NPS Ecosystem Restoration Program
Site Management Guidelines
VERSION 2.1 2004
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§ I. Introduction

NPS Managers are faced with a variety of ecosystem management challenges. Even in small parks, besides air pollution, visitor impacts, and road contractors as everyday issues, they must also find time to address old dump sites, new alien species and eroded hillsides left by former tenants. At the park and national levels, NPS needs to "get a handle" on the volume and range of degraded natural resources before it can develop appropriate strategies to remedy them. Managers also have to deal with the fact that much of their work is a restoration action of one form or another. This requires coordination of Fire Management and Weed Control, programs that are sufficiently funded with centralized organization, with other restoration efforts, such as site assessment and revegetation, which are addressed on a case-by-case basis. Parks are in the process of developing new information/databases through Inventory and Monitoring, and will also benefit from information generated by new programs in watershed assessment and fire condition assessment. These provide information a park, or broader scales and reflect dynamics processes or resources that more in and out of parks. Yet, many of our approaches to degraded resources are reflected at the "site" level. This is where we "see" degradation and can devise management approaches within defined geographic space. These guidelines are aimed at providing managers initial frameworks to address site conditions with broader watershed and landscape assessments and dynamic resources. It also addresses:

- Types of degraded resources
- Assessment of the level of degradation
- Checklists for activities
- Integration of weed control, and other programs into natural resource restoration
- Identification of stabilization and maintanence strategies that complement restoration
- Roles, responsibilities, partnering opportunities
- Prioritization for site level work
- Integration of site work to landscape and watershed scales

This document will be developed by using existing NPS guidance, specifically RM-77 Disturbed Lands. The Disturbed Lands Program has focused on road and dam removal, mines, and landform repair. This effort seeks to expand NPS ecological restoration to an integrated program that incorporates the broader range of stressors and degraded ecological and biological resources.

The handbook (at this time) does not address long-term, insidious disturbances such as air pollutants, climate change, etc. But the identification of resources degraded in whole or part by this type of disturbance should be forwarded to NRPC staff for assistance in developing a landscape approach to planning, partnerships and work. These guidelines are not intended to address the level of detail of Best Management Practices. This will be

a "living" document in that it will be updated and will add links to pertinent detailed tools or best management practices as they are identified or developed. In fact, the NRPC Ecosystem Restoration Program is working with the NRPC Watershed Assessment Program and interagency efforts on landscape scale fire assessments. This will eventually provide data we expect to be able to fully incorporate into site assessments, saving parks resources on individual surveys.

§ II. Principles

A. Resources interact at various levels.
Resource managers need to tailor restoration actions to the degree of degradation, and the park's intention / time frame to actively restore a site fully. In appropriate situations, ecological hierarchy issues related to the site objectives should be addressed; the degree to which is contingent on the temporal goal of the effort (these "stabilization" efforts may in fact be appropriate for long–term restoration):

Genotypes	Are organisms, including seed, of the appropriate genetic stock? Any knowledge of rare (G1 & G2) or T&E species in the vicinity of the site should be given additional consideration.
Populations	Are dispersers likely to use disturbed site? Did alien species negatively affect soil biota?
Communities	Are species replaced in a spatial arrangement consistent with site physical characteristics?
Ecosystems	Are soil conditions satisfactory to support nutrient cycles?
Landscapes	How will potential of major events such as fire, or lack of landscape scale processes affect restoration objectives?

This is the driving concept behind failures in single-species management, and why weed control efforts must look beyond control of weed species themselves.

B. Sites that have crossed thresholds require significant work.
NPS restoration programs should consider threshold and scale analysis in site assessment and DFC development. A threshold can be seen as the minimum level or value of a stimulus necessary to elicit a response. For park resources, levels of stimulus can be seen as stressors on a resource, and the response being the negative change in the resource. Once a threshold is crossed, the resource cannot recover to its original condition without assistance, in the form of active site work. As an example, as *Bromus tectorum* (cheatgrass) numbers increase in a native bunchgrass system they finally reach a stimulus level of increased soil carbon and nitrogen and alteration of historic fire frequency and severity. The system shifts across the threshold to a state of near-monoculture cheatgrass, and this state persists through positive feedback mechanisms in the species interactions with fire. Indicators that a resource that has crossed a threshold are low population numbers of a population, lack of inocula for populations (seeds, root fragments, pollinators), lack of representative successional stages in a landscape, significant loss of habitat, significant fragmentation of habitat, loss of upper soil layers, head cuts, stream widening, and significant shift in soil chemical, physical or biological properties.

