A FORESTER'S GUIDE TO MANAGING WILDLIFE HABITATS IN MAINE

University of Maine
Cooperative Extension Service

MAINE CHAPTER OF
THE WILDLIFE SOCIETY, INC.

A FORESTER'S GUIDE TO MANAGING WILDLIFE HABITATS IN MAINE

Edited by

CATHERINE A. ELLIOTT

University of Maine
Cooperative Extension Service

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"Game management and forestry grow natural species in an environment not greatly altered for the purpose in hand, relying on partial control of a few factors to enhance the yield above what unguided nature would produce. Their controls are barely visible; an observer, unless he were an expert, could see no difference between managed and unmanaged terrain. Hence their success depends more on the right factors and the right controls than on heavy investments of labor or materials."

Aldo Leopold
(1887-1948)

Dedicated to

MALCOLM W. COULTER

who has taught so many about the "right factors" and "right controls," and to

FOREST AND WILDLIFE MANAGERS

who use that knowledge to enhance the yield of "unguided nature."

PREFACE

The Wildlife Society is an organization of professional wildlife biologists. The principle objectives of The Society are: (1) to develop and promote sound stewardship of wildlife resources and of the environments upon which wildlife and humans depend, (2) to undertake an active role in preventing human-induced environmental degradation, (3) to increase awareness and appreciation of wildlife values, and (4) to seek the highest standards in all activities of the wildlife profession.

In keeping with these objectives, the Maine Chapter of The Wildlife Society (TWS) decided to write this handbook on the management of forest wildlife. From the Chapter's experience with the 1985 conference, "Is Good Forestry Good Wildlife Management?", (Maine Agriculture Experiment Station, Misc. Publ. No. 689, 1986), jointly sponsored with the New England Chapter of The Society of American Foresters (SAF) and the Atlantic International Chapter of the American Fisheries Society (AFS), the need for practical, technical information for forest managers became apparent. Thus, the Maine Chapter of TWS produced this publication.

Each section of the handbook was written by a member of TWS with expertise in a particular area. The University of Maine Cooperative Extension Service (UMCES) became involved through their wildlife and fisheries specialist, who served as compiler and editor for the handbook. Two reviews of the guide were conducted, the first primarily by wildlife biologists and the second primarily by practicing foresters. This review process ensured that the guide met the objectives of providing biologically sound, practical management recommendations for incorporating wildlife habitat management into current forest management planning and practices.

The Maine Department of Inland Fisheries and Wildlife and the Maine Forest Service were involved in the review of the guide and, together with UMCES and TWS, will be involved in the dissemination of the guide through workshops and other means.

It is the intent of the Maine Chapter of TWS to periodically review and revise the guide, and to expand it to provide additional information as requested by its users. Forests and their wildlife communities are dynamic systems, so we too must be dynamic, willing to make changes in what we do and the way we do it, to best maintain and enhance the multitude of resources the forest represents.

ACKNOWLEDGEMENTS

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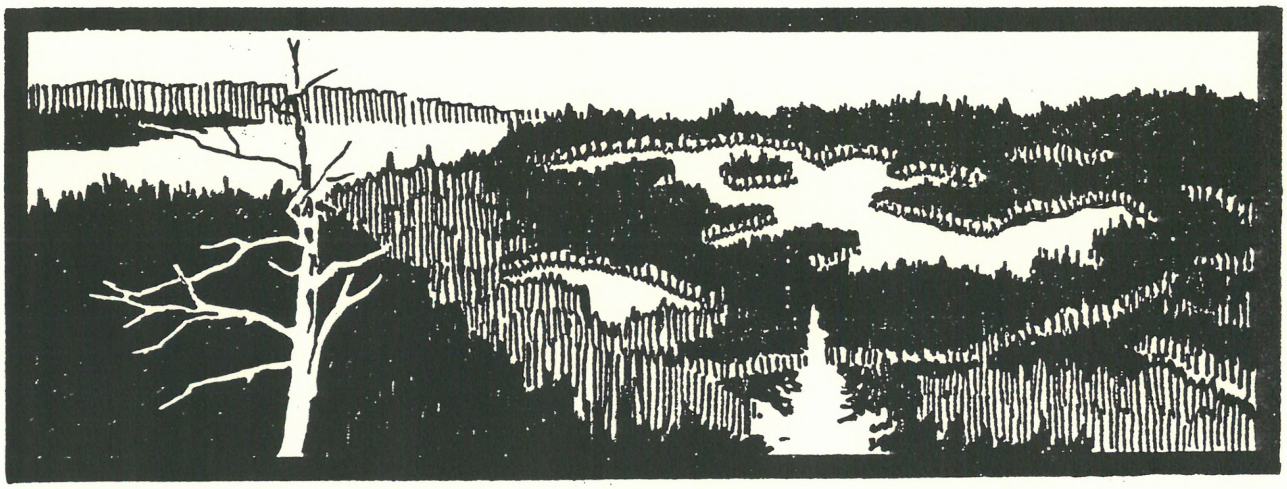


A. OVERVIEW

Land managers -- whether they are farmers, foresters, or wildlife biologists -- are practicing ecologists. They require specific knowledge to achieve specific land management goals. More and more, land managers are realizing that their actions affect resources other than the one they are manipulating, and they are attempting to integrate those resource values into their working plans. Ultimately, the objectives of the landowner and the training of the land manager will determine the approach taken to multiple-resource, multiple-use management.

During the next decade we, as forest resource managers, will be presented with new challenges from within our own professions, from the public, and from the forest itself. Advances in research continually add to our knowledge of how the forest and its wildlife function. Advances in technology add to the array of management tools available. The ecological implications of biomass harvesting is but one example of the challenges that will face us in the coming years. Increases in the human population, development and fragmentation of forest lands, and increased demand for access to public resources on private lands will add new dimensions to forest resource management in Maine. Although the spruce budworm is gone for now, other "natural managers," such as gypsy moth and beech nectria, will continue to affect logical management plans.

The intent of this guide is to encourage and assist the professional forester to become more consciously involved in wildlife management by identifying factors that influence forest wildlife, and to offer methods that enhance wildlife habitat. For the purpose of this guide we define wildlife as all terrestrial vertebrates - birds, mammals, reptiles, and amphibians. Depending upon current operating procedures and specific management objectives, implementing these practices will require minor or major modifications, and some will require additional dollars. Benefits will include better multiple-use management of lands, reduced soil erosion and road maintenance, improved public image, and increased recreational values.

We assume that foresters using this guide have knowledge of basic ecological principles and are familiar with the common wildlife species in Maine. Brief reviews of wildlife ecology and management, and landscape management and diversity (Section I) are followed by more detailed discussion of specific habitat and wildlife species management techniques (Sections II, III, and IV).

In compiling the information presented here, it was not our intent to be comprehensive, but rather to focus on those aspects of wildlife habitat management most directly affected by forest management. With few exceptions (Section IV), management for individual species is not discussed. Future revisions and additions may address species-specific management, depending on response and demand.

This guide is intended to provide the practicing forester with a minimum of background information and a maximum of directly applicable management recommendations. Readers are directed to the reference list in Appendix B from which more detailed information can be acquired as needed. The format was specifically chosen to be flexible, allowing revision, additions, and deletions as research and experience provide us with more information. We encourage anyone using this guide to send us your comments, complaints, and suggestions. A response form is included in Appendix A for your use. Improvements can only be made if we know what the problems are and what your needs are.

B. PRINCIPLES OF WILDLIFE MANAGEMENT

Barry Burgason
Assistant Regional Biologist
Maine Department of Inland Fisheries and Wildlife

1. HABITAT

The size and health of a wildlife population is largely determined by the resources available to it. These collective resources are referred to as the animal's **habitat.** The four basic components of habitat are: (1) food, (2) cover, (3) water, and (4) space. The need for food and water is well understood. Cover is used for many purposes, such as resting, hiding, escape, and nesting, and therefore takes various forms for different species and uses. Space, also called home range or territory, is the area occupied by an individual, a family group, or a social group, within which the needs for food, water, and cover can be met.

Although there may be considerable overlap in the habitat requirements of two or more similar species, each has its own unique requirements for food, cover, water, and space. Optimum habitat for one species may not be optimum for another. The habitat requirements of a single species often change with the seasons, and with the sex and age of the animal. For example, good nesting cover for a female ruffed grouse may not provide sufficient food or cover for her brood, or be good winter cover for any grouse. To manage habitats, the land manager must have an understanding of the year-round habitat requirements and other factors that influence wildlife populations.

