

# An Assessment of Mission Compatibility

From the perspective of Robustness

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## ABSTRACT

This applied research project examines the compatibility of the mission statements of natural resource management agencies in a coupled human-natural system. The coupled system examined is that of the Jackson Hole Valley in Wyoming. The mission statements can be considered ‘performance measures’ for each agency, which operationalizes the concept of robustness. Robustness specifies resilience and answers the question of “resilience of what to what?” The mission statements were coded using concepts from the Robustness framework developed by Anderies *et al.* (2004). The Robustness framework was developed to examine coupled systems ability to maintain function in the face of uncertain future disturbances. The analysis used has provided insight into the management of fire within the coupled human-natural system of the Jackson Hole Valley. The mission statements of two agencies, the Wyoming Game and Fish Department (WGFD) and the Bridger-Teton National Forest (BTNF) were found to incompatible with respect to fire management and wildlife management. The BTNF meets multiple objectives through fire suppression, which impact ecosystems and habitats. The resource management decisions made by the BTNF affect the WGFD’s ability to manage wildlife.

## Introduction

Global environmental challenges are abundant in the world today. There are many approaches to mitigating the impacts of these challenges. Actions at local and regional levels scale up to affect the global environment. This is similar to how individual actions scale up to collective actions. Institutions, defined as rules and norms, guide the use of limited resources by clearly defining permissible actions by individuals. Institutional arrangements are fundamentally important because all human systems are linked to natural systems and guide the trajectory of these coupled human-natural systems. Although the interactions between coupled systems are location specific, the impacts affect the Earth system due to the complex linkages across spatial scales.

This endeavor will examine how some of the natural resource management organizations in the coupled human-natural system of the Jackson Hole Valley may be incompatible in their current institutional configurations. This analysis will use ideas from the Robustness framework, an academic framework developed by Anderies *et al.* (2004) to identify potential vulnerabilities of coupled human-natural systems to disturbances. The concept of robustness is concerned with assessing trade-offs to uncertain future disturbances and provides a bridge to relate the resilience concepts to designed systems (Anderies *et al.*, 2004), which can be thought of as social systems. The framework allows for close examination of the interactions between human and natural systems to identify systemic feedback loops and vulnerabilities. These are examined to identify potential impacts on the function of the coupled system. Natural systems are complex and human interventions, through institutions, change the structure and the goods and services the natural system provides to human populations.

In order to clearly explain the concept of robustness, we will need to examine the difference between related topics. Most people are familiar with the concept of resilience, and understand it as the capacity to cope with change. Change may come in the form of shocks or disturbances, like natural disasters or disease outbreaks. Resilience is the ability of the system to maintain function in the face of disturbances. In academia, resilience “has evolved into an intellectual framework for understanding how complex systems *self-organize* and *change over time*.” The “systems-level concept” (Anderies *et al.*, 2013) of resilience broadly concerns the function of the system at large. General resilience does not answer: “resilience of what to what?” – a question posed by Carpenter *et al.* (2001).

The concept of robustness is more specific in that it provides insight to answers to this question by incorporating quantitative or qualitative performance measures. These performance measures link resilience with the decision-making process. A complex system can be considered “robust” if it is able to reduce sensitivity of systemic outputs or function under changing conditions. In evaluating robustness, it is important to understand that there are tradeoffs.

There are inherent robustness-performance and robustness-fragility tradeoffs. A coupled human-natural system cannot be robust to all possible shocks. A system that performs well may only do so under a narrow range of circumstances. A system that is robust to one type of disturbance may be highly vulnerable to others. The existence of these tradeoffs is fundamentally important to acknowledge by those who create policy (Anderies & Janssen, 2013). Formal institutions use policy to guide actions. These

institutions assess performance but seldom assess the tradeoffs associated with that performance. It is possible for institutions within the same coupled human-natural system to assess performance in ways that are incompatible. For example, one organizations performance measures may be improving at the cost of another.

An agency's mission statement can be viewed as a performance measure. The purpose of this research endeavor is to explore areas where performance measures (e.g. mission statements) of natural resource management agencies are incompatible. They are incompatible when they result in tradeoffs between organizational performances. It is important to understand that the robustness-performance tradeoffs discussed previously occur at the coupled human-natural systems level and not at the organizational level. The performance measures will be assessed for redundancy (e.g. overlap) to provide insight into areas of incompatibility.