The threshold concept reinforces the need to not only replace missing / damaged resources but recognizes the supporting conditions and processes of these resources. It is also a method to determine the limits of restoration actions. A resource may have

crossed more than one threshold to altered states, making a direct restoration to a historic condition, or state, unfeasible.

C. Scale assessment works to integrate site assessment into a broader assessment of a resource.
While assessments may be often directed at geographic sites, with discrete boundaries, causes of degradation and restoration solutions need to be evaluated at broader spatial and temporal scales. A park site that is habitat for a migratory songbird may be restored, but the songbird population may have crossed a threshold and is in decline because its total amount of habitat across its range is too low. The site should still be restored, but it will be inappropriate to use the songbird as the indicator of site restoration needs. The bird would be an appropriate indicator of landscape partnership success.

D. Restoration as the removal of barriers to site recovery
NPS should follow a standard sequence of actions when addressing a degraded resource. First, remove the agent that degrades the site. The next action is to remove the barriers that prevent the passive recovery of the resource. The actions that accomplish this are restoration actions.

Sites with only disturbance to vegetation and mild disturbance to soils ("roughed-up" by foot traffic, etc) and that are in proximity to plant inocula (adults, dispersal distance, seed bank, vegetative spread) are less likely to require seeding. As the area of disturbance increase, of degree of soil disturbance increases (machine compaction, erosion, etc) the need for mechanically treating the ground and adding native plant material increases.

E. Identification of the degrading agent may not acknowledge cumulative and indirect effects
Refer to RM 77 and elsewhere

F. Other Practical Matters "Parking Lot 1"

An intact, healthy, functioning ecosystem, unfortunately, is not a guarantee that the site will be free of alien species. Restoration work of "undisturbed" sites comes down to long-term commitments to prevent and control infestations. Here, it is appropriate to set species control priorities and density thresholds of various species for control.

Managers should not assume that any one project or species effort will be too expensive. It is much better to cost out projects so park, region and national staff can understand the resources required for us to do our job of preserving park resources.

INVENTORY

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PRELIMINARY "PARK" ASSESSMENT

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CATEGORIZATION & RESPONSE BY SITE CLASSIFICATION KEY

As inventory and assessments are conducted and certainly once it is concluded, identifying site types will assist the direction of various programs for initial and long-term actions.

1a. Site has no apparent anthropogenic disturbance to soils, landforms or vegetation Native plants are present and community patterns are within natural range of variation (NRV). Disturbance to vegetation is from natural pest outbreak, drought, wind, etc.
Site Class: NRV
Action: Monitoring

1b. Site has apparent disturbance to soils, landforms of vegetation **(Go to 2)**

2a. Vegetation (structure &/or composition) is altered; soil, landforms, hydrologic conditions not altered. **(Go to 3)**

2b. Site landforms, hydrologic conditions &/or soil altered **(Go to 5)**

3a. Site vegetation altered through uncharacteristic succession &/or uncharacteristic invasions by species within their native range
Site Class: Uncharacteristic Seral stage
Action: Evaluate for excluded ecosystem processes (eg., fire or grazing) or excessive application of processes (eg., herbivory)

3b. Site vegetation altered through invasion of alien species **(Go to 4)**

4a. Alien species not known to alter ecosystem properties, or control techniques are documented and native regeneration likely with control.
Site Class: Alien Invasion
Action: Set thresholds for weed control; monitoring; routine weed control

4b. Alien species known to, or suspected to alter ecosystem (particularly soil chemistry) properties
Site Class: Alien alteration of soil
Action: Set thresholds for action; weed control; stabilization native revegetation; restoration planning

5a. Newly opened areas as a result of natural disturbance – landslides, avalanches, floods, fire, hurricanes, windstorms, icestorms, etc.
Site Class: Natural Disturbance
Action: Set thresholds for weed control; monitoring; routine weed control; conservation of rare elements

5b. Site is disturbed through current or past management **(Go to 6)**

6a. Site is frequently and routinely disturbed. Examples are roadside maintenance, areas of foot and vehicular traffic, parking areas, cultural plantings, WUI fuel reduction or right-of-way zones.
Site Class: Active Management

Action: Adjust maintenance regime to promote native species; Set thresholds for weed control; monitoring; routine weed control; reclamation planting where useful.

