

# **Adapting Together: Overcoming Institutional Misfit for Climate Resilience in US National Parks and Forests.**

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## **Abstract**

The United States' public lands, including the revered National Parks (NP), draw global travelers to their breathtaking natural wonders. While iconic destinations like Yosemite and Yellowstone NP top many bucket lists, the equally stunning National Forests (NF) often remain underrated. Despite their shared beauty and species, the NP and NF, bordering each other, hold distinct popularity levels. Beneath the surface lies a crucial role of management and governance in addressing climate change vulnerabilities for both NP and NF biodiversity. This thesis probes institutional barriers impacting climate adaptation in these landscapes. Through qualitative and quantitative approaches involving interviews and surveys, the study unveils challenges such as limited collaboration, differing objectives, and resource constraints. The findings underscore the need for adaptive integrated methods and enhanced collaboration to safeguard biodiversity and bolster climate resilience. By illuminating management intricacies and collaborative dynamics, this research enhances our understanding of effective climate adaptation in these invaluable public lands. It emphasizes the imperative of overcoming these barriers for sustainable conservation.

## **Dedications**

To the most incredible, most selfless human on this earth

My grandfather John P. Taylor.

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## **List of Acronyms**

**BLM: Bureau of Land Management**

**DOI: Department of the Interior**

**EM: Ecosystem Management**

**ES: Ecosystem Services**

**ESM: Ecosystem Services Management**

**IPLM: Integrated Public Land Management**

**NF: National Forests**

**NP: National Parks**

**U.S.: United States**

**U.S.A.: United States of America**

**USDA: United State Department of Agriculture**

**USFS: United States Forest Service**

**USFW: United State Fish and Wildlife**

## Chapter 1: Introduction

This chapter provides an overview of the research topic, the problem statement, objectives, research questions, and a complete thesis plan overview.

### 1.1 Background:

Public lands are not just a human resource for recreation, leisure, and pretty scenery. Most importantly, public lands serve as critical habitats and ecosystems that support a wide range of wildlife and plant species (Jenkins et al., 2015). With so many systems and lives depending on these natural spaces, policymaking, and decision-making must be handled carefully and placed in the right hands to work collaboratively with all parties involved (Malekpour et al., 2021). The management and governance aspects within public lands are crucial, especially with the inevitable changes due to climate change. In society's apparent pursuit for constant development, we have coincidentally been causing irrefutable damage to the earth. Therefore, it is imperative to create collaborative ecosystem service management. Proper governance and management in public lands strive for a balance between multiple agencies.

National Parks and National Forests are protected areas (*The Lands We Share: America's Protected Areas*, n.d.). Protected areas are essential to environmental preservation and conservation initiatives (Michalak et al., 2022). Constant environmental and weather changes due to climate change have severely affected how effectively these agencies' function and manage these protected areas (Mawdsley et al., 2009). In recent years, climate change severely affects National Parks and Forests with constant fires, biological disturbance, and changing weather patterns (*Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II*, 2018); It is crucial to identify these new climate vulnerabilities to develop proactive management plans to respond appropriately to these changes and threats (Peek et al., 2022). Moreover, the governance dimension has been highlighted as a crucial missing link in successful climate change adaptation, mitigation, and disaster risk reduction and management; References to reports highlighted this missing link.

National Parks and the National Forests are federal agencies that manage public lands. The National Parks is a part of the Department of the Interior, and the National Forest is a part of the Department of Agriculture. Both agencies provide natural spaces for people and recreational uses ("What Are the Differences Between National Parks and National Forests?" n.d.-b), but some notable differences exist. The main difference being that the National Forests are managed with conservation principles (*What We Believe | US Forest Service*, n.d.). This means they sustainably utilize natural resources, i.e., timber, recreation, grazing, wildlife, fish, etc. While National Parks are managed on preservation principles, which means barely altering the existing state (*Preserving Places That Matter (U.S. National Park Service)*, n.d.).

Within the NP and NF, they use what is known as Integrated public land management (IPLM). IPLM is an approach to management that uses many different approaches. The five primary management approaches that both implements are collaborative management, Ecosystem Management (or Ecosystem Services management), multiple-use management, Wildlife management, and Adaptive management (Loomis, 2002).



Although the NP and NF use the same management approach(es), they still have many issues working together (Jantarasami et al., 2010). With different managing principles (conservation vs. preservation), they use each of the five management approaches differently. Each park uses them at different levels. Working collaboratively is complex, with different principles and different ways to use different management approaches. This brings what literature describes as an institutional misfit or mismatch.

Both the National Park Service and the United States Forest Service have put into place programs and procedures designed to help with adaptation and mitigation of the effects of climate change on biodiversity as well as lowering the likelihood of natural catastrophes (Peterson et al., 2011; *Climate Change and National Parks: Jonathan Jarvis*, 2016). These policies, programs, and procedures have become crucial elements in how they manage their agencies.

This thesis will explore how the National Parks and National Forests in the United States manage their lands regarding climate change vulnerability. This research will address both agencies' governance and management approaches and the institutional barriers between agencies. The theoretical framework that will be used in this thesis is known as Institutional misfit theory. Different agencies following different rules, norms, and values can lead to these institutions becoming incompatible or in conflict, leading to difficulties in decision-making and implementation (Balint et al., 2011). This can be a significant barrier to effective integrated land management approaches for climate change adaptation in U.S. public lands, where multiple agencies and stakeholders are involved (Peters et al., 2018).

## **1.2 Problem statement:**

Imagine the National Parks and Forest Service were perfectly aligned to meet the people's and the environment's needs. All while keeping the land protected for future generations to come. In a perfect world, this could be possible, but currently, this is not a reality. Despite the shared goal of climate change adaptation and mitigation in order to manage public lands for future generations, NP and NF in the U.S. are often managed separately and with different priorities, leading to fragmentation, conflicting policies, and limited coordination (Lonsdale et al., 2017). Climate change exacerbates this problem, creating new challenges and uncertainties for public land management, requiring integrated and adaptive approaches (Bierbaum et al., 2013). The institutional misfit among these agencies, compounded by political polarization, further hinders effective collaboration and adaptation (Lachapelle et al., 2003). Thus, the question arises of overcoming institutional misfit and fostering greater coordination and integration among these agencies to improve climate change adaptation while preserving the land's integrity and providing essential services to people. Answering this question requires a comprehensive understanding of these agencies' governance and management systems, the barriers to integration and coordination, and the potential solutions to address these challenges.

### 1.3 Research Objective:

This study aims to identify strategies to strengthen collaboration and integration across the United States National Parks and Forests in response to climate change vulnerability. This study explores the governance and management problems that prevent these agencies from collaborating effectively and investigating viable ways to remove these barriers. Finally, this study hopes to contribute to a better understanding of managing public lands in the face of environmental pressures and ensure their long-term viability.

### 1.4 Research question:

Drawing from the preceding sections, a key question emerges:

How does the governance of public lands (National Parks [NP] and National Forest [NF]) in the United States affect climate change vulnerability of the biodiversity present in the managed NP and NF areas?

#### Sub-Questions:

- What are the current integrated management approaches for NP/NF in the United States?
- How does climate change impacts NP/NF in the United States, and how do they frame/affect management approaches?
- What are the institutional barriers to addressing climate change on public lands (Institutional misfit)?
  - Are these agencies working together for a common goal or fighting one another?
  - How can these barriers be overcome or mitigated?

#### 1.4.1 Hypothesis:

Institutional misfit between the National Parks and National Forests creates barriers to effective biodiversity adaptation, conservation/ preservation, and management in the face of climate change.

**Hypothesis synthesis:** A detailed study will be conducted to evaluate this hypothesis, which integrates qualitative data from interviews and surveys with quantitative data from statistics surveys. The qualitative findings shed light on issues including lack of collaboration, closed communication, and insufficient funding. Simultaneously, quantitative data indicated empirical patterns in participants' perceptions on collaboration, management priorities, and climate change repercussions. This study aims to provide a comprehensive understanding of the organizational relationships, barriers, and opportunities within NP and NF management structures, thereby contributing to the development of successful approaches for addressing climate change impacts and preserving biodiversity on public lands.

## 1.5 Thesis Outline:

This thesis will include seven chapters. **Chapter One** includes an introduction, background, problem statement, research question, research objective, and theories and concepts. **Chapter Two** will be a literature review that will go into depth on what public lands are in the U.S., Why it is essential to talk about public lands governance and management, what types of management systems and approaches are already in place within the NP, and NF, the institutional barriers that threaten these public lands, and the effects it all has on climate change vulnerability. **Chapter Three** will be the methodology section that will explain the process in which this study was conducted. **Chapter Four** will introduce the findings and the discussion. This chapter will analyze and interpret the literature and results of the interviews and surveys. Additionally, chapter four will summarize the key findings, discusses their implications for theory and practice. **Chapter Five** will be the conclusion section, that will provide the limitations of the research, a conclusion and final thoughts, and suggests future research recommendations. Lastly, **Chapter Six** will be the references used to conduct this research.

## Chapter 2: Literature Review

In this chapter, the researcher reviews and synthesizes existing literature related to Integrated Public Land Management Approaches in the National Parks and Forests in the United States. This section covers the critical elements the reader needs to understand to conduct a proper analysis.

### 2.1 Theoretical Framework:

In this thesis, the theory of institutional misfit will be used as the basis of the theoretical framework. The theory itself is abstract, derived from the absence or opposition of several theories and concepts. More specifically, the concept of misfit (or mismatch) comes from “fit” or institutional fit. Fit is when organizations “should” be designed for excellent performance, efficiency, and effectiveness when they do, and this theory describes it as a “fit” (Burton, 2020). Misfits are created in opposition to the “fit” theory. Misfit happens when there are signs that organizational elements are not operating together, requiring action to improve by restoring fit (Burton, 2020). This (mis)fit theory, conjoined with institutional theory (which is organizational communication based on shared external rules, beliefs, and norms (Lammers & Garcia, 2017), creates an institutional misfit. For this thesis, the Institutional Misfit theory will examine the barriers to effectively managing vulnerability of biodiversity in National Parks and Forests in the face of climate change. Specifically, this theory aims to prove that institutional misfit between these two entities creates obstacles to successful biodiversity management in the context of climate change vulnerability.

By using institutional misfit theory, this research aims to gain some insights into institutional barriers that hinder effective decision-making and management practices on public land management and governance. Additionally, the theory may potentially help identify some strategies to overcome these barriers and promote more effective and integrated approaches to public land management. By applying the institutional misfit theory to the specific context of climate change vulnerability and biodiversity, the thesis may contribute to a better understanding of how institutional dynamics impact public land management and inform more adaptive and resilient frameworks for managing public lands.

## 2.2 Climate Change Vulnerabilities

Climate change is one of our time's most pressing environmental challenges, and its impact on biodiversity is a significant concern. Climate change is already impacting the landscapes across the United States (Sage, 2020). Forest fires, pest infestations, tree mortality, and many other factors affect forest ecosystems daily (Archie et al., 2012). Temperatures are increasing, snowfall and precipitation patterns are changing, and extreme climatic events are becoming more regular, such as severe rainstorms and record-high temperatures (*Climate Change Indicators in the United States | US EPA*, 2023). With the effects of climate on the national parks and forests increasingly becoming more visible, the future of many of them remains uncertain (*Climate and US National Forests and Parks*, 2020). Climate change will make it more difficult for environmental managers to maintain species diversity and preserve ecosystem function (Jantarasami et al., 2010). A climate change vulnerability assessment was conducted for the NP to identify what these parks are doing to battle climate change; the study found that only 10% of NP had park-specific assessments describing key climate impacts and identifying priority resource vulnerabilities, and 37% lacked any regional or park-specific assessments all together (Michalak et al., 2022). Public lands have such potential to assist in the battle against climate change. This shows that there are significant gaps when it comes to public lands and climate change adaptations. Making It even more pertinent for the future of these lands that proper management, a collaboration between agencies (NP & NF), and adaption methods are set in place.

## 2.3 What are public lands and their significance?

In the U.S., American citizens collectively own public lands managed by their perspective agencies. Within public lands, three primary levels of governmental entities manage them: federal, state, and local (R. Wilson, 2014). Many governmental agencies exist National Parks, the Forest Service, the Bureau of Land Management, State Parks, Local Parks, etc. (Rasker, 2022). Within those primary agencies, each has different objectives and policies for taking care of the land. Within the national park system alone, there are 28 designations (i.e., National Trails, Wildlife Refuge, Wilderness Areas, etc.) (*America's Public Lands Explained*, 2023). For this paper, two primary federal public lands, the National Parks and the National Forests, will be the focus. As mentioned, the NP and NF run off two distinct principles: preservation and conservation. Preservation means natural ecosystems must be preserved in their current state, as unaltered by humans as much as possible. At the same time, conservation

encompasses the long-term use and management of natural habitats and their resources to suit people's needs and interests for the present and future generations (Wilson 2015).

## 2.4 National Parks and National Forests

**Who:** The USA's National Parks and Forests are federally managed public lands. While federally managed, they are managed by entirely different government sectors (*National Park or National Forest? – Great Smoky Mountains National Park (U.S. National Park Service)*, n.d.). The NP agency is known as the National Park Service (NPS) and is governed by the United States Department of the Interior (DOI) (Pattiz, 2022). The NF agency is the United States Forest Service (USFS), governed by the United States Department of Agriculture (USDA) (Pattiz, 2022).

**What:** The National Park Service was established in 1916 and currently manages over 400 parks, monuments, and historical sites all across the United States (*Quick History of the National Park Service (U.S. National Park Service)*, n.d.). The NPS aims to protect and preserve unique and significant natural or cultural features while providing recreation, education, and scientific research opportunities (*Preserving Places That Matter (U.S. National Park Service)*, n.d.). With significant parcels of land, the NP consists of many ecosystems and landscapes but are generally characterized by their unique geographic features (*Chapter II - Government Policy Relevant to Natural and Cultural Areas Protection*, n.d.).

On the other hand, The USFS was started in 1905 and currently manages 193 million acres of forested land (*Forests and Grasslands | US Forest Service*, n.d.). The National Forests were established to sustainably manage forest resources (timber, water, and wildlife) (*What We Believe | US Forest Service*, n.d.). They are characterized by their forested landscapes, which provide a wide range of ecosystem services, such as carbon sequestration, water filtration, and wildlife habitat (*Ecosystem Services | Climate Change Resource Center*, n.d.).

**Why:** National Parks and National Forests in the USA are some of the most well-known public lands and play two different, yet essential, roles in climate change adaptation for biodiversity (*America's Public Lands Explained*, 2023). Studying institutional misfit between the National Parks and National Forests is crucial because it can improve our understanding of how climate change affects biodiversity conservation in public lands, identify best practices in integrated management approaches, identify institutional barriers, and inform policy recommendations for effective public land management in the face of climate change (Jantarasami et al., 2010).

**Management structures:** The daily administration and operation of the National Parks are under the control of the National Park Service. Services to visitors, resource management, law enforcement, and interpretation are among their responsibilities (*National Park Service - Planning*, n.d.). Additionally, a superintendent oversees the general operation of each National Park and answers to the Director of the National Park Service in Washington, D.C.

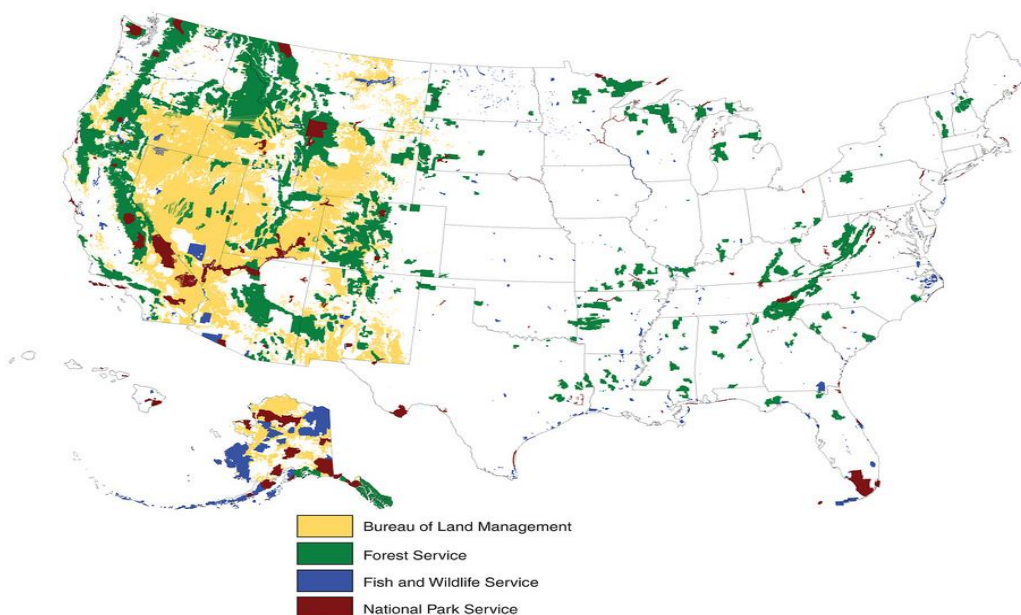
The agency's primary aim is to preserve and increase the health, variety, and productivity of the nation's forests and grasslands to satisfy the demands of current and future generations (*Forest*

*Management / US Forest Service, n.d.*). Each National Forest is managed by a Forest Supervisor responsible for the overall management of the forest and reports to the Regional Forester (*Forest Management / US Forest Service, n.d.*). The regional forester then reports to headquarters. Like the NPS, the chief is also in Washington D.C. and reports to the Under Secretary for Natural Resources and Environment, U.S. Department of Agriculture (*Agency Organization / US Forest Service, n.d.*)

In order to combine conservation with public use and pleasure, national parks and national forests both have complicated management frameworks incorporating various levels of government, stakeholder involvement, and resource management practices. Which inherently can make collaboration difficult between agencies.