2. INTERSPERSION AND JUXTAPOSITION

The type and availability of habitat providing food, cover, and water for wildlife is important, but the land manager must also consider the **interspersion**, or mixing, of different habitat types, and the **juxtaposition**, or proximity, of one habitat type to another. Often, an opening in the forest that provides abundant food, such as browse, herbaceous plants, or berries, does not provide adequate shelter from predators or weather except along its periphery. Conversely, a stand providing good cover may not provide sufficient food to entice particular wildlife species to use it. Thus, only when an area provides the proper mixture of food, cover, and water, within the range of an animal's normal daily movements, will that species benefit.

3. LIMITING FACTORS AND CARRYING CAPACITY

Wildlife populations have an inherent rate of increase that is generally suppressed by factors such as disease, predation, hunting, or habitat deficiencies. Ultimately, these **limiting factors** interact to define the **carrying capacity**, the maximum number of animals that can be sustained on an area of land, over a period of time. Only by changing the effect of one or more limiting factors can the carrying capacity be changed. The role of the wildlife manager is to identify which of several limiting factors is exerting the greatest effect on the wildlife population. This may not always be as simple as it seems because many of these factors interact with one another. For example, predation may be limiting population size. However, for the manager, improving nesting and escape cover may be more cost effective than a direct assault on the predator.

4. MANAGEMENT FOR SINGLE SPECIES AND FOR SPECIES DIVERSITY

One approach to wildlife management is to manage for a **single species** by concentrating on areas with suitable habitat and improving suboptimal habitat. Some other wildlife species, not specifically managed for, may also benefit, while others may decline.

A second approach is to manage for **species diversity**, that is, the greatest number of wildlife species possible. To achieve a diversity of wildlife, it is necessary to manage for a diversity of habitat types. Consideration should be given to increasing the variety of vegetative communities available; that is, plant species, stand ages, stand sizes, and locations relative to other habitat types (interspersion and juxtaposition). The diversity of vegetation structure within an individual stand is also important. For example, the number of songbird species found in a forest stand is directly related to the number of vertical layers of vegetation available.

Combining the single species and species diversity approaches can allow an efficient use of time and resources by concentration on "single species" where needed and economically justified, and applying the diversity concept to remaining habitats. The advantage of combining both approaches is that efforts are concentrated where benefits justify costs (i.e., single species management) while maintaining ecological integrity (i.e., species diversity management). Ultimately, the objectives of the landowner will determine the approach taken to integrating forest and wildlife management.

C. FOREST DIVERSITY AND LANDSCAPE MANAGEMENT

John W. Lanier
Forest Wildlife Biologist
USDA Forest Service
White Mountain National Forest

Most landscapes in Maine include some stream or river bottoms, side slopes, and hill or ridge tops. If left to natural succession, each of these landscapes can be expected to produce a particular type of vegetation and accompanying wildlife species. Little land, however, is left to natural processes because of increasing demands for forest products, outdoor recreation, and better fire suppression.

Land managers can choose to direct their efforts toward maintaining a diverse, productive landscape as well as producing desired outputs from the land. There are three important steps in undertaking this strategy:

(1) **recognize the capabilities** of the land being considered;

(2) **decide what kinds of wildlife could be emphasized** in any given situation based on the land capability assessment; and

(3) **define management options.**

The assessment of land capability must come first because the wildlife species that may occupy a given area are directly related to the type and amount of habitat that is available.

1. LAND CAPABILITY

The vegetative capability of the land under management is determined by the site's location within the state. Maine is in a transition zone from "hardwood dominated forest" to the south and west, to "softwood dominated forest" to the north and east. At any specific site, environmental factors, such as climate, topography, and soils, determine the species and productivity of the vegetation.

Knowledge of the potential or capability of a site for vegetation is important in determining forest management options. Harvest method, regeneration potential, site preparation, intensity of timber-stand improvement (TSI) activities, and susceptibility to wind throw, insects, and disease are at least in part determined by land capability. The characteristics of the vegetation, in turn, determine potential use by wildlife, and the effects of different management strategies on the wildlife community.

2. POTENTIAL WILDLIFE SPECIES

Wildlife species tend to group themselves according to vegetative associations and size classes. Therefore, when the amount and type of existing habitat has been determined, possible wildlife occurrence can also be determined using tables such as those presented by DeGraaf and Rudis (1986). Decisions can then be made as to which of these species will benefit or be adversely affected by proposed management prescriptions. Then, expected wildlife outputs can be evaluated by the manager or land-owner and management direction set to satisfy objectives.

Where the objective is to maintain or enhance populations of specific species, management prescriptions will be designed to provide and improve the habitat needed by those species. There are two basic controlling factors that must be remembered when deciding what species to consider and determining viable management prescriptions. The first factor is the size of the area under consideration. A 10-acre parcel will not meet the home range requirements of a moose, nor is a 2,000-acre area necessary for a mouse.

The second factor is the relative tolerance of an individual for other individuals of the same species. This is known as territoriality, and territory size varies among species. If territories become too small, conflicts, especially between breeding males, and other evidence of overcrowding will begin to appear. Breeding success and habitat quality will decline because of stress and over utilization.

Where the objective of management is wildlife species diversity, prescriptions will be designed to provide diverse habitats. The size and shape of each type of habitat, both forested and non-forested, its interspersion and juxtaposition with other habitats, and the structure of the vegetation within each habitat all contribute to habitat diversity. On small landholdings, the types of habitat surrounding the property being managed should also be considered when developing management prescriptions.

3. MANAGEMENT OPTIONS AND LANDSCAPE MANAGEMENT

After the vegetative and wildlife potential of an area have been determined, and the objectives of management determined, options for managing the land can be identified. Managing for all wildlife species on every acre is simply not possible. Some combination of species diversity and single species management will generally be necessary. Each forest management option will have an effect on wildlife populations, whether that option is no management, site conversion to a single tree species, or any of the variations in between. Most of the wildlife species in Maine use more than one vegetative type and can substitute one vegetative type for another if necessary. Therefore, if a land manager can identify the land capability and set management directions to provide, on a planned basis, vegetation that is

suited to the site and would occur there naturally, management is a long way toward providing wildlife habitat needs. The manager should set up a sustained yield program for each plant species under management; allow for a proportion of each type to remain in place beyond normal rotation age to provide for wildlife species that need older growth; and leave cavity trees, especially along stream corridors and pond and lake shores. By also providing or preserving special habitat features needed by those wildlife species of special interest, the land manager will probably come as close as possible to achieving a truly integrated wildlife and vegetation management scheme.

- II -

MANAGEMENT GUIDELINES FOR SELECTED

HABITATS AND HABITAT COMPONENTS

A. FOREST OPENINGS

Steven Oliveri
Land Use Regulation Commission
Maine Department of Conservation

Forest openings, whether permanent or temporary, are areas that are generally <10% stocked with trees and are dominated by perennial grasses, forbs, and fruiting shrubs. They are valuable to wildlife because with more light reaching the forest floor, the number of plant species available increases, diversifying the forest structure and providing seasonally important foods. Habitat components for many woodland species are made available and new habitats for open and edge-adapted species are provided. Some species that use openings require additional habitat components. Closed canopy shelter, perches for singing or hunting, denning cavities, and fresh water must be available within reasonable distances for the openings to be of value to those species with additional requirements. Topography, aspect, size of the opening, and distance to other openings will influence the use of new openings by wildlife and should be considered when planning cutting operations. In general, an opening of moderate size, with a southern exposure, will be most useful, especially when other openings are not already available within an otherwise mature forest.

MANAGEMENT GUIDELINES:

(1) Minimum size: An opening should be large enough to allow intolerant plants to become established. In general, a minimum of 1/4 acre is required.

(2) Maximum size: Many forest dwelling species are reluctant to travel very far from cover. A general guideline for maximum distance to a forest edge is 330 feet (5 chains) from the center of the opening, ie. 660 feet (10 chains) maximum width. For a regularly-shaped opening, this means a maximum of 10 acres. Openings of irregular shape can be larger (see #3 and #5).

(3) Shape: Irregular edges are preferable to straight ones. They produce a greater ratio of edge to area and also allow more complete use of open or cutover areas by wildlife by providing peninsulas of cover (Figure 1). Irregular shapes are also more aesthetic to many people, and may be preferred in areas easily seen by the public. If irregular shapes are not practical, strip, rectangular, or oval cuts are preferable to square or circular cuts.

