described the potential impacts of fire regime change as including air pollution, species extirpation or extinction, damage to cultural resources and facilities, land-type conversion, and loss of life.

Though not mentioned by many interviewees, it's worth pausing on land-use change. Expanding development, catastrophic fire, and climate change can all result in altered landscapes throughout and surrounding national parks.³⁷⁹ Such changes can

³⁷⁹ Andrew J. Hansen et al., “Exposure of U.S. National Parks to Land Use and Climate Change 1900–2100,” *Ecological Applications* 24, no. 3 (April 2014): 484–502, <https://doi.org/10.1890/13-0905.1>. Cory R. Davis and Andrew J. Hansen, “Trajectories in Land Use Change around U.S. National Parks and Challenges and Opportunities for Management,” *Ecological Applications* 21, no. 8 (December 2011): 3299–3316, <https://doi.org/10.1890/10-2404.1>.

impact parks' ecological processes and biodiversity.³⁸⁰ For example, habitat fragmentation can interrupt migration routes.³⁸¹ Development can also directly interfere with the visitor experience. One former superintendent described a powerline project degrading the ecological and scenic value of his park.

Any of these impacts are further complicated by the fact that most national parks were not designed to protect entire ecosystems or species' migration routes, but were rather designed with political or economic-based boundaries in mind.³⁸² The NPS knows; since the 1930's, as in *Fauna No. 1*, there have been calls to expand park boundaries. But in some areas, surrounding development prevents the possibility of ever achieving landscape-scale conservation, whether through land acquisition or in partnerships with adjacent public land managers or private land owners.³⁸³

Forces like climate change and air pollution do not respect park borders anyway. As science journalist Elizabeth Kolbert writes, "...the whole idea of a well-placed reserve becomes if not exactly moot, then certainly a lot more problematic."³⁸⁴ Throughout

³⁸⁰ Andrew J. Hansen and Ruth DeFries, "Ecological Mechanisms Linking Protected Areas to Surrounding Lands," *Ecological Applications* 17, no. 4 (June 2007): 974-988, <https://doi.org/10.1890/05-1098>.

³⁸¹ Lenore Fahrig, "Effects of Habitat Fragmentation on Biodiversity," *Annual Review of Ecology, Evolution, and Systematics* 34, no. 1 (November 2003): 487-515, <https://doi.org/10.1146/annurev.ecolsys.34.011802.132419>.

³⁸² William D. Newmark, "Legal and Biotic Boundaries of Western North American National Parks: A Problem of Congruence," *Biological Conservation* 33, no. 3 (1985): 197-208, [https://doi.org/10.1016/0006-3207\(85\)90013-8](https://doi.org/10.1016/0006-3207(85)90013-8). C. L. Shafer, "US National Park Buffer Zones: Historical, Scientific, Social, and Legal Aspects," *Environmental Management* 23, no. 1 (January 1999): 49-73.

³⁸³ Alisa A. Wade and David M. Theobald, "Residential Development Encroachment on U.S. Protected Areas," *Conservation Biology* 24, no. 1 (2010): 151-61, <https://doi.org/10.1111/j.1523-1739.2009.01296.x>. Sebastián Martinuzzi et al., "Scenarios of Future Land Use Change around United States' Protected Areas," *Biological Conservation* 184 (April 1, 2015): 446-455, <https://doi.org/10.1016/j.biocon.2015.02.015>.

³⁸⁴ Elizabeth Kolbert, *The Sixth Extinction* (New York: Henry Holt and Company, LLC, 2014), 170.

Hallac's parks, for example, he must contend with an eroding shoreline due to the effects of climate change on sea level rise, turning park lands from beach to ocean. At the same time Hallac must manage a growing interface with tourism and residential developments. I talked with a handful of NPS folks with experience in coastal landscapes who share Hallac's concerns. Dr. Rebecca Beavers, a Coastal Geologist with the NPS's Climate Change Response Program, wonders if sea level rise will result in competition for "sand rights" as parks contend with vacation homes and other developments for less and less beach-area.

According to two other park scientists, rising sea levels and coastal erosion are impacting parks on both the Pacific and Atlantic coasts. We've heard from Hallac already on how sea level rise impacts the beaches and marshes in his parks, but it also challenges his ability to protect park facilities and cultural resources. In 1990, the iconic Cape Hatteras lighthouse, originally built in 1870 and the tallest in the country, had to be moved inland to escape shoreline erosion. Cape Hatteras is not alone—Beavers pointed out that Gateway National Recreation Area in New York and New Jersey, as well as Golden Gate National Recreation Area in California, are similarly facing eroding infrastructure and historic buildings.

It's not just historic parks or recreation areas dealing with damages to infrastructure and cultural resources. Even parks set aside to protect primarily natural resources are host to historic and cultural resources, such as the historic mining sites within Joshua Tree National Park. Mateljak worries that at Lassen Volcanic National Park, a geologic park, they may not yet be aware of all the historic structures and artifacts they have and thus, all they may be losing. He also notes that when climate change

threatens the integrity of historic structures built in the 1930s or 1960s, maintenance isn't as simple as taking a trip to "Home Depot." There are "delicate," specific rules to follow, requiring skills and tools in historic restoration. Likewise, NPS geologist Beavers expresses her concern that historic structures will be vulnerable to climate change: "we're finding some of the materials like tabby in the southeast, or some of the adobe in the southwest are no longer as viable as the temperature, humidity, and other characteristics change." If that's the case, she continues, the NPS better plan for how to communicate those changes to the public.³⁸⁵

All parks—historical, natural, or otherwise—are vulnerable to climate change and other challenges, and yet all are charged with providing for the visitor experience and obliging the public interest in the context of that change. What if parks or their features change in ways that conflict with public interest? The NPS has turned to the social sciences in recent years to assist with exploring such questions.³⁸⁶ But the ability to predict or understand the potential for conflict may be limited because beyond ecological and physical changes, the politics as well as the values and demographics of the public are changing too.

³⁸⁵ This approach assumes that the public has a static and clear idea of what parks should look or be like and how socio-ecological change could impact that ideal. Many of the stories interviewees shared demonstrated that their publics do indeed recognize change, but whether that is the case probably depends on the prominence of the park or the feature affected and the types of values attached. It probably also varies by individual the ways in which or reasons that they value the park (and if those values are attached to features that will change). How much can we assume about what visitors want/expect/can accept in these places outside of a small number of key features and experiences?

³⁸⁶ National Park Service, "Social Science: Current Efforts," last modified May 23, 2019, <https://www.nps.gov/subjects/socialscience/currentefforts.htm>.

Politics and Publics

The second most common question I get asked when people learn that I research national parks is: “Oh no, is Donald Trump affecting your research?” Followed closely by, “Did he take away all your funding?”³⁸⁷ To the latter, no. You have to have federal grant money to have it taken away. But to the former, kind of.

On Tuesday, January 20, 2017, I was reclining on my roommate’s couch in the orange-painted living room of our rental house, supposedly working, but really watching the Presidential Inauguration. That’s when the NPS Office of Management and Budget called. At the time, I was still planning on performing a survey of visitor perceptions at Joshua Tree National Park, and to do so, you need to pass several tedious stages of approval with the OMB. They were calling me back from a previous inquiry, unrelated to the inauguration, but given the occasion, I couldn’t help but ask, “would it be a good idea to change some of the language in my proposal?” Specifically, “should I omit any mention of climate change from the title or abstract?” Their answer: “Yeah, probably.” I ended up moving the project in a different direction anyway, so I wouldn’t claim that the Trump administration affected my research (especially relative to researchers working within the Environmental Protection Agency, for example³⁸⁸).

But there’s no denying Donald Trump has had his moments of conflict with the NPS, starting on day one. While I was sitting on my couch talking to the OMB during the

³⁸⁷ The first, if you’re curious, is “So, will you become a national park ranger when you graduate?”

³⁸⁸ In a survey of scientists working for federal agencies, a study by the UCS showed high levels of censorship and low morale across the board, including in the NPS. Morale was lowest within the EPA. Union of Concerned Scientists, *Science under Trump* (Cambridge, MA: Union of Concerned Scientists, 2018), <https://www.ucsusa.org/center-science-and-democracy/promoting-scientific-integrity/scientist-survey-2018>.

inauguration, @NatlParkService, the official NPS Twitter account, re-tweeted *New York Times* editorialist Binyamin Appelbaum, “Compare the crowds: 2009 inauguration at left, 2017 inauguration at right. #Inauguration.” The accompanying photo juxtaposed Obama’s overflowing crowds with Trump’s relatively sparse attendance.³⁸⁹ President Trump, who to this day maintains that his inauguration crowds were the largest ever, furiously moved to temporarily deactivate all official Department of Interior twitter accounts. More than 18 months later, *the Guardian* reported on a series of January 21, 2017, phone calls in which then White House Press Secretary, Sean Spicer, and even President Trump himself, contacted then acting NPS Director Michael Reynolds and other NPS officials in search of more flattering photographs.³⁹⁰ Days later, @BadlandsNPS, official Twitter of Badlands National Park in South Dakota, was forced to delete a thread of climate change tweets. Around the same time, an alternative NPS account, @AltUSNatParkService, was created to counter the executive crack-down, and to this day maintains more than 80,000 followers.³⁹¹

Perhaps taking a cue from his boss, Trump’s first Secretary of the Interior, Ryan Zinke, also fought Twitter battles, though he attempted to do so offline. In December 2017, *The Hill* reported that Secretary Zinke summoned Joshua Tree National Park

³⁸⁹ And earlier that day, @NatlParkService had retweeted landscape designer and author Anne Trumble, “Civil rights, climate change, and health care scrubbed clean from White House website. Not a trace.”

³⁹⁰ Jon Swaine, “Trump Inauguration Crowd Photos Were Edited after He Intervened,” *The Guardian*, September 6, 2018, sec. World news, <https://www.theguardian.com/world/2018/sep/06/donald-trump-inauguration-crowd-size-photos-edited>. Reporting based on a June 2017 Freedom of Information Act request.

³⁹¹ Wynne Davis, “Rogue National Park Accounts Emerge On Twitter Amid Social Media Gag Orders,” *NPR.org*, January 25, 2017, <https://www.npr.org/sections/alltechconsidered/2017/01/25/511664825/rogue-national-park-accounts-emerge-on-twitter-amid-social-media-gag-orders>.

Superintendent David Smith to Washington, D.C., to warn him against climate change related tweets.³⁹² In November, Joshua Tree’s official account, @JoshuaTreeNPS tweeted, “An overwhelming consensus—over 97%—of climate scientists agree that human activity is the driving force behind today’s rate of global temperature increase. Natural factors that impact the climate are still at work, but cannot account for today’s rapid warming,” followed by a thread of related posts. Zinke made it clear to Smith, Trump’s administration wanted to bring climate change communications to a halt. The tweets, however, were not deleted.

These early-stage Twitter battles are not surprising granted Trump’s unprecedented preference for delivering updates and opinions via the platform. And social media restrictions reflect broader censorship in communications and research. In a 2018 survey of scientists working for federal agencies, the Union of Concerned Scientists reported the highest levels of censorship (related to climate change) within the NPS: “Survey results show that 18 percent of respondents (including 47 percent at NPS and 35 percent at EPA) had been asked to omit the phrase “climate change” from their work. And 20 percent of respondents [overall] reported engaging in self-censorship regarding climate change.”³⁹³ It appears I wasn’t the only one wondering if I should adjust my research language to the stated policies of the new administration.

Beyond social media antics and censorship, Trump’s administration has also impacted park policy, primarily via Zinke, as neither Trump nor Zinke has appointed an

³⁹² Scott Martelle, “Interior Secretary Zinke Reportedly Dressed down Joshua Tree Superintendent over Climate Change Tweets,” *The LA Times*, December 15, 2017, <https://www.latimes.com/opinion/opinion-la/la-ol-zinke-twitter-joshua-tree-climate-change-20171215-story.html>.

³⁹³ Union of Concerned Scientists, *Science under Trump*.

NPS Director. In honor of his role model, Theodore Roosevelt, Zinke famously rode his horse into his first day of work. The 26th President of the United States is remembered as a conservationist; during T. Roosevelt’s presidency, he expanded the NPS by five national parks and 18 national monuments, including the Grand Canyon, as well as the first National Monument, Devils Tower, WY.³⁹⁴ By contrast, after two years at the helm of the DOI,³⁹⁵ Zinke will be remembered for his efforts to help Trump reduce the extent of public lands. Among Zinke’s early responsibilities was an April 2017 order from Trump to review 27 National Monuments designated since 1996 for possible downsizing or downgrading. The subsequent report suggested downsizing a handful of monuments, including two Obama era National Monuments in Utah—Bears Ears and Grand Staircase-Escalante—by almost 2 million acres, an area bigger than the size of Delaware.³⁹⁶ It was the largest reduction in national monument land in history, affecting landscapes managed under the BLM, USFWS, Forest Service, and NPS. As of early 2019, lawsuits brought against the decision by Native American communities and conservationists were ongoing in federal court.³⁹⁷

³⁹⁴ U.S. Department of Interior, “The Conservation Legacy of Theodore Roosevelt,” last modified October 27, 2016, <https://www.doi.gov/blog/conservation-legacy-theodore-roosevelt>.

³⁹⁵ Zinke officially resigned on January 2, 2019, according to the *Washington Post*, “facing intense pressure to step down because of multiple probes tied to his real estate dealings in his home state of Montana and his conduct in office.” Juliet Eilperin, Josh Dawsey, and Darryl Fears, “Interior Secretary Zinke Resigns amid Investigations,” *The Washington Post*, December 15, 2018, https://www.washingtonpost.com/national/health-science/interior-secretary-zinke-resigns-amid-investigations/2018/12/15/481f9104-0077-11e9-ad40-cdfd0e0dd65a_story.html.

³⁹⁶ Ryan Zinke, “Final Report Summarizing Findings of the Review of Designations Under the Antiquities Act,” Memorandum for the President (Washington, DC: U.S. Department of the Interior, August 24, 2017).

³⁹⁷ Joe Fox, Lauren Tierney, Seth Blanchard, and Gabriel Florit, “Trump Reductions to Bears Ears National Monument: What Remains,” *The Washington Post*, April 2, 2019, https://www.washingtonpost.com/graphics/2019/national/bears-ears/?utm_term=.e9634b019aff.

I could write a second dissertation on the history of politics affecting parks. It's hopefully enough context to explain why I was curious to hear what interviewees would say about how politics impact preservation. I expected consternation and concern, especially given that one of the first acts of policy was to rescind Director's Order 100. Indeed, many interviewees saw that as a pessimistic indication of the administration's stance on climate change, as well as on science, and overall, as a step backwards. And yet a thread of optimism weaved its way into most conversations. For example, one former WASO leader stated that although concern is warranted, political impacts are neither thorough, nor eternal: "... No leader and no political party gets it all their way. But in many cases, the impact of a political party and a leader lasts for about a decade. And so, depending on how it plays out, the Trump administration will have a chilling effect, but it's not permanent."

Another former WASO administrator concurred: "The current Trump administration is kind of retrenching and sort of devaluing this work... we're gonna run with it at the university level and then be able to just step right back in when the administration changes."

For example, after he resigned as NPS Director in December 2016, Director Jarvis moved to the University of California, Berkeley, to serve as the founding Executive Director of the Institute for Parks, People, and Biodiversity. The interdisciplinary center is meant to serve as a bridge between the academy and the field, and they aim to provide field managers with access to cross-disciplinary research on relevant issues.

John J. Donahue, former Superintendent of Delaware Water Gap National Recreation Area, says, "it'll be back again because it's an issue to wrestle with." Part of

that is because climate change and other challenges will continue with or without policy directing a specific response. Donahue and other interviewees believe that continued socio-ecological challenges will eventually necessitate a return to the policies of DO-100, in some shape or form. Others see the mission as demanding continued action, regardless of the status of the Director's Order or the political climate. One park scientist notes that his work and sense of duty have survived the political transition:

“...even though the acting director was forced to rescind Director's Order 100, our work on climate change, our work on resource management for the 21st century does not strictly depend on that. Because the mission of the Park Service, the 1916 Organic Act, is to conserve resources for present and future generations. Everything that we're doing on climate change is in that phrase. Whereas, you know, an official policy certainly helps and facilitates it. The absence of that policy does not, you know, remove that mandate from the mission from that Organic Act.”

In the absence of DO-100, as well as without a climate-change-focused Executive, this scientist's work continues. His most recent publication was released right as the Trump administration wrapped up year two in office. Similarly, Mateljak downplays the impact of shifting administrations and their policies, noting that the larger mission stands firm despite shifting political emphases:

“... If you're referring to like park policy and administrative policy, things like that, we see shifts in it and it often it just means a new direction in emphasis. So, we might be in an era where we're focusing more on ...maintenance, or we might be in era where we focus on natural resources, or cultural resources, or visitor education. It doesn't really change our mission which has pretty much been the same, maybe just which parts are the bigger emphasis.”

Another interviewee, another park scientist, agreed that “each administration has its own focus.”³⁹⁸ Although she has seen and continues to see changing emphases as a result, the overall commitment to preserving resources in parks remains.

Long-term outlooks and optimism could arise from the conditions of the interviews. Many chose not to interview anonymously, and regardless, they could have been concerned that negative statements would impact their job security or their reputations in the NPS and conservation communities. However, Donahue and many others no longer work for the NPS. I also gave everyone the option to skip questions they were uncomfortable answering.

Overall optimism was also balanced with concern. For example, one park leader highlighted her apprehension over park fees—both their amounts and how they can be used. At the time of our interview, she was required by Washington to spend 55% of the 80% of entry fees that the park keeps on projects that would reduce the maintenance backlog. The criteria restricted eligible facilities to those “touched by visitors.”

Zinke and Trump entered office with a promise to address the NPS’s maintenance backlog, in line with their focus on visitor-facing facilities and infrastructure. The 11.9-billion-dollar backlog has been a headline since before I began this project (when it was just an 11.3-billion-dollar backlog). Clearly, despite political promises, it still poses a problem. A photo journal published by *Outside Magazine* in 2018 shows crumbling walkways, burst water pipelines, and closed trails and overlooks.³⁹⁹ Zinke’s means of

³⁹⁸ She also notes that in part things don’t shift as much as you’d think because funding cycles are typically around three years out. So things funded during Obama’s administration are, in general, still taking place.

³⁹⁹ J. Weston Phippen, “The Terrible State of Our National Parks—in Photos,” *Outside Online*, July 5, 2018, <https://www.outsideonline.com/2322611/national-parks-repair-maintenance-backlog-photos>.

reducing the backlog have been criticized, from controversial funding sources (e.g., raising entry fees⁴⁰⁰) to constraints placed on spending. For example, one interviewee described the impact those constraints have placed on her ability to care for her park's cultural and natural resources:

“...I haven't been allowed to make the decision to take that money that's collected at the gate and get rid of the invasive bamboo that has invaded big chunks of the battlefield. Because that's a recurring need, operational in nature, it's not a facility, it's not for maintenance, it's just ecosystem restoration. Didn't qualify. So, if I said that the difference between putting new flooring in a building that gets visitors once in a while and getting this ecosystem back online the way I need it by getting these invasive species out of it, there's gonna be times where I'm probably gonna pick getting rid of the invasive species as my priority, depending on what the totality of the resources are there that are threatened. But I oftentimes don't get to make that choice, so I'm scrambling for money from some other source because it's an ongoing need. It takes years to get rid of invasive species, if at all...So that's probably the biggest area where we get hamstrung, but it's not with ill intent, it's just it translates very poorly out in the field. Really hard to translate that...”

Despite her frustrations, the interviewee understands the need to reduce the maintenance backlog; you'd be hard pressed to find anyone who thinks it is *not* a concern. Facilities need to accommodate crowds. But the crowds are also likely visiting to experience the park features that the interviewee feels she doesn't have enough resources to care for. It's a historically tough balance to strike, and one that's become more precarious as crowds continue to grow.

⁴⁰⁰ National Park Service, “National Park Service Announces Plan to Address Infrastructure Needs & Improve Visitor Experience - Office of Communications (U.S. National Park Service),” last modified April 16, 2018, accessed May 19, 2019, <https://www.nps.gov/orgs/1207/04-12-2018-entrance-fees.htm>.

In the last decade, park visitation has reached all-time highs (more than 330 million annual visitors in 2016 and 2017, followed by 318 million in 2018).⁴⁰¹ Such visitation requires robust facilities and can lead to unpleasantly crowded trails and landmarks, as well as damage to resources. In Joshua Tree, for example, there is constant concern over the impact of cars pulling over the shoulder of the road, disturbing sensitive desert vegetation. The possible impacts of crowds in parks became most evident during the 2018-2019 government shutdown, when the Trump administration ordered the gates be left open despite the furloughed workforce. Without the mitigating and regulating presence of park staff, waste facilities overflowed, campgrounds were trashed, and in Joshua Tree, hundred-year old flagship trees were cut down.⁴⁰²

I spoke with a few academic researchers who study park visitation, and they noted that the possibility for heavy impacts on resources could result in future closures of some areas. But NPS employees I spoke with were typically more concerned about visitor reactions to the impacts of climate change on visitor facilities and infrastructure, as opposed to crowding (that's not to say that the crowds didn't concern them at all, of course). As one superintendent said, she understands why the maintenance backlog is urgent. Parking lots and road have been washed out due to flooding, sea-level rise, and glacial melt, and there is concern over how visitors could react. One former WASO leader told a story of community resistance to moving a parking lot at Assateague Island National Seashore. Hurricane Sandy eventually took out the parking lot, forcing the

⁴⁰¹ National Park Service, "Visitation Numbers (U.S. National Park Service)," last modified March 6, 2019, accessed May 19, 2019, <https://www.nps.gov/aboutus/visitation-numbers.htm>.

⁴⁰² Liam Stack, "Joshua Tree National Park's Signature Trees." Allyson Chiu, "A travesty to this nation." Michelle Sullivan Govani, "Close the National Parks Now."

move. Similar stories arose from parks in Alaska and, unsurprisingly, from Hallac's parks in the Outer Banks. Interviewees shared that along the east and west coasts there's growing concern that infrastructure will need to be resilient to hurricane winds and rising seas, not just for the sake of access, but for safety. So whether due to crowding or environmental factors, access may be limited in the future. And interviewees also stressed that limited access, though possibly important for protecting resources or visitor safety, risks betraying public expectations.

Some interviewees also emphasized that parks must engage with a younger, more diverse visitor base. Already, the NPS struggles to attract younger demographics. The centennial "Find Your Park" campaign aimed to engage millennials and their children, using social media platforms to encourage younger Americans to #findyourpark.⁴⁰³ Some calls for broader engagement seem motivated by self-preservation; if new demographics don't appreciate parks, parks could cease to be supported politically, financially, or culturally. As one interviewee puts it, parks must avoid "social inertia..." He continues, "...every generation has to get engaged ... to perpetuate the idea of national parks." But at the same time, there is also a clear sense of (and pride in) a duty to represent, as one current superintendent says, "the complete story of American history." She references a few of the National Monuments designated under President Obama's administration:

"... for many years we were preserving cultural resources associated with ...the white male culture in America. But we have been and are now adding a whole lot of other resources that reflect the more diverse history of the continent such as Cesar Chavez National Monument, Pullman National Monument, and places like that.

⁴⁰³ "Find Your Park," accessed October 3, 2019, <https://findyourpark.com/>.

Calls for diversity and representation extend to staffing as well. Interviewees were optimistic that the NPS is hiring younger staff with energy and new ideas. Welling notes that new staffing could impact how preservation is practiced, as well as what is considered worth preserving: “I think as people retire and you get new people in and you get people that are thinking about life in a different way, and the value of parks and the value of resources in a different way, it isn't to say we don't still have that same, you know, ideal of preserving resources and resource values and allowing people to enjoy nature, but we've got to be able to think forward.” Though unsure of what “thinking forward” might exactly entail, she predicts the NPS will need to understand evolving staff and public values, including possibly building a conservation system that increasingly involves people: “Those things are going to evolve and we have to be able to find a way that we evolve with them.”⁴⁰⁴ Evolution must account for how shifting values, publics, and politics intersect with wide-spread, complex environmental and climate change.

Inevitable Change

Across a majority of the interviews, there was an apparent belief or knowledge that current or future changes were inevitable—and not just for changes known to be inherent to ecosystem dynamics. Politics will always swing back and forth; development around parks will likely continue; climate change impacts will intensify. A little more

⁴⁰⁴ In their essay, “Move over Grizzly Adams,” Michelle Marvier and Hazel Wong express a similar sentiment, that parks and preservation must evolve to consider more ways of appreciating nature: “There is more than one right way to engage with nature, and it is counterproductive to build a wall between die-hard conservationists who relish week-long backpacking experiences and other who would never by choice go without a hot shower.” We must re-energize conservation by broadening participation, they conclude. Michelle Marvier and Hazel Wong, “Move over Grizzly Adams,” in *After Preservation*, eds., Ben A. Minteer and Stephen J. Pyne (Chicago: University of Chicago Press, 2015), 175.

than half of interviewees mentioned climate change as inevitable or as the cause of other inevitable changes. And it's important to note that the rest of my subjects did not present an opposing point of view—they simply didn't mention it. That is, no one said, "climate change is not happening," or, "climate change and its impacts can or will be stopped."

Occasionally I inferred a sense of inevitability from word choice. For example, a former WASO leader insisted: "The glaciers are moving, animals are moving, and plants are changing." They "are." Not, they "could be" or "might be." Others expressed that change is unavoidable based on evidence, either as presented in scientific literature or as experienced in their day-to-day work within parks. For example, those working within parks susceptible to sea level rise reflected on repetitive nature of damage. As many times as they have reset infrastructure and rebuilt facilities, storm surge and coastal erosion have continued, and will continue, to devastate. Hallac pointed out, "...we're not rebuilding in places where things just continually just get destroyed," insinuating that the damage will inevitably recur.

What stood out most to me were the instances in which interviewees seemed to believe little could be done to mitigate or stop change. For example, one WASO administrator wondered, "How do you grapple with... impairment that is influenced by things that are very difficult for you to control, like climate change, like air quality changes, like land use change that occurs at broad scales around parks that affect things like movement of species in and out of parks?" Change is out of humans' control, despite us being the cause. Change will happen no matter what management action is taken. This stands in contrast to the historical belief that preservation of parks through protective borders and informed interventions would be enough to halt change. A few others,

notably representing parks currently experiencing extraordinary change (the first is Hallac, the second a superintendent, and the third a park scientist and administrator), used metaphor to further illustrate this inevitability:

“These are losing battles. It's not possible to keep everything the way it is.”

“... We don't see ourselves as being able to stop the train...”

“... We ought to be doing something about [climate change]. And yet we can't throw ourselves in front of that bus. It's unrealistic.”

Not one interviewee spoke to the opposite. No one said, “we will win these battles,” or, “my foot is on the brakes” to halt the train or stop the bus.

Given that anthropogenic socio-ecological change is perceived as widespread, complicated, and inevitable, what does that mean for preserving parks? Especially, what does the growing influence of humans mean for the goal of preserving natural conditions? Is it possible to preserve naturalness? And how are we defining naturalness, anyway?

Naturalness

“What even is ‘natural’?”

I was walking along the shoulder of an empty road in southern Mississippi when my classmate first posed the question. I don't recall his name, but I remember his shaggy brown hair and thick-rimmed glasses. He wore baggy clothing in shades of black from new to faded-from-washing. Almost immediately, he'd been designated as “nerdy” by the group. Though, I laugh now—how cool could any of us have been? We all chose to spend New Year's Eve bird-watching with strangers.

It was January 2013, right outside of Ocean Springs, MS, just east of Biloxi, which is just east of New Orleans. I was spending winter break of my junior year of college at the Gulf Coast Research Laboratory to study coastal ornithology—birds found at or around the sea. We spent one third of our time in the classroom, and two thirds in the field, traversing beaches and swamps and coastal pine forests in search of birds large (Mississippi Sandhill Cranes) and small (warblers, wrens, and sparrows).

This was the first of many times my classmate would pose his question across our two weeks together, and each time another peer would interject: “‘Natural’ is all around us,” accompanied by deliberate upward gazes at Loblolly pines, arms extended out, as if serving up two heaping trays of “Can’t you see?!” And always followed by echoes of “yeah,” “duh,” and “definitely!!” from the group. The question struck me, but I stayed quiet. I had a lot of acne and insecurity back then, so I hesitated to stand out from the group of mostly 20-to-21 year olds who were clearly not in the mood for philosophical debates.

I used to be convinced that I would be an adventurous wildlife biologist, the likes of M. Sanjayan or David Attenborough. The coastal ornithology course was a lesson in field methods and species identification—a step towards a dream inspired by Hollywood visions of what it means to be an environmental scientist, *and not* realities like, I don’t love camping and I’m terrified of wild animals with fangs. Throughout college, I spent my summer, spring, and winter breaks on nature adventures, from the prairies of Iowa (more exciting than it sounds) to the barrier reefs of Belize. These trips weren’t university-sponsored, except for one official study-abroad experience in the cloud forests of Costa Rica. I spent my own money, saved up from my four jobs, and I went by myself.

The characters I met on these excursions were always my favorite part. Some are lifelong friends, even if only now from afar through Facebook or Instagram. Others became in-the-moment family—fast bonds formed through shared experiences of awe, exhaustion, or fear. Waking up to a 6-inch scorpion on your ceiling is enough to unite the most awkward of strangers. I don't claim to have formed lasting or even momentary bonds with them all. My philosophizing classmate in Mississippi would likely not remember me, but I remember him.

I knew there was something to his question, even if I wasn't sure how I would answer. And what if I did answer? Would the ridicule transfer to me? Would I give merit to his point of view? Did I want to do that? I wasn't sure what it meant for what I believed—that nature, and natural plants and animals and processes, were somehow “better” than and apart from that which is manmade, like cities, cars, trash, and climate change. Naturalness deserved our reverence and protection. Yet I'd always felt part of nature. And I wasn't obtuse to the fact that our means of protection can tend toward the artificial: politically bounded national parks, human-placed tags and radio satellites, even the arbitrary names and categories we bestow upon living things (which we were practicing on the birds of the Gulf Coast).

It's difficult to define what makes something “natural” or to explain (without serious reflection) how we preserve naturalness, or for that matter, “ecological integrity.” The former has baggage—within the park service, there's at least a century of disputed and shifting meaning and application. The latter is still taking shape, and depending on its context-specific final-form it may still rely on many of the same concepts, practices, and values that underpin naturalness.

But naturalness still guides policy so long as *Management Policies 2006* are in effect. So, I cite my former peer as I ask, “What even is ‘natural’?”

The U.S. National Park Service has an answer for that, or rather, almost 150 years of changing answers. The evolution of “naturalness” is similar and tied to the evolution of preservation—especially granted the ways in which the former has served as a baseline for the latter. Yellowstone National Park, set aside in 1872—44 years before the creation of the NPS—was legislated with a promise to “provide for preservation, from injury or spoliation, of all timber, mineral deposits, natural curiosities, or wonders within said park, and their retention in their natural condition.” And though naturalness is not so clearly referenced in the 1916 Organic Act, which instead refers to preserving parks in an “unimpaired condition,”⁴⁰⁵ the 1918 Lane Letter clarifies, “Every activity of the Service is subordinate to the duties imposed upon it to faithfully preserve the parks for posterity in essentially their natural state.”⁴⁰⁶

In his book *Preserving Nature in the National Parks*, Richard Sellars argues that early on, despite commitments to naturalness, “there seems to have been no serious

⁴⁰⁵ An Act to establish a National Park Service, and for other purposes, 16 U.S.C. §§ 1 et seq. (1916). David N. Cole and Laurie Yung, eds., *Beyond Naturalness: Rethinking Park and Wilderness Stewardship in an Era of Rapid Change*, 12.

⁴⁰⁶ Franklin Lane, “Secretary Lane’s Letter on National Park Management.” Lane’s famous words are repeated in Secretarial Letters throughout NPS history, including in 1925 and 1964. Hubert Work, “Statement of National Park Policy: Memorandum for the Director, National Park Service,” in *America’s National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 62-65 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), Originally published in 1925. Stewart Udall, “Management of the National Park Service: Memorandum for the Director, National Park Service,” in *America’s National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 272-276 (Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994), Originally published in 1964.

attempt to define what it meant to maintain natural conditions.”⁴⁰⁷ There were essentially two approaches: “to ignore, or to manipulate.” The former indicated a hands-off approach; except for guarding parks at their borders to prevent exploitation, no intentional management actions were taken.⁴⁰⁸ The latter was hands-on, including attempts to highlight charismatic animals or iconic scenery. Sellars writes that “in effect, they defined natural conditions to include the changes in nature they deemed appropriate.”⁴⁰⁹ Natural conditions then, were (and are) at least in part in the eye of the beholder and inherently normative, not objective. This doesn’t mean naturalness was invented out of whole cloth, but there were and continue to be choices being made all the time about what natural is, what it is supposed to contrast with, and how it is allowed to change.

In sum, for this early period parks were “natural” by virtue of being bounded off from humans, excepting the presence of tourists or adjustments made for scenic purposes. Recall from chapter three, this mostly-hands off strategy comported with the scientific knowledge at the time—Climax Theory.⁴¹⁰ Park borders, combined with a hands-off management approach, allowed systems to follow that natural process.

In the 1930’s, George M. Wright’s famous biological survey, and the subsequent *Fauna of the National Parks* report (*Fauna No. 1*), marked the emergence of naturalness equated to historical, or “primitive” conditions from a time before Europeans and the

⁴⁰⁷ Sellars, *Preserving Nature*, 22.

⁴⁰⁸ Cole and Yung, *Beyond Naturalness*, 15.

⁴⁰⁹ Sellars, *Preserving Nature*, 23.

⁴¹⁰ Aplet and Cole, “The Trouble with Naturalness,” 15.

“rigors of civilization” had spread across North America.⁴¹¹ Where before human intervention was largely considered unnecessary for and even antithetical to preservation of natural conditions, *Fauna No. 1* declared the human hand as key to restoring naturalness.