**Differences:** Other than different mandates/principles (conservation vs. preservation), as well as different ways of using integrated management, the most significant difference is the multiple-use mandate for National Forests (*What Are the Differences Between National Parks and National Forests?, n.d.*). The Multiple Use-Sustained Yield Act aimed to prevent the destruction (from extracting resources) of national forests by mandating their management to “meet the needs of the American people best,” prioritizing a balanced combination of outdoor recreation, range, timber, watershed, and wildlife and fish purposes (Clawson, 1978). Unlike the NF, the NP does not extract any resources for the people's or commercial use.

Additionally, in some cases, the agencies responsible for managing public lands may have different goals or policies that conflict with each other (E. Krwnpe & McCoy, n.d.), making it challenging to address issues like climate change effectively. For example, since the National Park Service and the US Forest Service may have different land management priorities and approaches, leading to institutional barriers and potential conflicts. These barriers can make implementing coordinated and effective management strategies that address climate change and protect biodiversity challenging (Jantarasami et al., 2010).



*Figure 1:* Shows where there are federal public lands in the USA. The national parks are in red, while the National forests are in green. The Bureau of Land Management and Fish and Wildlife Service are represented but irrelevant to this thesis. (*Federal Lands: Adopting a Formal, Risk-Based Approach Could Help Land Management Agencies Better Manage Their Law Enforcement Resources*, n.d.)<sup>1</sup>

## 2.5 Distinction between Governance vs. Management

Governance is the act of governing and the framework for managing organizations (Rhodes, 2007). Governance is more formal (such as laws, regulations, and policies). It specifies who may make choices, who can act on behalf of the organization, and who is responsible for how an organization and its employees behave and perform; in laments terms, it's the people who do the decision-making (Turner, 2020).

Management, on the other hand, is essentially a part of governance. Managers are more responsible for the informal day-to-day goals and objectives (such as cultural norms, beliefs, and values) established through governance (Governance, n.d.). Governance (n.d.) also states unlike governance, management has more of an operational approach, such as planning, organizing, staffing, etc.

The distinction between governance and management is essential for applying the institutional misfit approach in order to analyze the collaboration between formal institutions (governance: DOI & USDA) and informal institutions (management: NPS & USFS). The DOI and the USDA govern the National Parks and Forest, but the NPS and USFS manage the NP and NF. The NP and NF governance and management differ, which can directly affect climate change vulnerability from park to park (Peterson et al., 2011). In applying the institutional misfit approach, there will be an analysis of both the formal and informal institutions that shape governance and management. This includes examining if these agencies formal rules and regulations, such as laws and policies, are implemented and enforced and understanding the informal norms and practices that influence decision-making and behavior within the organization or system.

The distinction between governance and management is essential in this research to understand how institutions shape organizational behavior and outcomes and apply frameworks like the institutional misfit approach to analyze the interaction between formal and informal institutions and their effectiveness towards collaboration.

## 2.6 Integrative Management Approaches and Systems

The National Parks and Forest have embraced an integrated management approach to tackle intricate challenges (Margerum & Born, 1995). In the NP and NF, these integrated strategies entail blending diverse elements, disciplines, perspectives, and even management systems to address

<sup>1</sup> This image is excerpted from a U.S. Government Accountability Office report: [www.gao.gov/products/GAO-11-144](http://www.gao.gov/products/GAO-11-144)

multifaceted challenges and attain multiple objectives concurrently (Ferretti-Gallon et al., 2021). These approaches strive to minimize conflicts and optimize resource use while considering environmental, social, and economic factors (Integrated Land Management – Overview, n.d.). This perspective adopts a holistic outlook, underscoring the importance of interdisciplinary collaboration and interagency methods.

Within the NP and NF context, this approach combines five main management systems (these are the main management approaches the NP and NF use more than are not listed), as extensively documented in the literature review: multiple-use management, ecosystem-based management, adaptive management, wilderness management, and collaborative management – all subsumed under integrated management in the NP and NF.

Notably, while all five management systems find use in each park, their application varies considerably between parks. Specific management systems are emphasized in certain parks, contingent on their distinctive management challenges and priorities. Additionally, some parks incorporate other diverse management approaches not explicitly outlined here. This study exclusively focuses on the most prevalent methods cited in the literature.

### ***2.6.1 Collaborative Management***

Collaborative management is often defined as bringing public and private stakeholders together in collaborative discussions with public agencies to participate in a consensus-oriented decision-making process (Ansell & Gash, 2007). Collaborative governance is frequently mentioned as a method for developing a long-term strategy for long-term management of public lands (Ansell & Gash, 2007). It entails exchanging information, capabilities, resources, and decision-making between two or more sectors in order to accomplish a set of results that would only be reached if (Bryson et al., 2015). As a result, it is also known as cross-sectoral cooperation (Bryson et al., 2015). In some other literature, it can be known as collaborative public management when specific to public lands (McGuire, 2006). While collaborative management covers external human factors, such as stakeholders, ecosystem services management is similar but deals with more internal non-human environmental factors.

### ***2.6.2 Ecosystem (Services) Management (ESM, EM)***

The management of ecosystems has become increasingly crucial in the realm of natural resource management, particularly in the context of overseeing national parks and forests within the United States (Daily, 2000). The concept of ecosystem services (ESM) is centered around the non-human elements of these public lands but with a focus on their value to human populations. Essentially, ecosystem services represent the resources and benefits we obtain from the functioning of these ecosystems (Deal et al., 2017). The notion of ecosystem services management is now an essential part of global policies, partly due to the underregulating and over-extraction of ecosystem services causing a decline in the environment and biodiversity (Bubb et al., 2017).



### ***2.6.3 Multi-Use Management***

The multiple-Use management only applies to the National Forests. This management approach was implemented through the *Multiple-Use Sustained-Yield Act* by the United States Forest Service (USFS) in 1960 and is now a staple in their management approach (*Laws and Regulations | US Forest Service*, n.d.). Multiple-use act turned management was "to improve and protect the forest within the boundaries, or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber" (Gorte, 1999). Essentially, the guiding principle is to create sustainability, only take what you need and replace what you take. Notably, the Multiple-use approach uses objectives for accommodating activities like energy development, grazing, and leisure may clash with species conservation and land health aims (Carter et al., 2021). Although according to García-Fernández et al. (2008), it is regarded as a fair technique for meeting the expectations of many stakeholders, a more environmentally friendly harvesting practice, and a method of adding more value to forests, making them more resistant to conversion.

### ***2.6.4 Wilderness Management***

Wilderness management, which consists of over 800 federally designated wilderness areas, was established by the Wilderness Act of 1964 and is managed by many federal public lands, including the National Park Service and US Forest Service (*Wilderness (U.S. National Park Service)*, n.d.). Wilderness areas are unique because they are pure primitive wilderness, preserved for recreational and educational purposes (*Programs: National Conservation Lands: About: Wilderness | Bureau of Land Management*, n.d.). Although these spaces are meant to be "untouched," they require management and protection. The Wilderness Act emphasizes the importance of preserving the "wilderness character" of designated wilderness areas, but the act does not explicitly define the term (Congressional Research Service, 2022). The congressional document says that federal land management agencies have interpreted the concept of wilderness character in various ways, linking it to the characteristics described as untrammeled, natural, undeveloped, and/or primitive and unconfined recreation, while others have defined it differently. These agencies also have other management objectives, such as promoting certain natural conditions and managing wilderness for specific public purposes.

### ***2.6.5 Adaptation Management***

With the uncertainty of an ever-changing climate, adaptive strategies and management will be a standard for management approaches. Adaptive management is a natural resource management approach that recognizes the limitations of current knowledge and involves careful planning, hypothesis testing, data collecting, and continuous refining of management techniques (Allen et al., 2011). Adaptive management is highly regarded as a natural resource management decision-making technique that utilizes organized learning and adaptation processes to manage complexity and uncertainties (Månsson et al., 2022). The

problem currently with adaptive management is a lack of resources, inadequate actor involvement, and/or shortcomings in the operational processes (Månsson et al., 2022). Creating a plan of action with adaptive management takes time to understand how to prepare appropriately, and that is difficult when the despair of uncertainty is around the corner. However, the National Parks and the National Forests use adaptive management to help facilitate resilience within their vulnerable ecosystems (*I&M Networks Support Resilient Forest Management (U.S. National Park Service)*, n.d./ *Building Resilience in Function of Terrestrial Systems - Flathead National Forest | Climate Change Resource Center*, n.d.).

***Adaptation Strategies*** According to Peterson et al. (2011), “...adaptation in national forests and national parks can facilitate the integration of climate change in resource management and planning and make the adaptation process more efficient”. This means adaptation to climate change will be successful only if it can be fully integrated into governance and management for both NP and NF. Literature on both the NP and NF have adaptation strategies at the forefront of their lists to battle climate change.

## **Chapter 3: Methodology**

This study aims to examine the institutional misfit among agencies responsible for managing public lands in the United States and for identifying potential solutions to improve coordination and integration among these agencies to better adapt to the challenges of climate change. This chapter describes the research design, methods, and procedures for collecting and analyzing data. It also justifies the chosen approach and discusses its limitations.

### **3.1 Research Design**

This study will use a mixed-methods approach to investigate the institutional misfit and barriers to integrated land management in US National Parks and Forests and how it affects climate change adaptation. The study will be conducted in two parts:

#### ***3.1.1 Part One: Quantitative Analysis***

The first part of this study will involve a quantitative analysis of existing data. Firstly, analysis of official documents (primary and secondary sources), reports, and datasets from government agencies, academic institutions, and other organizations related to land management in National Parks and Forests. The quantitative aspect will involve a survey of park and forest managers to gather data on these agencies' governance and management systems, the challenges they face in collaboration and integration, and the potential solutions to overcome these challenges. All quantitative questions will be structured with a 4-point Likert scale and yes or no questions. To accurately capture participants' opinions without the

influence of a neutral response bias, a 4-point Likert scale was selected for this study. By excluding a middle option, commonly chosen as a neutral stance, the researcher aimed to discern the proper direction of participant's sentiments. This deliberate design choice allows for a more nuanced understanding of the participants' feelings and facilitates exploring distinct viewpoints within the given response options. The survey questions will be designed based on the literature review and input from relevant experts in the field. The analysis findings will give an overview of the existing state of integrated land management and possible hurdles to collaboration and adaptation.

*Example of Quantitative Question: On a scale of 1 to 4 (1 being none and 4 being often), how much collaboration and communication do you experience between the NP and NF agencies in implementing climate change adaptation strategies?*

### **3.1.2 Part Two: Qualitative Analysis**

The study's second part will involve qualitative analysis using interviews and surveys to gather in-depth perspectives and experiences of relevant stakeholders, including agency personnel, users, conservationists, and other experts. The qualitative analysis will explore the perceptions and attitudes toward integrated land management, identify potential solutions to overcome institutional misfits and investigate such an approach's perceived benefits and challenges. In order to gain a deeper understanding of their perspectives on the institutional misfit and its impact on climate change adaptation. The interview questions will also be designed based on the literature review and input from relevant experts.

*Example Qualitative Question: How do you perceive the effectiveness of current integrated management approaches in addressing climate change vulnerability of biodiversity in the managed NP and NF areas?*

## **3.2 Data Collection**

The data for this study will be collected from various sources, including official documents, reports, and datasets, as well as through interviews and surveys. The data will be collected using only ONLINE methods, such as online survey methods, as well as digital repositories of published academic and governmental reports.

**Table 1:** Shows how data will be collected, why, and from what avenues.

| Research Question   | Data information required to answer the question | Source of Data                           |
|---|--|--|
| How does the governance of public lands (National Parks [NP] and National Forest [NF]) in the United States affect climate change vulnerability of the biodiversity present in the managed NP and NF areas? | Current governance systems                       | Literature review                        |
| What are the current integrated management approaches for NP/NF in the United States?   | Current Integrated Management approaches         | Literature Review                        |
| What are the impacts of climate change on NP/NF in the United States?   | Impacts of climate change in the U.S.            | Literature Review<br>Interview<br>Survey |
| What are the institutional barriers to addressing climate change on public lands (Institutional misfit)?  | Institutional barriers                           | Literature review<br>Interview<br>Survey |

### 3.3 Data Analysis:

In this study, a mixed-methods analysis approach will be used to explore the relationship between institutional misfit, management approaches, and their effectiveness in addressing the impacts of climate change on biodiversity in National Parks and National Forests. The quantitative content analysis of survey

data will be supplemented with qualitative content analysis of interview responses and survey responses to identify patterns and themes related to management approaches and institutional misfit.

Additionally, Figure 18 (Pg.42) displays a map created for this thesis, showing the need for collaborations was created through QGIS software. This map shows how interconnectedness of these agencies in geographical context.

### **3.4 Ethical Considerations**

The ethical considerations were taken very seriously since it assures the participants' safety, rights, and well-being. This study intends to protect research integrity, respect participant autonomy, and avoid any potential damage or exploitation. This research also prioritizes ethical principles in order to sustain the ideals of honesty, respect, and social benefit in the quest for knowledge.

The ethical considerations for this research included:

- Informed consent
- Confidentiality and Anonymity
- Respect for Participants' Perspectives
- Avoidance of Bias
- Protection of Sensitive Information
- Minimization of Harm
- Compliance with Ethical Guidelines.

By upholding ethical principles, this research can contribute to meaningful and trustworthy results while upholding ethical standards in the scientific community. The concerns mentioned were given significant attention and carefully incorporated into every aspect of the study.

Several steps were taken in order to be granted approval for this research by the University of Twente. The University conducted a thorough application process, and the application had to be amended several times before approval. Ethical approval was obtained for this research on 10/05/2023.

## **Chapter Four: Findings and Discussion**

In this chapter, the application of mixed methods involving interviews and surveys, will be presented to answer the main research question and sub-questions. Both qualitative and quantitative data obtained from these sources will be displayed to provide comprehensive insights into the research topic.

This study conducted five anonymous interviews with participants who expressed their willingness to contribute to the research while maintaining their confidentiality. To assure each persons

anonymity, identifying information such as the interviewee's name and any specific details that could reveal their identity have been omitted from this report. When specifically citing Interviewees, they will be identified as Interviewees and then a number 1 through 5 (example: Interviewees 1,2,3,4,5). The number assigned to the interviewee was randomly assigned and had no significant meaning. Each interviewee was found through social media outlets and forums dedicated to public lands employees in the USA. There were no specific requirements to qualify other than the willingness to participate after being briefly informed of the content and the fact that they are former or current employees of the NP and NF. The interviews for this research focused on gathering qualitative data/results from current or former employees of the NP and NF.

Along with interviews, as part of the data collection method, online surveys were conducted to gather the opinions and experiences of the target population (former and current employees of the NP and NF). The surveys were distributed via email and social media platforms from the 16th of June to the 27th of June (2023). The surveys consisted of 28 questions, but depending on answers to specific questions, participants only had to answer approximately 24 questions. After 12 days of the active survey, there were 222 submitted respondents. While 222 surveys were submitted, not all were complete. Each participant could omit any question other than the employment status portion (to properly group participants)—the survey aimed to answer both qualitative and quantitative research questions. The questions were designed to measure the respondents' attitudes, beliefs, behaviors, and preferences regarding collaboration between the NP and NF concerning climate change and biodiversity. The surveys were anonymous and voluntary, and the respondents were informed about the purpose and scope of the research before taking part. When addressing something specific from a survey participant, they will only be identified as such (a survey participant). The survey data were analyzed using mixed methods to identify the main themes and patterns that emerged from the responses.

The findings section of this thesis takes a dive into the interesting and valuable insights gathered from both interviews and surveys. By combining different types of data, including personal stories, perspectives, and numerical data, we will get a fuller picture of the research topic. It's like putting together puzzle pieces to see the bigger picture. The interviews give us unique perspectives and deep insights, while the surveys will provide us with numerical data and trends with some additional perspectives with the open questions. Combining these different data sources gives us a more complete understanding of the research topic.

## 4.1 Qualitative Findings from the Interview

### 4.1.1 Main themes

- **Collaboration Challenges:** Limited collaboration and lack of personnel, capacity, and funding were major challenges to effective collaboration between agencies and neighboring national parks.
- **Integrated Management Approaches:** The importance of implementing integrated management approaches that connect different agencies and stakeholders involved in managing public lands is recognized. This approach promotes collaboration, information sharing, and coordinated decision-making.
- **Climate Change:** The impact of climate change on national parks and forests was discussed, including issues like prolonged fire seasons, changing ecosystems, and the need for climate change adaptation and mitigation efforts.

- **Funding and Resources:** There is a common mention of the need for increased funding and resources to support various aspects of park and forest management, including trail maintenance, infrastructure improvement, and visitor facilities.
- **Stakeholder Engagement:** Engaging stakeholders, including local communities, indigenous groups, and recreational users, was emphasized as crucial for effective collaboration and decision-making processes.
- **Importance of Education:** Educating employees and visitors about sustainable principles and responsible outdoor practices was highlighted as an important aspect of park and forest management.
- **Disconnect with Policymakers/Governance:** There were several mentions of “Washington” or “Hire-ups” which refers to the policy maker and governance and how they are too far disconnected to management and the employees.

