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The U.S. National Park Service: Organizational Adaptation in an Era of Complexity, Uncertainty, and Change

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THE US NATIONAL PARK SERVICE: ORGANIZATIONAL ADAPTATION IN AN ERA OF COMPLEXITY, UNCERTAINTY, AND CHANGE

By

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Thesis

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Conservation agencies worldwide are facing rapid, volatile social and ecological change, which is especially problematic for bureaucratic, hierarchical conservation organizations that are designed to be stable and resistant to change. The current science and management paradigm based on Progressive era ideology is proving to be inadequate to deal with this change, and the need for a new paradigm that embraces complexity and uncertainty in our social ecological systems is emerging.

The National Park Service (NPS) is one of these organizations that has acknowledged the need to better adapt to a changing environment. An external science committee recommends in *Revisiting Leopold: Resource Stewardship in the National Parks* (*Revisiting Leopold*) that the agency transform itself into one that recognizes relationships within social ecological systems at different scales, forms new partnerships, and accepts complexity, uncertainty, and dynamism as integral components of social ecological systems. However, organizational change is challenging due to structural and cultural factors and underlying assumptions that stymie organizational learning and adaptation.

The problem addressed in this thesis is that while *Revisiting Leopold* highlights the need for the organization to adopt a new ideology better suited to complex social ecological systems, the process of transforming this type of agency on an organizational level is difficult. To address this problem and better understand how managers perceive the ideas in *Revisiting Leopold*, twenty-three semi-structured interviews were conducted with managers across the NPS. In particular, this study evaluates the events, patterns, structures, cultures, and mental models at play within the organization. Several system archetypes and organizational learning disabilities emerged from the data that limit the ability of the organization to embrace a new management and scientific paradigm. This study also contributes to a greater understanding of the NPS as a system, which allows for the identification of leverage points that can be utilized if the NPS chooses to transform itself into this new paradigm.
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Chapter 1: Introduction

1.1 Background

Worldwide, conservation agencies and organizations are facing extraordinary complexity and rapid, turbulent change in social ecological systems (Walker, Carpenter, Anderies, Able, Cumming, Janssen, Norberg, Peterson, & Pritchard, 2002); in fact, in an age of ever increasing information and data, managers across numerous diverse fields and industries are experiencing unprecedented levels of complexity (Senge, 2006). Traditionally, protected areas have been viewed as “nature islands,” or a fortress model, in which biodiversity conservation can best be attained by delineating protected areas where ecosystems are permitted to operate untouched by people (Neumann, 2005). For many conservation agencies, the current science and management paradigm, based on this fortress model and generally characterized by a related reductionist, positivist philosophy and highly specialized science, is proving to be inadequate (Fairfax, 2005). New issues that managers face are much broader, often global, in scale with more lasting impacts. Scientists understand little about their effects and their complex causal relationships. However, managers still must make decisions with limited understanding (Funtowicz & Ravetz, 1993). As a result, the current worldview “is being replaced by a systemic, synthetic, and humanistic approach,” in which “natural systems are recognized as dynamic and complex…The science appropriate to this new condition will be based on the assumptions of unpredictability, incomplete control, and a plurality of legitimate perspectives” (Funtowicz & Ravetz, 1993, p. 739).
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However, while there is some level of recognition that science and management paradigms must change in this current era of turbulence and uncertainty, some conservation agencies are having more difficulty adapting to a changing environment. This particularly occurs in mission-driven conservation agencies with strong cultures, in which the agency’s missions and goals are heavily based on values and an ethical drive. Organizations with strong cultures sometimes find it challenging to respond to changes in their environment (Nyambe, 2005; Sorensen, 2002). Perhaps more problematic is the top-down, hierarchical nature of government bureaucracies that prevent them from being responsive and adaptable, because this type of structure is often inefficient and expensive (Osborne, 1993).

Even in an attempt to be adaptive, large bureaucratic organizations tend towards stability, because organizations are inclined to institutionalize what has worked in the past and aim for predictability. Lack of stability, dependability, and meaning is difficult for most organizations and therefore creates trepidation of change, stemming from a fear of uncertainty (Schein, 1995). “But, if the economic, political, technological, and socio-cultural global environment will itself become more turbulent and unpredictable, then new problems will constantly emerge and solutions [the organization has] developed will constantly become inadequate” (Schein, 1995, p. 4). In other words, even though they may recognize a need to be more flexible and adaptive, bureaucratic organizations tend to resist change.

Many conservation agencies of this type exist, but the NPS presents an appropriate and timely case study. In 1963, a committee appointed by the then Secretary of the Interior Stewart Udall and chaired by Aldo Starker Leopold published *Wildlife Management in the National Parks: The Leopold Report*. The report has been highly influential upon the ideology of the National Park Service (NPS, 2012b) and maintains that “a national park
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should present a vignette of primitive America” (NPS, 1963). However, in light of an emerging understanding of the complexity of social ecological systems, accelerating climactic and environmental change, scientific advances, and a more diverse population of Americans and park visitors, the National Park System Advisory Board Science Committee revisited the original report in 2012. The director of the NPS charged the committee, composed primarily of external scientists, with reexamining the goals and policies of resource management and actions required to implement these policies; the resulting product was a report entitled Revisiting Leopold: Resource Stewardship in the National Parks, hereafter referred to a Revisiting Leopold. The new report calls for recognizing that “parks exist as coupled natural-human systems,” are “embedded in larger regional and continental landscapes influenced by adjacent land and water uses and regional cultures” (NPS, 2012b, p. 9), and a need for increased collaboration, new partnerships, and expanded networks (NPS, 2012a). Revisiting Leopold notes that the new ideology of resource stewardship must focus on system resilience and processes as much as the visible iconic species. This means that “broad disciplinary and interdisciplinary scientific knowledge and scholarship are necessary to manage for change while confronting uncertainty” (NPS, 2012b, p. 10). Revisiting Leopold explicitly recognizes the complexity, uncertainty and continual change that is inherent in ecosystems and the surrounding socio-political context and highlights the need for managers to increase resilience and think at broader geographical and political scales (NPS, 2012b).

The difference in rhetoric between the original 1963 Leopold Report and more recent NPS documents, such as the 2012 Revisiting Leopold report, is evidence of an paradigm shift occurring among scientists and upper-level managers in the NPS from an era of positivism and short-term issue-driven management to a new era of learning,
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recognizing relationships within social ecological systems at different scales, forming new partnerships, and accepting complexity, uncertainty, and change as integral components of social ecological systems.

This new paradigm differs from the current status quo in the NPS because current science is highly specialized and “technically esoteric” (Funtowicz & Ravetz, 1993; Lewis, 2007), and policies reflect a relatively static view of park resources. The current model is partially based on a system with one set of desired conditions that can and should be maintained over time in which human actions result in predictable effects. (NPS, 2006, section 2.2; NPS, 2006, section 4.11). Revisiting Leopold maintains that science continues to play a critical role in resource stewardship, but that resilience, landscape-scale stewardship, and interdisciplinary science must be emphasized now and into the future (NPS, 2012b). The recently published Call to Action report echoes the sentiments of Revisiting Leopold. In the Call to Action, the NPS outlines its vision for 2016 and its second century. It characterizes the first century of the agency as “focused on stewardship and enjoyment of special places,” but calls for a second century vision in which it will “extend benefits of conservation across physical, social, political, and international boundaries in partnership with others,” as well as “adapt to the changing needs of visitors, communities, and partners; encouraging organizational innovation; and give employees the chance to reach their full potential” (NPS, 2012a, p. 5). Among many other goals, it directs parks to “increase resilience in the face of climate change,” “develop a multi-sector workforce that can adapt to continuous change, think systemically, evaluate risk, make decisions based on the best science and scholarship,” and “build a more flexible and adaptive organization” (NPS, 2012a, pp. 17–21). However, while parts of the organization may already do this to some extent, some elements of this vision have yet to be realized.
The specifics of what a resilient, more flexible, and adaptive agency would look like, as well as how the NPS would get there, remains to be seen.

1.2 Problem Statement

While the *Revisiting Leopold* report recognizes the need to better adapt to a changing environment, the NPS is one of several large, bureaucratic, hierarchical organizations. While it is not an internal policy document, *Revisiting Leopold* recommends that the agency become more adaptable by transforming itself into an agency that recognizes relationships within social ecological systems at different scales, forms new partnerships, and accepts complexity, uncertainty, and dynamism as integral components of social ecological systems. However, organizational change within bureaucratic organizations can be challenging due to cultural and structural factors that reinforce stability and resistance to change, which simultaneously stymies organizational learning and adaptation (Osborne, 1993).

Thus, the current problem is that an external science committee and some members of the NPS have recognized the need for the organization to adopt a new ideology better suited to a complex social ecological system, but structural and cultural barriers are preventing the agency from moving into a new paradigm.

1.3 Guiding Questions

The primary research question in this study is *whether* and *how* the NPS can transform as an organization in order to adapt to a complex, changing, and uncertain environment. Using systems thinking as a conceptual framework, this research explores (1) how managers perceive and react to the ideas outlined in the *Revisiting Leopold* report, (2) the structural and cultural components of the NPS as
a system and underlying mental models that affect the ability of the NPS to implement the ideas in *Revisiting Leopold* and (3) processes, feedbacks, and “learning disabilities” that affect the ability of the NPS to become a learning organization.
Chapter 2: Concepts That Frame This Research

The conceptual frameworks for this study serve as the link between the research problem, literature, methodology, and analysis. In particular, they help frame and better understand the following questions:

1. How do managers perceive and understand the ideas outlined in the *Revisiting Leopold* report?

2. What are the structural and cultural components of the NPS as a system and underlying mental models that affect the ability of the NPS to implement the ideas in *Revisiting Leopold*? And,

3. What are the processes, feedbacks, and “learning disabilities” that affect the ability of the NPS to become a learning organization?

The conceptual frameworks also guide decisions about who in the organization to talk to and the development of appropriate interview questions that help answer the guiding research questions.

This thesis employs systems thinking as the primary conceptual framework, and relies most heavily on Peter Senge’s model (Figure 1). The context for this study is increasing complexity and change in social ecological systems, making systems thinking particularly applicable because of its ability to identify recurring patterns, processes, and relationships in the midst of dynamic complexity. The ideas presented in the *Revisiting Leopold* report, such as managing for change, embracing uncertainty, working across boundaries at landscape and seascape scales, and managing for resiliency, among others, align neatly with the components of systems thinking.
A number of other academic fields are also relevant to and contributed to the research questions in this study (Table 1). Systems thinking was therefore an appropriate model because components of the concept emerge in literature across disciplines. The fundamental concepts of Senge’s framework also resonate through Schein’s work on organizational culture (Schein, 1995), Meadow’s work in the field of sustainability (Meadows, 1999), Fernandez and Rainey’s research in public administration (Fernandez & Rainey, 2006), Kotter’s research on leadership and organizational change (Kotter, 2007), and to an extent, Rogers’ diffusion of innovation theory (Rogers, 2003), among others. Thus, systems thinking served as a useful unifying thread.
Table 1: Supporting Concepts and Their Application to this Study

<table>
<thead>
<tr>
<th>Supporting Concepts</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Paradigms (Khun &amp; Popper)</td>
<td>How do scientific paradigms change?</td>
</tr>
<tr>
<td>Postnormal Science (Funtowicz &amp; Ravetz)</td>
<td>Why is the current scientific paradigm inadequate?</td>
</tr>
<tr>
<td>Diffusion of Innovations (Rogers)</td>
<td>Who are the change agents (early adopters) in the NPS?</td>
</tr>
<tr>
<td>Social Ecological Systems (Ostram, Walker &amp; Salt, others)</td>
<td>What does this new paradigm look like? Do managers understand it? Are NPS managers systems thinkers?</td>
</tr>
</tbody>
</table>

While this study focuses more on systemic processes and barriers to organizational change than it does on how a scientific paradigm shift would occur in the NPS, questions about the nature of paradigm shifts remain relevant and provide useful background. In particular, Karl Popper and Thomas Kuhn provide background and raise interesting questions about how scientific paradigms change, specifically with regard to whether new scientific approaches occur gradually and incrementally or whether there is a more abrupt paradigm shift in response to some crisis.

In turn, the nature of scientific change leads to questions about the role of science in the NPS. The concept of postnormal science presents one way to think about a new type of science appropriate to the complex, value-laden environment in which conservation agencies often operate and helps formulate questions about the type of decisions that
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managers make and the way that science, values, risk, and uncertainty factor into NPS decision-making.

The properties of this new paradigm as described in *Revisiting Leopold* are consistent with the properties of systems thinking and resilience. These concepts help to define the “system” and unpack the new ideology that *Revisiting Leopold* is describing. In other words, these theoretical concepts help identify what this new ideology looks like. The concept of systems thinking (of which resilience is a component) leads to questions about how *Revisiting Leopold* is perceived by NPS managers, whether it is understood by managers, whether it is indeed a new way of thinking or something managers feel they are already doing, and whether managers think that adopting and implementing this new ideology is even possible.

Finally, literature on the nature and characteristics of organizational change inform the sampling frame and the formulation of questions about whether and how the organization can undergo this type of transformation and become a learning organization. Diffusion of innovation theory speaks to how new ideas diffuse through organizations and how different types of people play different roles in the spread of a new idea; therefore it informs who was interviewed for this study. Organizational culture literature informs questions and analysis about the process of culture change in an organization, incentive structures, success, and risk-taking. Senge’s framework for creating a learning organization through the use of systems thinking contributes to analysis by highlighting factors that facilitate and hinder learning and adaptation in an organization at a variety of system levels. Finally, this study relies on Senge’s concept of archetypes and learning to support data analysis by helping to isolate patterns, processes, and feedback loops that affect the ability of the organization to learn and adapt. Together, the literature on diffusion of innovation
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theory, learning organizations, organizational culture, and systems thinking has informed questions about and analysis of whether and how the NPS can move into this new paradigm, the structural and cultural barriers that affect the ability to adopt the ideas in *Revisiting Leopold* and become more adaptive, and who in the organization to interview.

2.1 How Do We Think About Paradigm Shifts and Scientific Approaches?

Many of the ideas expressed in *Revisiting Leopold*, especially related to systems thinking and resilience, surfaced in academic literature the 1960’s and 1970’s respectively (Ackoff, 1962; Holling, 1973; Mingers & White, 2010), so why have they taken so long to emerge in NPS rhetoric? If the NPS is indeed moving towards a different scientific paradigm than the status quo, then it becomes important to understand how scientific paradigms change and the role of science in the NPS.

2.1.1 How do Scientific Paradigms Change?

Thomas Kuhn, in his seminal 1962 book *The Structure of Scientific Revolutions*, argues that change does not happen gradually. Rather, a new scientific regime replaces an existing scientific regime when it becomes evident that the existing approach is inadequate to address problems or explain anomalies posed by the environment. He terms these scientific revolutions “paradigm shifts” as a response to the view of “normal science,” that scientific knowledge accumulates and builds upon itself. The success of normal science, Kuhn writes, is attributable to “the ability of scientists regularly to select problems that can be solved with conceptual and instrumental techniques close to those already in existence” (Kuhn, 1998, p. 90). Instead, according to Kuhn, paradigms change in response to some crisis that causes the abandonment of a previous paradigm or institutional framework (Kuhn, 1998).
The alternative view and primary criticism of Kuhn’s assessment of scientific change is based on Karl Popper’s argument that change occurs incrementally and no paradigm is dominant. The objective of science is to find truth by the process of falsification and deduction; the elimination of what can be proved false will generate further scientific questions and in this way, new theories emerge. Thus Popper believes that knowledge evolves through “permanent scientific revolutions,” that each rejection of false scientific claims represents a revolution (Shareef, 1997).

This debate raises key questions for the shift in the scientific and managerial approach of the NPS. If the current science and management paradigm, generally characterized by a related reductionist, positivist philosophy and highly specialized science, is inadequate (Fairfax, 2005), then will the NPS be forced to change in response to a crisis? Will change happen incrementally, as Popper suggests? The question of whether a paradigm shift in the NPS will occur according to Khunian or Popper philosophies is beyond the scope of this research, but the literature on how scientific paradigms change provides important context for understanding the unique position in which the NPS finds itself.

### 2.1.2 What is the Role of Science in an Era of Complexity and Change?

These questions translate into related queries about what the old and potentially new scientific paradigms look like. For example, the question above inspired by Kuhn’s work concerning the limitations and anomalies in both the old and new paradigms lead to questions about the current and future role of science in the NPS. Whatever the nature of scientific change, why is the old scientific paradigm inadequate, and what will be the new approach to science? The concept of postnormal science presents one way to think about a
new type of science appropriate to the complex, value-laden environment in which conservation agencies often operate, and informs questions about the type of decisions that managers make and the way science is used in NPS decision-making.

Many of the important decisions made by NPS managers involve high profile, complicated situations in which stakeholders have polarized values (Lewis, 2007). Funtowicz and Ravetz discuss the inadequacies of traditional scientific methodologies in these instances and the emergence of a new scientific regime that is much better suited to situations involving high stakes, high levels of complexity, contested values, and urgent decisions (Funtowicz & Ravetz, 1993).

Before proceeding, it is important to define what is meant by complexity in this context. Emergent complexity within a system differs from ordinary complexity in its characteristics of stability and change. A system of emergent complexity is more unstable and experiences constant novelty. The behavior of ordinary complexity can be explained by processes with basic purposeful goals such as growth and survival. Emergent complex systems, however, do not operate “mechanistically and functionally; in them, at least some of the elements of the system possess individuality, along with some degree of intentionality, consciousness, foresight, purpose, symbolic representations and morality” (Funtowicz & Ravetz, 1994, p. 570). The difference between these two types of systems is the difference between a closed, predictable system and the more value-laden, volatile social ecological systems in which parks are operating today. Therefore, references to increasingly complex systems throughout this paper refer to systems characterized by emergent complexity.

Given the emergently complex systems in which the NPS functions, Funtowicz and Ravetz contend that traditional, positivist science is inadequate.
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“The reductionist, analytical worldview which divides systems into ever smaller elements, studied by ever more esoteric specialism, is being replaced by a systemic, synthetic, and humanistic approach. The old dichotomies of facts and values, and of knowledge and ignorance, are being transcended. Natural systems are recognized as dynamic and complex; those involving interactions with humanity are ‘emergent,’ including properties of reflection and contradiction. The science appropriate to this new condition will be based on the assumptions of unpredictability, incomplete control, and a plurality of legitimate perspectives.” (Funtowicz & Ravetz, 1993, p. 739)

The supremacy of the scientific method and the “technically esoteric” expertise of its scientists have subjugated all other forms of knowledge. Local knowledge of the environment, experience, and skills have been diminished and replaced by a form of science that in reality only legitimizes the knowledge of those with the ability to dedicate many years to higher education. Additionally, as mentioned above, this existing scientific paradigm is inadequate to address complexities and values associated current management issues (Funtowicz & Ravetz, 1993). Alvin Weinberg makes a similar argument in his differentiation between research and trans-science, in which he argues that some scientific questions contain so many variables and complex relationships that they cannot be answered by science. In short, research science, premised on unanimity and the absence of ambiguity, is insufficient for policy-making (Weinberg, 1972). For the purpose of this study, these insights prompt more specific research questions, such as, what types of decisions are managers faced with, and how do they make these decisions? What is the role of science, politics, and stakeholder values in decision-making? How are decision-makers dealing with complexity and change that is not fully understood?
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Funtowicz and Ravetz present postnormal science as a response to postmodern science, in which postnormal methodology accepts and addresses uncertainty, and values are dealt with overtly, rather than presumed. Geographic, temporal, and historical context is critical, and interactive communication is the basis for making scientific cases rather than the process of deduction (Funtowicz & Ravetz, 1993). Since “the policy issues of risk and the environment present the most urgent problems for science, uncertainty and quality are moving in from the periphery…of scientific methodology to become the central, integrating concepts” (Funtowicz & Ravetz, 1993, p. 792). This is not to suggest, however, that traditional positivist or applied science is not valuable or applicable, but that it is most useful when uncertainty and decision stakes are low. When uncertainty and decision stakes are high, they suggest professional consultancy (Funtowicz & Ravetz, 1993).

However, Carolan (2006) provides a critique of the democratization of science when complexity and risk are high, particularly as it relates to resource management and environmental decision-making. The inclusion of non-scientists in risky, complex, value-laden situations condones the exclusion of non-scientists when addressing more straightforward scientific questions; in other words, distinguishing between postmodern or research science and a different type of science that addresses uncertainty, such as postnormal science, implies that uncertainty is not inherent in science itself. As an alternative, the author proposes viewing problem-solving and decision making through the lens of various types of expertise. Particularly relevant to resource management issues is that of “public expertise,” referring to the integration of public values, which is especially vital when addressing environmental risks and hazards, as well as issues based on value judgments. If traditional equilibrium models are being replaced by acceptance of dynamic non-equilibrium models, then opinions about what states of an ecosystem are acceptable, or
the “right” ones present a new avenue for value judgments, in which case multiple types of expertise and the recognition of multiple legitimate perspectives is necessary (Carolan, 2006). While improving the adequacy of scientific methodology to deal with emergently complex systems is essential, Turnpenny et al. (2010) note that improved evidence does not automatically cause improved or even different decision-making. Existing organizational structures, laws, and policies may limit the scope of possible options and solutions, which hampers the open dialogue that postnormal science espouses (Turnpenny, Jones, & Lorenzoni, 2010).

The points and critiques that Carolan raises inform this research by raising the questions about the role of uncertainty and risk in all scientific decisions. For example, to understand the role of science in NPS decision-making, questions about how managers deal with uncertainty and risk as well as how acceptable it is to express uncertainty or take risks when making decisions become relevant. Because NPS managers often have to make value-judgments about what constitutes “ecosystem health,” or what states of an ecosystem are deemed the “right” ones, managers were also asked about public expertise in making value-laden decisions. In the final portion of this chapter, organizational behavior literature helps address Turnpenny et al.’s points about institutional structures that limit the implementation of postnormal science.

This concept of postnormal science (or trans-science) and its critiques will help distinguish between characteristics of the old and new paradigm, as well as bring to bear the limitations of different scientific approaches in solving complex resource management problems. The literature highlights the emergent complexity of the socio-ecological systems in which the NPS operates and helps characterize shifting scientific ideologies and approaches in the NPS as well as the type of information that is informing manager’s
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decisions. Finally, the concepts of emergent complexity and the nature of the urgent, high
stakes, value-laden decisions that managers are faced with helps narrow the sample to
managers at high-profile parks where management decisions are often publicly contested.

