

# BEST MANAGEMENT PRACTICES FOR NEW ENGLAND COTTONTAIL HABITAT (NEC)

## INTRODUCTION

**Management Focus of this document:** The BMPs presented here are directed at maximizing NEC restoration efforts, and minimizing incidental take of NEC in the process. Managers may wish to modify these guidelines based on other species and resource considerations. Habitats types here are general (e.g., native shrublands). Unique plant communities (coastal scrub, laurel, alder swamps) may require more specific prescriptions.

**Habitat Management Goal:** The desired outcome of habitat management is to create optimal conditions for NEC, which is dense horizontal and vertical woody cover, 3-15 feet high, with multiple layers of vegetation at a minimum stem density of 20,000/acre. This early successional thicket is ideally an extensive tangle of saplings, vines, shrubs and weeds with occasional herbaceous browse openings. Well-drained areas are required for nesting, and structural cover is needed for holing up.

**Patch size & proximity considerations:** Patch sizes should be at least 10 to 25 acres and located within 1 - 3 km of each other. Smaller patches may be considered if there is suitable habitat adjacent to or close by and connected by a corridor. Connected and adjacent patches should total 10 - 25 acres. Patches less than 5 acres may not regenerate vines, shrubs and herbaceous plants critical as forage.

**Rotational considerations:** A rule of thumb for large properties (> 100 acres) is to keep 10% of the forest in regenerating seedling/saplings at all times, but always retaining the minimum of 10 to 25 acres of suitable habitat.

**NEC occupancy considerations:** In sites that are unlikely to be occupied by rabbits, management can be conducted using standard environmental considerations. Unless there is good evidence that no NEC are present, work areas should be treated as if the site is probably occupied, and the potential for incidental take through management exists.

**Seasonal Timing considerations:** In occupied or potentially occupied areas, management operations are recommended after the nesting season, which corresponds to August through winter. If trees are cut in late winter, crowns left on site will provide cover and browse at a critical time. Management should be conducted incrementally, as warranted. In deciding what percentage of potential habitat to cut, managers should consider the quality and quantity of adjacent suitable habitat.

## Initial Habitat

Forest > 20 years old, trees > 6" dbh -native understory (potentially occupied) .....	3
Forest > 20 years old, trees > 6" dbh -invasive understory (potentially occupied) .....	5
Forest > 20 years old, trees > 6" dbh - sparse understory (unlikely to be occupied) .....	7
Successional Forest, trees 3"- 6" dbh .....	9
Seedling-Sapling Forest. Good habitat! .....	11
Shrubland - mostly native shrubs, Good habitat! .....	12
Shrubland - mostly invasive shrubs .....	14
Old Field .....	16
Grassland/Meadow/Wet Meadow .....	18
Literature Used .....	20

## Forest > 20 years old, trees > 6" dbh -native understory (potentially occupied)

**Definition: Trees > 6" dbh, understory primarily native shrubs and seedlings that may provide NEC food and cover. Minor invasive understory component.**

### **PRACTICE/TREATMENTS/ACTIVITIES**

Removal of trees/shrubs by handheld equipment (e.g., chainsaw, handsaw, loppers): While cutting by hand in a mature forest may not be feasible for clearing large areas, it may be practical to incrementally add to existing habitat. Remove, or girdle, all trees greater than 3" dbh and decadent shrubs. Apple trees, scrub oak, low-branching conifers, evergreen shrubs or other trees of exceptional value may be left. Leave a few decadent, shallow rooted, buttressed trees for escape cover.

Heavy duty mulching and mowing (e.g., Brontosaurus, Fecon): Generally, mulching and mowing equipment are not feasible for removal of large hardwoods, but may be used for one step in the removal of invasive or undesirable understory.

Forest harvesting, commercial or non-commercial generally with use of a skidder, forwarder, fellerbuncher, etc: Harvest all trees greater than 3" dbh. Leave tree parts < 6" in diameter (slash) on site to provide cover and winter food, nutrient replenishment to the site and prevent deer browse of regenerating trees. Tops should be lopped not to exceed 4' in height. Leave one or two brush piles per acre (see brush pile practice). Assess within the first growing season post harvest for invasive treatment and within 10 years for a re-cut. Plan harvest rotations to maintain a minimum of 10-25 acres in the less than 15 year old age class at all times. Apple trees, scrub oak, low-branching conifers, evergreen shrubs or other trees of exceptional value may be left. Leave a few decadent, shallow rooted, buttressed trees for escape cover.

Invasive treatment – chemical: Within one year post harvest, assess and treat area for invasives that have become established. Treatment is recommended between August and September. Assess for follow up treatment annually and treat as required.

Herbicide selection (broad-spectrum, selective) and application method (foliar, cut-stem, basal bark) will depend on target species and desirable vegetation outcome.

Invasive treatment - mechanical (chainsaw, Brontosaurus, Fecon): If post harvest invasive plants have grown to a size that is difficult to treat with chemicals alone, mechanical reduction of plant size and vigor can be used as a pretreatment to chemical application. For undesirable tree species, such as tree of heaven, the stem may be girdled or cut initially, followed by chemical treatment.

Invasive treatment - other (weed pulling/wrenching, flame torches, girdling): These techniques are labor intensive and best applied on small acreages or sensitive areas. On large parcels treatment is suitable where invasives plants are minimal. Undesirable individual trees, such as black locust or tree of heaven can effectively be controlled by girdling. Flame torching has been demonstrated to be effective on barberry.