#### 4.1.2 Summary of Interviews

The research findings revealed key themes related to the *challenges of Collaboration* between NP and NF, especially in regard to climate change and biodiversity. One interviewee mentioned, " *I haven't seen in my experience a lot of Collaboration between the two...in order to collaborate, it's going to require slightly different strategies than we currently use. In my experience, what we have a lot of is some people communicating. They are getting a seat at the round table, but a lot of that is making a meeting to make a meeting (Interviewee 2)*". Interviewee 2 is saying that although these agencies have important meetings to make changes and collaborate, yet nothing still seems to get done (especially when it comes to inter-agency collaboration). Additionally, one of the interviewees said that they work for an NF that does not border an NP, but it does border many other NFs. They claimed that the communication and collaboration between the same agencies, but different Forests, do not communicate or collaborate.

Alternatively, Interviewee 3 said that they had done some collaborations, but not between the NP and NF per se. They state that they have worked with a contracted conservation corps to work for the NP and NF. Interviewee 4 concurs that when it comes to not only collaboration but with climate adaptation. They talk about how many of the NP and NF employees also work or volunteer with grassroots organizations (NGOs) on the side so that the community gets involved and things will get done through the community. This also adds to the conversation about *stakeholders*. Interviewee 4 is a part of the indigenous community and strongly advocates for involving the indigenous community and bringing back sacred land practices. The Indigenous communities in the United States have been renowned for centuries for having proper land management (*Figure 2: Fa Et Al., 20207. Overlap of Global Intact Forest Landscapes and Indigenous Peoples' Lands., n.d.*). Both the NP and NF (in some parks and forests) have been slowly trying to re-introduce tribal conservation efforts, and thus far, they have been a win for conservation (*How Returning Lands to Native Tribes Is Helping Protect Nature, n.d.*). Involving the local communities and NGO's not only in the interviews but also in the surveys were the employee's thoughts on the local community and their important role in getting things done regarding conservation. While it is great to have community involvement, the NP and NF should also collaborate in this regard.

*Climate change* emerged as a significant factor impacting national parks and forests; one of the main claims for all interviewees was the significant impact of the fires on the NP and NF. With climate change increasing, the temperature, along with the NP and NF having a mindset of suppression vs. prevention, have created catastrophic fires in the previous years (*Climate Change + a Bad Policy Fuels*

*Fires. Let's Fix Both.*, n.d.). This has become one of the most prevalent observations on climate change impacts mentioned by NP and NF employees.

Now that employees have witnessed these climate change impacts, they call for the NP and NF to act. By *integrating more effective management approaches*. All interviewees talked about how the management of NP and NF can use some work in order to manage all types of ecosystems effectively and effectively the biggest barriers to collaborating together; interviewee 5 stated, "I believe it starts up at the top with actual policy." All interviewees mentioned that in order to achieve proper management, there needs to be more involvement from their respective *policy makers*. Interviewee 1 states, "You know, especially the last few years, we've had flip flops of different types of administrations... changes in policy or changes in management or changes in how we do things cannot happen at the time it happens. The government does things petty slowly, right? So, I feel like we're always at this stalemate with climate change". This interviewee talked about how the employees know what needs to be done. They see what needs to be done. And there's just a lot of bureaucratic red tape that handicaps us from doing what needs to be done.

Other than the management and policies, *the interviewees considered budgeting and funding major barriers*. "Parks and Forests have to increase their capacity and even add positions and have like liaisons between the two. We just simply, a lot of times, don't have the time or capacity to like to implement the improvements we want to. We talk about it all the time. We have all these ideas, and we have all these wants and wishes for the future (Interviewee 1)". Interview 2 linked the poor funding of the NP and NF and the local communities and stated, "We're so economically depressed that there's no ecological angle to it. It's strictly development to try to bring some economic relief to these suffering communities. So again, environment is not that it isn't important, but it's gonna take a back seat". The interviewee rounded a bit of all topics thus far, some parks and forests are struggling to stay afloat, and it affects several aspects surrounding them. If some NP and NF budgets were increased, it could help maintain a focus on climate change and biodiversity.

Additionally, educating the employees and the public/ visitors was another common theme throughout the interviews. People and employees should not only be educated on climate change affecting their surrounding parks or forests, but there should also be constant education of the employees within the NP to NF, NF to NF, and NP to NP. Along with more effective communication from policy makers to management and management to the "boots on the ground".

*\*For more detailed insight and a comprehensive overview of the Interview questions and their corresponding research objectives, please refer to table 4 in Appendix 4 (Pg.72). This table provides a concise breakdown of each qualitative interview question, its alignment with specific research inquiries, and the intended outcomes sought from participants' responses.*

## 4.2 Qualitative Findings from the Survey

### 4.2.1 Main themes

- **Climate Change Impacts on Biodiversity:** Survey participants identified various climate change impacts on National Parks and National Forests, focusing on biodiversity. These impacts included the decline of species like pika due to increasing temperatures, unhealthy forests devastated by drought, fungus, and bark beetles leading to catastrophic wildfires, and the loss of native plants and insects in many areas. Sea level rise, glacial melting, and changes in species range were also mentioned.



- **Fragmented Governance and Management Objectives:** Fragmented governance and differing management objectives are one significant barrier to addressing climate change on public lands. Participants highlighted that the National Parks and National Forests have separate departments (Interior vs. Agriculture) and missions, which can hinder effective collaboration and the development of joint strategies to combat climate change.
- **Limited Resources and Funding:** Resource allocation and limited funding emerged as another institutional barrier. Participants expressed concerns about inadequate funding for climate change adaptation efforts, particularly in the areas of fire management, wildlife conservation, hydrology, and botany. Insufficient resources and staffing levels were seen as hindrances to effectively addressing climate change's impacts.
- **Stakeholder Engagement and Collaboration:** Participants highlighted the importance of stakeholder engagement and collaboration to address climate change impacts. They recommended annual partnership meetings, sharing resources, and fostering strong agency partnerships. Suggestions were also made for increased communication, better coordination, and joint funding for interagency programs.
- **Limited collaboration (especially on ecosystem connectivity):** The need for more collaboration and coordination between the two agencies, particularly in addressing ecosystem connectivity and promoting effective climate change adaptation, was emphasized by participants as a barrier.
- **Inadequate management response:** Some participants expressed concerns about the slow and reactive nature of the management approaches to climate change. They felt that more proactive measures, such as thinning, prescribed burning, and landscape management, should be implemented to mitigate the impacts of climate change.
- **Limited focus on climate change:** Participants pointed out that climate change is not prioritized enough in the current management approaches of both National Parks and National Forests. They suggested that more attention and resources should be allocated to address climate change-related issues.
- **Insufficient education and outreach:** Some participants felt that there is a lack of educational outreach efforts to raise awareness about climate change and its impacts on public lands. They believed that more efforts should be made to educate visitors and the public about the importance of climate change mitigation and adaptation.
- **Challenges in decision-making:** Participants highlighted challenges related to climate change adaptation in decision-making processes. They mentioned factors such as bureaucratic red tape, resistance from long-time employees, and shifting political priorities as barriers to making timely and effective decisions.

#### *4.2.2 Summary of Survey (Open Questions)*

Like the interview, some common themes arose, as well as some new ones. In the survey, there were five open questions. The questions were designed to help answer this study's research question by understanding the perspective of current and former employees of the National Parks and Forests. The key themes discussed in the interview summary were Collaboration Challenges, Climate Change, Funding and

Resources, Stakeholder Engagement, and the importance of Education. This section will further elaborate on the key themes not discussed in the summary of the interviews.

Within the survey, the participants shed light on their respective organizations' **fragmented governance and management objectives**. A participant states, "*The governmental bodies need to listen to researchers and prioritize management decisions that are backed by new science and traditional ecological knowledge.*". This participant is trying to say that these two agencies need to prioritize effective management and make decisions backed by the scientists they employ. Additionally, another participant highlighted, "The two agencies have differing priorities, but any talk of intergovernmental collaboration must include the USFWS and BLM as well.". This suggests that any inter-agency collaboration must also include the other federal public land agencies (Bureau of Land Management and the United States Fish and Wildlife Service). This insinuates that a collaboration between the NP and NF alone would be fragmented, not include the other federal entities.

One survey participant had a lot to say on the effectiveness or **challenges in decision-making** "*These agencies were built decades ago by old white men with mediocre intentions and minimal understanding of the environment, let alone climate change. They are too big into the bureaucracy to change, they are staffed with incompetents, it's almost impossible to fire people, and there are no people at the helm with a vested interest in modern land preservation practices or working together. It's very 'every man for himself.' Everyone is so under-resourced and overworked that it's hard to get anything done, let alone new things. The bureaucracy of these agencies seems designed to prevent any real work from happening.*" This participant is saying the systems that have been in place since these agencies began need to be updated, especially regarding science. Americans tend to like things done exactly as they have always been done, so changing the minds of the "higher-ups" to put more initiative into climate change adaptation and collaboration is difficult. Other participants went as far as to say that there are issues with "*Resistance from long-time employees*" and "*Uneducated leadership*"; these governance systems are not working towards making effective decision-making, which inherently means that not a lot can be done under the current management.

Many participants also mentioned **Limited collaboration (especially on ecosystem connectivity)**. Participants stated, "Limited collaboration and lack of personnel, capacity, and funding were major challenges to effective collaboration between agencies and neighboring national parks.". Limited collaboration was a prominent theme in the interviews, but some focused on the ecosystem connectivity aspect in the survey. One participant said, "*The borders created by these NP and NF are imaginary, yet the same biodiversity and ecosystems are the same. They require that the policies be appropriately reflected through management to battle climate change impacts.*" These borders we have created and managed (separately with separate objectives) should not be in order to maintain the integrity of the ecosystem and biodiversity within them.

While management would be considered most of these participants' direct superior (most participants identified as a part of the labor force), most seem unsatisfied. Many participants identified that **inadequate management responses** are a significant barrier concerning climate change. Survey participants were asked, 'How does climate change impact the current management approaches in the National Parks and Forests?' Many answered things such as, "*It's slow and reactive with little educational outreach.*" And "*Honestly, it doesn't seem to impact management. We 'monitor,' but we don't change anything...*" The employees believe there has been a minimal impact regarding climate change, and management does not take it into perspective. "*I do not believe management takes climate change into consideration often.*" The lack of consideration regarding climate change can have significant ramifications and addressing it effectively has made the majority of the participants feel like their response needs to be revised and re-evaluated.

With a lot of bureaucratic 'red tape' as well as *limited focus on climate change*, participants felt that climate change adaptation and mitigation was not a priority. One participant stated, "*Minimally. They are primarily focused on facilitating ecotourism at the expense of biological imperatives. Special programs are taking a novel approach to fire management or habitat rehabilitation. However, those programs spend most of their time fighting for access to the limited pool of resources allocated for land management. Most of those resources go to enabling recreation and fighting fire. Our fire management practices are shoddy at best. Recreation is currently the 2nd biggest negative impact on the land next to climate change.*" The topic of fire budget was mentioned numerous times, and how all the resources of these agencies go to fire suppression, which leaves little for prevention and other departments within the NP and NF. Additionally, a separate participant stated, "*Wildfires have become more severe, causing these agencies to put more money into suppression and not nearly enough into thinning, prescribed burning, and other management tactics that can help reduce the need for fire suppression. Also, just more funds and staff for the other critical resources (fisheries, hydrology, botany, wildlife).*" While focusing primarily on fire suppression, the other fields feel neglected, leaving no room for other types of climate change adaptation or mitigation.

*\* For more detailed insight and a comprehensive overview of the survey questions and their corresponding research objectives, please refer to Table 5 in Appendix 5 (Pg.74). This table provides a concise breakdown of each qualitative survey question, its alignment with specific research inquiries, and the intended outcomes sought from participants' responses.*

## 4.3 Quantitative Survey Results

### 4.3.1 Demographics

The only demographic asked for survey participants was their occupation. Technically, the only specifics that were asked about their occupation were job title and position, so most personal identifiable questions would be considered employment history and/or status.

### 4.3.2 Employment History

This section seeks to gather information about the employment status of individuals participating in the study. By understanding the diverse range of employment statuses, this research aims to use these questions to establish a personal connection with participants and better understand their perspectives and experiences.

### 4.3.3 Current and Former Agencies

The interview and survey search scope were expanded to encompass current and former employees to ensure an adequate participant pool. Therefore, they were included in the selection process to capture a comprehensive range of perspectives and experiences.

#### The survey asked participants:

*Question one: Do you currently work for either the National Parks or Forest Service?*

The options for the current employees are:

- Yes, I currently work for the National Parks Only
- Yes, I currently work for the National Forests Only
- No, I currently do not work for either agency.
- Other, I am a contractor (which was asked to elaborate).

If the participant answered No, I am not a current employee for either, they were then directed to an additional question.

*Question 1.5: Have you previously worked for the National Parks or Forest Service?*

The options for the former employees are:

- Yes, I previously worked for the National Parks Only
- Yes, I previously worked for the National Forests Only
- No, I have not previously worked for either agency.
- Other, I previously was contracted (was asked to elaborate)

These findings shed light on the employment backgrounds of the survey participants, revealing the presence of current and former employees within the National Parks and Forest Service and individuals who have worked for these agencies through contracts. Being a current and former employee is the only requirement to participate in the survey.

#### ***4.3.4 Current and Former Job Title***

To gain an understanding of the participants' views, the interview and survey contain a question regarding each participant's position within the agency. This aids in the analysis of survey results and identifies any differences in attitudes or experiences depending on the various positions. The information gathered was designed to demonstrate each of the respondents' familiarity of regards to the scope of this survey.

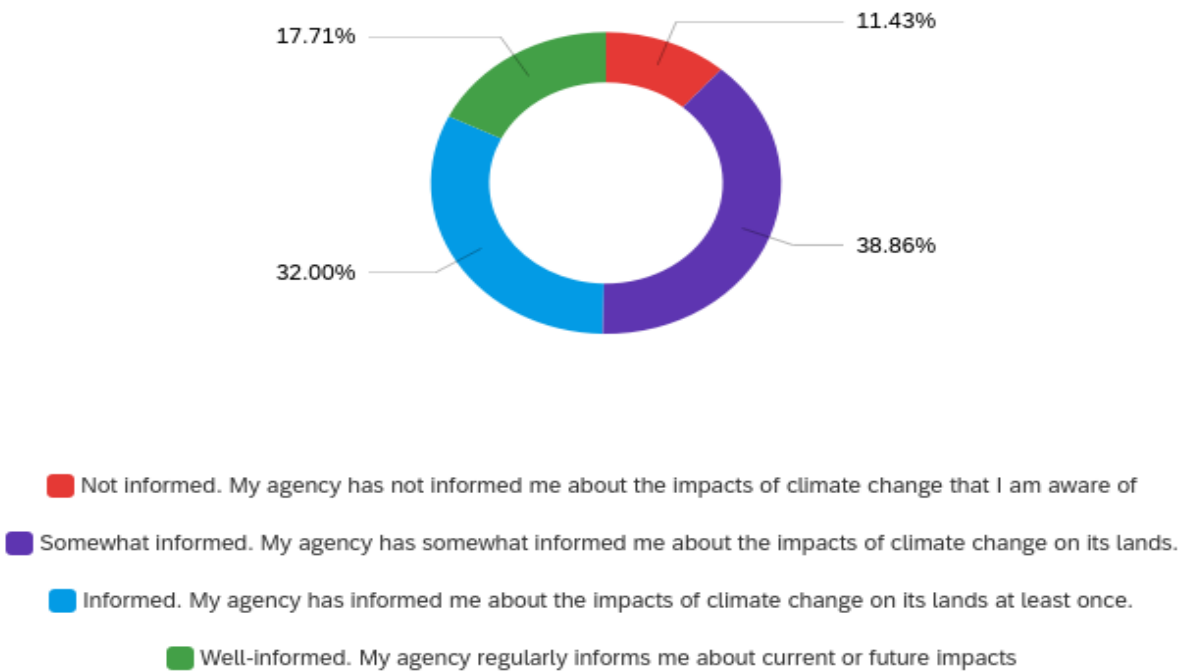
#### ***4.3.5 Employment Type***

The participants' employment type was asked in order to understand the diversity and dynamics of the organization's workforce. To ensure that all types of participants are represented.

