CONSIDERATIONS

- Invasive plants are dispersed in many ways including by wildlife, horticulture, personal and recreational vehicles, all-terrain vehicles (ATVs), bicycles, mowers and state and local departments of transportation. Forestry and its associated practices and equipment (skidders, trucks, mowers, etc) are just one way invasive plants can be introduced and existing infestation exacerbated.
- State law prevents the sale, distribution or transport of invasive species. RSA 430:51-57 states, "No person shall collect, transport, import, export, move, buy, sell, distribute, propagate or transplant any living and viable portion of any plant species, which includes all of their cultivars and varieties, listed in Table 3800.1, New Hampshire prohibited invasive species list." For example, the movement of viable seeds or fruits in the treads of heavy equipment or the transport and use of fill with invasives violates state law.
- Invasive plants thrive on disturbance, often requiring the combination of seed sources or vegetative propagule (plant pieces that root and sprout) and disturbance. Once established they can spread beyond the introduction site even in the absence of continued disturbance .
- Healthy functioning forest ecosystems are less susceptible to infestation by invasive plants. Though careful silvicultural planning and practices can reduce or prevent invasive plant infestations, forestry practices can create conditions suitable for invasive plants. These conditions occur when site disturbance exposes soil creating a seedbed or tree removal releases invasives already present.
- Early detection (pre-operation survey) and rapid response (development and implementation of a control plan) can prevent further spread of invasive plants.
- Prevention and control can be costly. Costs can be silvicultural, as in the case of modifying prescriptions or the failure of planned regeneration, or direct payments to control invasives or clean equipment. The costs associated with invasive plant prevention and control should be evaluated against silvicultural objectives, and be commensurate with the threat posed.
- Cleaning equipment will help prevent the spread of invasive plants into areas not already infested. Clean equipment is visibly free of mud, seeds, berries, and other plant material. Cleaning equipment using pressure washing equipment and catchment basins to collect wash water as well as hydraulic fluids, oil, and fuel though desirable, may not be practical and economically feasible.
- It will be difficult to know that sand, gravel, mulch and fill materials are invasives-free. Hay can contain seeds of invasives. Though straw is generally considered invasives-free, it is significantly more expensive than hay and not always weed-free.
- Deer over-population and browsing pressure in combination with invasive plant infestations can make it difficult to regenerate native plants and effect the growth of seedlings and saplings. Deer tend to selectively browse on native species, thereby giving invasive plants the advantage.
- Fire benefits many invasive plants and will result in their dominance in the regeneration layer.

RECOMMENDED PRACTICES

Develop a strategy for managing invasive plants based on owner objectives and the species and amount of invasives present. Methods exist for managing invasive prior to, during, or following a forestry project. Except as required by law, all these practices are voluntary.

Planning

- Conduct a pre-operation survey to determine whether invasive plants are present. This can be integrated into regular stand inventory and monitoring.
- Map infestations and use the mapped locations in planning skid trails and truck roads, harvest areas and landing locations. Avoid placing transportation infrastructure and landings in infested areas.
- Reuse landings and roads at invasive free sites, to limit new disturbance.
- Use invasives-free sand, gravel, mulch, and silt barriers.

Equipment Cleaning

- If operating at a site with invasive plants, inspect equipment to ensure seeds, berries, roots or branches aren't transported to an uninfested location. Clean equipment using a broom, compressed air or pressure washing before moving to a new location.
- Dispose of invasive debris in a manner that avoids further spread. Burning is the best disposal method.

Control

- Determine whether control is practical and ecologically feasible. Control may not be warranted for species that cause minimal interference with management objectives. Control may be impractical and costly for invasives that are present in large numbers, in which case avoiding them may be the best option
- Determine if control should take place before, during, or after the project. Control small to moderate infestations of species known to cause severe economic or ecological damage prior to project inception or immediately after.
- Three to five years of active control and monitoring are typically required to ensure effective control and depletion of seed reserves in the soil seed bank.
- **Mechanical control** can take many forms including hand pulling, digging, mowing, blading, and tilling. Due to its labor intensive nature and the large amount of soil disturbance it causes, it is best applied only to small numbers of plants in limited infestations.
- **Biological control** has limited application at this time. The only widely available biological control is for purple loosestrife, which may infest roadsides, wetlands and landings.
- **Chemical control** is the most cost-effective method. A variety of techniques and chemicals are available. The technique and herbicide used depend on the size of the infestation and species, as well as the timing of the application. Foliar or mist application with a backpack sprayer, basal bark treatments, frill treatments, and cut-stem or injection treatments are common techniques. Refer to the *Invasive Plant Management Guide* by the Connecticut Invasive Plant Working Group for information on invasive species management, chemical selection and concentrations, and control strategies. Contact the N.H. Division of Pesticide Control for the necessary license and permit requirements.

- Follow up monitoring and treatment are typically required. Without effective follow up, initial treatments may only make the problem worse.

Operation

- Avoid or minimize the movement of equipment and machinery from infested into invasive-free areas, unless cleaned prior to movement. Operate in invasive-free areas first. Operate from areas of lesser to greater infestation.
- Locate skid trails, haul roads and landings in invasive-free areas.
- If soil disturbance is needed to achieve a silvicultural objective in an infested stand, limit the disturbance to the target area.

Close Out and After

- To rehabilitate skid trails, truck roads and landings use a seed mix containing winter rye and short-lived and long-lived native species. The traditional "conservation mix" often contains several weedy undesirable species including a listed invasive plant- reed canary grass.
- Minimize the amount of time between close of operations and rehabilitation to reduce the chance of invasive establishment.
- Monitor project area, especially transportation infrastructure and landings for invasive plants for three to five years. If invasive plants are discovered begin control efforts immediately.
- Closely monitor sites where seed, mulch, or fill material were used. Focus follow-up monitoring efforts on high traffic areas or where invasive control was conducted. These are some of the most likely locations of new infestation.
- Don't plant invasive species, or those suspected of being invasive during rehabilitation work. Other problem plants, not listed as invasive in New Hampshire, are known to cause damage in other areas. Refer to the *Invasive Plant Atlas of New England*.

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Good Forestry in the Granite State: Draft Forest Health - Ice and Wind Damage

X.3 ICE AND WIND DAMAGE

BACKGROUND

Tornadoes, hurricanes, ice storms, and floods can damage the forest. Although hurricane-size storms are infrequent in New England, damaging wind storms can be expected every 15-30 years. Species and forest cover types vary greatly in resistance to wind damage. White pine is most susceptible. Up to 80% of the volume was damaged in the 1938 hurricane. Hemlock trees also were damaged. Spruce-fir (especially the fir) is next in susceptibility to losses from wind. Northern hardwoods are least damaged. The 1938 hurricane produced losses of about 10-20% even in stands that were heavily damaged. Factors other than cover type also affect vulnerability to wind and include:

- exposure to wind (noticeable in the mountain notches that characterize central and northern New Hampshire).
- soil depth and soil moisture (Shallow and wet soils are worst).
- stand age (Large, overmature stands are most susceptible).
- stand density (Heavily thinned stands most at risk).

