

REFERENCE MANUAL 41: WILDERNESS STEWARDSHIP

Guidelines for Evaluating Ecological Intervention Proposals in National Park Service Wilderness

Table of Contents

Recommendation and Approval	2
Summary	3
What is an Ecological Intervention?	3
Why this Guidance is Needed	4
Background on the Untrammeled and Natural Qualities of Wilderness Character	4
Untrammeled	4
Natural	5
A Framework for Evaluating Ecological Intervention Proposals in Wilderness	6
When to Use this Framework	6
<i>How to Use this Framework</i>	8
Explanation of the Eight Factors	10
<i>Factor 1. Cause of Degradation</i>	10
<i>Factor 2. Timing of Degradation</i>	10
<i>Factor 3. Origin of Degradation</i>	11
<i>Factor 4. Urgency of Degradation</i>	12
<i>Factor 5. Sustainability of Intervention</i>	13
<i>Factor 6. Outcome of Intervention</i>	14
<i>Factor 7. Intensity of Intervention</i>	15
<i>Factor 8. Experience with Intervention</i>	16
References Cited	17
Composition of the NWLC Ecological Intervention Work Group	18
Appendix 1. How this Framework was Developed and Options Considered but Not Used	19
Appendix 2. Example Use of this Framework on Control of Buffelgrass in Saguaro Wilderness ...	22
Appendix 3. Selected Law and Policy Related to Ecological Interventions in Wilderness	25

Recommendation and Approval for Inclusion in Reference Manual 41

Recommended by the National Wilderness Leadership Council:

Signature: SHAUNA POTOCKY Digitally signed by SHAUNA POTOCKY
Date: 2022.03.02 05:11:37 -09'00' Date: March 2, 2022
Title: Chair, National Wilderness Leadership Council

Concurrence by the WASO Wilderness Stewardship Division:

Signature: ROGER SEMLER Digitally signed by ROGER SEMLER
Date: 2022.03.02 07:54:06 -07'00' Date: March 2, 2022
Title: Program Manager, Wilderness Stewardship Division

Concurrence by the WASO Natural Resources Stewardship and Science Directorate:

Signature: RAYMOND SAUVAJOT Digitally signed by RAYMOND SAUVAJOT
Date: 2022.03.08 17:14:55 -05'00' Date: March 8, 2022
Title: Associate Director, Natural Resources Stewardship and Science

Approval for inclusion in Reference Manual 41 by WASO Visitor and Resource Protection:

Signature: JENNIFER FLYNN Digitally signed by JENNIFER FLYNN
Date: 2022.03.08 17:25:34 -05'00' Date: March 8, 2022
Title: Associate Director, Visitor and Resource Protection

Summary

An ecological intervention is an action that alters, restricts, controls, or manipulates the earth and its community of life. Such actions degrade the untrammeled quality but are usually taken to preserve or improve the natural quality of wilderness character.

The National Park Service (NPS) National Wilderness Leadership Council (NWLC) developed this guidance to help staff review and evaluate proposals for projects that would simultaneously affect both the natural and untrammeled qualities in wilderness. This guidance begins by providing background and context for understanding the complexity of these types of projects. The guidance then presents an evaluation framework to help staff consider a full range of issues associated with evaluating a proposed ecological intervention project. The evaluation framework is a set of eight factors that examine the cause, timing, origin, and urgency of the degradation, as well as the sustainability, outcome, intensity, and experience with the intervention.

The evaluation framework informs the Minimum Requirements Analysis (MRA), which is part of the park's overall compliance process for projects in wilderness. The evaluation framework herein is applicable to all categories of NPS wilderness, including designated, recommended, proposed, study, eligible, and potential wilderness. This guidance includes the following appendices:

- Appendix 1 provides the background of this NWLC work group, how this framework was developed, and the various options considered in developing this framework.
- Appendix 2 provides an example of using this framework.
- Appendix 3 provides a list of relevant law and policy excerpts related to ecological interventions in wilderness.

The guidance provided here is the culmination of considerable work by many people over several years. It should be understood however, that many of the challenging topics this document attempts to address continue to evolve. In particular, the ubiquitous threat of global climate change and its far-reaching effects on species composition or natural processes will only continue to present the NPS with increasingly complex conservation and management challenges. Over time, the NPS' efforts to respond to such challenges are likely to necessitate updates to this guidance. For example, one topic debated among field level managers is the question of the relevance of a taxa's origin to wilderness management. Until such questions have had the benefit of comprehensive consideration resulting in final resolution, the current guidance found here is grounded in fidelity to the NPS' current interpretation of relevant statutes and related policy as well as the agency's prevalent management philosophy.

What is an Ecological Intervention?

This guidance is applicable to all types of ecological interventions. For the purposes of this guidance, an ecological intervention is an action that alters, restricts, controls, or manipulates the earth and its community of life. While ecological interventions are actions that degrade the untrammeled quality of wilderness character, they are usually implemented to restore or improve the natural quality of wilderness character (see the explanation of the untrammeled and natural qualities below). Often, such actions correct or mitigate harmful impacts to ecological function or integrity that have occurred or are occurring in the wilderness. Ecological interventions include restoration projects, such as removing non-native species, reintroducing extirpated species, returning fire to the landscape, clearing contaminated water bodies, and restoring vegetation to a denuded landscape. Ecological interventions also include installing artificial water sources to maintain certain wildlife populations, relocating experimental populations that are declining due to a changing environment, killing predators to protect livestock, increasing hunting levels of native ungulates, and introducing species. See Appendix 6 in *Keeping It Wild 2: An Updated Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness*

Preservation System (Landres et al 2015, hereafter *Keeping It Wild 2*) for more information on what constitutes a trammeling action or intervention.

Why this Guidance is Needed

The Wilderness Act mandate to preserve both untrammelled and natural qualities of wilderness poses a challenge to NPS staff and managers, especially when ecological intervention proposals for preserving the natural quality require actions that degrade the untrammelled quality of wilderness.

Director's Order 41: Wilderness Stewardship (DO41) provides additional wilderness stewardship guidance based on current NPS policies and emphasizes preserving wilderness character, including both the untrammelled and natural qualities. NPS policies on natural resources stewardship support restoration actions. NPS policy could be considered conflicting under some instances, such as when a restoration action would require a trammeling action. This situation may create uncertainty about management objectives in wilderness and how to preserve both the untrammelled and natural qualities of wilderness character. *NPS Management Policies 2006, Section 6.3.5* directs parks to apply the minimum requirements concept to these types of decisions. The first step in this two-step process requires a determination of necessity, which can be challenging in cases involving an action that simultaneously affects both the natural and untrammelled qualities. Guidance has been lacking to help park staff make informed and transparent decisions about necessity and whether to move forward with a proposed ecological intervention project. This guidance aims to bring clarity to this complex topic, one that park managers are likely to see with increasing frequency in the coming years.

Background on the Untrammelled and Natural Qualities of Wilderness Character

Managers must approach ecological interventions with an understanding of the legal mandate to preserve both the untrammelled and natural qualities of wilderness, the importance of both un-manipulated and naturally functioning ecosystems, and the unique role that wilderness contributes to visitor experiences and societal ideals. Background on the untrammelled and natural qualities of wilderness character is provided here to set the context for why this framework is needed.

Untrammelled

Wilderness is untrammelled when the earth and its community of life are unhindered and free from the intentional actions of human control or manipulation. The idea of wilderness as a place that is untrammelled comes from the definition of wilderness in Section 2(c) of the 1964 Wilderness Act that states that wilderness is “an area where the earth and its community of life are untrammelled by man,” that wilderness “generally appears to have been affected primarily by the forces of nature,” and is an area “retaining its primeval character and influence.” Untrammelled is defined in the American Heritage dictionary (2011) as “allowed to run free,” and synonyms include unrestrained, unrestricted, unhindered, unimpeded, unencumbered, and self-willed. Ridder (2007) defined untrammelled as an absence of rationally planned human intervention. Kaye (2012) wrote that untrammelled wildness is “the state wherein those processes of an area’s genesis, free from human purpose, utility, or design, are allowed to shape its future. Thus, wildness is not the absence of all human effect; it can persist in environments that have been altered ... as long as we refrain from interfering with nature’s autonomous response.”

NPS Management Policies and DO41 provide guidance for wilderness stewardship and preserving wilderness character, but do not provide sufficient detail to help staff navigate complex, project-specific tradeoffs when there are impacts to both the untrammelled and natural qualities of wilderness character. This NWLC guidance therefore draws on the guidance provided in *Keeping It Wild 2*, which is included in *NPS Reference Manual 41: Wilderness Stewardship* as Level III NPS Policy.