### **4.4 Informed on Climate (Agency vs. Self)**

Since this research aims to explore the collaborative efforts of these agencies in addressing climate change and biodiversity, the following questions were asked:

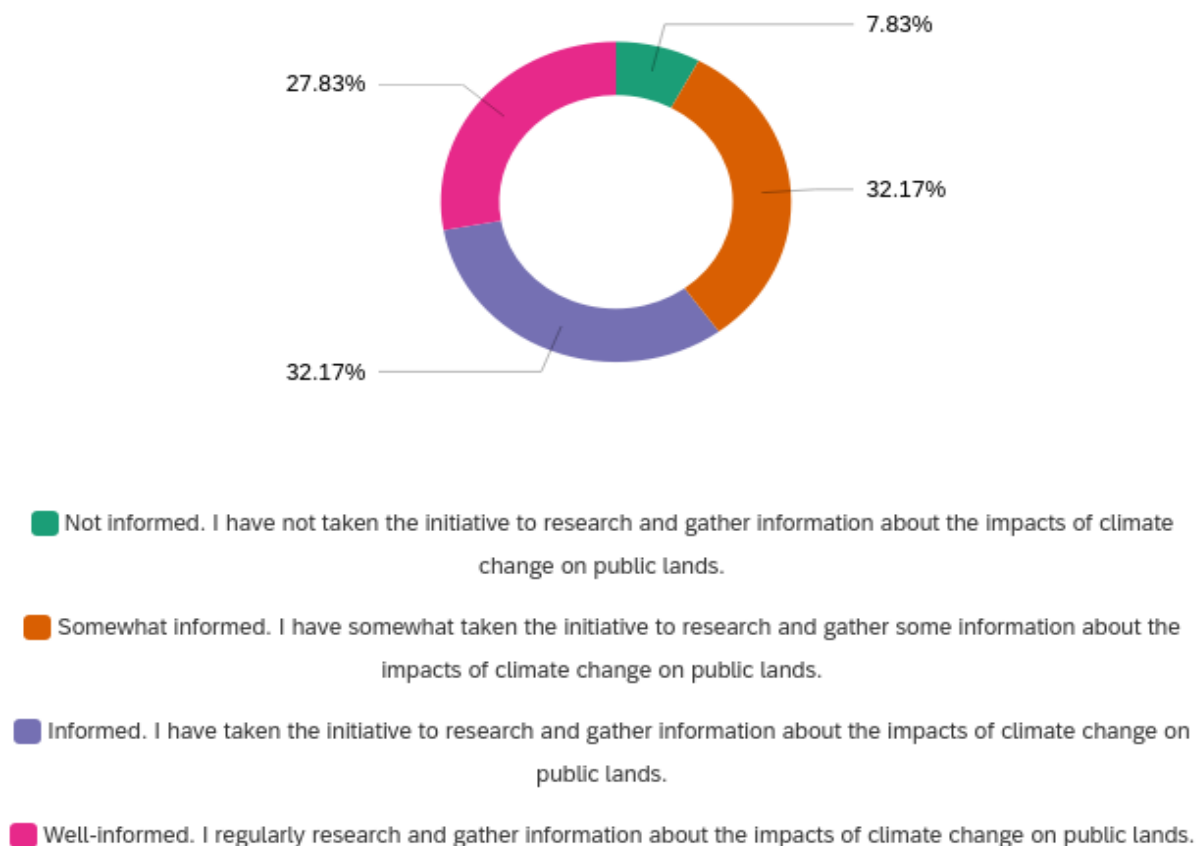
*How well-informed do you feel about the climate change impacts affecting public lands under your agency?*



**Figure 2:** In Figure 2, the analysis reveals survey participants' self-assessment of their level of knowledge regarding the climate change impacts affecting public lands under their respective agencies.

If respondents responded either “informed” or “Well-informed,” then they continued with the rest of the survey, but if respondents indicated they were either “Not informed” or “Somewhat informed,” they were directed to an additional question:

*Have you taken the initiative to research and gather information on your own about climate change impacts on public lands?*



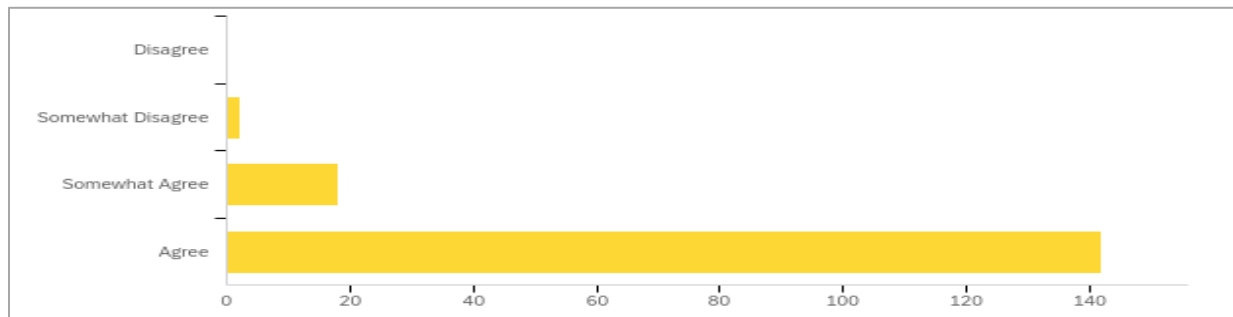
**Figure 3:** In Figure 3, the findings indicate the extent to which survey participants have taken the initiative to research and gather information independently about climate change impacts on public lands.

This question aims to assess whether individuals within the agency have personally sought out information about climate change impacts, even if their agency did not proactively provide it.

These survey questions were included to evaluate the effectiveness of agency communication and individual engagement regarding climate change impacts on public lands.

#### 4.5 Climbing the Likert Scale: Exploring Perceptions and Ratings

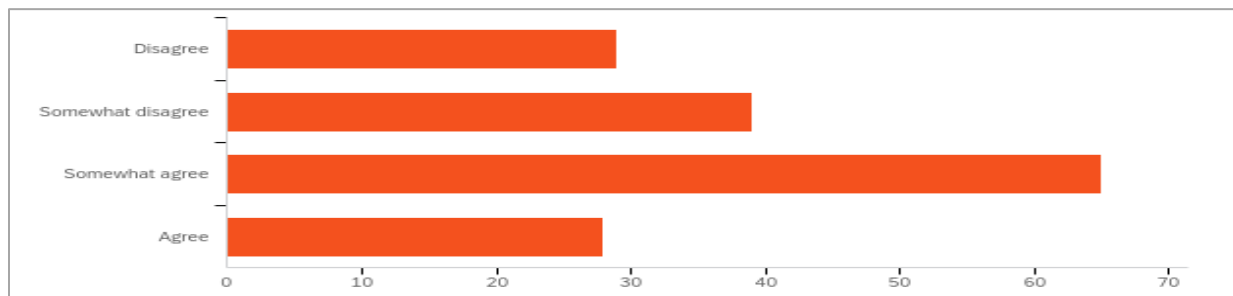
This section presents the findings of the survey through graphical representations of the Likert scale questions. The graphs provide a visual depiction of how survey participants responded to each question, allowing for a clear understanding of the distribution of responses and the overall patterns that emerged. All participants were asked to either disagree, somewhat disagree, somewhat agree, or agree with each statement.



**Figure 4:** In Figure 4, the results illustrate survey participants' perceptions regarding the differing priorities in the management of National Parks and National Forests, highlighting the potential disparity in management approaches between the two.

Out of the 162 participants who responded to the survey question regarding whether National Parks and National Forests are managed with different priorities, the findings indicate that a significant majority of 87.65% (142 participants) agreed with this statement. A smaller percentage of 11.11% (18 participants) somewhat agreed, while a significantly smaller proportion of only 1.23% (2 participants) somewhat disagreed or plainly disagreed.

These results highlight that most participants acknowledged that the National Parks and Forests are managed with differing priorities. Priorities meaning distinct objectives and strategies in their management approaches.

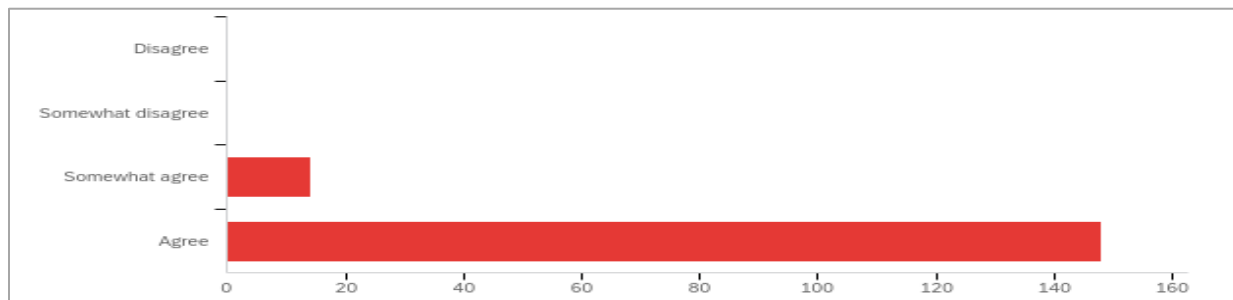


**Figure 5:** Figure 5 presents the participants' perspectives on the current governance and management systems of National Parks and Forests in their capacity to collaboratively address climate change.

The survey results regarding participants' perception of whether the current governance and management systems of National Parks and Forests can collaboratively address climate change show a varied range of responses. Of the 161 participants who participated, 18.01% (29 participants) disagreed with this statement, while 24.22% (39 participants) somewhat disagreed. On the other hand, 40.37% (65 participants) expressed a somewhat agree to address climate change collaboratively agree stance, and 17.39% (28 participants) agreed.

This suggests a mix of different perspectives on the effectiveness of the current governance and management systems in addressing climate change collaboratively. While a significant proportion of participants have reservations or doubts, a slightly larger number of people still believe in the potential of

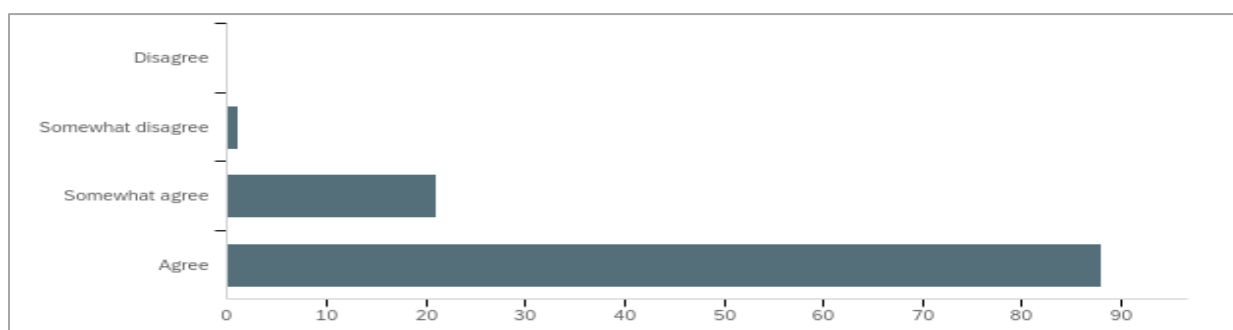
these systems to work together toward climate change adaptation. The results indicate a need for further exploration and improvement in order to enhance the collaborative efforts and effectiveness of governance and management systems.



**Figure 6:** Figure 6 examines the participants' perceptions regarding the impact of climate change on the biodiversity of National Parks and Forests areas.

This figure demonstrates that the participants agreed on climate change's impact on the biodiversity of National Parks and Forests. Of the 162 participants, the mass majority of 91.36% (148 participants) agreed with this statement, and only 8.64% (14 participants) somewhat agreed.

This demonstrates that all participants acknowledge the harmful consequences of climate change on the biodiversity of National Parks and Forests. This also demonstrates how climate change threatens these public areas' natural balance and variety. Furthermore, this only solidifies the significance of establishing appropriate adaptation strategies and policies to combat the effects of climate change to maintain biodiversity found in National Parks and Forests for future generations to enjoy.

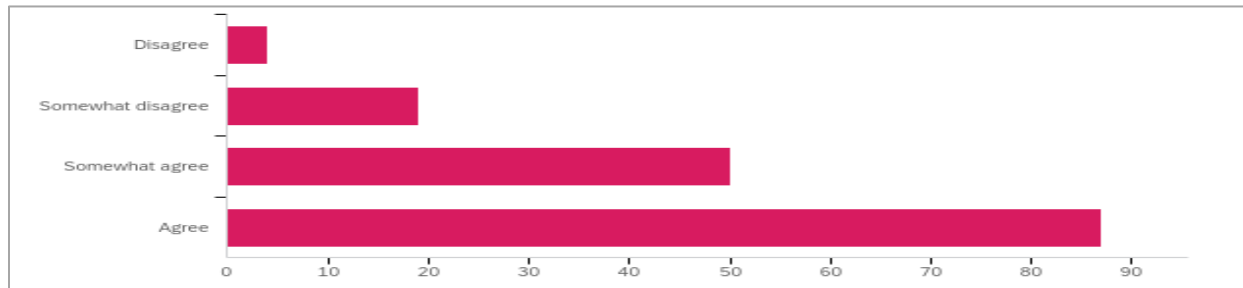


**Figure 7:** Figure 7 highlights the participants' views on the need for integrated and adaptive approaches in public land management to address the challenges posed by climate change.

The survey's findings show that participants strongly agree that climate change requires coordinated and adaptable approaches to public land management. A large percentage of, 80% (88 participants) agreed with the statement, with 19.09% (21 individuals) somewhat agreeing.



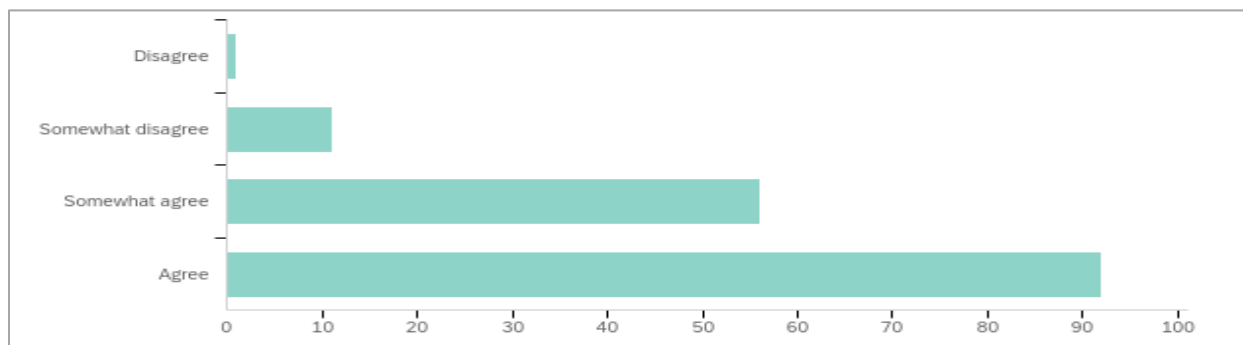
This highlights the significance of incorporating climate change concerns into public land management practices. The majority of participants recognize the need to develop adaptable methods to handle the problems posed by climate change. This is why the NP and NF need to create collaborative and adaptable measures to build and preserve public lands in the face of changing climatic circumstances.



**Figure 8:** Figure 8 illustrates the participants' perspectives on the lack of coordination among National Parks and National Forest agencies as a significant barrier to effectively addressing climate change on public lands.

The results indicate that participants generally think that a lack of cooperation across National Parks and National forests is an important roadblock to tackling climate change on public lands. Out of the 160 respondents, 31.25% (50 participants) agreed somewhat, whereas 54.37% (87 participants) agreed completely with the statement.

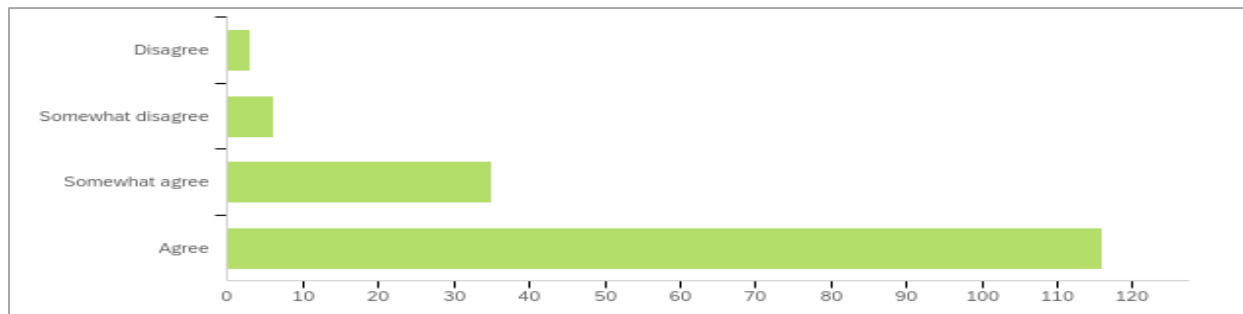
The results also emphasize the significance of effective coordination and collaboration among the public lands (NF and NP). Coordination issues may prevent the development and initial implementation of effective climate change policies and initiatives. To successfully manage climate change, National Park and Forest Service organizations should establish strong communication frameworks, share information and resources, and collaborate towards a common goal. The NP and NF can be at the forefront for all public lands to better adapt to climate change, minimize its effects, and protect the long-term viability through improving inter-agency collaboration.



**Figure 9:** Figure 9 depicts the participants' views on the disconnect among National Parks and National Forest employees with their agencies' policies and the policymakers.

This figure shows that a majority of the respondents, 57.5% (92 participants), agree that there is a disconnect among National Parks and National Forest employees with their agencies' policies and the policy makers. An additional 35% (56 participants) somewhat agree with this statement.

These findings suggest that there is a perceived gap between the employees working at the National Parks and National Forests and the policies set by their agencies and policy makers. This disconnect can have implications for effective decision-making, implementation of management strategies, and overall organizational alignment. Potentially, by bridging the gap, the NP and NF can foster better communication channels, promoting employee engagement, and involving employees in policy development processes. By enhancing the connection between employees and policy makers, National Parks and National Forests can improve the alignment of policies with boots-on-the-ground realities and promote effective collaboration and cooperation for addressing climate change and biodiversity conservation.

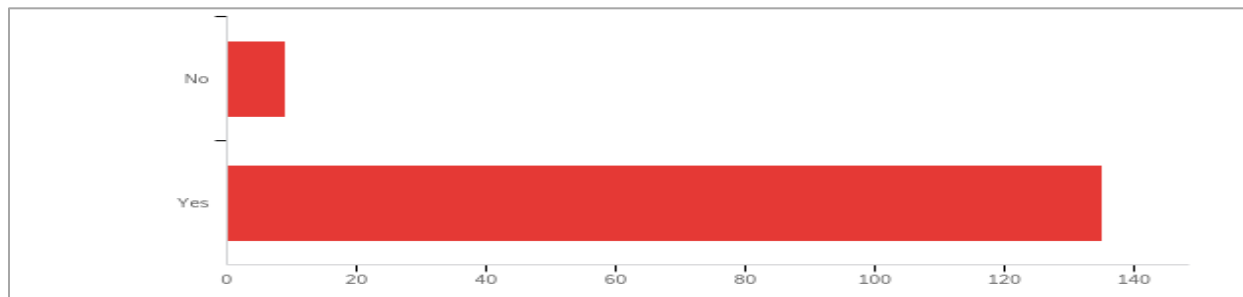


**Figure 10:** In figure 10, the data highlights the participants' recognition of the essential role of collaboration among National Parks and National Forest agencies in addressing climate change adaptation and mitigation on public lands.