2.2 What are the Properties of This “New” Paradigm?

The properties of this new paradigm as described in Revisiting Leopold are
consistent with the properties of systems thinking and resilience. Systems thinking and
resilience literature serve both to help define the “system” and better understand the new
ideology that Revisiting Leopold is describing. The concept of systems thinking (of which
resilience is a component), informs questions about how Revisiting Leopold is perceived by
NPS managers, whether it is understood by managers, whether it is indeed a new way of
thinking or something managers feel they are already doing, and whether managers think
that adopting and implementing this new ideology is even possible.

2.2.1 What is the “System?”

The literature and rhetoric surrounding SES research and resilience thinking often
employ the term “system,” and Elinor Ostrom helps readers understand and define a
system. She warns against oversimplification, yet offers a conceptual model in which a
system is comprised of interacting attributes of a resource structure (e.g. a forest, lake, or
grazing area), the resource units produced (e.g. timber, fish, cattle), the users of the system,
and the governance of the system, and each of these four components have multiple
variables (Anderies, Janssen, & Ostrom, 2004; Ostrom, 2007). Applied to the NPS, the
system at a broad organizational level consists of (1) all of the National Park System units,
including their biophysical resources, (2) the resource units they produce, including but not
limited to visitor experiences, ecosystem services, and cultural meanings, (3) the users of
the system, or employees, visitors, interest groups, local people, and those interested in or affected by park management, and (4) the governance, or laws, policies, and management decisions that affect the parks. However, a system exists within a nested hierarchy of systems, meaning there are multiple complex systems at various scales that influence each other (Walker & Salt, 2006, p.89). In other words, the NPS system exists within a larger system of the federal government, while simultaneously encompassing many smaller systems at the regional and park unit levels and smaller. *Revisiting Leopold* asks managers to think about the hierarchy of larger systems in which they operate; therefore, interview questions were partly designed to gauge the scales at which managers think and operate.

2.2.2 *What is Systems Thinking and Why is it Useful?*

Systems thinking began by examining concepts such as how segments of systems contribute to the whole, environmental and system boundaries, system structure, processes, hierarchies, feedback loops, and the role of knowledge of and control over systems (Mingers & White, 2010). Ackoff, an early founder of the field, raised the point that management problems are often misdiagnosed and improper methodologies are applied. While traditional science is highly useful for identifying whether a specific phenomenon causes another, it has no way to discover what other phenomena, events, or objects may have also caused the problem or situation. This shortcoming indicates the need to better understand organizational structure, communication, and decision-making processes (Ackoff, 1962).

As the applicability of the systems thinking concepts to a variety of fields became evident, these concepts coalesced into what is now largely referred to as the systems approach. The systems approach generally refers to four primary components: (1)
Understanding a circumstance holistically rather than from a reductionist mindset and the varied interacting variables within a social ecological environment; (2) acknowledging that relationships between variables are more significant than the variables themselves in affecting system behavior; (3) understanding a hierarchy of nested systems, each with their own properties, that also mutually influence each other; and (4) acknowledging that people behave in different ways due to differing goals, agendas, and rationalities (Mingers & White, 2010).

Systems thinking addresses many of the issues facing the NPS today. In light of the increasing complexity and scale involved in today’s resource stewardship problems, as well as the volatility and unpredictability of rapid social and environmental change, Revisiting Leopold calls for a recognition of “coupled human-natural systems,” a focus on system resilience and processes, and a new science and stewardship ideology based on new partnerships, thinking at broader scales, and interdisciplinary scholarship” (NPS, 2012b).

Peter Senge notes the importance of systems thinking for all institutions and organizations.

“Today, systems thinking is needed more than ever because we are becoming overwhelmed by complexity. Perhaps for the first time in history, human kind has the capacity to create far more information than anyone can absorb, to foster far greater interdependency than anyone can manage, and to accelerate change far faster than anyone’s ability to keep pace.” (Senge, 2006, p. 69)

Senge goes on to explain how organizations can use systems thinking to become more productive and successful learning organizations, or how they can adapt to change and unpredictability in their complex environment. “Adaptability captures the capacity of a social ecological system to learn, combine experience and knowledge, adjust its responses to changing external drivers and internal processes, and continue developing within the
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current stability domain” (Folke, Carpenter, Walker, Scheffer, & Chapin, 2010, p. 2). Thus, a learning organization is one that is highly adaptable, and the field of systems thinking encompasses tools and concepts of organizational learning and adaptability that can be mutually informative.

Incorporating systems thinking in order to become more adaptable is largely what Revisiting Leopold is asking the NPS to do. The literature on systems thinking helps formulate questions about whether NPS managers understand the properties of this new ideology. For example, in order gauge managers’ understanding of these concepts, they were asked how they envision the agency dealing with complexity and change. As Revisiting Leopold talks about “coupled human-natural systems,” managers were also asked how they distinguish between and deal with natural and anthropogenic components of the social ecological system.

2.2.3 How is Resilience a Form of Systems Thinking?

Resilience first emerged approximately forty years ago in C.S. Holling’s 1973 article, Resilience and Stability of Ecological Systems (Holling, 1973). Resilience is a fundamental concept of systems thinking that addresses the dynamics and processes of social ecological systems (Folke et al., 2010). It incorporates contemporary concepts of nonequilibrium models of systems, promotes redundancy over efficiency (if more actors fill the same function, a system is more resilient), and encourages managers to identify thresholds (or points at which a system’s processes and properties reorganize and tend towards an alternative equilibrium or stable state), and collaborate with stakeholders (Walker & Salt, 2006; Brunson, 2012). Rather than assuming that systems reach a stable, static, climax state, a nonequilibrium model and resilience thinking in general recognizes
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that systems are subject to disturbance, or shocks to the system (Brunson, 2012, p. 633) and have multiple stable states. Multiple stable states means that although a system may tend towards an equilibrium, there may be several possible and desirable equilibriums, and these equilibriums will change over time (Cote & Nightingale, 2011, p. 476). The term resilience specifically refers to how well a system can undergo shocks and disturbances and still retain the ability to function in a similar way such that its social and ecological processes and feedbacks are still intact (Holling, 1973, p. 14).

A similar and related concept to resilience is that of robustness. Robustness refers to “the maintenance of system performance either when subjected to external, unpredictable perturbations, or when there is uncertainty about the value of internal design parameters” (Anderies et al., 2004, p. 1). A social ecological system is robust if it keeps the ecological component of the system from transferring into a new domain of attraction (stable state) that will not sustain people or will cause the social component of the system to suffer. While resilience is very similar and still quite useful in a conceptual sense, robustness is helpful when the system has an element of design, as opposed to being completely self-organizing. In other words, in a system that is completely self-organized, it is difficult to create adaptive capacity (Anderies et al., 2004). In the NPS, robustness may help apply and design for resilience in a deliberate sense.

For the purpose of this study, the concepts of systems thinking, resilience, and robustness inspire questions about how Revisiting Leopold is perceived and understood by NPS managers. Specifically, these concepts help assess whether managers understand the ideas in Revisiting Leopold, whether they believe it is indeed a new way of thinking, or whether it’s something they believe they are already doing. Managers were asked to describe their reactions to and understanding of the report, whether they believe this
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represents a shift in ideology or a new paradigm for the NPS, as well as what they believe a resilient National Park System would look like.

2.3 What Do We Know About Organizational Change?

If managers understand this new ideology based on systems thinking, and believe that it’s both valuable and possible to attain, then questions about how a mission-driven organization transforms itself become particularly salient. This study drew upon literature from the disciplines of organizational change, business, organizational behavior, public administration, and others in order to formulate questions about whether and how the agency can transform itself and to decide whom to interview. This section discusses diffusion of innovation theory and the role of people in spreading a new idea through a social system, Peter Senge’s concept of the learning organization and structural impediments to learning and adaptation, and finally, ways in which organizational culture may present barriers to organizational change.

2.3.1 How do New Ideas Diffuse Through Organizations?

Rogers (2003) defines an organization as “a stable system of individuals who work together to achieve common goals through a hierarchy of ranks and a division of labor. Organizations are created to handle large-scale routine tasks through a pattern of regularized human relationships” (Rogers, 2003, p.404). Their ability to coordinate individual efforts is partially a result of their stability and “high degree of structure that is imposed on communication patterns” (Rogers, 2003, p.404). Bureaucratic organizations are characterized by authoritarian control, in which policies and directions are given by those in authority and executed by the individuals who accept the structure of authority (Rogers, 2003).
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Diffusion, as referred to in innovation research, “is the process in which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 2003, p. 5). Rogers also notes that “diffusion is a kind of social change, defined as the process by which alteration occurs in the structure and function of a social system” (Rogers, 2003, p.6). In this case, the new idea, or innovation, is the scientific and management ideology described in Revisiting Leopold. The social system is the NPS (although adoption of this new ideology would result in the understanding that the NPS is part of and connected to a larger socio-political system), and this research explores the change in structure and function of the NPS as a social system.

Diffusion of innovations theory suggests that the transmission of ideas happens most often between people who are alike, or homophilous, which can be problematic in organizations in which members are heterophilous, or come from different backgrounds, disciplines, and academic specialties. Organizations and people can also be more or less innovative, meaning the degree to which an idea is adopted earlier relative to other members of the system. Rogers defines five adopter categories of innovativeness, including the (1) innovators themselves, (2) early adopters, (3) early majority, (4) late majority, and (5) laggards. Time is also a factor in the rate of adoption, or “the relative speed with which an innovation is adopted by members of a social system” (Rogers, 2004, p.23).

Thus, based on diffusion theory, this study focuses on early adopters, or the opinion leaders in the organization that serve as a role model for other individuals. Early adopters are respected and in a central position in the communication network of a system (Rogers, 2003). This group has the most influence on how this new paradigm described in Revisiting Leopold is perceived, understood, and adopted. The pool of superintendents and resource managers at high profile parks likely fit this description: they are usually opinion leaders
and well respected within their parks. They are in a central position in the communication network because they are highly aware of and in-touch with policy from higher echelons of the NPS, but are also working on-the-ground in parks, and are attune to local issues. Additionally, several innovators were interviewed, or those who contributed to Revisiting Leopold, in order to provide additional insight into the thinking behind the report and how they envision the agency adopting this new ideology.

While degree of innovativeness is an important component in the spread of a new idea, the social structure of an organization plays a key role as well. The social structure, or the “patterned social relationships among the members of a system” (Rogers, 2003, p. 24), lends predictability and regularity to the way humans behave and determines the how information is communicated through people in an organization. In addition to organizational structure, organizational culture can affect the diffusion and adoption of new ideas. Organizations have norms, or “established behavior patterns for members of a social system… [that] tell individuals what behavior they are expected to perform” (Rogers, 2003, p.26). In some cases, an organization’s norms can be impediments to innovation or change (Rogers, 2003). This concept, that social structure and culture of an organization play a role in the diffusion of a new idea in an organization, supports the use of organizational behavior literature to further investigate the adoption of this new ideology in the NPS.

The concept of diffusion theory lends insight into how the social, structural, and cultural elements of the agency contribute to or inhibit the adoption of a new idea and supports a sampling frame composed primarily of superintendents and division chiefs, along with other early adopters at the regional and national level.
2.3.2 The NPS as a Learning Organization: What Facilitates and Hinders the NPS from Learning and Adaptation?

Government organizations of all kinds are encountering difficulties when it comes to adaptation, largely because of the systems in which they operate. Budget and hiring systems can be burdensome and inefficient, yet many of these systems worked well when they were created. Top-down, hierarchical agencies with many rules and regulations were originally designed to deliver a “standardized service,” or solve a problem, and bureaucrats were in control (Osborne, 1993). Now however, “in this environment of rapid change, the old top-down bureaucratic monopolies delivering standardized services are not effective. To be effective today, a government organization must be lean, fast on its feet, responsive…capable of adjusting to constant change, able to improve productivity” (Osborne, 1993, p. 351).

Peter Senge’s model of the learning organization is particularly applicable to understanding the structure of the NPS and the processes and feedbacks operating within it. Senge describes five disciplines, or qualities of learning organizations, necessary to maximize their success. Additionally, he identifies several “learning disabilities” that limit learning and success within individuals and organizations, as well as ten “archetypes,” or structural reinforcing patterns common in organizations that prevent the attainment of common goals (Senge, 2006). Systems thinking served as the primary conceptual basis for data analysis and was used as a tool to discern relationships, patterns, and structures occurring within the organization. In particular, Senge’s concepts of mental models, archetypes, and learning disabilities were used to identify feedbacks and processes that affect the ability of the organization to adapt and learn.
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Systems thinking is the first yet most fundamental of the five disciplines. Senge’s description of systems thinking is based on paying attention to the whole system in which an organization operates and its interrelationships, as opposed to relying on the natural tendency to focus on individual components, or “snapshots.” This includes the understanding of how actions and decisions play out over time. Systems thinking in this context is a collection of knowledge and set of tools developed to help individuals and organizations discern relationships across broader scales (Senge, 2006). Another of the five disciplines concerns mental models, which “are deeply ingrained assumptions, generalizations, or even pictures or images that influence how we understand the world and how we take action” (Senge, 2006, p.8). Quite often, people are not explicitly aware of their mental models or how they influence their decisions and actions. Productive learning involves introspectively examining internal assumptions and perceptions, as well as sharing them and allowing mental models to be influenced by others (Senge, 2006).

For example, Senge, Smith, Kruschwitz, Laur, and Schley present an “iceberg model” as a metaphor to illustrate how to examine complex situations at multiple levels. When organizations or people face difficult problems, it is easy to attribute it to a prior event. But, like an iceberg, much of the dynamics are occurring below the surface and aren’t immediately visible. Thus, to change an organization or solve a problem, it is important to look at patterns and trends, institutional structures, and mental models to understand the system (Figure 1). The further “down” on the iceberg, the more leverage one has to change the situation or influence the system (Senge et al., 2008).
Together, implementing Senge’s disciplines contributes to the development of a learning organization, or an organization that maximizes its success, adaptability, and sustainability. However, even the most successful organizations often do not maximize their potential due to common learning disabilities. “The way they are designed and managed, the way people’s jobs are defined, and, most importantly, the way we have all been taught to think and interact (not only in organizations but more broadly) create fundamental learning disabilities” (Senge, 2006, p.18). Senge defines seven learning disabilities that describe ways in which organizations hamper their own ability to learn and adapt. For example, organizations may fixate on events, in which a single, recent event becomes the explanation for a problem rather than “seeing the longer-term patterns of change that lie behind the events and from understanding the causes of those patterns” (Senge, 2006, p.21). Often, organizations and people fail to learn from their actions
because the consequences of those actions may not appear immediately, and teams of
people are unable to learn because they are focused on protecting their immediate, personal
interests and reducing the appearance of conflict or ignorance (Senge, 2006).

Senge’s framework of systems thinking, including the concept of the iceberg model,
serves as a useful tool with which to better understand how characteristics of the NPS exist
at multiple “levels” of the iceberg and how these characteristics may be barriers to adopting
the ideas in Revisiting Leopold. The concepts of learning disabilities and mental models
frame the analysis of interview data in terms of fundamental barriers and underlying
assumptions that hamper the ability of the NPS to becoming a learning organization
capable of adapting to its changing environment. Based on this concept of a learning
organization, managers were asked about structural and cultural characteristics of the
organization, including incentives for working towards longer-term goals rather than
attaining short-term achievements and working with others at broader scales.

2.3.3 What Are the Potential Structural Barriers to Adaptation and Why Do They Exist?

Like Senge’s learning disabilities, systems archetypes provided another useful
framework to identify and describe organizational structure impediments in the NPS to
becoming more adaptive and successful. However, where learning disabilities can operate
at the level of a single person, a team, a park, or the whole organization, archetypes operate
at the level of the system itself. “The purpose of the systems archetypes is to recondition
our perceptions, so as to be more able to see structures at play, and to see the leverage in
those structures” (Senge, 2006, p.94). The systems archetypes stem from a premise of
systems thinking, that patterns and relationships of which an organization is unaware often
are detrimental to the organization itself. Even among complex management problems,
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predictable patterns emerge. Once they are identified, it becomes easier to identify leverage points, or places where a small change can result in a great improvement in the situation. Senge identifies ten systems archetypes, each of which has a unique structure of reinforcing processes (sometimes called positive feedback loops), balancing processes (or negative feedback loops), and delays or time lags (Senge, 2006).

Identifying system archetypes from the interview data helps detect the larger feedbacks and processes at play in the NPS. This concept informed questions about organizational structure, challenges to implementing Revisiting Leopold, and whether respondents believe a mission-driven organization is structured to facilitate this kind of change. However, during the process of data analysis, system archetypes emerged throughout the data from a variety of interview questions.

2.3.4. What Are the Potential Cultural Barriers to Adaptation and Why Do They Exist?

The NPS emerged from the Progressive era, a culture that became deeply ingrained in the agency (Fairfax, 2005). Fairfax characterizes the land management doctrine of this era as one in which “centralized science and priorities replaces local experience and goals” (Fairfax, 2005, p. 264). However, the current global trend towards cooperation and the incorporation of local input, experiences, and knowledge, is at odds with the agency’s traditional political forests culture. “Therefore, we have a tentative conclusion that Progressive Era agencies are culturally inappropriate to the present era… and paramilitary uniformed, government agencies like the NPS and USFS are not optimal, perhaps not viable, or even relevant, to the 21st century” (Fairfax, 2005, pp. 265–266). Thus, a further examination NPS culture as it relates to the agency’s ability to adapt to a rapidly changing environment is warranted.
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Even in an attempt to be adaptive, organizations like the NPS tend towards stability, because organizations are inclined to institutionalize what has worked in the past and aim for predictability. Lack of stability, dependability, and meaning is difficult for most organizations and therefore creates trepidation of change, stemming from a fear of uncertainty. But, if an organization is unable to adapt, or “learn how to learn” (Schein, 1995, p. 5), then the organization will fail, and likely won’t succeed unless it is able to reduce the anxiety associated with learning (Schein, 1995). More specifically, it is important to consider what kind of organizational culture would foster continual learning at the agency scale. Schein defines culture as “shared mental models – shared ways of how we perceive the world, what mental categories we use for sorting it out, how we emotionally react to what we perceive, and how we put value on things. Culture is about tacit ways of being; it reflects the deeper and more pervasive elements of our group life” (Schein, 1995, p. 11).

Broadly speaking, U.S. culture as a whole often influences the culture of its organizations. Many organizations are based on a hierarchical model in which managers are expected to maintain total control and be dominant and confident in their decisions. Because this is not always consistent with reality, managers must themselves be able to learn and accept and admit their own susceptibility and uncertainty. Another hindrance to learning is that job duties are often very compartmentalized, or segregated from personal issues, such that job or task related problems are given priority over intrapersonal issues. The result of this compartmentalization is that the primary role of the managers is seen as quantitative, usually at the expensive of fostering more qualitative attributes such as communication and workplace dynamics. Additionally, organizational culture often has a bias towards the short-term rather than the long term. Reports and evaluations are often
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based on short-term numbers rather than long-term morale or employee development. In reality, building an adaptable organization is a long-term effort (Schein, 1995). Schein’s work in the organizational culture literature helps identify cultural aspects of the NPS that affect its ability to learn and adapt. Managers were asked to describe how success is evaluated and rewarded and about incentives for working towards long-term goals rather than short-term goals.

Organizational culture can be especially difficult to change when it is deeply ingrained (Levin & Sanger, 1994 in Sanger, 2008). While some theorists believe that the external environment drives organizational change, many leaders still attempt to change their organization from within (Sanger, 2008). Sanger’s study on creating a more flexible, adaptable, performance-based culture in government found that successful cultural transformation required “bold and sustained leadership” (Sanger, 2008, p. 641) in which leaders both model the cultural transformation themselves and communicate the goals to all employees, specifically by “pushing decision making down and empowering employees to act with accountability” (p. 641). Effective leaders encourage risk-taking by having a high tolerance for well-intentioned errors while creating a feedback system to see what works. Sanger found that successful cultural change involves “managing up as well as down” (p. 641). Managers must redistribute power to encourage greater participation of all agency employees and create more flexible budget and spending rules; the capability to change plans along the way necessitates the backing of external stakeholders (Sanger, 2008). For the purpose of this thesis, Sanger’s work supported questions about risk-taking and the extent to which failure is tolerated in the work place; it also informed analysis around the level of flexibility managers feel they possess and recommendations for agency transformation.
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In addition to leadership and incentive systems within an organization, the mission also has a strong influence on agency culture. The mission of a government agency can be empowering for employees, and a mission-driven agency can be quite effective when managers are able to “determine the best way to accomplish their agency’s mission” (Osborne, 1993, p. 353). Creating a vision and a sense of purpose is perhaps one of the most fundamental components of a successful organization, because goals, values, and behaviors all stem from the organization’s mission. A mission is most powerful if employees throughout all levels of the organization buy into it, rather than if it is merely pushed from the top-down. In fact, there are often “meaning-makers” within various levels of an organization that articulate and manifest what the group of employees as a whole truly stands for and works towards (Raelin, 2006).

The mission of the NPS is to “preserve unimpaired the natural and cultural resources and values of the national park system for the enjoyment, education, and inspiration of this and future generations” (NPS, 2014). Preserving resources “unimpaired” appears to imply a contradiction to some of the ideas in *Revisiting Leopold* such as managing for change and uncertainty. Because of the importance of the mission within a mission-driven agency, and the importance of “meaning-makers” throughout an organization, respondents were asked questions about the mission as it relates to *Revisiting Leopold* in order to understand the degree of buy-in amongst these early adopters and the meaning they ascribe to the mission.

Measurement of organizational culture in the literature most often uses values as a representation of culture (Jones, Jimmieson, & Griffiths, 2005). A common framework used to assess organizational culture is the Competing Values Framework (CVF), which examines the competing demands of organizations. Two axes create four quadrants. On the
horizontal axis, an organization either focuses on their internal or their external environment; on the vertical axis, an organization values either flexibility or control (Jones et al., 2005; Parker & Bradley, 2000). Government conservation agencies in the U.S., such as the NPS, typically fall within the control/internal focus quadrant, or the “internal process model,” which displays a “hierarchical culture…involving the enforcement of rules, conformity, and attention to technical matters” (Parker & Bradley, 2000). Parker and Bradley suggest that this hierarchical culture may inhibit public sector organizations from transforming, regardless of policies that may be in place to encourage change (Parker & Bradley, 2000). How then, can cultural change in the NPS occur? Parker and Bradley’s work suggests that even if the NPS changes its policies to reflect current ecological knowledge, cultural change will not necessarily follow.