OBJECTIVE

Prepare forests to withstand ice and wind damage, and when they do occur make informed forest management decisions.

CONSIDERATIONS

- Damage from natural factors such as wind, snow and ice regularly occur in New Hampshire's forests. This damage is a normal part of natural ecosystem functioning and an important factor in creating a diverse forest structure by providing dead and down woody material, wildlife trees, and openings for regeneration.
- Microbursts, in-line winds, tornadoes, hurricanes, and ice-forming events can cause economic damage. No amount of silvicultural preparation can eliminate the risk of catastrophic damage.
- Healthy trees blown over with roots intact will remain alive and insect- and pathogen-free for many months.
- Ice storms cause most forest damage at elevations between 1,000' and 3,000' and within hardwood stands. Softwood branches naturally point down. Under extreme weight they sag down and in rather than bend and break like hardwoods.
- It takes many years for previously healthy trees to succumb to a single severe ice storm. Discoloration and decay travel from the damaged branches into the stem of the tree only a few inches to a few feet per year. Breaks in the main stem are more severe than breaks of the secondary branches. Decay fungi and rot will affect the product quality and strength of the tree. It isn't necessary to quickly salvage standing, living ice storm

damaged trees.

- Salvaging trees damaged by an ice or wind storm can be difficult and dangerous and often only a portion of the original timber value is recouped.
- Fire hazards can increase with severe storms that accumulate large amounts of debris if followed by severe fire weather.

RECOMMENDED PRACTICES

Wind Damage

- Maintain a diverse forest to spread the risk, especially by limiting the acreage in susceptible types such as mature white pine on wet soils.
- Consider the rooting depth, butt flair, crown size and soil profile when planning a partial harvest in overstocked stands. Trees growing for long periods in tight conditions or on shallow or wet soils are at risk of wind throw from moderate to severe wind. Limit partial harvests in susceptible stands to no more than 1/3 of the basal area, and perhaps leaving an uncut buffer on the windward side of the stand.
- Position thin strip cuts so that prevailing winds skip across the narrow width rather than down the full length of the strip, orienting strips at right angles to the prevailing winds. Position larger openings so that prevailing winds cross at the narrowest point.
- Remove high risk trees that have stem cankers, forking tops and signs of internal decay.
- Consider even-aged management where repeated occurrences of wind damage is evident. Stands naturally growing in mosaics of even-aged groups because of localized wet or shallow soils or exposure to high winds are candidates.
- Post wind storm actions:
  - Determine the footprint of the storm.
  - Determine what percentage of trees were blown over with roots intact versus trees breaking above the stump and salvage broken trees first. There is no need to expedite removal if trees are blown over with tops and roots attached.

Ice Damage

- In forests with previous sign of branch breakage and top dieback, remove trees with weak or hazardous branch structure. Trees with branches forked in a "V" shape crotch are weaker than those with the stronger "U" shape.
- Post ice storm actions:
  - Determine the footprint of the storm.
  - Inventory to determine the percentage of trees damaged and the average amount of branch breakage by species and salvage according to the following guidelines:
    - Trees with less than 50% branch breakage are likely to recover, except for paper birch.
    - Trees with greater than 75% branch breakage are at risk to keep as a future high quality tree.
    - Trees with any bole breakage below the live crown are a high risk to keep.

percent

CROSS REFERENCES

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Good Forestry in the Granite State: Draft Forest Health - Logging Damage

5.4 LOGGING DAMAGE

BACKGROUND

Excessive damage to residual trees during a timber harvest can negate the intended benefits of harvest improvement operations.
Activities associated with felling, winching, and skidding can result in damage to 20 - 40% of the residual trees (trees left behind).

Young trees may be bent or broken during felling or crushed by harvesting equipment. Branches and tops may be broken during felling, reducing crown area and eventually tree vigor. Valuable lower trunks of larger trees may be wounded, allowing entry of fungi or insects that cause wood discoloration and decay. Injuries resulting in exposed sapwood wounds of 100 square inches or greater are likely to develop decay. Approximately 80% of skidding injuries are from bark scraped from the butt log of residual trees.

Skidding can cause root damage, allowing entry of rot-causing microorganisms. Repeated passes of heavy equipment over certain types of soils, especially during wet conditions, can compact soil air spaces, impeding root growth. Most healthy forest soils maintain about 50% solids, 25% air space and 25% water by volume. When these ratios change through compaction, roots are damaged and their growth restricted, erosion and run-off increase due to decreased permeability, and changes in soil temperature and microbial action disrupts soil nutrient cycling.

Logging may also combine with other stress factors to make individual trees and eventually stands more susceptible to die-back. Poor vigor invites insect and disease. Also, though a stand may not be physically damaged, the removal of trees may reduce the stand's ability to withstand wind.

OBJECTIVE

Control and minimize logging damage to residual trees and reduce the total area of soil compacted during harvest operations.

CONSIDERATIONS

- Research indicates that damage levels to the residual stand of 10% or less is possible by experienced operators.
- Minimizing damage depends equally on supervision, skid trail locations, and care in felling and skidding.
- More damage occurs when bark is loose during spring and early summer. However, it isn't always possible to avoid harvesting during these times, so extra caution is warranted.

- Certain species (e.g. paper birch and balsam fir) are more susceptible to damage than others.
- Trees growing on very dry, wet, or windy sites, or that have a history of insect or disease attacks are less likely to survive logging damage.
- Elements contributing to compaction include site conditions such as soil texture (particle size), soil moisture, unevenness of the ground, and slope. The number of passes and equipment characteristics also contribute and include: total weight of the equipment, vibration, speed, pressure on the soil (pounds per square inch or psi), tire or track tread design, and operator experience. Logger training, experience, attitude and motivation are more important than equipment size in minimizing logging damage.
- Wet soils and fine textured soils compact more readily than dry and or coarse soils.
- Soil compaction affects the type, productivity, and timing of natural regeneration.
- Forest floor scarification is often desired to promote regeneration.