These results show that a significant amount of the respondents, 72.5% (116 participants), agree that collaboration among National Parks and National Forest agencies is essential for effective climate change adaptation and mitigation on public lands. An additional 21.88% (35 participants) somewhat agree with this statement.

These findings underline the need for inter-agency coordination in addressing the difficulties that come with climate change. Teamwork can result in the pooling of resources, information, and skills, as well as coordinated decision-making and adaptive execution of strategies. National Parks and National Forests might boost their capability to mitigate climate change impacts, maintain biodiversity, and ensure the long-term viability of public resources by collaborating. Prioritizing and encouraging collaboration among these agencies is critical for successful climate change adaptation and mitigation on public lands.

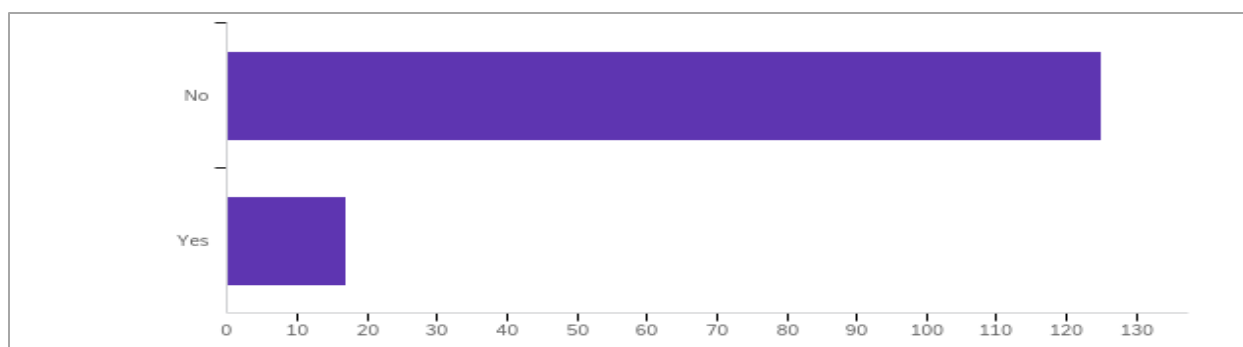
#### 4.6 Clear-cut Responses: Insights from Yes/No Questions



**Figure 11:** In Figure 11, the responses to the yes or no question "Do you believe that climate change is a significant threat to the biodiversity in the National Parks and National Forests?"

Based on the survey results, the question "Do you believe that climate change is a significant threat to the biodiversity in the National Parks and National Forests?" received responses from 144 participants. The majority of respondents, accounting for 93.75% (135 participants), answered "Yes," indicating that they perceive climate change as a significant threat to biodiversity in these protected areas. Only 6.25% (9 participants) answered "No," suggesting a minority view that climate change does not pose a significant threat to biodiversity in National Parks and National Forests.

Along with **Figure 6**, this demonstrates that survey participants are generally aware of the possible implications of climate change on biodiversity. The significant number of respondents who expressed worry reflects a broad awareness of the vulnerability of ecosystems in these protected regions. These findings highlight the need to prioritize climate change mitigation and adaptation techniques in National Parks and National Forests' management and conservation activities.

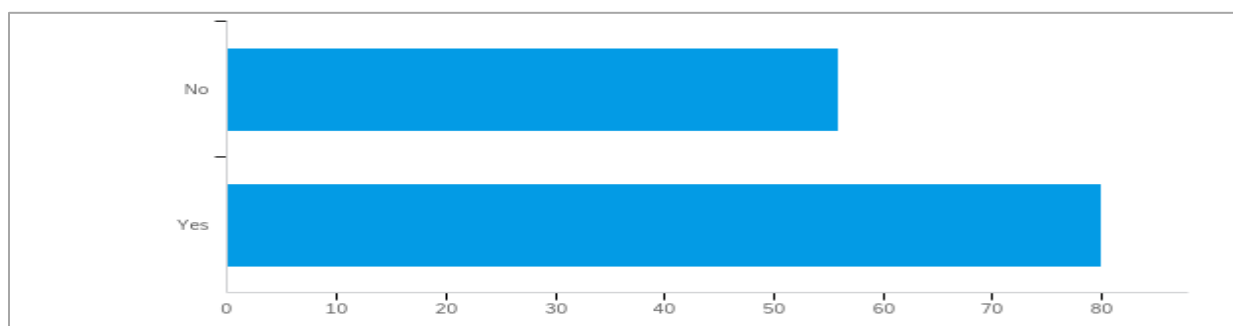


**Figure 12:** In Figure 12, the responses to the yes or no question "Do you believe the current governance and management systems of the National Parks and National Forests effectively address climate change?" provide valuable insights into the perceptions of the participants.

Based on the survey results, the question "Do you believe the current governance and management systems of the National Parks and National Forests effectively address climate change?" received

responses from 142 participants. The majority of respondents, accounting for 88.03% (125 participants), answered "No," indicating that they perceive the current governance and management systems to be ineffective in addressing climate change in these protected areas. Only 11.97% (17 participants) answered "Yes," suggesting a minority view that the existing systems are effective in addressing climate change.

These findings suggest that there is a lot of skepticism among the survey respondents about the current governance and management of the NP and NF. With the significant gap between participants this shows a perceived mismatch between the anticipated level of action and the actual execution of climate change initiatives inside National Parks and National Forests. This emphasizes the importance of critically assessing existing policies, practices, and decision - making processes to improve, not only the employees satisfaction but also the effectiveness climate change through governance and management.



**Figure 13:** In Figure 13, participants were asked the question, "Have you witnessed any instances where National Parks and Forests have conflicting policies or priorities?"

Based on the survey results, the question "Have you witnessed any instances where National Parks and Forests have conflicting policies or priorities? If Yes, please elaborate" received responses from 136 participants. Among the respondents, 58.82% (80 participants) answered "Yes," indicating that they have observed instances where conflicts arise between policies or priorities within National Parks and Forests. In contrast, 41.18% (56 participants) answered "No," suggesting they have not witnessed such conflicts.

With the significant percentage of participants reporting conflicting policies or priorities within these agencies is a potential challenge in achieving cohesive management and decision-making. The open-ended nature of this question allows for an array of perspectives on the specific instances and nature of conflicts that arise. It provides valuable qualitative insights into the complexities and nuances of managing these National Parks and Forests.

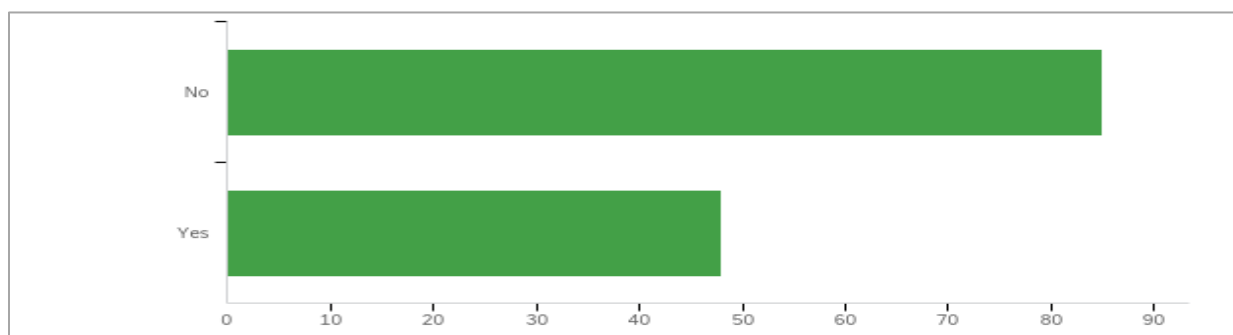
This question provided the participants the opportunity if they answered "Yes" to elaborate, giving it a bit of qualitative data backing their reasoning for believing that the NP and NF have conflicting policies. Below are commonalities on responses:

1. Conflicting Priorities: NPS preservation vs. USFS conservation
2. Environmental Impacts: Private contractors exploiting public lands.
3. Lack of Collaboration and Communication in general
4. Policy Differences: Different goals, policies, and priorities

5. Land Use and Boundaries: Challenges of managing different land uses and man-made boundaries.
6. Funding and Underfunding: Neglected science departments, firefighting prioritization
7. Diversity and Inclusion: Skepticism about commitment and hostile work environment

While some participants answered “Yes”, not all answered the please elaborate.

While the NP and NF are different agencies with different priorities, they commonly border one another (along with many other public land entities). Regardless of their policies and priorities, these “borders” are imaginary, and they need to come up with solutions together. These findings only emphasize the importance of creating clear communication channels and establishing a solid foundation for resolving conflicts collaboratively and finding common ground among diverse interests. It is crucial that they try to facilitate an ongoing dialogue and collaboration among relevant stakeholders, including park management, government agencies, local communities, and other relevant partners, to ensure the effective implementation of policies and priorities that support the long-term sustainability of National Parks and Forests.



**Figure 14:** In Figure 14, participants were asked the question, "Have there been successful instances of collaboration or joint initiatives between National Parks and National Forests that address climate change impacts?"

Based on the survey results, the question "Have there been successful instances of collaboration or joint initiatives between National Parks and National Forests that address climate change impacts? If yes, please elaborate" received responses from 133 participants. Among the respondents, 36.09% (48 participants) answered "Yes," indicating that they have observed successful collaborations or joint initiatives between National Parks and National Forests that specifically address climate change impacts. In contrast, most respondents, 63.91% (85 participants) answered "No," suggesting a perceived lack of such successful instances.

The responses provide valuable insights into the level of collaboration and joint efforts between National Parks and National Forests in addressing climate change impacts. Participants who answered "No" may shed some light on the barriers, challenges, or limitations that have affected the successful collaboration between NP and NF in addressing climate change impacts. These perspectives can

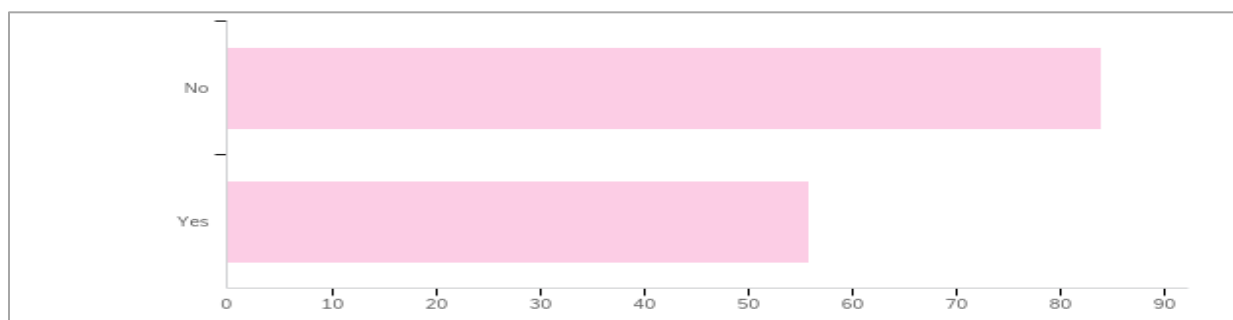
potentially help future efforts to overcome obstacles and enhance collaboration for more effective climate change adaptation and mitigation.

Like the previous question, the participants were offered the opportunity to elaborate if they answered “Yes,” giving it a bit of qualitative data to show some instances where employees have witnessed collaboration or joint initiatives with the NP and NF in regard to climate impacts. Below are the common themes in the responses provided:

1. Environmental Restoration and Fire Management: Collaborative efforts between National Parks and National Forests in addressing environmental restoration and implementing fire management strategies.
2. Research and Climate Change Adaptation: The two agencies collaborate in research initiatives and climate change adaptation planning.
3. Interagency Firefighting and Resource Sharing: Joint efforts in wildfire response and sharing of firefighting resources.
4. Watershed and Resource Management: Collaborative strategies for managing watersheds and shared natural resources.
5. Cross-Boundary Prescribed Fire: Cooperation in implementing prescribed fire practices across boundaries to manage ecosystems effectively.

While some participants answered “Yes,” not all answered please elaborate.

Overall, the findings suggest a need for increased attention and efforts in further developing collaborative approaches and joint initiatives between National Parks and National Forests to address the ever-rising challenges posed by climate change. By sharing knowledge, resources, and experiences between agencies, it can contribute to building more resilient ecosystems, enhancing biodiversity conservation, and ensuring the long-term sustainability of these public lands.



**Figure 15:** In Figure 15, participants were asked the question, "Do National Parks and National Forests work together towards a common goal of climate change adaptation and biodiversity conservation?"

With the question, "Do National Parks and National Forests work together towards a common goal of climate change adaptation and biodiversity conservation?", a total of 140 participants provided

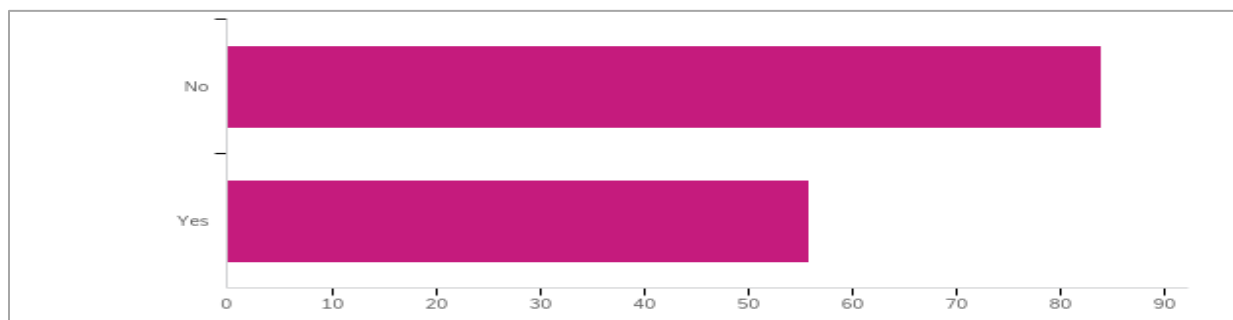
their feedback. Among the respondents, 40% (56 participants) believed that National Parks and National Forests collaborate toward this common goal. On the other hand, the majority of respondents, 60% (84 participants), indicated that they perceive a lack of collaboration.

These survey findings look into the perceived level of cooperation between National Parks and National Forests in addressing climate change adaptation and biodiversity conservation. The overall result suggests that there is a need for further efforts in order to help foster collaboration.

Those who responded positively "Yes" believe that both the NP and NF already share goals towards climate change, yet with the minority, the majority of the employees believe this is not a reality. Their insights can show that some effective strategies, approaches, and outcomes may be pursued in pursuit of these shared goals.

While participants who responded negatively "No" believe that goals on climate change adaptation is not a reality. This being the majority, it shows how there are still existing barriers, challenges, or other factors that may be disrupting effective collaboration between NP and NF in working towards common objectives. By understanding these challenges, future actions to promote collaboration, bridge gaps, and overcome obstacles may be possible in the near future.

Altogether the survey responses for this particular question display the significance of enhancing collaboration and coordination between National Parks and National Forests to address the impacts of climate change and safeguard biodiversity effectively. By working together towards a common goal (even if just for climate change and biodiversity), these agencies can leverage their resources, expertise, and respective roles to advance climate resilience and biodiversity conservation to help preserve these natural areas for the future to come.



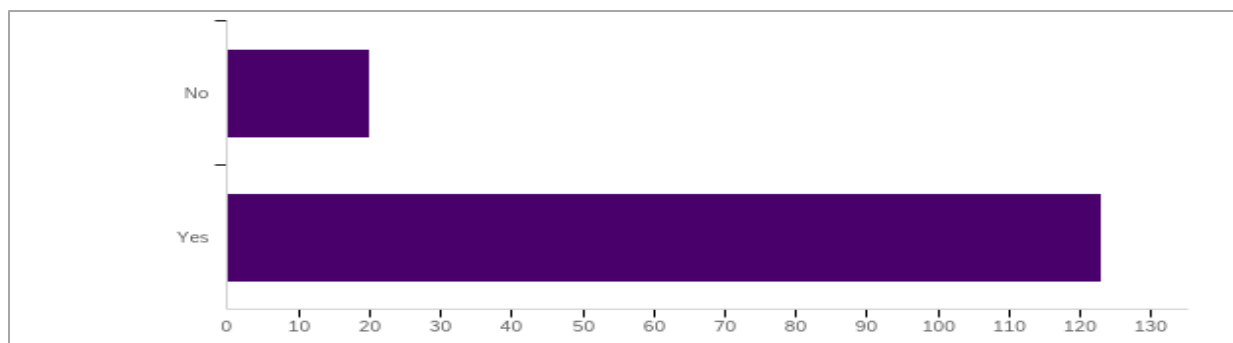
**Figure 16:** In Figure 16, participants were asked the question, "Do you believe National Parks and National Forests work together to help mitigate climate change effects and biodiversity loss?"

"Do you believe National Parks and National Forests work together to help mitigate climate change effects and biodiversity loss?" the survey received responses from 140 participants. The findings display that 60% (84 participants) believed that National Parks and National Forests do not effectively collaborate in mitigating climate change effects and biodiversity loss. On the other hand, 40% (56 participants) believed in the collaboration between these entities for addressing these environmental challenges.