In a “truly radical departure from earlier practices,” the report called upon park managers to employ scientific research and biological engineering to achieve restoration of natural conditions.⁴¹² They advocated for an active approach to remedy damage done by human influences, but they also recommended that “investigation” precede “intervention” in order to avoid hands-on methods where they were not necessary.⁴¹³ Thus, there seemed to remain an instinct that natural conditions would ideally prevail regardless of human influence.⁴¹⁴ But until that point could be reached, hands-on management could be justified to restore historical conditions, including continued artificial feeding, culling of ungulate herds to carrying capacity, reintroduction of extirpated species, and extermination of exotic species.⁴¹⁵

⁴¹¹ Sellars, *Preserving Nature*, 97.

⁴¹² Sellars, *Preserving Nature*, 96. Wright, Dixon, and Thompson, “Fauna of the National Parks of the United States, a Preliminary Survey of Faunal Relations in National Parks,” 106.

⁴¹³ Recommendation 5 in Wright, Dixon, and Thompson, “Fauna of the National Parks of the United States, a Preliminary Survey of Faunal Relations in National Parks,” 109.

⁴¹⁴ Wright and his team did not shy away from paradox, acknowledging that humans would always be part of the National Park System *as visitors*: “The unique feature of the case is that perpetuation of natural conditions will have to be forever reconciled with the presence of large numbers of people on the scene, a seeming anomaly.” Wright, Dixon, and Thompson, “Fauna of the National Parks of the United States, a Preliminary Survey of Faunal Relations in National Parks,” 106.

⁴¹⁵ Recommendations 7, 11, 12 and 13, respectively in Wright, Dixon, and Thompson, “Fauna of the National Parks of the United States, a Preliminary Survey of Faunal Relations in National Parks,” 109-110.

We already know how this story ends; *Fauna No. 1*'s direct influence on NPS management was short lived. After Wright's passing and the subsequent transfer of his biological division outside of the NPS, land managers largely defaulted to former management approaches. Ultimately, however, the principles and recommendations within *Fauna No. 1*, including the historical character of naturalness, emerged again and in full force with the 1963 *Leopold Report*.⁴¹⁶ Though the *Leopold Report*'s intention to maintain parks as "illusions of primitive America" mirrored *Fauna No. 1*, the report was also a reflection of its own times in terms of scientific understanding. Leopold et al. were concerned with whole "biotic communities" and their "associations," in addition to making species-specific recommendations.⁴¹⁷ The hands-on management targets under the *Leopold Report* revolved around restoration of biotic associations and communities to their natural dynamics, as in those that occurred in park landscapes before the arrival of Europeans.

As we saw in chapter two, Both *Fauna No. 1* and the *Leopold Report* ignored or miscalculated the impact of indigenous communities in park landscapes, long before Europeans arrived.⁴¹⁸ Sellars notes that *Fauna No. 1* did attempt to address the historical presence of Native Americans, claiming that the indigenous influence would have been minor, at least compared to the rapid, large scale changes brought upon "primitive" lands by Europeans.⁴¹⁹ Research throughout the 1980s and 1990s demonstrated the profound

⁴¹⁶ Leopold et al., "Wildlife Management in the National Parks."

⁴¹⁷ Leopold et al., "Wildlife Management in the National Parks."

⁴¹⁸ David N Cole et al., "Naturalness and Beyond: Protected Area Stewardship in an Era of Global Environmental Change," *The George Wright Forum* 25, no. 1 (2008): 21.

⁴¹⁹ Sellars, *Preserving Nature*, 97.

historical influence of indigenous peoples, including possibly on elk populations in Yellowstone, as well as on fire regimes throughout the continent.⁴²⁰ If humans have impacted parks for possibly thousands of years, how can managers make a clear-cut distinction between natural and artificial on those landscapes?⁴²¹

A temporal definition for “natural” is also perplexing given the ways in which striving for historical baselines required at times heavy-handed intervention to un-do historical anthropogenic (read, European) influence and damage. The *Leopold Report* recognized the paradox, but focused primarily on maintaining the *appearance* of naturalness: “...observable artificiality in any form must be minimized and obscured in every possible way.”⁴²² When interventions were necessary, they should remain as “hidden from visitors insofar as possible.”⁴²³

Sometime between 1963 and 1988, historical fidelity was abandoned. In *Beyond Naturalness*, Aplet (a forest scientist) and Cole claim that change “eventually” came in part because of the growing awareness of indigenous peoples’ histories on park lands, as well as due to new understandings of how nature works (e.g., disturbance ecology,

⁴²⁰ Charles E. Kay, “Technical Commentary: Aboriginal Overkill and Native Burning: Implications for Modern Ecosystem Management,” *Western Journal of Applied Forestry* 10(1995): 121-126. Stephen J. Pyne, *Between Two Fires* (Tucson, AZ: The University of Arizona Press, 1997). R.W. Kimmerer and F.K. Lake, “The Role of Indigenous Burning in Land Management,” *Journal of Forestry* 99(2001): 36-41. D. MacDonald, *Before Yellowstone* (Seattle: University of Washington Press, 2018).

⁴²¹ Aplet and Cole, “The Trouble with Naturalness,” 18. Aplet and Cole note that “the fact that many ecosystems perceived as natural were, and continue to be, substantially shaped by human activity erodes the meaning of *natural* as free from human effect.”

⁴²² Leopold et al., “Wildlife Management in the National Parks,” 242.

⁴²³ Leopold et al., “Wildlife Management in the National Parks,” 242.

nonequilibrium ecosystems, global biodiversity crisis).⁴²⁴ As I explained in the chapter three, I was able to find some evidence of this shift in *Management Policies (MP) 1988*: “The National Park Service will not seek to preserve natural systems in natural zones as though frozen at a given point in time.”⁴²⁵

MP 1988 did not attempt to redefine “natural.” Instead it defined “natural zones” in which the primary goal would be protection of natural resources (as opposed to recreation or protecting cultural resources). Within those zones, land managers would “try to maintain all the components and processes of naturally evolving park ecosystems...”⁴²⁶ So natural systems seemed to be defined by their ecology—the health and survival of all an ecosystem’s components and processes.

Dennis has been involved in writing *Management Policies* since 1975 when they first began to be produced in current form,⁴²⁷ and in 1999 he wrote an essay for the George Wright Forum regarding *MP 1988*.⁴²⁸ Acknowledging that *MP 1988* does not define “natural” or “natural process,” he explains that instead the document recognizes

⁴²⁴ For a review, see Aplet and Cole, “The Trouble with Naturalness,” 19-20. There is also a thorough review in: Richard J. Hobbs, Erika S. Zavaleta, David N. Cole, and Peter S. White, “Evolving Ecological Understandings: The Implications of Ecosystem Dynamics,” in *Beyond Naturalness*, eds. David N. Cole and Laurie Yung (Washington, D.C.: Island Press, 2010).

⁴²⁵ U.S. Department of Interior, National Park Service, *Management Policies* (Washington, D.C.: National Park Service, 1988), 4.2. (Pagination in the 1988 edition goes by section (4) and then page within the section (2).

⁴²⁶ U.S. Department of Interior, National Park Service, *Management Policies* (Washington, D.C.: National Park Service, 1988), 4.1-4.3.

⁴²⁷ A version was also produced in 1970, but looked quite different, published as three volumes instead of as one comprehensive document. Dennis showed me the 1970 policy documents when I visited his office in 2017. They were generally based on the 1963 Leopold Report.

⁴²⁸ John G. Dennis, “National Park Service Management Policies for the National Park System,” *The George Wright Forum* 16, no. 3 (1999): 12.

examples of natural resources (plants, animals, sights, and sounds). In addition, *MP 1988* also describes contexts in which natural conditions have been violated (species extinction due to human harm, removal of native natural resources, harvest, loss of natural fire regimes, etc.), seeming to point toward the separation of humans and nature.

But Dennis goes further than *MP 1988* to define the place of humans in parks: “The core of NPS policy approach,” he argues, “... deals with what is the human role in nature and perpetuation of nature?”⁴²⁹ According to Dennis, in 1999 the NPS “informally” held that “technological humans” (*Fauna No. 1* and the *Leopold Report* call them “Europeans”) should be prevented from further impacting landscapes. Native Americans (and traditional Native American land-use), however, were more-or-less considered part of the natural history and the present natural landscape. So although *MP 1988* does not explicitly define “natural,” 1999-Dennis⁴³⁰ interprets the policies protecting natural conditions as excluding “technological humans” but inclusive of indigenous peoples.⁴³¹

Two years later, *Management Policies 2001* recognized (as in *MP 1988*) that natural resources, processes and systems are dynamic, evolving, and interconnected, and the document declares that the NPS will work to support those natural dynamics with intervention only when necessary.⁴³² However, for the first time, *MP 2001*, also co-

⁴²⁹ Dennis, “National Park Service Management Policies for the National Park System,” 12.

⁴³⁰ I don’t want to assume 2019-Dennis continues to feel that way.

⁴³¹ Dennis, “National Park Service Management Policies for the National Park System,” 13.

⁴³² U.S. Department of Interior, National Park Service, *Management Policies 2001* (Washington, D.C.: National Park Service, 2001), 28. U.S. Department of Interior, National Park Service, *Management Policies 2006*, 36.

authored by Dennis, goes further to actually define a natural condition, declaring it as one that “would occur in the absence of human dominance over the landscape.”⁴³³ The current *Management Policies*, released in 2006, use the same definition of natural and the same policy language regarding management of ecosystem dynamics.⁴³⁴

Knowing that Dennis believes humans are not (and cannot be) completely separated from natural systems, I can’t help but think he and his *MP 2001* co-authors deliberately chose the word “dominance,” as opposed to “influence” or “impact.” In what could be a continuation of the NPS’s evolution toward explicitly accepting humans as part of park systems, they seem to be alluding to a line drawn between unavoidable human *influence* and unacceptable human *dominance*.

The NPS recognizes that nationally and globally-scaled external threats will penetrate park borders, posing challenges regardless of protected status. *MP 2006* acknowledges that “Activities that take place outside park boundaries and that are not managed by the Service can profoundly affect the Service’s ability to protect natural resources inside the parks.”⁴³⁵ Even back in 1999, Dennis identified the challenge of anthropogenic change—few units, if any, could be considered free from the influence of “technological humans.”⁴³⁶ So if parks cannot be protected from human influence, can they at least be safe-guarded from human “dominance”?

⁴³³ U.S. Department of Interior, National Park Service, *Management Policies 2001*, 28. U.S. Department of Interior, National Park Service, *Management Policies 2006*, 36. This means that sometime between 1999 and 2001 Dennis and his co-authors decided on an explicit definition.

⁴³⁴ U.S. Department of Interior, National Park Service, *Management Policies 2006*, 36.

⁴³⁵ U.S. Department of Interior, National Park Service, *Management Policies 2006*, 36.

⁴³⁶ Dennis, “National Park Service Management Policies for the National Park System,” 16.

Aplet and Cole seem to doubt it, asserting that “changes in science and society and the globalization of human influence have eroded the adequacy of naturalness as a guiding concept for protected area stewardship...”⁴³⁷ Similarly, Emma Marris declares, “We [humans] are already running the whole Earth, whether we admit it or not.”⁴³⁸ In Minter and Pyne’s edited collection, *After Preservation*, a diverse group of writers and environmental thinkers are tasked with addressing the question: what are we preserving in an age when human influence is relentlessly pervasive? Do we admit it’s time to take responsibility—to turn our unintended influence into intentional management? Or, are we witnessing “the tragic consummation of the destructive human domination of the earth, a last threshold crossed on the march to total ecological despotism?”⁴³⁹ Their different perspectives leave the debate open-ended.

So I wondered, what are the perspectives of park staff—the people charged with protecting natural conditions against global change? Do they think it is possible to preserve naturalness in parks? Or is it time to move “beyond naturalness”? If so, what replaces it?

Questioning Naturalness

In one of the earlier stages of qualitative analysis, I turned to pen, paper, scissors, and tape. I could have used computer programs to digitally achieve the same ends, but I find my brain operates in a more reflective and focused way when my screen is off. So, I

⁴³⁷ Aplet and Cole, “The Trouble with Naturalness,” 13-14.

⁴³⁸ Marris, *Rambunctious Garden*, 2.

⁴³⁹ Minter and Pyne, “Writing on Stone, Writing in the Wind,” 4.

printed and cut out every mention of a theme (here, “naturalness”), placed the segments on the table (or the floor), and moved them around, grouping, ungrouping, and regrouping, until I’d made sense of the patterns in the data. For “naturalness,” I ended up with two and a half piles: one for those who question naturalness, one for those who defend it, and a small, half-pile of those who I couldn’t quite justify placing in either group. The majority, though, fell into the former two distinct groups.

It was when I added identifiers back to the data, that I realized this was not going to be a simple task of describing why different types of people disagree. It wasn’t even going to be about why people from similar backgrounds have differing perspectives. People contradicted themselves.

Hallac, for example, questioned naturalness and the NPS’s ability to preserve a disappearing seashore. Yet, during the same conversation, he declared that “the most important thing [parks] do is just preserve undisturbed lands and landscapes.” How can that be the most important thing parks do, if he also feels they can’t do it anymore?

Maybe if I asked Hallac, he’d argue it’s not a contradiction. It’s possible to believe in impossible aims—ideals can drive us to think differently, dig deeper, achieve more. Some characterized naturalness as such, defending it as a *relative* goal. Sure, parks will never be free from human influence, but at least they aren’t strip malls.

One superintendent argued that the parks set aside for natural resources “provide an opportunity to glance into nature in a relatively undisturbed space.” She believed that lessons learned about the *relatively* natural processes in those parks can inform the management decisions of other agencies, like the National Forest Service: “Parks provide a baseline because we don’t manipulate the systems as...we like to think we don’t,

anyway, as heavily or at all in most cases, the way that some of the other public land managers do.”

A former WASO administrator noted that despite inevitable change, especially with external causes, the NPS “does what it can”:

Well, I think parks are preserving arenas where nature, to the extent that it can, proceeds unimpeded, you know. There are global processes which you can't do much about as a Park Service. And there are certainly regional processes, as well, that you can't. And there are internal park operations processes where you can ... I think it's really important that parks sort of manage these stages or these arenas where nature, as much as possible, becomes as natural as possible.

“As much as possible,” “as natural as possible,” even if it’s not and can’t ever be pristine.

As another superintendent shared, though parks are too small to “actually preserve complete ecosystems...I see the parks as these islands, if you will, of wilderness or natural resources that are really important as sort of icons of what our natural resources are in this country but also important sort of last bastions in some cases of remnants of habitats.” They’re the last bits of nature—valuable even if incomplete or imperfectly preserved. This perspective reminds me of how *Earth Island Journal* editor, Jason Mark, draws a line between a footpath and a highway in his book *Satellites in the High Country*. The footpath isn’t natural, but at least it’s not a six-lane highway.⁴⁴⁰ Relativity matters to Mark, as it seems to matter to some of the NPS employees I spoke with.

But the park service protects highways in addition to footpaths. The George Washington Parkway, for example, runs through Washington, D.C., 25 miles from Mount Vernon, the historic home of President George Washington and First Lady Martha Washington, to McLean, Virginia. Locals complain about the growing traffic and

⁴⁴⁰ Jason Mark, *Satellites in the High Country* (Washington, D.C.: Island Press, 2015), 156.

occurrence of car accidents, especially where the parkway runs past Ronald Reagan International Airport. Even along the parkway, however, the same former WASO administrator from above claimed that the NPS should strive for “as natural as possible”:

You can't in a sense ever achieve any kind of restoration of George Washington Parkway, but you can do what you can. You can control exotics. You can make it as healthy a system as possible. You can strive and spend every year getting a little bit better at making it where there are natural resources, making them healthy, as well as making it, you know, kind of presentable.

The parkway is less developed and presents a different, valuable experience compared to I-95. As the NPS claims, “The parkway and its associated trails provide a scenic place to play and rest in the busy Washington, DC metropolitan area.”⁴⁴¹ But what’s “healthy”? What’s “presentable”? What’s the value or the cost of removing “exotics?” Is that even possible? Even in a park unit that isn’t as developed as a parkway, it’s difficult to define those goals.

Many interviewees acknowledged that “exotic” or invasive species management is becoming more challenging across the NPS, especially in the context of current policies and climate change. Echoing Hallac’s concerns that changing climatic conditions might be less favorable for native species, a former WASO administrator noted that novel conditions could require the NPS to redefine invasive species management goals:

“...plants that were in one assemblage are now being overtaken by plants from another assemblage... we may have a lot to do in terms of re-describing what the dynamism is we're looking for and what we're managing to achieve with the climate-driven plant structures that we had no longer being the plant structures that we're going to have. That means we're going to have to rethink a lot of that stuff.”

⁴⁴¹ National Park Service, “A Scenic Approach,” last modified August 29, 2019, <https://www.nps.gov/gwmp/index.htm>.

Which “stuff” would the NPS need to “rethink”? Guidelines for controlling invasive species date back to the 1932 *Fauna No. 1*, which urged parks to eliminate exotics species established in parks, or to at the least, hold them to a minimum presence.⁴⁴² The 1963 Leopold Report also called for the removal or discouragement of exotic species, despite their intrusion into almost every park and the admission that in many they could be “here to stay.”⁴⁴³ Today’s invasive species policy originated with Executive Order 13112, signed by President Bill Clinton in 1999 to establish the National Invasive Species Council (NISC).⁴⁴⁴ The park service differentiates between “invasive” and “non-native” species, though neither are considered natural—the former, which the NPS removes or discourages, do harm to a system, while the latter are present in a system but not a cause for concern.⁴⁴⁵ As a few of my interviewees noted, they consistently work within their own parks to remove or control invasive species. There are also 17 Exotic Plant Management Teams in the NPS that travel throughout the system to help.

But the lines between native and non-native, as well as non-native and invasive, could be shifting. Are formerly invasive species still causing harm under conditions of

⁴⁴² Recommendation 13 in Wright, Dixon, and Thompson, “Fauna of the National Parks of the United States, a Preliminary Survey of Faunal Relations in National Parks,” 110.

⁴⁴³ Leopold et al., “Wildlife Management in the National Parks,” 240.

⁴⁴⁴ Exec. Order No. 13112, 64 Fed. Reg. 6183 (Feb. 8, 1999). Which safeguards the “interests of the United States by preventing, eradicating, and controlling invasive species, as well as restoring ecosystems and other assets impacted by invasive species.”

⁴⁴⁵ National Park Service, “Invasive & Non-native Species,” last modified August 8, 2019, <https://www.nps.gov/subjects/invasive/learn.htm>. U.S. Department of Interior, National Park Service, *Management Policies 2006*, 47.

climate change? Are formerly non-native, non-harmful species exhibiting invasive behaviors?⁴⁴⁶ What does it mean to be “harmful” to a system, anyway?

The NPS’s Climate Change Response Program exists to help park integrate climate change into their decision making, including decisions regarding invasive species. Examples of adaptation goals range from business as usual (continue to fight back invasive species) to considering circumstances in which major climate-mediated changes might occur. The Climate Change Response Program helps parks decide if they should they resist, or assist, change. There is still an overall focus on helping native species when it’s possible, but they urge parks to be flexible as conditions may change in unpredictable ways.⁴⁴⁷

Like what happens when a non-native or invasive species is a considered a treasured or endangered species in other contexts? As species grow intolerant of changing conditions in former habitats, they may be driven to migrate outside of their current ranges and into parks. National parks could thus become refuges for climate-sensitive species whose ranges are elsewhere in retreat.⁴⁴⁸ One superintendent shared the story of migrating sea turtles:

⁴⁴⁶ Mark A. Davis et al., “Don’t Judge Species on Their Origins,” *Nature* 474, no. 7350 (June 2011): 153. They talk about how the risk of invasive species may have been overblown (and the risks may also vary by time, doing more or less harm at different points in time).

⁴⁴⁷ National Park Service, “Invasive Species Management,” last modified January 11, 2016, <https://www.nps.gov/subjects/climatechange/invasivemgmt.htm>.

⁴⁴⁸ Kevin M. Johnston, Kathryn A. Freund, and Oswald J. Schmitz, “Projected Range Shifting by Montane Mammals under Climate Change: Implications for Cascadia’s National Parks,” *Ecosphere* 3, no. 11 (2012): art97, <https://doi.org/10.1890/ES12-00077.1>. This paper provides an example of eight mammal species of conservation concern in western Washington State, under four warming scenarios: “The high elevation of the major national parks in this region is likely to aid in their ability to continue to support these species, and they are predicted to continue to act as important protected refuges, even while species’ ranges may shrink dramatically elsewhere.”

“...sea turtles are now migrating as far north as Assateague Island. Well, Assateague Island National Seashore, you know, didn't have a sea turtle program before. If it hasn't already started one, it's going to need a sea turtle program.”

Or what happens if a species needs to migrate to survive, but is anchored in place due to biology or habitat fragmentation? Would parks move species to contexts in which they would have been considered as non-native and possible invasive? What if it's the park's own flagship species that may need to move outside of the park for continued survival?

The superintendent wondered:

“...are we going to have to move these sea turtles north from one park to another? And what are the ethics around that and what are the protocols around it? ... are we going to move some Joshua trees to a more northern climate? You know, what are we going to do to preserve these places in this rapidly changing climate?”

One park scientist believes there will be circumstances in which the NPS and the public will need to come to terms with novel species assemblages in parks, but he points out that we can choose to view species in terms of their function, as opposed to their origins.⁴⁴⁹

He told me the story of the NPS's many mid-elevation conifer forests:

They generally... have two canopies, and they can support the spotted owls and other wildlife... They also preserve a watershed so that it can provide water, both for natural streams, for fish and wildlife, but also for human uses. And it has a fire regime of about 10 to 30 years. And the fires come through and they don't completely destroy the canopy. So that's a functioning ecosystem. That functioning ecosystem, in some locations, depends on ponderosa pine. It depends on giant sequoia...in Sequoia and Kings Canyon and Yosemite National Parks.

⁴⁴⁹ In his book *Heatstroke*, Paleocologist Anthony Barnosky proposed a bifurcated protected area system. One set would be systems managed as much as possible as nature preserves with little manipulation; species would come and go but we'd respect the “wildness” of the system and they could have novel species assemblages. The other type of reserve would be focused on preservation of individual species or assemblages of species, and we'd actively manage them (often with a heavy hand) to do so. Anthony Barnosky, *Heatstroke, Nature in an Age of Global Warming* (Washington, D.C.: Island Press, 2009), 207-208.

The interviewee referred to the effect of different types of tree species on ecosystem function. In the science of ecosystem ecology, “functional types” are groups of species that play similar roles in ecosystems, including how they respond and how they affect ecosystem processes and other species.⁴⁵⁰ He pointed out that these different types of trees—ponderosa pine, giant sequoia—can perform similar functions in different ecosystems, and possibly in the same ecosystem: “... as long as we have that ecosystem...and it doesn't need to be Jeffrey pine. It could be some type of mid-elevation conifer that's serving that purpose.”

Does it matter if the species assemblage is unnatural so long as the natural function or purpose of the ecosystem—as a habitat for wild life, a watershed, etc.—is maintained because the novel species can fulfill the same function?

A 2011 *Nature* article, written by a group of 19 ecologists, argued that it was time to embrace novel ecosystems, including those that may incorporate species currently labeled as invasive. “Don’t judge species on their origins,” they urged.⁴⁵¹ In addition to pointing out that eradication is often impossible, they align with the park scientist above, claiming that non-native species can sometime fulfill the same or similar functions as native species. Similarly, in her book *Rambunctious Garden*, Marris challenges the “pervasive faith” that native ecosystems are better ecosystems.⁴⁵² That’s not necessarily

⁴⁵⁰ Chapin III, Matson, and Vitousek, *Principles of Terrestrial Ecosystem Ecology*, 324.

⁴⁵¹ Mark A. Davis et al., “Don’t Judge Species on Their Origins,” *Nature* 474, no. 7350 (June 2011): 153–54, <https://doi.org/10.1038/474153a>.

⁴⁵² Marris, *Rambunctious Garden*, 14. More recently, journalist Fred Pearce has discussed this more open minded view of invasive species in his book *The New Wild*. Fred Pearce, *The New Wild* (London: Icon Books, 2015).

true regarding ecosystem function, as in mid-elevation conifer forests, nor is it necessarily true for protecting charismatic or endangered species, as in the case of the sea turtles.

But regardless of their function or status, non-native species are considered unnatural under *MP 2006*. Thus, they “will not be allowed to displace native species if displacement can be prevented.”⁴⁵³ Perhaps that’s why Hallac imagines a day when somebody with authority announces: “Those 2006 Management Policies—they don’t apply anymore because they can’t. And here’s a new system. A new set of criteria for making management decisions when it comes to invasive species.”⁴⁵⁴

Naturalness can also be questioned on the basis that parks were perhaps never “natural” in the first place. The dunes, marshes, and beaches in the Outer Banks Group have been altered for at least the last century, and in some cases well before those individual parks were established. What’s the natural baseline if the ecosystem has always been impacted or dependent upon human intervention?

Similar questions arise when you consider the history and present reality of indigenous peoples’ relationships to park landscapes. I recall picking up Robert B. Keiter’s book *To Conserve Unimpaired* in the early months of my research and being stunned by his analysis that “with few exceptions, the early national parks were created

⁴⁵³ U.S. Department of Interior, National Park Service, *Management Policies 2006*, 43, 47.

⁴⁵⁴ Director’s Order 100 (rescinded) didn’t really make any clear recommendations about invasive species outside of the broad acknowledgement that novel conditions may need to be allowed and even fostered. It did note that invasive species are becoming more and more prevalent. And in the Revisiting Leopold Report, which inspired DO 100, the proposed goal of “ecological integrity” still prioritizes native species.

without regard for competing Native American claims or concerns.”⁴⁵⁵ Historical Native American influences on the land—and claims to the land—call into question the myth of the “pristine” park. In his famous and controversial essay published in the mid-1990s, “The Trouble with Wilderness,” historian William Cronon states: “The removal of Indians to create an ‘uninhabited wilderness’—uninhabited as never before in the human history of the place—reminds us just how invented, just how constructed, the American wilderness really is.”⁴⁵⁶ Native Americans thrived on park landscapes for thousands of years before they were protected areas, and in many cases, they altered the landscapes, too. In retrospect, many national parks and national monuments recognize Native American claims and historical alterations to park landscapes, but tensions have not completely dissolved. Keiter tells stories of entire tribes and families that were dispossessed of their ancestral homelands and sacred sites, including those who are still fighting for their rights today, such as in Badlands National Park, South Dakota.⁴⁵⁷

Parks in Alaska, as Leigh Welling points out, allow for certain indigenous uses, including subsistence and traditional hunting. Legislatively, humans are considered part of those park systems. During the final days of his administration, President Carter signed the Alaska National Interest Lands Conservation Act of 1980.⁴⁵⁸ In addition to doubling

⁴⁵⁵ Robert B. Keiter, *To Conserve Unimpaired* (Washington, D.C.: Island Press, 2013), 121.

⁴⁵⁶ William Cronon, “The Trouble with Wilderness: Or, Getting Back to the Wrong Nature,” *Environmental History* 1(1996): 15-16.

⁴⁵⁷ In his 1999 book *Dispossessing the Wilderness: Indian Removal and the Making of the National Parks*, Mark David Spence delivered a long-overdue critique that linked the creation of the first national parks with the federal policy of Indian removal. Mark David Spence, *Dispossessing the Wilderness: Indian Removal and the Making of the National Parks* (Oxford: Oxford University Press, 1999).

⁴⁵⁸ Alaska National Interest Lands Conservation Act of 1980, 16 U.S.C. §§ 3101 et seq. (1980).

the area of land managed by the NPS, the act also officially recognized lands claimed by Alaska Natives under the 1971 Alaska Native Claims Settlement Act and granted subsistence hunting, fishing, and other rights inside of park boundaries to Native and rural residents of Alaska.

I never met Welling in person, but from my first conversation with Jon Jarvis in 2017, I was told by several interviewees that I must if I wanted to learn more about the impact of climate change on park resources and policies. Under Former Director Jarvis, Welling served as the Chief for the Climate Change Response Program. Today, she is the Associate Regional Director in the Alaska Region, overseeing inventory and monitoring, science communication, partnership programs, public affairs, and Congressional affairs, among many other responsibilities. I knew based on her gleaming recommendations that she would have much to share about parks and climate change. But based on her experience in Alaska, she also had important insights into how to manage parks to incorporate people, including Native Americans: “I think it's a feature that absolutely defines how we manage up here in Alaska.”

She points out that she's not to trying to say it's a feature that's unique to Alaska.

Welling has seen parks that incorporate people in her international work, too:

“...other countries don't have the same stumbling blocks that we do. And they are already building protected areas in Mexico around coffee plantations. You know, they're working with what they have in order to build out conservation systems that involve people. And it's part of why I'm interested in being up here in Alaska because we already factor in human use on the landscape as a fundamental right. It's part of the enabling legislation. And I really like that model because I don't think you can take people off the landscape.”

Not long after our conversation, Welling emailed me an article from *Time*, “The Story We’ve Been Told About America’s National Parks is Incomplete.”⁴⁵⁹ In it, author Gilio-Whitaker presents evidence that the parks are founded on a problematic belief that pristine parks should be human-free—ignoring historical Indigenous habitation, as well as, “participating in the erasure of Indigenous peoples, thus replicating colonial patterns of white supremacy and settler privilege.”

In her email, Welling stressed her conviction that people and landscapes are inseparable, but that doesn’t mean she discounts nature. She wrote:

This article reminded me of our conversation and I wonder if this might help you understand a bit more where some of my answers are coming from. I’m not sure I conveyed very well my deep reverence for nature and for the need—now more than ever—to protect, conserve, connect, and restore natural and cultural landscapes. That said, to be viable and relevant, protected area conservation will necessarily evolve as a social institution and will therefore need to reflect multiple perspectives. A giant part of this is respect and alignment with indigenous and local communities. There is tension in this of course, but I think it’s essential if we have any hope of long-term conservation.

Welling’s “tension” seemed similar to what I’d been describing in my research journals as “contradiction.” I’d heard it in the stories of climate change impacts, challenging long-held policies and practices for invasive species, fire regime, and historical structures management. I’d seen it in the belief that naturalness was simultaneously impossible and worth striving for. It was present in the NPS’s decades long history of (re)defining and (re)deliberating, as Dennis says, “the human role in nature and perpetuation of nature.”⁴⁶⁰

⁴⁵⁹ Dina Gilio-Whitaker, “The Story We’ve Been Told About America’s National Parks Is Incomplete,” *Time*, April 2, 2019, <http://time.com/5562258/indigenous-environmental-justice/>.

⁴⁶⁰ Dennis, “National Park Service Management Policies for the National Park System,” 12.

On closer inspection, however, contradiction didn't adequately describe my interviewees' responses: "questioning," "defending," and "somewhere in the middle." Something more nuanced was happening here, not just among interviewees but within the minds of individuals. I wrote in my notes, "I feel like I'm watching minds in transition, an institution in transition, like I'm capturing thoughts, values, and perspectives caught in between." Opposition exists, but it's maybe not the defining feature of the distinct yet co-existing ideas—the old and new, traditional and revolutionary, safe and controversial—in a state of constant renegotiation.

It calls to my mind the "final thought" in the introduction to *After Preservation*; Minter and Pyne quote journalist John McPhee, as he ponders the collision of people and nature in the Yukon Alaska for his book *Coming into the Country*: "Only an easy going extremist would preserve every bit of country. And extremists alone would exploit it all. Everyone else has to think the matter through—choose a point of tolerance, however much the point might tend to one side."⁴⁶¹ I feel I've caught many of my interviewees, as well as myself, in the process of thinking the matter through. What's the point of tolerance? Will we find it amidst complicated, inevitable socio-ecological change? Where do we draw the line between tolerable human influence and unacceptable human dominance? Despite numerous attempts in policy, through books, or at conferences to pin the point, or define the line, we're all still asking: What does the future of preservation look like? How will it be practiced?

⁴⁶¹ Minter and Pyne, "Restoring the Narrative of American Environmentalism," 8.

The Scientific Solution

Up to this point, I've traced the evolution of preservation from a focus on scenery, to historical ecosystems, to ecological integrity. Naturalness has remained a baseline throughout each stage, demonstrating that the concept has likewise shifted in meaning. Today, interviewees feel that complex, anthropogenic, socio-ecological changes pose the ultimate challenge to preservation and naturalness—though a few raised the point that naturalness still provides an important standard of restraint and respect in the human relationship to nature, compared to other types of development and land-use. I'm certain none of my interviewees would argue against the importance of relative naturalness, but they still feel that policies and philosophies guiding park management have not quite caught up to the implications of rapid change. As Hallac noted, “we've not been able to wrap our minds around what we do for a rapidly evolving situation with an unknown destiny, it's kind of hard to know what we're preserving into the future.”

I described in chapter three how recent (though rescinded) policies adopted a stance of managing resources in the context of continuous change that is not fully understood. Both *Revisiting Leopold* and Director's Order 100 attempted to define new goals for preservation, ecological integrity and cultural authenticity. Science is key to informing and implementing both goals. But near the end of chapter three, I suggested that such scientific goals seem to be covering up the messy reality of socio-ecological change and conceptual conflict that I've discussed throughout chapter four, above. Still, many interviewees and others seem to believe that the answer to complexity and rapid change is science. For example, one superintendent described how science helps her understand which activities are damaging her park and which actions she can take to

restore the park's ecosystem to a "natural state." (Even with a scientific goal, naturalness still defines the baseline for preservation—at least for this superintendent).

If I want to explore the future of preservation, I'll need to study how science is done and used in parks. How can science tell us what we're preserving and how best to do it? How might its ability to inform management strategy and NPS policy be limited? Is preservation—at least in practice, but perhaps also as a goal—becoming a science? Is that desirable? Or is that possible, especially with so many park leaders and advocates still thinking through the core concepts?

5. THE SCIENCE OF PRESERVATION?

Answers

I asked a lot of questions growing up.