(4) Total area: Roughly 10% of a managed unit of forest should be in openings at any given time. A minimum of one acre of permanently maintained herbaceous openings per square mile is recommended.

(5) Maintain travel corridors: If a clearcut exceeds 150 acres and a substantial portion of the area is greater than 330 feet (5 chains) from the nearest edge, leave uncut strips, a minimum of 132 feet (2 chains) wide to enable wildlife species to make use of central portions of the cut. A minimum of 5% of clearcuts in excess of 150 acres should be maintained in travel corridors. An alternative to strips is to leave clumps of trees (1/2 - 1 acre) scattered throughout the opening, usually one clump per 5-10 acres.

(6) Management to provide openings should also consider other habitats or habitat components such as snag, den, and wolf trees, mast producing trees, deer wintering areas, and raptor and heron nest sites. Refer to Sections II.C, II.D, IV.A, and IV.D for more information on these subjects.

(7) Maintenance: Forest openings will, if untreated, revert to forest. Regulated stands that are harvested in an orderly sequence of small patches will provide a continuum of forest openings over time. In these areas, it will not be necessary to maintain permanent openings. Unregulated stands, large tracts of even-aged stands, and areas harvested using single-tree selection will benefit from maintenance of permanent openings. Controlled burns, selective herbicide application, brush hogging, or manual cutting with brushsaws a minimum of once every 5 years will maintain these openings. (See Section III.B for more information about herbaceous seeding.)

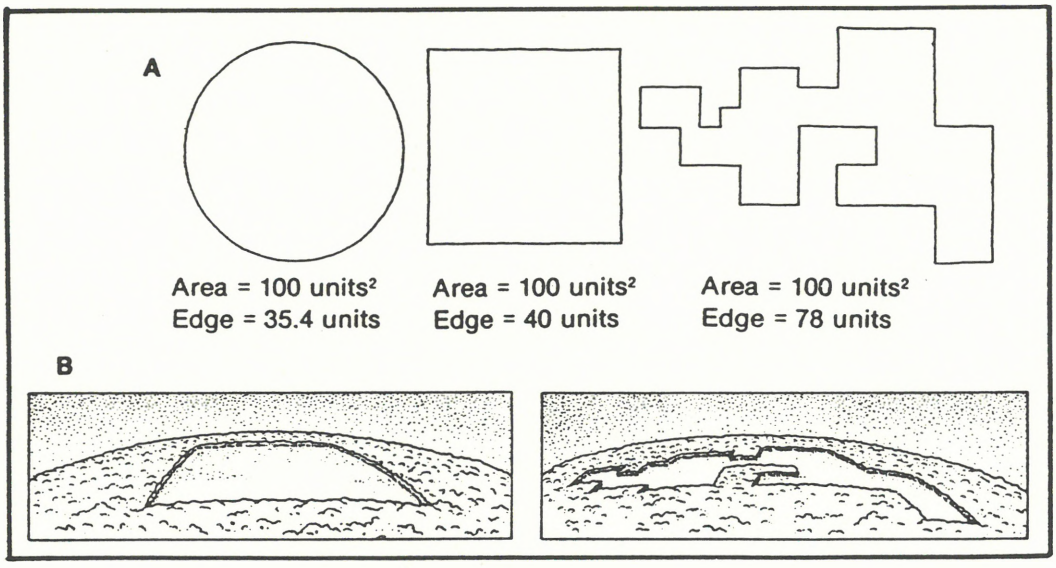


Figure 1. Edge-area relationships.
A. The amount of edge per unit area increases, and maximum distance to cover decreases, as the shape of a cut becomes more irregular.
B. Irregularly-shaped cuts can be made to fit the landscape and be less obvious to the observer.

B. RIPARIAN ZONES AND WETLANDS

Catherine A. Elliott
Wildlife and Fisheries Specialist
University of Maine Cooperative Extension Service

Riparian zones are lands adjacent to streams, rivers, ponds, lakes, and other water bodies. They are usually occupied by vegetation that is dependent upon relatively high soil moisture content, are periodically flooded, or have alluvial or hydric soils. Freshwater and coastal wetlands, marshes, and swamps are also important wildlife habitat and will be included in this discussion.

Riparian zones and wetlands are important features of the landscape because:

- the vegetation structure is often unique, very diverse, and multi-layered,
- they often contain plant species not found in drier uplands,
- they tend to be linear, creating a series of travel corridors and natural edges from the water to the uplands, and along the waterway,
- they reduce run-off, erosion, and sedimentation; filter water replenishing groundwater reserves; and help to moderate flooding,
- they are very productive ecosystems receiving water, nutrients, and energy from the adjacent upland systems,
- vegetation overhanging the water provides cover for fish and other aquatic organisms, and shade that prevents extreme temperature fluctuations (Figure 2).

The value of riparian zones and wetlands for wildlife is also varied. Most deer yards in Maine are in riparian conifer stands. Many wildlife species use riparian zones as travel corridors both in the zone itself and, in winter, on the adjacent frozen waterway where cover is nearby and travel is easier because of reduced snow depth. Young birds and mammals use riparian zones during dispersal from their birth place. Migrating birds often use riparian zones and wetlands as resting areas. The wildlife trees (snag and den trees) found in these areas are used extensively for nest sites and perches. Some wildlife species, such as waterfowl, wading birds, muskrat, beaver, and of course fish, require water as part of their habitat. Others, such as bald eagles and osprey, are dependent on water for their food and often nest nearby. Great blue heron rookeries are often located in wooded swamps and marshes containing large trees suitable for nest sites. Riparian zones and wetlands also serve as links between different types of habitat, providing dispersal and travel routes for species that would not otherwise cross large openings or cuts.

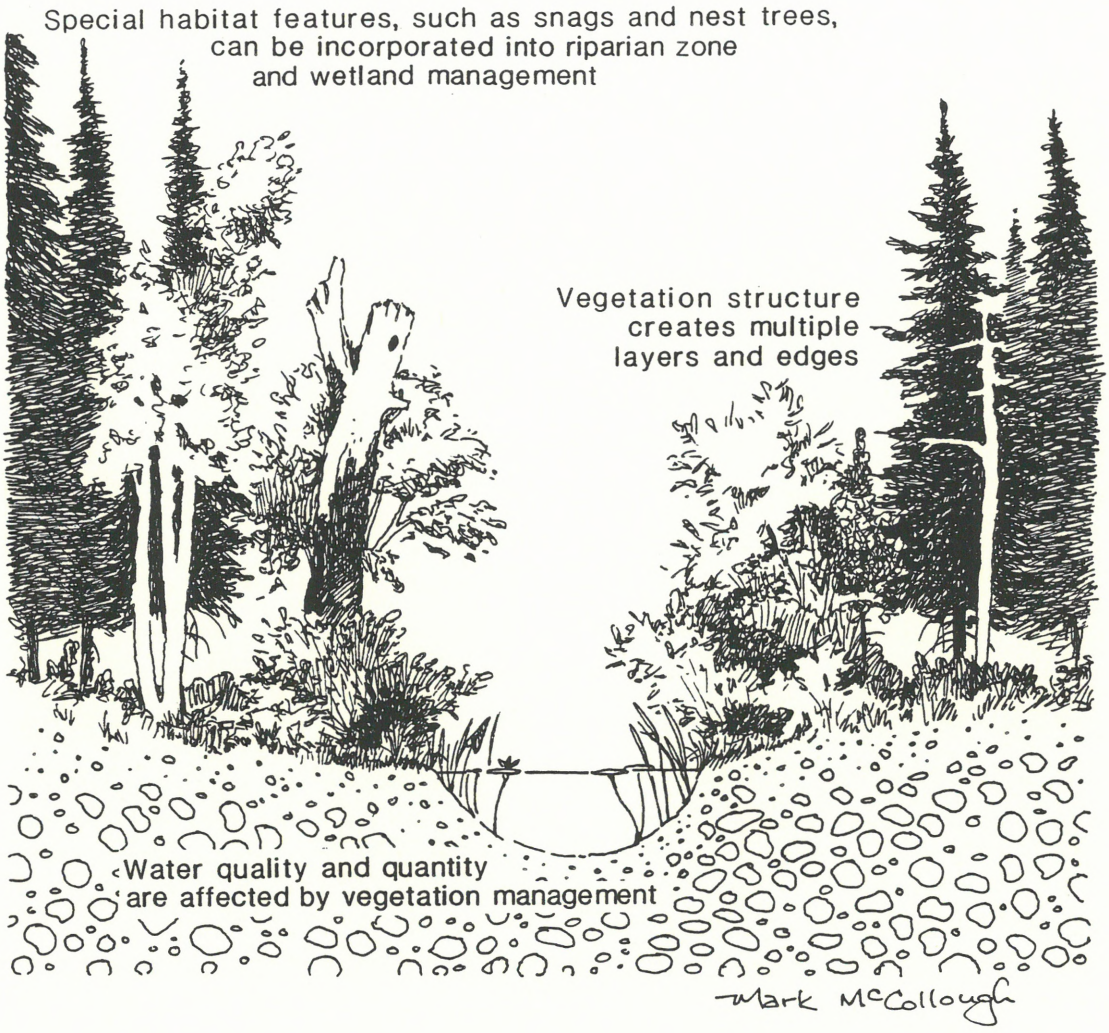


Figure 2. Riparian zones and wetlands are valuable for many reasons, including wildlife habitat.