The legislative mandate for wilderness to be untrammelled is unique among all Federal lands, defining wilderness in terms of *how* it is to be managed rather than *what* is managed. As described in *Keeping It Wild 2*, an essential principle of wilderness stewardship is that, in general, once an area is designated as wilderness any action that manipulates any aspect of the ecological system should be avoided unless it can be shown that such action is necessary to preserve wilderness character as a whole. Trammeling occurs whenever we intentionally manipulate the biophysical environment, regardless of whether the action itself occurs inside or outside of wilderness. In wilderness, managers have a responsibility to understand why a trammeling action has been proposed. While some interventions are one-time actions, others may create a need for future trammeling or set a precedent.

Preserving the untrammelled quality of wilderness is a gesture of humility and demonstrates capacity for restraint in human control or manipulation of the environment. The untrammelled quality reflects the transcendental/spiritual underpinnings of the wilderness movement. Understanding this meaning is crucial to understanding why preservation of wilderness character as a whole is the purpose of the Wilderness Act, as well as the larger symbolic function wilderness is meant to serve.

In addition to this symbolic value of untrammelled wilderness, there is also scientific value in having areas free from intervention. These areas serve as reference points against which we can view and measure changes that occur outside of wilderness when comparable ecosystems are present. In light of changing environmental conditions and our responses to them, wilderness areas can serve as controls so that we know if our ecological interventions in similar areas outside of wilderness are effective.

Natural

While the meaning of untrammelled is often difficult to understand, the term “natural” is equally difficult to define from an ecological perspective. Natural has many definitions in the American Heritage dictionary (2011) such as, “present in, or produced by nature” or “being in a state regarded as primitive, uncivilized”. Synonyms include pure, native, wild, or unaffected. What makes defining natural in the context of ecological intervention so difficult is that there is no single congruent definition shared by the public, ecologists, and managers of protected areas (Aplet and Cole 2010). In the context of wilderness stewardship, *Keeping It Wild in the National Park Service* (NPS 2014) defines the natural quality of wilderness character as, “Wilderness ecological systems are substantially free from the effects of modern civilization.” The natural quality of wilderness encompasses the integrity of ecological processes and may enhance visitor experiences in wilderness. Even though there is not a single definition of natural, it is clear that there is scientific and societal value in preserving intact indigenous ecosystems and processes in wilderness.

There is significant discussion in *NPS Management Policies, Chapter 4* of the terms “natural,” “natural conditions,” and “processes”. NPS policy is clear that natural processes should be restored if they are degraded. This statement is qualified in *NPS Management Policies, Section 6.3.7* where it states that, “Management intervention should only be undertaken to the extent necessary to correct past mistakes, the impacts of human use, and influences originating outside of wilderness boundaries.” *Keeping It Wild 2* states that “The Natural Quality is preserved when there are only indigenous species and natural ecological conditions and processes, and [this quality] may be improved by controlling or removing nonindigenous species or by restoring ecological conditions.”

NPS Management Policies, Chapter 4 defines natural conditions as, “the condition of resources that would occur in the absence of human dominance over the landscape.” In the context of evaluating proposals for ecological intervention in wilderness, proposed interventions would need to address the degradation of indigenous natural resources, processes, systems, and values that is caused by past or

ongoing human actions. At times, it is impossible to tease out the full influence of past and ongoing human activities in national parks and wilderness areas. Therefore, many ecologists now recommend focusing on outcomes and conservation goals, rather than encouraging managers to define natural conditions, specify a baseline or past ecological condition, or specific range of variation, (Hobbs et al. 2010, Stephenson et al. 2010). To be consistent with the NPS Organic Act and current NPS laws and policies, such outcomes and goals must focus on ecological function and integrity and emphasize indigenous species, natural resources, systems, processes, and values.

A Framework for Evaluating Ecological Intervention Proposals in Wilderness

The natural and untrammeled qualities are equally important aspects of wilderness. The purpose of the untrammeled quality is not to prevent restoration or adaptation projects but to hold us to a higher level of accountability within wilderness. With that in mind, the following evaluation framework was designed to help staff comprehensively and systematically evaluate proposals for ecological intervention in wilderness. The framework is composed of eight factors, each with accompanying text to guide thought and deliberation. The factors provide a check on ourselves to ensure that we carry out projects that are truly necessary and viable, and that we do so with the minimum possible adverse impacts. The factors are founded in *NPS Management Policies, Chapters 4 and 6*. Further discussion of *NPS Management Policies* is provided in Appendix 3.

Discussing a proposed intervention within the eight factors of this framework promotes clarity and may raise topics not otherwise considered. This framework is intended to support an interdisciplinary (ID) team reviewing a proposed intervention and its associated National Environmental Protection Act (NEPA) analysis. Ultimately, the framework and corresponding discussion informs the decision maker responsible for approving or denying the action, typically the Superintendent and/or Regional Director. Given the multiple mandates that drive and affect the management of NPS wilderness, it is important that staff representing all appropriate disciplines are part of the interdisciplinary team (ID team). This framework also provides a clear way to document the evaluation and decision and becomes part of the administrative and decision file.

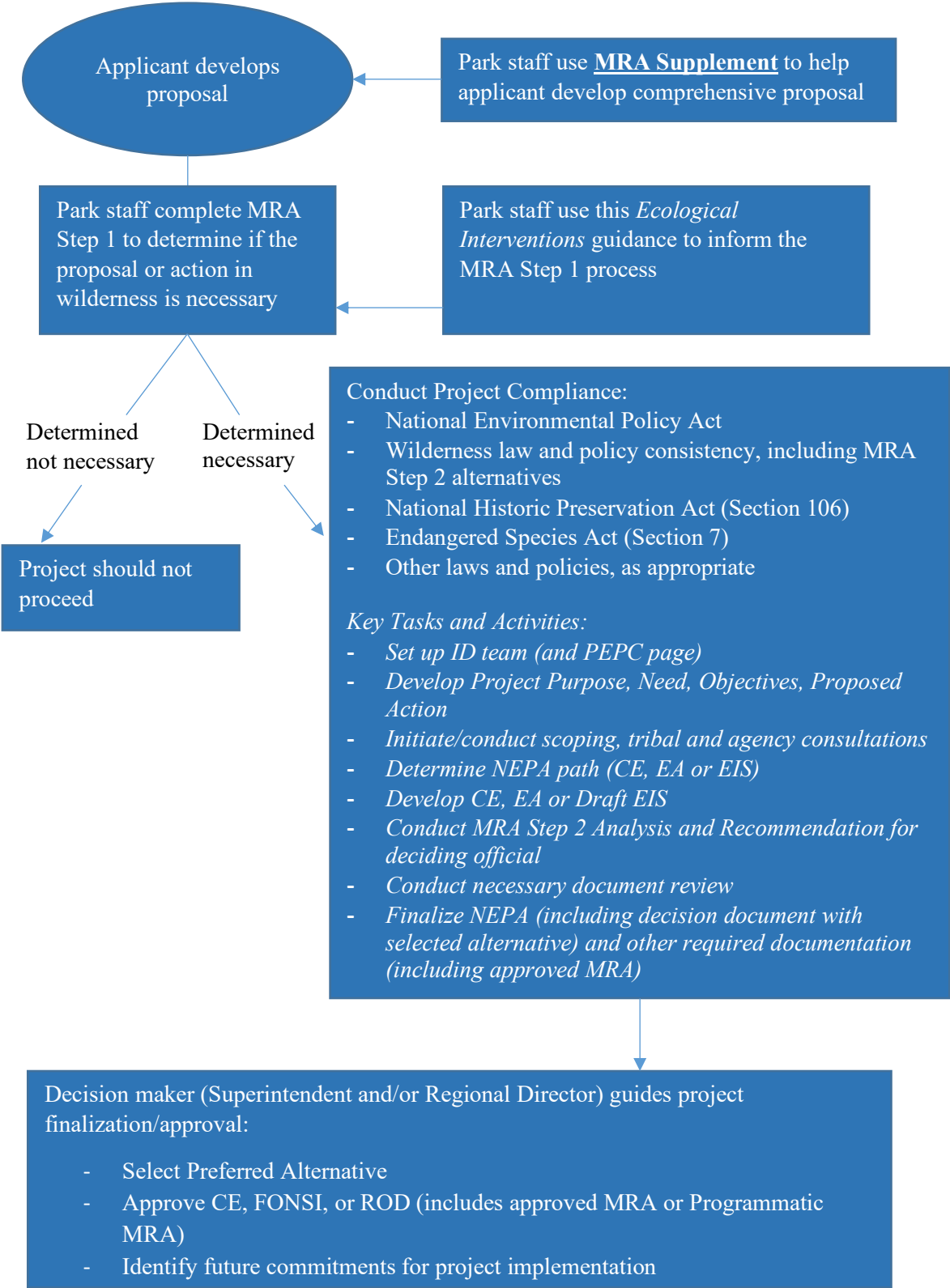
This section first describes when to use this framework in the general workflow of reviewing a proposed intervention. This is followed by a description of how to use this framework. Each of the eight factors is then described in detail.