6b. Site is disturbed be a discrete event that may re-occur, but is not intentionally routine. Examples are fires outside of the NRV, mines, hazardous and other waste releases, channel diversions, fill, excavations, building sites, ditches, headcuts, burned area rehab treatments, historic plantings not maintained as a cultural resource, hazard fuel treatments. **(Go to 7)**

7a. Site is actively degrading (primarily via erosion)
Site Class: Active Disturbed
Action: Stabilize for erosion control and for weed invasion **(Go to 7b)**

7b. Site is not actively degrading
Site Class: Stable Disturbed
Action: Restoration planning **(Go to 8)**

8a. Site conditions and processes are independent of landscape processes or landscape processes intact
Site Class: Landscape Independent
Action: Proceed with previously described site actions or planning

8b. Site conditions and processes are related to landscape processes and landscape processes are absent or significantly altered in terms of frequency and severity.
Site Class: Excluded process
Action: Model role of landscape process in restoration and persistence of site resources; establish partnerships to address landscape needs and integrate into site actions and planning.

NOTES –

1a. Historic grazing or logging, etc may have taken place, but native communities have recovered. Landscape processes are assumed to be present. If not, an altered desired condition of native vegetation may need to be determined until landscape processes can be restored. Assumes park has a vegetation management plan.

1b. "apparent disturbance" can be determined for most sites by lack of native vegetation, distinctly different soil color or texture, presence of gravel, paving, greater amounts of bare soil, pedestals, etc compared to reference sites. Disturbance indicators are listed and more thoroughly addressed in the Disturbed Lands Inventory and Assessment SOPs. While site assessments are helpful, first steps should include discussions with facilities and other staff on management history of the park.

3a. Are there native species that need to be replaced? Do they represent a functional group, or significant area of community density? This would raise likelihood that this would be an appropriate measure to undertake.

4a. Will addition of more native plants to the site make a difference in natives outcompeting weeds? Overseeding is a strategy that is used successfully in difficult environments, and could be considered on a trial basis.

4b. How are weeds successful? Are they more efficient at resource (including space) use? Do they alter biogeochemical and other ecosystem properties to establish positive feedback loops to support their spread into an "intact" ecosystem? An understanding of the basic biology of the alien species is key to understanding the ability to control it through restoration.

5a. Care should be taken to determine that the source of the symptoms is not actually driven by some other anthropogenic activity (landslides could be natural or caused by historic mining). Also, some of these natural processes are frequent, and provide equally frequent opportunity to be invaded by alien species. In this case, weed control will need to be prioritized based on conservation objectives such as protection of rare species, access, likelihood of spread, etc. Weed control programs may choose to not do control in isolated, frequently disturbed areas such as avalanche zones, but given the frequent nature of disturbance in these areas, they may have high conservation value reflected by rare species/communities. These resources must be considered a priority for conservation.

8b. Presently, NPS is experiencing decline in species due to alien pests such as Chestnut blight, Hemlock wooly adelgid, and Sudden Oak Death. While site mitigation strategies can be developed for environmental protection and replacement species, NPS should adopt range-wide strategies for an appropriate NPS role in prevention, mitigation, and restoration of such species. Park-by-park responses absent a broader strategy with partner organizations will be ineffective and inefficient.

PRIORITIZATION OF RESTORATION ACTIONS

Currently, restoration strategies within NPS are park-based and site, or project-based. Project selection is more opportunistic than strategic, but park and national Restoration Program development will emphasize the following prioritization for addressing degraded/disturbed sites or resources:

- Remove or minimize anthropogenic disturbances / agents of degradation / sources of alien dispersal

- Rare, threatened and endangered species and biological communities

- Triage Strategies
    - Restore or stabilize sites that are actively degrading and at risk of shifting across thresholds to undesirable states; or where biological and chemical contaminants are moving or are likely to move off-site into unaffected areas.
    - Site restoration where landscape processes are intact
    - Site restoration that is integrated with landscape process restoration

It is better to stratify prioritization by type of response. The Site Type Key identifies different responses, and a park manager can identify and prioritize work this way. For example, heavily disturbed sites that are still degrading, and present a problem as a weed source area in the park, weed specialists should work with resources managers to prescribe a native species cover that "stabilizes" the site from subsequent weed establishment. This preferably reflects an early seral stage of pre-disturbance

communities that can also be easily manipulated to achieve full site restoration. Roadside areas that require frequent weed control can be a priority for adaptive maintanence regime work. If a "biological contaminant" (aka: alien species) source cannot be contained off-site, and other restoration work commences on-site, continued weed control must be incorporated into all subsequent site management.

