NATURAL RESOURCES CONSERVATION SERVICE
SPECIFICATION GUIDE

RESTORATION AND MANAGEMENT OF DECLINING HABITATS (Code 643)

GENERAL SPECIFICATIONS

Plans and specifications for declining habitat restoration and management shall be prepared for each site or management unit according to the USDA, NRCS-MA Conservation Practice Standard No. 643, Criteria, Considerations, and Operation and Maintenance. They shall be recorded on specification sheets or job sheets.

HABTITAT TYPES

Oak Dominated Forests

Description

In much of the eastern United States, overstory oak tree species are not regenerating successfully on sites with moderately well drained (MWD) to somewhat poorly drained (SPD) soils (i.e., mesic) and are being replaced by various hardwood tree species that are more shade tolerant and less fire adapted, such as red maple and black birch, neither of which produce the oaks' hard mast, which is of great value to many species of wildlife. The decline of oak dominated forest habitat in the eastern United States has been attributed to the following changes:

Human Induced

- Practice of fire suppression and elimination of periodic burning
- Forest management practices inconsistent with the regeneration of oak

Environmental

- Gypsy moth defoliation
- Heavy deer browsing

Importance

Oak dominated forests, and the acorns they produce, play a key role in the distribution, abundance and behavior of a variety of wildlife species such as blue jays, wild turkey, white-tailed deer, mice, chipmunks, squirrels and black bears. However, the replacement of oak dominated forests by soft or non-mast producing forest communities could affect wildlife species that are not typically associated with acorn consumption. For example, preliminary research suggests that in forest stands dominated by red maple, the forest bird community was less abundant in both total numbers and species. This could be due to the differences in the physical traits between oaks and maples, including but not limited to leaf and petiole size, bark characteristics and decomposition rates of leaves. The larger leaved maples appear to negatively impact the foraging ability of some birds. Maple leaves decompose more quickly than oak leaves resulting in less insect sources available for species that forage among the forest floor, and the smoother barked maples provide less surface area for foraging and reduced numbers of insects.

Oak Biology

Seed Production and Dispersal

Oaks produce small acorn crops yearly and bumper acorn crops at various intervals depending on the species (see Table 1). In addition, acorn production is highly variable among individual oak trees.

Acorn development by oaks within the red oak group requires 2 growing years during which time insects, winter ice storms and other environmental factors may effect the development of the acorns. Acorn production in the white oak group requires only 1 year, however, crop size is strongly affected by the temperature at the time of flowering.

Acorns are typically dispersed by blue jays and small mammals such as squirrels and mice. It is estimated that only 1 percent of acorns are available for germination due to predation and damage by birds, mammals and insects.

Seedling Development

Acorn germination differs between the red oak and white oak groups (see Table 1). Oak seedlings spend their initial growth developing extensive tap roots which allow them to withstand periods of drought and to re-sprout following dieback, browsing or other factors that remove the above ground portion of the plant.

Light Requirements

Oak is considered mid-tolerant to shade; therefore controlling the light levels in the forest is a key factor in regenerating and growing oak. Oak seedlings require sunlight to germinate and grow; however, they can not compete successfully in open sunlight conditions with shade intolerant species such as aspen, grey birch and pin cherry. Also, because they require greater light conditions than many of their shade tolerant associates in the forest (e.g., red maple, beech, hemlock) oak seedlings are unable to successfully compete with these species in a dense understory.

Site Requirements

The various oak species have differing site requirements (see Table 1). In general, oaks growing on well drained (WD) to excessively well drained (EWD) soils (i.e., xeric sites) are better able to compete with other mesophytic hardwoods such as red maple.

Stump Sprouting Ability

Oak readily re-sprouts when cut and this trait can be a significant contributor to the stocking of the next stand. However, as age and stump diameter increase, sprouting ability decreases. Red, scarlet and chestnut oak stumps sprout more readily than white and black oaks.