The examination of coupled human-natural systems is a difficult task. It requires an in-depth knowledge of the interactions between human and natural systems that occur at multiple temporal and spatial scales. In relation to the Robustness framework (Figure 1) this document will examine interaction 3, the interaction between Public Infrastructure Providers [PIP] (e.g. Wyoming Game and Fish Department) and the Public Infrastructure [PI] (rules, regulations, and built infrastructure). This interaction relates to the building of public infrastructure (rules and regulations) that governs the resource system (e.g. the natural environment) and the production of built infrastructure. These Public Infrastructure Providers within the coupled human-natural system are the agencies that are involved in natural resource management in the Jackson Hole Valley. The agencies involved are: the Wyoming Game and Fish Department (WGFD), the National Elk Refuge (NER), the Grand Teton National Park (GTNP), the Bridger Teton National Forest (BTNF), and the town of Jackson Hole.

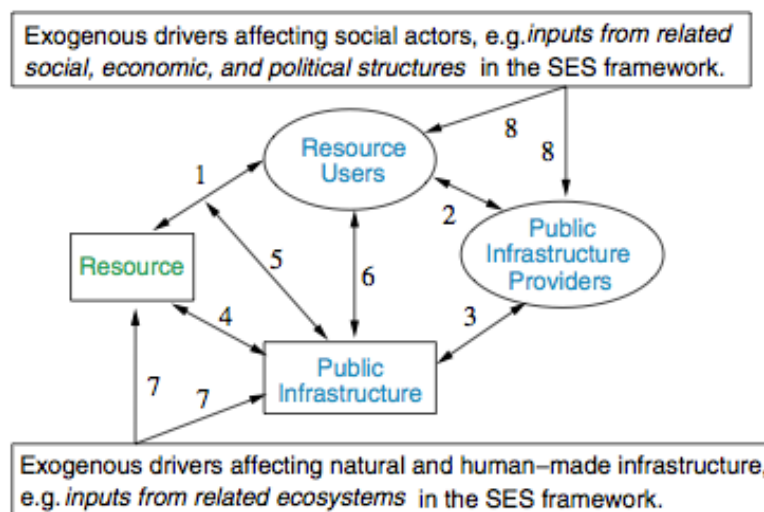


Figure 1. The Robustness framework as depicted in Anderies & Janssen (2013). This research examines interaction 3, the Relationship between Public Infrastructure Providers and the Public Infrastructure.

In this exploratory effort, I have examined how each of the above organizations measure performance based on their mission statements. This should not be considered an exhaustive analysis of all conflicts in relation to the de jure (legal) and de facto (practiced) rules of the natural resource management agencies in the Jackson Hole Valley. Further research will produce additional context specific incompatibilities. As a result of this effort, I have identified a key area of incompatibility between the two organizations performance measures: the BTNF and the WGFD. The area of incompatibility stems from the management of fire within the coupled system. The WGFD measures performance on the conservation of wildlife populations, but has little authority over the ecosystems and habitat upon which the wildlife depends. The fire management actions taken by the BTNF inherently affect the distribution of ecosystems and habitat, which affects the distribution of wildlife populations.

## Methods

### Study Site

The study site in question is the coupled human-natural system of the Jackson Hole Valley. This coupled system is nationally and internationally recognized as a tourist destination with abundant wildlife and verdant natural landscapes. Within the Jackson Hole Valley, there are multiple PIPs that are responsible for the management of natural and social resources. The natural environment is a part of the ‘public infrastructure’ in that it provides habitat and forage for wildlife and streams of goods and services that support the local economy.

The Robustness framework was used as a lens to capture the complexity of the interactions and to take a long-term perspective on the viability of the overall system in the face of uncertain future disturbances. This research focuses specifically on interaction #3 within the Robustness framework (see Figure 1). This is the interaction between the PIPs and the PI. To assess this link, I developed a ‘mission compatibility matrix’ to assess potential incompatibilities between the PIPs and the PI. The PIPs examined include: the Grand Teton National Park, the Wyoming Game and Fish Department, the National Elk Refuge, the Bridger Teton National Forest, and the Town of Jackson.

### Coding of Performance Measures

Each of the agencies mission statements can be viewed as their performance measures, to which progress is compared<sup>1</sup>. A coding scheme was developed to provide a means of comparison between these performance measures. Informed by the Robustness framework, the coding scheme was used to identify 1) area of investment (natural infrastructure or human-made infrastructure), 2) potential actions, and 3) desired outcomes. These groups were divided into subgroups to provide greater resolution into each agency’s performance measure orientation. Table 1 illustrates the groups and subgroups used to code the mission statements<sup>2</sup>.