Planting of shrubs - containers, bare root, whips. Select shrubs that root sucker or expand and grow quickly (willow, sumac, alder, poplar). Incorporate other preferred species such as field juniper, green briar, blueberries, native roses, winterberry, silky dogwood, blackberry, chokeberry. Consider site

conditions and if planting is actually necessary: Post-harvest, plant clumps of 25 - 100 shrubs per tenth acre (400 sq. ft.), plants spaced ~ every 2-4 ft. in cleared sites in Spring or Fall. Bare root/whips plant in Spring at greater densities, ~ every sq. ft. Temporary fencing may be needed. Intersperse shrub clusters with existing cover, stone walls and brush piles to minimize large open areas. Control weeds with herbicide prior to planting. After planting, apply mulch (e.g., fabric, chips).

Seeding of grasses and herbaceous vegetation to provide forage: Post harvest, broadcast seed log landings, skid trails and daylighted roads in spring and or fall with cool season grass mix (e.g., orchard grass, timothy, red top, clovers) at 40#/acre or as recommended by supplier. Fertilize and lime as soil tests indicate. Mow every two years to reduce woody vegetation. Treat invasives as necessary.

Slash management: Remove all woody material > 6" in diameter from felled trees. Leave slash to provide winter cover and forage, replenishment nutrients and to discourage deer browse of regenerating trees and shrubs. If re-entry is essential to future management of site (e.g., herbiciding, removal of slash down to 3" diameter may be required)

Brush mowing (farm tractor/brush hog): Periodic brush mowing of log landings and skid trails will extend the availability of herbaceous forage.

Corridor Management (ROW): Forest areas adjacent to shrub corridors should be prioritized as areas to create 25 -acre habitat patches. The corridor itself should be maintained in the 3" dbh class through herbiciding and/or mechanical cutting.

Edge enhancement: Edge enhancements where forest meets old field, powerlines, or fields are desirable. Cut a swath of a minimum width of 50 feet to encourage shrubs, young trees, vines and herbaceous material. A tiered approach may be taken to provide a variety of structure (e.g., shorter to taller from field to forest).

Natural Regeneration: This is principal process by which the managed forest will regenerate at the desired density of 20,000 stems per acre.

Brush piles, stone walls, rock piles, and constructed burrows. Green briar or grape planted near these structures will provide extra protection. Brush piles, stone walls, rock piles and planting clusters should be spaced to minimize the distance NEC are exposed between shelter areas: Pre or post harvest, construct one or two brush piles per acre. (6' -20' on a side and 4'-6' high; bottom layer of logs spaced 10'''-12''' apart; 2nd layer same but perpendicular to 1st; top with smaller limbs and branches). Periodically add new limbs and branches to extend the longevity of the pile.

Burrows may be constructed with corrugated plastic drainage pipe if no natural burrows exist. Avoid damage to stone walls during logging operations. Maintain or build stone walls or piles with adequate interstitial spaces for rabbits to enter.

## Forest > 20 years old, trees > 6" dbh -invasive understory (potentially occupied)

**Definition: Trees > 6" dbh, understory primarily invasive shrubs and seedlings that may provide NEC food and cover**

### **PRACTICE/TREATMENTS/ACTIVITIES**

Removal of trees/shrubs by handheld equipment (e.g., chainsaw, handsaw, loppers): While cutting by hand in a mature forest may not be feasible for clearing large areas, it may be practical to incrementally add to existing habitat. Remove, or girdle, all trees greater than 3" dbh and decadent shrubs. Apple trees, scrub oak, low-branching conifers, evergreen shrubs or other trees of exceptional value may be left. Leave a few decadent, shallow rooted, buttressed trees for escape cover.

Heavy duty mulching and mowing (e.g., Brontosaurus, Fecon): Generally, mulching and mowing equipment are not feasible for removal of large hardwoods.

Brush mowing of invasive understory will be the preliminary step of invasive treatment, followed by herbicide application prior to tree harvest. Brush mowing is ideally done in winter, followed by herbicide in the growing season, with tree removal the following winter. In occupied or potentially occupied sites, incremental removal may be necessary.

Forest harvesting, commercial or non-commercial generally with use of a skidder, forwarder, fellerbuncher, etc: Harvest all trees greater than 3" dbh. Leave tree parts < 6" in diameter (slash) on site to provide cover and winter food, nutrient replenishment to the site and prevent deer browse of regenerating trees. Tops should be lopped not to exceed 4' in height. Leave one or two brush piles per acre (see brush pile practice). Assess within the first growing season post harvest for invasive treatment and within 10 years for a recut. Plan harvest rotations to maintain a minimum of 10-25 acres in the less than 15 year old age class at all times. Apple trees, scrub oak, low-branching conifers, evergreen shrubs or other trees of exceptional value may be left. Leave a few decadent, shallow rooted, buttressed trees for escape cover.

Invasive treatment – chemical: If the invasive understory is providing suitable habitat, incremental removal may be warranted. While chemical treatment may be done post harvest, it is recommended that it be done before tree harvest to prevent an explosive release of invasive growth after canopy removal. Treatments should be done during the late growing in August or September. Assess for follow-up treatments annually and treat as required.

Herbicide selection (broad-spectrum, selective) and application method (foliar, cut-stem, basal bark) will depend on target species and desirable vegetation outcome. Skeletons of dead standing invasives may be left to provide winter cover.