MANAGEMENT RECOMMENDATIONS

In the unorganized townships of Maine, the Land Use Regulation Commission (LURC) regulations require buffer zones along streams, rivers, and lakes. In the organized townships, legislation such as the Stream Alterations Act, the Great Ponds Act, the Coastal Wetlands Act, the Freshwater Wetlands Act, and local zoning ordinances, regulate activities in riparian zones and wetlands and are enforced by the Department of Environmental Protection and local planning boards. All of these laws, and the regulations used to enforce them, were considered in developing

the following recommendations. (Deer yards are discussed separately. See Section IV.A.) Special features or uses of a particular riparian zone or wetland, such as the presence of old growth forest, threatened or endangered species, unique scenic values, or particular recreational values, should be considered on a site-by-site basis.

(1) Buffer zones along rivers and streams draining more than 50 square miles should be a minimum of 250 feet on each side of the waterway. Evidence suggests that wider buffer zones, up to 330 feet (5 chains), may be more effective and are preferred by many wildlife species. The first 100 feet should remain uncut or be treated with light selection cutting of stems >6 inches dbh. Cutting in the zone from 100 to 250 (or 330) feet should be single tree or group selection, removing no more than 40% of the volume per 10 year period.

(2) Buffer zones along streams draining less than 50 square miles should be a minimum of 100 feet on each side of the stream. The first 25 feet should remain uncut or be treated with light selection cutting of stems >6 inches dbh. Cutting in the zone from 25 to 100 feet should be single tree or group selection, removing no more than 40% of the volume per 10 year period.

(3) Buffer zones along streams draining less than 300 acres and along intermittent or seasonal streams, should be maintained to provide shading of the stream and prevent erosion and sedimentation.

(4) Buffer zones around lakes and freshwater and coastal wetlands should be a minimum of 250 feet, preferably 330 feet (5 chains). The first 75 feet should remain uncut or be treated with light selection cutting of stems >6 inches dbh. Cutting in the zone from 75 to 250 (or 330) feet should be single tree or group selection, removing no more than 40% of the volume per 10 year period.

(5) Buffer zones should not be laid out during winter as many small streams and wetlands will not be visible when frozen and snow-covered.

(6) Within the buffer zone, leave all potential wildlife trees (snag, den, and wolf trees), particularly large diameter hardwoods, and all raptor and heron nest trees standing. These will provide nest sites, perches, and future wildlife trees (see Section II.C and IV.D). These trees, and others, may eventually fall into the stream, providing habitat for various fish species, including brook trout, Atlantic salmon, and bass.

(7) Road rights-of-way that cross riparian zones should be as narrow as possible. Stump dumps and steep banks that would inhibit wildlife travel along and across streams should be avoided. Avoid disturbing the duff and soil within the right-of-way. Seeding road sides and ditches within the buffer zone is recommended (see Section III.B).

C. DEAD AND DYING WOODY MATERIAL

Catherine A. Elliott
Wildlife and Fisheries Specialist
University of Maine Cooperative Extension Service

To a forest manager, dead and dying woody material in a forest, both standing and downed, can indicate potential insect and disease problems, affect productivity of a site, and jeopardize the safety of woods workers. To a wildlife manager, the amount of dead and dying woody material indicates the availability of basic habitat for some 79 species of wildlife in Maine (Appendix F). Dead and dying woody material is used for shelter or hiding cover, for den, nest, and foraging sites, as well as sites for food storage, perching, basking, preening, and drumming (Figure 3).

Many species that use dead and dying woody material, particularly cavity-nesting birds, are insectivorous. Various studies have shown that, if maintained at sufficient population densities, insectivorous birds are effective in: decreasing populations of insects that attack trees; buffering epidemic outbreaks; and increasing the effectiveness of insects that parasitize those insects attacking the trees, by chipping the bark off infested trees. The benefits of this type of biological control are reduced economic loss to damaged trees and reduced expense and environmental concerns of pesticide application.

To maintain dead and dying woody material managers must consider what is there now, how various silvicultural activities will affect the amount and distribution of the material, and how the supply will change over time. The next two sections discuss the management of two major components of dead and dying woody material: 1. snag and den trees; and 2. woody debris.

1. SNAG AND DEN TREES

In Maine there are 58 wildlife species that use cavities in trees for nesting or denning (Appendix F). A shortage of suitable trees may result in reduced populations or the complete loss of some of these species. The retention of **snags**, dead or partially dead standing trees, and **den trees**, live trees with existing cavities, is essential to the well being of cavity-nesting species. Collectively, the term **wildlife tree** will be used to include both snag and den trees.

Snags can be classified as **hard snags**, which usually have some limbs remaining and fairly sound sapwood, or as **soft snags**, which usually have no limbs and are in advanced stages of decay. Cavities used by wildlife may be created by birds, mostly woodpeckers, called **primary excavators**. They choose a tree in