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<sup>1</sup> Appendix 1: Public Infrastructure Providers (PIP) performance measures (mission statements).

<sup>2</sup> Appendix 2: Subgroup coding descriptions.

| <b>Group</b>              | <b>Sub-group</b>          |
|---------------------------|---------------------------|
| Natural Infrastructure    | Fauna (wildlife)          |
|                           | Flora (plants)            |
|                           | Integrated                |
| Human Made Infrastructure | Cultural Heritage         |
|                           | Service Provision         |
|                           | Social                    |
| Potential Actions         | Conserve                  |
|                           | Construct                 |
|                           | Protect                   |
| Desired Outcomes          | Recreation                |
|                           | Conservation              |
|                           | Value Provision           |
|                           | Integrated Sustainability |

Table 1. Coding scheme used to assess mission orientation.

Coding criteria were developed for each subgroup and were used to compare the performance measures between the natural resource management agencies. Table 2 illustrates the coding scheme based on the mission statements (performance measures) of the WGFD, NER, GTNP, BTNF, and town of Jackson Hole.

### Analysis

The mapped missions were assessed for redundancy (e.g. overlap) to provide insight into areas of potential conflict. Assessing for redundancy shed light onto some potential incompatibilities, but did not lead to the incompatibility between fire management and wildlife. A key stakeholder interview was used to provide some context into the redundancy findings. This interview provided insight into a conflict that was not explained by mission redundancy, which was previously thought to be the origin of organizational incompatibilities.

## Results

The mission compatibility matrix was assessed for redundancy (e.g. overlap) to highlight areas where multiple agencies focused on similar issues (Table 2). This approach highlighted that there were 5 coding subgroups that expressed redundancy, in that at least 3 of the 5 agencies met the coding criteria. The grey highlighted columns are areas that could have been used to examine incompatibilities by examining the different approaches taken to accomplishing their organizational missions. After discussing with a key stakeholder and referring back to the mission compatibility matrix, a major incompatibility presented itself in the form of fire management by BTNF and wildlife management by WGFD. Therefore, fire management actions taken by the BTNF affect the performance measures of the WGFD with respect to wildlife.

Within the ‘area of investment – natural infrastructure’ group of the Mission Compatibility Matrix in Table 2, the Bridger-Teton National Forest focuses on ‘flora’ (plants) and ‘integrated’ and the Wyoming Game and Fish Department focuses on ‘fauna’ (wildlife). There is no redundancy between these two natural resource management organizations with respect to ‘fauna (wildlife)’, ‘flora (plants)’, and ‘integrated’. While ‘integrated’ implies a connection between flora and fauna, they do not overtly express a fauna (wildlife) related performance measure. Fire management inherently results in the management of habitats and ecosystem composition and furthermore affects populations of wildlife.

The following section provides an in-depth look at the incompatibilities between the WGFD and the BTNF with respect to fire management and wildlife management. Additional research was necessary to provide adequate contextual information.

|                                  | Area of Investment     |                |            |                           |                   |        | Actions  |           |         | Outcomes   |              |                 |                           |
|----------------------------------|------------------------|----------------|------------|---------------------------|-------------------|--------|----------|-----------|---------|------------|--------------|-----------------|---------------------------|
|                                  | Natural Infrastructure |                |            | Human Made Infrastructure |                   |        | Conserve | Construct | Protect | Recreation | Conservation | Value Provision | Integrated Sustainability |
| Agency                           | Fauna (Wildlife)       | Flora (Plants) | Integrated | Cultural Heritage         | Service Provision | Social |          |           |         |            |              |                 |                           |
| Grand Teton National Park        | x                      | x              | x          | x                         |                   | x      | x        |           | x       | x          | x            | x               |                           |
| Wyoming Game and Fish Department | x                      |                |            |                           | x                 |        |          | x         | x       |            |              | x               |                           |
| National Elk Refuge              | x                      | x              | x          | x                         | x                 |        | x        | x         | x       | x          | x            | x               |                           |
| Bridger-Teton National Forest    |                        | x              | x          |                           | x                 | x      | x        |           |         |            | x            | x               | x                         |
| Jackson Hole                     |                        |                | x          |                           |                   | x      | x        |           | x       |            |              | x               | x                         |

Table 2. Mission Compatibility Matrix. The grey columns indicate areas where the Public Infrastructure Provider missions (performance measures) exhibit redundancy. The red X's indicate an area where the mission statements of the Wyoming Game and Fish Department are incompatible with the Bridger-Teton National Forest. Fire management provides an appropriate example of this incompatibility.