Why do dogs love humans so much? Why do trees lose their leaves every fall? Why do birds sing? This was before Google. I sought answers in my Grandpa Harry's *World Book Encyclopedia* (which he still references today, more than 20 years later). I watched documentaries on PBS—one of the only four TV channels we had growing up. My dad took me to the Half Price Books store where I'd browse used textbooks about animal behavior and conservation biology. I had stacks of *Zoobooks* in my room—colorful children's magazines with facts and stories about animals from around the world. And I read every educational sign at every museum, zoo, and national park we ever went to. Through all my Q&A pursuits, I noticed a pattern:

“Archaeologists have found evidence of the human-dog relationship dating to tens of thousands of years ago. Throughout that time, humans selectively fed and bred dogs that were friendlier...”

“Scientists have shown that some trees evolved to lose their leaves to conserve energy during the winter. They are called deciduous trees...”

“Studies demonstrate that birds call and sing for lots of reasons, for example, to communicate danger, to say hello, to impress potential mates, and to share their location...”

Answers come from science.

At one point, my parents brought home “The Kids' Book of Answers,” (or some variation of that) and I remember my favorite page, which was also featured on the cover of the book: “Why do Zebras have stripes?” The answer to that one struck me. It went something like:

“There are many possible reasons. Perhaps they help with camouflage in tall grasses. They might deter biting flies. Or maybe, when in large groups, they confuse predators. The stripes could also have a social purpose, as each Zebra has a unique pattern. Scientists aren’t quite sure yet!”

Not only did scientists have answers, but in some cases, they still sought them. There are things still unknown, and scientists are the explorers.

By middle school, I decided I would be such an explorer, specifically as a marine biologist. Despite—or perhaps because of—growing up in the middle of the Iowan cornfields, I was drawn to the ocean. In my twelve-year-old mind, I imagined marine biologists as the story-tellers of the boundless mysteries of the sea. They swam with, lived with, observed, and photographed sea creatures and then shared their stories with the world. I’d later learn there was also some math involved, but that was fine with me. I was going to be a scientist. I was going to ask questions, do some math (apparently), discover answers, tell stories, and inspire people to protect the sea.

Keep in mind, I’ve always had many dreams: I simultaneously wanted to be a marine biologist, raise horses, and have a successful career as a professional singer and dancer. But no matter the flavor of the day, month, or year, one of the three or four things I wanted to be at any given time was some sort of scientist. I was good at science, teachers and peers strongly encouraged me to stick with science—to be a girl in STEM—and I liked seeking and having answers.

About nine years later, I was living my middle school dream. It was the summer between my junior and senior years of college, and I was spending the week on a twelve-person boat in the middle of the turquoise waters of the Caribbean Sea. For eight hours a

day, I swam the Mesoamerican Reef, observing, photographing, and measuring, the coral, seagrass, and fish surrounding Tobacco Caye, an island off the coast of Belize.

As I wrote in chapter one, by that point I'd been working in an evolutionary biology lab at the University of Iowa for a few years and had decided I didn't love it. I adored my peers and mentor, I understood the importance of the work, and I liked helping with our high school outreach efforts. But I couldn't find joy or meaning in the pipettes, test-tubes, and computer screens of A's, T's, G's, and C's. I realized, I enjoyed science a lot more when I felt that I was putting it into action. So, I signed up for an applied study abroad experience on conservation biology in the forests and reefs of Belize. We primarily assisted with monitoring the health of the reef, which, like reefs worldwide, was then in a declining state.⁴⁶²

Seeking, mapping, and tracking the causes and impacts of the reef's decline was tricky business. Different from my work in the lab, there were many factors to account for—all uncontrolled and contributing in different ways and weights depending on the species, the season, the geography, or even the daily weather. It got even trickier when we started to ask what we should do about it. Should we stop allowing cruise ships on the reef? Well, what about the tourism dollars contributing to the local economy? How would communities do without? Shouldn't we stop polluting the upstream rivers with human waste? But the country doesn't have equitable, reliable infrastructure for waste disposal. What do you propose those communities do with their waste otherwise? Maybe we could stop climate change? Not likely.

⁴⁶² Since then, the reef has made a major comeback. "Healthy Reefs for Healthy People," last modified in 2019, accessed October 3, 2019, <http://www.healthyreefs.org/cms/>.

I won't pretend I had an "aha!" moment on the trip, but I recall noticing that, not only are there questions that science hasn't yet answered, but maybe there are also questions that science *cannot* answer. Intuitively, I knew that. There had always been answers I'd chosen not to seek through science because it didn't make sense, in my mind, to do so. For example, why do we love who we love? In that department, I sought expression and meaning in art, music, and dance (though, I'm aware the evolutionary biologists and neuroscientists like to weigh in on that question). But the questions surrounding the health and future of the Mesoamerican Reef seemed scientific to me. Reefs were ecosystems that could and should be understood through ecology and the related life and natural sciences. So why wasn't science driving action to protect the reef?

I noticed the simultaneous inputs and roles of science, values, politics, and economics, and I became confused about which should lead when. I had an emerging awareness of problems or situations in which the ability of science to drive or derive solutions was limited. But still, I could not shake my lifelong practice of seeking answers in science—of trusting science to guide understanding and decisions. As I stated in chapter three, I was still a science cheerleader, despite my new-found reservations.

I didn't get beyond confusion at that point, but I was confused enough to change course from the undergraduate lab to graduate school where I would study the application of science to environmental problems. So, I took my confusion with me to Arizona for a PhD.

In this chapter, I describe my journey from confused to less (but still) confused through the experiences that challenged me, the frameworks that offered fresh insights,

and the interviewees who shared their own stories of science in the parks. I also explore how parks reconcile the reality and complexity of socio-ecological change with a decades-long trajectory toward more scientific approaches and goals for park preservation. Depending on the context, preservation—in practice and as a goal set in policy or park strategy—has increasingly come to be informed and even driven by science. Even as the Trump Administration has muffled science in park policy to some degree (for example by rescinding Director’s Order 100) some interviewees were adamant that the future of preservation will require, “more science-informed practices and goals.” In the words of one former NPS leader:

“I think the trend will continue to be in the direction of more scientifically informed management of our parks. This has to be, because issues are becoming more and more complex and managers are faced with extremely complex challenges for both natural and cultural resources. And they need good information to make... decisions. So yeah, I think the direction will continue...”

To this interviewee, changes and complexities in parks demand more science. Other interviewees raised concerns that complicate that view. It is these perspectives and counter-perspectives that I will explore in this chapter. First, I will review how applications of science to complex problems and systems can get, in the words of one interviewee, “gnarly.” The systems are wicked. The sciences are plural, and they’re limited in their capacity to answer normative or ethical questions. Then, I draw more heavily on interview data to highlight two broad themes that describe how the NPS applies science considering the complex issues they face: (1) science must be contextual, and (2) science is not the sole driver of decisions.

Gnarly Questions

Upon starting graduate school, I'd quickly learn I wasn't the first person to be confused. Lucky for me, in graduate school I would encounter a whole host of others—from academic predecessors to NPS interviewees—who'd found ways to make sense of, or at least to articulate, their confusion.

I'll fast forward to 2017, during one of my earliest interviews for this project. As before, I will not pretend that it felt like an “aha!” moment at the time, but it's a moment I often return to in reflections on my intellectual growth—an education I didn't realize I was getting. This person preferred to remain anonymous, so I will not share the details of their background or position beyond noting that they have a role within the NPS's Natural Resource Stewardship and Science Directorate, which supports the entire park system with scientific and technical matters and includes the Air Resources Division, the Biological Resources Division, and the Climate Change Response Program, among several others. We spoke on the phone on a sunny October morning—I was sitting at my kitchen table in Phoenix, and they were likely in front of their NPS desk. Our conversation revolved around the usual script: Please explain your role with the Park Service; What are the parks preserving and why?; and so on and so forth.

Then, I asked, “how does the NPS interpret existing policies and laws in the context of climate change?” This would be the first of many times in our conversation that the interviewee would refer to problems, questions, and situations, that are “gnarly.” Such gnarly problems not only challenge our scientific understanding, but also the philosophical and policy underpinnings of how we apprehend and manage parks.

... Here we are... where our fire regime, our wildfire regime, has been autonomous. You could call it natural. And we understand it to have a certain frequency of large fires. And we understand that a warming climate is going to change that frequency and, therefore, change our prior regime in a way that, given that we understand climate change is anthropogenic ... means that those changes ... are not natural. Should we then intervene and start setting prescribed fires so as to keep the fire regime historical, even though for the first time the fire regime would be in some ways not "natural" because it would be engineered by us?

In the context above, better understanding of the science of fire—regime history, frequency, trends, anthropogenic drivers of change—has not helped the park decide how to proceed, in part because policy is historically driven by an ideal, “naturalness,” that is challenged by that understanding. More knowledge has spurred more questions that cannot be answered by measurements or models, and yet still must be understood:

What is natural there? And how should we proceed? And are we clear on the policy to start intervening when the only departure from natural is sort of overarching massive change in the fire regime driven by a change in the atmosphere driven by human activity? So that's a gnarly question.

I believe this harkens back to the fact that science—or science-informed goals like ecological integrity—cannot mask unsettled terms and concepts like naturalness or exotic vs. native species. Those deeply embedded concepts contribute to twisted, challenging, “gnarly” questions. To some degree, these questions also resemble “wicked problems,” those that arise in systems existing at the intersection of myriad human values, uncertainty over present and future conditions, and social processes linking the system to a broader network of other such complex, dynamic systems.⁴⁶³ Certainly, the U.S. National Park Service fits that description.

⁴⁶³ Horst W. J. Rittel and Melvin M. Webber, “Dilemmas in a general theory of planning,” *Policy Sciences* 4(1973): 155-169.

Horst Rittel and Melvin Webber, professors of design and urban planning from Germany and the United States, respectively, formally defined wicked problems in their 1973 paper, “Dilemmas in a General Theory of Planning.” As designers of social systems, they focused primarily on the ways in which the complexity of social systems differs from the complexity of natural systems. In the former, seeking answers and solutions is complicated, perhaps even impossible due to the emergence of questions over not only what is efficient, but what is just and equitable (which may or may not be what is efficient). Around such questions, there is often a lack of consensus, including disagreement over what counts as a problem. Rittel and Webber argued that the scale and the interrelatedness of social processes and systems pose challenges for problem definition: the “outputs from one become inputs to others,” making it “less apparent where problem centers lie, and less apparent *where* and *how* we should intervene even if we do know what aims we seek ...and we are no longer surprised to find [problem-solving action] inducing problems of greater severity at some other node.”⁴⁶⁴

According to Rittel and Webber, these “wicked” characteristics stood in contrast to the kinds of “tame” problems in the natural sciences—those that can be defined, isolated, and solved. Take, for example, my undergraduate experience in the lab, in which we worked within a controlled, sterile setting to answer defined questions about the evolution of a particular set of genes responsible for modes of reproduction in a single species. Though we sourced our model organisms from the field, the lab in which we studied them was a closed system. And the goals were clear: track changes in the genetic code among members of this species with different reproductive modes (sexual vs.

⁴⁶⁴ Rittel and Webber, “Dilemmas in a general theory of planning,” 159.

asexual reproduction). *It was not a simple task.* There were many challenging concepts to understand and contribute to, related to evolutionary biology and genomics. There were also strenuous lab procedures, and—most difficult for me—complicated computer coding and analysis programs to master. But the lab was indeed tame *compared to the field.*

I wouldn't have known to call them so at the time, but the problems we encountered on the reef were wicked and not unlike the “gnarly questions” faced in national parks. First off, protected areas are open systems. The impacts of external forces are unavoidable and usually outside of managers' control, whether it's the effects of climate change on national park fire regimes or of waste management systems on the health of barrier reefs. Second, protected areas are shaped by and embedded in social processes. U.S. National Parks, for example, are defined by law and policy, which are determined through the social process we call politics—the collective process of negotiation and compromise among politicians, lobbyists, agencies, and citizens.⁴⁶⁵ Similarly, but perhaps even more complex due to its international nature, the Mesoamerican Reef exists within a constellation of competing legal, cultural, and economic demands and protections, from local fisheries, to a UNESCO World Heritage Site designation, to cruise ship hubs. Given the nature of competing interests surrounding these complex, open systems, it's no wonder that it's difficult to agree on proper interventions. And even if agreement is reached, the power to intervene is not always held by the parties in charge of protected area management.

I'm not the first to notice that ecosystem management presents a wicked problem, in part due to the recognition that—as I discussed in chapters three and four—

⁴⁶⁵ John W. Kingdon, *Agendas, alternatives, and public policies* (New York: Longman, 2003).

“ecosystems function as complex dynamic systems with nonlinear responses to internal and external forces, feedbacks across space and time, thresholds and inherent unpredictability.”⁴⁶⁶ In larger part, however, ecosystem management is wicked because when we manage ecosystems for human values or needs, we mix in our social processes and value systems with that inherent ecosystem complexity.⁴⁶⁷ Plus, even unmanaged ecosystems directly interact with human systems given the anthropogenic and open scale character of climate change, invasive species, and habitat fragmentation. In other words, the field—whether the park or the reef—is where natural science problems unavoidably intersect with social problems.

Few, if any, of my interviewees would dispute any of the above—that parks are wicked systems riddled with wicked problems. The future of park preservation, means and ends, must account for the wickedness. Some interviewees believe that means elevating the role of science; when the questions get more complex, we should double down on systematic investigation, inventory and monitoring, and expert consultation. But at the same time (and again highlighting that individuals can hold somewhat contradictory perspectives), almost all interviewees were adamant that science is rarely if ever the sole driver of decision making. In fact, as the Natural Resource Stewardship and Science Directorate employee pointed out, several interviewees encountered situations in which more information raised more questions—the gnarly kind that cannot be answered by measurements or models, and yet still must be understood, like, “what is natural?”

⁴⁶⁶ Ruth DeFries and Harini Nagendra, “Ecosystem management as a wicked problem,” *Science* 21(2017): 266.

⁴⁶⁷ DeFries and Nagendra, “Ecosystem management as a wicked problem.”

Before I go too much further into those experiences and stories, however, I'd like to highlight the ways in which science itself can be gnarly. Though not many interviewees spoke directly to the content that follows, I identified several whose experiences illustrate that "Science" is in fact plural "sciences," sciences can't measure and predict all aspects of a system, and sciences have limited utility in answering normative or ethical questions such as, "what should we preserve?"

Gnarly Science

Remember the questions park staff raised in chapter four, as they recognized changes happening throughout their parks? "How do we draw the line between native and exotic species under climate change?" "How do we draft triage plans to manage for the cultural and historical resources under threat by rising seas?" "Can we predict where, when, and why ecosystem type-conversions or novel ecosystems may occur?" Although these questions emerge out of wicked or gnarly socio-ecological systems, they each *appear* to be questions for science. To cite another paper from the 1970s, nuclear physicist Alvin Weinberg called these questions of trans-science: "Many of the issues which arise in the course of the interaction between science or technology and society...hang on answers to questions which can be asked of science and yet *which cannot be answered by science.*"⁴⁶⁸ In his paper, Weinberg identified a few types of such questions that each transcend science in different but related ways.

⁴⁶⁸ Alvin M. Weinberg, "Science and Trans-science," *Minerva* 10(1972): 209-222.

As I explored above in the context of wicked problems, one reason trans-science questions might arise is related to the social processes with which the questions or challenges intersect (and which, in the case of protected areas, govern them). Weinberg identified those as the types of challenges wherein “science is inadequate simply because the issues themselves involve moral and aesthetic judgements: they deal not with what is true, but rather with what is valuable.”⁴⁶⁹ For example, value-based judgements must be made when drawing the line between native and exotic species under conditions of rapid change.⁴⁷⁰ In chapter four, interviewees wondered what happens when a non-native or invasive species is considered a treasured or endangered species in other contexts? Such was the case with sea turtles popping up for the first time on the shores of certain coastal parks. Certainly, science could indicate such change and possibly inform us of why sea turtles are migrating outside their historical bounds, but it won’t decide for us what we should or shouldn’t do about it. Similarly, in the case of my anonymous interviewee’s questions regarding fire, what’s often “gnarly” about the questions raised is that it’s frequently unclear how science, politics, law, and broader community discourse should come together to manage change in parks in the absence of any clear guidance. Thus, my interviewee shared, “the purpose of the gnarly project is to make that clear and identify what the needs are and ultimately drive some efforts to... extend or clarify policy.” Although fire can be understood through scientific observation and experimentation,

⁴⁶⁹ Weinberg, “Science and Trans-science,” 213

⁴⁷⁰ Some scholars argue that the historical and cultural dependence of designations of native, exotic, etc., suggests that even the categories themselves are shot through with assumptions and value judgments. For example: Matthew K. Chew, “The Monstering of the Tamarisk: How Scientists made a Plant a Problem,” *Journal of the History of Biology* 42(2009): 231-266. Matthew K. Chew and Manfred D. Laubichler, “Natural Enemies—Metaphor or Misconception?,” *Science* 301(2003): 52-53.

value-based judgements must be made as to how policy should be extended or clarified, including how to balance the inputs to that process.

Even if we could isolate our questions from their social context, gathering the data to answer them is rarely as simple as opening your grandpa's *World Book Encyclopedia*. And as I discovered on the Mesoamerican Reef, it's also not always as straightforward as taking some measurements and doing some math. For one thing, there are many factors to measure, and likely many more that we're unaware of or that we don't yet know how to measure or interpret. In his essay, Weinberg describes questions which "could conceivably be answered according to strict scientific cannons if enough time and money were spent on them," but "to do so would be impractical."⁴⁷¹ In the example Weinberg shared—calculating the impacts of very low levels of radiation—it would simply take too many mice (8 billion in this case), across too many expensive experiments to determine any effects with confidence.⁴⁷²

"Impracticality" can be a judgement call (we never *really* escape social context)—how much money and time *should* we spend in our quest to find answers? Take the NPS Inventory and Monitoring Program, a set of 32 networks spread across the country, with monitoring programs in more than 280 park units.⁴⁷³ The goal is for I&M programs to provide managers with scientific information on the status, history, and trajectory of their resources and park systems, thus assisting them with evaluating current

⁴⁷¹ Weinberg, "Science and Trans-science," 211.

⁴⁷² Weinberg, "Science and Trans-science," 210.

⁴⁷³ National Park Service, "Inventory & Monitoring," last modified February 13, 2018, <https://www.nps.gov/im/index.htm>.

management strategies and measuring progress toward goals.⁴⁷⁴ If park resources are diligently tracked, the hope is that threats and abnormalities may be detected sooner than later, possibly resulting in a greater chance of successful mitigation.⁴⁷⁵ And of course the programs also fulfill policy and legal mandates. For example, monitoring is required by NPS *Management Policies 2006*, as well as by the National Parks Omnibus Management Act of 1998.⁴⁷⁶ But calls to establish such a program date back to 1932 in *Fauna No. 1*.⁴⁷⁷ It took 67 years for us to decide it was something worth spending time and money on.

And even today, the capacity for inventory and monitoring in some parks is still lacking—in resources, in staff, in funds—such that efforts become sporadic or nonexistent. As one long-time superintendent I spoke with noted, inconsistent I&M programs don't "give you the level of credibility in terms of making adjustments or whatever you need to do in any meaningful way." In the case of cultural resources within parks, another interviewee admitted that "... we don't even know what we have, let alone what we're losing to coastal erosion, or flooding, or glaciers melting back and revealing... artifacts that can just dissolve." Or as then Director Jarvis stated in a 2014 memo regarding Climate Change and Stewardship of Cultural Resources: "Every year, we lose irreplaceable parts of our collective cultural heritage, sometimes before we even

⁴⁷⁴ S. G. Fancy, J. E. Gross, and S. L. Carter, "Monitoring the condition of natural resources in U.S. National Parks," *Environmental Monitoring and Assessment* 151(2009): 161-174. National Park Service, "Inventory & Monitoring."

⁴⁷⁵ Fancy, Gross, and Carter, "Monitoring the condition of natural resources in U.S. National Parks," 171. National Park Service, "Inventory & Monitoring."

⁴⁷⁶ U.S. Department of Interior, National Park Service, *Management Policies 2006*, 37. National Parks Omnibus Management Act of 1998, 16 U.S.C. §§ 5911 et seq. (1998).

⁴⁷⁷ Wright, Dixon, and Thompson, "Fauna."

know they exist.”⁴⁷⁸ How do you draft a triage plan for imperiled cultural resources if you don’t even know what you have—either because you can’t afford to take inventory or because, even with unlimited financial resources or staff in a park, you couldn’t expect to know about *every artifact* in existence, such as those revealed through processes like erosion?

Where there exist adequate resources for robust I&M programs, a handful of interviewees—all NPS employees—generally held them in high regard, citing the importance of understanding park resources, establishing baselines and trends, and informing decisions with such information. But Weinberg noted another element of impracticality that characterizes trans-scientific questions: the inability to test our answers, or in the case of the parks, to test decisions. Weinberg argues, “Unless one is willing to build a full-scale prototype, and test it under the precise conditions which will be encountered in practice, there is always the uncertainty of extrapolating to new and untried circumstances.”⁴⁷⁹

Instead, we attempt to make predictions or create useful models that explore possible futures. But such models are appropriate only if they’ve been constructed such that stakeholders understand the assumptions and limitations inherent to them—no model is without them.⁴⁸⁰ For example, general circulation models (GCMs) are large-scale climate models that assume regional homogeneity, and it thus can be unwise to apply, too

⁴⁷⁸ Jarvis, "Climate Change and Stewardship of Cultural Resources."

⁴⁷⁹ Weinberg, "Science and Trans-science," 211.

⁴⁸⁰ Andrea Saltelli and Silvio Funtowicz, "When All Models Are Wrong," *Issues in Science and Technology* 30(2014): 79-85.

unquestioningly, a global model as such to a local context like a park. GCMs might miss more regional or localized variations such as transitional zones between ecosystems and the microclimates within the complex terrain.⁴⁸¹ Still, provided their limitations are understood, models can be useful for imagining possible futures and the potential impacts of a decision.

One interviewee shared a success story: models of projected sea level rise were used to adjust and re-prioritize restoration projects in the Pacific West region of the NPS. The same interviewee relies on models and monitoring to identify situations where “natural” fire regimes can be restored, as well as those where her team might be “assisting new ecosystems to occur in parks.” (It’s clear she doesn’t seem as troubled by the gnarly-ness of the term natural—and we know already that not everyone is.) But later I asked her, “what’s your biggest fear for the Park Service, moving forward?” She responded: “That...our models will be wrong. That’s always a fear.” By the time we know if they’re wrong or they’re right, the decision has been implemented. Even if you can readjust course, it’s likely that valuable park resources and processes have already been affected. You don’t get do-overs in the realm of trans-science.

Contributing to the messiness of mathematical models, sometimes the nature of applying science to these questions is complicated by the inconstant nature of the things we are studying. In such cases, Weinberg argued that “science is inadequate because the subject-matter is too variable to allow rationalization according to the strict scientific canons established within the natural sciences.”⁴⁸² Consider the electron vs. the eagle vs.

⁴⁸¹ Barrows and Murphy-Mariscal, “Modeling impacts of climate change on Joshua tree.”

⁴⁸² Weinberg, “Science and Trans-science,” 213.

the ecosystem, and in parallel, physics vs. ornithology vs. ecology. Numbers, or quantitative data, can be applied across the different objects of study, but, as economist Richard Nelson points out, numbers can be meaningless out of context, depending on the subject matter:

The kind of numbers one can estimate and work with in many fields tend to be at best approximate and incomplete indicators of what we would like to know about, rather than precise measures. As a consequence, almost always they can be understood only in a richer context of description and narrative.⁴⁸³

To continue with the example, electrons, the study objects of many physicists, are a great deal more uniform and mathematically predictable than eagles. Among ornithologists, for example, there are occasionally debates as to which eagles belong to a single species as opposed to a semi- or subspecies.⁴⁸⁴ In such scientific discourse, numerical observations—population counts, clutch sizes, or genetic differences—must often be accompanied by qualitative data, such as verbal explanations of behavior or photographic documentation of appearance. Further, studying eagles is quite different from investigations of entire ecosystems, which contain countless evolving species interacting with each other and the physical world, as well as humans and their “wicked,” open-scale, socio-political systems. And at that point, we are back in the realm of values-based judgments: “What is natural? How should we proceed? Are we clear on the policy?”

⁴⁸³ Richard R. Nelson, “Physics Envy: Get Over It,” *Issues in Science and Technology* 31(2015): 78.

⁴⁸⁴ Anita Gamauf et al., “Species or Subspecies? The Dilemma of Taxonomic Ranking of Some South-East Asian Hawk-Eagles (Genus *Spizaetus*),” *Bird Conservation International* 15, no. 1 (April 2005): 99–117, <https://doi.org/10.1017/S0959270905000080>. Asko Lõhmus and Ülo Väli, “Interbreeding of the Greater Aquila Clanga and Lesser Spotted Eagle A. Pomarina,” *Acta ornithoecol* 4.2-2(2001): 377-384. Nelson, “Physics Envy,” 74.

Importantly, Nelson argues that “qualitative description and explanation should not be regarded as an inferior form of scientific understanding with the aim of research to replace them with numbers, but rather as a vital aspect of our understanding that numbers can complement but not replace.”⁴⁸⁵ He has to point this out explicitly, because even when we know numbers are just proxies, there exists a psychological and even cultural tendency to assume they are reporting something more real (or even more valuable) than other, qualitative expressions. Nelson calls it, “physics envy.” Ecologist, C. S. Holling suggested that the quantitative orientation across the sciences, including ecology, “simply reflects an analytical approach developed in one area [classical physics] because it was useful and then transferred to another where it may not be.”⁴⁸⁶

In that example, it’s clear that different types of scientists study different phenomena. Discussions of a single, monolithic, capital “S,” “Science” in parks thus mask the existence of multiple *sciences*, which can be differentiated by their objects of study and their scales of investigation, but also their training programs and professional norms.⁴⁸⁷ As NPS scientist and administrator Leigh Welling noted, though she and her colleagues apply science to the NPS mission in terms of managing for ecosystem processes at landscape-scale, the ways in which science and the mission are interpreted together will differ: “It sort of depends on the discipline that you come from.” An ornithologist will study the eagle. An ecologist might be more likely to see and study the

⁴⁸⁵ Nelson, “Physics Envy,” 78.

⁴⁸⁶ C. S. Holling, “Resilience and Stability of Ecological Systems,” *Annual Review of Ecology and Systematics* 4(1973): 1.

⁴⁸⁷ Nelson, “Physics Envy.”

larger system within which the eagle lives. One's not more right or wrong than the other—they focus on the scale of their objects of study. The two might even collaborate to merge scales of understanding in useful ways; eagles can migrate across ecosystems, after all. But the different sciences are not always commensurable in the end. The challenge is not just the difficulty of reconciling sciences at different scales (which is hard enough). It's also about grappling with their diverse normative commitments, which have implications for how sciences inform decision making.

Let's back up for a moment to recognize that the diversity of sciences is partially a product of the richness of nature. In a 2004 paper, Dan Sarewitz argued that reality “is sufficiently rich and complex to support a science enterprise of enormous methodological, disciplinary, and institutional diversity.”⁴⁸⁸ The sciences (and scientists) do their job, presenting that richness through various disciplinary lenses and lines of inquiry. Sarewitz then makes the case that “there is likely to be a causal connection between the ways that we have organized scientific inquiry into nature, and the ways we organize human action (and thus political decision making) related to the environment.”⁴⁸⁹ In a few examples, Sarewitz describes how scientists hailing from different disciplines tend to emphasize or align with different worldviews because of their different views of nature. Consider the debates over genetically modified organisms (GMOs):

There are many ways to “understand” GMOs: in terms of their connection to food production, human health, economic development, ecosystem

⁴⁸⁸ Daniel Sarewitz, “How science makes environmental controversies worse,” *Environmental Science & Policy* 7(2004): 386.

⁴⁸⁹ Sarewitz, “How science makes environmental controversies worse,” 390.

dynamics, biotechnology innovation processes, plant genetic diversity, even culinary arts. Each of these perspectives is associated in part with separate disciplinary perspectives... It thus seems reasonable to expect that scientists from disciplines involved in design and application of GMOs, such as plant geneticists and molecular biologists, would be potentially more inclined to view GMOs in terms of their planned benefits, and ecologists or population biologists would be more sensitized to the possibility of unplanned risks at a systemic level.⁴⁹⁰

In that case, the different sciences cannot be reconciled because the sciences are responding to different problems or parts of the problem—health and economic benefits vs. ecological risks of GMOs. Bringing this back to park management, different views of how nature works can lead to different management choices in similar scenarios.⁴⁹¹ We see this in how static vs. dynamic views of nature can result in different, contradictory strategies, from hands-off to direct intervention, in the practice of preservation.

Again, let me be clear. I do not question whether sciences can do good, be useful, or play a key role in decision making within the U.S. National Parks. The discussion above is not a plea to cancel the NPS Inventory and Monitoring Program because of the thorniness of these questions. Science is necessary. It has been critical, for example, in informing important shifts in management policies and strategies stemming from an increased awareness of dynamic, ecosystem processes (as opposed to static, scenic

⁴⁹⁰ Sarewitz, “How science makes environmental controversies worse,” 391.

⁴⁹¹ C. S. Holling, “The resilience of terrestrial ecosystems; local surprise and global change,” in *Sustainable Development of the Biosphere*, eds. W.C. Clark and R.E. Munn (Cambridge: Cambridge University Press, 1986).

resources) and the large scale at which those ecosystem processes and their drivers of change operate.

But I hope I've adequately explained why we should be *asking questions* about the role of science—why we should wonder if our park managers and affiliated scientists recognize the gnarly questions they face and what that means for the ways in which they use science to understand challenges, make decisions, and set larger goals. Very early on in this project I found myself wrestling with my longstanding belief that science is the source of answers and my realization that science could not answer many of the normative, ethical, and political questions I'd come to care about. And I discovered many of my NPS interviewees related to that struggle.

How do you preserve parks against overwhelming human-driven influences? How will foundational concepts like “natural” evolve? How will preservation be practiced? How should it be practiced? For the National Park Service, such questions arise where a rapidly changing socio-ecological system intersects with more than 100 years of tradition, environmental philosophy, evolving political interests, and cultural symbolism. In other words, these are “gnarly” questions. Science is only one of many ways to explore them, and though it's often vital, most interviewees noted that it's not always the most important, nor it is always the most illuminating. Still, the trajectories of park history, park and national policy, and, for many NPS employees, personal experience, have all contributed to increasing applications of science to park management challenges.⁴⁹²

⁴⁹² Sellars, *Preserving Nature*. Beissinger et al., *Science, Conservation, and National Parks*. Director's Order 100. National Park System Advisory Board, *Revisiting Leopold*.

So, for the remainder of this chapter, I want to explore: How is science done? How is science used? And why? These are the things I asked interviewees and coded their answers for.⁴⁹³ Of course, because people are not electrons, that process revealed some inconsistency—the Park Service is heavily decentralized and full of contradicting opinions, including among positions of power like superintendents. But discussing these questions with my subjects also revealed some common ground, including much intentional thought and practice regarding the application of science to park management: Science should be contextualized. Partnerships are key to managing an open-scale system. Data inform, but they don't lead. Many wondered, what types of preservation challenges or questions might be beyond the reach of science (i.e., which could be considered trans-science)? And, how does one know which questions to answer through science, as opposed to through other types of knowledge, values, concepts, and inputs—especially when some concepts and information seem to be in states of perpetual change or redefinition?

If we wish to apply science to park management in ways that are useful, informed, and intentional, how could we not explore such gnarly questions?

Science in Context

I visited my first U.S. National Park before my earliest memories begin, but I know the map by heart. You enter Point Park through a castle-like gateway framed by four turrets—two that might be two meters high and two that must stand more than two stories tall. A short walk inwards, a twin pair of civil-war-era canons keeps watch over

⁴⁹³ See the Appendix for methodological details.

the Tennessee River, right where it flows along the south side of the city of Chattanooga. If you pass the canons to the left, you'll discover a shaded path that covers with leaves in the fall months. It's a loop, and at the half-way point a former Confederate observatory captures a sweeping view of Moccasin Bend at the base of Lookout Mountain. There, the river takes a U-turn alongside the ever-busy Interstate-24, or rather, the I-24 takes a U-turn along the river.

If it were November 24, 1863, you'd be amidst the "Battle Above the Clouds," the Union victory that captured Chattanooga, Tennessee, from the grips of the South. Though it was then a small town of around 2,500 people, Chattanooga is situated at the intersection of four major railways and the Tennessee River—a key supply route.⁴⁹⁴ It would still be more than a year before the end of the war, but the battle was considered a pivotal moment for the Union, opening a route for Northern soldiers and supplies heading into the deep south. Eventually, those soldiers and supplies would contribute to the 1864 Union victory in Atlanta that hastened the end of the war.⁴⁹⁵ In 1890, Lookout Mountain and the surrounding battlefields became the first National Military Park, designated in recognition of the unique battles that took place there, as well as in service of ongoing efforts to "heal the wounds" between North and South. Both Union and Confederate veterans were involved in the park planning process.⁴⁹⁶

⁴⁹⁴ National Park Service, "Stories," last modified March 8, 2018, <https://www.nps.gov/chch/learn/historyculture/stories.htm>.

⁴⁹⁵ National Park Service, "The Battles for Chattanooga," last modified April 23, 2017, <https://www.nps.gov/chch/learn/historyculture/battles-for-chattanooga.htm>.

⁴⁹⁶ American Battlefield Trust, "Our First National Military Park," accessed October 3, 2019, <https://www.battlefields.org/learn/articles/our-first-national-military-park>.