These results show how former and current NP and NF employees feel about the level of collaboration between the two agencies in mitigating the impacts of climate change and biodiversity loss. The majority of respondents expressed concerns about the lack of cooperation in these efforts, suggesting the need for improvement in collaborative initiatives.

While the majority showed their concerns by stating “No”, they do not believe the NP and NF work together to help mitigate climate change. A significant amount (40%) still answered “Yes.” This shows a significant divide, and that many employees feel that collaborative efforts between the agencies are happening regarding climate change effects and biodiversity loss.

In the end, these survey responses show the importance of strengthening the collaboration between National Parks and National Forests to address the adverse effects of climate change and biodiversity loss. By working together and adapting together, these entities can develop effective joint strategies, share resources, and implement actions that effectively mitigate the impacts of climate change and preserve biodiversity.



**Figure 17:** In Figure 17, participants were asked the question, "Do you believe National Parks and Forests should have a shared goal of adaptation and mitigation to climate change?".

Based on the survey question "Do you believe National Parks and Forests should have a shared goal of adaptation and mitigation to climate change?" received responses from 143 participants. The findings indicate that a significant majority, 86.01% (123 participants), believed that National Parks and Forests should have a shared goal of adaptation and mitigation to climate change. In contrast, 13.99% (20 participants) expressed a different viewpoint, stating that National Parks and Forests should not have a shared goal in this regard.

According to the survey results, employees significantly support the National Parks and Forests in developing and cooperating on adaptation and mitigation strategies to combat climate change. Overall, 86 percent supported the concept of a shared objective of adaptation and mitigation to handle climate change consequences effectively. By collaborating toward a similar goal, these agencies may be able to increase their resilience, safeguard their ecological integrity, and assure the long-term viability of these treasured public lands.



## 4.7 Summary of Quantitative Results

These graphs and statistics emphasize the National Parks and Forests and their need for improved coordination, integrated management approaches, and stakeholder engagement to effectively address climate change and preserve the biodiversity. As made clear from the findings (of both the interview and surveys), there is a serious disconnect between these agencies, policy makers, management, and employees. These agencies are supposed to be at the forefront of environmental issues, yet collaboration and communication (between both the NP and NF/ governance/ management) for climate change vulnerability is not stable. The findings highlight the urgency of addressing climate change impacts, such as prolonged fire seasons and changing ecosystems, through sustainable management practices and holistic governance.

The data collected from thorough surveys strongly underlines the urgency of addressing climate change effects, such as longer fire seasons (which was heavily mentioned within both the interviews and surveys regarding climate change) and shifts in ecosystems. This is not only vital for the preservation of these public lands but also for maintaining a broader ecological balance. Notably, 87.65% of respondents agree that fragmented collaboration and institutional obstacles are substantial barriers. This highlights the critical need for enhancing communication and cooperation between agencies.

Examining the statistics further shows the insightful patterns. An overwhelming 91.36% agree on the detrimental impact of climate change on biodiversity, underscoring the necessity of proactive conservation measures. Moreover, 54.37% acknowledge the lack of coordination among agencies as a significant challenge, emphasizing the importance of smoother channels of communication.

However, amidst the data-driven discussions, there are glimpses of optimism. Around 40% support the idea of collaborative synergy, suggesting the potential for a harmonious working approach. This sentiment resonates with the 72.5% who advocate for a joint commitment to climate adaptation and mitigation. Yet, the skepticism expressed by 60% regarding the effectiveness of collaborative measures between NP and NF in addressing climate change also points to the need for a strategic shift.

In this realm of empirically grounded certainty, a clear message emerges. The threat of prolonged fire seasons and ecological transformations is no longer speculative but a factual reality. The call for sustainable management practices and comprehensive governance is not mere conjecture, but a firm inference drawn from these quantitative insights. Ultimately, these numerical revelations unequivocally emphasize the transition from discourse to action – a collective effort that requires partnership, deliberate strategies, and a synchronized symphony of endeavors. The data speaks loudly and compels a united response.

## 4.8 Final Discussion of Qualitative and Quantitative Results

With the joint findings from qualitative interviews and quantitative surveys paints a comprehensive picture of the challenges, opportunities, and imperatives surrounding the governance and management of National Parks (NP) and National Forests (NF) in the face of climate change. Through an

intricate blend of qualitative insights and statistical trends, this study brings to light a tapestry of intricacies that define the present state of these iconic American public lands.

The qualitative interviews reveal a web of concerns that intertwine agency misalignment, inadequate funding, and limited communication. Employees and stakeholders within NP and NF articulate the pressing need for enhanced collaboration, holistic strategies, and more responsive governance. These qualitative narratives underscore the urgent call for these agencies, often revered as stewards of the environment, to strengthen their internal and external partnerships to address climate change challenges more effectively.

Complementing these stories, the quantitative data unveils statistical realities reinforcing the need for collaboration and adaptive strategies. The sheer magnitude of respondents recognizing the detrimental impact of climate change on biodiversity, standing at 91.36%, echoes the urgency of the situation. Similarly, the acknowledgment of a lack of coordination among NP and NF agencies by 54.37% emphasizes the tangible hurdles that must be overcome for cohesive efforts.

Yet, within these challenges, a spark of hope emerges. A substantial 72.5% voice a shared aspiration for joint initiatives between the NP and NF in regard to climate adaptation and mitigation, while 40% believe in the possibility of potential collaboration. While 40% can seem low, given that each agency is run under different missions, rules, and mandates; some believe that they should stay that way. This issue with this is the lack of awareness about how eco-systems work. While these agencies are for different things, these ecosystems that reside on the borders remain the same yet have different management. With this contrast between skepticism and optimism shows the complexities in which NP and NF operate, even though most agencies border another public land. This gives a little insight into complex institutional dynamics and the recognition or lack thereof of common goals.

Collectively, qualitative insights and quantitative data help paint a picture of the critical crossroads where these agencies stand. As captured through interviews and surveys, the discourse calls for enhanced collaboration, clearer communication, and resource optimization resonates through both avenues. This study plays the role of an amplifier, amplifying the voices of those directly involved, magnifying the data-supported trends, and emphasizing the urgency for change. The findings here prove the hypothesis of institutional misfit, while the discussion shows the need for reform. As the challenges of climate change persist, these narratives and numbers become a guiding light, pointing the way toward a more integrated, collaborative, and resilient future for these invaluable public lands.

**Figure 18:** This table shows the NP and NF park boundaries, with an emphasis on how all NF border a NP. This shows that collaboration should be at the forefront of these agencies.

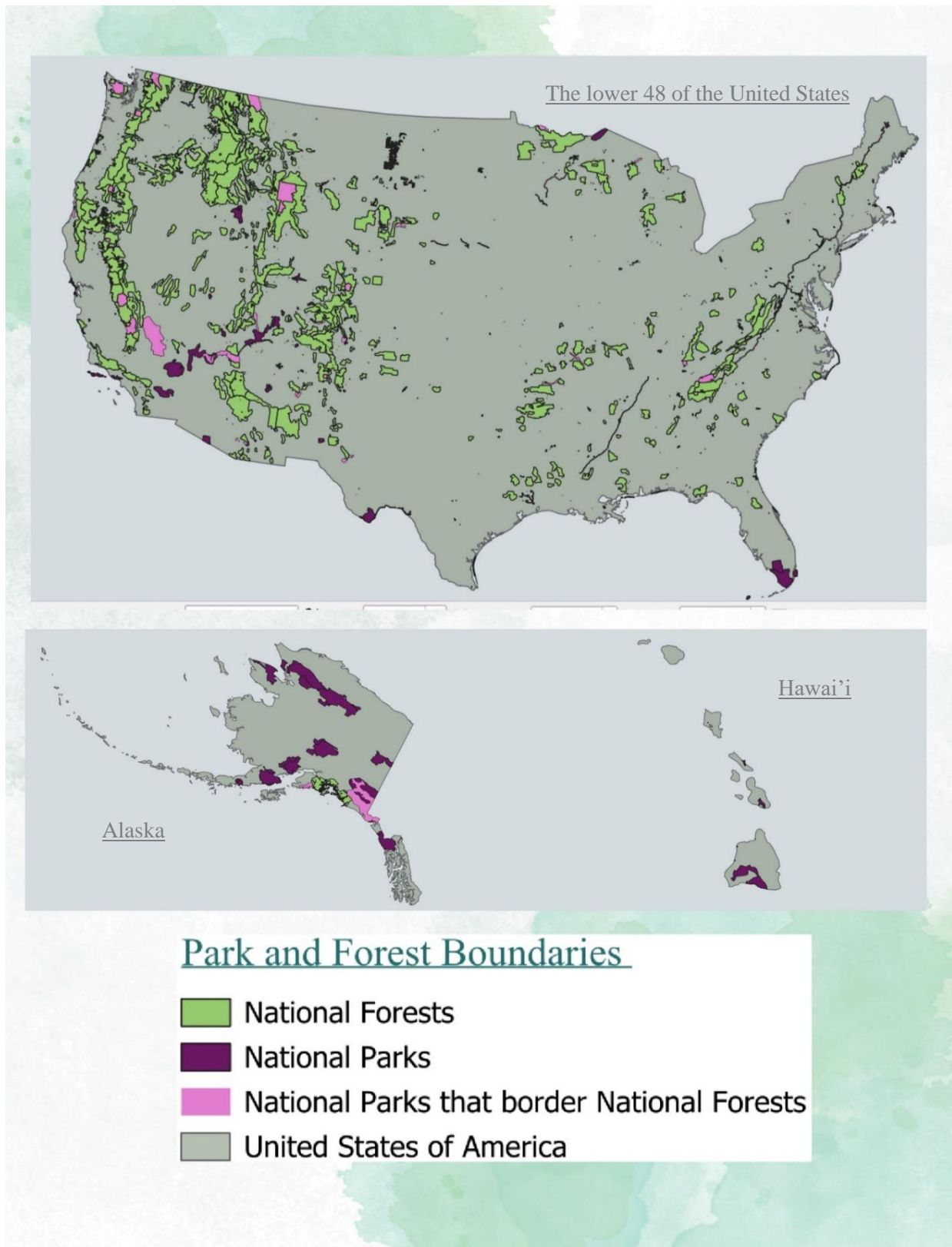


Figure 18 is a map that was designed using QGIS, and it shows the spatial dynamics between National Parks and National Forests in the United States. Among 440 national parks displayed (including all 28 National Park complexes), 68 share borders with National Forests. Remarkably, all 138 NF depicted on the map border at least one National Park. The unconventional NF borders, which can start and resume at different locations, add a bit of complexity to the map making it harder to show all boundaries and their connections; since minimal data describes each park and forest, the parks and forests could not be individually separated. All datasets/ shapefiles were acquired from National Parks, National Forests, or other governmental websites. This intriguing interplay highlights the significance of their interconnectedness and shows that more collaborative conservation and sustainable management strategies must be developed.

## Chapter Five: Conclusions

This section will delve into the thesis's conclusion, limitations, and recommendations.

### 5.1 Conclusion

In conclusion, this thesis dives into the complex realm of governance and management of public lands in the United States, focusing on National Parks (NP) and National Forests (NF) in the USA and their critical role in addressing climate change vulnerability while safeguarding biodiversity. The study has revealed some significant challenges stemming from institutional misfits, conflicting policies, and limited coordination between NP and NF agencies. These challenges display the pressing need for integrated and adaptive management approaches to tackle climate change impacts on public lands effectively.

The National Parks (NP) and National Forests (NF) use integrated management approaches, although with varying degrees of implementation. Despite their distinct mandates and policies guiding these agencies, it is essential for them to collaborate, given their geographical proximity and shared biodiversity and ecosystems. Stemming from the interviews and surveys the majority (all interviewees and 60% of the survey participants) believed that National Parks and National Forests do not effectively collaborate in mitigating climate change effects and biodiversity loss. With these current governance, policies, and management practices are inadequate in effectively addressing the impacts of climate change, a sentiment echoed by the employees themselves.

In order to effectively combat climate change impacts, it is crucial for the NP and NF to align their policies and management practices. The borders between these agencies may be “imaginary”, but the interconnectedness of biodiversity and ecosystems calls for unity, especially regarding climate change and biodiversity. By enhancing collaboration, information sharing, and coordinated decision-making, which are desperately needed in order to optimize the management of public lands, the NP and NF can assist in the mitigate the adverse effects of climate change.

The existing governance systems need to be reviewed and revised in order to strengthen and promote greater collaboration between the agencies. Additionally, comprehensive policies should be developed to ensure that climate change adaptation and mitigation are prioritized in managing these natural

resources. The mass majority of the interviewees declared that they do not believe that climate change adaptation and mitigation is a priority, and most definitely not a shared priority with 86.01% of the survey participant's claiming such. Factors such as adequate resources, funding, and personnel must be allocated properly to support these efforts, enabling the implementation of sustainable practices and the engagement of stakeholders at various levels.

The surveys provided a great deal of insight into the challenges and barriers faced by the NP and NF. The employees' perspectives and concerns showed the need for urgent action to address the limitations within governance, policies, and management approaches. By recognizing these issues and actively working towards improved collaboration and integrated management, the NP and NF can enhance their resilience to climate change and safeguard the valuable natural resources under their care. Overall, the institutional misfits between the National Parks and National Forests have created barriers to effective biodiversity adaptation, conservation/preservation, and management in the face of climate change. Meaning this study's hypothesis was proven true in this research.

Further research and ongoing dialogue conversations through stakeholders, including employees, policymakers, and local communities, are essential for developing effective strategies and policies. A more comprehensive and sustainable approach can be achieved by incorporating scientific knowledge, traditional ecological knowledge, and the experiences of those working on the ground (which is the primary workforce for both the NP and NF). Ultimately, the success of addressing climate change impacts in the NP and NF depends on the collective efforts of all stakeholders involved in their management.

This thesis has paved the way for further research into the complications of maintaining public lands in the context of climate change and institutional challenges. As our awareness of these challenges grows, we have a fresh chance to set the path for a more harmonious and integrated future in which National Parks and National Forests work together to meet the needs of both the environment and the people they serve. We can secure the preservation of these valuable landscapes by working toward this goal, leaving a lasting legacy for future generations.

I'll end this study with a quote from the survey, when asked if there was anything they would like to mention that was not represented in the questions, "*Nope. Thanks so much for doing this! Governmental agencies can be an amazing force for good, but we need to get away from our obsession with private industry. We need to hire more specialists and people who do boots on the groundwork. Our management plans need to be informed with up-to-date science that covers wildlife behavior, climate, invasive, tribal rights and knowledge, ecosystem health, etc. thanks!*".

## 5.2 Limitations

This study acknowledges several limitations that have influenced the scope and depth of its findings. One notable limitation pertains to potential biases and the completeness of data sources. Relying on existing literature and data may introduce inherent biases from those sources, and the inclusion of potentially outdated information could impact the relevance of the findings. Furthermore, while diligent efforts were made to ensure a comprehensive approach to data collection, the intricate nature of the research topic and the constraints of time and resources may have led to the oversight or insufficient exploration of certain aspects within the study.

Another limitation lies in the perspectives of participants and their accessibility. The findings heavily rely on the willingness of participants to share their experiences and insights. Self-selection bias in survey and interview participation could influence the comprehensiveness of the gathered data.

Additionally, the logistical challenges faced by NP and NF employees stationed in remote areas with limited internet access might have impacted their ability to contribute to the study.

The scope of the study introduces another set of limitations. Not all National Parks and National Forests share mutual borders, which naturally restricts the examination of collaboration challenges between specific NPs and NFs. This limitation underscores the need for future research to encompass a wider spectrum of interagency collaborations across various landscapes and contexts.

The challenges related to time differences, geographical locations of participants, and limited internet access for those working in remote backcountry areas may have posed difficulties in coordinating interviews and surveys since the study was conducted on USA agencies while in the Netherlands, these challenges could potentially affect the diversity and representation of the participant pool and limit the perspectives obtained. Future studies should consider alternative data collection methods, such as in-person interviews or communication channels that do not rely heavily on internet connectivity, to ensure the inclusion of perspectives from workers in remote areas.

One particularly significant limitation uncovered during the research is collaboration challenges extending beyond the NP-NF interface. Participants highlighted instances of collaboration gaps and barriers not only between NPs and NFs but also within the individual NP or NF systems. This complexity underscores the multifaceted nature of collaboration dynamics within the broader framework. While this study has illuminated NP-NF collaboration challenges, it signals the need for future investigations to delve into the intricacies of collaboration within and between the respective agencies.

These limitations provide valuable insights into the boundaries and constraints of this study. They emphasize the need for a cautious interpretation of the findings while highlighting potential future research directions. By recognizing and addressing these limitations, researchers can contribute to a more comprehensive understanding of climate change adaptation and collaboration within the dynamic context of the United States National Parks and National Forests.

## **5.3 Recommendations for Future Research and Practice**

### ***5.3.1 Broadening Research Scope and Collaborative Endeavor's***

Future research endeavors should be expanded to encompass a broader spectrum of stakeholders, including other federal agencies, state, municipal, and private entities. This expansion is crucial to understanding climate change impacts on public resources within the context of National Parks (NPs) and National Forests (NFs). For instance, survey respondents highlighted that 72.5% advocated for a shared goal of climate change adaptation and mitigation, indicating a strong desire for collaborative action across agencies. By including diverse stakeholders in research efforts, we can gain deeper insights into the challenges and opportunities that exist for cross - agency cooperation, ultimately leading to more effective climate change strategies.