Invasive treatment - mechanical (chainsaw, Brontosaurus, Fecon): For areas dominated by tall and very dense invasive plants (e.g., multiflora rose, bush honeysuckle), mechanical reduction can be used to reduce biomass and stress target plants prior to chemical application. Treatment is recommended prior to canopy removal.

Invasive treatment - other (weed pulling/wrenching, flame torches, girdling): These techniques are labor intensive and best applied on small acreages or sensitive areas. Undesirable individual trees, such as black locust or tree of heaven can effectively be controlled by girdling. Flame torching has been demonstrated to

be effective on barberry. If conducted with a large group, care should be taken to minimize NEC disturbance.

Planting of shrubs - containers, bare root, whips. Select shrubs that root sucker or expand and grow quickly (willow, sumac, alder, poplar). Incorporate other preferred species such as field juniper, green briar, blueberries, native roses, winterberry, silky dogwood, blackberry, chokeberry. Consider site conditions and if planting is actually necessary: Post-harvest, plant clumps of 25 - 100 shrubs per tenth acre (400 sq. ft.), plants spaced ~ every 2-4 ft. in cleared sites in Spring or Fall. Bare root/whips plant in Spring at greater densities, ~ every sq. ft. Temporary fencing may be needed. Intersperse shrub clusters with existing cover, stone walls and brush piles to minimize large open areas. Control weeds with herbicide prior to planting. After planting, apply mulch (e.g., fabric, chips).

Seeding of grasses and herbaceous vegetation to provide forage: Post harvest, broadcast seed log landings, skid trails and daylighted roads in spring or fall with cool season grass mix (e.g., orchard grass, timothy, red top, clovers) at 40#/acre or as recommended by supplier. Fertilize and lime as soil tests indicate. Mow every two years to reduce woody vegetation. Treat invasives as necessary.

Slash management: Remove all woody material > 6" in diameter from felled trees. Leave slash to provide winter cover and forage, replenishment nutrients and to discourage deer browse of regenerating trees and shrubs. If re-entry is essential to future management of site (e.g., herbiciding), removal of slash down to 3" diameter may be required)

Brush mowing (farm tractor/brush hog): Periodic brush mowing of log landings and skid trails will extend the availability of herbaceous forage.

Corridor Management (ROW): Forest areas adjacent to shrub corridors should be prioritized as areas to create 25 -acre habitat patches. The corridor itself should be maintained in the 3" dbh class through herbiciding and/or mechanical cutting.

Edge enhancement: Edge enhancements where forest meets old field, powerlines, or fields are desirable. Cut a swath of a minimum width of 50 feet to encourage shrubs, young trees, vines and herbaceous material. A tiered approach may be taken to provide a variety of structure (e.g., shorter to taller from field to forest).

Natural Regeneration: This is principal process by which the managed forest will regenerate at the desired density of 20,000 stems per acre.

Brush piles, stone walls, rock piles, and constructed burrows. Green briar or grape planted near these structures will provide extra protection.

Brush piles, stone walls, rock piles and planting clusters should be spaced to minimize the distance NEC are exposed between shelter areas: Pre or post harvest, construct one or two brush piles per acre (6' -20' on a side and 4'-6' high; bottom layer of logs spaced 12" apart; 2nd layer same but perpendicular to 1st; top with smaller limbs and branches). Periodically add new limbs and branches to extend the longevity of the pile.

Burrows may be constructed with corrugated plastic drainage pipe if no natural burrows exist.

Avoid damage to stone walls during logging operations. Maintain or build stone walls or piles with adequate interstitial spaces for rabbits to enter.

## Forest > 20 years old, trees > 6" dbh - sparse understory (unlikely to be occupied)

**Definition: Trees > 6" dbh, little understory providing no or poor NEC habitat**

### **PRACTICE/TREATMENTS/ACTIVITIES**

Removal of trees/shrubs by handheld equipment (e.g., chainsaw, handsaw, loppers): Occupation by NEC is not a concern; precautionary measures not needed. To minimize disturbance to other wildlife and maximize regeneration, cutting is recommended in winter. While cutting by hand in a mature forest may not be feasible for clearing large areas, it may be practical to incrementally add to existing habitat. Remove or girdle all trees greater than 3" dbh and decadent shrubs. Apple trees, scrub oak, low-branching conifers, evergreen shrubs or other trees of exceptional value may be left. Leave a few decadent, shallow rooted, buttressed trees for escape cover.

Forest harvesting, commercial or non-commercial generally with use of a skidder, forwarder, fellerbuncher, etc: Harvest all trees greater than 3" dbh. Leave tree parts < 6" in diameter (slash) on site to provide cover and winter food, nutrient replenishment to the site and prevent deer browse of regenerating trees. Tops should be lopped not to exceed 4' in height. Leave one or two brush pile per acre (see brush pile practice). Assess within the first growing season post harvest for invasive treatment and within 10 years for a recut. Plan harvest rotations to maintain a minimum of 10-25 acres in the less than 15 year old age class at all times. Apple trees, scrub oak, low-branching conifers, evergreen shrubs or other trees of exceptional value may be left. Leave a few decadent, shallow rooted, buttressed trees for escape cover.

Invasive treatment – chemical: Within one year post harvest, assess for invasives that have become established, and treat if necessary. Continue annual assessments and treat as required. Treatment is recommended in August and September. Herbicide selection (broad-spectrum, selective) and application method (foliar, cut-stem, basal bark) will depend on target species and desirable vegetation outcome.