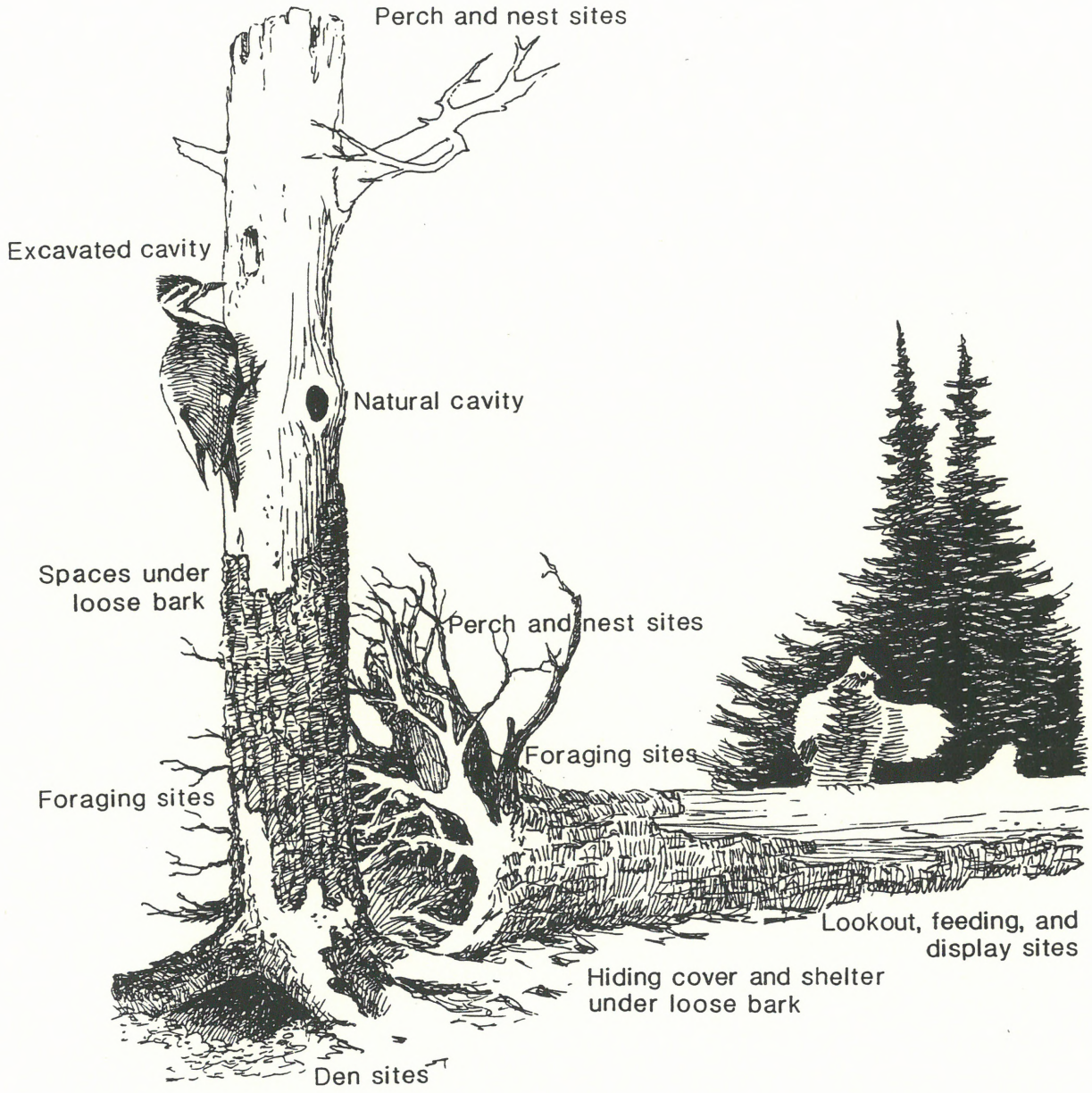


Figure 3. Features of dead and dying woody material used by wildlife.

which to excavate a hole, use the cavity that year, and then abandon it. All other species that use cavities are called **secondary users.** These species rely on the primary excavators and the natural processes of disease and decay to provide them with cavities from which to choose a nest site. Brown creepers and bats also use the spaces beneath the loose bark of dead or dying trees.

Use of a wildlife tree by a particular species depends on the characteristics of the tree (live/dead, dbh, height, and type of decay) and of the surrounding vegetation (species composition, age, and stand size). Birches, maples, elm, ash, basswood, beech, poplar, oak, pines, and hemlock are the tree species most often used for cavities.

How do you choose which trees to leave? Size is important. For example, a downy woodpecker requires a tree with a minimum dbh of 8 inches. A larger tree may be used but not a smaller one. The presence of heart-rot facilitates excavation and sound sapwood will provide protection from predators and insulation from temperature extremes. The most important features to look for in identifying potential cavity-nest trees are broken-off tops and large broken-off branches. The presence of conks or other fungal fruiting bodies, old wounds or scars, dead portions of the tree, and existing woodpecker cavities can also be indicators that heart-rot is present.

Snags and wolf trees that do not currently have cavities are also important components of the habitat. They provide: foraging sites and perches for insectivorous birds, kingfishers, and raptors; singing perches for many songbirds; and nest sites for species such as great blue herons and osprey. Pine marten and fisher raise their young in tree-cavity dens, and often use cavities as resting sites. Wolf trees often provide abundant mast or fruit (see Section II.D) as well as den sites.

MANAGEMENT RECOMMENDATIONS

Spacing of wildlife trees

Many wildlife species that use cavities are territorial, therefore fairly even spacing of wildlife trees will mean a greater proportion of the trees are available to individuals of a particular species. Some clumping of wildlife trees is acceptable or even necessary for several reasons: an individual or pair may use more than one tree each year; territories of adjacent pairs generally do not overlay; and more than one species may use the trees within a particular patch. For practical reasons, clumping of trees within buffer zones, corridors, and leave strips or patches may be the best way to provide adequate numbers of wildlife trees.

Short term management

(1) Wherever possible, leave all wildlife trees during both intermediate (thinning, salvage, sanitation) and regeneration (clearcutting, shelterwood, seed tree) cutting operations.

(2) Where choices must be made, leave the largest, relatively sound trees, especially those with cavities already present.

(3) Rule of thumb: leave a minimum of 4 wildlife trees >6" dbh per acre (40 trees per 10 acres). Where choices can be made, distribute among size classes as follows:

Over a 10-acre area leave:	4-5 wildlife trees > 18" dbh
	10-15 wildlife trees > 14" dbh
	20-25 wildlife trees > 6" dbh

Long term management

Dead trees do not remain standing forever. Plan to replace them by leaving some trees or patches of trees uncut to grow to large diameters for future wildlife trees.

(1) Within clearcuts, leave a 1/2 - 1 acre clump of trees in each 5-10 acres cut (5% of the cut). Areas left as travel corridors and in riparian zones can be used for this purpose.

(2) Leave large (live, dying, or dead) unmerchantable trees standing. Removing the tops and pruning large branches 6 inches from the trunk have been shown to be the most effective methods of hastening decay. Other methods, such as girdling and boring holes in the trunk, can be used but have not been as successful in promoting heart rot and cavity formation.

(3) Leave all wildlife trees in the uncut or selectively cut portions of riparian buffer zones (see Section II.B for more information on riparian zone management). Some of these trees may eventually fall into the stream or lake and provide cover and shelter for fish, thereby increasing the stream's carrying capacity.

(4) One approach to wildlife tree management is to provide enough trees of appropriate size to meet the needs of the primary excavators. It is assumed that by doing so, the needs of other cavity-using species will also be met. Information on territory size, number of snags used each year, and an allowance for unsuitable or unused trees is used to calculate number of wildlife trees required per acre. For more details, see Appendix G.

SAFETY

Any discussion of providing trees (snags) for wildlife must include a word about safety. Occupational Safety and Health Administration (OSHA) regulations require felling or removal of dead, broken, or rotten limbs or trees that are a hazard before cutting operations begin. The dangers of working near dead trees are real, as evidenced by statistics on injuries from falling limbs and trees, and are not to be overlooked. The value of these same trees to wildlife is also clear. If a snag is not removed, workers must remain 2 tree-lengths away. Leaving all snags standing, along with the trees within 2 tree-lengths of them, is simply not economically feasible. Therefore, decisions must be made about which snags to leave and which to fell. Safety

must come first, hence snags that are obvious hazards should be removed. Snags that can be left are those that do not pose a hazard or that can be avoided during logging. Snags in uncut strips and buffer zones, and unmerchantable trees anywhere should be left to provide wildlife habitat, both for the present and in the future.

2. WOODY DEBRIS

Woody debris, such as logs and slash, is an important habitat component for many wildlife species (Appendix F). It is used for nesting and shelter, as a source of and place to store food, as a lookout site, for drumming, sunning, and preening sites, and as natural bridges across streams. The animals that use woody debris are important links in the food chain and in nutrient cycling within the forest community. Decaying logs also serve as nurse-trees for seedlings, are important in nutrient cycling, and serve as colonization sites for fungi, including ectomycorrhizal fungi that are important to many tree species as sources of nitrogen.

The rate of decomposition of woody debris varies with the climate, the plant species, size of the material, and other factors. The size and stage of decay of woody debris determines what wildlife species can make use of it. Logs supported above the ground by branch stubs or roots provide shelter, feeding, and display sites. As the log decays and settles to the ground, the bark loosens and the vegetation surrounding the log develops, providing habitat for many wildlife species that will use the log for runways, nest sites, shelter, and a source of food. With further decay, the log becomes soft enough that small mammals can burrow inside. The burrows in turn provide habitat for snakes, toads, salamanders, and other animals. Logs with hollow portions may be used as dens by larger mammals. Decay and build-up of organic material around the log will eventually result in its almost complete burial, but the tunnels within and beneath the log will continue to be used for a long time.

In general, logs are considered to be more valuable for wildlife habitat than other woody debris because they persist longer. The larger the diameter of a log and the longer its length, the greater the value to wildlife, but small logs are better than none. Slash, both scattered and in piles, provides shelter, nest sites, and foraging sites, and can be particularly important in young cuts, allowing use of the habitat before vegetation has regrown.

MANAGEMENT RECOMMENDATIONS

(1) Retain existing logs. Decaying logs that are of no commercial value are very important wildlife habitat. If snags must be felled before operating on a site, leave them in place rather than removing them.

(2) In areas being cut (both intermediate and regeneration

cuts) provide at least 4 logs per acre. These should be as large and long as possible. At least 2 logs should be >12 inches dbh and >6 feet long. Hollow butt sections of felled trees are good choices.