## Fire management

Within the coupled human-natural system of Jackson Hole Valley, there are many actions taken by humans that impact the structure and function of the natural environment. These actions, over various temporal and spatial scales, impact the goods and services that the natural environment can provide to humans in the form of wildlife viewing, recreation, sporting opportunities, and many others. These actions also affect the ability of the natural environment to “self-organize and change over time” (Anderies *et al.*, 2013) and thereby affect the robustness of the coupled human-natural system. The management of fire is one of these actions.

The Jackson Hole Valley is a part of the Greater Yellowstone Ecosystem, where wildland fires are a naturally occurring disturbance. The natural environment in this area has evolved with a particular disturbance regime, which is described by a “pattern, frequency, and intensity of disturbances across the landscape or watershed”. These types of periodic disturbances maintain ecosystem productivity and supplement its capacity to provide ecosystem services (clean air, clean water, nutrient cycling, etc.) (Wyoming Game and Fish Department, 2010). At present, the BTNF manages “unplanned wildfires to accomplish multiple objectives” (Rojo, 2012). Typically, fire suppression strategies are used for unplanned wildland fires that “pose a threat to human life or to resource values” (United States Department of Agriculture Forest Service, n.d.).

Wildlife, habitat, and ecosystems are linked through complex interactions. Fire management actions taken by the BTNF inherently impact the distribution of ecosystems and habitats, which further affects the distribution of wildlife populations. According to the ‘mission compatibility matrix’ in Table 2, there is no redundancy between the two agencies with respect to investment in natural infrastructure. This provides evidence that the two performance measures may be incompatible in their current form.

According to the BTNF’s mission statement, they focus on specific ecosystems, namely “grasslands” and “forests” (The U.S. Forest Service, n.d.), whereas the WGFD’s mission focuses specifically on “wildlife” (The State of Wyoming, 2013; Wyoming Game and Fish Department, 2013). While there is no overlap between the two agencies with respect to natural infrastructure, there is evidence that they acknowledge the interactions between wildlife, habitat, and ecosystems. Even though they acknowledge these interactions, it is unclear how they prioritize the strategies and actions they implement to make progress toward their mission. There are clearly constraints that affect both organizations.

Beyond their mission of “Conserving Wildlife, Serving People” (Wyoming Game and Fish Department, 2013), the WGFD acknowledges that the wildlife management cannot be separated from habitat management, in that habitats sustain wildlife (Wyoming Game and Fish Department, 2009). The WGFD has identified numerous habitats that are “important to maintain or enhance” in their Strategic Habitat Plan and identified “altered fire regimes” and “loss of periodic fire” as major factors affecting the health of these wildlife habitats. Despite the importance of these habitats, they have “no statutory authority [...] to protect, restore or enhance wildlife habitat” other than on Wyoming Game and Fish Commission lands (Wyoming Game and Fish Department, 2009). These constraints extend beyond influence; they extend into flows of information.

In addition the WGFD identifies that it is important to keep resource managers informed about the location and value of critical habitats. This would enable these



resource managers to use additional information in determining the appropriate fire management measures given the value of the habitat (Wyoming Game and Fish Department, 2005). In order to effectively keep these resource managers informed, they have identified the importance of developing lasting partnerships with “private landowners and public land managers, conservation organizations, local, state, and federal governmental agencies and the public” in order to effectively implement their Strategic Habitat Plan and conserve wildlife (Wyoming Game and Fish Department, 2009). These partnerships may serve as the appropriate link for managing wildlife, habitat, and ecosystems in tandem.

Restoring fire to the landscape is fundamentally important for the natural environment in this coupled human-natural system. Miller (2010) argues that suppressing unplanned, lightning-ignited fires “removes one of the most important natural processes from fire-dependent ecosystems [...]” The BTNF strives to use both planned and unplanned fires to reintroduce the necessary natural disturbances to accomplish multiple resource objectives like “improving wildlife habitat” or “restoring diverse vegetation to the ecosystem” (United States Department of Agriculture Forest Service, n.d.). The BTNF use the National Fire Plan (NFP) to “guide all fire management activities” with the aim of restoring the historic fire regime and benefiting habitat (Wyoming Game and Fish Department, 2010). While both agencies acknowledge that restoring fire to the landscape is an essential step, the strategies and actions taken by the BTNF require the critical habitat information from the WGFD.