When to Use this Framework

The following workflow (Figure 1) integrates project compliance when reviewing and evaluating intervention proposals in wilderness. It shows that this framework is intended to inform Step One of the MRA by helping an ID Team determine if a project is appropriate, necessary, and whether the benefits outweigh the impacts. ID Team discussion of the eight factors may also inform Step Two of the MRA, as the factors may generate ideas and discussion on how best to carry out the project while preserving wilderness character.

The compliance process must follow all relevant law and policy. Wilderness compliance is one part of this process. Cultural resources or endangered species may also be involved in an ecological intervention proposal. In these instances, National Historic Preservation Act (NHPA) Section 106 (and other cultural resource laws and directives), and the Endangered Species Act (and other natural resources laws and directives) pertain. The decision maker will incorporate all relevant guidance into the final decision.

Figure 1. Suggested Workflow for Evaluating Ecological Intervention Proposals in Wilderness



How to Use this Framework

Of the framework's eight factors, the first four focus on ecological degradation and the remaining four focus on the proposed intervention. Each of the eight factors has accompanying "favors intervention" and "does not favor intervention" statements. If the proposal is comprehensive, the ID team should be able to relatively easily and quickly judge if the proposal favors or does not favor intervention for each factor. For each factor, the ID team then describes why the proposal aligns with the column it did.

These factors are essentially a list of considerations. There is no magic number of "favors intervention" or "does not favor intervention" statements to cause a project to move forward or not. For example, if a proposal aligns with only two "does not favor intervention" statements, but those two statements alert the park that the intervention would need to occur in perpetuity and would be very intensive with multiple and large impacts to other qualities of wilderness character, the park may not want to move forward. The opposite could occur as well.

The following table summarizes the eight factors and their accompanying statements about whether the situation favors intervention or not (Table 1). An example of using this framework for an actual intervention proposal is provided in Appendix 2.

Table 1. Factors to consider when evaluating ecological intervention proposals in wilderness.

Factor to Consider	Favors Intervention	Does NOT Favor Intervention
1. Cause of Degradation	If the ecological degradation was primarily caused by human action as opposed to natural causes	If the ecological degradation was primarily caused by natural forces as opposed to human action
2. Timing of Degradation	If the cause of the ecological degradation occurred in the past and will not potentially compromise the success of the intervention	If the cause of the ecological degradation is ongoing and will potentially compromise the success of the intervention
3. Origin of Degradation	If the origin of the ecological degradation occurs in a location where the agency has authority to act	If the origin of the ecological degradation is regional or global, or occurs outside the wilderness with little chance for a successful outcome within wilderness
4. Urgency of Degradation	If the degradation warrants a need to intervene quickly to prevent the degradation from becoming worse	If the degradation does not warrant a need to intervene quickly to prevent the degradation from becoming worse
5. Sustainability of Intervention	If climate-driven or other broad-scale, persistent ecological drivers will not interfere with correcting the degradation	If climate-driven or other broad-scale, persistent ecological drivers will likely interfere with correcting the degradation
6. Outcome of Intervention	If the intervention has a clear and identifiable point at which an achievable outcome is reached	If the intervention does not have a clear and identifiable point at which an achievable outcome is reached
7. Intensity of Intervention	If the intervention is a less intense undertaking due to the size of the area trammled, tools used, number and frequency of interventions	If the intervention is a more intense undertaking due to the size of the area trammled, tools used, number and frequency of interventions
8. Experience with Intervention	If the intervention has been successfully conducted previously and has low risk of unintended consequences	If the intervention has not been successfully conducted previously or has unknown or high risk of unintended consequences

When reviewing a proposal for ecological intervention, the ID team should consider all eight factors. In some instances, however, a factor might not be applicable. If this is the case, the team should explicitly explain why the factor isn't applicable. The factors and their accompanying statements do not intend to address every nuance involved in a proposed ecological intervention. The ID team will need to determine whether more details are necessary to complete its review.

The factors and their accompanying statements can also be used to help park staff clarify what aspects of a proposed intervention need to be more carefully considered. Looking at where a proposal aligns with "does not favor intervention" statements helps a park identify, and work to mitigate or resolve, factors that make the project less likely to move forward. Importantly, after reviewing the eight factors, the ID team may conclude that additional information or discussion with the project proponent is needed, or the ID team may recommend the project move forward only after certain modifications.

Finally, the examples listed on the following pages are used to describe aspects of projects that would favor intervention or aspects of projects that raise red flags. This paper does not suggest that all invasive plant eradication projects, for example, be approved or that all stream liming projects be denied.

Explanation of the Eight Factors

The eight factors that compose this framework are explained below. For each project, the ID team must evaluate the proposal in the context of all eight factors.

Factor 1. Cause of Degradation

Favors intervention: If the ecological degradation was primarily caused by human action as opposed to natural causes

Does not favor intervention: If the ecological degradation was primarily caused by natural forces as opposed to human action

In wilderness, ecological systems are allowed to change freely. A concern for this change is if direct human actions have caused or are exacerbating the change. A proposed intervention would fall into the “favors intervention” column for this factor if human action can be shown with reasonable certainty to be directly causing the ecological degradation. Conversely, there would be less support for a proposed intervention if there were not reasonable certainty that human activity is the cause of the ecological degradation. Interventions to address the negative consequences to natural resources from human actions are addressed in *NPS Management Policies, Section 6.3.7*, which implies restraint to limit such interventions, and only to the degree necessary to sufficiently address such impacts.

Examples

Examples of interventions that would fall into the “favors intervention” column for this factor are:

- Restoring indigenous species that were extirpated by human actions (such as direct removal of animals by overhunting or illegal harvesting of plants);
- Removing invasive species that were intentionally brought into the wilderness (such as stocking of lakes or streams with non-native fish);
- Restoring disturbed sites resulting from human activity that has damaged indigenous natural resources such as plants and soils that will not recover without intervention (such as over grazing by domestic livestock or ineffective check dams).

In contrast, examples of interventions that would fall into the “does not favor intervention” column for this factor include suppressing a lightning ignited fire or restoring a site that was altered by a naturally occurring flood or landslide event. The rationale behind this reasoning is because the ecological degradation was caused by a natural event rather than being directly attributable to a specific human action.

Factor 2. Timing of Degradation

Favors intervention: If the cause of the ecological degradation occurred in the past and will not potentially compromise the success of the intervention

Does not favor intervention: If the cause of the ecological degradation is ongoing and will potentially compromise the success of the intervention

Ongoing causes can compromise the success of an intervention. If managers do not remove the source of degradation that is causing damage to natural resources within the wilderness, there would be less support for ecological intervention targeted to restore those resources. Conversely, if the cause of the degradation

was in the past and no longer directly contributes to the ecological damage, then intervention to restore those natural resources would be more likely to be supported.

Examples

An example of a project that would fall into the “favors intervention” column for this factor is restoring the native plant community in an area within the wilderness that had been highly disturbed by the introduction of nonindigenous ungulates that no longer occur in the wilderness. Since these ungulates are no longer present, the probability of a successful seeding or planting restoration is greatly improved. Another example is if a site has been heavily disturbed by human activity and that human use is halted (or will be as part of the project), then that would be a factor that would make managers favor intervention with an appropriate site restoration project.

Interventions would fall into the “does not favor intervention” column for this factor if the cause of degradation is ongoing and would likely compromise restoration efforts. Examples include:

- If acid deposition had caused the loss of stream biota and the deposition is continuing, there would be less support for adding lime to buffer the acidity in the stream.
- If a nonindigenous ungulate species persists adjacent to a wilderness yet routinely enters the wilderness and causes resource damage by wallowing, then managers would be less likely to intervene to restore the native plant communities in these wallows (rather, our first management action would be to eliminate the ungulates);
- If livestock grazing occurs in wilderness, then intervention to restore riparian systems would be less likely (rather, a more appropriate action would be to develop a livestock management plan that manages impact to riparian areas).
- If nonindigenous fish persist upstream of a wilderness or if nonindigenous fish would be illegally stocked in a park, then there would be less support for intervening to remove the nonindigenous fish from a wilderness lake or stream.