One way to assess whether NPS culture can change is by examining readiness for change. Jones, Jimmieson, and Griffiths (2005) examined how organizational culture influences readiness for change and change implementation success. The authors define readiness for change as “the extent to which employees hold positive views about the need for organizational change (i.e. change acceptance), as well as the extent to which employees believe that such changes are likely to have positive implications for themselves and the wider organization” (Jones et al., 2005, p. 362). Employees who believe their organization has flexible polices and procedures are more likely to perceive their agency and coworkers as being more responsive to change, and opposition to change is typically minimal in a supportive and inclusive culture (Jones et al., 2005). Unfortunately, as the NPS falls within the control/internal focus quadrant, or the “internal process model,” readiness for change is likely to be quite low. However, if an organization wants to increase its readiness for change to facilitate a more fundamental cultural change, it should work to
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enhance open communication, participatory decision-making, and the perception that its policies and procedures can be flexible.

There are a variety of theoretical perspectives on how organizational change occurs within the public sector, specifically regarding whether cultural change is catalyzed by internal or external drivers. Despite disparities in the literature, there seems to be some agreement on components of successful organizational change in practice. Fernandez and Rainey (2006) present eight determinants of successful implementation of organizational change in the public sector, which share commonalities with Lovegrove, Ulosevich, and Warner’s (2010) five frames of transformation in government. Both strategies focus on ways that managers can lead and foster effective change.

Fernandez and Rainey’s eight determinants are distilled from common themes prevalent in the organizational change literature. The authors note that the process is not necessarily linear and all steps may not be necessary, but each contributes positively to successful change initiatives. The eight determinants are: (1) effectively communicate the need for change; (2) provide a plan with a clear, specific strategy based on causal theory; (3) build internal support and participation; (4) ensure top management support and have someone champion the cause; (5) build external support from stakeholders; (6) provide resources (financial, human, and technological); (7) institutionalize change by monitoring and sustaining implementation over time; and (8) pursue comprehensive change by understanding the subsystems of the organization and ensuring that the change is consistent throughout (Fernandez & Rainey, 2006). These eight determinants are also remarkably similar to Kotter’s (2005) eight steps for organizational transformation (Kotter, 2007).

Based upon Fairfax’s view that the current NPS mission is no longer culturally relevant, Schein’s view that large organizations are hesitant to change their fundamental
meanings, and Jones et al.'s concept of readiness for change, managers were asked about whether they believe a mission-driven organization such as the NPS can undergo this type of change, and whether the NPS mission facilitates this type of paradigm shift.

Organizational culture literature suggests that organizations may not be able to adapt if risk-taking is discouraged, and if employees believe agency policies to be inflexible, particularly with regard to budget and spending rules. In order to understand cultural barriers to change, this literature informed questions about managerial style, incentive structures, how managers deal with risk taking and failure, and the mission of the organization. Determinants of change also inform assessment of where the NPS is in the process of change. Importantly, this research contributes to the eighth determinant of successful change by increasing understanding the subsystems of the organization.

2.3.5 How Does One Intervene in a System?

Once there is a general understanding of the components of a system and how they work together, only then is it productive to attempt to change the system. Without an understanding of learning disabilities and archetypes that may be preventing the system from changing, managers often push the wrong “levers,” so to speak. Managers sometimes push aggressive change efforts, and then are baffled by the resistance to change. By examining the underlying structure, culture, mental models, learning disabilities, and archetypes that exist in the NPS, managers will be able to more effectively affect change if they wish (Meadows, 1999).

An important component of systems thinking is that of leverage points, or parts of a complex system where a minor change in one aspect can result in major changes throughout. Leverage points in complex systems are rarely intuitive, but if they are,
managers use them the wrong way, unintentionally exacerbating the issue they’re trying to solve (Meadows, 1999). For example, Jay Forrester illustrated this point in the context of a discussion around solving major world problems. While many tout growth as a solution to poverty, unemployment and hunger, Forrester demonstrated that what was needed was slower or sometimes even negative growth. Growth was indeed the leverage point, but in Forrester’s case study, world leaders were pushing in the wrong direction (Forrester, 1971; Meadows, 1999).

Because they are often counterintuitive, leverage points can be difficult to find. Meadows has identified twelve places within a system, or leverage points, where intervention is most effective. These points increase in effectiveness, or in the amount of leverage they bear, as one moves from physical attributes, to feedbacks, to system rules, and mental models and paradigms. For example, the point with the least amount of leverage, yet the most popular with managers, is termed “Constants, parameters, numbers” (Meadows, 1999, p. 5). This refers to the surface-level, often numeric details in a system, such as air quality standards, wage rates, or the acreage of land set aside for conservation. These are adjustable, but they’re not powerful leverage points because changing them rarely changes behavior. A more powerful leverage point, for example, would be “information flows” (Meadows, 1999, p. 12). Creating information feedback in a system is much more influential than the physical structure of the system itself. One of the most powerful leverage points is the leverage of mental models, or what Meadows terms “the mindset or paradigm out of which a system arises” (Meadows, 1999, p. 17). These could include shared assumptions (i.e. mental models) like “growth is good,” as in Forrester’s model above, or underlying assumptions about the role of science or the purpose of an organization (Meadows, 1999). If the NPS truly wants to transform into a more adaptive
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organization, or one that is able to adopt the ideas in *Revisiting Leopold*, then Meadow’s concept of leverage points can help identify those places where a relatively small action will create a much greater change in the NPS as a system.

Together, the literature on diffusion of innovation theory, systems thinking, learning organizations, and organizational culture has led to questions about how a more adaptive organization can or cannot be attained, what structural and cultural barriers may need to be mitigated for the transition to occur, and who in the organization to interview.

2.4. Summary

From a review of the literature discussed in this proposal, it is apparent that organizational change in bureaucratic, hierarchical organizations is difficult because their systems are often cumbersome and inefficient (Osborne, 1993) and employees may not believe in the ability of the organization to change because of constraining rules and regulations (Jones et al., 2005; Parker & Bradley, 2000). *Revisiting Leopold* proposes goals that speak to a new management paradigm for the NPS. Literature on scientific paradigms inform questions about the nature of change in scientific approaches, and postnormal science drives question about the role of science, values, and uncertainty in decision-making. Systems thinking and resilience inform questions and analysis around how *Revisiting Leopold* is perceived and understood, and the concept of learning organizations supports the assessment of structural and cultural attributes of the organization, as well as patterns, mental models, and feedbacks that affect the ability of the NPS to embrace a new paradigm. This conceptual framework leads to the following more specific research questions:
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Kuhn, Popper, and Postnormal Science:

- Do managers believe the ideas in Revisiting Leopold represent a paradigm shift or an ideological shift for the organization?
  - If so, what would be the impetus for change and where would it come from?
- What roles do science, political, values, and uncertainty play in decision-making?

Systems Thinking and Resilience:

- Do NPS managers understand the properties of this new ideology?
- How do managers perceive *Revisiting Leopold* and how (or do they) envision its implementation?
- How do they envision dealing with complexity and change?
- How do they define and address coupled human-natural systems?
- What does a resilient NPS system look like, and is it possible to attain?
- Are managers thinking and working at broader scales, and what are the incentives or disincentives to doing so?

Learning Organizations:

- What are the structural challenges to implementing Revisiting Leopold?
  - What are the mental models and learning disabilities that may be barriers to adaptation?
  - What are the system archetypes that may be barriers to adaptation?
- What are the cultural barriers to implementing Revisiting Leopold?
  - Can a mission-driven organization facilitate this kind of change?
  - How is success perceived in the NPS and what is its related incentive system?
  - How are cultural barriers to change, such as the ability for managers to accept uncertainty and take risks, incentivized in the NPS?

The specific research questions above, derived from the literature, directly inform interview questions. The interview guides, for both managers and contributors to *Revisiting Leopold*, are included in Appendix A and Appendix B respectively.

The conceptual framework also contributes to data analysis, specifically by informing the development of themes and coding. The analytical approach in Chapters 5, 6, and 7 relies primarily on Senge’s concepts of the “iceberg,” mental models, learning disabilities, and archetypes, as well as Meadows’ concept of leverage points.
Chapter 3: Methodology

3.1 Research Approach

This research is largely exploratory. Exploratory studies are conducted when relatively little is known about a topic, often due to its novelty (Singleton & Straits, 2010). In this case, the goal is to better understand the structure, culture, and ideology of the NPS as a system. Ultimately, the results of this study may inform the top levels of management within the NPS about the status of diffusion and adoption of the concepts in *Revisiting Leopold*, the extent to which employees possess a shared vision of this new paradigm, and an understanding of the NPS as a system at multiple levels. For on-the-ground managers, it is hoped that this study will demonstrate the need for such a change as well as create the platform for further dialogue about the concepts in the *Revisiting Leopold* report, implementation strategies, and barriers to change within the NPS. Finally, this research will help NPS managers at all levels to better understand their roles in fostering a learning organization, or how they can create an environment within the agency for learning, creativity, adaptation, and maximizing the achievement of their mission and goals.

In qualitative research, all data is interpreted through the researcher, and “all human activity, including research, is accomplished from a specific standpoint” (Warren & Karner, 2010, p. 9). Therefore, it is necessary to identify one’s position in relation to the topic. As an employee of the NPS, I am approaching this study with prior knowledge, biases, and mental models. A conscious effort has been made to detach myself from the data to the extent possible and to and rely only upon data obtained through this study. In addition, my committee chair has reviewed excerpts of data interpretation to ensure the validity.
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As a qualitative study, this research is also inductive, meaning that “concepts [are] derived from the data gathered” (Warren & Karner, 2010, p. 9) and findings are linked to specific theories (Warren & Karner, 2010). In this case, while it relies upon a conceptual framework based on systems thinking, organizational change literature, and other disciplines, it also employs grounded theory, which develops theory derived from the qualitative data gathered, rather than deriving theory from existing assumptions. A grounded approach encourages a loosely structured research design to enable theoretical ideas to surface from interview data over the progression of the study (Singleton & Straits, 2010).

In order to gather comparable information from respondents and retain the flexibility and openness of a grounded theory approach, the study utilizes semistructured interviews. Semistructured interviews have specific subtopics and goals yet allow a certain amount of liberty in how they are met (Singleton & Straits, 2010). This type of interview is also the most appropriate to the research approach and conceptual framework, given the grounded theory approach and the need to illicit responses from interviewees that directly address the issues in the literature and conceptual framework associated with organizational behavior and change.

3.2 Sampling Frame and Strategy

As the nature of field research typically concentrates on interactive social relationships and organizations, it usually entails the nonrandom selection of interviewees. Probability sampling, in which all respondents are randomly chosen and have a known probability of being selected, has the benefit of reducing biases and lends a level of generalizability to the population. However, the descriptive nature of this research does not
necessitate generalization; rather, the goal is to augment the informational value of respondents by increasing variation (Singleton & Straits, 2010). According to Singleton and Straits, “the delicate operation of entering the field – of locating suitable observation sites and making fruitful contacts – also necessitates nonrandom selection. Convenience, accessibility, and happenstance by and large determine where researchers can begin to make observations… and whom they will find most informative” (Singleton & Straits, 2010, p. 360). The authors also note that in the beginning stages of exploring a problem, when the goal is to gain more information about the issue in question, probability sampling may not be necessary. Rather, choosing a range of subjects nonrandomly is adequate (Singleton & Straits, 2010).

While one of the primary research questions in this study concerns the level of understanding and adoption of the *Revisiting Leopold* report in the NPS, this question is posed in the context of organizational change. Therefore, people in the NPS with leverage to instigate or achieve organizational change were specifically targeted. Diffusion of innovations theory suggests that when a new idea is adopted by an organization, members of the organization fall into one of five categories of innovativeness: the (1) innovators themselves, (2) early adopters, (3) early majority, (4) late majority, and (5) laggards (Rogers, 2003). Thus, in the case of this research project, diffusion theory supports a sampling frame of early adopters, or the opinion leaders in the organization that serve as role models for other individuals and have the most leverage to instigate change. Early adopters are respected and in a central position in the communication network of a system (Rogers, 2003). This group has the most influence on how this new ideology described in *Revisiting Leopold* is perceived, understood, and adopted. Peter Senge’s and Donella Meadow’s work in the field of systems thinking also supports this approach. According to
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Senge and Meadows, the people who are most likely to affect change in an organization are those who have the ability to influence mental models, or deeply ingrained assumptions or beliefs that affect how one sees the world (Meadows, 1999; Senge, 2006).

In the NPS, the group of people who fit this description are employees who are division chiefs within a park, management assistants, deputy superintendents, superintendents or higher. These people have the ability to set park policy, are usually opinion leaders, and are well respected by other members of the NPS. They are in a central position in the communication network because they are familiar with policy from higher echelons of the NPS, but are also in touch with local issues in parks. Other NPS employees included in the sampling frame are those who work at regional offices or at the national level. These employees also have a high amount of leverage within the organization, oftentimes more than park level personnel. Additionally, contributors to *Revisiting Leopold* were included to provide additional insight into the thinking behind the report and how they envision the agency adopting this new ideology.

The spectrum of employees within the organization ranges from low GS, or pay-grade, levels within parks to the Director of the NPS. The decision to target employees at the level of a division chief or higher results in the loss of some insight into how well the policies described in *Revisiting Leopold* are trickling down through the organization. However, this group of people is less likely to be able to speak to how well *Revisiting Leopold* is understood, and would be able to provide less insight on cultural and structural barriers to organizational change. Finally, even if lower level employees fully understood the ideology proposed in *Revisiting Leopold* and believed it should be implemented, they have less ability to affect change.
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Given the levels of employees in the sampling frame (park division chiefs and higher), efforts were made to ensure that respondents represented a diversity of geographic locations, offices, divisions, and park sizes. Generalizability is not a primary concern in this study; the method of snowball sampling, explained below, favors data richness at the expense of generalizability. However, obtaining a diversity of responses is important so that the range of responses captures the range of opinions that exist in the NPS. Because local economics and politics play a fundamental role in a park’s social ecological context, six of the seven park regions were represented in the sample. However, most respondents have previously worked in other office or parks in the system, and with previous work experiences included, all seven regions were represented.

Due to the nature of the research question at hand, this study largely targets managers who make difficult, value-laden, politicized decisions within complex social ecological environments (Funtowicz & Ravetz, 1993). While managers at parks of all sizes are facing these challenges, it is the managers at high-profile parks that are most often forced to confront this reality. Because of this, many of the parks represented in the sampling frame are relatively high profile parks. However, several smaller parks are included to create a sample that is more representative of the agency as a whole.

For the purposes of this study, the sampling frame was primarily limited to respondents who currently work at natural resource based parks (in addition to regional and national offices) because although Revisiting Leopold calls for the same principles to be applied to cultural resources, and cultural history certainly transcends park boundaries, the scope of this study is largely limited to natural resource management. In addition to regional and national offices, ten natural resource parks were represented by respondents.
currently working in those parks, and twenty-seven additional park units of all types were represented by respondents who had worked there in the past.

Due to the exploratory nature of this research, as well as the necessity for entrée with respondents, this study employed purposive and snowball sampling. In purposive sampling, “the investigator relies on his or her expert judgment to select units that are ‘representative’ or ‘typical’ of the population” (Singleton & Straits, 2010). The goal of this research is to collect as much rich, informative data from respondents as possible. Interviews began with seven initial interviewees with whom the researcher had entrée that represent a diversity of geographic regions, park sizes, and levels in the organization (within the sampling frame), and that the researcher believed would provide valuable data and insight on the topic. Following these interviews, snowball sampling was employed to identify additional respondents, in which respondents were asked to recommend others who might be able to provide rich data on the topic. Midway through the interview process, the diversity of parks, offices, geographic locations and vocations was assessed. At that point, four additional respondents were purposively selected to ensure geographic and vocational diversity in the sample.

The purpose of this method is to identify interviewees that will provide detailed, thoughtful responses. However, snowball sampling introduces bias by increasing the likelihood that recommended respondents are similar to the respondent that recommended them (Singleton & Straits, 2010). To mitigate this bias and avoid a situation in which all respondents agreed with one another, requests for other interviewees were carefully worded. Rather than asking, “Who else do you think I should talk to about this?” respondents were asked, “Who is taking steps to implement this, and who might disagree with you or the ideas in this report?”
In total, twenty-three respondents were interviewed. In their current positions, they represented six of seven NPS regions; with all NPS career experience included, respondents represented all regions. Slightly less than half of respondents currently work at the park unit level, approximately 20% work at the regional level, and about 30% work at the national level. While the term “manager” is used throughout this thesis synonymously with “respondents,” because all respondents interviewed make management decisions on some level, respondents represented a variety of roles within the NPS, including superintendents, division chiefs, physical or biological scientists, social scientists, visitor use specialists, planners, rangers, economists, or regional coordinators. In addition, two people who were involved in the publication of Revisiting Leopold were interviewed.

Snowball sampling and subsequent interviews continued until data saturation was reached. At this point, interviews did not lend new ideas or perspectives to the data; data from the last several respondents began to replicate ideas from other respondents. Additionally, when respondents were asked to suggest others to interview, many of those people respondents suggested had already been interviewed.

3.3 Data Collection

As mentioned above, twenty-three semistructured interviews were conducted before data saturation was reached. Interviews typically lasted between forty and seventy minutes. Semistructured interviews have specific subtopics and goals yet allow a certain amount of liberty in how they are met (Singleton & Straits, 2010). This method allowed the collection of comparable information from respondents, yet retained the flexibility for the interviewer to ask probing or follow-up questions in order to gain richer data or clarify responses.
Interview guides for both the contributors to *Revisiting Leopold* and general respondents are included in the appendix. An interview guide “stems from the general topic of investigation and from ideas and hypotheses that emerge in the field” (Singleton & Straits, 2010, p. 368). It consists of a series of questions designed to generate data that addresses guiding research questions and data that are grounded in the conceptual theories described in this proposal. The interview guide was pretested to ensure that the questions were optimally phrased and sequenced to generate data that address research questions and put the subject at ease. Additionally, after the first three interviews, phrasing of a few questions was slightly adjusted, but not to the extent that the meaning was altered (Warren & Karner, 2010).

Most interviews were conducted over the phone, and three were conducted in-person. The interviewer explained confidentiality procedures to each respondent at the beginning of the interview, and obtained verbal permission to record it. For this study, confidentiality protection was particularly important. The primary ethical consideration associated with this research is the potential for respondent’s answers to compromise their job, status in the workplace, or future job prospects if their responses were to be viewed by any one of their colleagues as controversial or deviant from NPS policy or norms. Therefore, the utmost effort was taken to protect the identity of respondents. Employee’s names, park names, and specific resource issues that could be linked to a particular park were omitted from the transcripts. Position titles were also omitted when necessary.

Finally, a remaining methodological concern regards the biases introduced by asking the respondents to read *Revisiting Leopold* before the interview. On one hand, asking respondents to read the document before the interview limited the ability to assess the level to which this document has permeated the organization. This approach could bias
results by suggesting that more respondents were familiar with the report than they would have been otherwise. On the other hand, to obtain quality data, interviewees must have knowledge about the topic and research question. If respondents had not read the report, they would not have been able to provide reactions to it, discuss their understanding of the concepts it proposes, and would have a reduced ability to speak to challenges or barriers to implementing these ideas within the NPS. To address this problem, respondents were asked whether they had read the report before being contacted for an interview. All but one respondent had read *Revisiting Leopold* prior to being contacted for an interview.

3.4 Data Analysis

Interviews were transcribed by a private transcriber, who has taken measures to protect the data and then deleted the audio files. Transcripts were then checked for accuracy and uploaded into NVivo, a qualitative analysis software program, to enable coding and analysis.

Data analysis entails “the search for patterns in data and for ideas that help explain the existence of those patterns” (Bernard, 1994, p. 360 in Singleton & Straits, 2010, p. 385). After reading and rereading transcripts, common themes from interviews emerged from the data. The data was then coded according to these themes in NVivo. Any nuances of coding rational and thought processes were captured in memos. “Memos are small pieces of analysis, usually a paragraph or two, that capture emergent ideas that help make sense of the reality one is encountering” (Singleton & Straits, 2010, p. 386).

Patterns and relationships emerged from themes and interview data, and then were interpreted and analyzed according to the conceptual framework described in the previous
chapter. All of the data and quotes cannot be included in the results and analysis, so data analysis involved an extensive process of reading and rereading transcripts and analyzing themes across interviews. A significant effort was made to accurately represent the full range of viewpoints and accurately portray the degree to which other respondents did or did not share those viewpoints. In some cases, where one sentiment was expressed by many respondents, one or two excerpts that expressed the idea most fully and clearly were used to represent the idea. Occasionally, a number of short succinct quotes are used to demonstrate either a broad range of viewpoints or extensive agreement around a particular idea. Excerpts were also chosen carefully with their full context in mind.
Chapter 4: Results

Throughout the course of data collection, 23 NPS managers were interviewed, including, scientists, division chiefs, superintendents, and planners at the park, regional, and national level. From interview data, it becomes possible to discern whether this sample of the NPS conforms to the paradigm described by the *Revisiting Leopold* report. Specifically, have the managers interviewed moved from a positivist, reductionist, Progressive-era paradigm towards a systems thinking paradigm? Do early adopters in the NPS have a shared vision of the new paradigm described in *Revisiting Leopold*?

Fernandez and Rainey (2006) present eight determinants of successful implementation of organizational change in the public sector, the primary components of which have been echoed throughout the field (Kotter, 2007; Lovegrove, Ulosevich, & Warner, 2010). Two of these components of successful change include effectively communicating the need for change and building internal support and participation (Fernandez & Rainey, 2006). The systems approach takes this a step further, maintaining that in order to become a learning organization, members must have a shared vision that is the driving force that provides focus and energy for learning. As Senge puts it, a shared vision “is the answer to the question, ‘What do we want to create?’” (Senge, 2006, p. 192). *Revisiting Leopold* attempts to inspire a shared vision for what this new paradigm would look like in the NPS. Therefore, it becomes relevant to assess whether the *Revisiting Leopold* report has successfully communicated a compelling vision for how and why the NPS must transform itself and whether managers support the ideas in the report.

The iceberg model further illustrates that to solve problems and improve an organization, managers often look to immediate events occurring around them. However,
like an iceberg, most of what explains and drives events is “underwater,” or unseen. It is more useful to examine reoccurring patterns and trends that drive events, and more useful still to examine the structures that contribute to these patterns. Ultimately, underneath patterns and structures are mental models, or fundamental, sometimes unknown, beliefs and assumptions. The further one descends down the iceberg, the greater one’s leverage to change the system (Senge et al., 2008). If the NPS is moving into a new paradigm of systems thinking, of embracing change, uncertainty, and complexity, it must not only demonstrate this in the form of events and actions, or positive receptivity to the report, but it must also possess a shared vision, as well as the structure, culture, and mental models to support it.