### ***5.3.2 In-Depth Exploration of Legislative Dynamics and Political Polarization***

To enhance the efficacy of future collaborative initiatives, a deeper exploration into the influence of legislation and political polarization on interagency cooperation is essential. Qualitative interviews underscored the challenges posed by differing management priorities between NPs and NFs. For example, Interviewee 2 highlighted that "changes in policy or changes in management... cannot happen at the time

it happens" due to bureaucratic obstacles. Further research into legislative frameworks and political dynamics can shed light on how such challenges can be addressed, allowing policymakers to develop strategies that navigate ideological divisions and promote collaborative decision-making.

### ***5.3.3 A Holistic Approach to Governance and Communication***

Moving forward, it is imperative for policymakers, land managers, and stakeholders to adopt a comprehensive approach to governance. The qualitative data revealed that 54.37% of participants identified the lack of coordination among NP and NF agencies as a key barrier to addressing climate change on public lands. This highlights the need for a more integrated approach to management. For instance, Interviewee 4 emphasized the importance of involving local communities and indigenous groups, suggesting that a holistic governance approach should incorporate diverse perspectives to foster collaboration and ensure effective climate change adaptation and mitigation.

### ***5.3.4 Prioritizing Funding and Capacity Building***

The insights garnered from survey responses and qualitative interviews underscore the critical need to prioritize funding and capacity-building efforts. Survey participants expressed concerns about inadequate funding for essential areas like fire management and wildlife conservation. The qualitative data further revealed that Interviewee 1 noted the challenges in implementing improvements due to limited capacity. Future research in funding and capacity building can provide a deeper understanding of how resource allocation impacts climate change strategies, enabling policymakers to allocate resources effectively and address gaps in funding.

### ***5.3.5 Fostering Intra-Agency Communication and Collaboration***

The compelling narrative that emerges from both qualitative and quantitative data emphasizes the need to strengthen communication and collaboration within the agencies. The qualitative interviews highlighted lacking collaboration, even between neighboring Parks and Forests. For example, Interviewee 3 mentioned collaborations with contracted conservation corps but noted a lack of direct NP – NF collaboration. Future research should explore strategies for enhancing intra-agency communication, such as regular meetings or shared resources, to overcome barriers and ensure that collective efforts are aligned toward effective climate change adaptation and biodiversity conservation.

Finally, these recommendations draw upon specific examples from the qualitative and quantitative data from the interviews and surveys. By incorporating diverse stakeholders, understanding legislative dynamics, adopting holistic governance, prioritizing funding, and fostering intra - agency collaboration, stakeholders can address the challenges identified in the data and enhance collaborative efforts for climate change adaptation and biodiversity conservation. These recommendations provide actionable steps that can guide future research and practice, facilitating a more coordinated and effective approach to safeguarding public lands and the vital biodiversity they sustain.

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*Appendices One: Survey Template*

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# Thesis\_Survey\_Final

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## Start of Block: Default Question Block

You are being invited to participate in research on Integrated Public Land Management Approaches in the National Parks and Forests in the United States: Overcoming Institutional Misfit to Improve Climate Change Adaptation for Biodiversity. The data will be used for the researcher's Master Thesis. Participation in this study is entirely voluntary, and you can withdraw anytime.

Caitlyn Taylor-Walker is doing this study from the Faculty of Behavioural, Management, and Social Sciences at the University of Twente.

This research aims to examine present challenges of the governance and management approaches of public lands regarding climate changes and biodiversity for the National Parks and National Forests in the United States. This research seeks to identify strategies for improving collaboration to address climate change impacts. A survey is being conducted among National Parks and Forest Service employees to gather insights on governance, management, collaboration, barriers, and potential solutions. By understanding these aspects, we can enhance the long-term viability of these invaluable landscapes.

This survey will take you approximately 10 minutes to complete. You are free to omit any questions. We believe no known risks are associated with this research study; however, as with any online activity, the risk of a breach is always possible. To the best of our ability, your answers in this study will remain confidential. We will minimize any risks by storing data in approved and secure University outlets, and no names will be used in order to anonymize (no personal information will be asked, i.e., Name, email, etc.)

### **Study contact details for further information:**

**Caitlyn Taylor-Walker, [c.c.taylor-walker@student.utwente.nl](mailto:c.c.taylor-walker@student.utwente.nl).**

**Advisor Contact Information: Athanasios Votsis, [a.votsis@utwente.nl](mailto:a.votsis@utwente.nl)**

**Ethics board contact information: [ethicscommittee-hss@utwente.nl](mailto:ethicscommittee-hss@utwente.nl)**

The ethics board has approved this research at the University of Twente in Enschede, Netherlands.

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I agree to these terms and grant permission to use the data provided by this survey.

Yes (1)

No (2)

*Skip To: End of Survey If I agree to these terms and grant permission to use the data provided by this survey. = No*

End of Block: Default Question Block

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Start of Block: Block 1

### **\*\*OPTIONAL READING\*\***

Before you start this survey, please read over any terms you may not be **familiar** with. Below are definitions provided in case you need a reference on specific terms:

#### **Climate change:**

Climate change in national parks and forests refers to the long-term alteration of weather patterns and environmental conditions within these protected areas; Climate change has various impacts, including rising temperatures, changing precipitation patterns, altered ecosystems, shifting wildlife habitats, and increased risks of natural disasters such as wildfires and extreme weather events. These changes pose significant challenges to managing, conserving, and preserving the unique natural resources, biodiversity, and cultural heritage found in national parks and forests.

#### **Adaptation:**

Practical strategies and adaptation measures are essential to mitigate the adverse effects of climate change and ensure the long-term sustainability of these vital ecosystems. This is called adaptation. This involves adjusting strategies and practices to protect national parks and forests' ecosystems and wildlife. The goal is to ensure the long-term sustainability of these areas amidst a changing climate.

#### **Mitigation:**

Mitigation refers to efforts to address the causes of climate change. It involves minimizing greenhouse gas emissions, promoting sustainable practices, and protecting natural resources.

*Mitigation strategies in National Parks and Forests include:*

- Adopting renewable energy sources
- Implementing conservation measures
- Promoting carbon sequestration through forest management.

End of Block: Block 1

---

Start of Block: Block 2

Do you currently work for either the National Parks or Forest Service?

- Yes, the National Parks only (1)
- Yes, the Forest Service only (2)
- No, I currently do not work for either (3)
- Other (Contractor or Conservation corps) (4) \_\_\_\_\_

*Skip To: Q6 If Do you currently work for either the National Parks or Forest Service? = Yes, the National Parks only*

*Skip To: Q6 If Do you currently work for either the National Parks or Forest Service? = Yes, the Forest Service only*

*Skip To: Q6 If Do you currently work for either the National Parks or Forest Service? = Other (Contractor or Conservation corps)*

*Skip To: Q5 If Do you currently work for either the National Parks or Forest Service? = No, I currently do not work for either*

---

Have you previously worked for the National Parks or Forest Service?

- Yes, the National Parks only (1)
- Yes, the Forest Service only (2)
- No, I have not previously worked for either (3)
- Both the National Parks and National Forests (4)
- Other (Contractor or Conservation corps) (5) \_\_\_\_\_

*Skip To: Q7 If Have you previously worked for the National Parks or Forest Service? = Yes, the National Parks only*

*Skip To: Q7 If Have you previously worked for the National Parks or Forest Service? = Yes, the Forest Service only*

*Skip To: Q7 If Have you previously worked for the National Parks or Forest Service? = Both the National Parks and National Forests*

*Skip To: Q7 If Have you previously worked for the National Parks or Forest Service? = Other (Contractor or Conservation corps)*

*Skip To: End of Survey If Have you previously worked for the National Parks or Forest Service? = No, I have not previously worked for either*

What is your current position considered?

- Laborer (1)
- Management (2)
- Administrative (3)
- Scientist/Researcher (4)
- Other (Please elaborate) (5) \_\_\_\_\_

*Skip To: Q8 If What is your current position considered? = Laborer*

*Skip To: Q8 If What is your current position considered? = Management*

*Skip To: Q8 If What is your current position considered? = Administrative*



*Skip To: Q8 If What is your current position considered? = Scientist/Researcher*

*Skip To: Q8 If What is your current position considered? = Other (Please elaborate)*

*Skip To: Q8 If Condition: Other (Please elaborate) Is Displayed. Skip To: What is your employment status at the....*

---

What was your previous position considered?

- Laborer (1)
- Management (2)
- Administrative (3)
- Scientist/Researcher (4)
- Other (Please elaborate) (5) \_\_\_\_\_

*Skip To: Q9 If What was your previous position considered? = Laborer*

*Skip To: Q9 If What was your previous position considered? = Management*

*Skip To: Q9 If What was your previous position considered? = Administrative*

*Skip To: Q9 If What was your previous position considered? = Scientist/Researcher*

*Skip To: Q9 If What was your previous position considered? = Other (Please elaborate)*

---

What is your employment status at the organization?

- Permanent employee (1)
- Semi-Permanent employee (2)
- Seasonal (3)
- Temporary (4)
- Contracted (5)
- Other (Please elaborate) (6) \_\_\_\_\_

*Skip To: End of Block If What is your employment status at the organization? = Permanent employee*

*Skip To: End of Block If What is your employment status at the organization? = Semi-Permanent employee*

*Skip To: End of Block If What is your employment status at the organization? = Seasonal*

*Skip To: End of Block If What is your employment status at the organization? = Temporary*

*Skip To: End of Block If What is your employment status at the organization? = Contracted*

*Skip To: End of Block If What is your employment status at the organization? = Other (Please elaborate)*

---

What was your employment status at the organization?

- Permanent employee (1)
- Semi-Permanent employee (2)
- Seasonal (3)
- Temporary (4)
- Contracted (5)
- Other (Please elaborate) (6) \_\_\_\_\_

**End of Block: Block 2**

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Start of Block: Block 3

**\*\* Definition Descriptions - Optional Reading \*\***

**Governance:**

Governance describes the management structures and decision-making in an organization. Effective governance ensures responsible management and the achievement of organizational goals.

***Examples of the governance of the Parks and Forests:***

- National Parks are managed by The Department of the Interior
- National Forests are managed by The United States Department of Agriculture

Consequently, National Parks and National Forests follow different rules and practices even when neighboring each other.

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Page Break

End of Block: Block 3

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Start of Block: Block 5

On a scale of Not Informed, Somewhat Informed, Informed, to Well Informed, how would you rate your level of knowledge or understanding regarding climate change impacts on public lands?

How well-informed do you feel about the climate change impacts affecting public lands under your agency?

- Not informed. My agency has not informed me about the impacts of climate change that I am aware of (1)
- Somewhat informed. My agency has somewhat informed me about the impacts of climate change on its lands. (2)
- Informed. My agency has informed me about the impacts of climate change on its lands at least once. (3)
- Well-informed. My agency regularly informs me about current or future impacts (4)

*Skip To: Q19 If How well-informed do you feel about the climate change impacts affecting public lands under your... = Informed. My agency has informed me about the impacts of climate change on its lands at least once.*

*Skip To: Q39 If How well-informed do you feel about the climate change impacts affecting public lands under your... = Well-informed. My agency regularly informs me about current or future impacts*

Have you taken the initiative to research and gather information on your own about climate change impacts on public lands?

- Not informed. I have not taken the initiative to research and gather information about the impacts of climate change on public lands. (1)
- Somewhat informed. I have somewhat taken the initiative to research and gather some information about the impacts of climate change on public lands. (2)
- Informed. I have taken the initiative to research and gather information about the impacts of climate change on public lands. (3)
- Well-informed. I regularly research and gather information about the impacts of climate change on public lands. (4)

---

Page Break

In this section, you will be provided with four response options such as: "Disagree," "Somewhat disagree," "Somewhat agree" or "Agree." Please choose the response that most accurately reflects your experience or opinion.

Climate change requires integrated and adaptive approaches for public land management?

- Disagree (1)
- Somewhat disagree (2)
- Somewhat agree (3)
- Agree (4)

National Parks and National Forests are managed with different priorities?

- Disagree (1)
- Somewhat Disagree (2)
- Somewhat Agree (3)
- Agree (4)

Current governance and management systems of National Parks and Forests are capable of collaboratively addressing climate change?

- Disagree (1)
- Somewhat disagree (2)
- Somewhat agree (3)
- Agree (4)

Climate change affects the biodiversity National Parks and Forests areas?

- Disagree (1)
- Somewhat disagree (2)
- Somewhat agree (3)
- Agree (4)

The lack of coordination among National Parks and National Forest agencies is a barrier to addressing climate change on public lands?

- Disagree (1)
  - Somewhat disagree (2)
  - Somewhat agree (3)
  - Agree (4)
- 

There is a disconnect among National Parks and National Forest employees with their agencies policies and the policy makers?

- Disagree (1)
- Somewhat disagree (2)
- Somewhat agree (3)
- Agree (4)

Collaboration among National Parks and National Forest agencies is essential for effective climate change adaptation and mitigation on public lands?

- Disagree (1)
- Somewhat disagree (2)
- Somewhat agree (3)
- Agree (4)

End of Block: Block 5

---

Start of Block: Block 4

In this section, please answer the following questions with a simple "Yes" or "No" response.

-----

Do you believe that climate change is a significant threat to the biodiversity in the National Parks and National Forests?

- No (1)
- Yes (2)
- 

Do National Parks and National Forests work together towards a common goal of climate change adaptation and biodiversity conservation?

- No (1)
- Yes (2)

Do you believe National Parks and National Forests work together to help mitigate climate change effects and biodiversity loss?

No (1)

Yes (2)

---

Do you believe National Parks and Forests should have a shared goal of adaptation and mitigation to climate change?

No (1)

Yes (2)

---

Do you believe the current governance and management systems of the National Parks and National Forests effectively address climate change?

No (1)

Yes (2)

---

Have you witnessed any instances where National Parks and Forests have conflicting policies or priorities? If Yes, please elaborate.

No (1)

Yes (2) \_\_\_\_\_



Have there been successful instances of collaboration or joint initiatives between National Parks and National Forests that address climate change impacts? If Yes, please elaborate.

No (1)

Yes (2) \_\_\_\_\_

End of Block: Block 4

---

Start of Block: Block 8

Please provide concise written responses to the following four questions. These questions require more in-depth answers compared to the rest of the survey, which primarily consisted of yes or no questions and multiple-choice questions.

-----

Briefly state climate change impacts (especially on biodiversity) you have seen on the National Parks and National Forests?

\_\_\_\_\_

-----

In your experience, what are the most significant barriers to collaboration between the National Parks and National Forests in climate change adaptation efforts?

\_\_\_\_\_

-----

In your opinion, what changes must be made for better collaboration between National Parks and National Forests to battle climate change?

\_\_\_\_\_

---

How does climate change impact the current management approaches in the National Parks and National Forests?

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End of Block: Block 8

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Start of Block: Block 6

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Open Question: Is there anything you would like to mention that should have been represented in this survey?

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End of Block: Block 6

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Start of Block: Block 7

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**Thank you for assisting me in my research.  
Please share this with other National Park and National Forest Employees!**

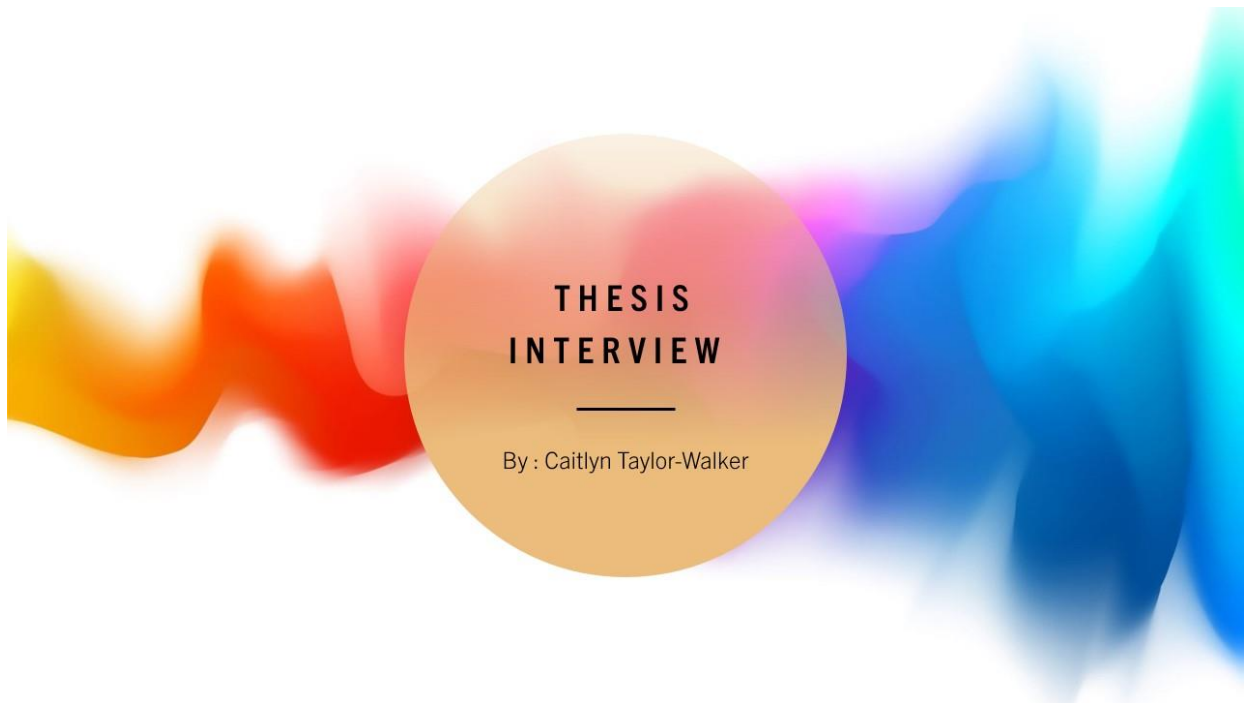
**If you are interested in the results of my research, please email me at [c.c.taylor-walker@student.utwente.nl](mailto:c.c.taylor-walker@student.utwente.nl)  
or follow me on LinkedIn: [Caitlyn Taylor-Walker's LinkedIn](#)**