Invasive treatment - mechanical (chainsaw, Brontosaurus, Fecon): If post harvest invasive plants have grown to a size that is difficult to treat with chemicals alone, mechanical reduction of plant size and vigor can be used as a pretreatment to chemical application. For undesirable tree species, such as tree of heaven, the stem may be girdled or cut initially, followed by chemical treatment.

Invasive treatment - other (weed pulling/wrenching, flame torches, girdling): These techniques are labor intensive and best applied on small acreages or sensitive areas. Undesirable individual trees, such as black locust or tree of heaven can effectively be controlled by girdling. Flame torching has been demonstrated to be effective on barberry. Weed pulling and wrenching is easiest in early spring

Planting of shrubs - containers, bare root, whips. Select shrubs that root sucker or expand and grow quickly (willow, sumac, alder, poplar). Incorporate other preferred species such as field juniper, green briar, blueberries, native roses, winterberry, silky dogwood, blackberry, chokeberry. Consider site conditions and if planting is actually necessary: Post-harvest, plant clumps of 25 - 100 shrubs per tenth acre (400 sq. ft.), plants spaced ~ every 2-4 ft. in cleared sites in Spring or Fall. Temporary fencing may be needed. Bare root/whips plant in Spring at greater densities, ~ every sq. ft. Intersperse shrub clusters with existing cover, stone walls and brush piles to minimize large open areas. Control weeds with herbicide prior to planting. After planting, apply mulch (e.g., fabric, chips).

Seeding of grasses and herbaceous vegetation to provide forage: Post harvest, broadcast seed log landings, skid trails and daylighted roads in spring or fall with cool season grass mix (e.g., orchard grass, timothy, red top, clovers) at 40#/acre or as recommended by supplier. Fertilize and lime as soil tests indicate. Mow every two years to reduce woody vegetation. Treat invasives as necessary.

Slash management: Remove all woody material > 6" in diameter from felled trees. Leave slash to provide winter cover and forage, replenishment nutrients and to discourage deer browse of regenerating trees and shrubs. If re-entry is essential to future management of site (e.g., herbiciding), removal of slash down to 3" diameter may be required)

Brush mowing (farm tractor/brush hog): Periodic brush mowing of log landings and skid trails will extend the availability of herbaceous forage.

Corridor Management (ROW): Forest areas adjacent to shrub corridors should be prioritized as areas to create 25 -acre habitat patches. The corridor itself should be maintained in the 3" dbh class through herbiciding and/or mechanical cutting.

Edge enhancement: Edge enhancements where forest meets old field, powerlines, or fields are desirable. Cut a swath of a minimum width of 50 feet to encourage shrubs, young trees, vines and herbaceous material. A tiered approach may be taken to provide a variety of structure (e.g., shorter to taller from field to forest).

Natural Regeneration: This is principal process by which the managed forest will regenerate at the desired density of 20,000 stems per acre.

Brush piles, stone walls, rock piles, and constructed burrows. Green briar or grape planted near these structures will provide extra protection.

Brush piles, stone walls, rock piles and planting clusters should be spaced to minimize the distance NEC are exposed between shelter areas: "Pre or post harvest, construct one or two brush piles per acre (6' -20' on a side and 4'-6' high; bottom layer of logs spaced 12'" apart; 2nd layer same but perpendicular to 1st; top with smaller limbs and branches). Periodically add new limbs and branches to extend the longevity of the pile.

Burrows may be constructed with corrugated plastic drainage pipe if no natural burrows exist.

Avoid damage to stone walls during logging operations. Maintain or build stone walls or piles with adequate interstitial spaces for rabbits to enter. "

## Successional Forest, trees 3" - 6" dbh

**Definition: Area dominated by trees > 3" dbh and < 6" dbh, no longer ideal habitat due to canopy closure and decline in stem density.**

### PRACTICE/TREATMENTS/ACTIVITIES

Removal of trees/shrubs by handheld equipment (e.g., chainsaw, handsaw, loppers): Cutting by hand in young forest may occur when a land owner is incrementally adding to existing habitat. Remove all trees greater than 3" dbh and decadent shrubs. Apple trees, scrub oak, low-branching conifers, evergreen shrubs or other trees of exceptional value may be left. Leave a few decadent, shallow rooted, buttressed trees for escape cover.

Heavy duty mulching and mowing (e.g., Brontosaurus, Fecon): This a preferred method for removal of trees in this size class, with removal rates of up to one acre per day. It permits precision cutting and minimizes environmental impacts. This may be achieved in incremental stages if warranted.

Invasive treatment – chemical: "Within one year post harvest, assess and treat area for invasives that have become established. Treatment is recommended in August or September. Assess annually and repeat treatment as required.

Herbicide selection (broad-spectrum, selective) and application method (foliar, cut-stem, basal bark) will depend on target species and desirable vegetation outcome. "

Invasive treatment - mechanical (chainsaw, Brontosaurus, Fecon): Use of mechanical equipment to remove invasives in a young forest is likely to be impractical. The restoration of this size class forest to seedling/sapling is essentially a mowing treatment of the whole area. However, mechanical treatment of individual problem plants with hand held tools may be warranted.

Invasive treatment - other (weed pulling/wrenching, flame torches, girdling): Use of these other treatments to remove invasives in a young forest is likely to be impractical. The restoration of this size class forest to seedling/sapling is essentially a mowing treatment of the whole area.