A century later, sometime in the early 1990's, I visited for the first time. Almost every August or November, our family of four descended upon Chattanooga for a visit to Grandpa and Grandma's house. And during nearly every stay, we'd visit Point Park on Lookout Mountain—officially called the Chickamauga and Chattanooga National Military Park. I don't remember how old I was—maybe 13—but during one of my later visits to Lookout Mountain I finally took note of the NPS Arrowhead adorning the signage around the park. Wait. *This* was a U.S. National Park? My experiences there did not register as in any obvious way related to our family vacations to the Badlands, or the Grand Canyon, or the Great Smoky Mountains. The latter were infinitely large landscapes filled with awe-inspiring sights and wildlife. The former, I equated to a city park crossed with a museum, containing paved pathways, cultivated gardens, and buildings full of military weapons and century-old photographs. That's not to say I enjoyed it less—it was simply a separate, unrelated experience in my mind.

The NPS arrowhead that I recognized that day has stood as the emblem for the NPS since 1951. Its design depicts the “major facets” of the NPS: “The Sequoia tree and bison represent vegetation and wildlife, the mountains and water represent scenic and recreational values, and the arrowhead represents historical and archaeological values.”⁴⁹⁷ This diversity of facets contributes to and stems from a great diversity of sites—Military Parks, Lakeshores, Memorials, and Recreation Areas, among many others. As I described in chapters two and three, a variety of laws and policies overlaps with and contributes to that diversity of sites, as well as expresses numerous cultural values and ideologies.

⁴⁹⁷ National Park Service, “History of the NPS Arrowhead,” last modified May 15, 2019, <https://www.nps.gov/glac/learn/news/history-of-the-nps-arrowhead.htm>.

From the Chickamauga and Chattanooga Battlefields to Carlsbad Caverns, and in every type of unit in between, the diversity that characterizes parks is a point of pride, as evidenced by ongoing efforts to designate sites that tell stories across the entire spectrum of American experiences and histories. That includes the recent additions of the Stonewall and Freedom Riders National Monuments, each proclaimed by President Obama.⁴⁹⁸ But that diversity also feeds into the gnarly nature of understanding and managing parks, and the NPS folks that I spoke with referenced it often. Parks and their protected features are variable in nature. What are the implications for how science is applied in parks?

Early on in my PhD, I toyed with the idea of doing a case study of one park—Joshua Tree National Park—from which I could draw lessons for the NPS at-large. I knew from my training in research methods that I would need to be careful about extrapolating case study conclusions, especially given the diversity within the Park Service. Still, I hoped that my methods and outcomes would be interesting for at least somewhat similar parks to observe or test themselves. I admittedly wasn't very clear about that in an early draft of my proposal, which John Dennis was quick to point out in a September 22, 2017, email (a follow up to the first email he sent that day):

Note that there now are 417 units in the National Park System, of which Joshua Tree is only one. As you ponder making inferences about management policy for the entire National Park System from a sample of 1, I urge you to keep in mind the great diversity of units contained within

⁴⁹⁸ National Park Service, "Recent Changes to the National Park System," last modified July 24, 2019, <https://www.nps.gov/aboutus/recent-changes.htm>.

this single system and the intent that NPS *Management Policies 2006* is designed to address all 417.⁴⁹⁹

I'd by then had a chance to explore *most* types of units. And I'd already downloaded and browsed the index of the U.S. National Parks that Dennis suggested I read in his next sentence. But his point was well taken, and I ensured all ensuing communications were clear on it—the conditions and solutions in Joshua Tree do not necessarily apply to others. Subsequent interviews revealed that his email reflected a broader theme; many of the conversations hit on the realities and implications of system diversity. In ways, their comments alluded to the differences among ecosystems and eagles and electrons; it's difficult to apply mathematical models and generalized theories—including policies—to objects of variability such as park units and their resources.

Where encompassing policies do exist, they tend to be broad, as in the 1916 Organic Act mandate. For example, when I asked Lee Welling, “What do parks preserve?” She replied, “Well, so my general answer is, we preserve what we call fundamental resources and values. So that's a very broad answer because it varies by park and it varies by enabling legislation.” She went on to explain that it could include scenery, or plants, or animals, or historical artifacts, among other possibilities. And as I shared above, Welling also noted that the ways in which sciences are applied to those resources and their preservation depends not only on the inherent variability of those objects, but also the variability among scientific disciplines regarding how they approach and view their subject matter.

⁴⁹⁹ An email to me on Friday, September 22, 2017, 12:16 PM.

Stemming from parks' heterogeneity, the challenges that parks face can also differ, and where challenges *are* similar, they'll often have different circumstantial implications or solutions. I spoke with one social scientist who has spent his career studying visitor-use patterns in parks. Though he believes the goal of managing for both use and preservation can be challenging in all parks, "the context varies enormously." He demonstrated his point with three examples. First, in the Grand Canyon, Arizona—among the most heavily visited parks—one of the major concerns is carrying capacity. How many people are too many? There are also debates regarding the types of use acceptable within the park. Should the NPS allow motorized boats on the Colorado River? Thus, issues are related not only to crowding but also to "the different kinds of environmental impact that emanate from different kinds of uses."

In his second example, he explains that the visitor-use challenges in Denali National Park, Alaska, tend to be driven "by wilderness and conventional notions of solitude and the [perceived] pristine character of the park." That is a stark contrast to the highly-developed visitor village that sits on the Grand Canyon's south rim. And at a third type of unit, Blue Ridge Parkway in North Carolina and Virginia, the concerns have to do with traffic: how many automobiles can the parkway and its buffering lands accommodate? But you wouldn't really expect solitude to be the goal there. And there's no dispute that motorized vehicles are an acceptable use.

So how does one do science in the context of this great variability? As the interviewee above alluded to, he does it by determining his research questions and agenda through a deep understanding of a park's unique purpose, culture, and challenges. You can ask similar questions of each site: how many visitors should we accommodate? What

types of visitation or use should we allow? But, the interviewee pointed out, the conceptualization of the problems, and thus answers, differs by the history, legislation, and character of each. I would add that the problems and answers can also differ *within* a park. Based on my experiences in the Grand Canyon, for example, the rules of rim are quite different from the types of permits and behaviors expected of a visitor who plans to camp in the canyon. And as a visitor planning to backpack through the depths of the canyon, I had expectations for a less crowded experience and a closer encounter with wilderness.⁵⁰⁰

Throughout the interview process, I spoke with researchers from within and around the Park Service, including many who rotate (or have rotated) positions between the NPS and academic institutions. Citing the range of resources, legal statuses, purposes, geographies, and management cultures, many were adamant that management strategies and solutions—and the science that informs them—must be mindful of context.

For an academic such as the visitor-use researcher above, that means cultivating a sense of embeddedness through close, mutually beneficial relationships with park employees and leaders. He spoke of long stints in parks—at times, entire sabbaticals—getting to know Park Service employees, their concerns, and the types of research questions that would fit their management concerns, as well as his own expertise and goals. Another academic researcher added that although some parks elicit RFPs (requests for proposals) to study certain challenges, much of the work she’s done with the NPS has grown from ongoing relationships with certain parks:

⁵⁰⁰ Even if only perceived—no areas within the park are currently legally designated “wilderness areas.”

I've realized being in a faculty position that a big part of it is about relationship-building and trust. So, once I moved ...for instance, one of the first things I did was...immediately went [and] had face-to-face meetings with both [parks and] other partners in the region to actually get a good idea of, "What's going on? What are the issues you're facing right now? What are your needs?" And then, you know, highlight to them, "What could our university—what could I—offer to help from a research perspective to address those needs?"

As well, she mentioned that faculty and students will occasionally develop ideas and approach the parks with them. But whatever the case of origin, project success is more likely when there exist “long-term relationships between the researchers (and their institutions) and the parks.” It should not be, in her words, “just a one-time, come in, help out, and then leave.”⁵⁰¹

Still, the efforts and intentions of the NPS and academic researchers and their institutions are not always in alignment, as they are in the experiences of the two researchers above. One retired administrator noted, “the academic world is a strange place with its own language and its own culture and its own bureaucracy... You know, the researcher may be doing something very, very interesting and they produce a dissertation on it, and they publish it in some obscure journal and in a language that the policymaker will either never see or understand.” In other words, he stated, we need more “bridge[s] between the policy questions that management has in an agency like the Park Service or the Forest Service or others, and the academic world of research.”

In line with that view, institutions within and between parks and universities have been developed to ensure the longevity and sustainability of healthy research

⁵⁰¹ I omitted and replaced identifiers (like names of parks, etc.) in this quote and the block quote above.

partnerships.⁵⁰² Within the NPS, for example, there are eighteen Research Learning Centers situated across the country which are open to permitted researchers, including from academia. Some also have staff available to assist researchers with understanding park needs.⁵⁰³ For example, the Desert Research Learning Center, adjacent to Saguaro National Park in Arizona, provides laboratory space and temporary researcher housing.⁵⁰⁴

In addition, several universities house official research groups or centers focused specifically on park research, including the Clemson Institute for Parks and the more recently developed UC Berkeley Institute for Parks, People and Biodiversity.⁵⁰⁵ UC Berkeley in particular has a long history of connections with the NPS, including as the home academic institution of A. Starker Leopold, chair of the Leopold Report committee.⁵⁰⁶ More recently, the NPS and UC Berkeley share a dual appointment staff member: Dr. Patrick Gonzalez serves as the NPS's principal climate change scientist, as well as an Associate Adjunct Professor of Environmental Science, Policy, and Management at UC Berkeley.⁵⁰⁷

⁵⁰² These resemble what Dave Guston calls, "boundary organizations." Actors from both sides of the boundary (here, the academy and the NPS) participate in the boundary organization. When attempting to solve problems, the boundary organization is accountable to both sets of actors. Another interviewee will refer to them directly below. David H. Guston, "Boundary Organizations in Environmental Policy and Science: An Introduction," *Science, Technology, and Human Values* 26(2001): 399-408.

⁵⁰³ National Park Service, "Research Needs," last modified April 18, 2016, <https://www.nps.gov/rlc/researchneeds.htm>.

⁵⁰⁴ National Park Service, "Desert Research Learning Center," last modified September 9, 2019, <https://www.nps.gov/im/sodn/drlc.htm>.

⁵⁰⁵ Jon Jarvis is the executive director.

⁵⁰⁶ For a brief review of their intertwined history, check out: Steven Beissinger and Tierne Nickel, "Historical connections between UC Berkeley, the birth of the U.S. National Park Service, and the growth of science in parks," in *Science, Conservation and National Parks*, eds. Steven Beissinger, David Ackerly, Holly Doremus, and Gary Machlis (Chicago: The University of Chicago Press, 2017).

⁵⁰⁷ "Patrick Gonzalez," accessed October 3, 2019, <http://www.patrickgonzalez.net/>.

Several universities, including UC Berkeley, also host Cooperative Ecosystem Studies Units meant to “provide research, technical assistance, and education to federal land management, environmental, and research agencies and their partners.” The program is partially related to the NPS’s discontent with Secretary Babbitt’s National Biological Survey in the 1990s. Recall, interviewees expressed frustrations with broken relationships and a reduction in relevant science—they worried that when scientists aren’t internal to the NPS, they are less obligated to produce applied work. According to two of my interviewees, the CESUs were one response to that loss of internal capacity. The South Florida-Caribbean CESU, for example, is located at the University of Miami—both university and federal agency partners (including the NPS) contribute to the CESU and applied projects related to monitoring indicator species, research coastal restoration impacts, and refining models for predicting flooding, among others.⁵⁰⁸ Beyond funding and empowering interdisciplinary and cross-sector research, the CESU’s foster an ethos of collaboration. As one former NPS administrator put it, these in-house units and centers provide “that water cooler culture kind of thing where people are talking and engaged.” Another interviewee—a superintendent—equated her park’s academic research partnerships to arranged marriages. Not all of them work out, but the CESUs are one ingredient for a lasting relationship because of how they provide clear channels for communication and collaboration.

Also, the George Wright Society used to convene park practitioners, researchers, advocates, and leaders on a bi-annual basis to exchange ideas, share challenges, and spark

⁵⁰⁸ “South Florida and Caribbean Cooperative Ecosystems Unit,” last modified in 2016, <http://sfc-cesu.com/>.

new partnerships. Although they unfortunately haven't hosted a conference in several years, The George Wright Society does still organize regular Park Breaks, "a week-long, park-based fellowship and field seminar for graduate students who are seriously thinking about a career in park management or park-related research and education." Students learn the importance of embedded work, first hand, through exploring "topics of importance to the host park," as well as interacting "with park researchers, natural and cultural resource managers, and policymakers."

Long-term, mutually beneficial relationships aren't just about developing contextualized research projects—they're also key in the application of results. For example, the visitor-use researcher shared that he and his team always aimed to hold debrief conversations:

...Of course, we would write them a project completion report, but we would also sit around the conference table and talk about it...And, you know, that was one of the things that I enjoyed most about my work. Some parks didn't seem to be interested in doing that, but most did. And, you know, it allowed me to tell them what I felt the most important findings were and what I thought the implications were, but also to put limits on, you know, what we found.

As in the case of models that I presented above, this researcher understands that his research is more likely to be appropriately useful if his Park Service collaborators are conscious of the assumptions and limitations inherent to the results. He continued, "There are always limits to any study, and I wanted to be sure that they were aware of that."

You might have noticed that he noted that not all parks participate in such conversations, and that brings us to another contextual factor influencing how science is done in parks: decentralization. I've stated before that within the bounds of the law, superintendents pretty much have self-governing rule over their parks. The ways in which

they choose to manage can be influenced by their varied backgrounds, personalities, and preferences. A few interviewees noted, for example, that park personnel—including superintendents—vary in their science literacy, given that they might come into their leadership roles from a career more focused on facilities, or law enforcement, among others. The Washington Office (WASO) thus aims to provide some centralized support to parks that need assistance with understanding, translating, using, and contextualizing science, largely through the Natural Resource Stewardship and Science Directorate and its several divisions.⁵⁰⁹ An employee from one of those divisions observed that the growing volume of science (and *sciences*) requires filtering and synthesis, even if you are science literate. His role and office, and the Directorate they live within, are meant to aid parks in deciphering which science is useful, when and where and how:

The amount of information coming out ... really is a challenge to the tradition of basing decisions on science. It takes maybe more boundary actors or boundary people that all synthesize and translate. And that's a lot of what our program does. And we feel like this issue keeps us pretty busy and that parks really want us to do that translation ...

In the case of the Climate Change Response Program, again that translation and application of science is done with a mindfulness for context. They produce park-specific briefs on request,⁵¹⁰ and host “scenario planning” workshops which help park managers imagine a range of possible futures based on the data and models (including limits and uncertainties) and park managers’ own observations and experiences in the park, past and

⁵⁰⁹ Explained by three interviewees who were all NPS employees and involved with the Directorate in different ways.

⁵¹⁰ Such as this one from the Badlands: U.S. Department of Interior, National Park Service, *Implications of Climate Scenarios for Badlands National Park Resource Management* (Fort Collins, CO: National Park Service, 2019), https://www.nps.gov/subjects/climatechange/upload/2019-03-26BADLClimateScenariosBrief_508Compliant.pdf.

present.⁵¹¹ Continuing with the theme of needing help with sifting through the data, the interviewee noted, “There are so many different climate resources in terms of global climate models that, you know, we have to have tools and approaches like scenario planning to work with the range of possible ways that the future might play out.” Of course, though all parks are asked to explore “alternative futures,” via *Management Policies 2006*, it is up to the managers and leaders in each park to seek out assistance in doing so, if they’d like it.⁵¹²

Park managers and leaders also differ in their approaches to doing and using science in their parks. To start, the research permitting process is park-specific. John Dennis, who was central to creating the modern permitting system, explained the logic behind the process:

The approval or denial is a park decision; it's not a service-wide decision. ... And in my view, it cannot be service-wide decision because we, in Washington or their counterparts in the region offices, don't know the individual details of each park, whereas the park superintendent and staff do. And so, the permit process says, "Is it valid science that's being proposed? Is it a valid PI? Will the proposed work have any impact on park operations? And will the proposed work have any impact on park resources and any impact on visitor enjoyment?"

Only on-ground staff have the insider knowledge needed to strategically determine which permits to approve, which to provide with additional support (e.g., funds or staffing), and which to decline perhaps due to limited resources or potential risks of negative impacts to

⁵¹¹ A few example-reports from recent scenario planning workshops in South Dakota and North Dakota: U. S. Department of Interior, National Park Service, *Natural Resource Report: Resource Management and Operations in Southwest South Dakota* (Fort Collins, CO: National Park Service, 2016), <https://irma.nps.gov/DataStore/DownloadFile/554801>. U. S. Department of Interior, National Park Service, *Natural Resource Report: Resource Management and Operations in Central North Dakota* (Fort Collins, CO: National Park Service, 2016), <https://irma.nps.gov/DataStore/DownloadFile/554412>.

⁵¹² U.S. Department of Interior, National Park Service, *Management Policies 2006*, 25.

the park (e.g., in some instances of specimen collection). Still, a few interviewees—two academic researchers and a WASO administrator—at times verged on frustration, stating plainly that decentralization can mean that some parks are going to be more supportive of science than others—“it’s pretty hit or miss,” whether staff are willing to engage with science. According to one park scientist, sometimes park staff will prefer to engage primarily with clearly applicable projects because of their limited resources, while others have the capacity to open their parks to projects of all types, including those that are less directly related to management challenges. Among several of my interviewees (a mix of current and former NPS employees), though, was a belief that when parks are able, they should be open to all kinds of (reasonably low-impact) research as a form of public enjoyment or use of the parks. In the preface to his edited collection, *Science, Conservation, and National Parks*, UC Berkeley Professor Steven Beissinger calls that, “Parks for Science” (to complement “Science for Parks”).⁵¹³

Despite the challenges of decentralization, it was described as a feature more often than a flaw. Leigh Welling, for example, admits that it can be hard at times to get everyone “rowing in the same direction,” perhaps even impossible. But the people of the NPS are mission-oriented, even if interpretations of that mission are bound to differ based on context. Dave Hallac struck a similar tone: it can be frustrating when there is a lack of centralized guidance, training, or coordination, but the NPS also shouldn’t “micromanage each individual manager” because their contexts and experiences differ. He was clear, though, that’s not to say there shouldn’t be some NPS-wide policies or programs. Hallac,

⁵¹³ Steven R. Beissinger, “Preface,” in *Science, Conservation, and National Parks*, eds. Steven R. Beissinger, David D. Ackerly, Holly Doremus, and Gary E. Machlis, (Chicago: University of Chicago Press, 2017), xii.

for one, would like to see the type of science literacy standards for superintendents that were proposed in the now rescinded Director's Order-100.

I noticed, though, that even those nationally-scaled policies seem pretty well tuned into the nature of the diverse, decentralized system. In a review of a couple different policies mandating or providing guidelines for how to do or how to use science in parks, there are several references to contextualizing science. Take this excerpt from *Management Policies 2006*, for example:

Superintendents must be mindful of the setting in which they undertake the protection of park resources. The practicability of achieving a natural soundscape may be quite reasonable at a park unit in a remote setting, but the same may not be true at a popular roadside viewpoint in the same park unit, or at a park unit in a more urban locale. Similarly, the restoration and maintenance of natural fire regimes can advance more rapidly and on a larger landscape scale in wilderness areas where considerations for public safety and the protection of private property and physical developments can usually be readily addressed.⁵¹⁴

With references to landscape-scale processes, MP 2006 importantly points out that context is also about acknowledging a park's place more broadly:

Science has demonstrated that few if any park units can fully realize or maintain their physical and biological integrity if managed as biogeographic islands. Instead, park units must be managed in the context of their larger ecosystems. The ecosystem context for some species and processes may be relatively small, while for others this context is vast. In any case, superintendents face the challenge of placing each of the resources they protect in their appropriate ecosystem context and then working with all involved and affected parties to advance their shared conservation goals and avoid adverse impacts on these resources.⁵¹⁵

⁵¹⁴ U.S. Department of Interior, National Park Service, *Management Policies 2006*, 37.

⁵¹⁵ U.S. Department of Interior, National Park Service, *Management Policies 2006*, 36-37.

Similarly, the Climate Change Response Program’s approach accounts for “small and large scales” in the process of synthesizing, translating, and delivering science to support parks.⁵¹⁶ To do so, they “begin with managers’ needs”—the local park context. But they also seek and “build connections across disciplines and organizations” to address the complex, interdisciplinary problems that might operate at larger, landscapes scales in the case of many park processes and challenges.⁵¹⁷

In researching the development of the NPS Inventory and Monitoring Program, I discovered that it demonstrated some of these guidelines for “science in context” in action. The design of the I&M Program started with an awareness of the audience: “managers, planners, natural resource specialists, interpreters, and scientists at the local park level.”⁵¹⁸ As members of that audience, my interviewees characterized the desire for such a program—driven, as I indicated before, by a desire to know and understand the resources they’re charged with preserving. Second, the program designers were aware of the limited resources available for I&M, and thus, the need to design a program that leverages “partnerships with parks, other NPS programs, and other agencies.” The I&M Program thus also exemplified the key role of partnerships (and embedded expertise) in park science, much like the network of CESUs, Research Learning Centers, and other academic partnerships discussed above. From the beginning, the I&M Program relied on

⁵¹⁶ National Park Service, “Park-specific Climate Science,” last modified December 6, 2018. <https://www.nps.gov/subjects/climatechange/parkclimatescience.htm>.

⁵¹⁷ National Park Service, “Policy and Planning,” last modified September 24, 2019, <https://www.nps.gov/subjects/climatechange/policyandplanning.htm>.

⁵¹⁸ Fancy, Gross, and Carter, “Monitoring the condition of natural resources in U.S. National Parks,” 163, Fig. 1.

the expertise of academics and researchers from other agencies to help develop the proper indicators and measures for the Vital Signs program.

Finally, the designers of the I&M program acknowledged that the variance in park units, resources, and management negated the utility of a “one size fits all” approach:

We evaluated and rejected the strategy of selecting a set of core indicators that every park would measure in a similar way because the “information rich” attributes that best characterized park ecosystems differed greatly among ecological systems, very few measures were common across parks, and because partnership opportunities (and the appropriate ecological indicators and sampling methodologies associated with them) available to parks differed throughout the national park system. We instead adopted a strategy that allowed each park, working with partners and subject-matter experts, to prioritize and select their vital signs based on their most critical data needs and local partnership opportunities, with coordination and sharing of protocols and data sets facilitated by the national office.⁵¹⁹

Goals and policies for choosing the indicators, or “vital signs,” were stated in general terms for the entire 32 networks—for example, “determine trends in the incidence of disease and infestation in selected plant communities...” It was then up to each region or park to determine the specifics—for example, “estimate trends in the proportion, severity, and survivorship of limber pine trees infected with white pine blister rust at Craters of the Moon National Monument.”⁵²⁰ The process of choosing such specifics relied on an interdisciplinary group decision-making process that included park managers and subject-matter experts.⁵²¹

⁵¹⁹ Fancy, Gross, and Carter, “Monitoring the condition of natural resources in U.S. National Parks,” 163-164.

⁵²⁰ Fancy, Gross, and Carter, “Monitoring the condition of natural resources in U.S. National Parks,” 165, citing Garrett et al. 2007. L. K. Garrett et al., *Natural Resource Report: Upper Columbia Basin Network vital signs monitoring plan* (Moscow, ID: National Park Service, 2007), NPS/UCBN/NRR-2007/002.

⁵²¹ Fancy, Gross, and Carter, “Monitoring the condition of natural resources in U.S. National Parks,” 167.

Admittedly, this contextualized design doesn't solve the issues I raised earlier: lack of funding or staff (or supporting partnerships) in some parks, inconsistent monitoring efforts, and the plain reality that there are some things we'll never have the tools or cognizance to measure, even though we should. It's worth doing still, so long as the NPS continues to be aware of these limitations and transparently discloses them in the process of synthesizing and translating the information for decision makers.⁵²² And those decision makers must use that information in the context of how it was collected and how it might be limited. As the visitor-use researcher emphasized, "there are always limits to any study..." Vital Signs are locally determined and oriented—as they should be—and thus one of their limitations is that they must be locally interpreted and used.

To summarize thus far, the NPS confronts the challenges associated with applying science to gnarly questions by emphasizing the importance of context. Science, including research design, application of results, and relationships with academic experts, should be deeply embedded in park contexts which can vary by unit-type, resources, problems, public purposes, and leadership. Some NPS policies and programs, such as the Inventory and Monitoring Program, accordingly recognize the implications of local variations and decentralization; they thus empower embedded research and management practices. These views were widely held across interviewees and the policies and programs I reviewed.

But before moving on, I have one more point to make about the Inventory and Monitoring Program, and I turn once more to John Dennis to help me make it. Like many

⁵²² Fancy, Gross, and Carter, "Monitoring the condition of natural resources in U.S. National Parks," 172.

of his colleagues, Dennis explained how climate change is presenting novel conditions that parks should strive to understand: "... we cannot assume that the system will operate in the future the way it used to in the past. And so, what we need to do, in my view, is do the science to better understand what the system is doing now, what processes are, what the components are." After using such science to model possible futures under climate change, the NPS should then, "ask of the species we have and of the processes we have, how will that projected change in the climate affect those?"

Fine. This is a story we know. Parks could determine some contextualized Vital Signs, engage in partnerships to build the capacity to track and test them, and then use those data—with the associated limitations—to develop numerous alternative possible futures for the park that can inform local management decisions.

As tends to happen in discussions of climate change and U.S. National Parks, Dennis next turned the conversation to Joshua Trees. What if one or more of the possible future scenarios for Joshua Tree National Park is devoid of Joshua Trees, the park's iconic species? Dennis wondered aloud, as others have, too: "Do we care? Do we want to take heroic measures to keep it in the park? Do we merely report on its demise, you know, through careful monitoring and stuff? Do we like the species so much we want to reach out to neighboring land managers where we project climate will be favorable and help move the species to that new place, which may be other public land, or it may be private land?"

We can collect data and use it to inform our understanding of change, but there will still be some gnarly questions to answer about that change and how we're going to manage it. To drive the point home, Dennis continued with another popular example, fire.

Science has contributed to our realization that climate change can lead to altered fire regimes that impact the plant and animal life living in the area. But, like the anonymous interviewee I featured at the start of this chapter, Dennis pointed out that change can raise some gnarly questions (though, he didn't use that term): "Do we have any iconic species we want to try to keep? Do we have any species from elsewhere that we project will move into this changed place? Or do we sit back and merely monitor and watch what and describe what happens so that people know what used to be here and now they know what is here?"

Dennis declared that each of the questions raised is a "site-specific," as well as a "value-specific" question, with "different managers" each bringing "different value systems into play." Dennis used the budget as a simple example; any interventions suggested by the data will cost money. Managers, drawing from their own experiences, values, and interpretations of park purpose, will have to assess: "Do we have an appropriation that will pay for it, or do we have a volunteer component that will pay for it or that will do the work?" As well, they might wonder, would it be worth it? Will it work? How do we know? Can we know? Is it possible we're just tracking the data of demise—that no matter what we do, species will be lost, including park icons?

It seems the more we know, the more aware we become of gnarly questions. And another part of contextualizing science requires understanding and using it in relation to the budgets and other types of values surrounding the gnarly questions that emerge. What is the role of science in answering normative questions related to ethics, economics, politics, and cultural value?

The Decision Drivers

The budget is just one of many possible decision-drivers, but it's a good place to start because it reflects a broader theme I detected throughout many of my interviews. Almost as common as the declaration that science is only one of many inputs, was the claim that the NPS balances the inputs because they must—whether it's due to a non-negotiable budget, a legal requirement, or a sense of duty inherent to a public agency.

In each conversation, I asked some iteration of, “How is science used? How does it inform policy?” And from across the spectrum of interviewees, including scientists, administrators, superintendents, division chiefs, and NPS retirees, there was almost always the response, “science informs decisions, but it's not the only input.” For example:

“I think with respect to policy, science should inform policy, and it does, but it's not the only thing that informs policy. And science should inform decisions, but it's not the only thing that informs decisions.”

“...science is only one of the things that need to be considered when you're making these important decisions.”

“[Science] doesn't drive the decision, it informs the decision. That's the distinction that you need to really focus on, is that the decisions that we make regarding resources are *science-informed* decisions [as opposed to science-driven].”

Even the few that believed science should *drive* decisions, had to admit that other factors unavoidably come into play. One such interviewee—a scientist who used to sit on the National Park Service Advisory Board—challenged the idea that the applications of science could be limited in some way, “Science is necessary. It's not a matter of limits, it's a matter of application of the findings and making decisions that are evidence-based.” But she went on to observe, “Certainly, there are many aspects of decision making that

include—other than just science—the politics, the social pressures, the availability of resources, etc.” Still, she insisted that science was fundamental to making informed decisions, even if other factors must come into play. Similarly, a representative from an interest group, seemed to lament the fact that science can’t be the primary input to decision making: “. . .unfortunately, you come to learn quickly that science is not the driver of pretty much anything. In an ideal world, yes, [it] would be.” It might be telling that those two individuals are not and have never been land managers tasked with making decisions in a park. They’ve perhaps never been asked to balance the inputs themselves. Though I did have one NPS retiree say of public opinion, “I’m probably not the one to give that undue deference.” It’s important, he clarified, but they can’t have whatever they want, especially not if the evidence demonstrates a heavy impact.

So, present in every interview, even among the few who thought that science was or should be the primary input, was the understanding that decisions are informed by many inputs, including science, but also the budget, the law, and broader public opinion, among others. Next, I asked, “why are there many inputs? And why ‘balance’ them?” And that’s when it became evident that in part, they balance because they’re required to do so. For example, “The law that establishes national parks says, ‘This is how we should manage the resources and these are the values for which this agency should be managing.’ And so we use science and need science to help inform our decisions, but it’s not the only thing. . .” This interviewee is a senior leader with the Natural Resource Science and Stewardship Directorate, and they went on to elaborate that even if the NPS were to hypothetically use science *alone*, public opinion has ways of making itself heard:

“...we can make decisions that are solely based on our scientific interpretation of predator-prey relationships, for example. Or management of a particular wildlife species. Or management of vegetation recovery following an outbreak of some kind of forest pathogen. All these things can be done using purely scientific information ... But if the decisions that we make are widely and strongly opposed by the public, there is a mechanism by which those decisions can change and that's through the Congressional and legislative process.”

That legislative process, the interviewee noted, is the process that establishes a park's existence and purpose. Although it's not a common occurrence,⁵²³ a park's existence and purpose can be revised or revoked through the very same process: “In the most extreme example... Congress could actually pass a law and say, ‘Well, that's all great that you, the National Park Service, think that this is how you want to manage your resources. But we're gonna change the enabling legislation for this particular park unit and say, no, you are hereby told through this public process, this political process, to manage things differently.’” Thus, the interviewee observes, the NPS has no choice but to “consider the more complex and messy public process” that is intertwined with park decisions.

When I queried a superintendent on why the public should be involved in decision making, she also referred to the power the people hold via their elected leadership: “...You want to keep the public involved, because they will make sure you know that these are their public lands.” She continued, if the public doesn't feel they were properly consulted (and sometimes, even if they were), they can make phone calls to the “politicals” that hold the powers of park appropriations and authorization. She also spoke of a sense of duty to the public: “I'm a superintendent. I'm charged with the responsibility that's written in law and that has subsequent regulations to it, and policies, and all that,

⁵²³ Joe Weber, “America's Lost National Park Units: A Closer Look,” *The George Wright Forum* 33(2016): 59-69.

but these places belong to the public. They're part of our collective heritage. And if we don't remember that, they will quickly find a reason to make better use of that land for some other need." A WASO administrator concurred: "At the end of day, we're a public agency and our decisions are reflections of not just the science but also of the expectations of the public."

These sentiments reflect the third of three principles originally presented in the 1918 Lane Letter and repeated throughout park policies and commentaries ever since. The former WASO administrator summarized, "the national interest must dictate all decisions affecting public or private enterprise in the parks." As reiterated most recently in the now-rescinded Director's Order 100, parks must be managed according to the best available science, but also and importantly, based on "accurate fidelity to the law" and "long-term public interest."⁵²⁴ Laws such as the National Environmental Policy Act, as well as *Management Policies 2006*, mandate that public involvement be sought to scope issues, identify alternative possibilities and plans, and review impacts and justifications.⁵²⁵

Echoing this, one park scientist I spoke with raised the point that parks exist as part of a democracy, and that the NPS itself thus abides by democratic decision-making processes. He shared an example from fire management—the California Air Resources Board must approve all prescribed burning in some of the parks he works with. Fire regime management in those parks competes with surrounding communities' desire to

⁵²⁴ Jarvis, "Resource Stewardship for the 21st Century," Director's Order 100. (*rescinded*).

⁵²⁵ National Environmental Policy Act, 42 U.S.C. § 4321 et seq. (1970). U.S. Department of Interior, National Park Service, *Management Policies 2006*, 12, 24-25.

have clean air: "...that's part of the democratic process. We have competing values. ...I think of that...that the role of science is to present the advantages of any course of action. But at some point, human values take over, and you really need, as a scientist, you need to, you know, respect that." Other interviewees from within the NPS concurred: scientists should stay out of the final decision. One even apologized before breaking the news: "...hopefully you won't be insulted by this, but... scientists really can't decide."

The park scientist continued, "And it goes both ways, right?" Using the Endangered Species Act as an example, the interviewee demonstrated that it did not escape him (nor did it escape many other interviewees) that laws and political processes often provide crucial support to science programs in service of public values, including the Endangered Species Act, the National Environmental Policy Act, and the National Parks Omnibus Management Act of 1998, among others. When one of the scientist's graduate students once asked why they were conducting a study to save a small, flowering plant with little economic value, he replied: "the American people have expressed their values, through the Endangered Species Act, that we are responsible for plants and animals, and we're not gonna let them disappear."

Those laws also result in lawsuits, and a few interviewees—all with administrative experience—noted that one important use of science is to back up NPS decisions in court. A former WASO administrator recalled how the lawsuits came from all sides—meaning interest groups with all sorts of ideologies, such as the hunting community or environmentalists—and when the National Park Service faced those interest groups in legal proceedings, "evidence-based decisions [had] the best chance of not being thrown out in court."