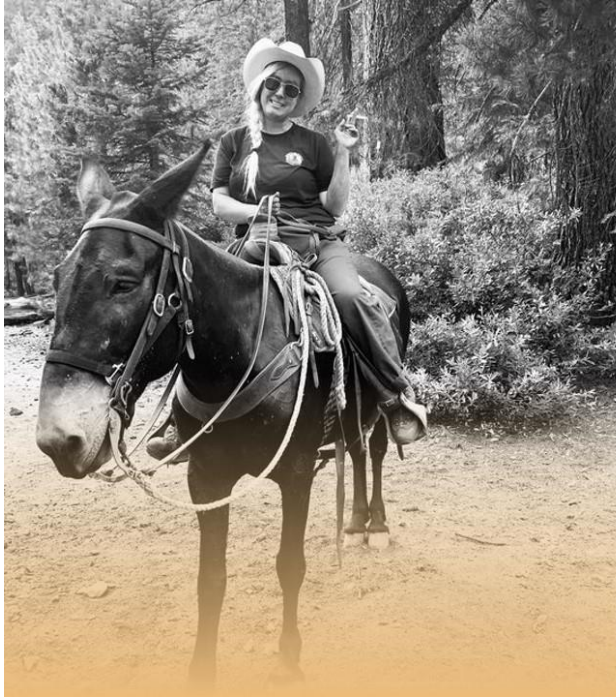
End of Block: Block 7

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*Appendices Two: Interview Slides*

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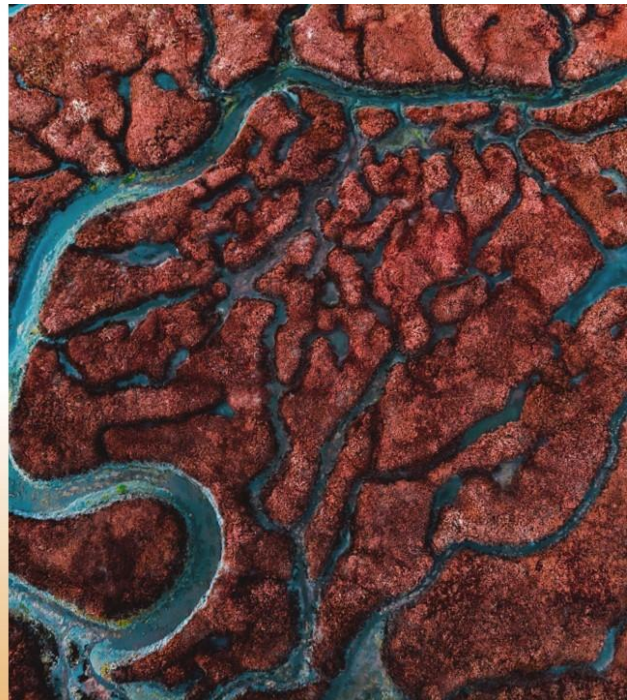


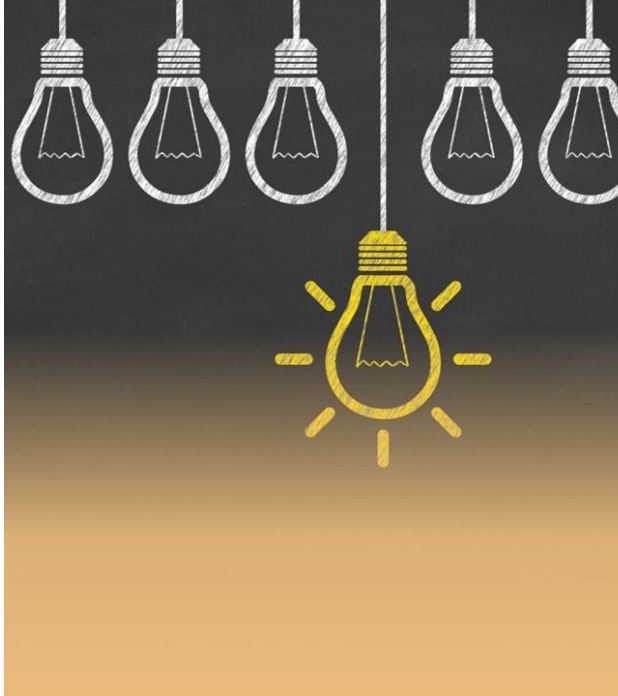
## ABOUT ME!

From California, but currently live in the Netherlands. I have a bachelors in Sustainable tourism management and Outdoor recreation. Currently, I am receiving my Masters in Environmental and Energy Management. I worked for the Parks and Forest for 15 years, which is why I was inspired to do my thesis on the Parks and National forest.

## INTRODUCTION

Climate change poses significant challenges to the governance and management of public lands, including National Parks (NP) and National Forests (NF) in the United States. Effective adaptation and mitigation strategies are crucial as these protected areas face increasing vulnerability to climate impacts.





Existing governance systems often suffer from fragmentation, conflicting policies, and limited coordination, hindering integrated approaches. To address these issues, this research aims to identify strategies for strengthening collaboration and integration across NP and NF in response to climate change.

## WHY INTERVIEW?

To achieve this, interview and surveys is being conducted among National Parks and Forest Service employees, gathering valuable insights on governance, management, collaboration, barriers, and potential solutions. By understanding these aspects, we can contribute to the knowledge base and enhance the long-term viability of these invaluable landscapes.





## INTERVIEW QUESTIONS:

- Name, Do you work for the Forest Service or National Parks (both)? What is your position(s)? And How many years have you worked for NP and/or NF?
- Do you know your agency's governance or management? If so, briefly describe what you know about your agency's governance or management systems.
- Can you describe your role in climate change adaptation and mitigation efforts within your agency? And how has your agency (NP/NF) adapted to the impacts of climate change on public lands in recent years? Explain which agency you are referring to in the answer.
- What are the most significant barriers to collaboration and integration between your agency and National Parks/National Forests in climate change adaptation and mitigation efforts?



## QUESTIONS CONTINUED...

- What are some potential solutions to improve collaboration and integration between your agency and National Parks/National Forests in climate change adaptation and mitigation efforts?
- How do you perceive the effectiveness of current integrated management approaches in addressing climate change vulnerability of biodiversity in the managed NP and NF areas?
- When making management decisions for public lands, how does your agency prioritize different objectives, such as biodiversity conservation, recreation, and economic development? Please also provide insight into the factors considered and the decision-making process employed by your agency in managing public lands.
- Can you provide an example of a successful collaboration between your agency and National Parks/National Forests in addressing climate change impacts?

## MORE QUESTIONS

- How does your agency balance biodiversity conservation, recreation, and economic development objectives in its management decisions?
- How well-informed do you feel about the climate change impacts affecting public lands under your agency?
- Under your agency's management, how are local communities and stakeholders involved in climate change adaptation and mitigation efforts for public lands?
- Do you know how your agency monitors and evaluates the effectiveness of climate change adaptation and mitigation measures in NP/NF areas?
- How can policy and management changes be effectively implemented to address the challenges of concepts such as disconnected governance approaches, conflicting management objectives, resource allocation, policy and regulatory differences, stakeholder engagement, limited collaboration on ecosystem connectivity, and promote effective climate change adaptation? Furthermore, how can collaboration between National Parks and National Forests be enhanced to support these adaptation efforts?
- Open Question: Is there anything you would like to mention that was not represented in this interview?



**THANK YOU FOR ASSISTING IN MY  
RESEARCH!**

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Appendices Three: Infographics

Do you work or have you worked for the National Parks and/or National Forests?



## LOOKING FOR INTERVIEWEES

Help a fellow trail worker get her master's degree!



Caitlyn Taylor-Walker  
c.c.taylor-walker@student.utwente.nl

Contact me!

Attention current and former National Park and National Forest Workers !!!

## SURVEY TIME!!

Take and share this survey to help a trail worker get her master's degree!

SCAN ME



Caitlyn Taylor-Walker

MSc Environment & Energy Management

ATTENTION!

I WILL BE CLOSING MY  
THESIS SURVEY  
TOMORROW,  
WEDNESDAY  
06/28/2023 AT 12:00 PM  
PST

THANK YOU ALL FOR YOUR HELP, SHARES, AND  
PARTICIPATION!  
MORE IMPORTANTLY, THANK YOU FOR HELPING ME  
GRADUATE!!



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*Appendices Four: Alignment of Research Questions with Interview*

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**Table 2:** The table below outlines the interview questions (Qualitative) and the corresponding research questions, along with the expected outcomes from participants' responses.

| Interview Questions<br>1-14:  | Research<br>Question:   | Expected<br>Outcomes:  |
|---|---|--|
| Name, do you work for the Forest Service or National Parks (both)? What is your position(s)? And how many years have you worked for NP and/or NF?   | This data was only collected to confirm they worked for the parks and to gain personal connection before going into the main questions. | <ul style="list-style-type: none"> <li>• Name (Only for researchers, anonymized in all research).</li> <li>• Agency(s)</li> <li>• How many years have you worked for the agency(s)</li> </ul>  |
| Do you know your agency's governance or management? If so, briefly describe what you know about your agency's governance or management systems.   | 2   | <ul style="list-style-type: none"> <li>• Yes, I know about my agency's governance and management.</li> <li>• No, I do not know specifics about my agency's governance and management.</li> <li>• If yes, then describe what they know.</li> </ul>  |
| Can you describe your role in climate change adaptation and mitigation efforts within your agency? And how has your agency (NP/NF) adapted to the impacts of climate change on public lands in recent years? Explain which agency you are referring to in the answer. | 3   | <p>Interviewee describes their role in climate change adaptation and how their agencies have adapted to changes.</p> <p style="text-align: center;">Or</p> <p>Interviewee cannot describe their role in climate change adaptation through their agencies.</p>  |
| What are the most significant barriers to collaboration and integration between your agency and National Parks/National Forests in climate change adaptation and mitigation efforts?  | 4   | Interviewee describes barriers like communication, funding, governance fragmentation, different management objectives, resource allocation, policy and regulatory differences, stakeholder engagement, etc.  |
| What are some potential solutions to improve collaboration and integration between your agency and National Parks/National Forests in climate change adaptation, and mitigation efforts?  | 4.2   | <ul style="list-style-type: none"> <li>• Interviewees are expected to give their opinion on how to improve these barriers for better collaboration.</li> <li>• Expected common answers would be things such as better communication, better collaboration, and funding.</li> <li>• Another possible outcome is the interviewee is unable to answer this question effectively.</li> </ul> |

|  |   |  |
|--|---|--|
| <p>How do you perceive the effectiveness of current integrated management approaches in addressing climate change vulnerability of biodiversity in the managed NP and NF areas?</p>  | <p>2-4</p>  | <p>Interviewees will give their opinion on the current effectiveness of integrated management regarding climate change and biodiversity.</p> <ul style="list-style-type: none"> <li>○ Yes, it is effective, and here is why...</li> <li>○ No, it is not effective, and here is why...</li> <li>○ I cannot answer this question effectively.</li> </ul> |
| <p>When making management decisions for public lands, how does your agency prioritize different objectives, such as biodiversity conservation, recreation, and economic development? Please also provide insight into the factors considered and the decision-making process employed by your agency in managing public lands.</p>   | <p>3</p>  | <p>Understanding and identifying each agency's decision-making process and priorities.</p>   |
| <p>Can you provide an example of a successful collaboration between your agency and National Parks/National Forests in addressing climate change impacts?</p>  | <p>2 and 4.1</p>  | <p>Description of successful collaboration between agencies in addressing climate change impacts.</p>  |
| <p>How does your agency balance biodiversity conservation, recreation, and economic development objectives in its management decisions?</p>  | <p>1-3</p>  | <p>Insight into the agency's approach to balancing different management objectives.</p>  |
| <p>How well-informed do you feel about the climate change impacts affecting public lands under your agency?</p>  | <p>2 and 4</p>  | <p>Self-assessment of the participant's level of knowledge on climate change impacts.</p>  |
| <p>Under your agency's management, how are local communities and stakeholders involved in climate change adaptation and mitigation efforts for public lands?</p>   | <p>3</p>  | <p>Description of community and stakeholder involvement in climate change efforts.</p>   |
| <p>Do you know how your agency monitors and evaluates the effectiveness of climate change adaptation and mitigation measures in NP/NF areas?</p>   | <p>3</p>  | <p>Knowledge or lack thereof the agency's monitoring and evaluation processes for climate change measures.</p>   |
| <p>How can policy and management changes be effectively implemented to address the challenges of concepts such as disconnected governance approaches, conflicting management objectives, resource allocation, policy and regulatory differences, stakeholder engagement, limited collaboration on ecosystem connectivity, and promote effective climate change adaptation? Furthermore, how can collaboration between National Parks and National Forests be enhanced to support these adaptation efforts?</p> | <p>4-4.2</p>  | <p>Suggestions for effective implementation of policy and management changes.</p>  |
| <p>Open Question: Is there anything you would like to mention that was not represented in this interview?</p>  | <p>This question was asked if the interviewee felt any aspects of the topic</p> | <p>Additional insights for further research and recommendations.</p>   |

|  |                         |  |
|--|-------------------------|--|
|  | needed to be addressed. |  |
|--|-------------------------|--|

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*Appendices Five: Alignment of Research Questions with Survey Questions*

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**Table 3:** The table below outlines the open- ended survey questions (Quantitative) and the corresponding research questions, along with the expected outcomes from participants' responses.

| <b>Survey Question (Quantitative)</b>   | <b>Research Questions</b> | <b>Expected Outcomes</b>   |
|---|---------------------------|--|
| Climate change requires integrated and adaptive approaches for public land management?  | 2                         | Identification of the relationship between governance structures and climate change vulnerability of biodiversity.             |
| National Parks and National Forests are managed with different priorities?  | 2                         | Exploration of existing management approaches and their level of integration across public lands.                              |
| Currently the governance and management systems of National Parks and Forests capable of collaboratively addressing climate change?   | 3                         | Understanding of the specific impacts of climate change on public lands and how these impacts influence management approaches. |
| Climate change affects the biodiversity of National Parks and Forest areas?   | 3                         |  |
| The lack of coordination among National Parks and National Forest agencies is a barrier to addressing climate change on public lands?   | 3-4.2                     | Identifying institutional challenges and barriers hindering effective climate change adaptation on public lands.               |
| There is a disconnect among National Parks and National Forest employees with their agency's policies and the policymakers?   | 4                         |  |
| Have you witnessed any instances where National Parks and Forests have conflicting policies or priorities? If yes, please elaborate   | 4                         |  |
| Have there been successful instances of collaboration or joint initiatives between National Parks and National Forests that address climate change impacts? If Yes, please elaborate. | 3 and 4                   |  |

|   |           |  |
|---|-----------|--|
| Do National Parks and National Forests work together towards a common goal of climate change adaptation and biodiversity conservation?  | 3-4.1     | Assessment of the level of collaboration and cooperation between agencies in addressing climate change and biodiversity conservation.                          |
| Do you believe National Parks and Forests should have a shared goal of adaptation and mitigation to climate change?   | 3 and 4.1 |  |
| Do you believe the current governance and management systems of the National Parks and National Forests effectively address climate change?   | 3 and 4.2 | Development of strategies and recommendations for overcoming institutional barriers and improving collaboration for climate change adaptation on public lands. |
| Have you witnessed any instances where National Parks and Forests have conflicting policies or priorities? If yes, please elaborate.  | 4.2       |  |
| Have there been successful instances of collaboration or joint initiatives between National Parks and National Forests that address climate change impacts? If Yes, please elaborate. | 4.2       |  |

**Table 4:** The table below outlines the open-ended survey questions (Qualitative) and the corresponding research questions, along with the expected outcomes from participants' responses.

| Survey Question (Qualitative)   | Research Question | Expected Outcomes   |
|---|-------------------|---|
| Briefly state climate change impacts (especially on biodiversity) you have seen on the National Parks and National Forests?               | 3                 | Identify specific climate change impacts on biodiversity in National Parks and National Forests           |
| How does climate change impact the current management approaches in the National Parks and National Forests?                              | 2 and 3           | Understand the influence of climate change on the current management strategies employed in these areas   |
| In your opinion, what changes must be made for better collaboration between National Parks and National Forests to battle climate change? | 4                 | Gather insights on necessary changes to enhance collaboration between National Parks and National Forests |

|   |   |  |
|---|---|--|
| In your experience, what are the most significant barriers to collaboration between the National Parks and National Forests in climate change adaptation efforts? | 4-4.2   | Identify key barriers to effective collaboration between National Parks and National Forests in climate change efforts |
| Open Question: Is there anything you would like to mention that should have been represented in this survey?  | Additional survey question to cover all aspects | Gather additional comments or suggestions not covered by the specific survey questions                                 |

These tables offer a transparent and structured depiction of the research methodology, facilitating a clear understanding of how questions were designed to address specific objectives. By including these tables in the discussion, the study's strong methodology becomes clear. It explains why certain questions were asked and supports the thoroughness of the research. This strengthens the thesis's credibility and highlights the importance of the findings.