RECOMMENDED PRACTICES

- Plan and mark skid trails and landings to accommodate the equipment as well as skidding needs of future harvests. Reuse existing trails. For partial harvests keep the area dedicated to skid trails at or below 20% of the total harvest area.
- Use loggers skilled in proper directional felling, winching, and skidding procedures. Ask for references.
- Include contract provisions that provide incentives to minimize damage and impose sanctions in the event of careless damage to the residual stand.
- Use equipment appropriate for the size and density of the trees and soil and site conditions.
- Use branches (slash) in skid trails as a protective road bed.
- Use "bumper" trees along skid trails to protect residual trees.
- Harvest sensitive or wet soils during frozen or dry ground conditions.
- Use group or patch cutting to reduce damage to the residual stand. Under this method trees can be felled toward newly created openings, rather than the residual stand.
- Work around pockets of advanced regeneration. Harvesting when a heavy snow cover is present will help protect small seedlings and saplings.
- Avoid harvesting heavily defoliated stands for two to three growing seasons to minimize stress on the trees.
- Avoid exposing adjacent uncut stands to prevailing winds. - to avoid wind throws especially in spruce stands.
- Monitor the harvest to make sure the operation is being properly conducted.

CROSS REFERENCE

Soil Productivity 1.1; Regeneration: The Right Tree on the Right Site 5.1;Insects, Diseases x.x.

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Topics in this section:

Mast
Cavity Trees, Dens and Snags
Dead and Down Woody Material
Overstory Inclusions
Permanent Openings
Temporary Openings Created by Forest Management
Aspen Management
Beaver-Created Openings
Deer Wintering Areas
Woodland Raptors
Bald Eagle Winter Roosts
Heron Colonies
Wildlife Species of Greatest Conservation Need

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Good Forestry in the Granite State: Draft Habitat - Mast

X.X MAST

BACKGROUND

Mast is critical to wildlife survival.
The fruits, nuts and seeds of woody plants are called mast when referring to their use by wildlife for food. Hard mast refers to nuts and seed and soft mast refers to fruits and berries. Seeds can regenerate the forest immediately following a natural disturbance or in conjunction with a harvest, but during most of the life of the forest, the majority of the seeds don't germinate and grow into seedlings. Most of the time they are eaten by wildlife as mast, the focus of this chapter.

Masting cycles, insects and disease, plant species, plant age, tree diameter and dominance, weather, and genetics affect mast production. "Masting" is the natural cycle in which trees and shrubs produce abundant seeds one year, followed by a year or more where mast production is moderate or low. The plant species, weather, and genetics are believed to control masting cycles. Genetics likely play the most important role in determining how much mast any individual tree or shrub is capable of producing. Some individual plants produce regular, abundant mast crops, while others consistently produce poor crops. There are few physical features of plants that allow managers to identify what plants are genetically superior mast producers. Even these plants don't produce superior crops every year. In general, plants that are mature and exposed to full sunlight, with little competition from surrounding plants, will be the plants most likely to produce abundant mast crops when all of the other conditions affecting mast production are favorable. Insects can reduce tree vigor or damage young fruits and result in at least a temporary reduction in the amount of mast

Hard Mast
American beech, hickory, and red, white and black oak are important in the diets of white-tailed deer, black bear, wild turkey, ruffed grouse, wood duck, and more than a dozen other mammals and birds. Beechnuts are an important autumn food source for black bears in northern New England. Beech trees begin heavy nut production at about 50 years or 8 inches diameter at breast height (DBH) and produce good crops at 2- to 8-year intervals. Red oaks bear heavy acorn crops at 2- to 5-year intervals and are at peak production when trees are 19-22 inch DBH. White oaks bear heavy crops at 4- to 10-year intervals, and peak in production at 24-30 inch DBH. There is considerable variation between trees, but individual trees tend to produce consistently good or poor acorn crops. White oak acorns are more palatable than red and black oak acorns because the former contain lower tannin levels. Ash, birches, maples, and conifers are also important sources of hard mast. Sources of hard mast have changed during the last century, most notably, chestnut blight eliminated American chestnut.

Soft Mast
Black cherry is the primary soft-mast producer and provides an important food source for

bears, small mammals, and 28 bird species. While 10-year old saplings may produce fruit, peak production occurs between 30 and 100 years. Good crops occur at 1- to 5-year intervals, although black cherries usually produce some fruit every year. Black cherry trees may vary widely in fruit production, making the production history of individual trees an important consideration in selecting trees for harvest or retention. Other important sources of soft mast include pin and choke cherries, wild apples, mountain ash, shadbush (also called serviceberry or juneberry), brambles (blackberries and raspberries), dogwoods, viburnums, blueberries, hackberries, elderberries, and grapes.

Sources of soft mast have changed with increases in non-native invasive shrubs such as autumn olive, barberry, buckthorn, honeysuckle, and multiflora rose. Some studies suggest that berries produced by non-native plants may have a lower nutritional value than those from native plants, but this depends on the species being compared. There are many concerns regarding the impact that non-native, invasive plants have on wildlife habitat. Landowners and managers are encouraged to take appropriate measures to eliminate and control the spread of these plants.

OBJECTIVE

Manage mast producing trees and shrubs for a continuous source of wildlife food and quality seed for regeneration.

CONSIDERATIONS

- The diversity and amount of mast lessens as you travel north.
- Individual oak, beech and black cherry trees may be poor timber quality but an invaluable source of mast. Such trees may have greater value left for wildlife than harvested for wood products.
- Beech-bark disease may affect management decisions in infected stands.
- Understory or edge shrubs such as high bush blueberry, huckleberry, maple-leaf viburnum, hazelnut, silky dogwood, and northern wild-raisin are an important source of mast and their mast production can often be improved simply by removing overtopping trees.
- It is illegal to plant non-native invasive such as multiflora rose, winged euonymus, non-native honeysuckle species, autumn olive, and other species per RSA 430:51-57.

capitalize

(Do you want to suggest some native species?

RECOMMENDED PRACTICES

gray dogwood, viburnums, American plum, blueberries, hazelnuts, etc.

- When managing stands with multiple mast-producing species, maintain the diversity of mast sources.
- Manage oak and beech stands on long rotations (100-125 years), growing trees to greater than 18-20 inch diameters to maximize acorn production and timber value. Maintain oak in well-stocked stands by retaining vigorous trees with dominant crowns.
- Retain beech trees with bear claw marks on the trunk or clumps of broken branches in the crown. Retain beech older than 40 years in stands supporting wild turkeys.
- Improve mast production by leaving dominant and co-dominant trees with healthy crowns. Remove neighboring trees that have crowns touching the crowns of the trees you are saving. Remove competing trees from at least three sides to provide gaps into

which the trees you retain can expand their crowns

- When harvesting stands with black cherry, retain some trees with high fruit production or any tree that shows evidence of use by bears (e.g., clumps of broken branches in the crown).
- Retain wild apple trees and gradually release them from competition. (Permanent Openings 3.2)
- Retain mountain ash when performing timber harvesting at high elevations
- Whenever possible, avoid harvesting mast stands during spring (April-May) and fall (September-November) foraging periods favored by bears and other wildlife.
- Consider identifying high-quality hard mast sites as "mast producing areas" devoted specifically to long-term mast production for wildlife.
- Retain softwood fingers extending into mast stands and dense, brushy growth around them to provide wildlife with protective cover. This is important when managing near old apple orchards.
- Allow log landings to regenerate naturally to promote the growth of mast producing shrubs such as brambles and strawberries. Encourage brambles by retaining down woody material in and around the landing.
- Favor the regeneration and maintenance of natives over non-natives. When planting mast-producing shrubs, select native species.