Factor 3. Origin of Degradation

Favors intervention: If the origin of the ecological degradation occurs in a location where the agency has authority to act

Does not favor intervention: If the origin of the ecological degradation is regional or global, or if it occurs outside the wilderness with little chance for a successful outcome inside the wilderness

The importance of this factor is tied to the authority and ability of park managers to take action. There is generally a greater likelihood of success if an NPS unit can design, implement, monitor, and measure the results of an ecological intervention project within their management jurisdiction. If the degradation originates beyond the park’s boundary, intervening is generally more complicated and restoration success may be less likely. There are instances however, where NPS management actions may be highly effective outside of NPS unit boundaries. For example, if the NPS has a cooperative management plan with another entity, the degradation is being successfully addressed on a regional basis, or in other situations where the NPS has authority to take action outside NPS boundaries (see *NPS Management Policies, Section 1.6*).

Examples

An example of a proposed intervention that would fall into the “favors intervention” column for this factor is a project designed to remove an invasive nonindigenous plant species from a portion of a wilderness, if the invasive species was isolated within a section of the wilderness.

An example that would fall into the “does not favor intervention” column for this factor is a project designed to remove cheatgrass from a wilderness if the origin of the cheatgrass was outside the park’s

boundary, no effort was being made to control it outside the park's boundary, and its range was continuing to expand. Action taken to control the species inside the park would be less likely to be effective because the species would move back into the park.

Factor 4. Urgency of Degradation

Favors intervention: If the degradation warrants a need to intervene quickly to prevent the degradation from becoming worse

Does not favor intervention: If the degradation does not warrant a need to intervene quickly to prevent the degradation from becoming worse

Park managers would more likely support an intervention to address ecological degradation that can be reasonably predicted to cause severe, pervasive, persistent, or permanent impacts to the natural quality of wilderness character. Instances when the ecological consequences are heightened by delaying intervention would more likely be supported. Proposals that demonstrate the need for urgent action to preserve species of special status (e.g., threatened, or endangered species, state listed species, or iconic species) would more likely be supported. Proposals should articulate if, and how, delaying action would make the desired outcome more uncertain, reduce the likelihood of success, and increase project effort and resources required.

Park staff may want to consider the following questions:

- How quickly is the ecological degradation, and its effects, spreading or becoming worse?
- Are the effects likely to be irreversible?
- Does acting now increase the likelihood of achieving a successful intervention outcome, or prevent further degradation?
- Is the threatened ecological component a keystone species?
- Might the degradation trigger a cascade of impacts across trophic levels?
- Do the impacts spread across ecological processes and components as well as across geography?

If there is not a clear demonstration of urgency to take action, the degradation can recover without intervention, or there is a high degree of uncertainty regarding the resource threat or pace of degradation, then the proposal would fall into the “does not favor intervention” column for this factor.

Examples

An example of a proposed intervention that would fall into the “favors intervention” column for this factor is eradicating an isolated patch of buffelgrass. Buffelgrass is a quickly spreading invasive species that is threatening the iconic saguaro cactus. Because the intervention would slow, stop, or reverse an ecological degradation that would become more severe over time, the intervention is time-sensitive and there is value in acting rapidly. Another example is the success story of the Sierra Nevada yellow-legged frog restoration. The yellow-legged frog species is federally listed and found only in wilderness. The frog species was on the brink of extinction when an intervention to eradicate nonnative fish species that were preventing the frogs' recovery coupled with interventions to battle a global fungus also killing the frogs were implemented. The frog population rebounded. Projects involving endangered species like these follow regional recovery plans and collaborative conservation efforts across the landscape regardless of boundaries.

Examples that would fall into the “does not favor intervention” column for this factor include:

- Eradicating non-native fish from a lake (in a situation where the fish are not reproducing or causing other harmful effects); and

- Controlling a non-native plant species, like shepherd’s purse (*Capsella bursa-pastoris*), that is small in stature and is able to survive only in small areas of already disturbed habitat. In these examples, an urgent response is likely unnecessary.

Factor 5. Sustainability of Intervention

Favors intervention: If climate-driven or other broad-scale, persistent ecological drivers will not interfere with correcting the degradation

Does not favor intervention: If climate-driven or other broad-scale, persistent ecological drivers will likely interfere with correcting the degradation

This factor explicitly asks the ID team to consider the feasibility of restoring ecological processes and integrity to a wilderness area impacted by broad-scale change. Wilderness ecosystems are allowed to change over time, as are all NPS lands per NPS policy. The rapid pace of ecological change wrought by climate and other environmental changes (such as large-scale air pollution, atmospheric deposition, light pollution, or invasive species) occurring on the landscape make the sustainability of the intervention important to consider. Based on NPS policy, ecological interventions should not attempt to return a landscape to a particular point in time or freeze an ecosystem in present time, but to focus on allowing ecological processes to function by removing human-caused degradations and stressors, when feasible.

In general, a proposed intervention is more likely to be supported if the system has been evaluated for its vulnerability to current and potential future environmental changes. In contrast, a proposed intervention is less likely to be supported if it restores or maintains an ecological process that is likely unsustainable given the current and potential future ecological system. Changes in ecosystem drivers may push ecological systems towards novel species composition, structures, or processes. In this instance, accepting the new system and adapting management to these new conditions would probably be the favored approach. If climate-driven ecological changes would likely make it impossible to maintain the outcome of the intervention, the intervention would be less likely to be supported.

The ID team should consider the following about the proposal when evaluating this factor:

- What is known and not known regarding how ecosystems are changing;
- Potential for unintended consequences;
- Vulnerability of park resources to broad-scale environmental changes;
- Potential impacts to ecological integrity from hurricanes, fires, mudslides, climate change, and other broad-scale changes; and
- Appropriateness of the adaptation action in response to the identified vulnerability.

The Ecological Integrity Framework (Unnasch et al 2009), prepared for the NPS, provides two relevant definitions: *resistance* is the capacity of ecosystems to tolerate disturbances without exhibiting significant change in structure and composition, and *resilience* is the ability of a system to recover from disturbance.

Examples

Examples that fall into the “favors intervention” column for this factor are projects where climate-driven or other broad-scale ecological changes will not interfere with correcting the degradation, and projects that facilitate ecological adaptation to the effects of a changing environment through removal of human caused stressors. Such projects could include the following:

- Removing a trail or a Civilian Conservation Corp era ditch through the middle of a meadow, both of which capture and move water away from the meadow. By removing these human-caused developments, surface sheet flow from snow melt will again move across the whole meadow thus returning and maintaining hydrological process integrity to the larger watershed system. Since

meadows and riparian areas support high species diversity and breeding habitat, this action would enhance the capacity of these systems to adapt to landscape-level environmental change and provide refuge for species dependent on riparian conditions. In short, broad-scale ecological drivers will not prevent or override the improvement of ecological integrity of the meadow when this intervention is implemented; thus, this intervention falls into the “favors intervention” column.

- The one-time eradication of nonindigenous fish in a wilderness lake where it has been determined that this lake would then be on a self-sustaining trajectory. This focused project is likely to be successfully implemented regardless of broad-scale ecosystem drivers.

Examples that would fall into the “does not favor intervention” column for this factor include:

- The assisted migration of plant species to locations where they did not exist indigenously (and presumably where broad-scale ecosystem drivers would continue to stress the species); and
- Eradication of cheat grass in an area that is dominated by these species. Because a warming climate is likely to increase cheat grass dominance over a larger area, eradication is likely no longer feasible in some locations. The ecosystem and such processes as the natural fire regime have fundamentally changed. The intervention cannot feasibly correct the degradation.

Factor 6. Outcome of Intervention

Favors intervention: If the intervention has a clear and identifiable point at which an achievable outcome is reached

Does not favor intervention: If the intervention does not have a clear and identifiable point at which an achievable outcome is reached

This factor considers whether the project has clearly articulated goals and if there is a high level of confidence that the intended results (e.g., a healthy species population) are achievable within an established timeframe. If the intervention has a clear, identifiable, and measurable point at which the action or intended outcome is complete, and if there is a high level of confidence that the intended results are achievable within an established timeframe, then the intervention would be more likely to be supported. In contrast, the intervention is less likely to be supported if it does not have a clear end point, intervention in perpetuity is required, or there is not a high level of confidence that the intended results are achievable within an established timeframe.

An intervention that must continue for many years would typically need to be carefully scrutinized. For example, there is substantial investment necessary to carry out multi-year interventions. Considerations for multi-year interventions include whether funding could be secured, and the political will sustained for that period of time. Interventions that lack confidence that desired results are achievable or would require repeated interventions over a long time period, would be less likely to be supported. Proposals that could be affected by global environmental change (e.g., reintroducing a species that require deep snowpack for denning) need to be carefully examined for whether they realistically have a known outcome, and a clear and measurable point at which the action or intended outcome is complete. For interventions that are anticipated to run for a longer time or have a maintenance phase, the ID team should require periodic evaluation of progress, such as every five years, to determine whether the initial goals are still appropriate and achievable.