Although there may be incompatibilities in their missions given the coding scheme used, supplemental, context specific research has provided evidence that both organizations want to reintroduce fire to the landscape. They both acknowledge the benefits to habitats. Despite compatibilities in their strategies, the actions they take have been shown to be incompatible. The fire management actions taken by the BTNF affect the ability of the WGFD to manage wildlife. It seems that these incompatibilities arise from their ability to share information and their prioritization of actions. These aspects will be discussed in the following section along with an institutional recommendation to mitigate incompatibilities and promote synergistic strategies and actions toward their performance measures.

## Conclusion

It is possible for the mission statements of organizations to be incompatible. This paper has examined the Public Infrastructure Providers in the coupled human-natural system of the Jackson Hole Valley. In utilizing a novel research method, this paper has illustrated how the mission statements of the Wyoming Game and Fish Department and the Bridger Teton National Forest are incompatible in their current form. Mission statements can be viewed as performance measures, and thus provide insight to the question: “resilience of what to what?” (Carpenter *et al.*, 2001).

The fire management actions taken by the Bridger-Teton National Forest affect the ability of the Wyoming Game and Fish Department to manage wildlife. The management of wildlife, habitats, and ecosystems need close collaboration. At present, these two organizations mission statements focus narrowly on wildlife or habitats. The natural environment is complex in its interactions. Disturbances reverberate through natural environment and impact its structure and function; thereby affecting ecosystems, habitats, and wildlife populations.

The Wyoming Game and Fish Department seeks to build effective partnerships to meet their wildlife goals. Both natural resource management agencies have goals to return the altered fire regime back to a more natural regime. While there are compatibilities in terms of strategies, there is evidence that there are incompatibilities in the actions taken by these organizations. A simple schematic in appendix 3 depicts the differences between organizational missions and actions. Incompatibilities between organizations performance measures lead to trade-offs. That is, the actions of one organization impact another organizations ability to meet their goals. The management of fire by the Bridger-Teton Nation Forest is a prime example of this, in that it affects the Wyoming Game and Fish Departments ability to meet their wildlife goals. This provides evidence that these organizations need more than just partnerships and information sharing.

To maximize the benefit to the public infrastructure within the Jackson Hole Valley, another institutional layer may prove helpful. This institution could help allocate resources to areas of mission compatibility with the goal of minimizing incompatibilities. This ‘meta’ institution could be used to dynamically manage jurisdictional boundaries and negotiate actions based on shared information and resources.

Throughout this research endeavor, assessing mission statements for redundancy (overlap) has proved to be more straightforward than assessing for modularity (functional components). Therefore, given resource constraints, this study has only been able to examine redundancy. An assessment of modularity is therefore a research area for future work. Given the contextual incompatibilities of fire management and wildlife management between two natural resource management agencies. Future work could also investigate the inner-workings of the proposed ‘meta’ institution.

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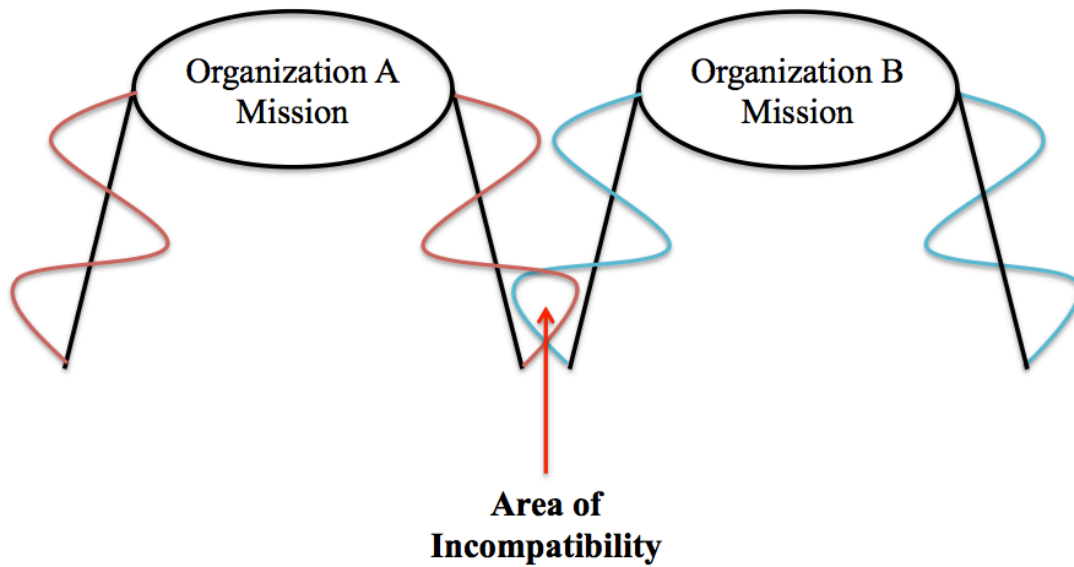
## Appendix 1