Planting of shrubs - containers, bare root, whips. Select shrubs that root sucker or expand and grow quickly (willow, sumac, alder, poplar). Incorporate other preferred species such as field juniper, green briar, blueberries, native roses, winterberry, silky dogwood, blackberry, chokeberry. Consider site conditions and if planting is actually necessary: Post harvest, to provide food and structure, introduce desirable species or to fill gaps. Plant clumps of 25 - 100 shrubs per tenth acre (400 sq. ft.), plants spaced ~ every 2-4 ft. in cleared sites in Spring or Fall. Bare root/whips plant in Spring at greater densities, ~ every sq. ft. Temporary fencing may be needed. Bare root/whips plant in Spring at greater densities, ~ every sq. ft. Intersperse shrub clusters with existing cover, stone walls and brush piles to minimize large open areas. Control weeds with herbicide prior to planting. After planting, apply mulch (e.g., fabric, chips).

Seeding of grasses and herbaceous vegetation to provide forage: Post mowing/mulching, seed small patches and access roads with cool season grass mix (e.g., orchard grass, timothy, red top, clovers) at 40#/acre or as recommended by supplier. Fertilize and lime as soil tests indicate. Mow every two years to reduce woody vegetation. Treat invasives as necessary.

Corridor Management (ROW): Forest areas adjacent to shrub corridors should be prioritized as areas to create 25 -acre habitat patches. The corridor itself should be maintained in the 3" dbh class through herbiciding and/or mechanical cutting.

Edge enhancement: Edge enhancements where forest meets old field, powerlines, or fields are desirable. Cut a swath of a minimum width of 50 feet to encourage shrubs, young trees, vines and herbaceous material. A tiered approach may be taken to provide a variety of structure (e.g., shorter to taller from field to forest).

Natural Regeneration: This is the principal process by which the managed forest will regenerate at the desired density of 20,000 stems per acre.

Brush piles, stone walls, rock piles, and constructed burrows. Green briar or grape planted near these structures will provide extra protection.

Brush piles, stone walls, rock piles and planting clusters should be spaced to minimize the distance NEC are exposed between shelter areas: Post mowing/mulching, construct one or two brush piles per acre (6' -20' on a side and 4'-6' high; bottom layer of logs spaced 12" apart; 2nd layer same but perpendicular to 1st; top with smaller limbs and branches). Periodically add new limbs and branches to extend the longevity of the pile.

Burrows may be constructed with corrugated plastic drainage pipe if no natural burrows exist.

Avoid damage to stone walls during mowing. Maintain or build stone walls or piles with adequate interstitial spaces for rabbits to enter.

## Seedling-Sapling Forest. Good habitat!

**Definition: Area dominated by trees < 3" dbh, and < 5 meters in height.**

### **PRACTICE/TREATMENTS/ACTIVITIES**

Removal of trees/shrubs by handheld equipment (e.g., chainsaw, handsaw, loppers): Cut individual trees or shrubs that have exceeded 3" dbh in winter. Apple trees, scrub oak, low-branching conifers, evergreen shrubs or other trees of exceptional value may be left.

Invasive treatment – chemical: "Assess annually and treat as required, preferably in August or September. Herbicide selection (broad-spectrum, selective) and application method (foliar, cut-stem, basal bark) will depend on target species and desirable vegetation outcome. "

Invasive treatment - mechanical (chainsaw, Brontosaurus, Fecon): Due to stem densities , treatment is impractical. However, if necessary, cut individual or patches of invasive plants, and follow with herbicide application. Assess annually and selectively treat as required.

Invasive treatment - other (weed pulling/wrenching, flame torches, girdling): Due to stem densities , treatment is impractical. However, if necessary, cut individual or patches of invasive plants, and follow with herbicide application. Assess annually and selectively treat as required.

Prescribed burns: Prescribed burns can be used to maintain grasslands and shrublands, and are especially effective in specific habitats such as scrub oak/pitch pine. Prescriptions need to be developed on a site specific basis in compliance with State and local regulations.

Natural Regeneration: This is the principal process by which the managed forest will regenerate at the desired density of 20,000 stems per acre.

Brush piles, stone walls, rock piles, and constructed burrows. Green briar or grape planted near these structures will provide extra protection.

Brush piles, stone walls, rock piles and planting clusters should be spaced to minimize the distance NEC are exposed between shelter areas: "Burrows may be constructed with corrugated plastic drainage pipe if no natural burrows exist.

Maintain or build stone walls or piles with adequate interstitial spaces for rabbits to enter. "

## Shrubland - mostly native shrubs, Good habitat!

**Definition:** Area dominated by multistemmed woody plants and seedling sapling trees, such as alders, viburnums, blueberries, dogwoods, etc.

### PRACTICE/TREATMENTS/ACTIVITIES

Removal of trees/shrubs by handheld equipment (e.g., chainsaw, handsaw, loppers): Evaluate and remove trees or shrubs > 3" dbh during winter. Consider treating stems of species that will not contribute to high stem density, such as oak. Evaluate and treat for invasives as needed. Large patches should be cut incrementally.

Heavy duty mulching and mowing (e.g., Brontosaurus, Fecon): This is a valuable technique for restoring significant areas of decadent or undesirable shrubs, with removal rates up to two acres per day. This may be achieved in incremental stages if warranted.