Table 1. Oak Biology

	Species	Average age for seed production	Bumper acorn crop intervals	Seedling Development	Site Requirements
White Oak Group	White Oak *(Quercus alba)*	After 50 yrs.	Every 4 to 10 yrs	Germination begins almost immediately after seed fall. For best germination, acorns require a light to moderate litter layer and an period of warm temperatures following seedfall	Grows best on middle and upper slopes w/ average soil quality; can tolerate all but the driest and wettest sites
	Chestnut Oak *(Quercus prinus)*	After 20 yrs.	Every 4 to 5 yrs		Most commonly found on ridgetops and upper slopes; tolerates shallow and/or WD or EWD soils
Red Oak Group	Red Oak *(Quercus rubra)*	After 25 yrs.	Every 2 to 5 yrs	Germination occurs in the spring following seedfall. The best germination occurs when the acorn is in contact with, or buried in the mineral soil and covered by a thin layer of leaf litter.	Good to average quality sites common to middle to lower slopes; prefers MWD or SPD soils
	Black Oak *(Quercus velutina)*	After 20 yrs (optimum 40 to 75 yrs.)	Every 2 to 4 yrs		Good to average quality sites common to middle to lower slopes; preferring MWD or SPD soils
	Scarlet Oak *(Quercus coccinea)*	After 20 yrs. (optimum 50yrs.)	3 to 5 yrs		Grows on a wide variety of soils, can tolerate WD to EWD soils

Locations to Target

Suitable sites for oak regeneration must meet all 3 criteria below:

1. **Forest stands containing acorn producing oaks, oaks with good stump sprouting potential, and/or sufficient advanced (existing) regeneration of seedling/sapling sized oaks –** Crown size is the most important tree characteristic associated with acorn production. Dominant or co-dominate oaks with tree crowns un-crowded by other trees produce the highest acorn yields.

   Stem diameter is the most important characteristic for determining the likelihood of regenerating oaks from stump sprouts. Stumps of all oak species are most likely to sprout if the tree has a small diameter, but larger stumps that do sprout produce more sprouts and faster shoot growth.
2. **Mesic or xeric sites** - Oak grows best on deep, SPD to MWD soils with thick A horizons; however, regeneration is easier on WD to EWD soils, where the oak is subject to less competition.
3. **Deer densities less than 30 deer/square mile** - Presently, no large section of the state has deer densities greater than 30 deer per square mile; however, if the site currently exhibits excessive deer browsing signs, oak regeneration success is unlikely.

Restoration Strategies

1. **Size of cut** – Oak regeneration projects should be a minimum of 1 acre; however, projects at least 5 acres in size are most desirable.
2. **Time management activities to minimize wildlife impacts** – Whenever possible, time the management activities so that they minimally affect seasonal wildlife activities. This adjustment is especially true for threatened, endangered and special concern species.
3. **Retain coarse woody debris** – Coarse woody debris consists of sound and rotting logs and stumps and other woody material greater than 3 inches in diameter, on the forest floor. Coarse woody debris is important for nutrient cycling, as cover for insects, small animals and amphibians, and as a medium for various bacteria, fungi, lichens and mosses. It affects soil development processes, promotes soil moisture and may reduce the risk of erosion.

   The maintenance of coarse woody debris is a critical element of managing for biodiversity. Although the quantity of coarse woody debris needed in the forest is not well known, a minimum of 2 cords (256 cubic feet) per acre should be maintained.

   To preserve existing coarse woody debris, avoid having equipment disturb pre-existing large downed logs, stumps and uprooted stumps.

   When creating coarse woody debris from cut material, use the following guidelines:

   (a) large pieces are more valuable than smaller pieces – strive for logs that are a minimum of 6 inches diameter, at least 6 feet long and with bark on,

   (b) bark-on is preferred to bark-off because these pieces may decay more slowly, and

   (c) dispersed coarse woody debris is preferred over large accumulations.
4. **Retain wildlife reserve trees** – Wildlife reserve trees should be retained when possible, but should not compete with the oak regeneration by shading released individuals. Wildlife reserve trees can be left scattered throughout the regeneration project or may be left in groups or islands. Groups or islands may be more appropriate within larger regeneration projects. Groups of retained trees may be located in the vicinity of cavity trees, soft mast producing trees, valuable softwood cover, other habitat features and sensitive areas. The retention of scattered reserve trees may be easier to employ on small cuts. Choose larger, wind-firm specimens and leave 6 to 12 standing trees per acre.
5. **Preserve sensitive areas** – Management activities will be conducted so as to protect sensitive areas such as vernal pools, riparian zones, other forest associated wetlands, cultural resources and structures.