CROSS REFERENCE

Overstory Inclusions 3.1; Permanent Openings 3.2; Deer Wintering Areas 3.5; Woodland Raptor Nest Trees 4.4; Regeneration: The Right Tree on the Right Site 5.1; Managing for High Quality Trees 5.3; Insects, Disease and Wind Damage 5.6.

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Good Forestry in the Granite State: Draft Habitat - Cavity Trees, Dens and Snags

X.X CAVITY TREES, DENS AND SNAGS

BACKGROUND

Retaining snags (dead or partially dead standing trees) and den trees (live trees with existing cavities) helps to maintain populations of wildlife that require cavities. Ten species of New Hampshire's forest birds excavate cavities for nesting and roosting. Another 15 birds and 18 mammals use natural or excavated cavities in forests for nesting, roosting, or denning. In addition, the brown creeper nests under loose flaps of bark, attached at the top, on standing dead trees. A variety of cavity tree sizes are required to meet the needs of different species (Table 1). While cavity trees of any size have value for smaller-bodied wildlife such as the black-capped chickadee and tufted titmouse, trees larger than 18 inches diameter at breast height (DBH) accommodate larger-bodied animals and are used by more species. Due to past agricultural and timber harvesting practices, cavity trees larger than 24 inches in diameter are uncommon.

OBJECTIVE

Maintain cavity and den trees, particularly trees with diameters exceeding 18 inches.

Table 1: **Minimum Tree Diameters for Cavity-using Species**	
6- 8"	>18"
Downy woodpecker*	Wood duck
Black-capped chickadee*	Common goldeneye
Boreal chickadee*	Hooded merganser
Tufted titmouse	Common merganser
House wren	Turkey vulture
Winter wren	Barred owl
Eastern bluebird	Pileated woodpecker*
	Silver-haired bat
6-12"	Gray squirrel
Northern saw-whet owl	Red squirrel
Hairy woodpecker*	Porcupine
Yellow-bellied sapsucker*	Marten
Red-breasted nuthatch*	Fisher
White-breasted nuthatch	Long-tailed weasel

make it easier for folks to understand that the * = primary cavity excavators. maybe put it @ the top of the list.

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Brown creeper	
Chimney swift	**> 24"**
Southern flying squirrel	Little brown bat
Northern flying squirrel	Big brown bat
Ermine	Gray fox
	Black bear
12-18"	Raccoon
Eastern screech-owl	
Three-toed woodpecker*	
Black-backed woodpecker*	
Northern flicker*	
Great crested flycatcher	
Northern long-eared bat	*=primary cavity excavators
Indiana myotis	

CONSIDERATIONS

- U.S. Occupational Safety and Health Administration (OSHA) regulations regarding dangerous tree removal may conflict with the recommendations of this section. They require the removal of all snags (i.e., standing dead or dying trees) by mechanical or other means. If the tree is to be left standing, it must be marked and no work conducted within two tree lengths of the tree, unless the employer demonstrates a shorter distance won't create a hazard for an employee. percent
- Cavity trees account for a very small percentage (< 10%) of the stand's live basal area.
- Broken large limbs in hardwood crowns provides smaller-diameter, cavities over time. These cavities are often difficult to spot from the ground.
- Sawtimber and large-sawtimber snags remain standing longer than pole-size snags.
- Snags provide various substrates on which woodpeckers and other bark gleaners forage for insects. They grow lichens, mosses, liverworts and fungi upon which many small mammals forage.
- Riparian zones, roadside buffers, scenic areas, and uncut patches contribute to snag retention goals for an ownership.
- Snags and cavity trees are recruited in forest stands of all ages when natural disturbances such as wind and ice break tree branches or damage entire trees. Unmanaged forest stands or those managed on a rotation long enough to allow some trees to mature and die of natural causes often contain a greater proportion of snags and cavity trees than younger stands, and are more likely to contain large diameter (18+ inches) tree that benefit a wide variety of wildlife species.
- Even distribution of snags may be desirable for some species, but there are many benefits to clumping snags. Uniformity isn't always operationally practical or desirable.
- Landowners harvesting timber may have to make a conscious effort leave some trees

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uncut if they are interested in retaining and recruiting snags and cavity trees greater than 24 inches in diameter. On smaller ownerships it may be necessary to manage snags on an acre by acre basis. On larger ownerships it is usually more practical to take a landscape-level approach, emphasizing snag retention on some areas, while not on other areas.

RECOMMENDED PRACTICES

- In areas under uneven-aged management:
  - Retain a minimum of 6 live cavity and/or snag trees per acre, with one exceeding 18 inches DBH and 3 exceeding 12 inches DBH.
  - When lacking such cavity trees, retain live trees of these diameters with defects likely to lead to cavity formation.
- In areas under even-aged management:
  - Leave an uncut patch for every 10 acres harvested, with patches totaling 5% of the area. Patch size may vary from a minimum of 1/4 acre. Riparian zones and other buffers can help to satisfy this goal.
  - Focus retention patches with the following trees as their nuclei:
    - Existing cavity trees exceeding 18 inches DBH or active den trees.
    - broken-topped live trees exceeding 12 inch DBH
    - secure standing dead trees, especially those with top-attached bark flaps
    - Living, large aspen and white pine, red spruce, eastern hemlock, sugar maple, beech, yellow birch, elm and oaks. Except for aspen, these trees will persist for long periods as standing dead trees.
- Retain large diameter dead snags.
- Retain live trees with existing cavities.
- Include the species, diameter and condition (e.g. living or dead) of snags and cavity trees as part of a forest inventory.

CROSS REFERENCE

Wetlands and Riparian Areas 2.1; Overstory Inclusions 3.1; Mast 3.6; Dead and Down Woody Debris 3.8; Forest Structure 5.2.

ADDITIONAL INFORMATION

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Good Forestry in the Granite State: Draft Habitat - Dead and Down Woody Material

X.X DEAD AND DOWN WOODY MATERIAL

BACKGROUND

Dead and down woody material (logs, stumps, limbs and upturned tree roots) in various stages of decay serves many critical functions.
Dead and down woody material, often referred to as coarse wood material (CWM) or coarse woody debris, is important for nutrient retention and cycling, as nurse logs for regeneration of trees and understory plants, and as wildlife habitat. Large (18+ inches) hollow or rotten logs and stumps generally have the greatest value. Softwood stands usually contain more and longer-lasting down woody material than hardwood stands. Maintaining snags and cavity trees will also serve to maintain CWM, as these trees eventually fall over.