(3) Snag trees will eventually become logs. Short and long term planning for snags will also help provide logs.

(4) On slopes, orient logs along contours and place against stumps when possible. This will provide benefits to wildlife as well as aid in reducing run-off and siltation. The early establishment of vegetation on the uphill side of the log will help stabilize erosion-prone sites.

(5) Leave slash on at least 10% of clearcut sites. A patchy distribution of slash, in piles or short rows, will provide habitat and not impede the movement of large mammals, such as deer and moose, through the cut.

(6) Do not add debris to streams and avoid disturbing material that is already established as part of the stream system.

(7) When prescribed burning is to be used, try to protect at least some logs from being burnt by covering them with dirt or wetting them down. Charring and case-hardening greatly reduce the value of logs to wildlife.

D. MAST

Steven Oliveri
Land Use Regulation Commission
Maine Department of Conservation

Mast is any nut, seed, or fruit produced by woody plants and consumed by wildlife. Mast is nutritious, containing more fat and protein than other plant foods, and is an actively sought and preferred food item. The abundance of mast generally peaks in fall, but certain types of mast persist into winter or are stored in caches to be used when other food sources are unavailable.

Many animals have adapted to take advantage of periods when mast is abundant. The fledging periods of fruit-eating birds, such as cedar waxwings and robins, coincide with the peak of wild cherry fruit production. In the autumn, bears, raccoons, and other animals fatten up on acorns and beech nuts to prepare for the critical winter period, or, like the wood duck, to undertake a long migration. Some mast may persist, frozen on branches above the winter snow cover, providing nourishment when other food items are scarce. A few species, such as blue jays and squirrels, store acorns and other mast in caches for later use.

By definition, all trees and shrubs are mast producers, but some are more important than others and merit special attention. Maintaining trees that are good seed producers, particularly in shelterwood and seed-tree cuts, will not only provide an important source of food for wildlife but, if tied to tree form and other requirements of "plus tree" selection, will provide quality seed for regeneration.

OAKS

Oaks produce their best acorn crops after they reach 50 years of age and 20 to 26 inches dbh. Acorn production declines in trees of larger diameter. Good crops do not occur each year; red oak produces a good crop every 2-5 years, white oak every 4-10 years. To provide optimum acorn production, leave vigorous trees with dominant crowns. Regenerate to ensure continuous coverage by a succession of age classes. Two-stage shelterwood or small, group-selection cuts are recommended. Some of the species that feed heavily on acorns are wood duck, ruffed grouse, wild turkey, blue jay, black bear, raccoon, red and gray squirrels, and white-tailed deer.

BEECH

Beech start producing nuts at about age 40, but heavy production of nuts does not occur until about age 60. Good nut crops occur every 2-5 years. Dominant trees will be the best producers. Beech matures slowly and does not regenerate well in large openings. Individual-tree selection or dense shelterwood (residual crown 80%) methods work best to regenerate beech. Avoid clearcutting and large patch cuts where productive beech stands are established. Ruffed grouse, spruce grouse, wild turkey, and some of the larger songbirds, such as the rose-breasted grosbeak, eat beech nuts. Mammal species that use beech nuts include those that eat acorns, as well as many small mammals.

BIRCHES

Of the hardwood species, birches are the most important mast producers, after the oaks and beeches, because of their abundance and the fact that they retain much of their seed crop above the snow during the winter. Paper birch and gray birch produce seed while still relatively young. Yellow birch takes longer to produce, about 40 years, but has a longer productive life span. Small birds and mammals consume many of the seeds. Redpolls and pine siskins rely on birch seeds for a major portion of their winter diet.

SOFTWOOD

White and red pine are the most important of the pines for mast production because of their abundance and distribution. Seed may be produced as early as 20 years of age, with 50-year-old to 150-year-old trees producing the best seed crops at intervals of 3-5 years.

White, red, and black spruce are valuable because they start producing seed at an early age and seldom suffer more than 2 poor seed years in a row. This means that spruce seed is generally available every year, in one location or another, even if other mast is not. Spruces also tend to retain seed in their cones for longer periods, therefore the seed is usually available throughout the winter.

Other softwood species in Maine are also important sources of seed for wildlife. Larch and balsam fir seeds are preferred foods of ruffed grouse, spruce grouse, finches, and crossbills. Hemlock seed is a preferred food of chickadees, siskins, and goldfinches. Many birds and small mammals, including mourning doves, chickadees, crossbills, finches, grosbeaks, pine warblers, nuthatches, mice, voles, and red squirrels, make use of softwood mast. It is particularly important because of its availability in winter.

WILD APPLES

Wild apple trees are so valuable as wildlife food that cutting is virtually never justified. Wild apples are eaten by a wide variety of wildlife species. Various songbirds, grouse, fisher, bear, and deer are common visitors to apple trees. In areas where viewing wildlife is important, apple trees are particularly valuable for attracting animals that can be readily seen.

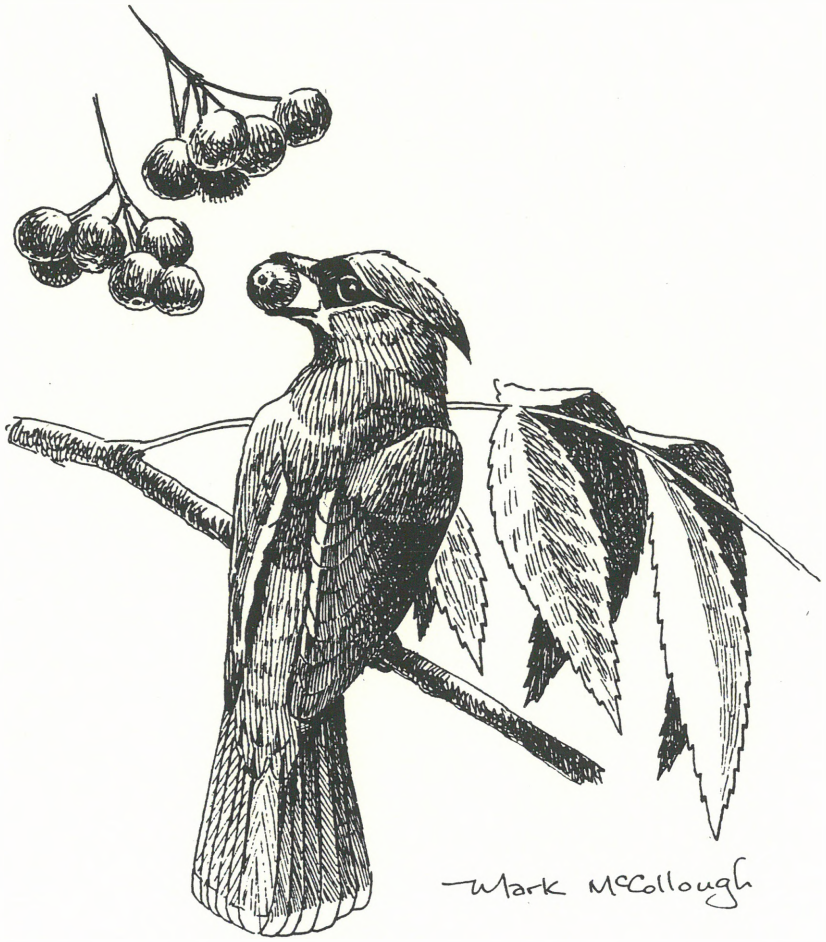
Wherever apple trees are encountered, it is very important that they be released from competition (see Appendix H). Pruning is necessary to maintain or increase the vigor of the tree. With apple trees that have been suppressed for many years, release and pruning should be done gradually, over several years, to avoid over-stressing and possibly killing the tree.

CHERRIES

Pin and choke cherries are not long lived but regenerate well in clearcuts, patch cuts, and burns. Because they are considered weed species by many foresters, they are often discriminated against in herbicide applications and site preparation. Leave some unsprayed areas (see Section III.A) to maintain these species, as they provide abundant fruit that is eaten by many birds and mammals. Black cherry is a valuable timber tree and should be encouraged on appropriate sites with moist, well-drained soils, especially in riparian buffer zones.