Regeneration Methods

The shelterwood method and the reserve tree method, both of which are even-aged silvicultural systems, most closely mimic the natural disturbance regime that favors oak regeneration. All management plans for natural oak regeneration should be based on these two methods and must incorporate provisions for a reliable and desirable source of seeds and/or sprouts.

1. Shelterwood

Description

The shelterwood method involves the gradual removal of the entire stand in a series of partial cuttings. Regeneration starts under the protection of the older trees and the advanced regeneration is finally released when it becomes desirable to give the new trees full use of the growing space.

If an oak dominated forest is the desired outcome, the target should be a minimum of 150 established oak stems per acre. A stem is generally considered established when it has a basal diameter of ¾ inch.

Preparatory Cut

If there are less than 50 established oak stems per acre, a preparatory cut can be done to improve the seed bearing capacity and wind-firmness of the stand. Remove up to 20% of the total stand basal area through selective removal of midstory and understory vegetation. This is best implemented by starting with the smallest diameter sub-canopy trees and moving up in size, but stopping short before opening up holes in the overstory (main canopy). This treatment should not result in direct radiation to the forest floor.

Regeneration Cut

The goals of the regeneration cut are to establish conditions that favor the germination and development of oak and other desirable seedlings. This can include such components as: creating canopy gaps which will increase light levels, removing undesirable trees from the overstory, exposing areas of mineral soil and incorporating organic matter into the soil. More than one seed cut may be required before adequate levels of advanced regeneration are obtained.

a) Ideally, this operation should occur during or immediately following a good acorn crop. If a good acorn crop does not occur within 3 years of the seed cut, the understory vegetation (e.g., shrubs and understory trees <1.5 inches DBH) should be controlled chemically and/or mechanically in order to minimize understory competition to germinating acorns when a good acorn crop occurs.
b) Harvesting equipment used during this operation can disturb the forest floor which may allow acorns to have better contact with the mineral soil thus potentially enhancing germination and protecting acorns from predators.
c) Remove 10 to 30% of the total stand basal area in order to provide optimum light conditions for oak seedling growth. The retention of the full-crowned oaks and other desirable tree species in the overstory provides the shade for the advanced regeneration.
d) Monitor the advanced regeneration and take actions necessary to control competing vegetation (see Development of Seedlings).

Development of Seedlings

This stage focuses on developing strong, healthy advance regeneration, with good root to shoot ratio and the control of unwanted vegetation by cutting, chemical treatment and/or prescribed fire. This stage generally occurs 1 to 5 years after the seed cut is conducted and continues as necessary until the overstory removal occurs.

a) To control unwanted vegetation, the use of herbicides with cutting will

yield better results than cutting alone. Cutting unwanted stems will typically lead to re-sprouting, which will result in increased shade to the oak seedlings. Herbicide treatments should be applied immediately after cutting. Selection of a product shall be based on: (1) product effectiveness, (2) non-target species impacts, (3) toxicological risks, and (4) off-site movement of chemicals. Practice standard Pest Management (595) must be followed. As required by federal law, chemicals are to be applied only for uses listed on the container label and all label directions and precautions must be followed.

b) Prescribed fire generally has a long term favorable impact on oak regeneration, due to several characteristics of oaks that allow them to tolerate fire better than other competing tree species (e.g., thick bark and the ability to re-sprout repeatedly due to a taproot). Prescribed fire can increase the dominance of oaks if it is used when the oak seedlings are well established but overwhelmed by competing vegetation. Repeated burning can be used to maintain the dominance of the oak seedlings; however, it should not be used more often than every 3 to 6 years. More frequent burning could result in mortality of oak seedlings. Practice standard Prescribed Burning (338) must be followed.

Overstory Removal

The timely removal of the canopy is needed for the advance regeneration to develop into mature trees. The timing of the overstory removal will depend upon the growth rate of the oak seedlings.

a) Conduct the overstory removal operation when the oak stems are at least 4.5 feet tall and less than 4 inches DBH. The more intense the competition is expected to be upon release, the larger the seedlings should be.

b) The overstory removal can occur in one or more separate harvest operations.