The following section is a general description of the types and variation of responses from interviewees, organized according to Senge’s iceberg model. This section will first discuss the general event-level reactions and receptivity to the report itself. Do the managers interviewed understand and support the components of this new paradigm? Next, patterns and trends in the NPS that facilitate or prevent the realization of this new paradigm will be described, followed by a description of the structural and cultural characteristics of the NPS that affect its ability to be a learning organization. Finally, several mental models that exist within the NPS emerged from the data that are likely underlying drivers of the system. While respondents were asked to speak to the nature of the organization as a whole, it is important to remember that the data and analysis in the following chapters represents the views of a sample of managers, and cannot necessarily be generalized to the organization as a whole.

4.1 What are the reactions to Revisiting Leopold?
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Shared visions are critical to a learning organization because generative learning, or transforming an organization into one that is more responsive and creative, “will seem abstract and meaningless until people become excited about a vision they truly want to accomplish” (Senge, 2006 p. 192). Vision, in other words, establishes an overarching goal. The report presents an overarching goal, but in order for employees to build a shared vision around it, they must first understand the concepts in it. This section describes data pertaining to (1) manager’s general reactions to the report, (2) level of agreement about the need for change, and (3) understanding of the fundamental concepts presented in *Revisiting Leopold*.

When asked, “What was your understanding of *Revisiting Leopold,* and what did you think of it?” the most common response, from approximately one third of respondents, was that it is largely a positive and needed statement that recognizes that our social and ecological environment is complex and changing rapidly and unpredictably, particularly with regard to climate change. “I think there was a need for it…The idea that people seem to have fixated from [the] Leopold [report], this vignette of primitive America, was pretty outdated, and most park managers and staff understood that” (R12), remarked one manager. Some of these respondents highlighted the need for the NPS to be more flexible and adaptable, or to manage at broader scales, as positive and necessary components of this report; several of these respondents remarked that the report was timely.

On the other hand, almost as many respondents remarked that they perceived the report to be very general, lacking in both detail and specific guidance regarding how these ideas might be implemented. Of this group of respondents, two remarked that implementing the ideas in this report would mean different things in different parks. For
example, one of these respondents remarked that terms such as “ecosystem integrity” (R1) are too general and can mean a variety of different things in different places. Another said, “They talk about managing for ecosystem integrity, and …it’s really hard to understand what it would mean in the case of an ecosystem that’s undergoing very rapid change…So I’m not quite sure how we are going to accomplish that.

On one hand, *Revisiting Leopold* says embrace change and sort of go with the punches, and on the other it says, ‘But also pure historic integrity.’ I think those two are contradictory.” (R11)

Two other respondents would have liked to see the report provide more guidance on and address climate change more specifically. “I would have loved a very, very, strong statement about, ‘This is what the policy of the National park Service should be looking at in the face of climate change as it relates especially to wildlife and vegetation species’” (R7). While almost a third of the respondents perceived the report as too broad and lacking specific guidance, not all of them believe this is problematic. Several of these respondents noted that the report was probably abstract on purpose, that it was just meant to be a broad philosophical statement, or that the level of detail is sufficient until the implementation team (a team of NPS employees charged with prioritizing items for implementation) can provide further guidance. “If I have a gripe with the report, it is that it is very broad and general in its recommendations,” one respondent explained, but “it is important to have broad statements about philosophical direction…so even if it’s not very specific about what next steps might be…there’s still a lot of value in explicitly recognizing that this perspective should be what drives the direction of the agency” (R16). In general, it appears that while many managers understand the need for this report, they aren’t clear about how it will be implemented. As Senge points out, a shared vision “will seem abstract and
meaningless until people become excited about a vision they truly want to accomplish” (Senge, 2006 p. 192).

There appears to be a lack of enthusiasm from approximately a third of respondents about this vision, perhaps driven by confusion about the new paradigm that this report entails. A few respondents thought that implementation will come in the form of policy changes, but due to the diversity of parks and ecosystems across the National Park System, it would be difficult to make a “one-size fits all” policy. One respondent also noted that it’s difficult to transform abstract philosophical statements into policy. This type of reaction, combined with concern about terms applying differently in different places, reflects a lack of understanding about the dynamic complexity that is an inherent component of this new paradigm. Managers are used to thinking in terms of detail complexity, a characteristic of the positivist paradigm, rather than dynamic complexity, in which “an action has one set of consequences locally and very different set of consequences in another part of the system… [and] when obvious interventions produces non obvious consequences” (Senge, 2006 p. 71).

Slightly less than a third of respondents see the report as a reexamination of the underlying principles and goals of the original Leopold report, an attempt to broaden the focus and make it more relevant. One respondent thinks that it’s both a “natural thought progression in terms of what the original Leopold Report said” (R7), and an “affirmation of the original Leopold Report” (R7).

A few respondents remarked that they felt the NPS was already doing many of the things in the report, such as recognizing that ecosystems are changing and using best available science. Two respondents remarked that many people in the NPS already understand or are trying to implement the ideas expressed in the report, and the real
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constraint is not a lack of understanding, but budgets, or “the wherewithal to do some of these things” (R11).

Several interviewees focused on the report’s emphasis on science. While some viewed this emphasis positively, some were more skeptical, noting that scientific information “is rarely unambiguous” (R9), and that many decisions are political, and science often only plays a small part. As another respondent put it, “Data doesn’t make decisions” (R19). Interestingly, while three respondents highlighted the report’s integration of natural and cultural resources, one respondent thought it should have been more “multifaceted, [and] interdisciplinary” (R2), remarking that it was written “through a scientific lens,” and “ignore[d] the values, the social values that are associated with the natural and cultural resources that the report was focusing on” (R2). From these responses, it appears that some respondents are demonstrating an understanding of postnormal science and the role of social values in a coupled human-natural system.

When asked about how they see the report being implemented, employees gave a broad range of responses. Many respondents, however, deferred to others in the NPS and seemed to be employing a “wait and see approach.” Six respondents cited the implementation team and several others don’t know how the report will be implemented or believed it was up to others, either more broadly in the NPS, their superiors, or “champions” within the organization.

While there does appear to be a broad variety of reactions to the report, demonstrating the lack of a shared vision for what this new paradigm might look like, a few managers do appear to be thinking about the uncertainty involved in scientific data and the influence of social values and politics on decision-making.
Equally important as a shared understanding of the concepts in the report is a shared understanding of the need for change. Therefore, managers must also believe that the ideas in this report do in fact represent a change, or an ideological shift for the NPS. Jones, Jimmieson, and Griffith (2005) maintain that an important component of organizational change in the public sector is the concept of readiness for change, which they define as “the extent to which employees hold positive views about the need for organizational change (i.e. change acceptance), as well as the extent to which employees believe that such changes are likely to have positive implications for themselves and the wider organization” (Jones et al., 2005, p. 362).

The overwhelming majority of respondents did in fact see the ideas in *Revisiting Leopold* as a needed change or shift in ideology for the NPS. Of these, six respondents believed that adopting the ideas in this report would be a necessary paradigm shift, while four thought it to be a needed “evolution” (R5; R7; R10; R16) of thought.

Three respondents admitted that *Revisiting Leopold* represented somewhat of a change, but hesitated to go as far as the majority of respondents. Two of these believed that while the thinking and understanding of individuals has changed, the organization as a whole is slow to catch up. “Ideologically it’s there, it’s changed, and it’s for the better” one respondent remarked, “but physically there are definitely some gaps” (R22). While individual members of the sample may be there ideologically, it is clear that the organization as a whole is not. While most respondents were receptive of the report as a whole, there was some confusion about concepts such as resilience, dealing with complexity and change, and the intersection of social and ecological systems, specifically with regard to the role of the NPS in an era of climate change.
Some of the widest variety and discrepancies in responses pertained to the topic of resiliency. Slightly less than a third of respondents admitted to not knowing or not understanding what resilience means in terms of on-the-ground management or in terms of management policies. Most of these interviewees understood the concept, but not its implementation. As one respondent put it, resilience is “interesting on a philosophical level, but when it comes down to park management it doesn’t mean much…it’s one step from action” (R6).

An equal number of respondents, slightly less than a third, pointed to increasing connectivity and collaboration with partners as a strategy to increase resilience. The remaining responses were varied, and included suggestions such as removing stressors that we have the ability to manage and taking “no-regrets actions” (R16) (e.g. removing pollution or non-native species), improving adaptive management embracing dynamic complexity, increasing redundancy in ecological and cultural systems, and increasing public education, so that the public can help the NPS prioritize the most important aspects of systems.

Interestingly, one respondent remarked that the word resiliency is often misused, and what managers “really mean is delayed onset to change” (R1). A few other respondents may not have understood the concept themselves, suggesting that managing for resilience would mean applying the same concept as zoning, or managing for different goals for different areas, or that managing for resilience “doesn’t require any human management” (R9). Once scientist understood the concept but viewed it quite narrowly, only as it applied to his or her field, remarking that “I don’t think you can look at it as a resilient national park. You’d look at it as an attempt to create resiliency primarily in the dominant plant communities on the landscape” (R20). There seems to be a wide range of understandings of
the concept, and only a few respondents recognized its application to the social-ecological system as a whole. For example, respondent 20 only thinks of resiliency within the context of plant communities. When respondent 19 was asked about what a resilient national park system would look like, he or she replied, “Hmm. Are you talking, like, resource resiliency, like plants and animals, or people resiliency” (R19)? These reactions demonstrate that not all managers understand resiliency in a systemic way.

On the other hand, most respondents did generally recognize the interconnectedness of social and ecologic systems, or coupled human-natural systems, largely with respect to climate change. “The reality is that to try to assess nature without human intervention is – I don’t know if it’s possible or even fair, because the reality is that we are part of that system” (R8). However, there seemed to be a general discomfort or lack of confidence from most respondents regarding what this means for NPS policy, especially in terms of what is considered natural and what is considered anthropogenic. As one respondent put it, “We’ve tied ourselves in knots over that [coupled human-natural systems] right now. It was pretty easy until climate change became accepted. We were managing for natural, and if we could detect anthropogenic influences, our goal was to weed them out…I think we, the Park Service, are very much stuck with, then what are we managing for?” (R11)

This reaction demonstrates that events such as climate change and the publication of Revisiting Leopold are causing some people to question their underlying mental models.

Because of the variety of reactions to the report and the amount of confusion surrounding the concepts presented within it, it is apparent that managers in this sample are lacking a shared vision of the new paradigm presented in Revisiting Leopold. In addition to
general reactions to the report, several patterns emerged from the data that demonstrate difficulties in breaking out of the paradigm in which the NPS is currently operating.

4.2 What are the Patterns and Trends in the System?

Below the event level on Senge’s iceberg model are patterns and trends (Senge et al., 2008). Sometimes events are part of larger patterns or underlying trends occurring in the NPS that could be affecting the ability of the organization to become more adaptable. This section will address patterns and trends that emerged from the interviews, including dwindling budgets and staff, staff turnover, a pattern of negative consequences in the event of failure, and the growing popularity of collaboration.

4.2.1 Dwindling Budgets and Staff

Almost all respondents highlighted budgets as a barrier to implementing the ideas in the Revisiting Leopold report. While funding mechanisms are also a structural barrier, there is a trend towards declining budgets and reduced staff, and a strong pattern emerged of managers wanting to accomplish various items in Revisiting Leopold but lacking the funding.

Most respondents saw dwindling budgets as the primary barrier to implementing the ideas in the report, and saw a disconnect between what the report calls for (e.g. more partnerships and collaboration, monitoring, increasing scientific capacity) and the way budgets are currently allocated. Many highlighted the fact that the agency spends the majority (approximately 75% according to interviewees) of their budget on visitor services, leaving little room for resources and monitoring.

One superintendent highlighted that there are barriers to working towards long-term goals, because
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“We are in such crisis management, day after day, trying to get through what’s being asked of us, either on the ground in the park or by regional or Washington offices or whoever. There’s a lot of reporting that comes at us…For example…we just got through the FY14 budget exercise, which was the 5% cut we took last year, and two days after we get through with it they say, ‘By the way, you need to take an additional 3%,’ so we’ve got to go back and redo it all. That kind of stuff takes a huge amount of time. You don’t have time to focus on the long-term stuff, you’re just trying to do the report of the day.” (R4)

Park staff, with reduced budgets and capacity, seem to spend all of their money and energy “doing the proverbial putting out of fires” (R22) and trying to simply keep their heads above water.

The funding cycles are a challenge to working long term, both from Congress for the agency as a whole and internal funding projects. Most of the appropriations are single-year appropriations, so unless an employee is carefully making sure that there’s money set aside for long-term monitoring and tracking it closely, it can fall through the cracks after a couple of years. While the NPS’ goal is long-term conservation, this is contradicted by the budget itself, because three-quarters of the budget is for day-to-day operations, several employees pointed out. While some managers would like to conduct long-term monitoring, for example, it’s “statistically challenging and very expensive” (R20). It’s much easier to garner funding to monitor “sexy” (R1) resources, which may or may not be the most important. Similarly, there’s a lot of “crisis award” happening, like “saving somebody’s life, diving into the burning building and dragging somebody out…We ought to reward folks because the building didn’t burn down to begin with” (R4).
Additionally, it is more difficult to place monetary value on natural resources than physical assets. “The feedback loops associated with visitor services tend to be pretty tight and direct” (R18), explains one respondent.

“We have defined assets, those assets have needed outcomes, those outcomes have projected budgets, those budgets then interface with a Congress loop that gives resources and feeds back into it… Whereas natural and cultural systems’ feedback loops are more variable because they’re not as well defined and we’re focused more on detail than we are the dynamic outcome.” (R18)

This respondent demonstrates an ability think systemically about feedbacks and dynamic complexity. In doing so, he or she highlights several deeper processes at play: the nature of funding allocation, a weak information feedback loop with regard to resources, and deeper cultural tendencies or mental models around how assets and resources are valued.

4.2.2 Staff Turnover

In addition to funding mechanisms, the nature of hiring and advancement through the organization create patterns that make it difficult to both adapt the ideas in *Revisiting Leopold* and become a learning organization. Management cycles often only last several years, and staff turnover rates can be high as employees seek to move up in the organization by applying for new positions. Therefore, it’s difficult to consistently apply science and maintain continuity in science-based decisions. When new staff or superintendents come in, they may not have the same understanding of or buy-in on the decision-making processes that occurred before their arrival. One respondent, when reacting to the report’s recommendation to expand the role of science, explained this recurring problem:
"It takes a lot of money to monitor things. Somebody’s got to do it, do the field work, write up the report, communicate the results to the park’s management team. I’ve seen the management team here at the park go through at least I’ll say half an iteration to two-thirds of an iteration, and when new folks come in…they didn’t go through the decision-making process that we went through before, so they don’t really have the same feel or the same buy-in for…decisions that were made in the past, and it may not be as high a priority for them now” (R12).

In other words, loss of institutional knowledge and shifting baselines are common problems and recurring patterns throughout the NPS that are likely driven by structural attributes of the human resources system.

4.2.3 Negative Consequences for Failure

Just as staff turnover appears to be making it difficult for managers to apply science and learn over time, other patterns are also making it difficult for managers to learn and be adaptive. For example, another pattern that emerged from interviews relates to how risk is perceived, incentivized, and dealt with. In general, the NPS culture is relatively risk-averse. Some of this risk aversion seems be driven by the public. The public doesn’t like to hear that the agency is uncertain about what’s going to happen, even when the agency is applying the best available science, a respondent explains. “I think our leaders get really nervous when we take a lot of risk, especially when it doesn’t turn out well…nobody likes surprises, they always want to be informed, and I agree, I don’t like surprises either” (R4), another interviewee remarks. When management decisions don’t turn out well, employees suffer a barrage of complaints from the public, and may be relocated to a low profile, less
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favorable position. This also creates a disincentive to take an action that may protect resources at the expense of visitor satisfaction. “The visitors write letters, and of course the resources can’t, but that’s what gets the attention, trying to make people happy, trying to soothe ruffled feathers, rather than look at what the issue was and what we did to try to protect the park” (R4).

Another societal trend occurring in the system is an increasingly litigious culture. In one sense, more is at stake for managers when making high-profile or risky decisions. As a result, science is playing more and more of a role in justifying decisions and reducing risk in an increasingly litigious environment.

Several managers brought up adaptive management as a way that the agency deals with risk and uncertainty in this context. One of these described both an “active” and a “passive” (R14) form of adaptive management, but another respondent believes the agency is not doing adaptive management in the true sense of the term. “You would find that [managers] would all define adaptive management as what is known in the literature as ‘managing adaptively.’ They would say ‘We put management actions into place and we monitor what happens, and we might make changes in the future.’ What human being didn’t do that in the past” (R1)?

The NPS also accounts for risk and uncertainty by employing the precautionary principle, which one respondent believes will become more important in the future, especially considering discussions around manipulations and interventions. Another believes that this principle is generally only applied when dealing with things that the NPS deems “natural.” “At the same time, we have not been particularly precautionary when it come to actions that we might take that we think, ‘Oh, that’s clearly not natural,’ so we’re going to go in there and take significant action” (R16), such as with invasive species.
In terms of the way that risky decisions are perceived, some believe that they’re perceived positively when successful, and negatively when they’re not. The NPS does ask managers to take informed risks, and the higher the level of risk, the higher up the hierarchy the decision should go. However, some employees are still concerned that if they try something and it doesn’t work out, that they won’t get the next job or opportunity. One respondent describes the consequences of failure as “dramatic…the consequences tend to be more political than not, and that political translates into financial along the way, and then the financial translates into conservation” (R18). Another believes that “in the future we’ll have to give managers the license to try things and fail, and we’ll have to reward what I’ll call ‘good failure,’ failure that teaches us something” (R23).

On the other hand, risky decisions that end in failure are okay if you can demonstrate that you’ve thought about it, a manager remarked. It’s perceived less negatively if managers demonstrate that they’ve made the decision thoughtfully and planned mitigation strategies. Others described a “risk-versus-benefit” (R21) way of evaluating decisions that includes gathering as much information and creating mitigation strategies, especially with regard to the way that they personally deal with problems. Another respondent pointed out that the NPS is not a homogenous organization, and that some parts of the organization are risk-averse, but there are also risk-takers.

Overall, there appears to be a recurring pattern of negative consequences in response to failure, which further perpetuates an already risk-averse culture. If the NPS wishes to adopt the paradigm illustrated in *Leopold Revisited*, it would need to more systematically incentivize targeted risk-taking. In order to be a learning organization, adaptive management must be allowed to occur in the true sense of the term, in which it’s okay to fail and learn from the consequences.
4.2.4 Growing Popularity of Collaboration

While risk-taking is being disincentivized, collaboration is being promoted, at least in the agency rhetoric. According to interview data, collaboration and partnerships appear to be growing trends. When asked how success is measured, responses ranged from the number of employee and visitor accidents and fatalities, to meeting budget goals, to relationships with communities, and employee and visitor satisfaction. “There’s a lot of pressure to ‘get along,’” one respondent noted. “Now we call former adversaries our ‘partners.’” If the NPS is dealing with a controversial situation, success is gauged by how many parties are satisfied” (R9). Also, things that promote visitation and are good for visitors seem to be rewarded well. In contrast, superintendents who deal with big resource issues probably receive less praise, another interviewee explained.

One of the goals in Revisiting Leopold is to create transformative experiences for visitors (NPS, 2012b). Very few respondents spoke to this concept, and transformative experiences was not a deliberate focus of the interview. However, one respondent described them as “experiences that both educate and inspire. It’s not enough to simply educate visitors without inspiring them, and it’s not sufficient or transformative to inspire them but not provide educational content” (R3). This respondent explained that this is because visitor experiences within the park are critical for resource stewardship and visitor engagement. This goal may serve to increase a particular type of public engagement and collaboration.

From the data, a number of trends emerged within the system, such as declining budgets and staff and an increasing “crisis management mode,” an increasingly litigious culture, and the rising pressure to “get along.” Common patterns across the system that managers continuously raised included budgets that favor visitor services over natural
resources, disincentives to risk-taking, and the loss of knowledge and buy-in associated with staff turnover. These trends and patterns have emerged as recurring process that limit the ability of the NPS to become a learning organization. However, they are driven by the structure and culture of the organization, and ultimately, by underlying mental models.

4.3 What are the Structural Attributes of the System?

Even more influential than patterns and trends in Senge’s iceberg model are the structural attributes of the system. The following section will discuss structural attributes of the NPS that emerged from interviews, including the hierarchical and decentralized nature of the organization, the siloed nature of the organization, structural issues around partnerships and transboundary management, and scientific capacity.

4.3.1 Hierarchical and Decentralized

Most respondents characterized the organizational structure as hierarchical, highly decentralized, and park-centric. There are seven regions, each with their own regional directors with different personalities and priorities, and a diversity of parks within that, of different unit types. These unit types respond to challenges in different ways, depending on whether they’re monuments, predominantly cultural parks, or “natural parks.”

All managers reflected on issues at a variety of scales and the interconnectedness of these issues across scales. However, they also described a very “park-centric” structure in which parks are relatively isolated from the political scales above it and park superintendents have a great deal of autonomy. “I once heard __ say that the Park Service is one of the best run ships in the worst-run Navy,” remarked one respondent. “It’s very park-centric. The superintendent is pretty close to God on earth. They get to do what they want to do within their park, within reason. I don’t see that changing, because parks are so
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– how can I say it? – paramount in the Park Service, because visitors connect with parks” (R23). Some respondents contrasted this to other federal land management agencies that have more of a “command and control structure” (R11) and are much more centralized.

“We’re a bunch of anarchists…it’s relatively easy in the Park Service to simply ignore instructions from __, or even from the regional office, because that’s the way we were designed. Parks are physically isolated from centers of population” (R11). Interestingly, this demonstrates a mentality in which managers really don’t see themselves in a panarchy of scaled systems. If superintendents are “pretty close to God on earth,” then a command-and-control structure does exist, albeit at the park scale rather than the national scale.

At the same time, the NPS is still a bureaucracy, with policies and directives that come from above. One respondent described the structure of the NPS as challenging, “because it’s an odd mix of top-down and bottom-up. The administration funnels decisions down from the top, but park units can operate very much as isolated units, and superintendents have ultimate decision-making power.