Coarse woody material is used by over 30% of the region's mammals, 45% of the amphibians, and 50% of the reptiles. It is used as a feeding site by rodents, shrews, black bears, and woodpeckers and provides shelter for many small mammals. Seventeen mammal species, including black bear, otter, mink, fisher, weasels and deer mouse either den or hunt, in or under downed logs. CWM creates moist micro-habitats that are used by amphibians. Downed logs create pools and riffles in streams that provide important fish habitat and basking and nesting locations for turtles, waterfowl, mink, and otter. Several ground-nesting birds (including juncos and winter wrens) nest in upturned tree roots. Dead and down woody material provides habitat for many other organisms such as insects and other invertebrates, mosses, fungi, and lichens.

OBJECTIVE

Manage for coarse woody material by retaining material that currently exist and allowing its accumulation where it is missing.

CONSIDERATIONS

- The amount of CWM is low in many forests, because of past land use. As forests are maturing, the supply of this material is naturally increasing as older trees die and fall over. However, more use of entire trees through chipping (whole tree or biomass harvesting) or other techniques such as firewood cutting that leave less CWM in the woods may reduce the supply of this material on certain woodlots.
- Dead and down woody material is a natural component in forests. It is recruited in forest stands of all ages when natural disturbances such as wind and ice break tree branches or damage entire trees. Unmanaged forests or those managed on a rotation long enough to allow some trees to mature and die naturally often have a greater proportion of this material than younger stands, and are more likely to contain large diameter (18+ inches) material.
- Recruiting and retaining this material requires a conscious effort, especially when

harvesting.

- CWM may have minimal economic value as biomass.
- CWM can provide a favorable microclimate for regeneration. It can protect developing tree seedlings from deer and moose browsing when the trees are young and vulnerable to browsing damage.

RECOMMENDED PRACTICES

- Avoid damaging existing CWM, especially large (18+ inches) hollow or rotten logs and rotten stumps.
- Leave cull material from harvested trees, especially sound hollow logs, in the woods. Leave some cull material in the woods during whole-tree or biomass harvests. Return large pieces of cull material bucked out on the landing to the woods.
- Avoid disrupting downed logs in and adjacent to streams, ponds and wetlands.
- Avoid disrupting upturned tree roots from May-July to protect nesting birds.
- Maintain or create softwood inclusions in hardwood stands to provide a supply of longer-lasting down woody material.
- Collect information about the type and abundance of CWM as part of a forest inventory.

CROSS REFERENCE

Overstory Inclusions 3.1; Cavity Trees, Dens and Snags 3.7; Forest Structure 5.2; Slash Disposal 6.4.

ADDITIONAL INFORMATION

DeGraaf, R.M., M. Yamasaki, W.B. Leak, and A. M. Lester. 2006. Technical guide to forest wildlife habitat management in New England. University of Vermont Press.

Good Forestry in the Granite State: Draft Habitat - Overstory Inclusions

x.x OVERSTORY INCLUSIONS

BACKGROUND

Maintaining or creating inclusions of overstory that are distinct from the surrounding forest type can greatly increase the habitat diversity of otherwise uniform areas. Overstory inclusions are small patches of forest that are distinct from the surrounding forest, but too small to be mapped or treated separately. A patch of hemlock in a pure hardwood stand, or patches of oak in a pine stand are examples of overstory inclusions.

25 percent

Inclusions provide feeding, nesting, and shelter that may not be present in continuous stands of a single forest type. Over a quarter of New England's bird species and a lesser number of mammals use overstory inclusions in one way or another. Deer, moose, and some furbearers are attracted to softwood inclusions within hardwood stands. Such inclusions may be important for facilitating movement of these animals during deep snow conditions.

Inclusions may range in size from just a few trees to more than an acre. The value of a minor inclusion increases in proportion to how different it is from the surrounding forest. Even a single softwood tree such as a hemlock, large-crowned spruce, or a large white pine within a pure hardwood stand, can greatly increase the variety of available habitats.

OBJECTIVE

Maintain and regenerate inclusions of softwood cover in predominantly hardwood stands and inclusions of hardwood cover in predominantly softwood stands.

CONSIDERATIONS

- Applying different treatments to small inclusions may be uneconomical if these treatments require different equipment or techniques.
- Small volumes of some species derived from treatment of inclusions may not be marketable.
- Inclusions may be prone to blowdown, sunscald, and other risks if surrounding cover is removed.
- Inclusions may be the result of either small-scale site differences or variations in the past disturbance history of a stand. Natural succession may work against the maintenance of these areas, especially if advance regeneration of the surrounding dominant vegetation is present. Maintenance and regeneration of inclusions will be more practical where inclusions result from relatively permanent site factors, rather than from variations in disturbance history across a uniform site.

RECOMMENDED PRACTICE

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- Create inclusions in large uniform stands if site conditions allow.
- Where inclusions exist, develop prescriptions to maintain or regenerate them in their current type. Inclusions shouldn't necessarily receive the same prescription as the rest of the stand.
- Leave inclusions unharvested if the inclusion is:
  - relatively unique to the area
  - small (1/4 acre or less) and the volume of timber generated from its treatment will be limited
  - from small-scale differences in site conditions and may be sensitive to disturbance (such as wet areas or shallow soils over ledge).
- Leave a buffer around softwood inclusions to provide protection from wind. The buffer should be at least 2-3 tree heights wide on the side exposed to prevailing winds. Don't remove more than 25% of the basal area within this buffer.
- Inclusions can often be incorporated with other desired habitat features such as a seep, vernal pool, or a large legacy tree.
- On larger ownerships, locate and map inclusion, for example with a GPS, for monitoring purposes.

CROSS REFERENCE

Aspen Management 3.4; Deer Wintering Areas 3.5; Mast 3.6.

ADDITIONAL INFORMATION

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Good Forestry in the Granite State: Draft Habitat - Permanent Openings

x.x PERMANENT WILDLIFE OPENINGS

BACKGROUND

Permanent openings up to a few acres in size - dominated by grasses, forbs, brambles, or shrubs - provide valuable habitat for many wildlife species.

Non-forested uplands and wetlands cover a small portion of New Hampshire but they may contribute a disproportionately high share of wildlife habitat. They provide necessary habitat for about 22% of New England's wildlife species, and seasonally important habitat to nearly 70% including "species of greatest conservation need" such as eastern towhee and New England cottontail.