2. Reserve Tree

Description

In this method the stand is cut clear except for certain trees, called seed trees, which are left standing singly or in groups for the purpose of providing seed to restock the cleared area. Only a small portion of the original stand is left. After a new crop is established these seed trees may be removed in a second cutting or left standing indefinitely. The implementation of this silvicultural method creates light conditions that are somewhere between a clearcut and a shelterwood cut.

Treatment

All trees in the stand, with the exception of large, acorn producing oaks and other desirable co-dominant species should be cut. The residual trees should be the healthiest and best seed producers in the stand.

Development of Seedlings

This stage focuses on developing strong, healthy seedlings, with good root to shoot ratio and the control of unwanted vegetation by cutting, chemical treatment and/or prescribed fire. This stage generally occurs 1 to 5 years after the reserve tree cut is conducted and continues as necessary until the new oak stand matures.

a) A minimum of 150 established oak stems per acre is needed in order to successfully regenerate an oak dominated forest stand. A stem is generally considered established when it has a basal diameter of ¾ inch.

b) To control unwanted vegetation, the use of herbicides with cutting will yield better results than cutting alone. Cutting unwanted stems will

typically lead to re-sprouting, which will result in increased shade to the oak seedlings. Herbicide treatments should be applied immediately after cutting. Selection of a product shall be based on:
(1) product effectiveness,
(2) non-target species impacts,
(3) toxicological risks, and
(4) off-site movement of chemicals.
Practice standard Pest Management (595) must be followed.

c) Prescribed fire can increase the dominance of oaks if it is used when the oak seedlings are well established but overwhelmed by competing vegetation. Repeated burning can be used to maintain the dominance of the oak seedlings; however, it should not be used more often than every 3 to 6 years. More frequent burning could result in mortality of oak seedlings. Practice standard Prescribed Burning (338) must be followed.

OLD FIELD/SHRUBLAND

Description

Old field/shrubland habitat is variable but typically has a mix of forbs and shrubs along with some tree seedlings. Grasses, if present, are not dominant. It is usually a successional stage that occurs during the transition from field to forest. Some sites such as wetlands, sandy sites and ledge areas can support a relatively stable shrub cover; however, most shrub communities in the northeast are successional.

Importance

Shrubland associated birds (such as Golden Winged Warbler, Ruffed Grouse, Brown Thrasher, Eastern Towhee, Field Sparrow, White throated Sparrow and American Woodcock) are experiencing significant declines and have been identified as a suite of species that should receive a high degree of conservation attention in the northeastern United States. Shrub associated mammals (such as the New England cottontail and Bobcat) have also declined; the New England cottontail to such low numbers that it is currently a candidate for federal listing on the endangered species list.

Locations to Target

1. **Near similar habitat** – Priority should be given to sites located within ½ mile of other shrubland habitat. Because many of the shrubland dependent species will utilize other early successional woody habitats such as regenerating clear cuts and powerline right of ways, sites located within ½ mile of these habitat types should also be given priority.
2. **Forest edges** - Early successional woody habitat can be developed along field/forest edges to create an important transition zone between different habitat types. Abrupt, or "hard" edges, often have negative effects on birds due to increased rates of nest predation (by animals such as cats, skunks and raccoons) and nest parasitism (by cowbirds). These negative "edge effects" are greatest within 150 feet of the forest edge. To provide adequate habitat for shrubland associated birds, early successional woody habitat along field/forest edges should be a minimum of 150 feet wide.

Restoration/Management Strategies

1. **Shrubland size** – Priority should be given to shrubland patches at least 5 acres in size; however smaller patches may also provide some habitat value.
2. **Limit management activities during the breeding season** – The primary nesting season for most bird species in Massachusetts is from April 15 to August 1. Whenever possible, conduct restoration and management activities outside the primary nesting season.
3. **Management frequency** – To prevent succession to forest, shrubland habitat will typically require regular disturbance. To determine the disturbance interval, consider the habitat preferences of the targeted species (Table 2).