Examples

Examples that fall into the “favors intervention” column for this factor could include the following:

- Projects of short duration with a clear, achievable outcome, such as the eradication of an isolated patch of an invasive plant species that can be eradicated with one treatment followed by two seasons of follow up treatment. Once removed, ecological function could resume.

- Projects of longer duration with clearly articulated goals, outcomes, and timeframes might be grizzly bear or wolf reintroductions into appropriate formerly occupied habitat.

Examples of projects that would fall into the “does not favor intervention” column for this factor include:

- Eradication of an invasive plant species that has become established along a well-used trail and will likely continue to be brought in by visitors. In this case, the fact that treatment would need to occur every year in perpetuity would be one reason why a park would be less likely to support the project.
- Restoring an aquatic species in a lower watershed lake when it is known that the stressor for the lower lake is still in place upstream of this lake; in this case, a favorable long-term outcome for the lower watershed intervention might be uncertain.

Factor 7: Intensity of the Intervention

Favors intervention: If the intervention is a less intense undertaking due to the size of the area trammled, tools used, number and frequency of interventions

Does not favor intervention: If the intervention is a more intense undertaking due to the size of the area trammled, tools used, number and frequency of interventions

The intent of this factor is to help the ID team holistically consider all the potential impacts of the proposed intervention and to gauge the relative intensity of the proposed intervention. Impacts may occur from the tools used to implement the project (e.g., chainsaw or other motorized equipment compared to non-motorized tool), the number of actions (e.g., single entry compared to multiple entries), the area affected (e.g., five acres compared to 100 acres), the timing or seasonality of the actions (e.g., in winter compared to summer), how frequently actions are taken (e.g., one action per year compared to five actions per year), and overall length of the intervention (e.g., accomplished in one day or five years). The goal of this factor is to generally minimize impacts to wilderness character.

This factor cannot offer a concrete definition of what constitutes an acceptable intensity because every situation is unique. In general, however, the lower the impact the more acceptable it is to allow the intervention to proceed, and the higher the impact the less likely the intervention would be supported.

Examples

Examples of less intensive undertakings that would fall into the “favors intervention” column for this factor are:

- Removal of nonindigenous stocked fish from one wilderness lake where the project is completed in two seasons using non-motorized tools and transportation methods: and
- Prescribed fire on five acres of a 500,000-acre park that does not require helicopter support or large camps of long duration.

On the other hand, interventions that would fall into the “does not favor intervention” column for this factor are:

- Removal of fish in lakes throughout a wilderness requiring multiple piscicide applications and use of helicopters.
- Prescribed fire on 1,000 acres that requires helicopter support and large camps.

Factor 8. Experience with Intervention

Favors intervention: If the intervention has been successfully conducted previously, and has low risk of unintended consequences

Does not favor intervention: If the intervention has not been successfully conducted previously or has unknown or high risk of unintended consequences

NPS Management Policies, Section 6.3.7 states, “Management actions [...] should be attempted only when the knowledge and tools exist to accomplish clearly articulated goals.” Correspondingly, a proposed intervention successfully conducted previously in similar circumstances would garner more support than an untried, failed, or marginally successful past intervention.

Wilderness is not always an appropriate venue for interventions where the primary purpose is to test a methodology. This depends on whether the same conditions for scientific research are available outside the wilderness.

ID teams should consider both the general type of intervention (e.g., fire suppression, vegetation restoration), as well as the details that are specific to the proposal. For example, has this type of work been successfully conducted in this park or in a similar situation/environment to what is being proposed? Has this type of intervention been successfully conducted on the species or process that is the focus of the proposal? Has the same methodology been successfully employed? Are managers experienced in the use of the appropriate methods and/or consulting with experts?

“Successfully conducted previously” means that the methodology has been field tested and an appropriate amount of time has transpired to be able to record consequences, including unintended consequences, of the intervention. Based on previous outcomes, managers can gain a high level of confidence in the predicted outcome and effects of the current proposal.

ID teams must be cognizant that for some, there may not be a body of previous work by which to evaluate the likelihood of success of the proposed intervention. In some cases, there may be a need to conduct a smaller test of the proposed intervention. If possible, experiments or trials should occur outside wilderness. Sometimes, however, the only place to test methodology is in wilderness, and the park must weigh the potential benefits and impacts as it evaluates such proposals.

Examples

An example of an intervention that would fall into the “favors intervention” column for this factor is planting native vegetation to recover a species or a native plant community. Revegetation efforts have been conducted many times on Federal land. There is substantial knowledge and experience with projects that work well and those that do not. The ID team would want to have a good sense for how well the project would work in that specific wilderness environment before proposing a recommendation. A project on adjacent or similar lands that had successful results would be a critical discussion point for the ID team.

On the other hand, a proposal that would “not favor intervention” for this factor is transplanting an alpine species into areas where they are not known to have occurred in an effort to extend their range in the face of broad-scale environmental changes. Lack of certainty about methods and outcomes would make this project less likely to move forward in wilderness.

References Cited

Aplet, G.H. and D.N. Cole. 2010. The trouble with naturalness: rethinking park and wilderness goals. Pages 12-29 in *Beyond Naturalness – Rethinking Park and Wilderness Stewardship in an Era of Rapid Change* (D.N. Cole and L. Yung, editors). Island Press, Washington DC.

Cole, D.N. and L. Yung, editors. 2010. *Beyond Naturalness – Rethinking Park and Wilderness Stewardship in an Era of Rapid Change*. Island Press, Washington DC.

Hahn, B., and P. Landres. 2017. Supplement to Minimum Requirements Analysis/Decision Guide (MRA/MRDG): Evaluating Proposals for Ecological Intervention in Wilderness. Manuscript on file at the Aldo Leopold Wilderness Research Institute.

Hobbs, R.J., E.S. Zavaleta, D.N. Cole, and P.S. White. 2010. Evolving ecological understandings: the implications of ecosystem dynamics. Pages 34-49 in *Beyond Naturalness – Rethinking Park and Wilderness Stewardship in an Era of Rapid Change* (D.N. Cole and L. Yung, editors). Island Press, Washington DC.

Kaye, Roger. 2012. What Future for Wilderness within a Climate-Changing National Wildlife Refuge System? *International Journal of Wilderness*, Vol 18, No 1.

Landres, Peter et al. 2015. Keeping It Wild 2: An updated interagency strategy to monitor trends in wilderness character across the National Wilderness Preservation System. Gen. Tech. Rep. RMRS-GTR-340. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

National Park Service [NPS]. 2004. National Wilderness Leadership Council White Paper #2 What Constitutes Appropriate Conservation and Restoration Activities in Wilderness?

National Park Service [NPS]. 2006. Management Policies.

National Park Service [NPS]. 2014. Keeping It Wild in the National Park Service: a user guide to integrating wilderness character into park planning, management, and monitoring. WASO 909/121797. Lakewood, CO. 219 p.

Ridder, Ben. 2007. *Journal of Agricultural and Environmental Ethics* (2007) 20:195–213 DOI 10.1007/s10806-006-9025-6.

Stephenson, N.L. 2014. Making the transition to the third era of natural resources management. *George Wright Forum* 31:227-235.

Stephenson, N.L., C.I. Millar, and D.N. Cole. 2010. Shifting environmental foundations: the unprecedented and unpredictable future. Pages 50-67 in *Beyond Naturalness – Rethinking Park and*

Wilderness Stewardship in an Era of Rapid Change (D.N. Cole and L. Yung, editors). Island Press, Washington DC.

The American Heritage dictionary of the English language. 4th ed. Boston: Houghton Mifflin.
Unnasch, R.S., D. P. Braun, P. J. Comer, G. E. Eckert. 2008. The Ecological Integrity Assessment Framework: A Framework for Assessing the Ecological Integrity of Biological and Ecological Resources of the National Park System. Report to the National Park Service.

Composition of the NWLC Ecological Intervention Work Group

- Fred Herling (Retired - Supervisory Park Planner, Everglades and Dry Tortugas National Parks)
- Nyssa Landres (Wilderness Coordinator, Wrangell-St. Elias National Park and Preserve)
- Peter Landres (Retired - Ecologist, Aldo Leopold Wilderness Research Institute)
- Adrienne Lindholm (Alaska Region Wilderness Coordinator)
- Linda Mazzu (Retired - Superintendent, Bryce Canyon National Park. Former Chief of Resources Management and Science, Yosemite National Park)
- Jack Oelfke (Retired - Chief of Natural and Cultural Resources, North Cascades National Park Complex)

Additional work group participation was from Dan Brown (Retired - Superintendent, Gulf Islands National Seashore) and Beth Hahn (Ecologist, Aldo Leopold Wilderness Research Institute).

