NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

RESTORATION AND MANAGEMENT OF NATURAL ECOSYSTEMS

(Acre)
CODE 766

DEFINITION

Restoring and maintaining the physical, chemical, and biological conditions necessary to allow natural ecosystems to function and evolve over time. This practice includes site and landscape manipulations designed to mimic or replace lost ecosystem structure or function (e.g. controlled burning of fire maintained communities).

PURPOSE

General Purpose

- Restore ecosystems degraded by human activity
- Increase the level of ecosystem function beneficial to humans such as fish and wildlife habitat, recreational opportunity, water quality improvement, and landscape aesthetic quality.
- Improve the ecological health of connected ecosystems within a geographic area.
- Reduce habitat fragmentation.
- Improve the chances for long term human survival through a sustaining environment.
- Reduce the adverse effects of anthropogenic climate change (e.g. global warming).

Ecosystem Specific Purposes

a. Aquatic Ecosystems

- Restore water bodies and watercourses.
- Improve aquatic habitats for fish and wildlife.
- Provide fish passage.

b. Beaver Dominated Wetlands and Uplands

- Restore a natural, long term, cycle of fluctuating water levels.
- Provide a variety of important plant and animal habitats over time including, open water, emergent wetlands, mud flats, sedge meadows, scrub/shrub wetlands, forested wetlands, and uplands, and, standing dead timber in water.
- Improve downstream water quality.

c. Early Successional Ecosystems

- Restore early seral stage forests, “grasslands”, old fields, and other disturbance regimes lost because of fire suppression and other human activity.

d. Fresh Water Wetlands

- Restore all types of freshwater wetlands
- Increase biodiversity

e. Mesic Forests

- Restore a diversity of forest successional stages in a given area including early successional and climax forests.
- Restore long term ecological cycles interrupted by timber harvest and land clearing.

f. Riparian Forests

- Restore a highly productive and diverse ecosystem, which has been severely degraded by agriculture and development.
- Protect water quality by attenuating pollutants, such as excess sediment and nutrients, in surface and ground water.
- Provide natural levels of energy and nutrients to streams and rivers in the form of leaves and woody debris.
- Reduce stream bank erosion to natural levels through the stabilizing effects of tree roots.
- Reduce stream temperature to natural levels by shading.
- Restore the natural habitat linking function of riparian corridors.
- Improve aesthetic quality of riparian areas.

g. Saline Vegetated Tidal Marshes (Salt Marshes)

- Restore tidal flow to degraded salt marshes.
- Allow access to marsh for fish, which travel between fresh and salt water during their life cycles.
- Restore characteristic salt marsh plant community.

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- Provide wildlife habitat, especially for highly adapted species (e.g. seaside sparrow *Ammospiza maritima*).
- Restore an important visual component of the Massachusetts Coastal Area.
- Reduce mosquito populations.

h. Xeric Forests (Pine Barrens)

- Restore habitat for rare moths and butterflies.
- Restore an important visual component of the Massachusetts Forests.
- Restore a forest community drastically reduced by mining and urban development.

CONDITIONS WHERE THIS PRACTICE APPLIES

This practice applies to any degraded ecosystem where the environmental benefits of restoration outweigh the costs.

CRITERIA

General Criteria

- Ideally, ecosystem restoration is the establishment of the physical, chemical, and biological conditions necessary for developing and maintaining the biotic and abiotic components of the target ecosystem. At a minimum, restoration is the significant improvement in at least one of these conditions such that there is a measurable improvement in ecosystem structure and function. For example, increasing tidal flow to a salt marsh or the controlled burning of a Pine Barrens.
- The level of detail of the planning process will be commensurate with the magnitude of the project. It is intended that the restoration plan and documentation described below will be incorporated into the conservation plan and planning notes.
- A restoration plan and supporting data will be developed which will document all information necessary for a successful restoration. The restoration plan will include where necessary such things as:
  - ◊ The ecological history (how the ecosystem developed over time in response to changing climatic, edaphic, biological, and social forces) of the restoration site and surrounding landscape to the extent necessary to successfully restore the target ecosystem,
  - ◊ Baseline conditions,
  - ◊ The anthropogenic stressors that have degraded or destroyed the target ecosystem and the practices which will be used to relieve the stressors,
  - ◊ Any special studies (e.g. flood studies, plant inventories cultural resource inventories, etc),
  - ◊ Monitoring plans.
- Protect important ecosystems that might be damaged during restoration. For example, a vernal pool on the site.
- Evaluate how the target ecosystem will change over time in response to climatic, edaphic, hydrologic, and other natural phenomena and how these changes will affect the restoration.
- Evaluate the potential impacts of restoration on all mandated “red flag features” such as endangered species, cultural resources etc.
- The restoration will be designed to be as self-sustaining as practical. For example, natural flooding is preferable to pumping.
- In those situations where necessary natural processes (e.g. wildfire) no longer take place, appropriate alternatives which mimic those processes or their outcome (e.g. prescribed burning) will be adopted.
- Fire management will be carried out only by properly trained personnel and all necessary permits will be obtained.
- Livestock will be excluded from the site except where grazing is used as a restoration practice.
- Invasive plant species will be controlled to the extent practical by methods documented to be effective in the scientific literature. All necessary permits for the application of herbicides will be obtained and herbicides will be applied only by qualified people.
- Natural revegetation by native plants is preferred, but care will be taken to control invasive species and cultivars of native plants that have invasive tendencies.
- The cutting or removal of vegetation, snags or fallen debris will ordinarily not be allowed, except where it is done as a restoration technique (e.g. site preparation or to control of invasive species).