Table 2: Habitat Preferences of Shrubland Dependent Wildlife	
Species	**Habitat Preferences**
American Woodcock	Require mix of habitat, including forest openings or clearings for singing; regenerating and second growth hardwoods for nesting and dense, moist shrubby areas for feeding.
Blue-winged Warbler	Dense vegetation in the herb and shrub layers and little vegetation above 9 feet
Broad-Winged Hawk	Large blocks of forest with openings such as regenerating clear cuts
Brown Thrasher	Thickets, open woodlands with brushy undergrowth, shrubby shelterbelts
Chestnut-sided warbler	Slight to moderate herb density and low shrub density of short height
Common yellowthroat	Slight to moderate herb density and dense shrub density
Eastern Towhee	Dense shrub, small tree cover near ground and well developed litter layer; Breeds in shrub habitats, often in dry environments and open ground
Field Sparrow	Relatively early stage of old field with scattered shrubs/trees – will not readily use a site shrubs become dense
Golden-winged warbler	Typically use patches of herbs, shrubs (50% of territory) and scattered trees, plus a forested edge
Mourning Warbler	Thickets and semi-open areas with dense shrubs including regenerating clear cuts
New England cottontail	Shrub land interspersed with herbaceous vegetation
Northern Bobwhite	Mix of open and brushy areas such as cropland, pasture and wide brushy hedgerows
Prairie Warbler	Brushy second growth, dry scrub areas
Ruffed Grouse	Sapling to pole stage hardwoods interspersed with mature forest
Whip-poor-whil	Nests in dry woodlands with an open understory but forages in young brushy forests such as regenerating clear cuts
White-throated Sparrow	Coniferous and mixed forests with clearings of thick shrubby growth and other edge habitat
Willow Flycatcher	Breeds in moist shrubby areas, often with standing or running water nearby
Yellow-breasted Chat	Later stages of old field with moderate to dense shrub cover

Restoration/Management Activities

Shrubland may be developed or maintained by one or a combination of the following methods:

1. **Mechanical: including brush hogging, mulching mowers, hand cutting, chainsaw or other approved techniques.**
   - If the site is a mix of tall growing tree species and shrubs, avoid a total clearing operation in which all vegetation is cut down. Instead, selectively clear tall growing tree species, leaving behind desirable shrub species that can act as seed sources for regeneration (Table 3). This method preserves the habitat as opposed to cutting all woody vegetation. Repeat the process on a 3 – 10 year interval or as needed to manage the site for the targeted species.
   - Clusters of valuable native shrubs and small trees shall be marked for retention prior to any mechanical activities that could cause their removal.
   - Woody material cut during reclamation shall be either: (a) chipped and spread no deeper than 4 inches across the site, (b) removed from site, or (c) used to make brush piles. No slash shall be placed within 50 feet of any drainage course or wetland.

2. **Planting** – Planting may be appropriate to enhance existing shrubland habitat; however, because it is typically not cost-effective, it should generally not be used to create shrubland where none currently exists. Select plant species that are native and favor berry producing shrubs. Practice standard Tree/Shrub Establishment (612) must be followed.
3. **Prescribed Burning -** Burning may be used to manage the plant community but should be restricted to sites that are dominated by fire tolerant vegetation such as scrub oak. Practice standard Prescribed Burning (338) must be followed.
4. **Chemical** - Herbicides may be used to control tall growing tree species and invasive plant species. When using chemicals to control tall growing tree species, focus on trees greater than 3-4 inches dbh or apply treatment when the tree coverage exceeds 5-10 percent. Application techniques can include cut-stem treatment, basal bark application or stem-injection. Careful planning and application are required when using chemicals to improve existing habitat. Selection of a product shall be based on: (a) product effectiveness, (b) non-target species impacts, (c) toxicological risks, and (d) off-site movement of chemicals.
5. **Invasive Exotic Plants** - If non-native invasive plant species are present in an area, they must be controlled. In general, if the site is easily traversed, it's better to treat the invasive species before a management cut occurs. If the vegetation is too dense to walk through, it is probably better to do the management cut and treat the invasive species re-sprouts at a later time. Practice standard Pest Management (595) must be followed.