Appendix 1. How this Framework was Developed and Options Considered but Not Used

This appendix describes the background of this NWLC work group, how this framework was developed, and various options for evaluating proposals for ecological intervention in wilderness that this NWLC work group considered, discussed, and ultimately dismissed.

During its September 2016 meeting, the NWLC tasked a work group with drafting practical guidance to help field staff make informed and transparent decisions about ecological intervention proposals in wilderness.

The NWLC work group used the [MRA Supplement for Evaluating Proposals for Ecological Intervention in Wilderness](#) (Hahn and Landres 2017) as a starting point. The MRA supplement is intended to ensure that all relevant information is included in any proposal for ecological intervention in wilderness and is neutral on whether the intervention should or should not be taken. The supplement should help park staff identify issues that need to be resolved before moving forward with the MRA and other required analyses. The NWLC framework takes the proposal evaluation process to the important next step of identifying critical factors that would make a proposed intervention more or less likely to be approved.

The NWLC work group considered engaging staff from the other three wilderness managing agencies in developing this guidance because the concerns about ecological intervention in wilderness are shared by all the agencies. The work group decided that its initial approach should focus on building a practical tool to serve the needs, policies, and culture of NPS staff and managers. Once discussion and refinement within the NPS is completed, this approach can be shared with the other agencies to foster discussions on the big-picture needs of the National Wilderness Preservation System (NWPS) and perhaps a coherent interagency approach to considering ecological interventions in wilderness.

Several options were initially considered for how to approach developing practical guidance about ecological intervention in wilderness but were ultimately dismissed.

Option 1. Not allow any intervention in any wilderness area.

This option provides that no ecological interventions would be considered or allowed to occur in any wilderness.

- **Merits of this option.** This option clearly and unequivocally addresses the statement in the Wilderness Act that wilderness is “as an area where the earth and its community of life are untrammeled by man.” This clarity would remove the need for further debate or discussion on whether, and what type of interventions may or may not be appropriate in wilderness.
- **Shortcomings of the option.** This option has two primary shortcomings. First, this approach does not reflect the statutory and policy requirements that guide wilderness management. In addition to preserving the untrammeled quality, the Wilderness Act also mandates the preservation of natural conditions. NPS policy similarly requires preserving natural resource ecosystems. As a result, a categorical decision that ecological restoration cannot occur in wilderness is not supported by law and policy. Second, the purpose of this work group is to provide guidance for managers to navigate the ambiguous realm created by the mandate of the Wilderness Act, and supported in NPS policy, to leave wilderness untrammeled while also preserving natural conditions. By solely focusing on preservation of the untrammeled quality, this option does not address the nuance managers must consider when making decisions about ecological restoration in wilderness. Third, other laws have substantive requirements that may prompt intervention.
- **Group decision.** This option was not selected by the work group.

Option 2. Administratively designate an entire wilderness as either: 1) untrammeled, where no interventions whatsoever would be allowed; or 2) natural, where all reasonable interventions aimed at restoring or protecting the natural quality would be allowed.

This option would establish whether the entirety of a particular wilderness would either allow interventions or prohibit any interventions whatsoever. This option is different from the previous option, that *all* wildernesses will only be untrammeled, whereas this option is that *some* wildernesses may allow ecological interventions.

- Merits of this option. This option would give effect to the phrasing of the Wilderness Act that “wilderness is to be untrammeled by man...” and would clearly delineate where trammeling actions are acceptable and where they are not. No further debate or discussion would be warranted or required, thus providing managers guidance. Unlike Option 1, this option would allow some areas to allow interventions. The scientific value provided by wilderness as a natural laboratory would be preserved because some areas would be untrammeled and used as a benchmark for ecological change. Simultaneously, other wilderness areas would provide for scientific value by allowing ecological interventions to occur.
- Shortcomings of this option. This option would cause areas that are designated as untrammeled to violate the Wilderness Act’s mandate to preserve natural conditions, and areas that are designated as natural to violate the Act’s mandate to preserve its untrammeled character. Further, there is no legal, policy, or scholarly guidance on how to designate which areas would be untrammeled and which would be natural. This option conflicts with NPS policy, as provided in *Chapters 4 and 6 of NPS Management Policies*. This option also doesn’t address the reality that situations prompting ecological interventions are frequently caused by activities occurring outside of the wilderness boundaries and that such situations are responsive to unforeseen circumstances. This option doesn’t meet the goals of the work group to provide managers guidance in accordance with law and policy.
- Group decision. This option was not selected by the work group.

Option 3. Establish zones within a particular wilderness where either the untrammeled or natural quality would have primacy.

This option would establish zones within a particular wilderness where either the untrammeled or natural quality would be emphasized. In other words, some zones would be more encouraging of ecological intervention, whereas other zones would discourage ecological intervention.

- Merits of this option. This option provides substantial flexibility to local managers and provides a clear distinction of how the balance between the natural and untrammeled qualities of wilderness character would be addressed. This option also clearly addresses the mandate of the Wilderness Act to keep wilderness untrammeled while also preserving natural conditions.
- Shortcomings of this option. There are four primary shortcomings to this option.
 - First, park planning, as would be needed to establish these zones, is extremely behind schedule across the NPS and many parks are operating without current management plans. Further, this is a controversial topic that would add another level of complexity to a planning process that is already contentious.
 - Second, this option does not address the reality that many proposed interventions arise from unforeseen circumstances that planning cannot address, and for which the park may not want to preclude a management response. This approach may reduce local managers’ adaptability to changing on-the-ground environments.
 - Third, wilderness is already a zone within a larger system of protected areas. As wilderness, untrammeled is one of the values of the area and cannot be “zoned out.” Further, establishing additional zones within a wilderness may be problematic because managers must holistically preserve the wilderness character of the entire area.

- Fourth, administrative boundaries are porous. Even if a particular area was zoned as untrammeled, there would likely be impacts to the natural quality incurred from sources in nearby areas. It is also difficult to develop meaningful and functional boundaries to delineate between the natural and untrammeled qualities of wilderness, especially within a single wilderness.
- Group decision. This option was not selected by the work group. However, a park may pursue zonation at their discretion. In other words, an individual park may choose to zone its wilderness with primacy being given to one wilderness character quality over another (e.g., untrammeled primacy, or natural primacy), but this approach will not be the primary one advocated by this work group.

Option 4. Develop policy clarification via an interagency task force.

An interagency task force would be chartered to develop clarification of NPS, Bureau of Land Management, US Fish and Wildlife Service, and US Forest Service policy on this topic.

- Merits of this option. The NWPS is managed by four different land management agencies. This approach would recognize the interagency nature of the NWPS and provide consistent guidance across the system. Moreover, policy guidance would clarify the tension between the natural and untrammeled qualities at a high level.
- Shortcomings of this option. While this approach is arguably the most desirable, it simply isn't feasible at this time. Parks need direction and help grappling with this topic now. The reality of the drawn-out time frame for results from an interagency work group also doesn't address more immediate needs. This approach also wouldn't allow for local flexibility, though this may be perceived as a shortcoming or strength in different contexts.
- Group decision. This option was not selected by the work group. This work group is addressing this topic for the NPS NWLC and not the Interagency Wilderness Steering Committee or other interagency group. The work group will share its results with the other agencies and hopes that it may provide the starting point for a subsequent interagency effort. Clarification of NPS policy to reduce conflicting direction, though, would be an important step to assist with such complex issues.

Option 5. Case-by-case basis.

Each proposed intervention would be reviewed and decided on a case-by-case basis and no additional guidance would be provided.

- Merits of this option. This approach provides the maximum discretion to each wilderness unit. It likewise acknowledges that each ecological intervention arises from unique circumstances and is subject to a different array of ecological, political, social, and other factors.
- Shortcomings of this option. The goal of this work group is to provide guidance on how to help managers make these difficult decisions. Allowing each decision to be a case-by-case basis preserves the status quo and does not meet the goal of this work group. Guidance to help managers work through interventions on a case-by-case basis is also already provided in the Hahn-Landres Intervention Framework.
- Group decision. This option was not selected by the work group.

Appendix 2. Example Use of this Framework on Control of Buffelgrass in Saguaro Wilderness

The appendix describes the background for this example then presents the table of factors with how this hypothetical ID team judged each statement for whether intervention would be more or less likely.