- Protect restored ecosystems to the extent possible from nutrients and other pollutants in surface and ground water.
- Control erosion and sedimentation during practice installation and maintenance.
- All necessary permits will be the responsibility of the land user.
- Any approved NRCS practice may be used if it is necessary to achieve the restoration goals (e.g. sediment basin to protect a restored aquatic ecosystem).

Ecosystem Specific Criteria

a. Aquatic Ecosystems

- Restoration sites will be in watercourses and water bodies degraded by human activity such as dam and dock construction, pollution, water withdrawal, and channelization.
- Fish ladders will be designed for a specific site by a qualified engineer.
- Other applicable practices include: STRUCTURE FOR WATER CONTROL (587), RIPARIAN FORESTED BUFFER (391), STREAM CHANNEL STABILIZATION (584), STREAMBANK AND SHORELINE PROTECTION (580), FENCING (382), PEST MANAGEMENT (595), SEDIMENT BASIN (350).

b. Beaver Dominated Wetlands and Uplands

- Restoration sites will be in areas that can reasonably be assumed to have beaver in the past. Sites with high value ecosystems that would be damaged by beaver activity (e.g. bogs) will be evaluated on a case by case basis and avoided or protected by measures designed for that purpose.
- It is expected that over the long term, beaver populations will fluctuate in response to food supply, predation, disease, etc. During periods when beavers are absent, natural reforestation will be allowed to take place. Tree planting is allowed for wildlife purposes such as planting white pines to provide future nesting sites for Great Blue Heron (*Ardea hernias*). ***Tree planting should occur on Hummock soils in wetlands.***
- The potential flood hazard of beaver activity will be analyzed using techniques commensurate with the complexity of the project and the severity of potential flooding.
- Surface water elevations will be left to the control of beavers where possible. Where water levels must be controlled to prevent flooding or other reasons, control measures such as beaver pipes will be installed and maintained.
- Other applicable practices include: STRUCTURE FOR WATER CONTROL (587), RIPARIAN FORESTED BUFFER (391), STREAM CHANNEL STABILIZATION (584), STREAMBANK AND SHORELINE PROTECTION (580), FENCING (382), PEST MANAGEMENT (595), SEDIMENT BASIN (350).

c. Early Successional Ecosystems

- At a minimum, areas maintained in early succession herbaceous/grassland will be limed and fertilized according to a soil test and mowed annually after August 1. Such areas will be retested and amended at five-year intervals for the life of the management plan up to and including the last year of the planned period.
- Reseeding of herbaceous/grassland will be in a prepared seedbed. Seeding mixes will be formulated case by case based on site characteristics and project objectives.
- Trees and other vegetation cut as part of a management strategy for maintaining early successional habitats will be left on site. Bush piling and windrowing is allowed when necessary to maintain particular habitats (e.g. grassland).
- Areas maintained as shrubland will be manipulated as necessary to favor desired species. Planting of native shrubs is allowed.
- Other applicable practices include: FENCING (382), PEST MANAGEMENT (595).

d. Fresh Water Wetlands

- Restoration will be on hydric or formerly hydric soils.
- The plant community restored will approximate as closely as practical a recognized plant community appropriate to the site.

e. Mesic Forests

- Restoration sites will be on well drained and moderately drained soils.
- The plant community restored will approximate as closely as practical a recognized forest type (e.g. Northern Hardwoods) appropriate to the site. Other applicable practices include STREAMBANK