A step or two (or three) below the court system, a few other interviewees explained how science is used to justify their decisions to the general public, such as in community forums. For example, one superintendent explained the need to balance visitor desires for more parking with her duty to protect an onsite battlefield from the potential impacts of automobiles. She felt that the science helped her disentangle the long and short-term impacts so that she could make informed decisions about what sorts of impacts to allow:

“And based on [the science], and based on the habitat use, we could say, ‘We can allow for a portion of this area to be occupied by vehicles, but it will be for only this time of year, and for only this duration, and only under these conditions, and for only this number of vehicles. And then because we want it out of this other area where we do believe we still have some resources that are at risk, we’re gonna keep them out of there.’”

Ultimately, she felt that science helped her balance her legal duty to protect park resources with her community’s request to have more access to parking: “I can offer you this, I can’t offer you the whole thing, but I can offer you this portion, and that will meet at least some of the need, and then we’ll have to come up with alternate solutions for the rest of the need collaboratively, because I’ve got science that says, ‘If I go beyond this, I’m gonna have long-term detrimental effects,’ and I can’t do that.” She added that previous decision makers hadn’t followed that process, and thus the community had been left to wonder if decisions regarding parking were “arbitrary.” In her experience, “science provides the credibility and the legitimacy and the sincerity behind decisions within the park.”

As I’ll explain in the next chapter through an example shared by Dave Hallac from Cape Hatteras, using science to justify a decision does not guarantee a resolution

that garners public understanding, especially when there are long-standing values and symbolism attached to the object of the decision (and as is probably *not* the case, I'm assuming, for a parking lot). The parking lot example still shows one of many ways in which a park manager might evaluate and balance their overlapping legal duties to protect resources, engage the public, and use science.

Recall from before, the NPS's intertwinement with “messy and complex public processes”—through legal requirements, community contexts, and anthropogenic socio-ecological changes—is part of what riddles them with wicked or gnarly problems. Parks are political entities.

Consider park boundaries. I'm not a landscape ecologist, but I'm certain most ecosystems are not shaped like polygons. Yellowstone National Park, for example, composes a (roughly) square-shaped, almost 3,500 square-mile corner of Wyoming, that bleeds slightly across the border into Montana and Idaho. The Greater Yellowstone Ecosystem, however, encompasses at least more than three times that area, and up to seven times depending on who you ask to describe the boundaries of the ecosystem.⁵²⁶ (It should not surprise the reader at this point that the definition of an ecosystem is up for debate.) Beyond the park, the Greater Yellowstone Ecosystem crosses into Grand Teton National Park, parts of five different U.S. National Forests, three wildlife refuges, as well as land holdings of the Bureau of Land Management, private owners, and Native

⁵²⁶ For example: Duncan Patten, “Defining the Greater Yellowstone Ecosystem,” in *The Greater Yellowstone Ecosystem: Redefining America's Wilderness Heritage*, eds. Robert B. Keiter and Mark S Boyce, 19-26 (New Haven, CT: Yale University Press, 1991).

Americans. Spanning the states of Wyoming, Idaho, and Montana, the lands encompassed are managed by state, federal, and tribal governments, plus private land owners.⁵²⁷

Park boundaries are not typically arranged according to the laws of nature—and if they were, which laws of which view of nature would we use? Instead, they’re arranged according to the competing interests of the individuals, groups, and institutions (including sciences and scientists) whose inputs were considered in the process of drafting and passing the laws of humans. Recognizing that, many parks (like Yellowstone) strive to engage in partnerships that enable ecosystem-scale management of the resources and processes that are meant to be protected but that sometimes extend beyond park boundaries. As noted in *Management Policies 2006*, “The National Park Service cooperates with partners to extend the benefits of natural and cultural resource conservation throughout this country and the world.”⁵²⁸ So in addition to balancing decision-making inputs within parks, many (if not most) NPS land managers must also consider their collaborators—public partners, other government agencies, non-profits, tribal groups—to help manage their park resources considering their *broader context*.

This takes me back to the Mesoamerican Reef and our team’s attempt at protecting an open system full of unbounded ecosystem processes and sea life within human-set boundaries governed by competing interests and legal jurisdictions. Back in 2013 I’d thought I was applying the study of ecology to the protection of an ecological

⁵²⁷ Entire paragraph sourced from: National Park Service, “Greater Yellowstone Ecosystem,” last modified August 1, 2019, <https://www.nps.gov/yell/learn/nature/greater-yellowstone-ecosystem.htm>.

⁵²⁸ U.S. Department of Interior, National Park Service, *Management Policies 2006*, inside cover page.

entity. Really, we were contributing to the protection (of a segment) of a socio-ecological system that should be managed with a full range of inputs based in the ecological and life sciences, social sciences, legal expertise, community engagement, public comment, and historical and cultural awareness. In general, I think it's safe to say that NPS land managers practice that daily, though where the balance ends up is a function of their personal backgrounds and park contexts.

In this chapter, I sought to understand how the NPS applies science in the context of gnarly questions and wicked systems. I desired for the themes—"Science in Context" and "Balance the Inputs"—to lead the content. I wanted the NPS to speak for itself to some degree. But something fell flat for me. I found myself frustrated by the consistent matter-of-fact explanations provided when I asked, "why?" Why should research agendas be designed, conducted, and used in context? Why can't science drive decisions? Why do the views of the public matter?

Most interviewees justified their answers logistically or legally. For example, parks and their protected resources are variable; it's obvious that research programs and science policies must be sensitive to that. Or, inputs are balanced because of mandates in the law. Or, park managers have a civic duty to preserve parks to the best of their ability. For some that justified applications of science while for others it demanded community input to decisions. Most felt it compelled them to do both. These data paint a picture of a public institution that is clearly and importantly aware of the implications of that categorization. Interviewees demonstrated that their primary commitments are written in the law, though their personal motivations, opinions, and priorities might vary. And of

course, the law is meant to reflect the national interest to which parks have been explicitly obligated since their beginnings.

But there might be a caveat, here. While I rarely detected resentment underlying their general deference to laws and the public in decision making, there seemed to be a belief that, “all these things can be done using purely scientific information,” as one NPS leader mentioned. Sure, science can’t drive decisions because of a legal requirement or a public mandate. In an “ideal world,” though, perhaps it’s voice would be stronger, or the strongest, or the only one worth listening to? It amounts to some sort of, “yeah, there are legal and logistical reasons science can’t lead, but if those disappeared maybe science could lead?” Interviewees at times ignored the inevitable and inescapable indeterminacy of their complex, gnarly systems—the uncertainty will always be there and there will always be room for politics. They also occasionally forgot that declaring a scientific goal for preservation, such as ecological integrity, doesn’t clean up the “mess” of values, traditions, and cultural commitments tied to (or perhaps “tying down”) concepts like naturalness.

For my final chapter, and in conclusion, I’m going to dig a bit deeper into the perspectives of those (far fewer) interviewees who went beyond matters of logistics or legal obligation. They wondered more explicitly about the limits of science to inform park decisions—science does not guarantee certainty, it does not confer control, and it cannot be the sole arbiter of truth. Preservation is not a science.

6. LOOKING FORWARD

But First, Looking Back

At 9:45a on August 15, 2016, I took a deep breath in as I entered the “Rattlesnake Conference Room” at Joshua Tree National Park Headquarters. I’m sure I didn’t exhale until 12:01p when we broke for lunch. I sat in a folding chair next to Kush, while the park staff and leaders served themselves: their choice of turkey, ham, or veggie sandwiches with chips, cookies, and a pickle. I’d brought an NPS birthday cake, too; the Centennial Celebration was only 10 days away.

Throughout the last two hours, I’d introduced the group of park staff and leaders to my proposed doctoral research—I wanted their input to create a survey that would measure visitor perceptions of and preferences regarding change in the park. What are the most notable or important features of the park? How were they changing or expected to change? And what was driving such change? I carefully recorded every answer on giant sticky-note posters that I positioned on the surrounding walls. We had lists upon lists of resources and changes, causes and effects. I’d kept time and tight control of the conversation, reeling in every digression, but we were still one minute late to lunch.

I won’t call it a failure of my preparation—checklists, timelines, print-outs, binders, and contingency plans. That morning, I had spaced yellow legal pads and ASU pens evenly around the table. I’d even planned my outfit carefully: a pair of dark blue jeans, a white oxford shirt with the sleeves rolled up, and my favorite bracelet—rudraksha seeds framing a jade pendant meant to signify balance. I completed the look

with my trusty 5-year-old Chacos—robust (ugly), strappy sandals I’ve worn around the world from France to Costa Rica. They have good arch support.

All the planning served as a distraction. My parents and sister had left from Iowa at dawn to drive to Tennessee. My Grandfather’s funeral was on Saturday, with family gatherings all week long. They’d be there by Wednesday. I’d just make it by Friday. But on that Monday, I had to be in Joshua Tree. I couldn’t waste the time, resources, and preparation that many people had dedicated to the success of the day.

People do not know that I am an introvert. I enjoy conversations, gatherings, and, on occasion, even public speaking. But my enjoyment is made possible only by the corresponding unwind, and on that day, it was lunch. As I went quiet and my mind drifted, I heard Kush in the background asking the staff member to his left, “Has anyone ever told you that you look like Ron Swanson from *Parks and Rec*?” The staff member hadn’t seen the show, but he countered, “The kids around here always tell me I look like Zach Galifianakis!” Kush could see it, “Shit, you do!” They laughed.

The conversations around the room brought my mind back from the road to Tennessee. One biologist spoke softly, reflecting on his favorite spot in the park beneath the Live Oak Tree, just a short drive south of park headquarters. The team leader had his corner of the table laughing, describing the time he had been confused for a bus driver in his uniform because he forgot to wear his distinctive hat. Another group reflected on a family whose mother had passed away in the park the day before. They’d been on the way back from a hike, but there wasn’t enough water for everyone in the family, especially not in the August heat. One person at the table had been responsible for addressing the media and consoling the family. The room went quiet.

My approach shifted in those moments. I had treated the morning as a lecture with some Q&A, but I left my afternoon-script resting on the table. That's not to say I didn't have a purpose—I wanted to continue understanding their perspectives on the park, its features, and the changes. I simply loosened my grip on the conversation. The stewardship story-telling continued.

Throughout the afternoon, staff remarked on the need for more data to inform decision-making. In some cases, they felt the lack of data hindered their ability to “effect change”:

... What are species' responses to climate change? In the absence of those studies and the holes in your data, how effective are changes in management or management policies when you don't have the data there to support them? So, while we have the ability to effect change, we don't always have the data.

Others lamented the need for more studies, the lack of knowledge, and not having enough science. All were framed as impediments to making management decisions or developing appropriate management strategies. They also introduced me to the realities of how complicated their challenges are, including the networked relatedness of some attributes, challenges, and choices. For example:

“Is [the water table] going down because there's more of a draw [for renewable energy]? Because of a drought? Because of climate change? Or because of more people living in the area and how we're living? Either way, it is affecting the ecosystem adjacent to the oasis that's here. And the wildlife that would be dependent on it...if you had wildlife feeding on water 40 years ago because it was above surface, that wildlife is no longer using that and [the wildlife is] being displaced into the urban-wild-land interface, so into the community more so—you know, my backyard.”

The water table decline is potentially a consequence of many interacting and related drivers of change. Change to the water table, in turn, has impacts on wildlife distributions, potentially increasing the urban-wildlife interface.

That morning we had focused on mapping out management challenges to reveal appropriate choices. In line with the comments on missing data, above, I brought data to bear on those challenges, identifying the gaps in knowledge. How, through science, could I help fill the gaps by finding or creating the missing data? That was my reflex—my learned response to complex questions. What does the science say? But I also began to wonder in my notes, “is it *possible* to map out the relatedness among attributes, challenges, and choices? ... To what extent is missing data inherent to or causal of complex situations?” Maybe the uncertainty was a characteristic of the system’s complexity? And maybe science didn’t have the answers? Still, the NPS employees at the table that day were certain they needed that missing data. And I tended to agree.

Evolving Conclusions

I recently discovered a quote by Johannes Kepler, who was famous for documenting his failures and dead-ends as thoroughly as his successes (in addition to discovering the three laws of planetary motion—no big deal): “What matters to me is not merely to impart to the reader what I have to say, but above all to convey to him [or her!] the reasons, subterfuges, and lucky hazards which led me to my discoveries.”⁵²⁹ What matters to me is that you know my perspective evolved, and I’m still not sure I’ve landed on a conclusion I’m satisfied with.

⁵²⁹ As quoted in David Epstein, *Range* (New York: Riverhead Books, 2019), 115.

To paraphrase Didion, in writing the matter out, I've been thinking the matter through. For example, I once thought this conclusion would provide a definitive set of recommendations for the NPS. I believed I would conclude that the future of preservation is science, we get there through more political and financial support of scientific research and personnel. The voices of scientists must be elevated to inform sound preservation practices and policies. I thought I would applaud the most recent commitments outlined in *Revisiting Leopold* and Director's Order 100. I would encourage that such policies should persevere or return despite a setback during the Trump administration.

That was in 2015, before I'd begun to reflect on my personal experiences, interview data, literature, and park policies and how those might combine to change my perspective. As I learned more about the limits of science(s) to inform decision making in complex socio-ecological systems, my conclusion changed: Preservation is pluralistic— involving sciences, public voices, traditional perspectives, and decisions made through democratic, political processes. We get there by dispelling the myth of a simple link between evidence and action. I'd educate the park service: please don't over-correct your historical resistance to science by designing every policy and strategy based on science alone. Everyone's voice matters in the preservation of public lands. That was in 2017.

In 2019, I'm warier of making recommendations. The Park Service seems to get enough of those from well-meaning academics and other outsiders. But as discussed in chapter five, the Park Service is full of people who understand that science alone cannot inform preservation, because preservation is indeed “plural,” informed and driven by politics, partnerships, public voices, and personal meaning, among others. The NPS folks I spoke with also understand that where science does inform practices or goals, it must be

sensitive to each park's purpose, resources, and unique challenges. And they declared their overarching commitment to their higher public purpose and legal mandate.

Still, however, science seems to be the primary response to growing recognition of complexity and pervasive change in parks. Applications of science are increasing all over the park service, in part due to a historical trajectory and cultural commentary the parks have responded to in the last few decades, but also due a seemingly programmed response to complex questions. The participants in my Joshua Tree National Park focus group, for example, were adamant that missing data often impedes action. In my expanded interviews across the NPS, the same message appeared again and again. More science leads to better policies and better decisions. Does that perspective expect too much of science? That's not a question I was quite ready to ask during my 2016 focus group, leaving it instead only for a small note in my journal: maybe the data gaps are inherent to the system? Maybe they can't be resolved?

I described in chapter five how interviewees reflected on the limits of science, but often those limits were framed in terms of logistics and legal obligations, as opposed to the ways in which science itself is complicated or limited in its ability to inform decisions in a complex socio-ecological system. Few linked the limits of science to the conceptual messiness that interviewees lament in chapter four. What is natural, anymore? Do scientific goals like "ecological integrity" help if they only mask instead of resolve such concepts?

A few interviewees touched on such issues. Through their stories, they demonstrate that this ideal world in which science could lead the way, if not for legal obligations and logistical constraints, is not possible. Science does not guarantee certainty

or control, and it is especially limited in its capacity to inform or drive a decision when there exist unexamined or unresolved values that are deeply attached to a park and its resources. I suspect that many more NPS land managers have experiences with these ideas, though they didn't articulate them. These perspectives cannot be considered themes due to their rarity across the interviewees, but I feel they speak in powerful ways to the future of preservation in the context of continuous change we do not understand and concepts we have not been able to (and may never) concretely define.

Science. Values. Truth?

I noticed the themes from chapter five somewhat align with the concept of “post-normal science,” developed in the 1990s by mathematicians and philosophers of science Silvio Funtowicz and Jerome R. Ravetz. Post-normal science questions “may include a large scientific component in their description, sometimes even to the point of being capable of expression in scientific language,” as with “trans-science” questions (Funtowicz and Ravetz give a nod to Weinberg). But more specifically than trans-science, post-normal science is an *approach* necessitated in policy problems characterized by high levels of complexity and uncertainty, disputed values, as well as high-stakes, urgent decisions.⁵³⁰ Such problems may still require scientific input, but that input is uncertain to such a degree that an “extended peer community,” including anyone with a stake in the decision, should be welcomed to the table along with experts and decision makers.⁵³¹

⁵³⁰ Silvio O. Funtowicz and Jerome R. Ravetz, “Science for the post-normal age,” *Futures* 25(1990): 744.

⁵³¹ Funtowicz and Ravetz, “Science for the post-normal age,” 752.

This conceptual framework aligns well with the ways in which NPS employees describe science as being done and being used in parks. For example, related to the themes of “science in context” and “balancing inputs,” Funtowicz and Ravetz declare:

When problems lack neat solutions, when environmental and ethical aspects of the issues are prominent, when the phenomena themselves are ambiguous, and when all research techniques are open to methodological criticism, then the debates on quality are not enhanced by the exclusion of all but the specialist researchers and official experts. The extension of the peer community is then not merely an ethical or political act; it can possibly enrich the processes of scientific investigation. Knowledge of local conditions may determine which data are strong and relevant, and can also help to define policy problems.”⁵³²

When the problems are gnarly, welcoming more inputs into the decision-making process can aid in the contextualization of science. Science is thus not irrelevant, but it is “no longer [a science] in which location (in place and time) and process are irrelevant to explanations.”⁵³³ In chapter five, most interviewees communicated the importance of performing and applying science in context, in addition to sharing their legal and logistical reasons for balancing science with other decision-making inputs such as public feedback. But isn’t science supposed to produce universal, value-free truth? Isn’t the point of good science that it *can* be untethered from time and place? Isn’t science better or stronger the more generalizable it is? In describing the ways in which they apply sciences to parks, interviewees have thus challenged the traditional defining characteristics of science (as have Funtowicz and Ravetz).

The framework doesn’t stop with the importance of context and stakeholder input. I’d also like to recognize the few interviewees who reflected on Funtowicz and Ravetz’s

⁵³² Funtowicz and Ravetz, “Science for the post-normal age,” 752-753.

⁵³³ Funtowicz and Ravetz, “Science for the post-normal age,” 740.

view that post-normal science begins where uncertainty soars, control diminishes, stakes are high, and values are disputed. First, the use of science in decision making does not equate to certainty in or control over a situation. Uncertainty is the possibility, based on what we know now, that more than one outcome could occur in the present or the future, combined with the potential for unintended consequences of interventions due to the complex, interrelated, and networked nature of the systems and situations.⁵³⁴ As one NPS scientist explained to me, uncertainty is one reason—beyond the legal requirement—to rely on multiple inputs to decision making:

Science cannot, at this time, predict exactly where and when some of these climate changes will occur. And with that, we have to work with the other systems at play, whether it be politics, or it be decision making at the local, regional, federal levels, and states...

Echoing the interviewee above, in the final chapter to their edited collection *Beyond Naturalness*, editors Cole, Yung, and co-author Hobbs, declare that increasing uncertainty demands “more subjective approaches” to park management that welcome diverse perspectives to the table, such as scenario planning.⁵³⁵ Funtowicz and Ravetz would probably agree, noting, “Science cannot always provide well founded theories based on experimentation for explanation and prediction, but can frequently achieve at best only mathematical models and computer simulations, which [as I noted in chapter five] are essentially untestable... Therefore, policy cannot proceed on the basis of factual

⁵³⁴ Roger A. Pielke, Jr., *The Honest Broker* (Cambridge: Cambridge University Press, 2007), 55. Horst W. J. Rittel and Melvin M. Webber, “Dilemmas in a general theory of planning,” *Policy Sciences* 4(1973): 159.

⁵³⁵ Laurie Yung, David Cole, and Richard Hobbs, “A Path Forward: Conserving Protected Areas in the Context of Global Change,” in *Beyond Naturalness*, eds. David N. Cole and Laurie Yung (Washington, D.C.: Island Press, 2010), 265.

predictions, but only on policy forecasts.”⁵³⁶ This contributes to the logic behind “extending peer communities” beyond science to inform decisions.

Uncertainty didn’t faze everyone that I spoke with. Many admitted to uncertainty in park preservation, but saw science as the key to reducing it. Even if uncertainty is irreducible now, science will one day progress far enough to reduce it in the future. The NPS scientist above explicitly says this: “Science cannot, *at this time*, predict...” [emphasis added]. This is similar to the claim within *Revisiting Leopold* that “the overarching goal of NPS resource management should be to steward NPS resources for continuous change that is *not yet* fully understood...” [emphasis added].⁵³⁷ The report does, however, go on to urge the NPS to embrace the precautionary principle, which was later defined in Director’s Order 100 as requiring that “when an action, activity or emerging condition raises plausible or probable threats of harm to park resources and/or human health, management should take anticipatory action even when there is uncertainty.”⁵³⁸ In other words, decisions will sometimes need to be made—erring on the side of caution—before certainty can be found (if it can be found). DO-100 adds that principles of adaptive management will also be key to 21st century park stewardship—managers have permission to make precautionary decisions and then adjust as new

⁵³⁶ Funtowicz and Ravetz, “Science for the post-normal age,” 742.

⁵³⁷ National Park System Advisory Board, *Revisiting Leopold*, 15.

⁵³⁸ Jonathan B. Jarvis, “Resource Stewardship for the 21st Century,” Director’s Order 100 (Washington D.C.: National Park Service, Dec. 20, 2016).

information becomes available, achieved through careful monitoring of decisions and impacts.⁵³⁹

But it won't always be the case that more science or monitoring will reduce uncertainty over time. First, uncertainty can be rooted in science itself—or rather, in the sciences and their competing views of nature. Daniel Sarewitz explains, more research doesn't always succeed at reducing uncertainty, “for example, when additional research reveals heretofore unknown complexities in natural systems, or highlights the differences between competing disciplinary perspectives, and thus expands the realm of what is known to be unknown.”⁵⁴⁰

In some cases, uncertainty might also be related to the judgements and values that we attach to approaches and outcomes—which one would be best or worst?⁵⁴¹ Answers could be sought in the context of economics, biodiversity conservation, cultural inclusivity, recreational uses, and more. Then, uncertainty is a reflection of the social and political conflicts that are inherent to a wicked system and that inform different ways to answer those questions. In parks, those conflicts are likely to involve questions over what parks are meant to preserve—not just the resources or types of units, but also the unresolved concepts that are meant to serve as overarching goals: “naturalness,” “unimpaired,” and competing aims for “use” vs. “preservation.” More scientific research will not resolve that mess.

⁵³⁹ Recall that DO-100 is no longer in effect, but I continue to review these two documents because interviewees have signaled that they represent the future directions of park management, regardless of the current political climate.

⁵⁴⁰ Daniel Sarewitz, “How science makes environmental controversies worse,” *Environmental Science and Policy* 7(2004): 396.

⁵⁴¹ Pielke, Jr., *The Honest Broker*, 57.

Even if you could claim to have total certainty in scientific understanding, that doesn't necessarily grant control over the phenomenon or object of interest. I sort of alluded to this earlier when I wondered if the Inventory and Monitoring Program was collecting data on the decline of Joshua Trees without conferring the ability to do anything about it within the boundaries of the park. In her book, *In Search of the Canary Tree*, conservation scientist Lauren E. Oakes encountered similar questions regarding yellow-cedar trees in Alaska: "Your questions—what happens after the trees dies," [her interviewee] said, "So what? If you answer it, what then? On to the next project? Scientists have proven, again and again, a remarkable capacity for simply monitoring a species to extinction."⁵⁴²

A couple of my interviewees pointed out that science often proceeds more slowly than the urgent pace of decision making. There might be a delay between our attainment of understanding and our window for action. Their collective claim calls to mind Weinberg's "trans-science," and cases in which it might be impractical to wait for the data before taking vital action. Conservation biologist Michael Soulé made this point in his 1985 paper, "What is conservation biology?"⁵⁴³ He described conservation biology as a "crisis discipline" in which the scientific experts are often required to act without perfect knowledge due to the urgent timeline and high stakes of the challenges: "In crisis disciplines, one must act before knowing all the facts; crisis disciplines are thus a mixture

⁵⁴² Lauren E. Oakes, *In Search of the Canary Tree* (New York: Basic Books, 2018), 38.

⁵⁴³ Michael Soulé, "What is Conservation Biology?" *BioScience* 35(1985): 727-734.

of science and art, and their pursuit requires intuition as well as information...Tolerating uncertainty is often necessary.”⁵⁴⁴

But this is more than a matter of practicality, or not being able to collect the information quickly enough to act. Leigh Welling reminded me that many changes are unstoppable, no matter what we know (or what we don't know) or how quickly (or how slowly) we can move:

...there's an acknowledgement that has happened over the last 10 years that we can't necessarily maintain parks how they've been and how we want them to be. I think up until even 10 years ago...there was still this idea that when we do a planning document to decide how to manage, we establish our goals and we map how we get to them. We say here's our desired future. We sit around, we all talk about what we want the park to be, what the values are and what is the desired condition for the park? ... That's sort of the complicated approach that has been.

And now, the NPS is beginning to realize that neither researching nor deliberating on the impacts of climate change or desired futures will guarantee control.

...You know, this is a dynamic system and there's honestly little that a park can do or a park service can do to somehow stop [climate change] from happening. ...Oftentimes what you're doing right now is you're finding intermediate things that you can do to kind of bridge between the way we've managed in the past and the way we expect we're gonna need to manage in the future. And in some cases we're just gonna have to say we can't control that. And that's different.

Her sentiments are related to the theme of “inevitable change” that I described in chapter four. They're also reflected in policies released during the Obama administration, including the assertion in Director's Order 100 that “new and complex environmental and social forces...may be beyond the influence of the NPS and their consequences may be

⁵⁴⁴ Soulé, “What is Conservation Biology?”

irreversible.”⁵⁴⁵ Two years before DO-100, Director Jarvis released a 2014 memo calling on cultural resource managers to “recognize loss” in the face of climate change impacts: “Managers should consider choices such as documenting some resources and allowing them to fall into ruin rather than rebuilding after major storms. Such decisions for loss cannot be made lightly nor without appropriate consultation and compliance.”⁵⁴⁶ Jarvis directed managers to “consult broadly” across the scientific community, visitors, Native Americans and other traditionally associated people, and more. The role of science then, as articulated in both documents, is to aid in understanding novel environmental and social challenges in “collaboration with partners outside park boundaries; and open and inclusive communication with partners and the public.”⁵⁴⁷

Finally, science cannot resolve value disputes. To make this final point, I will turn back to Dave Hallac and the “success story” of the Cape Hatteras Lighthouse.

At the end of chapter five, a superintendent told the story of how her parking-lot problem was solved by conducting (and sharing with the public) a study on its possible short and long term impacts. Similarly, Dave Hallac shared with me, “We're mostly focused on being able to articulate, with strong science, the actual change that's occurring. And we're focused on bringing to bear solid scientific estimates and forecasts about what's likely to happen in the future.” Hallac and his team rely on science to justify

⁵⁴⁵ Jarvis, "Resource Stewardship for the 21st Century," Director's Order 100.

⁵⁴⁶ Jonathan B. Jarvis, "Climate Change and Stewardship of Cultural Resources," Policy Memorandum 14-02 (Washington D.C.: National Park Service, Feb. 10, 2014).

⁵⁴⁷ Jarvis, "Resource Stewardship for the 21st Century," Director's Order 100.

their policies of “not rebuilding in places where things just continually get destroyed.” And yet later in our conversation, as he told the story of the Cape Hatteras Lighthouse, it became evident that even in cases where the values appear aligned and the intervention is supported with time, resources, and a seeming majority of the political capital, science may still be limited in its capacity to inform a decision because of the conflicting values and symbolism that are deeply and historically attached to, in this case, a lighthouse.

Funtowicz and Strand allude to this when they describe the defects of the “modern model of science policy” in which first, a decision maker develops a policy by becoming informed (by science, for example), and then second, they sort out the diverse values and preferences. This approach assumes one truth, or one possible true answer, when there are likely many in a gnarly context. Funtowicz and Strand argue that this approach, “assumes not only that uncertainty can be eliminated or controlled, but also that the scientific information can be complete in the sense that it tells the policy maker everything that is necessary to know in order to decide for the common good.” In other words, we assume “there is only one correct description of the system, and it is to be provided by science.”⁵⁴⁸ Indeed, in Hallac’s story below, the mounting evidence seemed to suggest there was a single obvious choice to make: move the Cape Hatteras Lighthouse or to let it sink into the sea. Not so.

⁵⁴⁸ Silvio O. Funtowicz and Roger Strand, “Models of Science Policy,” in *Biosafety First: Holistic Approaches to Risk and Uncertainty in Genetic Engineering and Genetically Modified Organisms*, eds. T. Traavik, and L.C. Lim (Trondheim: Tapir Academic Press, 2007), 1. (Pagination of PDF does not match pagination in book).

Hallac tells me there are three lighthouses in Cape Hatteras National Seashore, North Carolina, but Cape Hatteras Lighthouse is “in the heart of the seashore. Is it iconic. . . it’s the symbol of navigation and the Coast Guard.”

The lighthouse is “iconic” for its height, its location, its history, and its paint-job—spiraling black and white stripes extending from its bright red base to the beacon at the top. Standing a (*very specific*) height of 198.49 feet tall, Cape Hatteras Lighthouse is the tallest brick lighthouse in the United States. It was constructed in 1870 for a total of \$167,500 to replace the original lighthouse, which was first lit in 1803 but partially destroyed in the Civil War. Though the current structure has gone through periodic episodes during which it was decommissioned, it still functions today to guide ships passing through the “Graveyard of the Atlantic,” an area in which the Gulf Stream intersects with the lesser known Virginia Drift and Labrador Current to dangerous effect.⁵⁴⁹

In 1937, during a brief period of disuse, the lighthouse became part of the first U.S. National Seashore. Given its legacy, Hallac explains that the National Park Service spends many resources preserving it, especially against the ongoing process of coastal erosion. And his staff members accommodate hundreds of thousands of visitors every year who visit the park to climb its 269 steps.⁵⁵⁰ It holds special value not only to visitors from all over the world, Hallac tells me, but to the community: “their ancestors were

⁵⁴⁹ National Park Service, “Cape Hatteras Light Station,” last modified May 14, 2019, accessed October 14, 2019, <https://www.nps.gov/caha/planyourvisit/chls.htm>.

⁵⁵⁰ National Park Service, “Cape Hatteras National Seashore Sees Highest Visitation Since 2003,” last modified February 7, 2019, accessed October 14, 2019, https://www.nps.gov/caha/learn/news/19_006.htm.

lighthouse keepers and ... helped to build it, had some role in it. It's very important to them.”

Since long before the lighthouse became an NPS icon, and even longer before climate change models predicted sea level rise in the outer banks, its prominent place on the beach has been threatened by coastal erosion. Between 1870 and 1919, it’s distance from the shoreline diminished from the original 1500 feet to less than 300 feet.

Throughout the twentieth century the park invested in pumping unknown quantities of sand onto the beach to combat erosion. Still, by 1975 the tower stood only 175 feet from the shoreline. And then, in March 1980 a storm whipped through the area, washing away the remains of the original 1803 lighthouse, as well as more than 100 feet of shoreline. Closer than it had ever been, Cape Hatteras Lighthouse was separated from the sea by, at most, just 70 feet of sand. Hallac recalls, “we realized we had to do something about this. We were trying to fight the ocean. We were hardening the shoreline. It wasn't working. The lighthouse was in danger.”

In 1987 the NPS commissioned a report from the National Academy of Sciences, a culmination of seven years of planning, including a National Environmental Policy Act public comment process, community forums, and plans for a seawall. Published in 1988, the National Academies report recommended relocation as the best strategy for preserving the structure. And in 1997, a second independent study sponsored by North Carolina State University concurred.⁵⁵¹ By 1998, the NPS secured Congressional funding for the move. In Hallac’s words, “... all of the best available science was pointing

⁵⁵¹ National Research Council, *Saving Cape Hatteras Lighthouse from the Sea: Options and Policy Implications* (Washington, D.C.: The National Academies Press, 1988), <https://doi.org/10.17226/9502>.

towards, ‘move the lighthouse.’” The choice was thus clear. In 1999, the NPS moved Cape Hatteras Lighthouse 2900 feet to the southwest in a span of 23 days. In total, the U.S. government spent around 10 million dollars on the move. And not one of the lighthouse’s more than one million bricks was damaged in the process.⁵⁵²

This all transpired long before Hallac took on the role of superintendent in early 2015. And yet, the move repeatedly came up in early conversations with his new community:

I started my job four years ago, and I met with some, not just locals but natives—people that were born on the island, whose families have been on the island for a while. And they started telling me about all the friction they've had with the park service, and I asked if they could give me some examples. And time and time again, I heard, ‘moving the Cape Hatteras Lighthouse.’ They were still angry about that. And I thought to myself, who would be angry about this? I thought this was a major accomplishment that everybody patted us on the back for, that everybody was applauding. I thought we were heroes because we did this.

On closer inspection, however, the period leading up to the move was also marked by many debates, most regarding which was riskier—leaving the lighthouse in place or moving it inland. In 1990, for example, the *Washington Post* reported on the NPS’s decision *not* to move the “endangered lighthouse.” The Park Service felt the danger was not yet immediate. A local group, “Save the Lighthouse Committee,” lamented the decision as evidence that the NPS was bowing to pressure from local businesses who feared their profits would suffer should the lighthouse be moved or worse, damaged in the move.⁵⁵³

⁵⁵² National Park Service, “Cape Hatteras Light Station.”

⁵⁵³ Bill McAllister, “U.S. decides not to move endangered lighthouse,” *The Washington Post*, April 10, 1990, <https://www.washingtonpost.com/archive/politics/1990/04/10/us-decides-not-to-move-endangered-lighthouse/fc87d499-cc9b-44e3-baa1-0b91be00731f/>.