Other park values can also be addressed at the discretion of the Park manager. This approach to prioritization is presented to put greater emphasis on reducing the potential for cumulative effects and greater expense once resources or sites are addressed.

Costs
Costs are not considered in this prioritization. To evaluate the role of costs in prioritization would require a valuation of specific resources and a thorough understanding of connectivity of the resource in question with other resources. It is better to focus on the role of costs when conducting threshold analysis or alternative analysis in restoration planning. This would be based on the establishment of clear objectives for the condition of the park resource. Part of this consideration is that efforts to fund less expensive, but piecemeal projects often fail, and end up costing more than it would have initially. The National Park Service aims to make all degraded resources whole. The NPS Mission directs nothing less, and gives other land management agencies a benchmark against which to evaluate their ecological restoration activities in a multiple use context.

CHARACTERIZATION

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RESTORATION PLANNING

DFCS, RESTORATION OBJECTIVES AND PERFORMANCE MEASURES

More detailed guidelines for developing DFCs is forthcoming in 2005. See
Developing Objectives in RM77 Disturbed Lands
Desired Future Behavior, too!
Also, we need to work in projections of resource response to air pollutants, climate change, etc.

CONTRACTOR SPECS –

GENETIC CONSIDERATIONS

CULTURAL LANDSCAPES

GLOSSARY

Reference Condition: In the absence of detailed pre-disturbance data on the site in question, a site that is used as a standard for setting measurable objectives and evaluating success of a project. Reference conditions include sites with similar conditions that have not been degraded, or could be a generalized ecosystem distilled from information on similar systems in the same ecoregion.

Reclamation planting: Planting of a designed species mix with focus on erosion control/weed competition. More emphasis on function than biodiversity. Can include alien species if they are non-invasive, and there are long-term plans to replace them with native species.

Restoration Planning: Full scale investigations to evaluate soil conditions, native species material development and placement, geomorphology and hydrology alteration, landscape processes, barriers to recovery, restoration strategy development, methodological alternative development, etc.

Natural Range of Variability (NRV):
How some measurable parameter varies over time - ie how we would expect it to vary - without human influence. There is no set time period and the range for any parameter should be evaluated on a resource–by-resource basis. Examples include population size, distribution of metapopulations, species abundance in a community, species range, genetic variability, seral stage of a community, seed set, disturbance regime, and migration pathways.
It recognizes that complex systems, including ecosystems, have a range within they are self-sustaining and beyond which they move into a state of disequilibrium (Egan and Howell)

Desired Future Condition (DFC): Specific management targets for the characteristics of natural resources, cultural resources, and visitor experiences. DFC's establish the standards by which current conditions are assessed, and they provide a framework for identifying management actions and the desired outcomes of that management. The desired characteristics for a natural resource reflects its i) current and historic condition, ii) current ecological context (e.g., climate, neighboring land use), iii) dynamic nature, and iv) those processes (such as natural disturbances) that are required to sustain the desired condition of the resource. This results in a dynamic range of states that are acceptable as the DFC for the resource. These may be specified at any level of ecological organization (e.g., landscapes, ecosystems, or populations), and should consider issues of interaction among these levels, and spatial and temporal scale.

Desired Future Condition (DFC) statements can be qualitative for the purposes of general plans, such as the GMP, or when there is insufficient information to develop a quantitative statement. FMPs and RSPs should have quantitative DFC statements. Planning can include management actions that take incremental steps towards achieving DFCs.

Disturbance: Any physical effect on the site that results in reorganization or resources or A disturbance is a relatively discrete event in time and space that alters the structure of populations, communities, and ecosystems. It can do so by altering the density, the biomass, or the spatial distribution of the biota, by affecting the availability and distribution of resources and substrate, or by otherwise altering the physical environment. It often results in the creation of patches and the modification of spatial heterogeneity. Disturbance is a relative term that requires explicit delineation of the system of concern, including the spatial and temporal scale of the components of interest.