AND SHORELINE PROTECTION (580), FENCING (382), PEST MANAGEMENT (595).

f. Riparian Forests

- Restoration will be on all soil series bordering wetlands, water courses and water bodies.
- Minimum width of restoration will be the lessor of 10 times the width of water course or water body or 100 feet.
- The plant community will be restored to approximate as closely as possible a natural riparian community appropriate for the site.
- Other applicable practices include: RIPARIAN FORESTED BUFFER (391), STREAM CHANNEL STABILIZATION (584), STREAMBANK AND SHORELINE PROTECTION (580), FENCING (382), PIPELINE (516), TROUGH OR TANK (614).

g. Saline Vegetated Tidal Marshes (Salt Marshes)

- Tidal flow will be restored to approximate natural conditions as closely as possible.
- Culverts and ditches installed to restore tidal flow will meet NRCS standard for STRUCTURE FOR WATER CONTROL (587).
- Appropriate flood hazard studies will be made to insure that restoration does not increase the risk of flooding. If necessary, flood control measures such as self-regulating tide gates, protective dikes, and flood proofing will be installed as part of the restoration.
- Other applicable practices include STRUCTURE FOR WATER CONTROL (587), RIPARIAN FORESTED BUFFER (391), STREAM BANK AND SHORELINE PROTECTION (580), STREAM CHANNEL STABILIZATION (584), STREAMBANK AND SHORELINE PROTECTION (580), FENCING (382), PEST MANAGEMENT (595).

h. Xeric Forests (Pine Barrens)

- Restoration sites will be on substrates of excessively drained sand such as abandoned sand and gravel mines, or outwash soils.
- The plant community will be restored to approximate as closely as possible a recognized Pine Barrens type (e.g. Pitch Pine-Scrub Oak Forest/Woodland).
- Area will be managed as a disturbance climax community by the application of management techniques which mimic natural processes or outcomes (e.g. prescribed burning).
- Other applicable practices include: RIPARIAN FORESTED BUFFER (391), STREAM BANK AND SHORELINE PROTECTION (580), FENCING (382), PEST MANAGEMENT (595).

CONSIDERATIONS

General Considerations

- Ecosystems are complex; their parts are connected in many ways that we do not fully understand. Be vigilant so that unexpected consequences can be detected early and corrected.
- Consider that humans are now an integral part of most ecosystems. Ecological restoration does not necessarily mean removing people from the scene, rather it means reducing as much as practical the stress that humans cause on natural ecosystems.
- Consider that our knowledge of ecosystems is incomplete but we must use the best available information when restoring ecosystems.
- Consider using a flexible management approach so that changes can be made and management strategies altered based on experience.
- Consider the existing habitat value of the site prior to restoration

Ecosystem Specific Considerations

a. Aquatic Ecosystems

- Consider the social implications of dam removal (e.g. loss of ice skating ponds etc.)
- Consider the habitat value of impounded water.

b. Beaver Dominated Wetlands and uplands

- Consider the social impacts of beaver activity (e.g. the perception that beavers are a nuisance).

c. Early Successional Ecosystems

- Consider the potential for habitat fragmentation caused by permanent early successional habitats.

d. Fresh Water Wetlands

- Consider social impacts of the loss of agricultural land.

e. Mesic Forests

- Consider the loss of forest products.

f. Riparian Forests

- Consider the potential loss of agricultural land.

g. Vegetated Saline Tidal Marshes (Salt Marshes)

- Consider the social implications of restoration and non-restoration. For example, consider the increased mosquito populations in degraded marshes, potential for induced flooding of restoration and non-restoration).

h. Xeric Forests (Pine Barrens)

- Consider the potential of the site for white pine, a commercially valuable species.
- Consider the potential impacts of future mining.

PLANS AND SPECIFICATIONS

Plans and Specifications for restoration shall be in keeping with the requirements for applying this practice to achieve its intended purpose and shall be recorded using approved specification sheets, job sheets, narrative statements in the conservation plan, or other acceptable documentation. Wetland permits were needed will be secured before restoration activities begin.

OPERATION AND MAINTENANCE

The purpose of operation, maintenance, and management is to insure that the ecosystem functions in a sustainable way over time.

Management actions should mimic the actions or outcomes of natural processes.

REFERENCES

Hacker, Donald, Sherri Evans, Marc Evans and Kay Harker. 1993. *Landscape Restoration Handbook.* Lewis Publishers, Boca Raton, FL.