Regions and Washington office staff sometimes are stuck in the middle. This makes communication and information sharing very challenging, because the people at the bottom don’t feel in control of the decisions they’re making and the people on the top have trouble understanding what the need of the field are.” (R19)

Respondents’ descriptions of a decentralized, autonomous organization on one hand, and a top-down hierarchy on the other, creates a schizophrenic and conflicting picture of the organizational structure. Regardless, some respondents believe that a decentralized structure has both positive and negative effects. For example, a decentralized structure encourages innovation and creativity in one park that is sometimes copied in
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others. Good ideas are not always communicated among relatively isolated parks, however. The NPS lacks a “technology transfer piece” (R18), as one respondent put it, which could serve as an information feedback.

When rapid change is needed, some respondents believe the lack of command-and-control structure at the national level inhibits the ability to force change agency-wide. While some recognized that although the agency wants to or is trying to deal with complexity, there are not “appropriate strategies or policies to deal with that at this point in time” (R1). One respondent used the word “schizophrenic” (R7) to describe how the agency is responding, meaning that different parks are taking different actions that contradict each other in their approach or philosophy. Also, while one park may come up with a creative way to tackle climate change at the park level, climate change is still a regional or landscape level problem that takes thinking, funding, and expertise beyond what a park has in-house. There are no divisions that cut across all disciplines and parks, such as a climate change division, to foster agency-wide progress on this issue. Another related negative effect of this park-centric structure that emerged from the interviews was the tendency of park employees to limit the scope of their thinking to the park in which they work.

4.3.2 Siloed Organization

In addition to the relative disconnectedness of parks and the tension between the Washington office and the field, respondents described a siloed organization of distinct directorates and divisions within a hierarchical, militaristic structure that inhibits interdisciplinary work. The different divisions within the agency create “turf wars” (R13). According to some respondents, this siloed structure creates challenges from both a
business culture standpoint and a practical standpoint, because budgets and missions are disconnected. “We don’t even have a good Venn diagram of where the overlap is” (R23).

While most employees mentioned the slow nature of change in a bureaucracy and how long it may take a directive to trickle down from the top to the park level, some pointed to the siloed structure as a cause. The implementation of new ideas is difficult in a siloed structure because employees must “run things up the flagpole” to make sure that superiors are on board. Even within the Washington Office, there are several different independent, siloed programs, one respondent noted. Adapting to change is like steering a large ship; it just takes time. “When you start enacting and implementing changes…it’s once again herding cats. They’re all doing their own thing again. Organizationally it could be improved, and some of these silos or some people call it stovepipes need to be broken down” (R22).

Also, the siloed structure of the organization can hamstring the ability of the agency to meet the goals of *Revisiting Leopold*. “Most of the financial structures set forth by Congress don’t allow for exchange of funds. Once they put it in a pipeline, they expect it to be used in that pipeline. So we have some fundamental administrative challenges that are beyond the Park Service itself and that speak more to how we as a country address conservation across the landscape” (R18).

4.3.4 Partnerships and Transboundary Management

While the NPS appears to be somewhat disjointed at the agency scale due to these silos or “stovepipes,” all of the land management agencies seem to also be disjointed at the landscape scale. It doesn’t make sense for ecosystem scale management to have separate federal land management agencies, remarked one respondent. “I guarantee…that we will
look back on ourselves in a hundred years and say, ‘I cannot believe we have a Forest Service and a Fish and Wildlife refuge and NPS.’ From a strategic standpoint in terms of management conversation and lands across the continent, it’s so silly” (R1). The same respondent went on to explain that this division creates too many mission and institutional barriers to being highly effective in transboundary management. All managers (state and federal) in an ecosystem should agree on common vital signs and jointly monitor and report on it. If not, “we’re all working from a different sheet of music. In some cases we don’t even have sheets of music, we’ve got some song that we remember, but we’re singing different songs” (R1).

In addition to different missions and goals of land management agencies, there are also some practical, structural barriers to transboundary collaboration, such as high university overheads and law and policy restrictions on spending money outside of park boundaries. One respondent pointed out that “when you’re requesting money for a project, if you try to do a couple of parks, try to go in together and request a project, one park has to be the owner of that project, and that kind of kicks out another project for that park. You only have so many projects you can ask for, and when two parks go together, you’ve lost one of your projects” (R4). This works as a disincentive to partnering with other parks.

In fact, there seemed to be very few structural incentives to working outside of park boundaries. According to several respondents, the people collaborating at broader scales are a select group of motivated, creative individuals that aren’t often rewarded for their efforts by their supervisors. One notable exception is the existence of Landscape Conservation Cooperatives (LCCs) that serve as landscape-level networks for science and management issues at the regional scale.
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Many employees highlighted the need to reevaluate and update management policies to be more in line with the goals of the *Revisiting Leopold* report and current management realities. Comments about the current *2006 Management Policies* often pertained to the need to incorporate mechanisms to allow the agency to meaningfully engage in large-scale conservation, not just for the protection of the individual park, but for opportunities to engage in a larger conservation arena.

4.3.5 Scientific Capacity

In addition to building partnerships with agencies, another common response to the question about how the report might be implemented was that the NPS needs to build partnerships with scientists and universities. Many cited the need to build capacity for scientists in parks, specifically the need to allocate more time, money and effort towards science, monitoring, skill development, information sharing, and increasing scientific literacy. Several mentioned that they would like to see more long-term partnerships with scientists and universities, but that this is difficult due to policy and contracting constraints. Two mentioned the LCCs already in place in many parts of the country.

When asked how they believe the agency can best deal with complexity and rapid change, many respondents cited increased long-term monitoring in order to better understand system changes. However, monitoring is expensive, and although partnering with universities is a good way to do that, university partnerships are even more expensive. Legally and contractually, it’s extremely difficult to spend money outside of park boundaries. Most of the appropriations from Congress are single-year appropriations, so unless an employee is carefully making sure that there’s money set aside for long-term monitoring and tracking it closely, it can fall through the cracks after a couple of years.
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Several respondents described the loss of agency scientists to the U.S.G.S. years ago. As a result, additional scientific capacity is based on scarce additional funding, especially in smaller parks. Compared to the other agencies, one respondent believes the NPS has fewer social scientists “that work to bring disciplines together. We have planners, but not necessarily people in the social sciences conducting scientific methods produced by the social sciences” (R13).

Another interviewee pointed out that while many agency employees have backgrounds in mathematics and the “hard sciences” (R17), they move up the career ladder into management, planning, or project manager roles in which they’re not using their technical knowledge. As a result, the agency may have untapped scientific capacity.

4.4 What are the Cultural Characteristics of the System?

While not specified as a “layer” on Senge’s iceberg, the cultural characteristics of a system are also highly influential on how it operates. Cultural characteristics often appear to be interrelated with structural characteristics, but also affected by some of the mental models. Thus, cultural characteristics that emerged from interviews are discussed here, and include the NPS’s tradition of preservation, cultures surrounding each division, how success is rewarded and incentivized, risk-aversion, and perceptions of organizational change.

4.4.1 Tradition of Preservation

Many of the interviewees believe that a cultural shift within the NPS is necessary to implement the ideas in the Revisiting Leopold report. Some respondents see the NPS as a fairly conservative agency, perhaps more so than other land management agencies that some respondents view as more flexible and adaptable. Respondents cite a long tradition of
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preservation and protection that has somewhat trapped the NPS in a more conservative approach. The other agencies are a bit more “loose and less hierarchical. They’re more jack-of-all-trades, instead of compartmentalized, like LE, interp[retation], and resources. They’re into multiple use, and that presets an organization and the people in it to adapt better” (R20), says one respondent.

4.4.2 Divisional

The above respondent’s perception of the NPS as “compartmentalized” was also echoed by many other respondents. The organizational structure seems to influence the organizational culture, because many employees brought up cultural barriers that stem from the siloed structure. For example, some noted that employees don’t work across divisional lines well, because directions are set by their division chiefs and supervisors. While resource managers may be aware of the types of problems that the report highlights, there must be buy-in from all divisions, which would require a major culture shift, explains a respondent.

Another respondent notes that a lot of the staff has a law enforcement background, which comes with a military mentality of controlling crowds and giving out tickets. Instead, the NPS needs younger people with more diverse backgrounds. Perhaps this is a symptom of another phenomenon described by a different interviewee. “We have the park ranger, who used to be the be-all and end-all. That’s slowly morphed into specialties…we’ve gone from the generalist to the specialist, and if you’re going to be adaptive, it’s hard to get specialists to adapt quickly to anything” (R18).

4.4.3 Motivation and Success
While NPS employees may be highly specialized, many are also fairly self-motivated. Because they don’t receive bonuses or significant awards, and are often paid less than they might be in the private sector, many elect to do their jobs because “it’s the right thing to do. You do it because you’re going to make a small step towards leaving this place unimpaired for future generations” (R7). Another respondent explained that, “There are people out there, especially superintendents, who are like, ‘You’re just doing your job, just do it. Don’t expect a reward.’ That’s part of our culture. It’s rewarding in the fact that you’re working in beautiful places and doing cool stuff, but the Park Service itself is more like the military” (R20).

In terms of recognition for good work, several respondents noted that they can only give or receive small things such as mugs, t-shirts, or pencils, so employees ultimately must be intrinsically motivated. Or, publicly spotlighting good work is perhaps the most effective way to reward an employee. Employees generally aren’t going to receive approval and accolades proportionate to the amount of investment and work they put in, one respondent notes. For example, the respondent described having to turn employees away during the government shutdown, because they’re dedicated and wanted to be at work. This particular manager expressed frustration that he or she couldn’t reward staff with anything more meaningful than pens, pencils, or cups, such as lengthy time-off or monetary awards.

Another issue related to rewarding success is that employees naturally work to achieve goals that are attainable within the timespan that they occupy a particular position. One interviewee pointed out that

“We’re good at giving awards to people for individual actions, something that takes place over a relatively short term. We are terrible at acknowledging and rewarding long-term leadership. It isn’t even reflected necessarily in who gets
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promoted, which I’ve never completely understood…I sometimes am completely befuddled by who moves up in the organization and who does not. Some of the very best seem to move up, and also some of the truly mediocre seem to move up.” (R11)

The people who hold upper management positions or positions in the Washington Office are those who have been there for a long time. “The individuals managing the agency are generally 30-plus-year employees of the Park Service, …[and] you have basically the older crowd managing this agency who are maybe still doing things the way they were done in the ‘70’s… You don’t often have a young go-getter who gets placed into a position of power or decision-making” (R22). In order to adapt and change more quickly, the agency needs a wider diversity of those with power and decision-making ability, this respondent believes.

Another employee critiqued the NPS’ lack of a merit-based promotion system. Unless an employee does something that’s perceived as an adverse action of some kind by management, there’s not an incentive or motivation to perform well; if someone performs really well, his or her job may not change. Employees can be either incredibly productive, average, or non-productive, and there isn’t a system where, for example, a high-quality, a highly productive researcher is rewarded for productivity and long-term success over the course of his or her career.

4.4.4 Risk-Aversion

Another cultural trait that is closely related to the motivation and incentive system discussed above is a culture of risk-aversion. Managers were asked to assess the degree to which they consider themselves risk-takers. A few described themselves as fairly
conservative. One respondent put it this way: “According to Meyers-Briggs, I’m not a big risk-taker. As it relates to many of these issues and interdisciplinary nontraditional approaches, I’m a pretty big risk-taker, a largely creative, out of the box thinker. But I compare that to the agency as a whole. If you’re comparing me to Google, it may be a totally different deal” (R13)!

Others fell in the middle of the spectrum, describing themselves as “moderate” (R21) or “calculated” (R7; R15; R18), willing to take informed risks with as much knowledge as possible. “It’s a good idea to be precautionary, but in a changing climate scenario, that could also limit our options and limit our creativity” (R16), said another.

Some of the self-described risk-takers had some caveats, or reasons why they felt able to take risks. One manager qualified his or her response, noting that, “I’m more risky than some of my peers, but in more of an entrepreneurial sense, early adopter sense… but more in the early adopter phase than the innovation phase… I tend to take more political risks than financial risks…calculated (R18)”.

Others believed that they were able to be risk takers because they are “old enough, secure enough in my career that I can take risks…[and] I’m not really on the front lines of making decisions anymore” (R23). Another observed, “I’m fairly outspoken. I say what I think…And if I wanted to be a park superintendent, that probably would not be a trait that would stand me in very good stead (R11)”.

_Revisiting Leopold_ promotes the precautionary principle, meaning that managers should be “conservative in allowing actions and activities that may heighten impairment of park resources and consistent in avoiding actions and activities that may irreversibly impact park resources and systems” (NPS, 2012b, p. 15). However, what does it mean to “irreversibly impact park resources” in an era of rapid change? Does such a “conservative” approach promote learning and adaptation?
4.4.5 Perceptions of Organizational Change

Perhaps with the exception of the precautionary principle, most respondents agreed that the majority of the ideas in *Revisiting Leopold* represent a paradigm shift or an ideological change for the NPS. However, when asked about how and where a change like this would occur in the NPS, or where the impetus for change comes from, respondents gave a wide variety of responses. In fact, almost every interviewee responded differently. However, responses can generally be grouped into three categories: those who believe that change comes from various levels or groups within the organization, those who believe it will come from an outside force, such as a particular catalyst, Congress, or public opinion, and those who expressed skepticism about change in the NPS due to organizational characteristics.

Several respondents cited a “combination of scales and perspectives” (R16) as an impetus for change, from both the park level (especially superintendents and resource managers) to the White House Council on Environmental Quality and the Director. These respondents tended to think that change occurs from both the “top-down and bottom-up” (R3).

Five people specifically referenced Rogers’ diffusion of innovation theory, citing early adopters as the change agents in the NPS. When asked who these early adopters are, one respondent believed them to be the corps of people who are superintendents, regional directors, and those who work in the Washington office. Another suggested the formation of a group of “respected peer leaders” (R6). One respondent specifically listed several superintendents, a few people in resource management-related positions at parks, and a few regional level people that work with the Inventory and Monitoring Program. Another termed them “trailblazers” (R10), or those “front-line staff people who are confronting
changes that they see right in front of their faces and having to grapple with these questions and what they mean on the ground” (R10).

Another group believes that change will primarily come from outside forces, such as from non-governmental organizations, academia, societal values, Congress (more specifically, Congress’ ability to bring the public on board), or the general recognition of the need to change that arises out of a need, or specifically, a desperate budget situation. Two respondents believed that the agency needs an “aha! moment” (R13; R23), or a catalyst, “where we take a really different and incorrect perspective and we learn from it, almost like the Yellowstone fires and what that meant for fire ecology and forest management” (R13).

Finally, several respondents seemed to be discouraged or skeptical about ideological change within the NPS. “Most of the important ideas in ‘Revisiting’ have already been discussed by the leadership in the Park Service…we’re already aware of it, it’s just very, very difficult to implement” (R11), said one respondent. Another agrees that parks know what they need to do, but they don’t have the budgets or the staff to do it. Not all believe that change is impossible, but that it will likely take time. “It’s not like, ‘Let’s convene a symposium and we’ll decide this,’” an interviewee remarked. “This is going to be years and years, and it’s going to be really really messy, and it’s going to be really really emotional, and it’s going to be really, really hard. It’s going to be hard because it’s going to be ambiguous for a relatively long period of time” (R10). This feeling of skepticism from several of the respondents indicates low levels of readiness for change, and that that NPS likely does fall within the control/internal focus quadrant of the competing values framework, which suggests that organizational change may be a difficult undertaking (Jones et al., 2005).
4.5 What are the Mental Models Operating Within the System?

The bottom level of Senge’s iceberg model, and therefore the place with the most leverage in terms of organizational change, is that of mental models. While many mental models are likely at play in the NPS, several emerged from those interviewed, including mental models according to one’s division, around the role of science, the role of the organization, and the mission.

4.5.1 Divisional Lenses

Underlying the structure and culture of the organization are mental models, or deeply held beliefs and assumptions about the system and the world. Demonstrating how mental models, culture, and structure influence each other, one respondent explained that employees have certain mental models, or lenses, according to the division in which they work.

“There does exist a Cultural Resource directorate, a Natural Resource directorate, and a particular discipline or disciplines of the social sciences fall in between…Oftentimes within these bureaucracies and with how humans organize the world, their lens, their mental model on some of these issues and the sciences associated with some of these issues are going to be biased with sciences they have studied and are most familiar with. They may not be the sciences that are needed at the time.” (R13)

Employees may also have different paradigms depending on the type of park unit at which they work (e.g. recreation area, historic site, or a large “natural” park). This reveals that employees hold conflicting mental models about their role in the organization, and their
narrow mental models may be preventing them from understanding how to best work with other towards the broader goal of the organization.

4.5.2 Science is the Answer

When asked how they see the organization coping with change and complexity, additional mental models emerged, such as an inability to break out of the positivist science and the strict preservationist nature of the old paradigm. In response to this question, almost a third of the respondents cited the need for more science, research and information sharing. While some believe that the NPS is improving with regard to science and research, most believe that the current level of science and communication about science is still inadequate. According to some, the organization is both undertrained and underfunded in this capacity. One respondent had this to say about the use of science:

“It feels like there’s an undercurrent of, ‘Well, you put that science out there to meet your needs or to prove a point or to skew it in your direction of whatever your spin is on it,’ rather than just taking science for fact that happened in the past. Science was fact. It was…I’m hoping that *Revisiting Leopold* will…allow us to put some more faith and trust throughout segments of society in what science can mean for understanding where we’re headed and put us into some common language.” (R8)

This respondent highlights two ways that science can be used in the NPS, one way highlighted advertently and the other inadvertently. In one capacity, science can be a used by managers as tool, such as to support a controversial decision. However, many respondents also seemed to think that more science will help to reduce some of the complexity and uncertainty in the social ecological system, an idea explored in more detail
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in later chapters. Both of these views reveal underlying mental models about the roles of science in the NPS.

On the other hand, a few respondents explicitly remarked that the NPS needs to become more systemic and holistic in its thinking and management. These respondents specifically recognized the “nebulous interconnectivities of the system” (R13), and that increasing complexity “induces more value-based decision making” (R13) based on our culture and mental models. While many employees appear to be rooted in a positivist paradigm, a few employees seem to have mental models more in line with a systems thinking paradigm.

A few respondents remarked that sometimes managers don’t understand or accept all of the uncertainty in science, that it is a “process and self-correcting” (R1). They often take science as providing some sort of answer, perhaps because it’s more convenient. As another respondent puts it,

“When we talk about putting things into a probability space and trying to communicate these complex mathematical terms to managers, it’s very difficult. That’s a big challenge, because managers even two levels above my position get lost in very simple graphics, for example. They need a Power Point presentation with a big sign that says, ‘Take this one!’” (R9)

On the other hand, another respondent sees the relationship between science and management as an improving one, especially in terms of awareness of the uncertainties of ecological change.

Alternatively, sometimes there exists “sort of a good old boys’ approach that, ‘We’ve done this study, we must know the results, we must know how to build a trail or do that because that’s how I was taught when I was a seasonal,’ sort of thing. There’s that
network. By improving the understanding of how and where it’s appropriate to use science and how and where it’s appropriate to not use science is probably an important improvement” (R6).

4.5.3 Preserve the Past

In addition to mental models about the role of science, NPS employees also seem to be holding on to a broader mental model of needing to preserve the past and sometimes demonstrating a fear of change. As one respondent remarked, “With the Park Service, where we have this long-term trajectory of the past to which we are trying to preserve, to contrast with conserve, just the paradigm of change alone can be threatening… Culturally we have a lot of traditional roles and responsibilities which may need to be reconfigured and retooled” (R18).

Some employees struggled with complexity because they felt confined by laws and rigid policies that make it difficult to deal with complexity. One respondent complained about a recurring response among employees: “We can’t. The rules don’t allow us to do that” (R8). The NPS is mentally thinking about the world as it used to be, the same respondent remarked, and unable to anticipate what is likely to come our way and plan accordingly. The problem is with the Organic Act, another interviewee believes, which directs the Service to “preserve and protect…You can’t preserve or protect something that’s changing right under your feet” (R20). Another law that is incompatible with rapid change is the National Environmental Policy Act (NEPA). “It can take a decade or longer to make a decision through NEPA. That doesn’t speak to adaptation, at least in a short-term sense” (R18), one respondent observes. Together, these laws appear to cultivate mental models of resistance to change.
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One respondent believes that the problem or barrier to change is the perceived lack of need for new policy. The *Management Policies 2006* are very hands-off, and reflect a goal of putting “pieces of systems back into place that had previously been disturbed by humans and then tries to have as much of a hands-off approach…and tries to provide this really wonderful, unimpacted visitation experience for visitors” (R1).

For many employees, the greatest cultural challenge will be moving away from the mentality of preserving the past, and thinking at scales bigger than the individual park. Some employees believe this isn’t a conversation the NPS has tackled yet: “we either have to be willing to invest to preserve or maintain what we currently have, or have some serious discussions about what happens when an entire environment changes… [and we cross] difficult thresholds” (R8).

However, some of this may be driven by the public and how the public views the role of parks. “We can have all the best biophysical science in the world on you name the topic, but public opinion and acceptance of what we want to do in every case ultimately affects the success or failure of what we do” (R1). This sentiment was echoed by many managers. People must see the direct connection between themselves and the resources, a respondent explained. Effective management is more difficult, for example, when people “look out their window and see these beautiful mountains, and once a year they do a picnic in __, but other things in life are important to them. We don’t have a connection to them” (R1).

4.5.4 The NPS Mission

As described above, the way that the public views the role of the NPS is important. However, the way that the employees themselves view the role of the organization is also
important, especially in creating a strong shared vision. The NPS is a mission-driven organization, and most interviewees are supportive of and identify with the agency’s mission. Of those interviewed, the overwhelming majority do not see incompatibilities between the mission, to “leave [resources] unimpaired for future generations,” and what the *Revisiting Leopold* report is recommending. “Our mission is thoughtfully crafted… I do not think that our mission is static. It never has been” (R17), says one respondent. In order to preserve resources for future generations, we have to adapt to rapidly changing conditions, says another.

While the majority of those interviewed like and support the mission, some of these respondents believe that the interpretation of it, the policies surrounding it, or the way that management responds to it need to change. One respondent questioned whether this is possible within the bureaucratic system. While some of the underlying assumptions around preservation may have been incorrect at the time of the enabling legislation, another respondent concedes, we now have a better understanding about inevitable change over time. For some, the mission itself isn’t problematic, “it’s just a matter of opening the lens wider” (R5) or coming “to a different understanding of ‘impaired’ and ‘unimpaired” (R12).