SHRUBS

Many shrubs produce valuable food for wildlife. Hornbeam and alder are valuable because their catkins persist above the snow through much of the winter. Serviceberry (also called Juneberry or shadbush) provides fruit early in the year. Mountain ash fruits in late summer and holds its fruit into early winter. Beaked hazelnut mast is preferred by many species, and because the plant is fairly tolerant it is often an understory species. Other important mast producers include hawthorn, dogwood, blueberry, viburnums, raspberry, blackberry, and elderberry. Many mast-producing shrubs are intolerants and are considered weed species. Skip areas in herbicide spray operations (see Section III.B) and edges of roads and landings are good places to maintain intolerant shrubs. Lay out woods roads and skid trails to avoid destroying particularly vigorous patches of understory shrubs.



- III -

MANAGEMENT GUIDELINES FOR SELECTED

HABITAT TREATMENTS

A. HERBICIDES

David J. Santillo[1]
Graduate Student
Department of Wildlife, University of Maine

Herbicide treatments affect wildlife by changing the structure and diversity of the vegetation, ie. habitat. The effects of herbicide-induced habitat changes on wildlife are still being researched. The recommendations presented here are an attempt to consider methods to maintain or improve wildlife habitat on clearcuts treated for conifer release.

The two herbicides currently used most often for conifer release in Maine are glyphosate and triclopyr. When properly applied, these and other forestry herbicides are not toxic to wildlife, however, they do affect wildlife habitat. The extent to which wildlife habitat is affected depends on:

(1) the magnitude or abruptness of the vegetation change;

(2) the size of the area treated and its temporal relationship to surrounding treatments;

(3) the duration and extent of recovery of vegetation structure and diversity; and

(4) the amount and distribution of untreated skip areas within the treated block.

The responses of individual wildlife species to these changes in the vegetation will depend on the habitat needs of the species. The habitat components most affected by herbicides are deciduous cover, particularly for songbirds and small mammals, and food, especially deciduous browse, seeds, berries, and insects. The objective of these recommendations is to maintain cover and food for wildlife on sites treated with herbicides, without sacrificing too large a portion of the future tree harvest.

SKIP AREAS

Skip areas are those spots within an herbicide-treated site missed during treatment, either by mistake or by design. These skip areas are important to wildlife because:

(1) They help to maintain the diversity and density of bird species in areas dominated by conifer regeneration, both planted and natural. Leaving small islands of deciduous brush within the site and providing an untreated fringe around the edge will benefit many birds and other wildlife species.

(2) They provide areas where wildlife trees can be allowed

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[1] present address: Wildlife Ecologist, Ecology and Environment, Inc., Pleasantview Drive, Lancaster, NY 14086.

to develop and then be retained at the next harvest (see Section II.C).

(3) They are a source of browse for snowshoe hare, deer, and moose, especially when within 200-300 feet of cover. Evidence suggests that moose and deer will concentrate browsing pressure in skip areas, acting as natural herbicides.

Guidelines for skip areas

Designed skips are more desirable than unintentional skips because of control over size, location, and shape. Leave approximately 1 acre purposely untreated for every 20 acres treated (5% of the cut area). When added to unintentional skips, the total untreated area should still be less than 10% of the cut, the level at which retreatment is often considered. The majority of skip areas could be placed along logging roads, in areas of unstable soil, within wet swale areas of cuts, as buffer strips along water courses, and in areas of very low conifer stocking. These areas will provide valuable habitat for wildlife if untreated, whereas they are of limited value for conifer production. Additional scattered untreated patches within large treated blocks will increase the area's value for wildlife (Figure 4).

A block or "blob" effect is more desirable than the "sliver" effect usually found in unintentional skips. Contiguous blocks

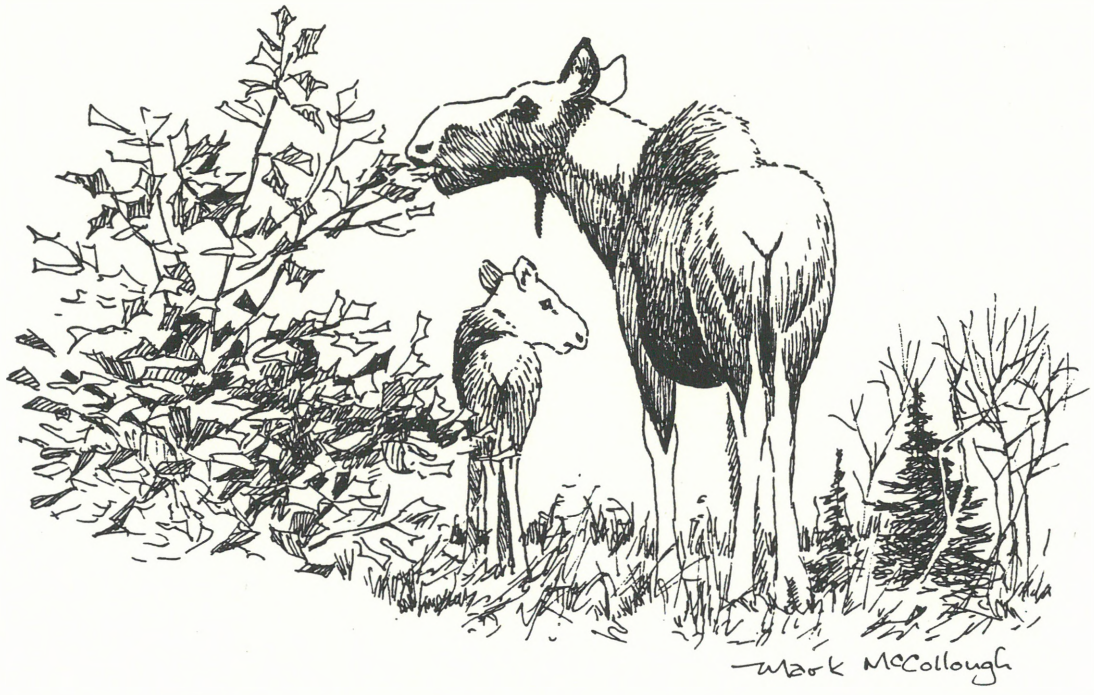


Figure 4. Skip areas, both intentional and unintentional, can increase the amount of food and cover available to wildlife in herbicide-treated clearcuts.

of habitat are usually more productive than very thin, broken strips because they provide better cover and a greater abundance of browse. The skip areas described can be achieved by a boom-on, boom-off, boom-on action by the pilot during aerial application. A skip of desired size can be achieved if aircraft speed and treatment swath width are known. Length of the skip is determined by dividing area of the skip (square feet) by the swath width (feet). The pilot must know the number of seconds the boom must be off, so length of the skip (feet) is then divided by airspeed (feet per second). The location of the skip area must be marked prior to treatment. Pilots can be cued by large white plastic bags tied over bushes at the beginning and end of proposed skip areas. These methods can easily be adapted to ground application techniques, such as skidder-mounted sprayers.

CREATING WILDLIFE TREES

Herbicides can be used to create wildlife trees to supplement those already present. Hardwood trees that are living and left standing when an area is cut, and then killed during herbicide treatment, should remain standing longer than the wildlife trees present at the time of the cut.

If herbicides are being applied from the ground, these trees can be left anywhere in the cut. During aerial application, safety considerations of flying near standing trees may require leaving these trees in areas that are not going to be sprayed, or in clumps that will be avoided. The combination of forest, deciduous brush, and wildlife trees will improve the vegetative diversity of the cut. See Section II.C for more information on wildlife tree management.

CHOICE OF HERBICIDE

Each herbicide controls a different spectrum of plant species. For wildlife, an herbicide that achieves the goal of conifer release with the narrowest spectrum of species control is most desirable because a greater diversity of vegetation will remain after treatment.

The herbicide Garlon^{R} (triclopyr) can serve as an example. Triclopyr achieves conifer release while maintaining a cover of grasses and some forbs. This cover helps to moderate extremes in temperature and humidity (microclimate) at the ground surface, which improves tree seedling survival. The grasses and forbs also provide cover and nesting sites for songbirds and small mammals, and food in the form of plant material, seeds, and insects.

In comparison, glyphosate has a broader spectrum of plant control that results in less residual ground cover and, therefore, less habitat value for wildlife.

RATE OF APPLICATION

Varying the rate of application of herbicides to achieve different degrees of control also has potential to enhance wildlife habitat. A lower application rate does not necessarily mean ineffective control, and it will cost less and be beneficial to wildlife. Scattered individuals of less sensitive shrubs and forbs may remain or be reduced to a state of low vigor. Many wildlife species will make use of the food and cover, and browsing by moose and deer may provide additional control of the shrubs.