Background

Saguaro National Monument was established in 1933 to protect a superb example of a Sonoran Desert ecosystem, including the iconic saguaro cactus. The Monument was given national park status in 1994 with 84,000 acres, and in 1976 Congress established the Saguaro Wilderness of 70,905 acres. Saguaro National Park (SNP) staff detected the presence of buffelgrass (*Cenchrus ciliaris*) in 1989, a non-native invasive perennial grass species that had been introduced to the American Southwest in 1940 from Africa for use as cattle forage. Buffelgrass is a highly invasive perennial bunchgrass that out-competes native Sonoran Desert plants for resources and establishes dense stands in a variety of desert ecosystems by reproducing rapidly. The greatest threat posed by buffelgrass is an ecosystem type conversion—from a Sonoran Desert ecosystem to a grassland ecosystem—coupled with the introduction of fire. The Sonoran Desert is not naturally adapted to fire. Buffelgrass infestations significantly increase fuel loads and provide a continuous fuel source, resulting in more frequent and intense fires that threaten the saguaro cactus and other species and habitats found within the Saguaro Wilderness.

Buffelgrass is officially listed as a noxious weed in Arizona, so it's no longer planted there. There are infestations on private and public lands near the park, and there are on-going community efforts to remove them.

When monitoring efforts and digital mapping revealed that buffelgrass was spreading rapidly in the early 1990's, wilderness managers at SNP began to remove the plant by hand and later through the use of herbicides. Despite these efforts, buffelgrass continued to colonize steep, inaccessible mountainsides. Managers recognized that both manual and chemical removal of buffelgrass degrades the untrammeled quality of wilderness character in the Saguaro Wilderness. Without action, however, SNP determined that the saguaro cactus and other Sonoran Desert resources under their management were at risk of converting to a buffelgrass monoculture.

The park proposed using helicopters to spray herbicide across 350 acres of remote and challenging terrain to remove buffelgrass and retain native ecosystems. The herbicide, glyphosate, is non-selective chemical and works by inhibiting plant growth. Areas targeted for aerial application are required to have 50% or more buffelgrass plant cover in an attempt to minimize collateral damage to native plants.

Example Use of the NWLC Ecological Intervention Framework

Table 2, below, lists eight factors with yellow highlighted boxes showing the conclusion of a hypothetical ID team (in this case, the NWLC Ecological Intervention Work Group) about whether each factor would contribute to building a case for the buffelgrass treatment being approved or denied. The ID team spent about 30 minutes discussing this example and reaching a consensus to fill out this table. ***In each yellow highlighted box, italics text provides the reason for why the ID team selected the box.***

After filling Table 2 out, the ID team's impression was that the statements of Factors 6 and 7 built a case to not approve this treatment. Embarking on a high intensity project that does not have a clear end point gave the ID team great pause. However, the statements of Factors 1, 2, 4, 5, and 8 built a case for approving the project. Factor 3 raised very important points of consideration but did not significantly sway the decision one way or another.

The need to intervene to protect saguaros and other Sonoran Desert plants the park was established to protect (Factor 4) stood out as the most compelling factor to this ID team. This coupled with the knowledge that ongoing efforts are underway to remove the seed source outside the park boundary led the ID team to a final recommendation of approving the treatment.

The ID team also considered recommending that the project be implemented on a short-term basis, evaluated for its effectiveness and degree of impact to other wilderness character qualities, and be periodically re-evaluated for whether the treatment should continue. The ID team also felt like it might be possible for the park to find areas where control of the spread of buffelgrass rather than eradication may end up being more feasible.

Table 2. Factor-Specific Conclusions for Buffelgrass Example

Factor to Consider	Favors Intervention	Does not favor intervention
1. Cause of Degradation	If the ecological degradation was primarily caused by human action as opposed to natural causes <i>The presence of buffelgrass in Saguaro NP is directly human caused because it was introduced as cattle forage</i>	If the ecological degradation was primarily caused by natural forces as opposed to human action
2. Timing of Degradation	If the cause of the ecological degradation occurred in the past and will not potentially compromise the success of the intervention <i>Buffelgrass is no longer planted in Arizona as cattle forage.</i>	If the cause of the ecological degradation is ongoing and will potentially compromise the success of the intervention
3. Origin of Degradation	If the origin of the ecological degradation occurs in a location where the agency has authority to act <i>While there are buffelgrass infestations on private and public lands near the park, there are ongoing community efforts to remove them. Since it is a state listed species, it is given higher priority.</i>	If the origin of the ecological degradation is regional or global, or occurs outside the wilderness with little chance for a successful outcome within wilderness <i>The original source of buffelgrass is from outside the wilderness, and even though the impact is now inside the wilderness and there are sources inside the wilderness, buffelgrass can continue to come from outside the wilderness where NPS does not have jurisdiction. Although there are ongoing efforts outside the park to remove buffelgrass, until these infestations are gone, they remain a possible seed source.</i>
4. Urgency of Degradation	If the degradation warrants an urgent need for the intervention to prevent the degradation from becoming much worse <i>Saguaro NP was created to preserve a superb example of the Sonoran Desert</i>	If the degradation does not warrant an urgent need for the intervention to prevent the degradation from becoming much worse

	<i>ecosystem which is non fire adapted. Buffelgrass will cause an eco-type conversion. Buffelgrass spreads quickly and fire promotes its spread, so we assume that there is a high likelihood of the degradation becoming much worse and threatening the survival of saguaros and other Sonoran Desert plants the park was established to protect.</i>	
5. Sustainability of Intervention	If climate-driven or other broad-scale, persistent ecological drivers will not interfere with correcting the degradation <i>Buffelgrass promotes more frequent and widespread fires, and its removal would interrupt the buffelgrass/fire positive feedback cycle. This buffelgrass/fire relationship exists largely independent of climate-driven or other broadscale drivers, and thus breaking up that relationship would favor intervention.</i>	If climate-driven or other broad-scale, persistent ecological drivers will likely interfere with correcting the degradation
6. Outcome of Intervention	If the intervention has a clear and identifiable point at which an achievable outcome is reached	If the intervention does not have a clear and identifiable point at which an achievable outcome is reached <i>Buffelgrass treatment may need to be perpetual because it may continue to come in from outside the wilderness. (If eradication was not the goal, but clear outcomes and maintenance schedule were articulated, it could be more likely to be supported.)</i>
7. Intensity of Intervention	If the intervention is a less intense undertaking due to the size of the area trammed, tools used, number and frequency of interventions	If the intervention is a more intense undertaking due to the size of the area trammed, tools used, number and frequency of interventions <i>Buffelgrass treatment will occur over 350 acres. Because of the aerial application, number, and frequency of applications, use of helicopters, and non-target effects of herbicide, this is a relatively intense action.</i>
8. Experience with Intervention	If the intervention has been successfully conducted previously and has low risk of unintended consequences <i>This type of treatment has been done before, so there is experience with it</i>	If the intervention has not been successfully conducted previously or has unknown or high risk of unintended consequences

Appendix 3. Selected Law and Policy Related to Ecological Interventions in Wilderness

This appendix provides selected excerpts from law and *NPS Management Policies* that may be important when considering an ecological intervention project in wilderness. The list below identifies critical sections of law and policy, but by no means should be thought of as all-inclusive or comprehensive. This is particularly true of Chapter 4: Natural Resource Management, Section 4.4 Biological Resource Management that outlines many natural resource-related issues that could lead to consideration of an ecological intervention proposal.

The intent is to help park managers and staff begin thinking carefully about the critical parameters of a proposal or potential project. Please use these documents (links to electronic versions are provided below) and coordinate with the ID team members to ensure compliance and consistency with all relevant and applicable law and policy, including NPS Director's Orders, Reference Manuals and other program guidance documents.

[NPS Organic Act \(54 U.S. Code § 100101\)](#)

“The Secretary, acting through the Director of the National Park Service, shall promote and regulate the use of the National Park System by means and measures that conform to the fundamental purpose of the System units, which purpose is to conserve the scenery, natural and historic objects, and wild life in the System units and to provide for the enjoyment of the scenery, natural and historic objects, and wild life in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.”

[The Wilderness Act of 1964 \(Public Law 88-577\)](#)

Section 2(c)

“A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammelled by man An area of wilderness is further defined to mean ...land retaining its primeval character and influence, without permanent improvements..., which is protected and managed so as to preserve its natural conditions and which ...generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable...”

Section 4(b)

“Except as otherwise provided in this Act, each agency administering any area designated as wilderness shall be responsible for preserving the wilderness character of the area and shall so administer such area for such other purposes for which it may have been established as also to preserve its wilderness character. Except as otherwise provided in this Act, wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use.”