Table 3: Example of plants to selectively favor when creating shrubland habitat

Common Name	Latin Name
Alder	*Alnus sp.*
Apple, Pear	*Pyrus sp.*
Arrow-wood, Nannyberry, etc	*Viburnum sp.*
Blackberry, raspberry, dewberry, etc.	*Rubus sp.*
Blueberry	*Vaccinium sp.*
Chokecherry	*Prunus sp.*
Dogwood	*Cornus sp.*
Elderberry	*Sambucus sp.*
Greenbrier	*Smilax sp.*
Hazelnut	*Corylus sp.*
Meadowsweet	*Spirea sp.*
Serviceberry	*Amelanchier sp.*
Sumac	*Sumac sp.*
Sweet pepper bush	*Clethra sp.*
Winterberry	*Ilex sp.*

EARLY SUCCESSIONAL FOREST

Description

Early successional forests are dominated by regenerating seedling to sapling sized trees. They often occur near a field edge or in areas where disturbances such as wind storms, fire or timber harvests have removed trees. Presently, Massachusetts' forests are predominately even aged, 50 to 100 years old, and are lacking adequate seedling and sapling forest.

Importance

Many of the declining shrubland dependent species listed under *Old Field*/*Shrubland* can also utilize early successional forest in addition to the shrubland habitats.

Locations to Target

1. **Near similar habitat** – Priority should be given to sites located within ½ mile of other early successional woody habitats, such as powerline right of ways, shrub wetlands, and regenerating clear cuts.
2. **Poorly stocked stands** - Focus early successional forest operations on sites dominated by "pioneer" tree species such as aspen, paper/gray birch, ash and pin cherry;

on poorly stocked forest stands that are the result of having been high-graded (i.e., partial cutting of only the best or highest grade trees, leaving poor quality trees behind that eventually dominate the site); or sites that have low fertility or gravelly soils. Slopes should be less than 6 percent.

3. **Timber harvest sites** – Several even-aged silvicultural methods that are used to regenerate shade intolerant tree species (e.g., seed-tree, and silvicultural clearcut) provide optimum conditions for early successional forest regeneration. Although these sites will ultimately be managed for timber, the regenerating forest provides good early successional woody habitat for a period of about 10 years.

Restoration/Management Strategies

1. **Size of cut** - Early successional forest cuts should be a minimum of 5.0 acres in size. Small selection cuts do not provide the equivalent habitat for breeding birds that larger clear cuts do. If a cut less than 5 acres in size will be done, it must be located near existing early successional woody habitat or additional cuts must be done so that the total early successional woody habitat is at least 5 acres in size.
2. **Limit management activities during the breeding season** – The primary nesting season for most bird species in Massachusetts is from April 15 to August 1. Whenever possible, conduct restoration and management activities outside the primary nesting season.
3. **Retain deadwood** – Coarse woody debris consists of sound and rotting logs and stumps and other woody material greater than 3 inches in diameter, on the forest floor. Although the quantity of coarse woody debris needed in the forest is not well known, a minimum of 2 cords (256 cubic feet) per acre should be maintained.

   To preserve existing coarse woody debris, avoid having equipment disturb pre-existing large downed logs, stumps and uprooted stumps. When creating coarse woody debris from cut material, use the following guidelines: (a) large pieces of coarse woody debris are more valuable than smaller pieces – strive for logs that are a minimum of 6 inches diameter, at least 6 feet long and with bark on, (b) "bark on" is preferred to "bark off", and (c) dispersed coarse woody debris is preferred over large accumulations (although some piles are good and can be used by wildlife).
4. **Retain wildlife reserve trees** - Wildlife reserve trees should be retained when possible, but they should not impair the regeneration of the early successional forest due to shading. Reserve trees can be left scattered throughout the cut or left in clumps or islands, and can greatly enhance the aesthetics of an early successional cut. Wildlife reserve trees located in clumps are generally more wind-firm and the micro-habitat created by the clump of trees can provide habitat for remnant populations of amphibians. The clumps can be centered around wetland inclusions, mast trees, cavity trees and sensitive sites.