Several years later, the NPS would change its tune, citing the imminence of coastal erosion, but that didn't quiet the debates. Another *Washington Post* article summarized: One local worried the lighthouse could be destroyed in the move; a tourist argued that moving it would erase its history; a group of engineers from a state university declared that moving it was the only option in the face of deteriorating support beams and protective structures; another local thought moving it was the only option given the weather conditions; still another local wanted the NPS to rely instead on sea walls, even though such barriers were against state regulations; a former superintendent worried that the move was too risky for the historic structure.⁵⁵⁴ Perhaps summing it up for everyone, a local school principal reflected, "When you've lived here for all your life, you hate to see it moved...but you hate to see it fall into the sea. It's a Catch-22."⁵⁵⁵

Ultimately, it was a federal judge who would cut through the debates to ensure the "major engineering marvel" took place. On April 2, 1999, the judge ruled against a suit brought on by County officials and a local business man—the plaintiffs had claimed that the National Park Service had failed to conduct environmental impact studies prior to the move.⁵⁵⁶ By July 9, 1999, the Cape Hatteras Lighthouse sat upon its new foundation, the result of "a sound public policy decision based on the best science and engineering

⁵⁵⁴ Estes Thompson, "Moving Debate on Cape Hatteras," *The Washington Post*, November 28, 1997, accessed October 15, 2019, <https://www.washingtonpost.com/archive/politics/1997/11/28/moving-debate-on-cape-hatteras-lighthouse/717cc65a-ddc1-4232-bce3-82fc590a3594/>.

⁵⁵⁵ Hart Matthews, "One last look before lighthouse's move," *The Washington Post*, November 23, 1998, accessed October 15, 2019, <https://www.washingtonpost.com/archive/politics/1998/11/23/one-last-look-before-lighthouses-move/a7c5b7a7-e98e-421e-95de-ebd60a1c43b7/>.

⁵⁵⁶ Reuters, "National News Briefs; Judge Allows move on Hatteras Lighthouse," *The New York Times*, April 4, 1999, accessed October 14, 2019, <https://www.nytimes.com/1999/04/04/us/national-news-briefs-judge-allows-move-of-hatteras-lighthouse.html>.

information available,” according to the NPS.⁵⁵⁷ Although science did spur the original proposal to move the lighthouse, that claim ignores the years of public deliberation, governmental process, and the lawsuit that would eventually make the move possible. I don’t know whether Hallac was aware of all that at the time of our conversation.

Twenty years later, Hallac believes the move was the right decision. In a recent interview with local news, he explained, “If we hadn’t moved the lighthouse, we’d be regularly dealing with the wrath of the ocean pounding that lighthouse in tropical storms and hurricanes... We’re talking about waves smacking against the lighthouse.”⁵⁵⁸ The lighthouse is safely in place, at least 1500 feet from the shoreline as it was originally intended to be. Visitation continues to hit record levels, supporting local businesses. I can’t blame Hallac for wondering, what were people still upset about?

I started to ask the question, ‘Why?’ I couldn’t fathom...I never even thought remotely that anybody would have been upset about this. I thought this was a great accomplishment. And the answer was, ‘it was the first time that you were giving up.’

It turns out that beyond debates over risk or economic impacts, resolving the lighthouse’s precarious position was not simply a matter of calculating probable outcomes (e.g., the lighthouse will or will not sink). The situation was also representative of complex perceptions of community identity—the lighthouse, kept in place, seems to have symbolized resiliency. Hallac reflected:

So prior to moving the lighthouse, we pumped sand on the beach. We put sandbags on the beach. We put jetties out. We did everything we could to

⁵⁵⁷ National Park Service, “Cape Hatteras Light Station.”

⁵⁵⁸ Mark Price, “Would iconic Cape Hatteras Lighthouse be underwater now if it wasn’t moved 20 years ago?” *The Charlotte Observer*, September 3, 2018, accessed October 14, 2019, <https://www.charlotteobserver.com/news/local/article217755815.html>.

fight Mother Nature and hold the sea back. And we were doing that not just in front of the lighthouse, but in many areas up and down the 70 miles of seashore. And so when we decided to move the Cape Hatteras Lighthouse, this was very symbolic. To the public, in their minds, this was us announcing to the world, ‘We're giving up on the community. We're giving up on holding the ocean back from the towns, villages, and the beaches.’ ... And that was unacceptable for them, and for many of them, it's still unacceptable.

I asked Hallac, how did you respond? How do you continue to respond? First, he listens:

“They need to be heard. And I did that, and I continue to do that. And I don't necessarily agree with their concerns, but I certainly am able to appreciate and understand them.”

And then he “tends to do something that a lot of managers do...that is not always successful... I present them with the best available science that I have.” And yet, he’s perfectly aware of the (lack of) impact that can have:

... it's funny that I do that a lot because I'm a scientist by training...I heard somebody say this once. Facts and data...data compute, data don't convert. So you can provide all the science in the world, but when somebody is feeling a certain way about something because it's driven by certain values, you're most likely not going to change the way they think about it. Despite that, it's my tendency to always bring the best available science to the table. And that typically does indicate that change is happening... It's not possible to keep everything the way it is.

Through his story, Hallac reminds me that parks are more than historical sites, or recreational grounds, or (parts of) ecosystems. Parks and the resources they preserve hold deep cultural and symbolic significance for their local and historical communities and for our nation. And the same object or park may harbor competing values. For the locals living in and around Cape Hatteras, the lighthouse’s relocation was a sign of waning community resilience—a threat to their community’s very existence. For the scientists and engineers from the National Academies, the NPS, and the state university, it was a symbol of the triumph of science to inform logical decisions that led to the prolonged

preservation of a treasured historical structure. Understanding and considering each of those values is part of the gnarly task our park managers face in their mission to preserve our parks.

At the end of Hallac's story, science still holds a privileged role, not least because it's part of Hallac's experience and worldview.

And this is the part where I hesitate. Mostly, I hesitate to speak for Hallac, or to accidentally misinterpret him. Hallac is careful to consider the diverse values of his community, while also bringing the best available science—whatever that is—to the table. After “listening to” and “appreciating” community concerns, the NPS's decision to move the lighthouse remains a triumph of science. The facts are undeniable; had the lighthouse been kept in place, it would currently sit (or sink) among the waves. Values aside, science would have always led to the right decision.

But this telling ignores the fact that coastal erosion has long been a reality for the Outer Banks—since before there was an NPS, before people talked about climate change, and before the National Academies outlined the facts in an official report.⁵⁵⁹ The community didn't need a reality check or a report to know the risks of living where they've long lived, or of keeping the lighthouse where it was. They may have fought for other solutions to lighthouse's predicament, but I didn't come across a record of anyone who denied the existence of risk.⁵⁶⁰ Recall the musing of the local school principal: “When you've lived here for all your life, you hate to see it moved...but you hate to see it

⁵⁵⁹ Though yes, climate change and sea level rise have intensified the phenomenon.

⁵⁶⁰ I can't say no such person existed, but I can say they didn't make a lot of noise if they did exist.

fall into the sea. It's a Catch-22."⁵⁶¹ The NPS and the community struggled to find the right, universal solution because there wasn't one. Still, there had to be a prevailing worldview because inaction spelled destruction. In the end, it was science (though let's not forget it was the judge who made the final call). I'm not saying the NPS made the wrong decision in moving the lighthouse. But to hold it up as a triumph of "the best science and engineering information available," ignores the more challenging, accompanying task of mapping out the landscape of values. Hallac's job is gnarly.

What I like about this story, is also what makes it frustrating—the contradiction, the conflict, the feeling of dissatisfaction is leaves me with. I think it shows why we still have the urge to turn to science first in the search for the answers to our gnarly questions. Science feels familiar—it's how many of us are used to seeking answers. But this story also reveals that the scientific answer to a gnarly question does not resolve the value disputes inherent to a complex socio-ecological system. That's why, for example, concepts like "ecological integrity" end up as only a thin veil over the unresolved concept of "naturalness."

How Could We Not Seek to Understand?

I observed in chapter four that I've caught many of my interviewees in a moment of transition regarding how they interpret and operationalize naturalness. Discord existed not only among the interviewees, but also within the minds of individuals. That made it very difficult for me to analyze: "these people think this way and those people think that way and here is why." Many were simply in the middle of figuring it out. Throughout this

⁵⁶¹ Matthews, "One last look before lighthouse's move."

process I've found that people, including myself, can exist just fine (though sometimes uncomfortably) with our internal contradictions.

This sort of internal discord caused me confusion over how to interpret and categorize my interviewees. I had to learn to tap into my own uncertainty over the topics and concepts in question—to empathize through remembering that I was *asking them* in part because of *my own* confusion and curiosity. One hurdle I could not get past, however, is my fear that I caught them saying things they didn't mean to say. I imagine them reading back and thinking, "That's not how I really see it. Did I say that? She must be misinterpreting me?" I don't doubt that I've projected my own intuitions and internal contradictions onto their words and stories, or perhaps more accurately, that our shared experiences and emotions stood out most strongly to me—which is in part why I've aimed to be transparent about my personal journey. For example, despite my questions over the role of science in decision making, at the start of this project I still felt a strong impulse to apply science to gnarly questions, fed by a desire to make sense of change. As someone trained in science—as well as someone who's sought answers in science since I started asking questions—it's how I instinctively made sense of the natural world or any general unknown. Above, Hallac admits as much, too, "... it's funny that I do that a lot because I'm a scientist by training." I bring this up to note that it's perhaps not too strange that Hallac simultaneously focuses on "bringing to bear solid scientific estimates and forecasts about what's likely to happen in the future," while understanding that "you can provide all the science in the world, but when somebody is feeling a certain way about something because it's driven by certain values, you're most likely not going to change the way they think about it."

Further, I believe many scientists see themselves as contributing to the problems they care most about in the ways they know best—no matter how “objective” they might claim to be. In her book about the Alaskan yellow cedar trees, Oakes describes science as the “action” she can take to ward off her “helplessness,” brought on (in this excerpt) by reading yet another study revealing the impacts of climate change on global tree populations:

Instead of freezing in any sense of helplessness, I wanted to go back to Alaska immediately. Allen’s study threw another log on the fire for me. It made we want to listen more. Observe more. Do more. Hope, a friend once told me, is like an untethered prayer. It’s what we turn to when nothing we are doing and nothing we are striving for is working out. I wasn’t interested in passive longing for some other future condition. Edward Abbey once said that “sentiment without action is the ruin of the soul.” To me, his words called for something more empowering than hope—a belief; a faith, perhaps, that what we do matters. The global synthesis made we want to find a way through far more than hope. Forward through action. Science, I believed, was what I could do.⁵⁶²

Hers is a reaction I’ve had myself—though maybe not related to the same exact problem of climate change. The most vivid though imperfect metaphor that comes to mind is the “desire to know” that I felt when I was first told the lumps in my neck could be cancerous. Even if it wouldn’t make them go away, I laid awake every night wanting to gain and apply knowledge immediately. I wanted to act in the way I knew best: through science (in this case reading journal articles on thyroid cancer). It’s what instilled a sense of control when things seemed otherwise despairing.

Based on my interviews, many of the NPS folks I spoke with can relate. Science is something they can do—an action they can take—when their parks are melting, burning, or sinking into the sea. As the interviewee who I credit with coining “gnarly

⁵⁶² Oakes, *In Search of the Canary Tree*, 50.

questions” so deftly put it, “how could we not seek to understand ...?” It’s a reflex, or more likely a learned worldview that’s tough to unlearn. I mentioned this before: When science has always been able to give you the answers you’ve sought, why wouldn’t you turn to it, especially as the questions are getting more complex and the challenges higher stakes?

Throughout this dissertation, I’ve thought back to the origins of my “learned worldview.” In doing so, this dissertation at times became a letter to my younger self and previous mindsets. Now, nearing the end of this project, I’ve started to reflect on the ways in which my former perspective and the circumstances leading to it were and continue to be products of the broader cultural commentary on science. Even my biology major during college was in part driven by the ongoing national push to encourage more women and girls to pursue STEM pathways. I viewed the role of science as privileged in decision making, because I was taught that science provided the most systematic and quantitative means for assessing what is true and that the best truths were universal and mathematical. Views like that (as in the “physics envy” story from chapter four) are held and taught widely, driving increased applications of metrics, measures, and data analytics across sectors, often without regard for the limits of such quantitative understanding in complex systems.

Such cultural commentaries surely impact views of science within and around the NPS. For example, a few of my interviewees expressed concern that science is currently under attack by the Trump administration. Likewise, in their 2018 book, *The Future of Conservation in America, A Chart for Rough Water*, Jon Jarvis and Gary Machlis acknowledge Trump’s election and the surrounding political discourse (including “anti-

science attitudes” and the “erosion of science”) as major factors in the NPS’s current challenging circumstance—they deem it “rough water.” As part of their “chart,” they urge the NPS and park advocates to continue supporting “science in the public interest,” and to keep integrating science into decision making.⁵⁶³ Examining the current political climate, you start to understand why the NPS might be quick to defend the role of science in preservation. They’ve only recently elevated the role of science in decision making, after decades of being critiqued for their failure to apply scientific principles to preservation. Now that system-wide worldview on science—so difficult to change for so long—is under threat from their very own leadership.

Understanding that cultural commentary contributes to our views of science, my interviewees (and I) should be able to simultaneously hold our worldview or mindset or reflex—whatever we should call it—and hold space for understanding, considering, and acting upon the views and values of others (and not just when it’s legally mandated). We should also recognize that sometimes there won’t be a resolution of those views and values even after all the understanding and considering is through (which it never is, when it comes to gnarly questions).

Measurements and Meaning and a Return to Joshua Tree

The choice to begin in Joshua Tree (in the research process, as well as in the dissertation) was intentional, but also lucky. I was following several leads that indicated the park would be central to discussions regarding the future of preservation in national parks. I

⁵⁶³ Gary E. Machlis and Jonathan B. Jarvis, *Conservation in America, A Chart for Rough Water* (Chicago: University of Chicago Press, 2018), 45, 57.

couldn't have known just how big a role it would play (and continue to play) in the narratives about that future. Many interviewees mentioned the park, each sharing some iteration of the following, from a WASO leader:

What happens if at some distant point in the future, Joshua trees no longer exist in Joshua Tree National Park? Does it get de-authorized as a park? Do you change the name of the park? Should the National Park Service go in there and plant Joshua trees everywhere and water them, and keep them sufficiently cool so that they persist? Those are, you know, interesting philosophical questions that are not that far from the truth in some places.

This line of questioning motivated my initial interest in my research. I was fascinated by the place-based stories that led me to wonder, how do we preserve parks in the twenty first century? Joshua Tree has been a testing grounds for many methods of understanding and managing for change, including citizen science programs, social science research to evaluate visitor perceptions, academic and non-profit research partnerships, and scenario planning. Beyond methodology, the park, its trees, and its future spark important debates revolving around how to distinguish impairment from preservation, authenticity, and naturalness. The WASO leader that I quote on Joshua Tree above, believes those are the biggest questions the NPS faces, looking forward:

...there will always be—I think—a lot of room for interpretation of what it means for something to be impaired and what kinds of uses and what kinds of activities cross that line into impairment. And there's no simple answer, right? It is not a question that can be objectively answered. It will always have a subjective component about somebody's interpretation. How much impairment is okay?

As the interviewee suggests, it may always be something they're in the middle of thinking through as circumstances, challenges, leaders, and knowledge change. And as those things change, they are also overlapping—the diversity of parks, public values, political interests, and sciences coexist, as well as the different ways we might want to

relate to parks and define how we preserve them (and relative to what). That's related to perhaps the most important point in the edited collection *Beyond Naturalness: Moving beyond naturalness* doesn't necessarily mean defining a new standard for all parks for all of time, but rather acknowledging that it's a messy concept that will be defined, operationalized, and legislated in diverse ways that must be clarified in context. In some parks we might still care about historical baselines, while in others we might be more interested in scenery, recreation, or biodiversity. I predict that in most cases, we care about many goals for the same resources or parks simultaneously.

Echoing Soulé, former superintendent John Donahue told me, "land management is not really a science. It's an art." But in the face of complex, sometimes conflicting values that yield uncertainty as to how to manage parks, it's hard not to yearn for the "certainty" or familiarity of science. We fixate on science because we want answers, but to turn away from values and toward science provides only a false sense of simplicity—science itself is complicated, and it cannot eliminate the complexity and uncertainty inherent to the NPS as a socio-ecological system. To some degree, the NPS knows this and is experimenting with tools and ideas to complement applications of science, like scenario planning—though not evenly throughout the system, and certainly not uniformly among park scholars and advocates. I think many of my interviewees still wonder, how does one know which questions to answer through science or through other types of knowledge, values, concepts, and inputs—especially when some concepts and information seem to be in states of perpetual change or redefinition? It depends, of course, and that's kind of the point. It's a question I hope they ask for as long as they are stewards of national parks.

This time around, the sky was blue, no clouds. The January breeze felt like a slap against my throat. I zipped my white puffer vest closed all the way to the top and tucked my chin beneath the collar to shield my neck from the cold. I sat alone atop a boulder, staring at water in the reservoir. Its surface held still, but every so often the breeze stirred ripples, momentarily disturbing the reflection of the geologic formations that rose high on all sides of the water's edge.

I'd last been there a year and a half ago, in the ruthless heat of August. I remembered how few people had braved the heat. Many more braved the cold. Barker Dam is one of the most popular places in Joshua Tree National Park, no matter the time of year—and that's why I was there. At that point, I was still under the illusion that I would conduct a visitor survey, and I needed to collect some preliminary data in a visitor focus group—what do you value about the park? Why do you visit? What does it mean to you?

My friend Tyler and I spent hours recruiting participants the day before. I'd dragged him along with me for assistance and good company. We just needed eight people (and really, we weren't allowed to have many more than that without seeking government approval). We handed out more than fifty flyers—that had to be enough. I asked people, “would you show up for a free lunch?” Seven people verbally agreed. A handful of others said, “possibly!” None appeared the next day. So, Tyler and I drove to Barker Dam and handed out free sandwiches in hopes we could gather an impromptu focus group in the parking lot. That didn't really work, either. People shared brief

opinions and then ran off with the food. There was no conversation. I'm lucky Tyler was there—he helped me laugh it off.

Afterwards we took a hike around the reservoir. Tyler quickly climbed to heights I would never dare pursue. I was nervous for him. Earlier that week a psychic had told him he would likely be paralyzed on his next trip. I'm not saying I believe psychics, but I did get the sense that Tyler was tempting fate. I sat and watched him—as if that would keep him safe—until his orange backpack disappeared behind a distant boulder. An hour later I would circle the base of the butte and find him in one piece on the other side. He did eventually admit to being terrified on the way down, the psychic's words echoing in his mind with each cautious move.

Left alone for the moment, I stared at the water, reflecting on the day and my failed focus group. I repeated the questions to myself: what do you value about the park? Why do you visit? What does it mean to you? Remembering, I'm drawn back to the words of Jan Dizard: “In important ways, nature is about what we make it out to be. ... This is not to say that nature does not have qualities that one can apprehend, measure, record, and catalogue. It is to say that the meaning we attach to these qualities matters at least as much as the qualities themselves.”⁵⁶⁴

For all my fascination with and discussion of the role(s) of science(s) in defining the practices and goals of preservation, none of it can be isolated from meaning. Preservation is about what's going on in our minds⁵⁶⁵—our relationships and values and life experiences—in addition to what's on the ground throughout the landscapes and

⁵⁶⁴ Dizard, *Going Wild*, xii.

⁵⁶⁵ People make a science of that too, just like I was attempting through my visitor survey.

historical sites and the natural and cultural treasures they protect. As an idea, preservation has never been isolated from the cultural and political conversations of moments throughout history—including today’s commentary regarding the rightful place of science in decision making.

I spent most of this dissertation focused on the NPS’s occupation with preserving “stuff”—the “natural and historic objects, and the wild life therein.” That’s a function of where I was coming from and who I was when I started. But I recognize that it’s also the case that no small part of the NPS’s role has been about protecting and promoting a (relatively) restrained, appreciative, aesthetically and morally grounded vision of what it means to care about our natural and cultural heritage as something other than a commodity to consume (and possibly destroy in the process). In that way, preservation itself is one value among many providing a commentary on a certain kind of relationship to nature, history, and culture. What arises for me is a question science cannot touch: can we preserve an ethic of relating to national parks in this way while parks are rapidly changing, perhaps in ways that destabilize the interaction? The media, interest groups, and even some scientists sometimes warn of the end of nature in the parks, the end of preservation, or even the end of parks or the NPS in general. I believe the risks for parks are as real as they’ve always been. But we’ll find them in one piece on the other side of all of this, so long as they continue to cautiously, intentionally strive toward balancing and understanding the powers and limits of each way of understanding and valuing parks, including science.

Parks will change and whether we can still find what we are looking for in them, depends. For me, Joshua Tree would still hold significance without the trees because the

value I place in the park is about the experiences I've had there and the growth I've done there. I would miss the trees, but I would still feel connected to the landscape as the site of a pivotal moment in my life. The park once held space for my grief. I don't need or want science to measure what it means to me.

REFERENCES

- Abbey, Edward. *Desert Solitaire*. New York: Ballantine Books, 1968.
- Agee, J. K., D. R. Field, and E. F. Starkey. "Cooperative Park Study Units: university based science programs in the National Park Service." *Journal of Environmental Education* 14 (1982): 24-28.
- Albright, Horace M. "A Forestry Policy for the National Parks." In *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 89-98. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1931.
- Albright, Horace M. "Research in the National Parks." In *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 122-131. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1933.
- Albright, Horace M. "The National Park Service's Policy on Predatory Mammals." In *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 87-88. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1931.
- Allen, E. B., L. E. Rao, R. J. Steers, A. Bytnerowicz, and M. E. Fenn. "Impacts of atmospheric nitrogen deposition on vegetation and soils in Joshua Tree National Park." In *The Mojave Desert: Ecosystem Processes and Sustainability*, edited by R. H. Webb, L. F. Fenstermaker, J. S. Heaton, D. L. Hughson, E. V. McDonald, and D. M. Miller, 78-100. Las Vegas: University of Nevada Press, 2009.
- An Act Authorizing a Grant to the State of California of the Yosemite Valley and of the Land Embracing the Mariposa Big Tree Grove, 13 Stat. 325 (1864).
- An Act for the Preservation of American Antiquities, 16 U.S.C. § 432 (1906).
- An Act for the Relief of Unemployment Through the Performance of Useful Public Work, and for Other Purposes, 16 U.S.C. §§ 585-590 (1933).
- An Act to Authorize a Study of the Park, Parkway, and Recreational Area Programs in the United States, and for other purposes, 16 U.S.C. §§ 1700 et seq. (1936).
- An Act to Establish a National Military Park at the Battlefield of Chickamauga, 16 U.S.C. § 424 (1890).
- An Act to establish a National Park Service, and for other purposes, 16 U.S.C. §§ 1 et seq. (1916).

An Act to Establish a National Wilderness Preservation System for the Permanent Good of Whole People, and for Other Purposes, 16 U.S.C. §§ 1131 et seq (1964).

An Act to Facilitate the Management of the National Park System and Miscellaneous Areas Administered in Connection with that System, and for Other Purposes, 67 Stat. 495 (1953).

An Act to Provide for Improved Management and Increased Accountability for Certain National Park Service Programs, and for other purposes, 16 U.S.C. §§ 5901 et seq (1998).

An Act to Provide for the Preservation of Historic American Sites, Buildings, Objects, and Antiquities of National Significance, and for other purposes, 16 U.S.C. §§ 461 et seq. (1935).

An Act to Set Apart a Certain Tract of Land Lying Near the Headwaters of the Yellowstone River as a Public Park, 17 Stat. 32 (1872).

Anderson, M. F. *Polishing the Jewel: an Administrative History of Grand Canyon National Park*. Grand Canyon, AZ: Grand Canyon Association, 2000.

Antolini, Denise E. "National Park Law in the U.S.: Conservation, Conflict, and Centennial Values," *William & Mary Environmental Law & Policy Review* 33(2009): 851-921.

Aplet, Gregory H., and David N. Cole. "The Trouble with Naturalness: Rethinking Park and Wilderness Goals." in *Beyond Naturalness*, eds. David N Cole and Laurie Yung, 12-33. Washington, D.C.: Island Press, 2010.

Beissinger, Steven R., and David D. Ackerly. "Science, Parks, and Conservation in a Rapidly Changing World." In *Science, Conservation, and National Parks*, eds. Steven R. Beissinger, David D. Ackerly, Holly Doremus, and Gary E. Machlis, 363-387. Chicago: University of Chicago Press, 2017.

Bernard, H. R., A. Wutich, and G. W. Ryan. *Analyzing Qualitative Data*. Thousand Oaks, CA: Sage Publications, 2017.

Botkin, Daniel. *Discordant Harmonies: A New Ecology for the Twenty-first Century*. (Oxford: Oxford University Press, 1990).

Bradley, E. H., L. A. Curry, and K. J. Devers. "Qualitative Data Analysis for Health Services Research: Developing Taxonomy, Themes, and Theory." *Health Services Research* 42(2007): 1758-1770.

Carr, Ethan. "Olmstead and Scenic Preservation." Last modified 2014. Accessed September 18, 2019. <http://www.pbs.org/wned/frederick-law-olmsted/learn-more/olmsted-and-scenic-preservation/>.

Carr, Ethan. *Wilderness by Design*. Lincoln, Nebraska: University of Nebraska Press, 1998.

Catlin, George. *Illustrations of the Manners, Customs, and Conditions of the North American Indian*. London: H. G. Bohn, 1851.

Chapin III, F. Stuart, Pamela A. Matson, and Peter Vitousek. *Principles of Terrestrial Ecosystem Ecology*, 2nd ed. New York: Springer, 2012).

Chase, Alston. *Playing God in Yellowstone*. Orlando, FL: First Harvest/Harcourt Brace Jovanovich, 1987.

Chiu, Allyson. "'A travesty to this nation': People are destroying Joshua trees in Joshua Tree National Park." *The Washington Post*, January 11, 2019. Accessed September 8, 2019. <https://www.washingtonpost.com/nation/2019/01/11/travesty-this-nation-people-are-destroying-joshua-trees-joshua-tree-national-park/>.

Clements, F. E. *Plant Succession: An Analysis of the Development of Vegetation*. Washington, D.C.: Carnegie Institution of Washington Publication 242, 1916.

Cole, D. N., and L. Yung. *Beyond Naturalness: Rethinking Park and Wilderness Stewardship in an Era of Rapid Change*. Washington, D.C.: Island Press, 2011.

"Cooperative Ecosystem Studies Units," accessed September 24, 2019, <http://www.cesu.psu.edu/default.htm>.

DeVoto, Bernard. "Let's Close the National Parks." In *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 183-189. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1953 in *Harper's Magazine*.

Diamond, Joel M., Christopher A. Call, and Nora Devoe. "Effects of targeted cattle grazing on fire behavior of cheatgrass-dominated rangeland in the northern Great Basin, USA." *International Journal of Wildland Fire* 18 (2009): 944-950.

Dilsaver, Larry M. "The Ecological Revolution, 1964-1969." In *America's National Park System: The Critical Documents*, ed. Larry M. Dilsaver, 269-370. Lanham, Maryland: Rowman and Littlefield Publishers, 1994.

Dilsaver, Larry M. *America's National Park System*. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994.

Director's Order 100 of December 20, 2016. "Resource Stewardship for the 21st Century." *Rescinded (no longer in the code and no longer in effect)*.
https://www.nps.gov/policy/DOrders/DO_100.htm.

Dizard, Jan. *Going Wild: Hunting, Animal Rights, and the Contested Meaning of Nature*. Amherst, MA: University of Massachusetts Press, 1994.

Douglas, William O. "John Muir's Public Service." Last modified 2019. Accessed September 21, 2019.
http://vault.sierraclub.org/john_muir_exhibit/life/muir_publicservice_douglas.aspx.

Drury, Newton B. "The National Parks in Wartime." In *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 167-173. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1943.

Dunaway, Finis. *Natural Visions*. Chicago: University of Chicago Press, 2008.

Epstein, David. *Range*. New York: Riverhead Books, 2019.

"Excerpts from Executive Order No. 6166 of June 10, 1933 and Executive Order No. 6228 of July 28, 1933." In *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 116-121. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1933.

"Find Your Park." Accessed September 26, 2019. <https://findyourpark.com/>.

Funtowicz, Silvio O., and Jerome R. Ravetz. "Science for the post-normal age." *Futures* 25(1990): 739-755.

Funtowicz, Silvio O., and Roger Strand. "Models of Science Policy." In *Biosafety First: Holistic Approaches to Risk and Uncertainty in Genetic Engineering and Genetically Modified Organisms*, eds. T. Traavik, and L.C. Lim, 1-21. Trondheim: Tapir Academic Press, 2007. (Pagination does not match book).

Gammon, Katharine. "The shutdown is over. Can Joshua Tree recover?" *The Guardian*, February 4, 2019. Accessed September 8, 2019.
<https://www.theguardian.com/environment/2019/feb/04/the-shutdown-is-over-can-joshua-tree-recover>.

Gleason, H. A. "The Individualistic Concept of Plant Association." *Bulletin of the Torrey Botanical Club* 53(1926): 7-26.

Gonzalez, Patrick, Fuyao Wang, Michael Notara, Danial J Vimont, and John W Williams. "Disproportionate magnitude of climate change in United States national

parks.” *Environmental Research Letters*. 13 (2018): 10400a. Accessed September 8, 2019. doi:10.1088/1748-9326/aade09.

Gonzalez, Patrick. “Climate Change Trends, Impacts and Vulnerabilities in U.S. National Parks.” In *Science, Conservation, and National Parks*, eds. Steven R. Beissinger, David D. Ackerly, Holly Doremus, and Gary Machlis, 102-140. Chicago: The University of Chicago Press, 2017.

Govani, Michelle. “A Journey to the Place Between Wild and Wrecked.” *Minding Nature* 11(2018): 77-83.

Govani, Michelle. “Close the National Parks Now.” *Slate*, January 15, 2019. Accessed September 8, 2019. <https://slate.com/technology/2019/01/close-national-parks-government-shutdown.html>.

Harvey, Mark. *A Symbol of Wilderness: Echo Park and the American Conservation Movement*. Albuquerque: University of New Mexico Press, 1994.

Keane, Robert E., Paul F. Hessburg, Peter B. Landres, and Fred J. Swanson. “The Use of Historical Range and Variability (HRV) in Landscape Management.” *Forest Ecology and Management* 258(2009): 1025-1037.

Kearney, John. J. “Is the Air Visibility of Our National Parks Being Adequately Protected?” *EPA Journal* 7(1981): 2-6.

Keiter, Robert B. “Ancestral Lands,” in *To Conserve Unimpaired*, Robert Keiter, 121-142. Washington, D.C.: Island Press, 2013.

Kiefer, Philip. “Iconic trees may disappear—but scientists are fighting back.” *National Geographic*, October 15, 2018. Accessed September 8, 2019. <https://www.nationalgeographic.com/environment/2018/10/joshua-trees-moths-threatened-climate-change-scientists-seek-solutions/>.

Land, George. “Joshua Tree National Park Experiencing Record Visitation.” Last modified December 29, 2016. Accessed September 9, 2019. <https://www.nps.gov/jotr/learn/news/jtnp-experiencing-record-visitation.htm>.

Land, George. “New Campground Procedures.” Last modified December 19, 2018. Accessed September 9, 2019. <https://www.nps.gov/jotr/learn/news/new-campground-procedures.htm>.

Land, George. “Park Sees Record Numbers Over Thanksgiving Week.” Last modified December 3, 2018. Accessed September 9, 2019. <https://www.nps.gov/jotr/learn/news/park-sees-record-numbers-over-thanksgiving-week.htm>.

Lane, Franklin. "Secretary Lane's Letter on National Park Management." In *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 48-52. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1918.

Leopold, A. S., S. A. Cain, C. M. Cottam, I. N. Gabrielson, and T. L. Kimball. "Wildlife Management in the National Parks." In *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 237-252. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1963.

Liedloff, Adam C., Michael C. Coughenour, John Ludwig, and Rodd Dyer. "Modelling the trade-off between fire and grazing in a tropical savanna landscape, northern Australia." *Environment International* 27 (2001): 173-180.

Machlis, Gary E., and Jonathan B. Jarvis. *Conservation in America, A Chart for Rough Water*. Chicago: University of Chicago Press, 2018.

Mackintosh, Barry, Janet A McDonnell, and John H Sprinkly, Jr. *The National Parks: Shaping the System*. (Hancock, Michigan: George Wright Society, 2018), published as a special issue of *The George Wright Forum* 35 (2018): 1-132.

Mappes, Harmony A. "National Parks: For Use and 'Enjoyment' or for 'Presevation'?" and the Role of the National Park Service *Management Policies* in That Determination." *Iowa Law Review* 92(2006-2007): 601-636.

Marris, Emma. "Conservation biology: The end of the wild." *Nature*. 469 (2011): 150-152.

Marris, Emma. "The Yellowstone Model." In *Rambunctious Garden*, Emma Marris, 17-36. New York: Bloomsbury, 2011.

Marris, Emma. *Rambunctious Garden*. New York: Bloomsbury, 2011.

Martelle, Scott. "Opinion: Interior Secretary Zinke reportedly dressed down Joshua Tree superintendent over climate change tweets." *Los Angeles Times*, December 15, 2017. Accessed September 8, 2019. <https://www.latimes.com/opinion/opinion-la/la-ol-zinke-twitter-joshua-tree-climate-change-20171215-story.html>.

Matthews, Hart. "One last look before lighthouse's move." *The Washington Post*, November 23, 1998. Accessed October 15, 2019. <https://www.washingtonpost.com/archive/politics/1998/11/23/one-last-look-before-lighthouses-move/a7c5b7a7-e98e-421e-95de-ebd60a1c43b7/>.

McAllister, Bill. "U.S. decides not to move endangered lighthouse." *The Washington Post*, April 10, 1990. Accessed October 14, 2019.

<https://www.washingtonpost.com/archive/politics/1990/04/10/us-decides-not-to-move-endangered-lighthouse/fc87d499-cc9b-44e3-baa1-0b91be00731f/>.

McDonnell, Janet A. "Reassessing the National Park Service and the National Park System." *The George Wright Forum* 25(2008): 6-14.

Miles, John C. *Wilderness in the National Parks*. Seattle: University of Washington Press, 2009.