[NPS Management Policies \(2006\)](#)

Chapter 6 – Wilderness Management

6.1 General Statement

The National Park Service will manage wilderness areas for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness.

6.3.5 Minimum Requirement

All management decisions affecting wilderness must be consistent with the minimum requirement concept.

6.3.6 Scientific Activities in Wilderness

The statutory purposes of wilderness include scientific activities, and these activities are encouraged and permitted when consistent with the Service's responsibilities to preserve and manage wilderness.

6.3.6.1 General Policy

The National Park Service has a responsibility to support appropriate scientific activities in wilderness and to use science to improve wilderness management. The Service recognizes that wilderness can and should serve as an important resource for long-term research into and study and observation of ecological processes and the impact of humans on these ecosystems. The National Park Service further recognizes that appropriate scientific activities may be critical to the long-term preservation of wilderness.

6.3.7 Natural Resources Management

The National Park Service recognizes that wilderness is a composite resource with interrelated parts. Without natural resources, especially indigenous and endemic species, a wilderness experience would not be possible. Natural resources are critical, defining elements of the wilderness resource, but they need to be managed within the context of the whole ecosystem. Natural resource management plans will be integrated with and cross-reference wilderness management plans. Pursuing a series of independent component projects in wilderness, such as single-species management, will not necessarily accomplish the over-arching goal of wilderness management. Natural resources management in wilderness will include and be guided by a coordinated program of scientific inventory, monitoring, and research.

The principle of non-degradation will be applied to wilderness management, and each wilderness area's condition will be measured and assessed against its own unimpaired standard. Natural processes will be allowed, insofar as possible, to shape and control wilderness ecosystems. Management should seek to sustain the natural distribution, numbers, population composition, and interaction of indigenous species. Management intervention should only be undertaken to the extent necessary to correct past mistakes, the impacts of human use, and influences originating outside of wilderness boundaries.

Management actions, including the restoration of extirpated native species, the alteration of natural fire regimes, the control of invasive alien species, the management of endangered species, and the protection of air and water quality, should be attempted only when the knowledge and tools exist to accomplish clearly articulated goals.

6.3.8 Cultural Resources

The Wilderness Act specifies that the designation of any area of the park system as wilderness "shall in no manner lower the standards evolved for the use and preservation of" such unit of the park system under the various laws applicable to that unit (16 USC 1133(a)(3)). Thus, the laws pertaining to historic preservation also remain applicable within wilderness but must generally be administered to preserve the area's wilderness character. The responsible decision-maker will include appropriate consideration of the application of these provisions of the Wilderness Act in analyses and decision-making concerning cultural resources.

Cultural resources that have been included within wilderness will be protected and maintained according to the pertinent laws and policies governing cultural resources using management methods that are consistent with the preservation of wilderness character and values. These laws include the Antiquities Act and the Historic Sites, Buildings and Antiquities Act, as well as subsequent historic preservation legislation, including the National Historic Preservation Act, the Archaeological Resources Protection Act, and the Native American Graves Protection and Repatriation Act.

Chapter 4 – Natural Resources Management

Introduction

The National Park Service will strive to understand, maintain, restore, and protect the inherent integrity of the natural resources, processes, systems, and values of the parks while providing meaningful and appropriate opportunities to enjoy them. The Service recognizes that natural processes and species are evolving, and the Service will allow this evolution to continue—minimally influenced by human actions. The natural resources, processes, systems, and values that the Service preserves are described generally in the 1916 NPS Organic Act and in the enabling legislation or presidential proclamation establishing each park. They are described in greater detail in management plans specific to each park. Natural resources, processes, systems, and values found in parks include

- physical resources such as water, air, soils, topographic features, geologic features, paleontological resources, and natural soundscapes and clear skies, both during the day and at night
- physical processes such as weather, erosion, cave formation, and wildland fire
- biological resources such as native plants, animals, and communities
- biological processes such as photosynthesis, succession, and evolution
- ecosystems
- highly valued associated characteristics such as scenic views

In this chapter, natural resources, processes, systems, and values are all included in the term “natural resources.” The term “natural condition” is used here to describe the condition of resources that would occur in the absence of human dominance over the landscape.

4.1 General Management Concepts

Natural resources will be managed to preserve fundamental physical and biological processes, as well as individual species, features, and plant and animal communities. The Service will not attempt to solely preserve individual species (except threatened or endangered species) or individual natural processes; rather, it will try to maintain all the components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and genetic and ecological integrity of the plant and animal species native to those ecosystems. Just as all components of a natural system will be recognized as important, natural change will also be recognized as an integral part of the functioning of natural systems.

The Service will not intervene in natural biological or physical processes, except

- when directed by Congress.
- in emergencies in which human life and property are at stake.
- to restore natural ecosystem functioning that has been disrupted by past or ongoing human activities; or
- when a park plan has identified the intervention as necessary to protect other park resources, human health and safety, or facilities.

Any such intervention will be kept to the minimum necessary to achieve the stated management objectives.

By preserving these components and processes in their natural condition, the Service will prevent resource degradation and therefore avoid any subsequent need for resource restoration. In managing parks to preserve naturally evolving ecosystems, and in accordance with requirements of the [National Parks Omnibus Management Act of 1998](#), the Service will use the findings of science and the analyses of scientifically trained resource specialists in decision-making.

4.1.5 Restoration of Natural Systems

The Service will reestablish natural functions and processes in parks unless otherwise directed by Congress. Landscapes disturbed by natural phenomena, such as landslides, earthquakes, floods, hurricanes, tornadoes, and fires, will be allowed to recover naturally unless manipulation is necessary to protect other park resources, developments, or employee and public safety. Impacts on natural systems resulting from human disturbances include the introduction of exotic species; the contamination of air, water, and soil; changes to hydrologic patterns and sediment transport; the acceleration of erosion and sedimentation; and the disruption of natural processes. The Service will seek to return such disturbed areas to the natural conditions and processes characteristic of the ecological zone in which the damaged resources are situated. The Service will use the best available technology, within available resources, to restore the biological and physical components of these systems, accelerating both their recovery and the recovery of landscape and biological community structure and function. Efforts may include, for example:

- removal of exotic species
- removal of contaminants and non-historic structures or facilities
- restoration of abandoned mineral lands, abandoned or unauthorized roads, areas overgrazed by domestic animals, or disrupted natural waterways and/or shoreline processes
- restoration of areas disturbed by NPS administrative, management, or development activities (such as hazard tree removal, construction, or sand and gravel extraction) or by public use
- restoration of natural soundscapes
- restoration of native plants and animals
- restoration of natural visibility

When park development/facilities are damaged or destroyed and replacement is necessary, the development will be replaced or relocated to promote the restoration of natural resources and processes.

4.4.1 General Principles for Managing Biological Resources

The National Park Service will maintain as parts of the natural ecosystems of parks all plants and animals native to park ecosystems.

The Service will successfully maintain native plants and animals by

- preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur;
- restoring native plant and animal populations in parks when they have been extirpated by past human-caused actions; and
- minimizing human impacts on native plants, animals, populations, communities, and ecosystems, and the processes that sustain them.

Chapter 5 – Cultural Resource Management

Introduction

The National Park Service is the steward of many of America's most important cultural resources. These resources are categorized as archeological resources, cultural landscapes, ethnographic resources, historic and prehistoric structures, and museum collections. The Service's cultural resource management program involves

- research to identify, evaluate, document, register, and establish basic information about cultural resources and traditionally associated peoples;
- planning to ensure that management processes for making decisions and setting priorities integrate information about cultural resources and provide for consultation and collaboration with outside entities; and

- stewardship to ensure that cultural resources are preserved and protected, receive appropriate treatments (including maintenance) to achieve desired conditions, and are made available for public understanding and enjoyment.

5.2 Planning

Effective park stewardship requires informed decision-making about a park's cultural resources. This is best accomplished through a comprehensive planning process. Effective planning is based on an understanding of what a park's cultural resources are and why those resources are significant. To gain this understanding, the Service must obtain baseline data on the nature and types of cultural resources, and their (1) distribution; (2) condition; (3) significance; and (4) local, regional, and national contexts. Cultural resource planning, and the resource evaluation process that is part of it, will include consultation with cultural resource professionals and scholars having relevant expertise; traditionally associated peoples; and other groups and individuals. Current scholarship and needs for research are considered in this process, along with the park's legislative history and other relevant information.

5.3.1 Protection and Preservation of Cultural Resources

The National Park Service will employ the most effective concepts, techniques, and equipment to protect cultural resources against theft, fire, vandalism, overuse, deterioration, environmental impacts, and other threats without compromising the integrity of the resources.