   In general, when selecting wildlife reserve trees, choose larger, wind-firm specimens and leave 6 to 12 trees standing per acre. Shallow-rooted tree species are most susceptible to windthrow when exposed after cutting (most conifers are shallow rooted with the exception of white pine). To ensure future coarse woody debris inputs, consider leaving snags (both dead and live) which will become coarse woody debris in the short and long term.
5. **Revegetation** - Early successional cuts shall be left to re-vegetate naturally; however, if non-native invasive species invade, they must be controlled. Practice standard Pest Management (595) must be followed.
6. **Preserve sensitive areas** - Early successional cuts will be conducted so as to protect sensitive areas such as vernal pools, riparian zones, other forest associated wetlands, cultural resources and structures.
7. **Management frequency** – To ensure that some portion of the forest is in early successional woody habitat, staggered cuts conducted on a rotational basis (e.g., every 10 years) should be considered. To determine the cutting frequency, consider the needs of the targeted species (Table 4). For example, Ruffed grouse and Woodcock prefer an older stage of succession than other early successional dependent species.

Table4: Number of years after clear cutting an eastern deciduous forest that breeding, early successional birds first appear, become common, and then decline (from DeGraaf andYamasaki, 2004)			
Bird Species	**First Appear**	**Become Common**	**Decline**
Ruffed Grouse	10	15	20
Northern flicker	1	1	7-10
Olive-sided flycatcher	1	1	3-4
Willow flycatcher	1	2	5-7
Tree swallow	1	1	7-10
Winter wren	1	4	7-10
Eastern bluebird	1	1	2
Veery	3	10	20
Swainson's thrush	2	4	15
Cedar waxwing	2	4	7-10
Chestnut-sided warbler	2	4	10
Black and white warbler	3	10	-*
Mourning warbler	2	5	10
Common yellowthroat	2	6	10
Canada warbler	5	15	-*
White-throated sparrow	1	2	-*
Rose-breasted grosbeak	3	15	-*

-* Present until next cutting cycle

Restoration/Management Activities –

Early successional woody habitat may be developed or maintained by one or a combination of the following methods:

1. **Mechanical: including brontosaurus, chainsaw, tree shear or other approved techniques**

- Whenever possible, management should occur outside the primary nesting season of April 15 – August 1.
- Wildlife reserve trees will be marked for retention prior to activities that could cause their removal. In a forested environment, 75 to 90% of the overstory canopy should be cut to ensure that shading does not hinder regeneration of desired species.
- Woody material cut during reclamation (slash) shall be used to create adequate amounts of coarse woody debris when necessary. The remainder shall be either: (a) chipped and spread no deeper than 3.5 inches across the site, (b) removed from site, or (c) stacked in piles and burned. If desired, and within black bear habitat, woody material can be used to create bear dens. Tops can be retained on site if placed in brush piles. No slash shall be placed within 50 feet of any drainage course or wetland.

2. **Prescribed Burning -** Prescribed burning shall be conducted by certified individuals following an approved burn plan. Practice standard Prescribed Burning (338) must be followed.
3. **Chemical** - Herbicides may be used to manipulate plant succession, control exotic invasive plant species and improve habitat diversity. If non-native invasive species are present in an area planned for an early successional cut, they must be controlled because the increased sunlight to the area could dramatically increase the growth of the invasive species. In general, if the site is easily traversed, it's better to treat the invasive species before a management cut occurs. If the vegetation is too dense to walk through, it is probably better to do the management cut and treat the invasive species re-sprouts at a later time. Practice standard Pest Management (595) must be followed.

APPLICABLE LAWS AND REGULATIONS

The Massachusetts Forest Cutting Practices Act sets forth regulations on the cutting of timber in Massachusetts. Filing requirements under the Act are based on volume, cutting area and the use of timber products. All landowners must comply with this Act.
http://www.mass.gov/dcr/stewardship/forestry/service/lawsnforms.htm

Under the Massachusetts Wetlands Protection Act, work in or near jurisdictional resource areas including wetlands and perennial streams may require a permit from the local Conservation Commission and Department of Environmental Protection.

DEFINITIONS

Advance Regeneration – seedlings, saplings, or sprouts that have become established beneath an overstory canopy, either following a harvest or as a result of natural establishment not associated with cutting.

Basal Area of a Stand – the sum of basal areas of all the trees in a stand, expressed as square feet per acre.