Only two respondents doubted the compatibility of the NPS mission with the ideas outlined in the report, and two others believed that there was a philosophical disconnect. The mission encourages the NPS to hold things in stasis, and “we’ll have to get over the fact that we have interpreted our mission to be holding resources at bay from modern man…The mission itself is now flawed, but how we interpret the mission might be untenable given the changes we’re seeing. New interpretations of the mission will be necessary” (R23), says one respondent.
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When asked if the Park Service mission facilitates managing for change, one respondent replied, “Currently I don’t think it does…we do need a little bit of a fine-tuning of our mission to emphasize that adaptability in how we manage lands in managing for change in the future” (R15).

The mission of an organization is often highly influential in determining values and behaviors of those within it, especially if there is buy-in from employees at a variety of levels (Raelin, 2006). It appears that for the sample of managers interviewed, the majority of respondents fundamentally supported and believed in the mission of the NPS, and did not consider the mandate to preserve resources “unimpaired” to be problematic. This is somewhat surprising due to the fact that managers also supported the idea of managing for change and uncertainty. These managers, however, appear to be exercising their ability to determine the best way to accomplish their agency’s mission (Osborne, 1993, p. 353), a characteristic of a more adaptive organization (Osborne, 1993). It is also possible that in their role as early adopters and respected employees within the NPS, these respondents may also serve as “meaning-makers” (Raelin, 2006). If so, then their ability to interpret “unimpaired” in a broader sense and reconcile the mission with *Revisiting Leopold* may be beneficial for the broader adoption of the ideas within the report. Alternatively, it is possible that this sample of the NPS population has not yet fully embraced what it will mean to manage for change and uncertainty.

Given the above responses that illuminate much about the NPS as a system, it becomes apparent that there are a variety of barriers to implementing *Revisiting Leopold*, and the NPS employees interviewed do not yet have a shared vision of the new paradigm. While a few managers are demonstrating an understanding of systems thinking, many problematic attributes exist at the event, pattern, structure, and mental model levels. These
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attributes are often quite interrelated; the following chapter will explore some of the relationships between them.
Chapter 5: Analysis

5.1 Relationships Within the System

Senge’s iceberg model is a useful tool for demonstrating structures that operate at a variety of different levels within a system. It is tempting to interpret problems and events as they appear on the surface, yet more difficult to understand and address the underlying processes, trends, structures, and mental models that also contribute to the way the system operates. While this is a useful framework for interpreting and presenting data, in reality, many of the properties of the system that emerged from interviews manifest at multiple levels of the iceberg. Additionally, the various levels of the iceberg are interconnected, and often influence each other. Events and patterns are usually influenced by structural and cultural aspects of the system, and these are usually driven by underlying mental models. Structural attributes may influence cultural attributes of the system, and vice-versa. For example, mental models about one’s role in the organization according to one’s division influence the respective cultures associated with each division. These cultures both influence and are influenced by the siloed structure of the organization, which in turn affects patterns and events such as competition between divisions for funding in the face of declining budgets. This section will explore some of the relationships and interconnectivities among properties of the NPS system that emerged from the data, and how they affect the ability of the NPS to become a learning organization. Again, the following discussion is derived from the views of a sample of managers, and cannot necessarily be generalized to the organization as a whole.

5.1.1 Management Cycles and Short-term Management
One of the properties of systems thinking is the ability to think and manage at broader temporal scales and to understand that actions may have consequences that manifest much farther into the future than anticipated or than managers have the capacity to perceive. This type of long-term thinking is critical to becoming a learning organization, yet several structural attributes of the NPS that emerged from this sample are contributing to a culture of short-term thinking. For example, employees often only occupy a position for a few years before changing positions and/or parks in order to advance up the career ladder, or they may vacate a position if their supervisor deems that they are performing poorly. As respondent 13 explains it, “…in some cases getting a promotion just means you’ve been moved out of your current role so something could actually happen in your current role. And in others, it actually means that someone is actually taking on a larger role because they’ve been proven competent…” (R13). Because employees often occupy a position for a limited period of time, success is also measured within that timeframe. A “management cycle application, is the way that success is measured,” reports respondent 6. “If the work you’re doing can be applied for something of interest on a reasonable management cycle, it’s respected and applied” (R6). It’s understandable that an employee would strive to demonstrate success within the time-period that they hold a position, but this creates an incentive to work towards shorter-term goals rather than thinking at broader temporal scales. “We’re good at giving awards to people for individual actions, something that takes place over a relatively short term. We’re terrible at acknowledging and rewarding long-term leadership” (R11). Part of the reason for this may simply be the nature of the people who work for the NPS.

“Most of the people I know who work for the Park Service, they’re can-do people, they like to be able to achieve, they like to be able to have some sort of visible
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success. And generally speaking, people have a very, very short time horizon relative to an ecological time horizon. There is this human tendency to want to do something that shows results in six months, twelve months, three years. People are considered to be long-range thinkers when they’re thinking out five years.” (R10)

To the extent that this is the case, then it is likely a combination of cultural and structural attributes of the organization that contribute to the myopic nature of the NPS.

A culture of rewarding short-term successes may also be driven by funding cycles. “Most of our appropriations are single-year appropriations,” explains one respondent. “So unless somebody’s really watching very carefully that there is money set aside for monitoring, and sometimes the monitoring may be once every year or it might be once every five years or twice every six or seven years…Without somebody tracking that closely, that work can often fall through the cracks after a couple of years” (R21). As this example demonstrates, structural attributes of an organization are often driving the cultural manifestations. In this case, the nature of management cycles, position timelines, and funding cycles contribute to a culture of incentivizing and rewarding short-term successes and short-term management. In order for the NPS to become a learning organization, it may need to alter some of its institutional structures to incentivize long-term thinking and management that are more in line with ecosystem scale changes rather than management scale changes.

5.1.2 Disincentives and Risk-Aversion

In the above example, an NPS culture that prioritizes short-term goals can be a product of how success is evaluated and rewarded institutionally. Similarly, success also plays a role in the culture of risk-aversion that emerged from interviews. However, there
are interrelated factors at all levels of the iceberg that likely contribute to a culture of risk-aversion. Interviews revealed that there is a pattern of negative consequences in response to failure. When asked how the NPS deals with risk and uncertainty in social ecological systems, one respondent remarked, “Oh, we reward it when it’s successful, and we usually punish it when it’s not successful” (R7). While it appears from interview data that this pattern occurs intermittently, when a manager publicly takes a risk and isn’t successful, respondents report “dramatic” (R18) consequences, “raking over the coals” (R9), and an “incentive system…set up around ‘Don’t make mistakes’” (R10). “We see the failure and we forget the lessons from it…Nobody wants to fail” (R23), says another respondent. From interview data, it appears success for managers is dependent on not taking risks publicly. This creates a culture of risk-aversion that makes learning as an organization difficult.

Some of this culture of risk-aversion may also be driven by underlying mental models about preservation and leaving resources unimpaired. The *Revisiting Leopold* report reinforces the importance of the precautionary principle. One employee explains the preservationist culture as stemming from the mission, which is “basically put the pieces back and use a hands-off approach to allow ecosystem processes to occur” (R1). “We’re a very conservative organization” (R11), says another.

Some employees may also be influenced by their mental models regarding the level of control they have over the system. “I think we have a perception of much more management control over an environment or of people than we really have. I think there’s a whole lot of ego wrapped up in the term ‘park management’” (R6). Within this sample of respondents, it appears that both the negative consequences in the face of public “failure,” as well as the underlying mental models about preservation and the need to control and “manage” the environment contribute to a culture of risk-aversion.
5.1.3 Siloed Structure and Narrow Job Roles

Another example of how various levels of the iceberg model are interconnected relates to the siloed structure of the NPS, and how this leads to cultural barriers, problematic mental models, and ultimately may prevent the implementation of the ideas in *Revisiting Leopold*. The NPS is divided into multiple divisions and directorates that often compete for funding. While on the surface it may be obvious that interdivisional communication is beneficial to learning and efficiency, the organizational structure makes this difficult. There is “a lot of communication that emphasizes interdisciplinary work but when the rubber meets the road, it becomes very hierarchical, very militaristic in its structure, where certain directorates, certain divisions, certain organizations end up having turf wars in moving forward. That really inhibits interdisciplinary work” (R13). The siloed structure contributes to a culture in which interdisciplinary work is difficult and divisions are sometimes in competition with each other rather than working together towards the broader mission.

Even deeper than this culture, however, are the underlying mental models about each employee’s role in the organization and how they define their own job. “The park ranger…used to be the be-all and end-all,” remarks one respondent. “We’ve gone from generalist to specialist…and it’s hard to get specialists to adapt to anything” (R18). This is likely because specialists see their job as very narrow. For example, one interviewee is a scientist, and when asked about resiliency, responded, “Well, I don’t think you can look at it as a resilient national park. You’d look at it as an attempt to create resilience in primarily the dominant plant communities on the landscape” (R20). While this respondent understands the concept of resiliency, he or she only sees its application to his or her particular field of expertise. Different divisions, or silos, have their own goals; employees
within these divisions often have specific backgrounds suited to their division which may influence the way they interpret the environment and approach particular problems.

“There does exist a Cultural Resource directorate, a Natural Resource directorate, and a particular discipline or disciplines of the social sciences…Oftentimes within these bureaucracies and with how humans organize the world, their lens, their mental model on some of these issues and the sciences associated with some of these issues are going to be biased with sciences they have studied and are most familiar with. They may not be the sciences that are needed at the time.” (R13)

If employees in different divisions have different “lens,” or ways of seeing the world, then the problem is deeper than the organizational structure. It’s unclear whether these underlying mental models influence the creation of these silos, whether the siloed structure informs these mental models, or both, but there is clearly a relationship between these two levels of the iceberg.

Senge uses the analogy of three blind men touching different parts of an elephant to describe the importance of looking at an organization systemically. All three men possess real facts about part of the elephant, “but they will never know an elephant” (Senge, 2006, p.66) as a whole. “To understand the most challenging managerial issues requires seeing the whole system that generates the issues” (Senge, 2006, p. 66). These underlying mental models, culture, and structure may ultimately affect the ability of the NPS to adopt the ideas in Revisiting Leopold. To create a shared vision, all employees must understand and buy into the concepts of the new paradigm, not just those in resource management. With regard to the report itself, on interviewee wondered, “How many chiefs of maintenance and maintenance supervisors have been educated about this? And visitor protection staff, too,
how many chief rangers and district rangers and whatnot” (R12). That question is difficult to answer and beyond the scope of this study, but breaking down silos and narrow mental models within the NPS will likely be important for creating a shared vision around the implementation of this report and for the creation of a learning organization.

5.1.4 Transboundary Management: Rhetoric and Agency Culture

Another component of systems thinking is an ability to think at broader scales, or to see oneself within a panarchy of nested hierarchies (Walker & Salt, 2006). To become a learning organization, managers must understand the systems operating at both larger and smaller scales. *Revisiting Leopold* calls for NPS employees to understand that parks are “embedded in larger regional and continental landscapes influenced by adjacent land and water uses and regional cultures” (NPS, 2012).

The managers interviewed for this study all generally understood the need to collaborate at broader scales. “It’s pretty clear we can’t do our job without working together” (R12), remarked one respondent. Additionally, the concept of collaboration with stakeholders seems to be increasing in popularity. “There’s a lot of pressure to ‘get along,’” one respondent noted. “Now we call former adversaries our ‘partners.’ If the NPS is dealing with a controversial situation, success is gauged by how many parties are satisfied” (R9). However, if the NPS wants employees to collaborate at broader scales and employ more transboundary management at the landscape scale, it cannot accomplish this simply at the event level of the iceberg. “There’s a lot of personal incentive in [collaborating at broader scales]… everybody says, ‘partner, partner, partner,’ but all of the internal systems in the Park Service make that difficult” (R1).
Although there are cultural and mental model barriers to working at broader scales, interviews indicate that the most significant barriers are structural. Land management agencies have different missions and legal jurisdictions. “Sometimes those are federal jurisdictional boundaries between one agency and another, but it goes way beyond that. Obviously you’re looking at landscapes that are a mosaic of different kinds of government engagement and private sector. It becomes complicated fast” (R5). Funding mechanisms and associated rules about how that money can be spent further complicates transboundary management. “Working outside of parks, our ability to get money, much less use it for conservation efforts that are larger-scale than any one park doesn’t exist. Right now we chase project funds or park-based dollars…There’s a couple real small conservation pots, but in general…within our current funding rubric, that doesn’t exist” (R8), one respondent explains.

Culturally, the NPS seems to still be schizophrenic with regard to incentivizing working at broader scales. Managers hear a lot of rhetoric about the importance of transboundary management and collaborating at broader scales (e.g. “everybody says, ‘partner, partner, partner’” (R1)), but many other respondents remarked that the only incentive to doing so was personal. “The people who do that… it’s almost like, they don’t necessarily get punished, but they just don’t get any credit for it, really” (R23).

Several other respondents spoke to the contradiction between the current culture and the need to work at broader scales. “The culture says, ‘Stay in your park. Work in your park, don’t stick your neck out. You’re getting paid to protect the resources in __ [park unit], and you shouldn’t be lollygagging or running around with a bunch of other people in a partnership,’ even though it helps the park” (R20). In “Revisiting Leopold,” remarks another respondent, “the committee is instructing the Park Service to get outside the
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boundaries of its parks to work with other landscape managing agencies and think big picture…but I can tell you that that’s not how we’re used to working, ‘we’ the Park Service and ‘we’ most other agencies” (R11). Another interviewee considers there to be a level of “cultural arrogance in the national park system” (R16) with regard to working with other agencies.

Another barrier, believes one respondent, is that both agencies and communities need to have a reason to collaborate. They must “see something in it for themselves…in some cases it could be more water, and in other cases for a local community it could be flood protection. It could be tourism opportunities and economic development” (R1). Otherwise, if the agencies or the public don’t see any “tangible benefits” (R1), then cooperation can be difficult. This speaks to underlying mental models on both the part of park managers, and the public. It appears that some managers in the NPS don’t yet fully believe in the intrinsic value of working outside their boundaries, and it highlights the differing mental models that the public holds with regard to the role of parks in their communities.

Additionally, the decentralized structure of parks may have contributed to a tendency of some NPS employees to be inward looking and hold park-centric mental models of their role in conservation. “Historically the agency has been managing each park as somewhat of an island, not worrying as much about beyond the boundaries” (R22). On the mental model level, however, this may be changing. “The role of the superintendent each year is becoming more and more focused on reaching out to those neighboring communities, neighboring agencies, and other partners…Unfortunately, right now at this point, it’s mainly just that, talking about it” (R22). Without cultural support for
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partnerships and transboundary management, as well as the structures in place to allow it, landscape scale conservation will continue to be an elusive goal.

5.1.5 Budgets, Spending, and Public Support

Almost all respondents reported budgets and staff cuts as a barrier to implementing the ideas in *Revisiting Leopold*. As a result, respondents report that this puts managers in a reactive mode, where they are “responding to the crisis of the day” at the expense of “some of the resource programs that are really important” (R4). However, there may be other reasons that some programs are not receiving funding in accordance with the extent to which managers deem them important. For example, several respondents reported that it’s difficult to acquire money for projects that aren’t “sexy” (R1; R20) or high profile. One manager remarks:

“We get a huge amount or reward for the success of the ___ restoration program because of its visibility. We also have a really, really good aquatic invasive species program right now that I believe has been responsible for prevention of a lot of bad things that could have come to this park, but because it’s not a sexy project…people don’t take notice to it. A lot of money doesn’t flow towards it.”

(R1)

This may be driven by a cultural tendency of the NPS, or by the public’s mental models about what is important to preserve. A superintendent notes that “…the visitors write letters, and of course resources can’t, but that’s what gets the attention, trying to make people happy, trying to soothe ruffled feathers, rather than look at…what we did to try to protect the park” (R4). Regardless, public opinion seems to impact how resources are managed.
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The NPS’ funding structure also plays a role in how funding is allocated for projects. In terms of a superintendent’s baseline budget, “75% of your budget goes to visitor services…and only 25% of your budget goes to resources. And that’s generous. That’s a [large] park. In most parks, it’s probably less than that” (R23).

According to Jones et al.’s concept of readiness for change, employees who believe their organization has flexible polices and procedures are more likely to perceive change positively (Jones et al., 2005). With regard to fiscal policy, flexible budget and spending rules are an important component of transition to a more flexible, adaptable culture in government agencies (Sanger, 2008). Whether it’s due to structural budget constraints or the forces of public opinion, managers consider their hands tied with regard to how they can allocate fiscal resources. This seems to be hampering their ability to institute long-term monitoring programs and increase scientific capacity. Further, this may make it more difficult to manage resources that are key to maintaining resiliency, for example, or to implement some of the other ideas in the Revisiting Leopold report.

Another factor that is revealing with regard to visitor support is the concept of transformative experiences. While not many respondents addressed this particular goal, one respondent noted that transformative experiences involve both education and inspiration; it is “absolutely crucial for resource stewardship [for] visitors to be engaged” (R3). Whether the respondent was implying that inspired visitors improve resource stewardship in the financial and political sense, in the behavioral sense, or both, it reinforces the degree of importance that the NPS places on public opinion.

Several mental models may be underlying this system. It is apparent that NPS employees believe that public support, either politically, financially, or more personally, is necessary to continue to function as an organization and to maintain relevance. This
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assumption may be true, but regardless, it is influencing spending practices, possibly at the expense of critical resource projects. The public also possesses mental models about how the NPS should spend its money, whether it is on visitor services such as picnic tables and restrooms, or on “sexy,” “visible,” resources. In order to give managers the flexibility they need to implement *Revisiting Leopold* and become a learning organization, it may be beneficial to consider these underlying assumptions.

5.2 Learning Disabilities

Other types of barriers to adopting the ideas in the *Revisiting Leopold* report, closely related to mental models, are what Peter Senge terms “learning disabilities” (Senge, 2006). Identifying learning disabilities is important because if the NPS wishes to transform itself in the way that *Revisiting Leopold* describes, then it must identify the processes that are preventing it from becoming more adaptive and working more systemically.

Many organizations learn poorly, regardless of whether they are in the private or public sector, large or small. What these organizations have in common, however, are similar reasons that they learn poorly, or learning disabilities. “The way they are designed and managed, the way people’s jobs are defined, and, most importantly, the way we have all been taught to think and interact (not only in organizations but more broadly) create fundamental learning disabilities” (Senge, 2006, p. 18). When learning disabilities are at play, even intelligent, motivated employees have trouble solving organizational problems, and “often the harder they try to solve problems, the worse the results” (p. 18). In other words, simply trying hard to implement the ideas in *Revisiting Leopold* may not be enough to transition into a new paradigm if learning disabilities are occurring.
5.2.1 “I Am My Position”

Many employees, especially government employees, are taught to be dedicated to their jobs, sometimes to the extent that employees confound them with their own identities (Senge, 2006). This is especially true in the NPS, an organization in which employees are highly intrinsically motivated. This manifests itself in mental models such as “I am a Park Ranger.” When asked about their occupation, most people explain the duties they carry out rather than the mission of the organization to which they belong. They may view their position as part of a larger system over which they have little control, so they execute their position while trying to deal with the attributes of the organization over which they have no influence. For example, in the NPS, employees might think of this as simply coping with “the red tape” or the “bureaucracy.” As a result, employees often view their duties as constrained by the scope of their job title, and when they concentrate on only their job, employees feel very little responsibility for the circumstances created when all positions intersect. When this combined circumstance is less than ideal, it may be difficult to see why, so people automatically assume that “someone screwed up” (Senge, 2006, p. 19).

Perhaps because of the siloed nature of the organization, many NPS employees demonstrate this “I am my position” learning disability. This is tied to different underlying mental models about the purpose of one’s job depending on which division one works within. As described in the section above, “The park ranger…used to be the be-all and end-all…We’ve gone from generalist to specialist…and it’s hard to get specialists to adapt to anything” (R18). This is likely because specialists see their job as very narrow, just as the scientist mentioned in the previous section understood the concept of resiliency but was only able to apply it in terms of plant communities. Different divisions, or silos, have their
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own goals and employees within these divisions often have different backgrounds that influence the ways they view and approach the world.

Not only do employees have narrow lenses through which they see their position, but all employees did in fact describe their job purely in terms of the boundaries of their positions. For example, “I work on a lot of planning products for various parks” (R22), “I do the T&E species, wildlife, lead, sound, geology…research permitting” (R20), or “I serve as the point of contact for all the __ coordinators for the __ parks” (R2), were representative types of responses when employees were asked to describe their job. None mentioned the broader purpose of the NPS. While this is a natural response to the question asked, it reveals a tendency for employees to identify more with their position than with the larger mission of the NPS. This perpetuates an assumption that as long as an employee executes the duties of their position, then the organization will function as it should. However, to become a learning organization, managers must be able to step back and examine what happens to the NPS system when positions interact on an organizational scale.

While remedying the “I am my position” learning disability will help the NPS become a better learning organization, a strong identification with one’s position may be an attribute with which the NPS can work if it wants to change the current system. For example, if the NPS wants to implement the ideas in Revisiting Leopold, then it may be able to incorporate some of the ideas in the report into employee’s management descriptions in the short-term. In the long-term, it would be beneficial to work on changing mental models about the scope of each employee’s position.

5.2.2 “The Enemy is Out There”
Another learning disability, which is actually a derivative of “I am my position,” is “the enemy is out there,” meaning a tendency to look outside oneself when there is a problem. When people focus solely on their own job, they fail to see how their actions affect circumstances beyond their position, and when problems arise, people “misperceive these new problems as externally caused” (Senge, 2006, p. 20).

For example, almost all respondents cited a variety of structural and cultural barriers within the organization to implementing the ideas in *Revisiting Leopold*, but very few spoke about how they themselves could work to implement some of the ideas in the report. While most employees recognized that the new paradigm described in *Revisiting Leopold* represents a needed change for the organization, many deferred to others in the NPS and seemed to be employing a “wait and see approach” when asked about how the report would be implemented. Six respondents cited the implementation team and several others “don’t know” how the report will be implemented or believed it was up to others, either more broadly in the NPS, their superiors, or “champions” within the organization. “A lot’s going to depend on [my supervisor]” (R12), remarked an interviewee.

Respondents also blamed factors outside the organization for the inability to shift into a new paradigm. “From where I sit, Congress is the most likely source of our challenge right now. The reason I say that is because you have such divergent philosophies within that organization, and ultimately that entity becomes representative of the public as a whole” (R8). In response to a question about challenges to implementing the report, a respondent hopes for “a more reasonable climate in Congress” (R5), and another spoke to the need for “some authority from Congress” (R21) to deal with these issues. Beyond Congress, “public opinion and acceptance of what we want to do in every case ultimately affects the success or failure of what we want to do” (R1). While these respondents may
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not be wrong, very little, if any, introspection about the respondents themselves emerged from interviews. For managers to truly begin to think systemically, they must be able to see their own role in the system.