Some guidelines suggest 3-5% of forest land should be maintained in permanent openings. The value of these openings depends on the surrounding landscape. They are more beneficial in large areas of continuous forest cover than in areas with a mixture of forest and non-forest habitats.

Permanent openings in a managed forest include (1) remnant meadows, pastures, or orchards on abandoned agricultural land, (2) log landings and roads created during timber harvesting and maintained afterward, and (3) openings where herbaceous forages are planted and maintained as wildlife food plots.

OBJECTIVE

Create or maintain permanent openings dominated by grasses, forbs, or shrubs within forest-dominated upland landscapes.

CONSIDERATIONS

- Openings with a combination of grasses, forbs, brambles, and fruiting shrubs attract and support a greater diversity of wildlife than openings containing less plant diversity.
- Site conditions affect the ability of any given site to support a diversity of plants and structural conditions. Even slight variations in soil moisture or type can result in different plants. Old fields occurring on productive agricultural soils generally revert to a greater diversity of plants and support higher stem densities than do upland forests recently cleared. High stem density is a critical factor in determining habitat quality for some species such as American woodcock and New England cottontails.
- Maintaining permanent openings involves a cost. It is usually cheaper to maintain an existing field than to convert a forest into an herbaceous opening. Removing stumps and rocks significantly increases the cost and may require a permit from the N.H. Department of Environmental Services. Forest openings maintained as shrub openings often regenerate faster and support greater plant diversity when the stumps aren't removed. Financial assistance may be available to help create and maintain permanent

openings.

- It is often more practical, efficient, and cost-effective to create temporary openings as part of regular timber sales, creating new openings in each successive harvest, rather than to create and maintain permanent openings. Small temporary openings can be created by patch-cutting trees as part of an annual firewood harvest (x.x Temporary Openings).
- Openings less than 2 acres usually don't attract wildlife species that don't already occur in the vicinity, though chestnut-sided warblers and common yellowthroats are attracted to small openings. The purpose of small openings is to increase the amount and type of foraging and cover available to species already present.
- Openings 5 acres and larger are most likely to attract and support species not already present, especially when created in extensively forested landscapes.
- All openings eventually revert back to trees if they aren't maintained
- Maintaining permanent openings removes some land from timber production. Seeded log landings and woods roads maintained as openings benefit wildlife and remain available for use in future harvests.
- Prescribed fire can maintain permanent openings. Conditions in which fire can be used are specific (e.g., wind speed, temperature, humidity, fuel load) and often unpredictable (x.x pine barrens). Permits are required and trained personnel are needed to plan and oversee the burn. The Natural Resources Conservation Service (NRCS) or UNH Cooperative Extension (UNHCE) can provide more information.

RECOMMENDED PRACTICES

N.H.

- Contact the UNHCE Wildlife Specialist or a NH Fish and Game Wildlife Biologist for site-specific recommendations such as (1) where to locate openings, (2) the appropriate size to meet your objectives, (3) options for creating and maintaining openings, and (4) information about financial assistance programs.
- Maintain existing fields, old-fields, wet meadows, pastures or orchards to develop and keep the type of plants and plant structure desired.
  - Mow openings with grasses or other non-woody vegetation at least once every three years to keep woody plants from dominating. The plants desired and the site growing conditions determines mowing frequency.
  - Maintain shrub openings by periodically removing individual trees as they begin to overtop the shrubs. Mowing shrub openings often isn't needed once desired shrubs dominate. Remove non-native, invasive shrubs.
- Mow openings after August 1 since most wildlife have completed breeding and the young are fledged. Specific management objectives may dictate mowing earlier or later than August 1.
- Rotary mowers (e.g. brush hog), forestry mowers (e.g., brontosaurus, skid-steer mounted mowers), and hand tools (e.g., chainsaw, brush saw) are commonly used to maintain permanent openings.
  - Allow shrub openings maintained with a rotary mower to grow to the point that, if they were to grow any longer, they would be difficult to mow – this usually means mowing about once every 5 years. Rotary mowers mow material up to 1 inch diameter efficiently.
  - Mow shrub openings with a forestry mower about once every six to ten years

depending on the specific mower and how fast the shrubs and trees are growing. Forestry mowers mow woody material larger than 1 inch diameter, with the largest mowers capable of efficiently mowing trees up to 6 inches.
    - Use chainsaws and brush saws to remove individual trees or small groups of trees as soon as they begin to overtop desired shrubs. Brush saws are generally effective at mowing trees up to 1 inch.
- Mowing part of the opening one year and the remainder a year or more later maintains a diversity of plant heights and types.
- Retain old apple trees and prune and release them to maintain their vigor.

Recommendations for establishing new openings

- Orient openings to incorporate a variety of soil types. For example, orient the opening to run across, rather than parallel to changes in soil types.
- Locate openings so they abut habitat edges such as wetlands, fields, and power lines. These non-forest habitats often contain plants and structure similar to what will regenerate in the openings. Locating openings adjacent to these habitats increases the functional area occupied by that structure and tends to provide a greater benefit than a similar size opening located within a closed-canopy stand.
- Retain hard and soft mast trees and shrubs, large diameter trees, and snags along the edges of the openings.
- Retain pockets of softwoods along the edges as year-round cover. For example, patches of dense, young white pines along the edges of openings often attracts eastern towhees and Nashville warblers, which otherwise might not use the openings.
- Make the perimeter of the opening irregular to maximize the amount of edge.
- Keep slash, coarse woody material and other cover objects intact in most openings to minimize the effects of soil-drying on amphibians and to provide temporary cover, nesting sites, and perches while the cut regenerates.
- Remove slash from openings created specifically as singing grounds or nesting and foraging cover for woodcock as it is difficult for woodcock to forage and move through slash.
- When clearing forested sites, cut trees as low to the ground as practical to ensure full use of harvested trees, to allow for brush hogging, or to ensure browse remains as accessible for as long as possible (i.e., sprouts from tall stumps grow beyond browsing height faster than those from short stumps). Some large stumps and rocks may need removal. If you don't have a way to keep woody plants from invading, removing stumps will be a wasted effort.
- To convert forest to herbaceous opening, stump and grade to create a suitable seedbed and to allow for regular mowing, and follow seeding recommendations below.
- Clear landings and selected woods roads of debris, level and smooth the ground. Plant with a recommended seed mix only if necessary to stabilize the soil, to meet wildlife objectives, or for aesthetics. Otherwise let natural vegetation establish itself. Contact the NRCS or UNHCE for information on site-specific seeding options.
    - If landings and woods roads are planted to high quality forages such as clovers, chicory, or brassicas, apply lime and fertilizer according to a soil test prior to planting.