Invasive treatment – chemical: Assess annually and treat as required, preferably in August or September. Consider treating stems of species that will not contribute to high stem density, such as oak. Herbicide selection (broad-spectrum, selective) and application method (foliar, cut-stem, basal bark) will depend on target species and desirable vegetation outcome.

Invasive treatment - mechanical (chainsaw, Brontosaurus, Fecon): Cut individual or patches of invasive plants, and follow with herbicide application. Assess annually and selectively treat as required.

Invasive treatment - other (weed pulling/wrenching, flame torches, girdling): Treat individuals or patches of invasive plants. When girdling, include herbicide treatment to improve efficacy. Assess annually and selectively treat as required.

Seeding of shrubs. Plant 5-7 lbs/ac sumac, blueberries, roses, winterberry, silky dogwood, blackberry, chokeberry...consider site condition. Note, this is an experimental practice; allow 8-10 years to see benefits: Treat individuals or patches of invasive plants. When girdling, include herbicide treatment to improve efficacy. Assess annually and selectively treat as required.

Brush mowing (farm tractor/brush hog): This is a valuable technique for restoring significant areas of decadent or undesirable shrubs in the 3" or smaller dbh size class, with removal rates up to two acres per day. This may be achieved in incremental stages if warranted.

Prescribed burns: Prescribed burns can be used to maintain grasslands and shrublands, and are especially effective in specific habitats such as scrub oak/pitch pine. Prescriptions need to be developed on a site specific basis in compliance with State and local regulations.

Natural Regeneration: This is the principal process by which the managed shrubland will regenerate at the desired density of 20,000 stems per acre.

Brush piles, stone walls, rock piles, and constructed burrows. Green briar or grape planted near these structures will provide extra protection.

Brush piles, stone walls, rock piles and planting clusters should be spaced to minimize the distance NEC are exposed between shelter areas: "Burrows may be constructed with corrugated plastic drainage pipe if no

natural burrows exist.

Maintain or build stone walls or piles with adequate interstitial spaces for rabbits to enter. "

## Shrubland - mostly invasive shrubs

**Definition:** Area dominated by invasive shrubs such as bush honey suckles, Japanese barberry, or multiflora rose, and young seedling or sapling trees less than 5 meters in height.

### PRACTICE/TREATMENTS/ACTIVITIES

Removal of trees/shrubs by handheld equipment (e.g., chainsaw, handsaw, loppers): Evaluate and remove trees or shrubs > 3" dbh. Large patches should be cut incrementally.

Conversion of invasive to native plant species is preferable, but not always feasible.

Managing and utilizing the invasive species as habitat may be warranted in cases where the site and adjacent lands are overwhelmingly dominated by invasives.

Heavy duty mulching and mowing (e.g., Brontosaurus, Fecon): This is a valuable technique for restoring significant areas of decadent or undesirable shrubs, with removal rates up to two acres per day. This may be achieved in incremental stages if warranted.

Invasive treatment – chemical: Conversion of invasive to native plant species is preferable, but not always feasible.

If the area is occupied, large patches should be treated incrementally.

Assess annually and treat as required, preferably in August or September.

Herbicide selection (broad-spectrum, selective) and application method (foliar, cut-stem, basal bark) will depend on target species and desirable vegetation outcome.

Invasive treatment - mechanical (chainsaw, Brontosaurus, Fecon): This is a valuable technique for restoring significant areas of decadent or undesirable shrubs, with removal rates up to two acres per day using a Fecon mower. If the goal is conversion to a more native shrubland, mowing should be conducted at peak biomass in June - July, followed by herbicide treatment in August or September. This may be achieved in incremental stages if warranted.

Invasive treatment - other (weed pulling/wrenching, flame torches, girdling): Impractical to apply broad scale control in dense shrubby vegetation. Selective treatment possible for individuals or patches. When girdling, include herbicide treatment to improve efficacy. Assess annually and selectively treat as required.

Planting of shrubs - containers, bare root, whips. Select shrubs that root sucker or expand and grow quickly (willow, sumac, alder, poplar). Incorporate other preferred species such as field juniper, green briar, blueberries, native roses, winterberry, silky dogwood, blackberry, chokeberry. Consider site conditions and if planting is actually necessary: Post-invasive plant control, to provide food and structure, introduce desirable species or to fill gaps. Plant clumps of 25 - 100 shrubs per tenth acre (400 sq. ft.), plants spaced ~ every 2-4 ft. in cleared sites in Spring or Fall. Bare root/whips plant in Spring at greater densities, ~ every sq ft. Temporary fencing may be needed. Intersperse shrub clusters with existing cover, stone walls and brush piles to minimize large open areas. Control weeds with herbicide prior to planting. After planting, apply mulch (e.g., fabric, chips).

Seeding of grasses and herbaceous vegetation to provide forage: Post mowing/mulching, seed small patches and access roads with cool season grass mix (e.g., orchard grass, timothy, red top, clovers) at 40#/acre or as recommended by supplier. Fertilize and lime as soil tests indicate. Mow every two years to reduce woody vegetation. Treat invasives as necessary.

Brush mowing (farm tractor/brush hog): This is a valuable technique for restoring significant areas of decadent or undesirable shrubs in the 3" or smaller dbh size class, with removal rates up to two acres per day. This may be achieved in incremental stages if warranted.