Basal Area of a Tree – the area in square feet of the cross-section of a tree stem at breast height (4.5 feet above the ground).

Clearcut – Removal of all the trees in a stand. Regeneration will come from a seed source located nearby or from root/stump sprouts

Sapling – a tree greater than 1 inch DBH and less than 4.9 inches DBH.

Seed-tree – All of the trees are removed at one time except for a few residual seed trees which will provide the source of the new seedlings.

Seedling – a young tree of seed origin, less than 1 inch DBH.

Wildlife Reserve Trees

Den Tree – A live or dead tree of any diameter containing a natural cavity or exfoliating bark used by wildlife for nesting, brood rearing, hibernating, roosting, daily or seasonal shelter and escape.

Mast Tree – Species which provide nuts and/or fruit.

Nest Tree – Trees containing large nests (2-3 feet diameter) built by crows and hawks that resemble a platform of sticks when viewed from the ground. These may be used by owls or re-used by hawks.

Snag – Includes standing dead, or partially dead trees which are at least 6-inches dbh and 20 feet tall ("stub" if shorter).

REFERENCES

Brose, P., D. Van Lear, and R. Cooper. 1999. Using shelterwood harvests and prescribed fire to regenerate oak stands on productive upland sites. Forest Ecology and Management 113: 125-141.

Confer, J.L., S.M. Pascoe. 2003. Avian communities on utility rights-of-way and other managed shrublands in the northeastern United States. Forest Ecology and Management 185: 193-205.

DeGraaf, R.M., M. Yamasaki. 2003. Options for managing early-successional forest and shrubland bird habitats in the northeastern United States. Forest Ecology and Management 185: 179-191.

Desmarais, K. 1998. Northern red oak regeneration: biology and silviculture. University of New Hampshire and State of New Hamphire Division of Forests and Lands. 22pp.

Detmers, R. 2003. Status and Conservation of shrubland birds in the northeastern US. Forest Ecology and Management 185: 81-93.

Detmers, R. and K.V. Rosenberg. 2000. Partners in flight bird conservation plan for the southern New England physiographic area 09 (version 1.0). 51pp.

Hall, B., G. Motzkin, D.R. Foster, M. Syfert and J. Burk. 2002. Three hundred years of forest and land-use change in Massachusetts, USA. Journal of Biogeography 29:1319-1335.

Healy, W.M., K.W. Gottschalk, R.P.Long, and P.M. Wargo. 1997. Changes in eastern forests: chestnut is gone, are the oaks far behind? Changes in eastern forests. 14pp.

Healy, W.M., A.M. Lewis and E.F. Boose, 1998. Variation of red oak acorn production. Forest Ecology and Management 116 (1999) 1-11.

King, D.I., R.M. DeGraaf and C.R. Griffin. 2001. Productivity of early successional shrubland birds in clearcuts and groupcuts in an eastern deciduous forest. Journal of Wildlife Management 65(2):345-350.

Litvaitis, J.A., D.L. Wagner, J.L. Confer, M.D. Tarr, and E.J. Snyder. 1999. Early-successional forests and shrub-dominated habitats: land use artifacts or critical community in the northeastern United States. Northeast Wildlife 54:101-118.

Northeast Upland Habitat Technical Committee. 2006. Managing grasslands, shrublands, and young forest habitats for wildlife – a guide for the northeast. 104pp.

Rodewald, A. 2003. Decline of oak forests and implications for forest wildlife conservation. Natural Areas Journal 23:368-371.

Scanlon, J. 1992. Managing forests to enhance wildlife diversity in Massachusetts. Northeast Wildlife Vol. 49.

Stringer, J. Oak shelterwood: a technique to improve oak regeneration. University of Kentucky Cooperative Extension publication SREF-FM-005. 8pp.

Ward, J.S., and T.E Worthley. 2005. Forest Regeneration Handbook. Connecticut Agricultural Experiment Station. http://ww.canr.uconn.edu.ces/forest

Ward, J.S., T.E. Worthley, P.J. Smallidge and K.P Bennett, 2006. Northeastern forest regeneration handbook. USDA Forest Service, NA-TP-03-06