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NRCS wants to see hay or cover on seeded areas esp. banks

- Don't spread hay on areas planted to high-quality forages. Weeds will be introduced and compete with desirable forages.
- Clover plots require mowing at least three times a year. If mowing only once a year select a less expensive seed mixture with a combination of perennial grasses and forbs such as clover, vetch, and bird's-foot trefoil.
- Don't plant invasives and regularly inspect openings for invasive plants introduced by birds or other means.

CROSS REFERENCE

Landings 6.3; Aesthetics of Clearcutting 6.5; x.x Invasives; x.x temporary openings; invasive x.x

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and along roads.

Good Forestry in the Granite State: Draft Habitat - Temporary Openings Created by Forest Management

X.X TEMPORARY OPENINGS CREATED BY FOREST MANAGEMENT

BACKGROUND

Shrubland wildlife species are rapidly declining in New England.
Many wildlife species such as black racer and milk snake; woodcock, brown thrasher, whip-poor-will, chestnut-sided warbler, common yellowthroat, eastern towhee, and indigo bunting; New England cottontail, meadow vole, and meadow jumping mouse require grass- and shrub-dominated early successional habitat for shelter and forage throughout the year. Early successional wildlife habitats (young trees and shrubs) have become very uncommon in much of the northeast, largely due to the maturation of the forests. These habitats are ephemeral and created through some type of human or natural disturbance (e.g., forest management clearcuts, periodic hurricanes, fire, beaver activity, and insects). Coastal and valley-bottom forests, historically exposed to disturbances from windthrow and fire are far less available as habitat today due to development, coupled with fire suppression. Today's forests are often shaped by public desire to view extensive, unbroken forests in all directions, making the presence of big patches and gaps of vibrant shrubby forest regeneration, created through even-aged management far less likely on the landscape.

OBJECTIVE

Provide a sufficient range of early successional habitat through regenerating shade intolerant forest types.

CONSIDERATIONS

- Integrated timber and wildlife habitat management can efficiently and cost-effectively create early successional habitat.
- Larger regenerating patches attract more species of early successional wildlife than smaller regenerating patches. To attract and support early successional birds, the minimum effective patch size probably exceeds 2 1/2 acres and spans the gap between the maximum size of group selection cuts (2 acres) and small clearcuts (10 acres).
- Shade intolerant tree species (aspens, pin cherry, and paper birch) are best regenerated by clearcut, patch and large group selection practices during the snow-free season.
- Use of clearcuts by early successional birds peaks around 10 years post-cut, and generally disappear from clearcuts within 20 years. A more frequent re-entry schedule than every 20 years can help maintain the occurrence of such ephemeral habitat.
- Isolated patches of early successional habitat in extensively forested landscapes are likely to have lower rates of shrubland bird occupancy than forested landscapes with higher percentages of early successional habitat.
- Statewide estimates to optimize early successional habitat for the array of early successional wildlife suggest a goal of 5 percent to 20 (%) percent of the landscape in an early

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successional condition. This goal includes regeneration (0 to 10 year age class) and permanent openings with all properties contributing.

RECOMMENDED PRACTICES

- Develop habitat composition goals for a property that include young forest, as well as mature and older forest for a broad diversity of wildlife over time.
- Increase the use of group selection, patch and clearcut methods to diversify a closed canopy, increasing the gap size whenever possible.
- Regenerate shade intolerant and mid-tolerant trees using shorter rotations, larger cuts, and site scarification.
- To increase the effective area of available early successional habitat spatially and over time, locate new groups, patches and clearcuts adjacent to temporary and permanent openings (i.e. utility corridor rights of way, scrub-shrub wetlands, frost pockets, and brushy old fields).

CROSS REFERENCE

Permanent openings, beaver-created openings, aspen management, forest regeneration, pine barrens wildlife

ADDITIONAL INFORMATION

DeGraaf, R.M., M. Yamasaki, W.B. Leak, and A.M. Lester. 2006. Technical Guide to Forest Wildlife Habitat Management in New England. Burlington, VT: University of Vermont Press. 305 p.

Good Forestry in the Granite State: Draft Habitat - Aspen Management

X.X ASPEN MANAGEMENT

BACKGROUND

Aspen (also known as poplar or popple) stands are the preferred habitat for ruffed grouse, woodcock, Nashville warbler, beaver and other wildlife.

Although aspen is one of the most widely distributed forest types in North America, it is relatively uncommon in New Hampshire covering approximately 2% of the state's forest area. Aspen, including trembling aspen (*Populus tremuloides*) and bigtooth aspen, (*P. grandidentata*) often grow in close association with white birch and occurs chiefly as a "pioneer" forest type. Pioneer types are the first to colonize disturbed areas such as burns and field edges. Bigtooth and trembling aspen are extremely intolerant of shade. They need full sunlight to grow. Disturbances such as fire or clearcutting are needed to regenerate shade-intolerant species such as aspen and white birch. In the absence of disturbance, aspen is replaced by more shade-tolerant trees such as spruce, fir, white pine, or northern hardwoods.

OBJECTIVE

Maintain or expand the aspen type to enhance wildlife habitat diversity.

CONSIDERATIONS

- Aspen seed is extremely small and light. It can be blown long distances, but requires exposed mineral soil for successful germination.
- Aspen typically regenerates by root suckering. When an area containing aspen is clearcut, dormant buds on the roots sprout, often producing several thousand suckers per acre. Because they have an established root system, the suckers (collectively called a clone) may grow four feet tall or more during the first year.
- All flowers on an individual tree are the same sex. Male aspens have larger buds and are more valuable food for ruffed grouse.
- Trembling aspen stands reach maturity and begin to deteriorate at about 40 years old, though deterioration may begin at age 30 on poor sites or age 50+ on good sites. At maturity, aspen trees are generally 10 to 16 inches in diameter at breast height depending on the quality of the site. Bigtooth aspen grows longer and larger than trembling aspen.
- Growing aspen requires short-rotation management (40 +/- years). On poor sites such as infertile sands, short-rotation management may lead to soil nutrient depletion, particularly if whole-tree harvesting is used.
- Once aspen is gone, it is difficult to get it back, requiring cutting aspens in order to regenerate aspen from root suckers.
- A number of insects and diseases attack aspen. The only feasible method of dealing with them is to keep aspen stands vigorous by harvesting them at an appropriate

rotation age.

- Aspen stands managed as feeding and nesting cover for woodcock or grouse are often 1 to 5 acres. Aspen openings as large as 10-20 acres are valuable for other early successional songbirds and mammals.
- Older and over-mature aspen provide potential nest sites for pileated woodpeckers and other cavity nesters.