Millar, Constance I., Nathan L. Stephenson, Scott L. Stephens. "Climate change and forests of the future: managing in the face of uncertainty." *Ecological Applications* 17(2007): 2145-2151.

Miller, Char. *Gifford Pinchot and the Making of Modern Environmentalism*. Washington, D.C.: Island Press, 2001.

Minteer, Ben and Stephen Pyne, "Writing on Stone, Writing in the Wind." In *After Preservation*, ed. Ben Minteer and Stephen Pyne, 1-8. Chicago: University of Chicago Press, 2015.

Minteer, Ben and Stephen Pyne. "Restoring the Narrative of American Environmentalism." *Restoration Ecology* 21 (2013): 6-11.

Morgan, P., G. H. Aplet, J. B. Haufler, H. C. Humphries, M. M. Moore, W. D. Wilson. "Historical Range of Variability: A useful tool for evaluating ecosystem change." *Journal of Sustainable Forestry* 2(1994): 87-111.

Mortitz, M. A., E. Batllori, R. A. Bradstock, A. M. Gill, J. Handmer, P. F. Hessberg, J. Leonard, et al. "Learning to coexist with wildfire." *Nature* 515(2014): 10-18.

Muir, John. "A wind-storm in the forests." In *The Mountains of California*, John Muir, Chapter 10. New York: The Century Company, 1894.

Muir, John. "Among the Animals." In *Our National Parks*, John Muir, Chapter 6. Cambridge: The Riverside Press, 1901.

Muir, John. "The Hetch Hetchy Valley." *Sierra Club Bulletin* 6 (1908): 211-220.

Nash, Roderick Frazier. *Wilderness and the American Mind*. New Haven: Yale University Press, 2014.

National Academy of Sciences. Committee on Improving the Science and Technology Programs of the National Park Service. "Limited Progress Made in Documenting and Mitigating Threats to the Parks." In *America's National Park System: the Critical*

Documents, edited by Larry M. Dilsaver, 446-449. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1992.

National Academy of Sciences. National Research Council. "A Report by the Advisory Committee to the National Park Service of Research." In *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 253-262. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1963.

National Environmental Policy Act, 42 U.S.C. § 4321 et seq. (1970).

National Park Service, "Frequently Asked Questions," last modified September 8, 2019, <https://www.nps.gov/aboutus/faqs.htm>.

National Park Service. "'Things to Know' ...about National Park Service policy and the Directives System." Last modified August 18, 2017. Last accessed September 24, 2019. <https://www.nps.gov/policy/DOrders/thingstoknow.htm>.

National Park Service. "Advisory Board Members." Last modified July 22, 2019. Accessed September 26, 2019. <https://www.nps.gov/resources/advisoryboardmembers.htm>.

National Park Service. "Cape Hatteras Light Station." Last modified May 14, 2019. Accessed October 14, 2019. <https://www.nps.gov/caha/planyourvisit/chls.htm>.

National Park Service. "Cape Hatteras National Seashore Sees Highest Visitation Since 2003." Last modified February 7, 2019. Accessed October 14, 2019. https://www.nps.gov/caha/learn/news/19_006.htm.

National Park Service. "Law, Policies & Regulation,." Last modified May 22, 2019. Accessed September 24, 2019, <https://www.nps.gov/aboutus/lawsandpolicies.htm>.

National Park Service. "Muir Woods, People." Last modified February 2, 2016. Accessed September 21, 2019. <https://www.nps.gov/muwo/learn/historyculture/people.htm>.

National Park Service. "Park Air Profiles – Joshua Tree National Park." Last modified June 18, 2018. Accessed September 9, 2019. <https://www.nps.gov/articles/airprofiles-jotr.htm>.

National Park Service. "People." Last modified September 20, 2017. Accessed September 19, 2019. <https://www.nps.gov/yose/learn/historyculture/people.htm>.

National Park Service. "Policy Memoranda." Last modified August 30, 2019. Last accessed September 24, 2019. <https://www.nps.gov/policy/PolMemos/policymemoranda.htm>.

National Park Service. “Science and Natural Resource Management for the National Parks: Milestones, 1916–2016.” Last modified April 13, 2018. https://www.nps.gov/articles/parkscience34-1_insert_timeline_hunt_et_al_3883.htm.

National Park Service. “Visitor Spending Effects - Economic Contributions of National Park Visitor Spending.” Last modified April 25, 2018. Accessed September 9, 2019. <https://www.nps.gov/subjects/socialscience/vse.htm>.

National Park Service. Office of Science and Technology. “State of the Parks, A Report to the Congress.” In *America’s National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 405-410. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1980.

National Park System Advisory Board. *Revisiting Leopold: Resource Stewardship in the National Parks*. Washington, D.C.: National Park System Advisory Board, 2012.

National Parks Association. “National Primeval Park Standards, A Declaration of Policy.” In *America’s National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 174-177. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1945.

National Research Council. *Saving Cape Hatteras Lighthouse from the Sea: Options and Policy Implications*. Washington, D.C.: The National Academies Press, 1988. <https://doi.org/10.17226/9502>.

Oakes, Lauren E. *In Search of the Canary Tree*. New York: Basic Books, 2018.

Obama, Barack. “Inaugural Address.” January 20, 2009, transcript and mp4, The White House (archive), Washington, D.C. <https://obamawhitehouse.archives.gov/blog/2009/01/21/president-barack-obamas-inaugural-address>.

Olmstead, Frederick Law. “The Yosemite Valley and the Mariposa Big Tree Grove.” In *America’s National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 12-27. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1865.

Ostrov, Jerome. “Visibility Protection under the Clean Air Act: Preserving Scenic and Parkland Areas in the Southwest.” *Ecology Law Quarterly* 10 (1982): 397-453.

Parks Canada. “Ecological Integrity.” Last modified May 2, 2018. Accessed September 24, 2019. <https://www.pc.gc.ca/en/nature/science/conservation/ie-ei>.

Price, Mark. "Would iconic Cape Hatteras Lighthouse be underwater now if it wasn't moved 20 years ago?" *The Charlotte Observer*, September 3, 2018. Accessed October 14, 2019. <https://www.charlotteobserver.com/news/local/article217755815.html>.

Rao, L. E., E. B. Allen, and T. Meixner. "Risk-based determination of critical nitrogen deposition loads for fire spread in southern California deserts." *Ecological Applications*. 20 (2010): 1320–1335.

Reuters. "National News Briefs; Judge Allows move on Hatteras Lighthouse." *The New York Times*, April 4, 1999. Accessed October 14, 2019.

<https://www.nytimes.com/1999/04/04/us/national-news-briefs-judge-allows-move-of-hatteras-lighthouse.html>.

Runte, Alfred. *National Parks, The American Experience*. Lanham, Maryland: Taylor Trade Publishing, 2010.

Runte, Alfred. *Trains of Discovery: Railroads and the Legacy of Our National Parks*. Lanham, Maryland: Roberts Rinehart Publishers, 2011. Rev. 5th ed.

Sahagun, Louis. "Drought hastens decline of the Joshua Tree, California's desert symbol." *Los Angeles Times*, June 6, 2015. Accessed September 8, 2019.

<https://www.latimes.com/science/la-me-joshua-20150607-story.html>.

Sarewitz, Daniel. "How science makes environmental controversies worse." *Environmental Science and Policy* 7(2004): 385-403.

Schnayerson, Michael. "Who's ruining our National Parks?" *Vanity Fair*, June 7, 2006.

Seidl, R., M. J. Schelhaas, and M. J. Lexer. "Unraveling the drivers of intensifying forest disturbance regimes in Europe." *Global Change Biology* 17(2011): 2842-2852.

Sellars, Richard West. *Preserving Nature in the National Parks*. New Haven: Yale University Press, 2009.

Sierra Club. "New York Times 1913 Editorials Opposing Damming of Hetch Hetchy." accessed September 21, 2019.

https://vault.sierraclub.org/ca/hetchhetchy/ny_times_1913_editorials.html.

Sommer, Lauren. "Planning for the future of a park where the trees have one name." *NPR*, August 2, 2016. Accessed September 8, 2019.

<https://www.npr.org/2016/08/02/487938345/planning-for-the-future-of-a-park-where-the-trees-have-one-name>.

Soulé, Michael. "What is Conservation Biology?" *BioScience* 35(1985): 727-734.

Spence, M. "Dispossessing the Wilderness: Yosemite Indians and the National Park Idea, 1864-1930." *Pacific Historical Review* 65 (1996): 27-59.

Stack, Liam. "Joshua Tree National Park's Signature Trees Are Among Shutdown Victims." *The New York Times*, January 11, 2019. Accessed September 8, 2019. <https://www.nytimes.com/2019/01/11/us/joshua-trees-cut-down.html>.

Stegner, Wallace, ed. *This is Dinosaur: Echo Park Country and Its Magic Rivers*. New York: Knopf, 1955.

Stephenson, N. L. "Making the Transition to the Third Era of Natural Resources Management." *The George Wright Forum* 31 (2014): 227-235.

Steven R. Beissinger and David D. Ackerly. "Science, Parks, and Conservation in a Rapidly Changing World." In *Science, Conservation, and National Parks*, eds. Steven R. Beissinger, David D. Ackerly, Holly Doremus, and Gary Machlis, 363-387. Chicago: The University of Chicago Press, 2017.

Sutter, Paul. *Driven Wild: How the Fight against Automobiles Launched the Modern Wilderness Movement*. Seattle: University of Washington Press, 2002.

The Raker Act, 38 Stat. 242 (1913).

"The Record: A Historic Commitment to Protecting the Environment and Addressing the Impacts of Climate Change." Accessed September 26, 2019. <https://obamawhitehouse.archives.gov/the-record/climate>.

The Sierra Club. "Stephen T. Mather." Last modified 2019. Accessed April 30, 2015. http://vault.sierraclub.org/john_muir_exhibit/people/mather.aspx

Thomas, Catherine Cullinane, Lynne Koontz, and Egan Cornachione. "2018 National Park Visitor Spending Effects." *Natural Resource Report*. NPS/NRSS/EQD/NRR—2019/1922. Fort Collins, Colorado: National Park Service, 2019.

Thompson, Estes. "Moving Debate on Cape Hatteras." *The Washington Post*, November 28, 1997. Accessed October 15, 2019. <https://www.washingtonpost.com/archive/politics/1997/11/28/moving-debate-on-cape-hatteras-lighthouse/717cc65a-ddc1-4232-bce3-82fc590a3594/>.

Thoreau, Henry David. *The Maine Woods*. Cambridge, Massachusetts: The Riverside Press, 1892.

Thoreau, Henry David. *Walden; or, Life in the Woods*. Cambridge, Massachusetts: The Riverside Press, 1854.

Turner, Monica, Daniel, D Donato, Winslow D. Hansen, Brian J. Harvey, William H. Romme, and A. Leroy Westerling. "Climate Change and Novel Disturbance Regimes in National Park Landscapes." In *Science, Conservation, and National Parks*, eds. Steven R. Beissinger, David D. Ackerly, Holly Doremus, and Gary Machlis, 77-101. Chicago: The University of Chicago Press, 2017.

Turner, Monica, W. H. Hargrove, R. H. Gardner, and W. H. Romme. "Effects of fire on landscape heterogeneity in Yellowstone National Park, Wyoming." *Journal of Vegetation Sciences* 5(1994): 731-742.

Turner, Monica, W. H. Romme, and D.B. Tinker. "Surprises and lessons from the 1988 Yellowstone fires." *Frontier in Ecology and the Environment* 1(2003): 351-358.

Turner, Monica, W. H. Romme, R. H. Gardner, and W. W. Hargrove. "Effects of fire size and pattern on early succession in Yellowstone National Park." *Ecological Monographs* 67(1997): 411-433.

Turner, Monica, W. H. Romme, R. H. Gardner, R. V. O'Neill, and T. K. Kratz. "A revised concept of landscape equilibrium: disturbance and stability on scaled landscapes." *Landscape Ecology* 8(1993): 213-227.

Tweed, William. *Uncertain Path*. Berkeley and Los Angeles, CA: University of California Press, 2010.

U.S. Congress, Senate. Committee on Public Lands. *Bureau of National Parks: Report (to Accompany S. 3463)*. 62nd Cong., 2d sess., 1912. S. Rep. 676-62).

U.S. Congress. "Protection of Casa Grande Ruin." In *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 30. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1889.

U.S. Congress. House of Representatives. Committee on the Public Lands. *Establishment of a National Park Service: Hearing before the Committee on the Public Lands*. 62nd Cong., 2nd sess., April 24, 1912.

U.S. Congress. House of Representatives. Committee on the Public Lands. *National Park Service: Hearing before the Committee on the Public Lands*. 64th Cong., 1st sess., April 5 and April 6, 1916.

U.S. Congress. House of Representatives. Committee on the Public Lands. *National Park Service: Hearing before the Committee on the Public Lands*. 63rd Cong., 2nd sess., April 29, 1914.

U.S. Congress. House. *To establish a Bureau of National Parks, and for other purposes*. HR 16090. 62nd Cong., 2nd sess. Introduced in the House December 16, 1911.

https://congressional-proquest-com.ezproxy1.lib.asu.edu/legisinsight?id=62%20H.R.%2016090&type=BILL_DOC.

U.S. Congress. House. *To establish a National Park Service, and for other purposes*. HR 22995. 62nd Cong., 2nd sess. Introduced in the House April 8, 1912. https://congressional-proquest-com.ezproxy1.lib.asu.edu/legisinsight?id=62%20H.R.%2022995&type=BILL_DOC.

U.S. Congress. House. *To establish a National Park Service, and for other purposes*. HR 104. 62nd Cong., 1st sess. Introduced in the House April 7, 2013. https://congressional-proquest-com.ezproxy1.lib.asu.edu/legisinsight?id=63%20H.R.%20104&type=BILL_DOC.

U.S. Congress. House. *To establish a National Park Service, and for other purposes*. HR 434. 64th Cong., 1st sess. Introduced in the House December 6, 1915. https://congressional-proquest-com.ezproxy1.lib.asu.edu/legisinsight?id=64%20H.R.%20434&type=BILL_DOC.

U.S. Congress. Senate. Committee on Public Lands. *Bureau of National Parks: Hearing before the Committee on Public Lands*. 62nd Cong., 2nd sess., April 17, 1912.

U.S. Congress. Senate. *To establish a Bureau of National Parks, and for other purposes*. S 3463. 62nd Cong., 2nd sess. Introduced in the Senate December 7, 1911. https://congressional-proquest-com.ezproxy1.lib.asu.edu/legisinsight?id=62%20S.%203463&type=BILL_DOC.

U.S. Department of Interior. National Park Service. "A Back Country Management Plan for Sequoia and Kings Canyon National Parks." In *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 211-216. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1963.

U.S. Department of Interior. National Park Service. "A Study on the Park and Recreation Problem of the United States." In *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 151-164. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1941.

U.S. Department of Interior. National Park Service. "Superintendents' Resolution on Overdevelopment." In *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 57-61. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1922.

U.S. Department of Interior. National Park Service. "Wildlife Management in National Parks." In *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 217-223. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1962, 217.

U.S. Department of Interior. National Park Service. *A Call to Action: Preparing for a Second Century of Stewardship and Engagement*. Washington, D.C.: National Park Service, 2015.

U.S. Department of Interior. National Park Service. *Climate Change Action Plan 2012-2014*. Washington, D.C.: National Park Service, 2012.

U.S. Department of Interior. National Park Service. *Climate Change Response Strategy*. Washington, D.C.: National Park Service, 2010.

U.S. Department of Interior. National Park Service. *Green Parks Plan*. Washington, D.C.: National Park Service, 2016.

U.S. Department of Interior. National Park Service. *Management Policies 2006*. Washington, D.C.: National Park Service, 2006.

U.S. Department of Interior. National Park Service. *Management Policies*. Washington, D.C.: National Park Service, 1988.

U.S. Department of the Interior. National Park Service, Technical Preservation Services. *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings*, revised by Anne E. Grimmer. Washington, D.C., 2017.
<https://www.nps.gov/tps/standards/four-treatments/treatment-preservation.htm>.

United States General Accounting Office. "Limited Progress Made in Documenting and Mitigating Threats to the Parks." In *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 414-417. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1987.

U.S. Congress. Senate. *To establish a National Park Service, and for other purposes*. S 826. 63rd Cong., 1st sess. Introduced in the Senate April 12, 1913. https://congressional-proquest-com.ezproxy1.lib.asu.edu/legisinsight?id=63%20S.%20826&type=BILL_DOC.

U.S. Congress. House. *To establish a National Park Service*. HR 8668. 64th Cong., 1st sess. Introduced in the House January 11, 1916. https://congressional-proquest-com.ezproxy1.lib.asu.edu/legisinsight?id=64%20H.R.%208668&type=BILL_DOC.

Wagner, Frederic H. "Whatever happened to the National Biological Survey?" *BioScience* 49(1999): 219-222.

Westerling, A. L., H. G. Hidalgo, D. R. Cayan, and T. W. Swetnam. "Warming and early spring increase western us forest wildfire activity." *Science* 313(2006): 940-943.

Wilderness Act, U.S. Code 16 (1964) § 1131 et seq.

Winks, R. "Robin Winks on the Evolution and Meaning of the Organic Act." *The George Wright Forum* 24 (2007), 6-21.

Wirth, Conrad. "Mission 66 Special Presentation to President Eisenhower and the Cabinet." In *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 193-196. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1956.

Worster, Donald. *A Passion for Nature*. Oxford: Oxford University Press, 2008.

Wright, George M., Joseph Dixon, and Ben Thompson. "Fauna of the National Parks of the United States, a Preliminary Survey of Faunal Relations in National Parks." In *America's National Park System: the Critical Documents*, edited by Larry M. Dilsaver, 104-110. Lanham, Maryland: Rowman & Littlefield Publishers, Inc., 1994. Originally published in 1932. Also called "Fauna No 1).

Wu, J., and O. L. Loucks. "From balance of nature to hierarchical patch dynamics: a paradigm shift in ecology." *Quarterly Review of Biology* 70(1995): 439-466.

Wuerthner, George, Eileen Crist, and Tom Butler, eds. *Protecting the Wild*. Washington, D.C.: Island Press, 2015.

Yung, Laurie, David Cole, and Richard Hobbs. "A Path Forward: Conserving Protected Areas in the Context of Global Change." In *Beyond Naturalness*, eds. David N. Cole and Laurie Yung, 252-269. Washington, D.C.: Island Press, 2010.

Ziesler, P. S. "Statistical abstract: 2018." *Natural Resource Data Series*. NPS/NRSS/EQD/NRDS—2019/1219. Fort Collins, Colorado: National Park Service, 2019.

APPENDIX A
QUALITATIVE METHODS

QUALITATIVE METHODS OVERVIEW

Introduction:⁵⁶⁶

Qualitative data analysis is crucial for “understanding phenomena within their context, uncovering links among concepts and behaviors, and generating or refining theory.”⁵⁶⁷ My approach is integrative, calling on both inductive and deductive methods.⁵⁶⁸ In inductive research, text is reviewed line-by-line in detail to assign codes that are not preconceived. In deductive research, coding is based on themes and ideas already coming from academic literature and previous work. Thus, a deductive approach starts with an organizing framework or theory. Though there exist many helpful conceptual frameworks, there is no “theory” related to the concepts I am considering. There is however, a great wealth of journalistic and grey literature, as well as some related academic literature. A review of this may have given me an idea of what to expect to find in the data, but given that no one has before interviewed the sample I’ve interviewed, I aimed to enter with a partially blank slate in case new themes emerged.

The interview protocols (Appendix C) I developed covered four general areas of interest: (1) the use of science to inform decision making, (2) the role of different types of inputs, such as law, or public opinion, in decision making, (3) the impacts of socio-ecological change, and (4) interviewee perspectives on the history and future of preservation more broadly. My committee assisted in reviewing and approving my final

⁵⁶⁶ In general, methods are based on: E.H. Bradley, L.A. Curry, and K.J. Devers, “Qualitative Data Analysis for Health Services Research: Developing Taxonomy, Themes, and Theory,” *Health Services Research* 42(2007): 1758-1770. H. R. Bernard, A. Wutich, and G. W. Ryan, *Analyzing Qualitative Data* (Thousand Oaks, CA: Sage Publications, 2017).

⁵⁶⁷ Bradley, Curry, and Devers, “Qualitative Data,” 1759.

⁵⁶⁸ Bernard, Wutich, and Ryan, *Analyzing Qualitative Data*, 130.

script, which was then approved by the Arizona State University Institutional Review Board. Though I had a script, the interviews were semi-structured, which means there were “flexible in that the interviewer can modify order and details of how topics are covered.”⁵⁶⁹ The script thus served more as a guideline than a rule. Though I covered all topics with all interviewees, I did not do so in the same order, manner, or with the same probes (follow up questions); interviewees could guide the conversation with their stories and examples, allowing rich perspectives to emerge that might not in a more structured interview setting or survey. I used a similar approach during the focus group I conducted in Joshua Tree National Park (details below). Before beginning an interview or the focus group, I obtained consent (see Appendix B). Some interviewees chose to have their names associated with their answers, while others preferred to be anonymous. All interviews and the focus group were recorded, with permission. I also took notes.

Sampling:

Initial potential interviewees were chosen purposefully, for example, for their involvement in drafting policies, for former or current leadership roles, or for their reputation among my contacts and other interviewees as “someone worth talking with.” (At the end of each interview, I asked for referrals—this is called snowball sampling.) In total, I spoke with 29 individuals—22 in semi-structured interviews and 7 during a focus group in Joshua Tree National Park. I had a 53% response rate, meaning 53% of people I reached out to, agreed to participate. Some interviews and the focus group took place in person (where grant money and time allowed), while other interviews took place by

⁵⁶⁹ Bernard, Wutich, and Ryan, *Analyzing Qualitative Data*, 76.

Skype or by phone at the interviewee's convenience. All but 4 participants currently work or have worked for the National Park Service. The four who had not included: an academic researcher with a history of partnership with the NPS, another academic researcher who sits on the board of the George Wright Society, a former member of the National Park Service Advisory Board, and an employee of the National Parks Conservation Association. It was my intention to speak with more academic researchers, but I had poor response rates among them and ran out of time. Future work could focus on this population to compare perspectives of the academy to those of the NPS.

Data Analysis: more information can be found in Appendix D.

I recorded all interviews and the focus group. For the focus group, I listened to the voice recording and transcribed the entire recording myself. For the semi-structured interviews, I was able to afford transcription services thanks to a generous grant from the ASU Graduate and Professional Student Association. Upon receiving completed transcripts, I read through them while listening to the recordings to ensure accuracy and to add non-verbal cues (long pauses, tone of voice). I next read the transcripts several times to pick out "significant statements." These are statements made about how individuals are experiencing a phenomenon (like socio-ecological change in parks). Significant statements should represent a range of perspectives. I grouped those statements into themes using the processes of selective coding and constant comparison in which I continued to group statements into fewer and fewer non-overlapping themes until I had six unique, descriptive themes:

- a. Inevitable change

- b. Questioning Naturalness
- c. Defending Naturalness
- d. Current Policy Reflections
- e. How is science done?
- f. How is science used?

I completed the coding process using a combination of old-fashioned paper, scissors, and tape, as well as computer software, MAXQDA version 2018.1. These themes were next checked for reliability in a second coder process (See Appendix D for more details on analysis and the second-coder process, as well as full definitions of themes). Finally, I used the themes to develop a narrative, in combination with an analysis of policy documents, laws, and the literature.

Limitations:

First, interviewees are not a representative sample. I believe those I spoke with were more likely to have an interest in or background in science, possibly motivating their interest in study participation.. For example, though I invited a representative sample of employees to the Joshua Tree National Park focus group, the participants who RSVP'd and attended were overwhelmingly from the natural and cultural resources division and had some science experience, such as a degree in a science-related field. My use of snowball sampling also may have contributed to the formation of a somewhat homogenous group (I noticed many people referred the same individuals), though I aimed to start with a diverse group in my purposeful sampling stage.

The National Park Service is an enormous, decentralized institution. This is something I learned as the project went on. In hindsight, I wish I would have given more

time to my interview process, so that I could speak with more individuals from more diverse backgrounds and kinds of parks, but I was focused on my mixed methods approach and had limited time. I am aware this is perhaps my most significant limitation in the eyes of the National Park Service, though I'm not sure that they or I would ever be satisfied with the number of participants. I do know, however, that as I analyzed interviews and texts side-by-side I reached saturation on the themes I discovered. I just think it's extremely important to note that if I had spoken to more interviewees from, for example, a law enforcement or education background, I may not have reached saturation with only 29 interviewees. Their perspectives are not represented here—the focus became those with science backgrounds or roles related to science.

Interviewees (and the parks) always exist in the public eye, even when anonymous. It is possible that participants may have been cautious in their answers, mindful of the current political environment under the Trump Administration. That may also have been a reason some chose not to participate. In addition, it's possible that some interviewees were concerned about the reality of anonymity (given that many positions, like superintendents of certain parks, are singular), affecting their answers or their willingness to participate.

Additional focus group details:

I conducted a focus group at JOTR on August 15, 2016, with seven of JOTR's management staff, chosen via a purposive sampling procedure. I chose participants with a range of work experience and titles. The meeting included a short questionnaire and a focus group that lasted three hours.

I initiated the focus group with a brief PowerPoint to explain the purpose of the research. We then discussed possible environmental changes and management concerns for JOTR. I asked open-ended questions and led a discussion to understand management responses to change. After lunch, participants and I worked together to develop the foundation for the initial survey design. We chose which attributes should be included in the model and then assigned possible attribute levels.

As stated above, the meeting was voice recorded, for later transcription and analysis. My assistant and I took supplementary notes during the group meeting, as well.

APPENDIX B

IRB APPROVAL AND CONSENT PROCESS

The Arizona State University Institutional Review board initially approved this qualitative study on August 17, 2017. An update was submitted and approved on August 15, 2018 (for round two). Approval is valid until August 14, 2023. Below, I have included the consent form and the different IRB-approved letters of invitation used to recruit participants during the two rounds of interviews that took place (Fall 2017 and Winter/Spring 2019), and the focus group.

As well, I have the following CITI trainings (which were valid during the completion of this study).

- RCR – Humanities Responsible Conduct of Research completed on 6/10/2015
- IRB – Social & Behavioral Research (Group 2) completed on 9/18/2015

CONSENT FORMS

Title of research study: ***Former to Future: Preservation as Policy?***

Investigators: ***Michelle Sullivan Govani and Ben Minter***

Thank you for agreeing to participate in this study. I am interested in learning about policy and strategy responses to environmental, climate, and social-cultural changes within and around the National Park Service. We invite you to take part in this research study because of your invaluable insights regarding national park management, science, and/or policy. This interview will last no more than one hour.

You must be 18 years or older to participate. Your participation is voluntary. You may choose to answer (or decline to answer) any question. There is no penalty if you decide to withdraw from the session. I assure some level of confidentiality to your responses. Specifically, your name will not be associated with the information that you share with me. However, in some cases you might choose to share information known only to someone in your position. Efforts will be made to limit the use and disclosure of your personal information, including research study records, to people who have a need to review this information. The results of this study may be used in reports, presentations, or publications.

I would like your permission to audio record this session. *Please let me know if you do not want the session to be recorded; you can also change your mind after the interview begins.*

If you have any questions, please contact Ben Minter at ben.minter@asu.edu or Michelle Sullivan at mksulli3@asu.edu. This research has been reviewed and approved by the Social Behavioral IRB at Arizona State University. You may talk to them at (480) 965-6788 or by email at research.integrity@asu.edu if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You have questions about your rights as a research participant.
- You want to get information or provide input about this research.

Your signature documents your permission to take part in this research.

Signature of participant

Date

Printed name of participant

Signature of person obtaining consent

Date

Printed name of person obtaining consent

Title of research study: *Preserving Parks in a Changing World: A Study of Management Challenges and Public Choice at Joshua Tree National Park, CA*
Investigators: *Michelle Sullivan and Ben Minter*

Thank you for agreeing to participate in this study. I am interested in learning about management responses to environmental changes within Joshua Tree National Park. We invite you to take part in this research study because you are member of the staff at Joshua Tree National Park with invaluable insights on park management. This session will include a short demographic questionnaire that will take a couple of minutes and a focus group that will last approximately 3 hours. For 90 minutes this morning, we will discuss possible environmental changes and management concerns for JOTR. We will spend the second 90 minutes developing a survey instrument that will be administered to park visitors in the spring of 2017.

You must be 18 years or older to participate. Your participation is voluntary. You may choose to answer (or decline to answer) any question. There is no penalty if you decide to withdraw from the session. While I assure confidentiality of all your information on my part and will not associate your name with your responses, note that I cannot make that guarantee for others in the focus group with respect to what you say during the session. Efforts will be made to limit the use and disclosure of your personal information, including research study records, to people who have a need to review this information. I cannot promise complete secrecy, but all the information I collect will be grouped together and reported only as a summary of the results. The results of this study may be used in reports, presentations, or publications, but your name will not be used.

I would like to audio record this session. It will not be recorded without your permission. *Please let me know if you do not want the session to be recorded; you can also change your mind after the focus group begins.*

If you have any questions, please contact Ben Minter at ben.minter@asu.edu or Michelle Sullivan at mksulli3@asu.edu. This research has been reviewed and approved by the Social Behavioral IRB at Arizona State University. You may talk to them at (480) 965-6788 or by email at research.integrity@asu.edu if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You have questions about your rights as a research participant.
- You want to get information or provide input about this research.

Your verbal agreement indicates your consent to participate.

LETTER OF INVITATION ROUND ONE INTERVIEWS (October 2017)

DATE

ADDRESS (differs depending on which agency/NGO they are from)

Dear XXXXXXXXXXXX,

My name is Michelle Sullivan, and I am a Ph.D. candidate in Biology and Society in the School of Life Sciences at Arizona State University. I am writing to invite you to participate in an interview I am conducting as part of my dissertation research with the National Park Service.

The purpose of this interview will be to discuss the future viability of a preservationist ideal (and policy) for the National Park Service, as well as to examine the role of scientific process and evidence in National Park Service decision-making. (INSERT, unique to each, why I am asking them specifically and mention network, previous meeting, other connection, if there is one).

Interviews will occur in person in Washington, D.C., between **October 16th and 20th**, **location and time to be determined based on your best availability.**

The Arizona State University Institutional Review Board (IRB) has granted approval for this interview. Data collection involves audiotape. Tapes will be erased upon completion of the study. Please know that your participation in this study is voluntary. If you can participate, please let me know by emailing me (Michelle) at mksulli3@asu.edu by July 31st. I look forward to hearing from you and gaining your participation in this important project. Please call me (515-681-9376) for any questions or additional information.

Sincerely,

Michelle Sullivan

mksulli3@asu.edu

515-681-9376

Skype: michelle-k-sullivan

Ph.D. Candidate

Center for Biology and Society

School of Life Sciences

Arizona State University

LETTER OF INVITATION ROUND TWO INTERVIEWS (February 2019)

DATE
ADDRESS

Dear XXXXXXXXXXXX,

My name is Michelle Govani, and I am a Ph.D. candidate in Biology and Society in the School of Life Sciences at Arizona State University. I am writing to invite you to participate in an interview I am conducting as part of my dissertation research with the National Park Service.

The purpose of this brief interview will be to discuss the future of preservation in the national parks, as well as to examine the role of science in National Park Service decision-making. (INSERT, unique to each, why I am asking them specifically and mention network, previous meeting, other connection, if there is one).

Interviews will occur via phone or Skype during the month of February, based on your best availability.

The Arizona State University Institutional Review Board (IRB) has granted approval for this interview. Data collection involves audiotape. Tapes will be erased upon completion of the study. Please know that your participation in this study is voluntary. If you can participate, please let me know by emailing me (Michelle) at mksulli3@asu.edu by February 8, 2019. I look forward to hearing from you and gaining your participation in this project. Please email or call me (515-681-9376) if you have any questions.

Sincerely,

Michelle Sullivan
mksulli3@asu.edu
515-681-9376
Skype: michelle-k-sullivan
Ph.D. Candidate
Center for Biology and Society
School of Life Sciences
Arizona State University

LETTER OF INVITATION FOCUS GROUP

January 21, 2016
Joshua Tree National Park
74485 National Park Drive
Twentynine Palms, CA 92277-3597

Dear XXXXXXXXXXXX,

My name is Michelle Sullivan, and I am a Ph.D. student in Biology and Society in the School of Life Sciences at Arizona State University. I am writing to invite you to participate in a focus group and workshop I am conducting as part of my dissertation research at Joshua Tree National Park. This meeting is designed to 1) understand how JOTR is changing environmentally and socially, and 2) cooperatively design a visitor survey instrument to be administered to park visitors next year. The survey will be designed to help us better understand which attributes of the park visitors weigh most in their consideration of the value of the park.

The National Park Service (NPS) Office of Management and Budget (OMB) has granted approval for this meeting. I have been in touch with JOTR staff, including Michael Vamstad (Wildlife Ecologist) and Karin Messaros (Assistant Superintendent) over the last few months, to coordinate this first stage of my study. Michael kindly provided me with your contact information as someone who would have invaluable insights and might be interested in participating.

The focus group/ workshop will occur on **August 15th in the Rattlesnake Room at the JOTR headquarters, 29 Palms**. Given the dual goals of the meeting, I would like to meet with you from 10:00am – 1:00pm. Lunch and refreshments (including an NPS 100th birthday cake) will be provided at the meeting.

Your participation in this study is voluntary. Please let me know if you are able to attend by emailing me (Michelle) at mksulli3@asu.edu by June 15th. Please also let me know if you have any dietary restrictions or requests. I look forward to hearing from you and gaining your participation in this important project. Please call me (515-681-9376) for any questions or additional information.

Sincerely,

Michelle Sullivan
mksulli3@asu.edu
515-681-9376
Skype: michelle-k-sullivan
Ph.D. Student
School of Life Sciences
Arizona State University

NOTE: Data collection involves audiotape. Tapes will be erased upon completion of the study. Participants must be 18 and older.