5.2.3 “The Illusion of Taking Charge”

Being “proactive” is a popular endeavor. Many managers “proclaim the need for taking charge in facing difficult problems. What is typically meant by this is that we should face up to difficult issues, stop waiting for someone else to do something, and solve problems before they grow into crises” (Senge, 2006, p. 20). Unfortunately, being proactive often means aggressively fighting the “enemy out there,” which will not solve problems unless managers understand how they themselves are part of the problem. “True proactiveness comes from seeing how we contribute to our own problems” (Senge, 2006, p. 21).

In order to implement the recommendations in Revisiting Leopold, the authors suggest a systematic review of agency policies, yet also advise against altering the founding legislation of the NPS. They convey the need for urgent “structural changes and long-term investments” (NPS, 2012b, p. 23). While the recommendations of the Implementation Team have not been released at the time of this writing, it would also behoove the NPS to examine the underlying systemic processes of the system before employing an “urgent” (NPS, 2012b, p.23) proactive approach.

5.2.4 Fixation on Events

A common tendency within organizations is to fixate on events that have caused current problems, which leads to “event level” solutions. Senge notes that this is an evolutionary human tendency, because for much of early human history, the principle
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threats to survival were from rapid events, rather than from slower gradual processes (e.g. an arms race or environmental degradation) (Senge, 2006). However, by not seeing the longer-term, slower variables that are contributing to problems, organizations will be unable to solve them.

While some respondents were able to think more systemically about the report, “fixation on events” was evident in many interviews. For example, some managers reported that they were struggling to implement ideas in the report because they were busy doing budget exercises, reacting to the crisis of the day, or lacked specific guidance about how to implement the report. However, a few recognized longer-term patterns of change and the need to think at that scale. One superintendent described the loss of infrastructure from significant storm events, and noted that, “We’re dealing with it on a case-by-case basis, but in total, if you look across the landscape, it really has potential for a very cumulative effect, a dramatic impact on natural resources, cultural resources, and societal support for parks…” (R10). Some managers are thinking about the longer-term impacts, but according to this respondent, some employees still seem to be reacting to the loss of infrastructure at the event level.

Like the example above, some employees seem to be trying to think in terms of long-term variables, but are stymied by other factors that cast issues in terms of short-term events. With regard to climate change, says the same superintendent, “[interpreters] clearly see that they want to be able to talk about climate change, to talk about what the impacts are and what people can do, but they’re also grappling with the unfortunate political situation where climate change is seen as an issue as opposed to fact based” (R10). If interpreters are still dealing with the short-term or event level debate over whether climate-
change is fact based, then they are inhibited from being able to engage in deeper discussions about such as how to address it into the future.

A fixation on short-term events is also evident in the way that success is evaluated and rewarded. “If you don’t design a goal around a three-to-five-year horizon, its relevancy to park and regional management is pretty low, and really to most people involved, the relevancy of any project that takes more than two or three or four years to have a result is pretty low. I’m not sure that’ll ever change, or that there’s a reason or need to change it” (R6). This issue relates to other cultural and structural barriers that prevent thinking at larger temporal scales, but this quote also highlights the tendency of supervisors to evaluate short-term events that their employees accomplish rather than examining how those goals or projects are contributing to longer-term variables.
Chapter 6: System Archetypes

For organizational purposes, much of this thesis has presented findings in discrete sections. Systems thinking, however, is a method for examining the whole. It is about examining interrelationships and patterns instead of individual pieces, as well as a tool to understand positive and negative feedback loops. This chapter draws upon Senge’s concept of archetypes (Senge, 2006) to examine circles of causality that emerged from the data, rather than simply linear relationships.

Feedback loops occur when actions either reinforce or counteract each other. In an era of complexity, feedback loops create simplicity by revealing deeper patterns that operate below surface-level events. There are two types of feedback loops: reinforcing, or positive feedbacks, and balancing, or negative feedbacks. When a reinforcing loop is occurring, managers may fail to see how small actions create large consequences, and when a balancing feedback loop is occurring, managers may not understand why they cannot break out of the status quo, despite their best efforts. Feedbacks can manifest in a potentially infinite number of ways, but there are several general patterns or structures that recur over and over again across all field and types of organizations. Senge terms these archetypes, and has identified 10 archetypes that repeatedly manifest in a variety of different organizations. Once identified, they highlight places where managers have leverage to change the situation (Senge, 2006). This section will explore a few of the many archetypes that describe the relationships as depicted by the respondents.

6.1 Limits to Growth

In the limits to growth archetype, one reinforcing feedback loop is experiencing a period of accelerated growth. This growth is slowed, however, by a balancing feedback that
limits the extent to which the reinforcing loop can grow. A common warning symptom that this type of archetype is occurring is when managers notice that even though they’re trying hard to promote something, the organization seems to stay in the same place (Senge, 2006).

This archetype emerged from the data when respondents spoke about transboundary management and their attempts to collaborate at broader scales, as *Revisiting Leopold* recommends. Respondents all understood that parks exist as political “islands,” as well as the need for and the benefit of collaborating with partners and managing at the ecosystem scale. The rhetoric of partnership and collaboration outside of park boundaries has been increasing, which serves as the growing action. However, many respondents also described fiscal, legal, contractual, and ideological barriers to doing this in practice. Thus, the “growth” of transboundary management is limited by structural and cultural constraints. The figure below shows the general model of the archetype, with its manifestation in the NPS below it.
In order to break the counterbalancing cycle of limits to growth, managers should avoid trying to force the growth process; it will only stall until the limitations are removed. In this case, further advocating the “partner, partner, partner” (R1) rhetoric will be fruitless until the practical limits to doing so are loosened.

6.2 Fixes That Fail

When managers run into problems, they often employ the easiest, most immediate solution, or the solution that has seemed to work in the past. The fixes that fail archetype occurs when a solution is effective in the short term but has unintended longer-term outcomes which may necessitate more of the same fix. A red flag that may indicate that this archetype is occurring is when managers notice that, “it always seemed to work before; why isn’t it working now” (Senge, 2006, p. 399)?
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When interviewees were asked about how to deal with complexity, uncertainty, and rapid change, many cited the need for more science and information. While this may provide a short-term solution in the context of an Environmental Impact Statement, litigation, or a particular resource issue, this is not a long-term fix to the fundamental problem. Over time, more science will simply generate more questions and uncertainty, and likely reveal more complexity.

Figure 4: Fixes that Fail

To solve difficult, complex problems, managers need to concentrate on the long-term rather than the short-term. Short-term fixes should only be used to “buy time” while dealing with the underlying solution. The above archetype demonstrates that many NPS employees, and even upper-level managers, are still stuck in a positivist scientific paradigm. Positivist science is necessary and appropriate in many situations. However, in the face of emergent complexity and wicked problems, or problems that don’t have a single obvious solution, only responses with varying degrees of practicality (Brunson, 2012), managers are struggling to break out of their mental models, and are instead relying on
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“more of the same” to solve problems for which positivist science isn’t appropriate. More science is not a bad thing, and in fact, more science will likely be needed to understand systemic relationships into the future. However, this calls for a different type of science, such as Funtowicz and Ravetz’s postnormal science (1993).

6.3 Eroding Goals

The *eroding goals* archetype is somewhat similar to *fixes that fail* in that managers have a tendency to employ a short-term solution to correct a problem, which results in immediate positive outcomes but unintended long-term outcomes. However, in the *eroding goals* archetype, the short-term fix allows a long-term goal to erode. A common phrase associated with this archetype might be, “it’s okay if our standards slide a little, just until the crisis is over” (Senge, 2006, p. 394).

Two of the most common themes throughout interviews were declining budgets and being stuck in a “crisis-management” mode; many respondents drew a causal relationship between the two. Several others brought up the fact that a large proportion of the budget is allocated to visitor services, leaving little left over for natural resources and long-term monitoring. Managers felt long-term monitoring was important, but often saw the funding for it fall through the cracks or go to fixing the crisis of the day. In this case, the goal is improving understanding of the system through long-term monitoring, but this goal is counterbalanced by crises and day-to-day expenses (e.g. fires, road maintenance). In order to improve knowledge of the system, an employee may set aside money for long-term monitoring, but over time, that money is siphoned off for other things. Meanwhile, managers continue to adjust targets and expectations downwards.
The only way to combat goal erosion is for managers to focus on the long-term vision. This archetype will continue to be a problem unless the NPS can break its myopic culture driven by management and funding cycles, as discussed in previous chapters. Managers must readjust their mental models regarding the temporal scope of their goals, and make worthwhile long-term efforts a priority.
Chapter 7: Conclusion

While many of the respondents in this study have recognized the need for the organization to adopt a new ideology better suited to a complex social ecological system, the process of transforming this type of agency on an organizational level is difficult. This study examined a variety of factors, processes, and feedbacks that emerged from interview data in order to assess whether and how the NPS can adopt the new paradigm proposed in *Revisiting Leopold* and become a learning organization.

While most of those interviewed recognized the need for organizational change, and some are already thinking systemically, there remain several institutional barriers that are currently preventing the NPS from becoming more adaptable in the face of complexity, uncertainty, and volatile change. For example, managers demonstrated the lack of a shared vision around what the implementation of *Revisiting Leopold* will look like. Some struggled with fundamental concepts of this new paradigm, such as resiliency and managing for coupled human-natural systems. Patterns such as staff turnover and trends such as declining budgets force employees to operate on short-term scales. Structural components of the NPS, such as decentralized, relatively autonomous parks and rigid silos make communication and efficient collaboration difficult, while laws and policies surrounding use of funds and partnerships stymie collaboration. Cultural attributes of the NPS, such as precautionary preservation and risk-aversion preclude organizational learning; deeply ingrained mental models about job roles and the role of science anchor employees to the old paradigm.

7.1 An Opportunity for Transformation
Thomas Kuhn argues that change does not happen gradually but rather, a new scientific regime replaces an existing scientific regime when it becomes evident that the existing approach is inadequate to address problems or explain anomalies posed by the environment (Kuhn, 1998). The publication of the *Revisiting Leopold* report suggests that the NPS’ current paradigm is inadequate to cope with the complexity and change of its social and ecological environment, but from the sample of managers interviewed, NPS appears to be stuck in the existing regime. According to Kuhn, paradigms change in response to some crisis that causes the abandonment of a previous paradigm or institutional framework (Kuhn, 1998), and perhaps the NPS has simply not yet confronted that crisis. However, in advance of an impending crisis and global environmental change, there is often an assumption that people have a limited ability to purposefully effect change (O’Brien, 2011).

Karen O’Brien questions this assumption. In the face of change, humans often consider only three options: mitigation, adaptation, and suffering. Most organizations will experience each of these, but sometimes organizations also fail to consider transformation. “In one sense, this is not surprising,” O’Brien writes, “as transformation often challenges the status quo, threatening those who benefit from current systems and structures (O’Brien, 2011, p. 668). However, it may be a less painful option than waiting until a crisis forces an abrupt paradigm shift.

This thesis examines the ability of the NPS to become a more adaptive organization in the face of change. Adaptation generally “refers to the act of making something fit for a new situation or use” (O’Brien, 2011, p. 669), which in this case refers to making the NPS as an organization “fit,” or continue to function and remain relevant, in a new context of change, complexity, and uncertainty. However, in order to do that, it has become clear that
the NPS also needs to transform, which encompasses “physical and/or qualitative changes in form, structure, or meaning making” (O’Brien, 2011, p. 670). This type of deliberate transformation often includes a variety of institutional, behavioral, and cultural changes that also entails challenging values, assumptions, beliefs, and identities (O’Brien, 2011), which aligns with and supports Senge’s process of becoming a learning organization (Senge, 2006). While this is not an easy process, the upside is that the NPS has a unique opportunity to begin transformation before some form of a crisis abruptly forces the organization fully into the new paradigm.

The first step to transforming and becoming a learning organization is to learn to examine the organization systemically; identify the short-and long-term variables at play, the relationships between those variables, and how they operate at different scales. Without an understanding of learning disabilities and archetypes that may be preventing the system from changing, managers often apply their efforts in the wrong places. Managers may push aggressive change efforts, and then are baffled by the resistance to change. By examining the patterns and trends, structures, cultures, and mental models at play, managers will better be able to identify the processes and feedbacks that are responsible for resisting change (Senge, 2006).

7.2 Leverage Points and Recommendations

Once there is a general understanding of the components of a system and how they work together, only then is it productive to attempt to change the system. When trying to change a system, the most leverage or tractability occurs in trying to change the paradigm by being open-minded, challenging existing beliefs and assumptions, and then identifying anomalies and failures in the old paradigm. Meadows identifies twelve places in a system,
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or leverage points, where small changes can result in larger transformation. These points increase in effectiveness, or in the amount of leverage they lend, as one moves from physical attributes, to feedbacks, to system rules and mental models (Meadows, 1999).

The barriers to change identified in this study vary in terms of the degree of effort required on the part of the agency to change them. Thus, Meadow’s concept of leverage points can help identify those places where some effort will result in much greater changes throughout the system. If the NPS is serious about changing its paradigm and implementing the ideas in *Revisiting Leopold*, it may want to consider the following examples of leverage points, which increase in order of effectiveness.

### 7.2.1 Parameters

Parameters, meaning numbers or figures, have the least leverage to change a system because they rarely change behavior (Meadows, 1999), but in this case, an example of a parameter would be the amount of funding the NPS receives. For instance, the NPS could adjust parameters by increasing the amount of funding for ecosystem-scale conservation efforts, for social scientists, or for types of science that help managers understand systemic processes.

### 7.2.2 The Sizes of Buffers and Stabilizing Stocks Relative to Their Flows

This leverage point refers to those things that make a system either stable or nimble. To increase the stability of the system, one would increase the capacity of the buffer (Meadows, 1999). If the NPS decides that it truly values certain natural or cultural resources and wants to maintain them in the face of future change, it can do this by creating redundancy. Purposefully adding redundancy in ecological and cultural systems would increase resiliency, or the ability of the system to undergo disturbances and maintain those
attributes that the NPS deems important (or more accurately robustness, due to the element of design and intentionality in this example). On the other hand, if the NPS wishes to become more reactive to changing social attitudes and demographics, for example, it might consider increasing the flexibility of its workforce. A large stabilizing stock of “30-plus-year employees” (R22), for instance, is a buffer that leads to inflexibility. However, this leverage point also ranks low in terms of effectiveness, because buffers and stabilizing stocks don’t alter the fundamental nature of the problem (Meadows, 1999).

7.2.3 The Structure and Nodes of Intersection

This leverage point refers to the physical structure and organization of a system, but doesn’t often provide leverage because structure and design are difficult to change (Meadows, 1999). Similarly, this is not a particularly useful leverage point in the NPS, because a merger with other land management agencies or formally breaking down the divisions and directorates within the NPS would be a major task. As this study has shown, many of the barriers to implementing the ideas in Revisiting Leopold and becoming a learning organization are related to the structure of the system, but exercising this leverage point would be a heavy lift.

7.2.4 The Length of Delays Relative to System Changes

Delays in feedbacks are common sources of frustration in organizations. “If you’re trying to adjust a system state to your goal, but you only receive delayed information about what the system state is, you will overshoot and undershoot. Same if your information is timely, but your response isn’t,” writes Meadows (1999, p. 8). This leverage point has a great amount of power to affect change in a system, but it’s often hard to remove delays, especially in a big organization or when change is rapid (Meadows, 1999). Superintendents
and other managers make decisions all of the time that affect the natural and social environment, but the consequences of those decisions may not appear for a long time. Meanwhile, the system has continued to change. For example, NEPA processes can take years or even decades, so by the time a decision has gone into effect, the information or on-the-ground conditions may have changed. Or, the consequences of a superintendent’s management decision may not surface until years after the superintendent has retired or moved on. Delays are difficult to change, but the NPS can add leverage by increasing information feedbacks, such as through the process of long-term monitoring. The NPS could also reevaluate the structural and cultural attributes that reward and incentivize short-term management (e.g. the nature of management cycles, position timelines, and funding cycles). In order for the NPS to become a learning organization, it may need to incentivize long-term thinking and management that are more in line with ecosystem scale changes rather than management scale changes.

7.2.5 The Strength of Negative Feedback Loops

In the archetype examples in the previous chapter, the negative, or balancing feedback loops served to unintentionally check or prevent desired change. Negative feedback loops can also be beneficial, however, and serve to keep a process on track towards meeting its goal. For example, comments and feedback from the public can serve as a desirable check on an agency when it begins to take actions with which the public disagrees. Similarly, monitoring systems that trigger agency action in the event of resource degradation is a beneficial negative feedback loop. As the NPS undergoes change as an organization and its social ecological system undergoes rapid change, it will be important for the NPS to monitor these changes and foster communication with the public. Further
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examination of other system archetypes will help identify other beneficial balancing feedbacks that provide valuable checks on the system as well as negative feedbacks that prevent desirable growth.

7.2.6 The Gain Around Driving Positive Feedback Loops

Meadows presents positive feedback loops, processes of growth, as an undesirable condition that will make the system “ultimately destroy itself” (Meadows, 1999). However, if an organization is attempting to move into a new paradigm, positive feedback loops may be beneficial places to influence the system, precisely because they are self-reinforcing. For example, in the archetypes described in chapter 6, relaxing the balancing feedbacks and allowing the positive loops to grow would help the NPS implement the ideas in Revisiting Leopold and work more systemically. The desire to work across boundaries is growing; loosening the balancing forces of contractual constraints, prohibitive overheads, and “cultural arrogance” (R16) could help push the system into the new paradigm.

7.2.7 The Structure of Information Flows

Creating new information feedbacks is a powerful leverage point. It’s different than those previously mentioned because it’s not a parameter adjustment or reinforcing or breaking down an existing loop, but rather a new feedback loop (Meadows, 1999). Instituting strong, regular, and open communication feedbacks in which park-level managers and policy-makers could communicate freely would help solve many of the problems managers reported. For example, the manager who felt that he or she was spending all his or her time repeating budget exercises might be able to effect positive change if policy-makers were aware of on-the-ground impacts. Respondents expressed confusion over the overlap in duties amongst agencies and divisions. If there were greater
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information flows and feedbacks amongst land management agencies, individual parks, and divisions within parks, then this would increase efficiency and learning. One of the learning disabilities, “the enemy is out there,” could be partially alleviated by creating new information feedbacks that enable employees to see how their actions affect others and the organization as a whole.

7.2.8 The Rules of the System

Laws, policies, and incentive systems were not only strong themes that emerged from interviews, but they are also strong leverage points (Meadows, 1999). While laws are difficult to change, policies are periodically updated, and managers have the ability to influence incentive systems. Respondents spoke to many policy and incentive barriers to implementing the ideas in *Revisiting Leopold*, specifically with regard to cyclic and inflexible funding allocations; policies, rules and other disincentives to working with partners outside of park boundaries; disincentives to taking risks and learning; disincentives to working towards long-term goals; and fiscal disincentives for long-term monitoring programs, among others. Many of these can be changed through policy or through the way that success is evaluated and rewarded by supervisors and more broadly across the NPS. For example, in order to incentivize longer-term thinking, performance standards can be written in terms of longer-term goals, or greater efforts can be made to create continuity of knowledge and long-term goals even as employees change positions or parks.

7.2.9 The Power to Add, Change, Evolve, or Self-Organize System Structure

The ability of a system or an organization to self-organize, or alter its own structure, feedback loops, or rules, is an important aspect of resilience (Meadows, 1999). This speaks
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to O’Brien’s notion that organizations can transform themselves in the face of environmental change (O’Brien, 2011).

Katzenbach, Steffen, and Kronley argue that to make cultural change “stick,” organizations should match their strategy to the existing culture, and focus on critical shifts that play to the strengths of the agency culture (Katzenbach, Steffen, & Kronley, 2012). Interview data reveals an organization of employees who are highly intrinsically motivated; thus this is an attribute on which the NPS can capitalize.

Components of self-organization include raw material and means for experimentation (Meadows, 1999). In the case of the NPS and its unique situation on the verge of a paradigm shift, the raw material is a group of motivated early adopters and information about the system, its relationships, and feedbacks. The benefit of the decentralized organizational structure that respondents described is that it provides a convenient means for experimentation. Twenty-three early adopters were interviewed in this study, some of whom are in a unique position to test aspects of agency transformation within their park or region. Innovations in a decentralized system will align more closely with park-level needs and on the ground problems, and are more likely to be adopted at the local level (Rogers, 2003). Additionally, respondents report high levels of creativity at the park level. To the extent that the organization is also hierarchical and centralized at some scales, this can aid direct communication between change agents, opinion leaders, and adopters (Rogers, 2003).

In order to exercise this leverage point and self-evolve, however, some managers must be given the power to change and evolve. To become a learning organization and use these lessons in a truly adaptive sense to improve self-organization and transformation, managers must be able to take risks, fail, and learn constructively from failure.
The Goals of the System

The goal of a system is one of the strongest leverage points, because it is the goal that determines structures, flows, and feedbacks. This type of goal is broader than goals that people often think of as the goals of their job (e.g. to educate visitors, to study resources, or to provide for visitor safety). Examples of broader, systemic goals include resilience, survival, or preservation. The NPS as a system was originally set up to preserve resources in a static condition, as a snapshot in time.

Now, in an environment of complexity, uncertainty, and rapid, volatile change, the goals of the system are changing. *Revisiting Leopold* describes goals appropriate to this new paradigm, but managers are still struggling to discern what this means for on-the-ground management. Respondents widely admitted confusion about resilience, and what the purpose of the organization is now that the lines between what is natural and what is anthropogenic have been blurred. If the NPS can invest in creating a shared vision within the NPS for what this new management paradigm will look like, then this will perhaps be one of the most powerful leverage points.

The Mental Models Out of Which a Paradigm Arises

As in Senge’s iceberg model, all goals, processes, feedbacks, cultures, structures, and events flow from the mental models that form the basis for the paradigm (Senge et al., 2008). These unstated assumptions and beliefs are where some of the greatest leverage lies. Paradigms are difficult to change at the society or organizational scale, but Meadows draws upon Kuhn to explain how paradigms change:

“You keep pointing at the anomalies and failures in the old paradigm, you keep speaking louder and with assurance from the new one, you insert people with
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the new paradigm in places of public visibility and power. You don’t waste time with reactionaries; rather you work with active change agents and with the vast middle ground of people who are open minded.” (Meadows, 1999, p. 18)

Interview data showed that mental models surrounding impairment and the NPS mission appear to be changing, because the majority of respondents felt that the mission could be viewed with a wider lens to encompass the concept of change. Very few respondents reported feeling uncomfortable or noticing a conflict with the NPS mission and embracing volatile change and uncertainty. This study purposefully targeted early adopters, however, and not all employees have embraced the idea of managing for change. As several respondents described, the preservationist model of the old paradigm still very much pervades the organization. Other mental models about job roles (“I am my position”) and the role of science as providing an answer or a short term fix also need to be addressed if the NPS wishes to move into a more systemic, postnormal paradigm.