RECOMMENDED PRACTICES

- To regenerate aspen when a stand has at least 10-20 square feet of basal area per acre of aspen:
  - Harvest stands before the trees mature and begin to decline in vigor. Fast-growing, pole-sized trees sprout more vigorously than older, slower growing stands.
  - Create openings with a diameter at least 1½ times as large as the surrounding trees are tall to allow sunlight to reach the ground.
  - Clearcut nearly all of the stand and ideally cut all stems 1 inch in diameter and greater to ensure direct sunlight and to stimulate the best root-suckering response. The number of root suckers is directly proportional to the number of aspen stems removed.
  - Cut aspen when dormant (late-autumn through early-spring) and avoid disturbance to aspen roots to maximize the density of root-suckers.
- To increase aspen where it occurs in very small groups or as individual trees mixed with other species such as growing along old woods roads, skid trails, and landings:
  - Locate openings following the above recommendations, so as to cut some, but not all of the aspens.
  - Locate openings southwest of the aspens that are kept to maximize sunlight and heat exposure to roots and root suckers.
  - Expand these openings in subsequent harvests.
- Establishing aspen where none exists is more difficult and may require site preparation to enhance the germination and survival of seedlings.
- Where possible, retain downed logs at least 12 inches in diameter for ruffed grouse drumming.

CROSS REFERENCE

Overstory Inclusions 3.1; Regeneration: The Right Tree on the Right Site 5.1; Clearcutting 5.5; Aesthetics of Clearcutting 6.5.

ADDITIONAL INFORMATION

DeGraaf, R.M., M Yamasaki, W. B. Leak, and A.M. Lester. 2006. Technical guide to Forest Wildlife Habitat Management in New England, University of Vermont Press.

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Good Forestry in the Granite State: Draft Habitat - Beaver-Created Openings

X.X BEAVER-CREATED OPENINGS

BACKGROUND

Beavers add to habitat diversity through their foraging and dam-building activities. Openings created by beavers follow a predictable cycle of change. Beaver-created openings progress from newly flooded areas, to open water ponds, to open meadows containing scattered small trees and shrubs. Each of these stages provides habitat for a variety of wildlife. Frogs, turtles, waterfowl, great blue herons, swallows, otter, mink, and moose regularly use the open water stage. Geese, grouse, woodcock, woodpeckers, common yellowthroats, yellow warblers, bog lemmings, bears, deer, and moose use the open meadow stage. Through their damming activities, beavers have served a historically important role as a natural form of disturbance, creating young forest habitat required by many wildlife species.

Beaver flowages (i.e., flat water behind the dam) also influence water quality, as dams trap sediments and open meadows slow seasonal run-off. As a result, beaver flowages play an important role in nutrient cycling. During the open water stage, nutrients enter beaver flowages. Where flowages stagnate, nutrients drop out of the water and accumulate in the organic matter at the bottom. When beavers abandon flowages and water levels drop, organic matter dries and decomposes, allowing grasses and forbs to colonize. In time, shrubs and trees reoccupy these meadows. Beavers are attracted back to the site by this abundant food. Beavers create a dam, and the cycle begins again.

OBJECTIVE

Maintain adequate food supplies for beavers along wetland drainages where beaver dam-building and subsequent wetland openings are desired, and where water levels can be controlled to minimize damage to roads and personal property.

CONSIDERATIONS

- The highest-quality habitat for beavers occurs where shallow gradient streams flow through wide valleys dominated by hardwood forests:
  - Stream gradients in occupied habitats are always less than 12%. Gradients less than 3% are optimal.
  - Valley (drainage) widths greater than 150 feet wide are optimal.
  - Hardwood buds, leaves, current annual twig growth, and cambium are required food. Streams and wetlands with hardwoods (especially aspen) growing within the first 100 feet of the water's edge are most suitable. Hardwood saplings less than 3 inches in diameter are preferred food from late-summer through winter.
  - Aquatic plants including water lily, duck potato, waterweed, pondweed, and duckweed are important foods in spring through summer.

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- Large beaver flowages may be especially valuable for providing habitat for birds that require scrub-shrub habitats.
- Beavers can become a nuisance and have an economic impact to property owners when their tree-cutting and dam-building exceed an acceptable level. Numbers within a colony can grow to exceed the available food supply, resulting in starvation and site abandonment. Hunting or trapping can be used to remove nuisance beavers or to keep numbers within a colony low in order to extend the length of time beavers will occupy a site.
- Hunting or trapping of beavers and disturbing beaver dams is subject to regulation under RSA 210:9. Property owners can give written permission and access to licensed trappers during the regular trapping season. Outside of the legal season, NH Fish and Game (NHF&G) can provide the name of a local trapper who can remove nuisance animals under state supervision. Gradual removal of beaver dams can be accomplished in ways that slowly release impounded water without causing erosion and siltation if needed.
- Harvesting more than 50% of the basal area near a beaver flowage may require a variance to the basal area law (RSA 227-J:9).

RECOMMENDED PRACTICES

- Whenever possible, allow beaver dam-building activities to occur unimpeded in order to maintain natural water flow and forest disturbance patterns that maintain a high level of habitat diversity beneficial to a wide range of wildlife.
- To control flooding by beavers:
  - Determine the maximum acreage of flooding acceptable and set an appropriate water control device (solid or wood pipe, beaver box) at that level.
  - Maintain water depths at least 5-6 feet deep to allow beavers to access their lodge and travel under the ice during the winter. Beavers will likely abandon sites where water level is lowered to the point that ice forms to the pond bottom.
  - A permit from the NH Department of Environmental Services (NHDES) may be required to install a beaver pipe.
  - Consult with NHF&G or UNH Cooperative Extension for plans for water-control devices.
  - Perform at least annual maintenance on any device to ensure it is working properly and that it hasn't become plugged or buried by beavers.
- Consider using stone fords for stream crossings when a solid maintenance-free base is needed. Consult with the Natural Resource Conservation Service or the NHDES for permitting requirements.
- Maintain beavers at an active flowage, or encourage beavers to colonize an unoccupied flowage, by regenerating aspen and other hardwoods in small patches or strips adjacent to flat, wide riparian corridors. Locate patches or strips up to 1 acre to maximize the amount of young forest growth within 100 feet of the water's edge (x.x riparian). Create additional openings as needed to maintain an adequate supply of preferred food for beavers.
- If beavers are removing food faster than it grows, work with a local trapper to remove 2 to 4 beavers from the flowage annually to reduce the number of animals the food

supply must support, thereby extending the length of time that beavers are able occupy the flowage.

- Where safety allows, leave dead standing trees within and adjacent to beaver flowages.
- Consult with the NHF&G for additional information about RSA 210:9 and the NH Division of Forests and Lands about RSA 227-J:9.

CROSS REFERENCE

Wetlands and Riparian Areas 2.1; Water Quality 2.2; Aspen Management 3.4. Herons x.x.

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