| Organization                            | Mission Statement                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Grand Teton National Park</b>        | "The NPS, through GTNP, is dedicated to the preservation and protection of the Teton Range and its surrounding landscapes, ecosystems, cultural and historic resources. The singular geologic setting makes the area and its features unique on our planet."<br>(Grand Teton National Park, 2005)                                                                                                                                                                                                                                                                                                                                             |
| <b>Wyoming Game and Fish Department</b> | "Conserving wildlife, serving people." (Wyoming Game and Fish Department, 2013)<br><br>The responsibilities of the department are defined in W.S. 23-1-103. The Department is charged with providing... "an adequate and flexible system for control propagation, management, protection and regulation of all Wyoming wildlife." (State of Wyoming, n.d.)                                                                                                                                                                                                                                                                                    |
| <b>National Elk Refuge</b>              | "The National Elk Refuge provides, preserves, restores, and manages winter habitat for the nationally significant Jackson Elk Herd as well as habitat for endangered species, birds, fish, and other big game animals." (National Elk Refuge, 2014)<br><br>"This was followed in 1927 by an expansion of the NER for the purpose of providing 'for the grazing of, and as a refuge for, American elk and other big game animals' (44 stat. 1246). Other purposes address threatened and endangered species, wildlife in general, and wildlife oriented recreation." (National Elk Refuge and Grand Teton National Park, 2001)                 |
| <b>Bridger Teton National Forest</b>    | "The mission of the Forest Service is to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of the present and future generations. The mission of the Forest Service is guided by the fundamental principle of providing the greatest amount of good for the greatest amount of people in the long run and is characterize by the slogan: Caring for the Land and Serving the People." (The U.S. Forest Service, n.d.)<br><br>*The mission statement of the U.S. Forest Service was used. Locating a mission statement specific to the Bridger Teton National Forest proved unfruitful. |
| <b>Town of Jackson</b>                  | "Preserve and protect the area's ecosystem in order to ensure a healthy environment, community and economy for current and future generations." (Jackson / Teton County, 2012)                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## Appendix 2

| Group                     | Sub-group                 | Description                                                                                                |
|---------------------------|---------------------------|------------------------------------------------------------------------------------------------------------|
| Natural Infrastructure    | Fauna (wildlife)          | Pertaining to wildlife. Actions related to the management of wildlife.                                     |
|                           | Flora (plants)            | Pertaining to plants specifically.                                                                         |
|                           | Integrated                | Refers to landscapes, ecosystems, or habitats. Implies interaction between flora and fauna.                |
| Human Made Infrastructure | Cultural Heritage         | Expresses a normative value to a given location, practice, or way of life.                                 |
|                           | Service Provision         | Identifies value in a particular resource.                                                                 |
|                           | Social                    | Expresses collective human interest.                                                                       |
| Potential Actions         | Conserve                  | Maintenance of a particular resource.                                                                      |
|                           | Construct                 | The generation of knowledge or infrastructure through a particular process.                                |
|                           | Protect                   | Relating to uniqueness.                                                                                    |
| Desired Outcomes          | Recreation                | Relating to outdoor experience provided by the natural environment.                                        |
|                           | Conservation              | Provides reason for conservation practices.                                                                |
|                           | Value Provision           | Exhibits resource value (existential, monetary, systemic, etc.) to human populations                       |
|                           | Integrated Sustainability | Relates to environmental, social, and economic systems. Broaches topic of inter/intra-generational equity. |

### Appendix 3



This graphic depicts the conceptual difference between an organizations mission and the actions the organization takes to make progress toward their mission. The straight lines indicate the organizations de jure mission (e.g. legal) and the curved lines indicate the de facto actions (e.g. practiced). In this schematic, there is an area where the de facto actions overlap and are incompatible. This diagram is meant for conceptual purposes only and does not indicate any specific situation.