APPENDIX C
INTERVIEW PROTOCOLS

INTERVIEW PROTOCOL ROUND ONE (October-November 2017)

Introductions.

Study Purpose.

Consent.

Permission to Record?

Questions:

- Please share more about your responsibilities as **(INSERT TITLE)** with the **(INSERT INSTITUTION)**. What is your role, if any, in the decision-making or policy process for the National Park Service?
- In your role as (Job) at (Work) what major park and protected area management and/or policy issues are you occupied with these days?
- Why do you think these particular problems are the ones that are receiving attention? How did they become hot issues?
- Are there issues/problems that you feel are not receiving enough attention?
- How is scientific evidence used to inform decision making at the NPS? What is the importance of scientific information to decision-making, relative to other forms of information (e.g., economic, legal, feasibility, political popularity, public opinion)? Has this changed throughout your tenure?
 - (probe, what is the role of basic vs. applied science in park management?)
 - (probe, what is the role of the national parks in promoting scientific research?)
- Is there a role for public input in NPS decision-making? Why or why not? In what ways?
 - (probe, is there a role for citizen-science in NPS decision-making?)
 - (probe, should local communities have a role in management and if so, how?)
- How do you see environmental and climatic changes to park landscapes affecting management philosophy?
 - (be prepared to offer illustration)
 - (probe, do you believe historical values, traditions, and policies constrain shifts in that philosophy? How? Why?)
 - (probe, do you see these changes as posing a threat to the preservationist mission?)
 - (probe, is existing managerial discretion sufficient to respond to these changes or should more significant policy and administrative changes be entertained?)

INTERVIEW PROTOCOL ROUND TWO (February-March 2019)

This interview protocol was shortened to focus on the themes of primary interest that emerged from round one.

Introductions.

Study Purpose.

Consent.

Permission to Record?

Questions:

- Warm up: introductions.
- What are the parks preserving and why? Have you seen this change throughout your experience with parks? If so, why/how?
 - E.g., What is the role of science in preservation, as you interpret preservation today?
 - E.g., How do you see environmental and climatic changes to park landscapes affecting preservation? What about shifting politics or public expectations?
- Throughout the years, there have been repeated calls for the park service to promote research and evidence-based policy in parks (e.g., Leopold Report, State of the Parks, Vail Agenda, Sellars' book, Revisiting Leopold, etc.). Do you have any thoughts about the impact of any of those reports, and why they had the impact (or lack thereof) that they did? Have any of them impacted your approach to your role with the NPS?
 - E.g., How is scientific evidence used to inform decision making at the NPS?
 - E.g., What are the limits of science to inform decision making?
- What does the future (next 100 years) of managing parks look like for the U.S. National Parks?
 - E.g., What would be the worst/best case scenario?
 - E.g., What is your biggest fear? What is your biggest hope?

JOTR FOCUS GROUP SCRIPT (August 2016)

Date: _____

Site: _____

Number of Attendees: _____

Facilitator: _____

Assistant Facilitator: _____

PART ONE:

- Introduction (10 minutes)
 - Self-introduction
 - Group-introductions
 - Name
 - Position
 - Favorite location or feature in JOTR
 - Assurance of anonymity and structure of focus groups
 - Review the consent form
 - Extra things not on consent form
 - We will capture thoughts and ideas on the flip-chart
 - Avoid interruptions, allow us to get key points on paper
 - I may have to stop the discussion at times so we have time to address all the topics
 - Add an extra note about the voice-recorder: does anyone feel uncomfortable with that?
 - Ground Rules: “Before we get started, I would like to share some simple ground rules to help facilitate our discussion. To help focus our dialogue I will try to keep us on schedule so we have time to complete all discussion topics. I may need to interrupt you to keep on schedule or on topic. I also want everyone to have the opportunity to participate so I may redirect the conversation or ask specific individuals to share their ideas.”
 - You do not need to respond to me directly all the time. Feel free to follow up on something someone else says, add something, or share a different experience. I would like this to be a conversation.
 - There are no wrong answers. You don’t have to agree with each other.
 - Feel free to share your point of view even if it differs from others’.
- Introduce study (Brief PowerPoint, 5 min)
 - **Focus Group Purpose:** The purpose of the focus group with JOTR staff is to develop scenarios of future environmental change at JOTR and to understand how JOTR management might respond to different scenarios

of environmental change in the park. Focus group data will be used to design a survey instrument that I will then use to gather data on visitor perceptions of both environmental changes and management practices in the park.

- **NOTE benefit to participants**
- Warm-up (10 minutes)
 - What do you think makes JOTR unique from other national parks?
 - Probe (Long form): What does JOTR preserve or protect? Nature? Joshua trees? Visitor experience?
- Discussion of current environmental changes (20 minutes)
 - Begin with definition of “Anthropocene,” the Age of Man.
 - Are you comfortable with the concept of the Anthropocene?
 - Do you see evidence of any of the Anthropocene (environmental or social change) happening in the park now?
 - Fill in gaps with a review of data from Ch. 2 of my dissertation, presented as a table in handouts
 - Do you agree or disagree with any of the studies/data presented?
 - Probe if disagree: What prompts you to disagree? Do you see a contrasting scenario in the park?
 - What other environmental challenges or changes, not presented, do you feel should be considered in our scenarios of the future?
 - Rate drivers of change: (write on board, e.g.: climate, exotics, fire, pollution, etc.)
 - Predictability
 - Ability to control
 - Which of these forces most significantly contribute to JOTR’s future?
 - Which drivers of change pose a particular challenge for park protection and the preservationist mandate?
- Discussion of current management responses (10 minutes)
 - Given the presented and agreed upon potential changes to the park, what sorts of management responses that you are currently implementing are applicable?
 - (NOTE: this is important to record because we CANNOT include current management responses in the public survey)
 - **How is JOTR working within the National Park Service’s climate adaptation strategy and other system-wide policies for environmental challenges?**
 - How does this constrain management options for JOTR, if at all?

- Discussion of possible future management responses (30 minutes)
 - Given the presented and agreed upon potential changes to the park, what sorts of management responses (not currently in action) do you envision implementing?
 - Probe: **Do you feel that there are any interventions that may be controversial for or challenged by the public?**
 - Probe: Are some management responses likely to be more acceptable to the public than others?
 - Where does JOTR staff draw the line in terms of management interventions and manipulations of the park landscape and/or natural resources?
 - **Are some management-induced changes off the table, no matter how rapidly or severely ecological change progresses? Which sorts of management responses have been deemed too costly or too impractical, if any?**
 - Example: Is it acceptable to water the Joshua trees?
 - Probe: **Talk a little about the constraints and boundaries you feel are operating in JOTR – either park specific constraints having to do with tradition or management protocols established here or more general NPS preservationist policies.**

PART TWO: Lunch is served (10 minutes break. While eating, present on choice modeling.)

- Overview of Choice Modeling and Survey Instrument (10 minutes, PowerPoint)
 - Choice Outcome: a decision made by comparing alternatives and selecting an action. An individual's preferences for specific alternatives best determine which alternative is chosen, but constraints (e.g., budget) also affect choice.
 - Preference data is not as telling as choice, e.g., A person may prefer a beach house but choose an inland apartment because they are constrained by their budget.
 - Choice Modeling: A survey instrument that provides an understanding of what contributes to choice, uncovers the weight assigned to each attribute of the alternatives (PRESENT EXAMPLES)
 - Challenge: to find a way to identify, capture, and use as much as possible of the information that an individual takes into consideration when they process a situation leading to a choice.
 - Choice Set (Survey) Construction (EXAMPLES from previous NPS studies):
 - Alternatives are mutually exclusive
 - Understand that participant choice is based on their perception

- Reality may be 35min, perception of 25min
 - Careful to avoid ambiguity in attribute meaning
 - **Purpose of the survey:** I will gather quantitative data on visitor perceptions of environmental change and management scenarios. This research will make a contribution to the NPS's understanding of how visitors are likely to respond to particular scenarios of environmental change and to scenarios of management response to environmental change.
 - **“We will work together today to decide which attributes of JOTR should be included in the choice sets based on relevance to the visitor experience and importance to the state of the park (environmentally and socially) overall. We will discuss selection of attributes and different levels or qualities that the attributes could take. For example, the presence of Joshua trees may be determined as an important park attribute. That attribute could be divided into different levels such as ‘number of trees’ or ‘percentage of tree cover.’”**
- Attribute Selection (60 minutes)
 - Basic Questions:
 - What existing park scenarios are available?
 - What are their attributes?
 - Who are the visitors?
 - Is visitation consistent over time or seasonal?
 - Present Data from the 2010 Visitor Study
 - What are some of the things that you think visitors like most about JOTR?
 - What are some of the top reported visitor concerns...?
 - ...About the condition of natural resources in the park?
 - ...About their park experience in general?
 - What determinants drive demand for the park?
 - Create a List Attributes:
 - List on the flip chart
 - What are the extreme ranges/endpoints for attribute levels for each attribute? Suggest assigning values outside of the observed range for modeling purposes (based on models of environmental change in the park).
 - How many attribute levels per attribute? Note: doesn't have to be the same number of levels for all attributes
 - More levels=more information, Fewer levels=simpler model
 - Understanding and defining *qualitative* attributes
 - Nominal= no natural order (e.g., car color)
 - Ordinal= natural order (e.g., satisfaction with the restroom facilities)

- Clean up the List of Attributes
 - Identify any confusing terminology
 - Exclude insignificant alternatives (cull the list of attributes).
Acknowledge that this is a subjective process.
- Scenario building (extra activity if there is time)
 - Review list of important drivers of change
 - Review list of management options
 - Formulate:
 - Best-case scenario for JOTR's future
 - Worst-case scenario
 - Most-likely-case scenario
- Close: (3 minutes)
 - Is there anything else you would like to add to the scenarios or anything you would like to add to the meeting notes?
 - Thank you for meeting with me today. Recall that the information discussed and gathered today will form the basis for a public survey to be implemented in the park next fall. Please, do not hesitate to contact me with any questions at anytime by email or phone.

APPENDIX D
INTERVIEW ANALYSIS

ANALYTIC METHODS

According to Bernard et al. 2017, there are five tasks in analyzing text: (1) discovering themes and sub-themes, (2) describing elements of themes, (3) building code books or hierarchies of themes, (4) applying themes to text, and (5) linking themes in theoretical models:

Discover Themes:

I was awarded funds through ASU's Graduate and Professional Student Association, as well as the ASU School of Life Sciences to access professional transcription services for my interviews. I conducted an initial read-through while listening through the recording to ensure transcription quality. This initial read through also presented an opportunity to: (1) send transcript copies to the interviewees who requested them, (2) take a first pass at identifying key quotes and potential themes, and (3) identify obvious missing data and further interviewees/follow-up. I then printed the text of each interview to take a first pass at coding with pen and paper (as well as scissors and tape). Next, all the files were uploaded to MaxQDA, the software I used to analyze the transcripts. This marked the start of formal coding, during which I coded each interview transcript for concepts, relationships, participant perspectives, participant characteristics, and setting. Throughout the process, I used memos in the MaxQDA software to keep tabs of ideas about relationships and proposed hypotheses for links among themes.

I read the transcripts several times to identify themes, core concepts and recurring topics of the discussion. With each repetitive reading, I grouped themes using the

processes of selective coding and constant comparison in which I continued to group statements into fewer and fewer non-overlapping themes until I had unique, broad themes. I discovered themes based on one or more of the following characteristics: (1) repetition, (2) indigenous categories, or topics only insiders seemed likely to know, (3) similarities and differences among different types of interviewees. I also used the physical process of cutting and sorting to assist with grouping statements into broader themes. *Important themes* were identified based on the: (1) frequency of their occurrence (higher frequency can be a good indicator of importance), (2) pervasiveness across interviewees, (3) interviewees reactions to theme violation (tone, etc.), and (4) context specificity.

Describe Elements of Themes:

Themes are defined, revised (second coder analysis), analyzed, and then written up. This process is not linear—stages happen in overlapping fashion. The codes that I used for final analysis were thematic, though I did use structural (gender, location, etc.) and memo (field notes, commentary) codes in my thought process. Codes are described in detail below.

Build Code-Book:

At first my code books contained many themes—around 40-50. After a process of repetitive revision and refinement, I ended up with the six themes described below. These are themes I reached saturation on, meaning my interviewees began to speak in similar terms and on similar topics—at that point no new concepts related to those themes were

emerging from the data. However, one limitation of my data set is that the group of interviewees is relatively homogenous—focused on or experienced with science. If I diversified my sample, I may no longer be at saturation.

Apply Themes to Text/Test Reliability:

After developing a first-draft code book and applying it across several of the interview transcripts, it was time to test for the reliability of the themes by calculating inter-coder reliability.⁵⁷⁰ This is done to test whether different people apply the themes to the same parts of the text. However, measuring the overlap of agreement alone is not enough to test for reliability because people can agree or disagree based on chance. Thus, statistical measures have been developed to account for chance, and for this project I used a measure called, Cohen's Kappa, or k . Cohen's Kappa measures: how much better than chance is the agreement between a pair of coders regarding the presence or absence of themes in texts?

The first step in calculating Cohen's Kappa is to examine overall agreement in the texts among coders. To do so, I asked two of my colleagues—both graduate student peers—to apply my code book to a randomly selected subset of my data (I used a random number generator). In total, they were asked to apply six themes to four randomly selected interviews. I went through their materials and calculated the number of times we agreed on presence vs. absence of the themes (“code present” vs. code absent” numbers for each segment of the text). Segments were defined as the entire part of a text containing a single answer to a single question (usually, a paragraph or two).

⁵⁷⁰ Bernard, Wutich, and Ryan, *Analyzing Qualitative Data*, 256-261.

The following are the details related to calculating Cohen's Kappa, k :

$$k = (\text{observed} - \text{chance}) / (1 - \text{chance})$$

$$\text{"observed"} = (a+d)/n$$

$$\text{probability of "chance"} = [\{(a+b)/n\} * \{(a+c)/n\}] + [\{(c+d)/n\} * \{(b+d)/n\}]$$

Table 1: Example Matrix for Calculating Cohen's Kappa.

		Coder 2		Coder 1 totals
		Yes	No	
Coder 1	Yes	1 (a)	1 (b)	2
	No	3 (c)	5 (d)	8
Coder 2 totals		4	6	10 (n)

When $k=1$, that means there was perfect agreement among coders. When $k=0$, that means any agreement or disagreement was probably due to chance. The scale for Cohen's Kappa is as follows:

- $k=0$, agreement is equivalent to chance
- $k=0.1-0.2$, slight real agreement
- $k=0.21-0.4$, fair agreement
- $k=0.41-0.6$, moderate agreement
- $k=0.61-0.8$, substantial agreement
- $k=0.81-0.99$, near perfect agreement
- $k=1$, perfect agreement

There are two important factors to consider in interpreting Cohen's Kappa values. First, the more inference that is required to decipher meaning in the text (vs. just coding for direct words or language), the more likely codes are going to be less reliable across second and third coders. Second, more prevalent (or common, or high frequency) codes

are easier to identify compared to rarer ones. Because they are common, second and third coders are more likely to identify high frequency codes reliably. We can expect to see lower Cohen's Kappa calculations for rarer codes.

Link Themes in Theoretical, Thematic, or Taxonomic Models:

After calculating inter-coder reliability and refining the codes, I finished applying the codes to the texts. Then, I began to analyze the ways in which they were linked and related. Throughout the coding process I kept memos of possible links and relationships, including any recurrent or unifying ideas (or ideas to the contrary). Then, I spent many hour exploring how themes are related to ideas in the literature and in policy.

CODE BOOK

Inevitable Change

- Mnemonic: InevitCh
- Description: Interviewee describes a currently occurring change or predicted change as certain to happen or unavoidable. Despite attempts to stop or re-direct change through management or policy efforts, it will still occur (at least in their perception of the situation). There are varying degrees to this theme, including (1) certainty of inevitability supported by scientific evidence, (2) a general sense that change is “going to” happen based on experience, and most intense, (3) a sense that change will happen no matter what is tried to stop or mitigate it.
- Inclusion/exclusion criteria: Note, this refers only to current and predicted changes... not past changes. Changes should only apply to natural and cultural resources (landscapes, plants, animals, artifacts, etc.), and facilities. Please do not apply this code to changes in policy or to changes in politics.
- Examples:
 - Here, general change is presented as inevitable in his manner of speaking.
Dennis 96:
 - “... the temperature and precipitation at least will change. The soil dynamics also over time will change, but it will take longer because the vegetation change is gonna affect the soil, maybe, depending on the nature of the change.
 - Noting strong scientific support as a basis for certainty of change.
Gonzalez 106-107:

- What's empowering is the...I would say, first, the overwhelming scientific base that is documenting global change, and specifically climate change. And historical impacts that have been detected and attributed to human climate change. And then, other research that has looked at future vulnerabilities, and what might happen if we don't reduce our emissions from human activities that cause climate change. So we have this overwhelming...you know, scientific...you know, strong scientific basis on climate change.
- Close, but not an example: n/a

Naturalness

- Questioning Naturalness
 - Mnemonic: QNat
 - Description: Instances in which the interviewee notes that the concept of natural is more complicated or ambiguous than implied in literature, philosophy, or policy...or just more complicated as a concept in general.
 - Inclusion/exclusion criteria: To include, the interviewee must complicate or question the concept or naturalness. They do not necessarily need to also question policy, nor do they have to necessarily state that it's no longer a worthy goal. Questioning the clarity or value of the concept (it's definition) is not the same as questioning park policy, though there may be overlap. (In other words, this excludes instances where policy is questioned without also questioning the concepts driving policy).

- Typical example, Schuurman 22-23
 - ... Here we are in Alaska where our fire regime, our wildfire regime, has been autonomous. You could call it natural. And we understand it to have a certain frequency of large fires. And we understand that a warming climate is going to change that frequency and, therefore, change our prior regime in a way that, given that we understand climate change is anthropogenic, ... means that those changes that start fire regime are not natural. Should we then intervene and start setting prescribed fires so as to keep the fire regime historical, even though for the first time the fire regime would be in some ways not "natural" because it would be engineered by us? What is natural there? And how should we proceed? And are we clear on the policy to start intervening when the only departure from natural is sort of overarching massive change in the fire regime driven by a change in the atmosphere driven by human activity? So that's a gnarly question.
- Atypical example: Providing an alternative concept to work toward, because the concept of naturalness doesn't work anymore.
 - You know, Director's Order 100, for instance, unfortunately, recently rescinded, took some steps in that direction that I probably was speaking about with the gnarly stuff in terms of defining a forward-looking concept

of ecological integrity as a guide, sort of as an alternative to natural as a guide. (Schuurman 62)

- Close, but not an example: Mentioning something as natural without questioning it, or simply calling something unnatural. Here, Jarvis states that a landscape has been converted to commercial use, but is not questioning the concept of “natural.” Jarvis 58-61:
 - The native tallgrass prairie kinda stuff is one of the least protected environments in North America, not only in the US. There's very little of it in Mexico but there's a lot of it in the US, there's a lot of it in Canada. But it's where we grow wheat and corn, right? So most of it's been commercial.... Yeah. So you know that part of the world and you know that very little of it is natural anymore.
- Defending or Accepting Naturalness
 - Mnemonic: DNat
 - Description: Interviewee expresses belief or evidence that the concept of naturalness can still work in the face of change. Or, the interviewee notes that even if the concept is questionable, it still serves as a worthy *relative* goal. Interviewees who defend naturalness or natural as concepts range from those who believe naturalness is still possible to those who believe it's questionable but still reasonable or worthy as a goal or guidepost for the park service. There is overlap and interpretation/inference at play here, as some have complex, sometimes paradoxical thought patterns (i.e., they

believe human-caused changes are inevitable but then still defend naturalness as a goal or baseline).

- Inclusion/exclusion criteria: Defend natural or naturalness. Does not include references or defenses of current policies that may be based on the concepts, though there may be some overlap.
- Typical example, Soukup 74:
 - Well, I think parks are preserving arenas where nature, to the extent that it can, proceeds unimpeded, you know. There are global processes which you can't do much about as a Park Service. And there are certainly regional processes, as well, that you can't. And there are internal park operations processes where you can. And I think, by and large, it's really important for parks to do their decision-making based on a good, solid understanding of what parks need to be ecologically healthy and have ecological integrity and all of that. And that's really quite important that that be the goal and not to freeze it in time, not to try to stifle change. And we haven't done that for decades. People keep saying, "Oh, you're still managing under the vignette of primitive America." Well, no that's about 20 years late. If you look at the management policies, if you look at the evolution of management policies, we started saying that parks management for dynamic systems, oh back in the late '70s, I think. It really irked me, but anyway, I think it's really

important that parks sort of manage these stages or these arenas where nature, as much as possible, become as natural as possible.

○ Atypical example:

- Stating naturalness as a goal, as if it's unquestionably possible.

Dennis 120:

- And what we as humans can do to minimize the impact. And so, we've developed food storage containers, we've developed trashcans, we've written regulations, we've built interpretive programs. And our goal is to have the bears doing their thing naturally, paying no attention to the humans. And the humans knowing how to behave in bear country so they don't attract the attention of bears.

○ Close, but not an example:

- “Stress” is not necessarily synonymous with “natural”... so while Jarvis is arguing that parks are useful as comparatively less stress systems, he says nothing about naturalness, Jarvis 51:

- The third, of course, is that sort of long-term monitoring. Science parks are some of the least stressed systems out there, so we serve somewhat as a benchmark and we need to continue that work.

- Calling something a natural resource. Dennis 135:

- And up to that point, I had always viewed sounds and noise as an aesthetic quality of parks. And he pointed out to me

that, "No, they are really natural resources." Sounds as a natural resource and he laid it out for me and showed me why. So, I got the message, changed my viewpoint.

Recent Policy Reflections

- Mnemonic: RPR
- Description: Interviewees reflect on their positive, negative, or neutral thoughts regarding the application or relevance of the following: Organic Act of 1916 (founded the NPS), Revisiting Leopold Report, Director's Order-100 (DO-100), Management Policies 2006, and any other memos or orders signed by Jarvis during the Obama administration. A step beyond questioning, complicating, or defending the concept of naturalness, interviewees reflect on the current or recent (including rescinded policies of the last administration) criteria, policies, and goals of the moment.
- Inclusion/exclusion criteria: Excludes reflections on individual park management strategies. Excludes reflections on the following laws: Antiquities Act, Wilderness Act, Endangered Species Act, Clean Air Act, National Environmental Policy Act. Also excludes recommendations or proposals of new policy. Sometimes relevance or value in defense of recent policy is stated in relative terms... "yeah what we're trying to do is a lot more difficult granted changing contexts but it's still worth striving for." Or they may express that policy is sufficient *despite* challenges.
- Typical examples:

- Negative, Hallac 70: Again, my biggest hope is that we develop policy that provides managers like me some guidance on what to do. Because the policy that we have right now is completely unclear. It is somewhat flexible, but it's so flexible and unclear that parks are doing a whole variety of different things that would result in very, very different outcomes that are inconsistent, and really start to deviate from some of the original purposes of the national park system.
- Positive, Washburn 44: And then, of course, the "Director's Order 100," was developed out of the recommendations from the Revisiting Leopold Report. And that was really important policy that really looked at, you know, how we should be doing resources management into the future. And you know, I think really could have shaped our approach to resources management over the next 100 years. But as you may know, that was rescinded by the Trump Administration, that was one of the first things they did when they got into office was rescind "Director's Order 100."
- Atypical/tricky example:
 - This exemplifies how the thoughts of NPS staff often exist in grey areas. Here, Machlis defends the policy of “preservation,” but questions WHAT parks are preserving. It’s also tricky because it requires insider knowledge—awareness of what he is referencing to (see comments). These are rare, so don’t worry too much about it. Machlis 170: If what you wanna preserve is the old argument of vignette of primitive America, the same animals and the same trees doing the same thing just like 200 years

ago, that's not going to happen. The glaciers are moving, animals are moving, plants are changing. But if you wanna preserve functioning ecosystems, that can adapt to change, that can be done. And it's essential. So, the question is not in my opinion, "Is preservation relevant?" It is. It's very relevant. It's, what are you preserving?

- Close, but not examples:
 - Point out that the law is used as the guidepost does not equate to defending it. It's a statement of process (follow the law) without ascribing a value-judgement (the law is bad/good). Jarvis 44:
 - Well, yeah, I'd love to hear your example. I'll rip first, but... So, decision-making, policy decision-making regarding national parks, I've always been guided by sort of these three elements, and they are the accurate fidelity to the law, and so there is a body of law that has been established that both just created the National Park Service, created this individual park, gives us some clarity as to what the park is supposed to be all about, and then there's a body of additional laws, the Wilderness Act, Internal Policy Act, Clean Air Act, all those body of law. Those are laws, they're like speed limits, you can't exceed them, so you may...you need to consider them.
 - Like above, Savajot points out that he obeys law but is not necessarily defending/judging it. Savjot 40:

- The law that establishes national parks and says, "This is how we should manage the resources and these are the values for which this agency should be managing resources for," also come into play in our decisions.
 - Providing a new idea for policy. For example, Valdez suggesting that the NPS pay attention to the UN Sustainability Goals. Valdez, 139:
 - But it's funny how the DOI should be paying attention to this, because this is the global context of how... And the United States is a member, you know, not really appreciative member right now but we're a member. And we should be, all the DOI bureaus should be required to demonstrate how they're meeting these goals, including the park service. And in there is environmental, that's where the people element comes in. How are you helping poor communities? Most of the parks were developed in, you know, these cheap landscapes, and that's where people live because it's cheap. Are they a part of that park because they're on and the outside of it? How do those communities get integrated?

How is science done? (Or not done)

- Mnemonic: SD
- Description: This code applies anytime a participant describes the ways in which science is organized, funded, or performed in the parks (or the ways in which it is NOT). Those doing the organizing, funding, or performing of science could be

academic researchers, park employees, non-profits research teams, or citizen scientists. Interviewees might fall into one of those categories, and thus might be describing their own work. Science includes all disciplines of research (social science, ecology, geology, economics, citizen science, academic science, park science, etc.). Though not as common, it also includes discussions of what motivates a research project (i.e., how it got started, legal requirements, etc.).

- Inclusion/exclusion criteria: This does NOT include how science is used by land managers or decision makers after it is done. It does include discussions of how land managers or decision makers might participate in the motivations for or implementation of a project, including sharing that they need some research for a help in a decision.
- Examples:
 - Savajot 35, here describing institutions within the NPS that do science:
 - The park service has, with other agencies, the cooperative ecosystem study unit program as an example of that. But we've got other things like that that we're trying to get off the ground or continue to support. So, those kinds of things. And I guess I would sort of categorize them as more programmatic like citizen science, and more sort of operational like are there agreements or templates that can be used.
 - Manning 49, here describing how a research proposal came about (motivations):

- You know, so some parks like Zion and Yellowstone, you know, they've seen huge increases in use and they just feel like they're in a crisis situation. And, you know, somebody wrote to me this morning on email asking me a question about a proposal. Not yet a proposal, a call for a proposal, but it's an inquiry about some research that would address some visitor use issues in Yellowstone, for example, and I know that there are things going on in Zion. And, you know, these parks I think feel like they're, just like I said, they're in a crisis. They don't really quite know what to do about it.
- Close, but not an example: Any of the examples of how science is used, below ;)
 - But here is a somewhat tricky one where Savajot is describing the role of scientists in decision making and how they might feel about that role (50-51):
 - And it is difficult for anyone, I think, to come in and sort of develop their information and collect their data, and say, "Well, this information suggests or tells me to do this." And you're not actually gonna do that, does that mean that you don't believe or don't feel that this work is valuable? You need to get past that and say no, and in fact, it is valuable, it's very useful. But it is one factor in often many that need to be considered. You know, the most sort of hardcore interpretation of what scientists are, though, are these dispassionate observers, right? It should never bother a

scientist that you simply get the data or you simply provide the data and then people do what they wish. Because, you know, as a dispassionate scientist [sarcasm], of course, you simply are providing the information and saying, "The consequence of this action is that. The consequence of that action is this." At the end of the day, "I'm a scientist and I don't tell you which action to take, I just tell you what the results will be." But of course, we know in reality that scientists are human beings and get stuck in this whole thing about they actually have opinions as well. And those opinions are not entirely driven by just, you know, believing that the objective science gets handed over and I no longer get involved. And so it's very difficult to disentangle people's involvement in providing information and their interest in influencing the outcome.

How is science used? (Or not used)

- Mnemonic: SU
- Description: This code applies when the use of science is discussed—either its use in decision making at the local park level, or its use in writing policy at higher levels of organization in the NPS. It also applies if someone talks about science used in decision making more generally. The code also applies when they discuss how science is not used in decision making, or its limits in use. Again, interviewees might see putting science to use as part of their jobs, and in that case

it would apply to their own description of their job. Discussions of limits might revolve around talking about other factors that play into decision making (competing with the role of science), or they might revolve around limits inherent to science itself (like uncertainty). Science is again defined as all disciplines of research (social science, ecology, geology, economics, citizen science, academic science, park science, etc.).

- Inclusion/exclusion criteria: Don't forget to include discussions of how science is NOT used! You can include references to past, current, and future policies and decisions (no temporal restriction).
- Examples:
 - Savajot 39:
 - I find myself in the position that I'm in, in the role that I'm in now often... So most of the people that work for me would probably call themselves scientists. There's a wide variety but probably the majority. And I often find myself talking to them about how the work that they are doing is so critical and important to the work we do in the National Park Service. But that it is, as you had mentioned earlier, it informs the decisions. But at the end of day, we're a public agency and our decisions are reflections of not just the science but also of the expectations of the public. And so, it's a little different than being a university scientist where you can, you know, make these scientific discoveries that suggest management actions and say, "Well, thus science says that thou shall do this

because if you don't, then these consequences will occur with such and such probability, and therefore, you must take action."

- Gonzalez 34:
 - And I contribute to decision making by creating original knowledge on climate change, and in national parks. That's park-specific knowledge about climate change...park-specific information about climate change. And then helping staff integrate that scientific...and translating that information into a form that resource managers can use it to make decisions. So I'm on the front end of that decision making process of providing a sound, robust scientific basis for resource management, specifically under climate change.
- A rarer (atypical) example, Machlis (48) says that evidence is sometimes used in court to defend decisions: You either had a good evidence through your decision or you were sued and you lost.
- Close, but not an example:
 - Of course, this excludes talking about how science is done, e.g., "uncertainty was calculated." To be included, they would have to continue, "...and based on that uncertainty, we felt uncomfortable with using the results in a decision," for example.

SECOND CODER PROCESS AND RESULTS

Instructions given to the second coder group:

- (1) Review the themes below. I've defined them and provided examples.
- (2) *One theme at a time:*
 - a. As you read through the data subset indicate (in the designated way, see below) instances where you believe the theme is represented.
 - b. After applying the theme to each interview, reflect on the ease with which (or not) you were able to apply the theme. Would anything have made application better? (e.g., clarifications to the definition, better examples, etc.).
 - c. * It is very important that you apply the themes one at a time. But, it is up to you if you'd like to apply them all in one copy of the document or save new copy of the document each time with only one theme coded within. I like doing all at once, but some people find that messy/confusing!
 - d. **The important aspect of this exercise for statistical purposes is the *presence or absence* of the theme. In other words, don't worry about the unit of coding—when you detect the theme, you can code just the word, the sentence, the paragraph, or the entire question response where it appears. When I analyze I will look at the entire response to a question to see if you coded anything within it.
 - e. ***Not all the themes will show up in the all the documents!
- (3) See the theme indications I'd like you to use below (diversified so that you could apply in one document if you want).

- a. Inevitable change (highlight)
- b. Questioning Naturalness (underline)
- c. Defending Naturalness (~~striketrough~~)
- d. Current Policy Reflections (red text)
- e. How is science done? (Or not done) (bold)
- f. How is science used? (Or not used) (*italicize*)

(4) Return the coded documents (and any accompanying feedback) to Michelle by June 17th for intercoder reliability analysis.

(5) Enjoy your \$50.00 gift card (tell me where you want it to), and don't hesitate to ask Michelle to do the same for you if the need ever arises!

Final Results of Cohen's Kappa calculation:

Recall the scale: When $k=1$, that means there was perfect agreement among coders.

When $k=0$, that means any agreement or disagreement was probably due to chance. The scale for Cohen's Kappa is as follows:

- $k=0$, agreement is equivalent to chance
- $k=0.1-0.2$, slight real agreement
- $k=0.21-0.4$, fair agreement
- $k=0.41-0.6$, moderate agreement
- $k=0.61-0.8$, substantial agreement
- $k=0.81-0.99$, near perfect agreement
- $k=1$, perfect agreement

Though I had two colleagues complete second coding, I used only the values from the colleague who had a better knowledge of my subject matter—science policy and conservation biology in protected areas. The other coder’s values of k were lower, but she also was not as familiar with the subject matter.

Results for each code:

(1) Inevitable change

- a. 0.72, substantial agreement
- b. This code did not need to be refined.

(2) Questioning Naturalness

- a. 0.47, moderate agreement
- b. Though k was lower for this theme, it was also a far rarer code. As explained above, rarer codes are by nature likely going to have lower values of k .

(3) Defending Naturalness

- a. 0.65, substantial agreement
- b. This code did not need to be refined.

(4) Current Policy Reflections

- a. 0.47, moderate agreement
- b. The main cause for our disagreement was that she viewed discussions of funding as policy reflections, while I initially did not. She is correct, financial matters in the Park Service are determined by Congress at the highest level, so I decided to refine this theme definition to include any mentions of funding.

(5) How is science done? (Or not done)

- a. 0.58, moderate agreement
- b. Our disagreement was rooted in the fact that she marked several segments in the text of a non-scientist's interview regarding how he thinks science should be done. This is not reflective, however, of how science is currently done so I had initially decided not to adjust the code to her interpretation. Then I realized, I had construed the code as how science is done (*or not done*). In the end, I thus adjusted to her findings.

(6) How is science used? (Or not used)

- a. 0.81, substantial agreement
- b. This code did not to be refined.