Prescribed burns: Prescribed burns can be used to maintain grasslands and shrublands, and are especially effective in specific habitats such as scrub oak/pitch pine. Prescriptions need to be developed on a site specific basis in compliance with State and local regulations.

Natural Regeneration: Managing and utilizing the invasive species as habitat may be warranted in cases where the site and adjacent lands are overwhelmingly dominated by invasives. This is the principal process by which the managed shrubland will regenerate at the desired density of 20,000 stems per acre.

Brush piles, stone walls, rock piles, and constructed burrows. Green briar or grape planted near these structures will provide extra protection.

Brush piles, stone walls, rock piles and planting clusters should be spaced to minimize the distance NEC are exposed between shelter areas: Burrows may be constructed with corrugated plastic drainage pipe if no natural burrows exist.

Maintain or build stone walls or piles with adequate interstitial spaces for rabbits to enter.

## Old Field

**Definition: Transitional areas dominated by grasses, forbs, as well as some shrubs and small trees. The vegetative make up varies with the area's management history and the length of time since abandonment**

### PRACTICE/TREATMENTS/ACTIVITIES

Removal of trees/shrubs by handheld equipment (e.g., chainsaw, handsaw, loppers): Evaluate and remove trees or decadent shrubs > 3" dbh. Apple trees, scrub oak, low-branching conifers, evergreen shrubs or other trees of exceptional value may be left. Evaluate and treat for invasives as needed.

Heavy duty mulching and mowing (e.g., Brontosaurus, Fecon): This is a valuable technique for maintaining suitable structure and composition of woody vegetation or to create transitional zones at field edges. Old fields should contain no more than 25% woody cover no larger than 3" dbh . Apple trees, scrub oak, low-branching conifers, evergreen shrubs or other trees of exceptional value may be left.

Invasive treatment – chemical: Assess annually and treat as required, preferably in August or September. Herbicide selection (broad-spectrum, selective) and application method (foliar, cut-stem, basal bark) will depend on target species and desirable vegetation outcome.

Invasive treatment - mechanical (chainsaw, Brontosaurus, Fecon): Cut individual or patches of invasive plants, and follow with herbicide application. Assess annually and selectively treat as required.

Invasive treatment - other (weed pulling/wrenching, flame torches, girdling): These techniques are labor intensive and best applied on small acreages or sensitive areas. On large parcels treatment is suitable where invasives plants are minimal. Undesirable individual trees, such as black locust or tree of heaven can effectively be controlled by girdling. Flame torching has been demonstrated to be effective on barberry.

Seeding of shrubs. Plant 5-7 lbs/ac sumac, blueberries, roses, winterberry, silky dogwood, blackberry, chokeberry...consider site condition. Note, this is an experimental practice; allow 8-10 years to see benefits: Site preparation including mowing, herbiciding, tilling and planting. Best scenario, site prep in summer and plant in fall - broadcast or drill. May be used for creating field buffers, small patches or complete conversion to shrublands.

Planting of shrubs - containers, bare root, whips. Select shrubs that root sucker or expand and grow quickly (willow, sumac, alder, poplar). Incorporate other preferred species such as field juniper, green briar, blueberries, native roses, winterberry, silky dogwood, blackberry, chokeberry. Consider site conditions and if planting is actually necessary: To enhance food and structure, introduce desirable species or to fill gaps. Plant clumps of 25 - 100 shrubs per tenth acre (400 sq. ft.), plants spaced ~ every 2-4 ft. in cleared sites in Spring or Fall. Bare root/whips plant in Spring at greater densities, ~ every sq ft. Temporary fencing may be needed. Intersperse shrub clusters with existing cover, stone walls and brush piles to minimize large open areas. Control weeds with herbicide prior to planting. After planting, apply mulch (e.g., fabric, chips).

Brush mowing (farm tractor/brush hog): This is a valuable technique for maintaining suitable structure and composition of woody vegetation or to create transitional zones at field edges. Old fields should contain

no more than 25% woody cover no larger than 3" dbh. Apple trees, scrub oak, low-branching conifers, evergreen shrubs or other trees of exceptional value may be left.

Prescribed burns: Prescribed burns can be used to maintain grasslands and shrublands, and are especially effective in specific habitats such as scrub oak/pitch pine. Prescriptions need to be developed on a site specific basis in compliance with State and local regulations.

Field Mowing: Mow every 2 or 3 years to maintain grasses, forbs small woody vegetation as desired.

Edge enhancement: Where field meets forest, it may be desirable to establish edges through plantings or natural regeneration. To serve as useful corridors, the shrub edge should be a minimum of 50" wide.

Strip Disking: To stimulate forbs in fields where present, light strip disking during late fall after seed set can be effective:

Disks should run parallel, or nearly so, to the direction of travel and at a depth of only 2 to 4 inches.

Maintain at least 50 % residue remains.

Do not perform light disking on sites where invasive or noxious plant species are present unless invasive species are controlled prior to disking. Any disking on areas which have never been plowed or have high erosion potential is strongly discouraged.

Natural Regeneration: Given consideration of available habitat for NEC and needs of other species, it may be desirable to allow native shrubs and trees to expand and dominate the site. If this is the course of action, follow-up with treatments such as brush mowing, herbiciding or prescribed burning to control invasives as required. Sites should be reclaimed on a 15 year rotation as with seedling/sapling forest.

Brush piles, stone walls, rock piles, and constructed burrows. Green briar or grape planted near these structures will provide extra protection.