7.2.12 Transcending Paradigms

The final leverage point is beyond the scope of the paradigm; it is the ability to take a step back, detach oneself, and to recognize that paradigms are constantly changing; thus one “true” paradigm does not exist. Everyone is shaped by their own assumptions and beliefs, so the ability to remove oneself from one’s own mental model and remain flexible is the most effective tool of all (Meadows, 1999). The National Park Service has undergone several paradigm changes in its history (Sellars, 1997), and will continue to do so in the future.
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With this in mind, the NPS is in a position to evaluate whether it wishes to transform itself to embrace the type of paradigm the *Revisiting Leopold* describes. As the implementation team begins to think through how it might prioritize and implement some of the ideas in *Revisiting Leopold*, it would benefit from considering some of the mental models, structural and cultural characteristics, archetypes, learning disabilities, and leverage points identified from the data in this study.

7.3 Recommendations for Experimental Sites

*Revisiting Leopold* represents an attempt to address one of Meadow’s leverage points, changing the goals of the system (Meadows, 1999), but it’s clear that the NPS hasn’t yet succeeded in changing the mental models out of which the “old” paradigm arose. However, one of the most powerful leverage points is the power to add, change, evolve, or self-organize system structure (Meadows, 1999). In the interest of becoming a learning organization, I propose testing some of the recommendations in this report and experimenting with leverage points in some selected units managed by early adopters. If select units are able to test these ideas and observe how they affect the system, then this will help the NPS better understand itself as a system as well as the most effective places to enact change. The following section draws upon the literature and the results of this study to develop specific suggestions as to what an experimental site might look like and who within the organization should lead this type of experiment.

In accordance with the idea of emergent complexity, actions taken in one location at one point in time will likely result in different consequences than those of the same action taken at a different place and/or time. Therefore, I recommend selecting multiple park units in multiple regions, and comparing the processes and outcomes of suggested experimental
actions. Similarly, in accordance with the concept of nested hierarchies, I recommend experimenting with one or two offices at the regional scale and one or two divisions or work units at the national scale.

To capitalize on the strengths of the current decentralized structure of which respondents spoke, it may be most beneficial to select park units, offices, or divisions that are relatively autonomous from one another. Based on Rogers’ work, a decentralized system has several advantages from a diffusion perspective. For example, members of a decentralized unit will have more buy-in with regard to the innovation, as the implementation of new ideas often involves spontaneity and local creativity. In addition, solutions are more likely to address the needs of the employees, and therefore are likely to instigate higher levels of adoption (Rogers, 2003).

I also suggest capitalizing on the early adopters within the organization to act as change agents. Early adopters are well respected by their peers, occupy a position with enough power and leverage to enact change, likely understand the concepts in Revisiting Leopold, and may already thinking systemically (Rogers, 2003). These are superintendents and the types of employees at the regional and national level that fall within my sampling frame.

A change agent is most successful when they are in touch with those hoping to enact change, but are more socially integrated with the “clients,” or the employees in which they hope to inspire change. Those early adopters or change agents who are socially integrated with the unit in which they want to enact change are better positioned to receive feedback, possess credibility and rapport, and are better able to tailor these experimental actions to their employees’ needs (Rogers, 2003). This provides further support for the use
7.3.1 What type of actions would an experimental unit employ?

As Senge conveys through his iceberg model, it is more effective to enact change at the bottom levels of the iceberg than it is to work at the event level (Senge et al., 2008). Therefore, the change agents at each unit should address the culture and mental models of the experimental units, as well as the learning disabilities and archetypes identified in this study. In doing so, they will also be testing several of Meadows’ most effective leverage points. Table 2 summarizes suggested experimentation actions, which are discussed in more specific detail below.

Finally, the suggestions described below are designed to be specific enough to provide clear, useful suggestions for change agents, yet broad enough to leave room for local creativity and for change agents to feel empowered to test these recommendations in a way that meets local needs and circumstances. In this way, successful experimental actions and innovations will carry higher rates of adoption (Rogers, 2003).

<table>
<thead>
<tr>
<th>Systemic Properties</th>
<th>Recommendations for An Experimental Unit</th>
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| Culture of Learning   | • Discuss and develop a shared vision for this change effort and for the organization under the new paradigm  
                      • Create and incentivize a culture of risk tolerance and learning  
                      • Reward and incentivize transboundary management, long-term goals, and interdisciplinary work |
| Mental Models         | • Break divisional “lenses” through interdisciplinary education, collaboration, and communication  
                      • Explore alternate forms of knowledge and decision-making, such as more interdisciplinary, systemic, and postnormal science |
Organizational Adaptation in an Era of Complexity, Uncertainty, and Change

| Learning Disabilities | • Discuss what it means to manage for change and address fear around the topic  
|                       | • Create flexibility in the budget to allow managers to focus on long-term goals and balanced priorities
|                       | • Write longer term goals and breadth into position descriptions and performance evaluations  
|                       | • Create information feedbacks across divisions and over time  
|                       | • Conduct open dialogues to discuss park-level and agency-level goals and issues, and explore how everyone’s actions contribute  
|                       | • Be introspective and consider systemic relationships before taking actions
| Archetypes            | • Allow desired positive feedback loops to build, and loosen undesired negative feedback loops  
|                       | • Evaluate whether short-term fixes that have worked in the past are truly addressing the root of the problem  
|                       | • Identify important long-term goals and ensure funding and continuity of support for those goals
| Learning Feedbacks    | • Document, discuss, and share progress on and issues with the experiment

7.3.2 Fostering a Culture of Learning

Critical to any change effort and learning organization is a shared vision of the agency’s goals and how to achieve them. Change agents should initiate an open discussion of the concepts fundamental to the new paradigm such as resilience, coupled human-natural systems, scale, and the role of science, and what they mean for the organization.

As the data from this study show, some employees identified a culture of risk-aversion, as well as disincentives to risk-taking and learning. Change agents should foster a culture of informed risk-taking, such that employees feel empowered to exercise creativity, take risks within reason, and employ true adaptive management. To do this, managers should reward creativity and innovation, even when the effort has unexpected outcomes.
Organizational Adaptation in an Era of Complexity, Uncertainty, and Change

Additionally, while collaborative efforts appear to be growing in popularity, some respondents felt that some managers and supervisors still discourage working at broader scales. In an experimental site, a change agent should encourage and reward partnerships and collaboration with entities outside of park boundaries, perhaps by rewarding and recognizing employees’ efforts.

7.3.3 Addressing Mental Models

In order to address the mental models that perpetuate the old paradigm, people must first become aware of them. I recommend that change agents encourage introspection in themselves and employees, and discuss mental models openly. For example, one way that change agents can help break divisional lenses is to discuss how employees’ mental models differ across divisions, and then actively promote and provide opportunities for interdisciplinary education, collaboration, and communication. In addition to the mental models discussed in this thesis, employees will likely identify other mental models that exist within the organization.

Another important issue managers of experimental units should discuss with employees concerns what it means to manage for change. Managing for change will be different depending on the NPS unit or office and the values that the public and agency place on certain resources. This will likely involve a series of difficult discussions, and change agents should specifically address the fear and discomfort that employees and the public will likely possess about the topic.

In addition to these discussions, I recommend that change agents and managers in these experimental units consider the role of science in decision-making, specifically by considering what types of science are appropriate in various decision-making contexts. In
the interest of better understanding the system in which the unit operates, change agents may want to consider studies that explore relationships between variables in the system and incorporate more social science.

This study also revealed mental models around a perceived need to cater to visitors and public opinion. Several managers felt that this perceived need sometimes interfered with the ability to protect resources; this mental model is institutionalized in the form of rigid budget allocations that heavily favor spending on visitor services. In order to break away from the tendency to spend money on short-term projects and visitor services at the expense of long-term monitoring or non-charismatic but necessary projects, change agents in experimental units must have greater budget flexibility. Creating flexibility in the budget may allow managers to maintain focus on long-term goals and will allow managers to allocate funds in accordance with their priorities. Importantly, more budget flexibility will also allow units to test whether mental models have indeed shifted, based on the way that managers choose to spend money.

7.3.4 Addressing Learning Disabilities

Senge identifies seven organizational learning disabilities (Senge, 2006), and four are discussed in this thesis. As with mental models, change agents may wish to discuss organizational learning disabilities with employees and attempt to identify others that may exist within that unit. According to the results of this study, I recommend that change agents address the “I am my position” learning disability by incorporating more breadth into position descriptions and performance evaluations. For example, rather than simply detailing the narrow duties of a specific position, change agents should promote position descriptions and performance evaluations that include working with others towards broader
park and agency goals. Similarly, they should also include longer-term goals at greater temporal scales. Change agents should encourage continuity of worthwhile projects over time, even as employees turn over.

Further, to prevent “the enemy is out there” mentality, I recommend that change agents create and strengthen information feedbacks across divisions and over time. This could include regular interdisciplinary meetings to discuss park or unit level issues with a broader range of employees at multiple GS levels rather than just amongst the management team or a select interdisciplinary team. Employees should feel free to discuss issues openly, and these open dialogues should explore the ways in which all employees’ actions contribute to successes or problems at the unit and agency levels. Finally, change agents themselves should be introspective and consider systemic relationships before taking actions, and avoid the tendency to be proactive without attempting to understand the root of the problem.

7.3.5 Using Archetypes

This study examined three archetypes: limits to growth, fixes that fail, and eroding goals (Senge, 2006). While other feedbacks and processes operate within the organization, I recommend that change agents within experimental units test the leverage points that these archetypes bring to light.

For example, in the limits to growth archetype discussed in the previous chapter, the growing understanding of the need for partnerships and transboundary management emerged as a desirable positive feedback loop. However, it is being checked by legal, fiscal, contractual, and practical barriers to working at broader scales. Therefore, I recommend that change agents in these experimental units attempt to loosen these
Organizational Adaptation in an Era of Complexity, Uncertainty, and Change

constraints to the extent that they are able, and observe whether dismantling the balancing feedback loop results in more partnerships and transboundary management.

The second archetype that emerged from this data is fixes that fail. Data collected from respondents revealed a tendency to rely upon more science and research to cope with complexity and uncertainty, which often in turn, reveals more complexity and uncertainty. In this example, change agents should promote a greater acceptance of complexity and uncertainty, which will likely involve addressing employees’ mental models and better communication about these issues with the public.

The third archetype, eroding goals, is one that requires change agents and managers to hold themselves accountable. Despite day-to-day pressures that distract managers from long-term goals, change agents and managers must find a way to maintain focus on long-term efforts to attain their goals. Whether this involves setting aside consistent and reliable funding for long-term monitoring or important projects, it is important that decision-makers recognize that some enduring efforts are necessary or worthwhile, even though results don’t often manifest until years later.

7.3.6 Creating Feedbacks to Learn from Experimental Sites

Whether these recommendations result in the intended consequences or not, an equally valuable outcome of this proposed experiment is a greater understanding of the system in which the NPS operates and its complexities. To learn from these actions, change agents at experimental sites should document progress on and issues with implementing the above recommendations. Furthermore, it will be useful to discuss progress and issues with employees of the experimental unit, other experimental sites, and the broader organization.
Based on the results of this thesis, my primary recommendation for the NPS is to examine and reflect upon the relationships, processes and feedbacks at play within and outside of the organization. By understanding the systems at play within the organization as well as the broader system in which it operates, the NPS will be better prepared to adapt to its rapidly changing, complex, and uncertain environment.

7.4 Conceptual Model, Limitations, and Further Research

After considering the process and outcomes of this study, the following section evaluates the utility and appropriateness of systems thinking as a primary conceptual framework, discusses the limitations of this study, and raises opportunities for future research.

7.4.1 Systems Thinking as a Framework for This Study

This thesis primarily employs systems thinking as a conceptual framework, and relies most heavily on Peter Senge’s model. In retrospect, this model was in fact a highly useful and applicable framework to apply to this research topic. The context for this study is increasing complexity and change in social ecological systems, making systems thinking particularly applicable because of its ability to identify recurring patterns, processes, and relationships in the midst of dynamic complexity. The ideas presented in the Revisiting Leopold report, such as managing for change, embracing uncertainty, working across boundaries at landscape and seascape scales, and managing for resiliency, among others, align neatly with the components of systems thinking.

A number of academic fields were relevant to and contributed the research questions in this study. Systems thinking was therefore an appropriate model because components of the concept emerge in literature across disciplines. The fundamental
concepts of Senge’s framework also resonate through Ackoff’s work in the field of operational research (Ackoff, 1962), Schein’s work on organizational culture (Schein, 1995), Meadow’s work in the field of sustainability (Meadows, 1999), Fernandez and Rainey’s research in public administration (Fernandez & Rainey, 2006), Kotter’s research on leadership and change (Kotter, 2007), O’Brien’s work in sociology and human geography (O’Brien, 2011), and to an extent, Rogers’ diffusion of innovation theory (Rogers, 2003), among others. Thus, systems thinking served as a useful unifying thread.

This research not only produced many hours of data, which in itself became quite complex, but I have also been personally involved in the organization for the past four years. Senge’s concept of systems thinking was critical to helping me detach myself from my own mental models about the organization, to the extent possible, in order to examine the larger systemic processes and feedbacks occurring within it.

7.4.2 Limitations of This Study

This same reason, however, also highlights a limitation of this study. The author’s experience working for the NPS inevitably introduces some level of bias. For example, the author knows a number of the respondents personally, which could alter the responses given or the nature of the conversation. Further, the motivation to conduct the research arose partly from personal experience, which may have influenced the development of research questions and other components of the study.

While all qualitative data is interpreted through the researcher, and “all human activity, including research, is accomplished from a specific standpoint” (Warren & Karner, 2010, p. 9), efforts were made to reduce bias and increase validity. All results
reported and conclusions drawn can be traced directly back to interview data, and the author’s primary advisor checked portions of the author’s interpretations of raw data.

A second limitation of this study relates to the sampling method. Snowball sampling was employed with the intent of finding respondents that would provide the richest data on the topic. However, it is limited by the fact that respondents refer others that they know personally. In an effort to prevent selecting a sample of employees with similar viewpoints, respondents were asked to refer another employee who might be taking steps to implement the report, as well as to refer an employee who might disagree with the respondent or the ideas in the report. Regardless, it is possible that respondents have stronger networks with those who hold similar viewpoints.

All respondents but one had read the report prior to being contacted for the interview, but many people had re-read or reviewed the report before the interview. In one sense, this was helpful because respondents were more likely to understand the question and provide rich, thoughtful answers. However, it is possible that the ideas in the report influenced respondents’ personal viewpoints. Although interviewees were assured of confidentiality, some may have consciously or unconsciously felt the need to agree with the ideas in the report, even if the report conflicted with their personal mental models about the organization.

Third, a major limitation of this study was that respondents were asked to make generalities about the NPS as an organization. While this is necessary for an organizational-level study, and many respondents substantiated their views with specific examples and stories, no organization is homogenous. As one interviewee pointed out, “Everything you can say about the Park Service is false. Everything you can say about the Park Service is true” (R3). There is a lot of variation within an organization, and although
every effort was made to ensure a diverse and representative sample, many nuances may not have emerged. In the same way that the researcher’s interpretation of data is subjective and affected by other influences, interviewees also give subjective responses. It is possible that interviewees’ responses are influenced by social norms and perceptions about how the NPS operates.

Finally, it is important to note that the results of this study, like most qualitative research, are not generalizable. Results are limited by the individuals interviewed, the point in time of the interview, other circumstances of data collection.

7.4.3 Further Research Questions

The findings of this study imply further research implications and opportunities. A limited number of mental models, learning disabilities, and archetypes were analyzed for this study, but these are by no means exhaustive. Additional consideration of other processes and feedbacks are critical to becoming a learning organization. A need exists to experiment with some of these leverage points if the NPS truly wants to transform the agency. As mentioned above, parks managed by early adopters provide a convenient unit in which to test some of the recommendations and considerations of this study.

Also, the NPS operates within a system of nested hierarchies, and as a result, it would be both beneficial and interesting to apply these research questions at different scales. Other land management agencies are grappling with similar issues, and may provide valuable insight on the nature of organizational change and transformation. Similarly, individual parks are likely addressing the changing paradigm in different ways, which may or may not depend on characteristics of that park.
Additionally, interviewees’ responses may have been influenced by the ideas in the *Revisiting Leopold* report, or by a conscious or subconscious desire to support the ideas within it. Further research could explore the extent to which an organization is moving into a new paradigm in the absence of a report that promotes its central ideas.

An interesting outcome of this study was the ease with which respondents were able to reconcile the NPS mission with managing for change that is not fully understood. At the same time, respondents also demonstrated discomfort with regard to the purpose of the NPS under the new paradigm. This raises questions about the process of altering deeply ingrained mental models, and how employees cope with competing goals.

This study intentionally targeted early adopters, identified as those at the division chief level and above. However, in order to understand the extent to which the new paradigm is permeating through the whole organization, future studies may benefit from a wider sampling frame.

Finally, this thesis largely focused on natural resource parks and natural resource issues. Social and cultural components were included to the extent that social and ecological systems are interrelated, but further research into both social and cultural aspects of the system are warranted.
References


Organizational Adaptation in an Era of Complexity, Uncertainty, and Change


Organizational Adaptation in an Era of Complexity, Uncertainty, and Change


Appendix A: Interview Guide

Background
1. Can you briefly describe your current job and list any other parks or NPS offices that you’ve worked at?

Social Ecological Systems and Resilience
2. If you’ve had a chance to review it, what was your understanding of *Revisiting Leopold*, and what did you think of it?

<table>
<thead>
<tr>
<th>Some Level of Understanding/ Neutral or Positive Reception</th>
<th>Does Not Understand/ Negative Perception of Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. How do you see this being implemented, both in your park and across the NPS?</td>
<td>a. What was confusing or problematic in the report?</td>
</tr>
<tr>
<td>i. The Leopold Report largely redefines the scope of our environment and the problems we face as much more complex and rapidly changing than in the past. How do you see the agency dealing with this type of complexity and change?</td>
<td>b. What would you have liked to see in the document to make the report more useful?</td>
</tr>
<tr>
<td>ii. This report redefines what the NPS previously considered natural and calls for coupled human-natural systems, so how do we deal with what is natural and what is anthropogenic?</td>
<td>i. The problems the NPS faces are more complex and our environment is changing much more rapidly than in the past. How do you see the agency dealing with this type of complexity and change?</td>
</tr>
<tr>
<td>iii. The report talks about managing for resilience, such that a system can undergo disturbances but still retain the ability to function in a similar way. What would a resilient National Park System look like?</td>
<td>ii. This report redefines what the NPS previously considered natural and calls for coupled human-natural systems, so how do we deal with what is natural and what is anthropogenic?</td>
</tr>
<tr>
<td>c. Do you see this as a change, or a shift in NPS ideology that needs to or should happen in the NPS?</td>
<td></td>
</tr>
<tr>
<td>i. If so, what do you think would be the impetus for change, and where would or should it come from?</td>
<td>ii. If not, why not? If the NPS is already doing this, how? Can you give an example?</td>
</tr>
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The Learning Organization: Organizational Structure & Culture

3. What would be the challenges to implementing this?
   a. Do you think a mission-driven organization can do this? Does the NPS mission facilitate this kind of change?
   b. Do you think the NPS is structured in a way to allow it to do this? What are the incentives to collaborating at broader scales?
   c. What are the incentives for working towards longer-term goals rather than attaining short-term achievements?

4. What are the qualities of a good and effective manager (superintendent or resource manager)?
   a. How is success evaluated and rewarded in the NPS?
   b. How does the NPS deal with risk and uncertainty in social and ecological systems?
      iii. What happens when NPS fails, or makes a mistake?
   d. How would you describe your own inclination towards risk-taking?

Postnormal Science

5. What roles do science, politics, and values play in decision-making? What type of information is most helpful when making difficult, high profile, or value-laden decisions?
   a. How important and useful is stakeholder input?
Appendix B: Interview Guide for Contributors to Revisiting Leopold

1. Can you briefly describe your current job and your involvement in the Revisiting Leopold Report?

Social Ecological Systems and Resilience

2. Why was this report created?
   a. What do you want this report to do?
   b. Who was the audience? Who was this meant to speak to?
   c. Were you hoping for impacts similar to the impacts of the first report?

3. Process
   a. How were the contributors/ members of the Advisory Board Science Committee chosen?
   b. How did you decide what was most important to address in the Revisiting Leopold report?

4. Change
   a. Is there some new insight on change that this committee felt like even the scientific community needs to think about in a different way? (perhaps the pace of change, where in the system change is occurring, or social change?) What was this “new” insight on change?
   b. How did the team envision – balance between continual change and preservation & ecological restoration?
      - I know that the report specifically says that the committee is not suggesting a revision of the NPS mission, but can you manage for continual change in the NPS without revisiting the mission? Is there a philosophic disconnect here?

5. Tell me about this idea of transformative experiences – where do you see that going? Why that word? Why that type of experience and who is transforming? Does it imply that the NPS has to transform to make this happen?

Scientific Paradigm/Ideology Shifts

6. Do you see this an ideological shift or a substantial evolution within the NPS?

7. Some people (do) see this as a major ideological shift for the agency. How do you think change occurs within a large organization like the NPS?
   a. Do you think it’s in response to some crisis or apparent need, or do you think ideological change happens gradually?

Systems Thinking and Organizational Change
8. Have you received any feedback or reactions from NPS employees? If so, what was the general response? 
   a. Generally, without giving away their identities, what was their position in the NPS, and why do you think they felt this way?

9. How do you see this being rolled out, or implemented?

10. What do you think the challenges are to implementing this within the NPS? 
   a. What do you see as the structural barriers to implementation, if any? 
   b. What do you see as the cultural barriers to implementation, if any?

11. What kinds of science programs do you see emerging in the NPS to deal with these human-natural systems? 
   • So if we consider the NPS as a social-ecological system, with its own set of pre-existing values that guide/determine how it operates, how do you envision building in a feedback to these socio-ecological systems that will inform these underlying values that guide the processes within the agency? 
   • How do we use the science the report is calling for to inform the underlying values that drive the system, or drive the way the NPS operates?

12. Do you know of anybody who is taking steps to implement this?

13. Do you know of anyone who might disagree with you or the ideas in this report?