Brush piles, stone walls, rock piles and planting clusters should be spaced to minimize the distance NEC are exposed between shelter areas: "Brush piles may be used as cover at field edges. Construct one brush pile per acre (6' -20' on a side and 4'-6' high; bottom layer of logs spaced 12" apart; 2nd layer same but perpendicular to 1st; top with smaller limbs and branches). Periodically add new limbs and branches to extend the longevity of the pile.

Burrows may be constructed with corrugated plastic drainage pipe if no natural burrows exist.

Stone walls or piles with adequate interstitial spaces can provide critical cover.

## Grassland/Meadow/Wet Meadow

**Definition: Area dominated by broad-leaved herbs, grasses, sedges and other herbaceous vegetation without or with a very small woody component.**

### PRACTICE/TREATMENTS/ACTIVITIES

Removal of trees/shrubs by handheld equipment (e.g., chainsaw, handsaw, loppers): Evaluate and remove trees or shrubs > 3" dbh. Apple trees, scrub oak, low-branching conifers, evergreen shrubs or other trees of exceptional value may be left. Evaluate and treat for invasives as needed.

Heavy duty mulching and mowing (e.g., Brontosaurus, Fecon): This is a valuable technique for removing encroaching woody vegetation or to create transitional zones at field edges.

Invasive treatment – chemical: Assess annually and treat as required, preferably in August or September. Herbicide selection (broad-spectrum, selective) and application method (foliar, cut-stem, basal bark) will depend on target species and desirable vegetation outcome.

Invasive treatment - mechanical (chainsaw, Brontosaurus, Fecon): Cut or mow individual or patches of invasive plants, and follow with herbicide application. Assess annually and selectively treat as required.

Invasive treatment - other (weed pulling/wrenching, flame torches, girdling): These techniques are labor intensive and best applied on small acreages or sensitive areas. On large parcels treatment is suitable where invasives plants are minimal. Undesirable individual trees, such as black locust or tree of heaven can effectively be controlled by girdling. Flame torching has been demonstrated to be effective on barberry.

Seeding of shrubs. Plant 5-7 lbs/ac sumac, blueberries, roses, winterberry, silky dogwood, blackberry, chokeberry...consider site condition. Note, this is an experimental practice; allow 8-10 years to see benefits: Site preparation including mowing, herbiciding, tilling and planting. Best scenario, site prep in summer and plant in fall - broadcast or drill. May be used for creating field buffers, small patches or complete conversion to shrublands.

Planting of shrubs - containers, bare root, whips. Select shrubs that root sucker or expand and grow quickly (willow, sumac, alder, poplar). Incorporate other preferred species such as field juniper, green briar, blueberries, native roses, winterberry, silky dogwood, blackberry, chokeberry. Consider site conditions and if planting is actually necessary: To enhance food and structure, introduce desirable species or to fill gaps. Plant clumps of 25 - 100 shrubs per tenth acre (400 sq. ft.), plants spaced ~ every 2-4 ft. in cleared sites in Spring or Fall. Bare root/whips plant in Spring at greater densities, ~ every sq ft. Temporary fencing may be needed. Intersperse shrub clusters with existing cover, stone walls and brush piles to minimize large open areas. Control weeds with herbicide prior to planting. After planting, apply mulch (e.g., fabric, chips). For whole field conversion to shrublands, plant shrubs approximately every 4 feet to achieve ~2,700 plants per acre.

Brush mowing (farm tractor/brush hog): This is a valuable technique for removing encroaching woody vegetation or to create transitional zones at field edges.

Prescribed burns: Prescribed burns can be used to maintain grasslands and shrublands, and are especially effective in specific habitats such as scrub oak/pitch pine. Prescriptions need to be developed on a site specific basis in compliance with State and local regulations.

Field Mowing: Mow every 2 or 3 years to maintain grasses, forbs small woody vegetation as desired.

Edge enhancement: Where field meets forest, it may be desirable to establish edges through plantings or natural regeneration. To serve as useful corridors, the shrub edge should be a minimum of 50" wide.

Strip Disking: To stimulate forbs in fields where present, light strip disking during late fall after seed set can be effective:

Disks should run parallel, or nearly so, to the direction of travel and at a depth of only 2 to 4 inches.

Maintain at least 50 % residue remains.

Do not perform light disking on sites where invasive or noxious plant species are present unless invasive species are controlled prior to disking. Any disking on areas which have never been plowed or have high erosion potential is strongly discouraged.

Natural Regeneration: Given consideration of available habitat for NEC and needs of other species, it may be desirable to allow native shrubs and trees to expand and dominate the site. If this is the course of action, follow-up with treatments such as brush mowing, herbiciding or prescribed burning to control invasives as required. Sites should be reclaimed on a 15 year rotation as with seedling/sapling forest.

Brush piles, stone walls, rock piles, and constructed burrows. Green briar or grape planted near these structures will provide extra protection.

Brush piles, stone walls, rock piles and planting clusters should be spaced to minimize the distance NEC are exposed between shelter areas: Brush piles may be used as cover at field edges. Construct one brush pile per acre (6' -20' on a side and 4'-6' high; bottom layer of logs spaced 12'" apart; 2nd layer same but perpendicular to 1st; top with smaller limbs and branches). Periodically add new limbs and branches to extend the longevity of the pile.

Burrows may be constructed with corrugated plastic drainage pipe if no natural burrows exist.

Stone walls or piles with adequate interstitial spaces can provide critical cover.

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