A lower rate of application can be achieved for the entire treatment area by simply diluting the herbicide in the carrier. It is also possible to apply at a lower rate by speeding up the aircraft during aerial application. The pilot may fly at normal speed for one swath and increase speed for the next, alternating higher and lower rates of application.

DISTRIBUTING TREATMENTS IN TIME

Just as the most desirable tree harvesting scheme for wildlife is one where cutting is distributed in time and space to provide diversity and interspersion, herbicide treatments can be used to break up the monotypic vegetation of large clearcuts. The goal is to subtly increase the diversity of vegetative structure within a large clearcut or between adjacent clearcuts of similar age.

If a site of more than 100 acres is planned with the intention of applying herbicides for conifer release, treat half the area for **pre-release**, that is, prior to brush overtopping the conifers. The other half, as is current practice, is treated for **release** 2-5 years later. By the time the second half is treated, vegetative structure and diversity will have recovered to some extent on the first half. This will help to maintain favorable browse conditions for ungulates, and habitat for songbirds over the long term.

Staggering the treatments of adjacent, similar-aged sites will also help to maintain or increase vegetation diversity. One approach to timing an herbicide treatment for a given site is to look at the cutting and herbicide treatment history of the surrounding land. For purposes of scale, consider a moose's average home range with a radius of 1.5 miles. If the majority of potential spray sites within 1.5 miles of a newly created site have been treated within the last 2-3 years, the habitat of the new site is valuable to retain as a source of food. Allowing the surrounding treated sites to recover slightly before treating the new site would be beneficial to moose and other wildlife.

B. HERBACEOUS SEEDINGS

Robert J. Wengrzynek
Biologist
Soil Conservation Service

The habitat value of woodlands can be improved by planting mixtures of grasses and legumes on roads, roadsides, skidder trails, landings, borrow pits, and drainage ditches. In addition, plantings will reduce erosion and help protect streams, ponds, and wetlands from siltation. Landowners who have properly done extensive seeding and erosion control have demonstrated that the value of seeding, in terms of wildlife, aesthetics, and reduced road maintenance, will usually far exceed the costs. Detailed planning assistance is available from local Soil and Water Conservation District offices (listed in Appendix E).

The following are benefits of planting grasses and legumes:

- succession and invasion by woody plants are slowed, thus reducing costs of long-term brush control
- landings, skid trails, and winter roads are maintained in open, usable condition for longer periods of time
- visibility and safety are improved
- soil moisture holding capacity is increased and run-off reduced
- sedimentation in wetlands, streams, and ponds is reduced
- turbidity and nutrient levels in streams and lakes are reduced
- maintenance or re-establishment of fire lines is easier
- cover and very nutritious food are provided for many wildlife species, especially early spring foods that can be critically important for deer, hare, and bears
- seedings adjacent to deer wintering areas provide an important diet supplement in March and April
- the value of forest-opening edge as wildlife habitat is increased.

SEED MIXTURES

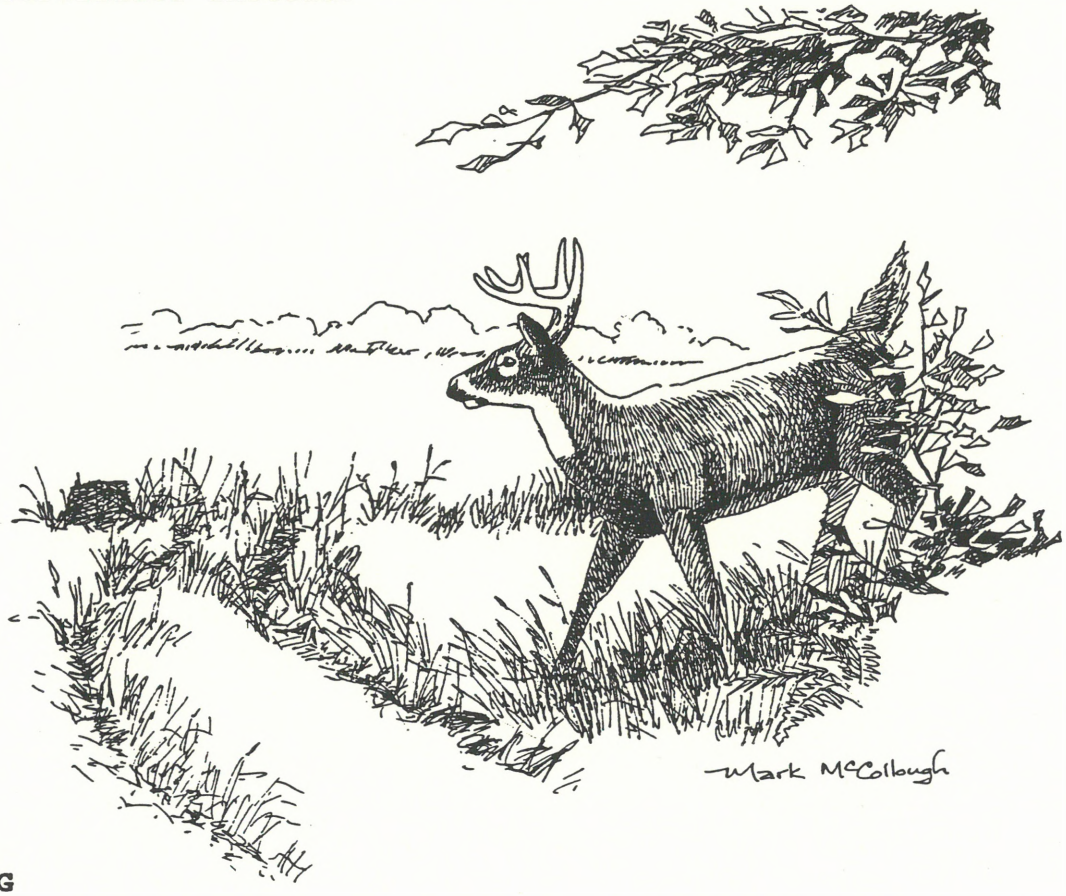
Ideally, seed mixtures are formulated with soil type, moisture and light conditions, and future treatment in mind, but cost and local availability are usually the deciding factors. Commonly available mixes, often called Soil Conservation Mix or Roadside Mix, contain annual rye and perennial grasses, fescues, bluegrasses, redtop, and clover. Commercially available pasture and hayland mixes are also suitable for sites where erosion is not a serious problem. If the seed mix you are using does not contain a legume, add ladino, alsike, or white dutch clover, and a legume innoculant, to the mix.

LIMING AND FERTILIZING

Wildlife food values are enhanced as palatability, nutritional value, and biomass increase with improved site conditions and fertility. The pH and fertility of the soil not only affects establishment in the first season, but determines the long-term composition and vitality of the seeding. Lime and fertilizer should be applied before the seed. Rake or "drag" the site if possible to mix lime and fertilizer into the soil.

The amount of lime added to the site will determine the pH of the soil. Legumes (clovers) are especially sensitive to pH and will maintain themselves best if the pH is above 6.0, however, they will grow at lower pH levels. If pH is <5.5, 3 tons per acre of lime will be needed. If pH is 5.5-6.0, 2 tons per acre should be added. If pH is 6.0-6.5, 1 ton per acre will be sufficient.

Ideally, soil should be tested and fertilizer applied according to recommendations for "Pasture seeding," available from SCS offices. However, a general guideline for minimum fertilizing without soil tests is 400-800 pounds per acre of 5-10-10 fertilizer. If seedings are on gravel or subsoil, use 16-16-16 fertilizer instead.



SEEDING

If access is easy; scarify the soil, broadcast seed, and rake or harrow to cover seed lightly. A drop or broadcast seeder may be pulled behind a pickup, ATV, skidder, or tractor. Broadcasting using a hand crank "cyclone" type seeder is also

effective. Avoid hand casting of seed because this will often waste seed and money. Hydroseeding, although expensive, is quick and usually worth the cost on areas that are large, hard to reach, or rough, and the results are usually guaranteed by the contractor.

The amount of seed needed will vary with the seed mix and planting method, but plan on using at least 40-60 pounds per acre of general "conservation" mixes, then include an additional 10 pounds per acre of rye grasses for fast cover, and 1-2 pounds per acre of clover for wildlife.

Although not necessary in all situations, mulch can be used to protect the seed and conserve moisture. Hay is usually the easiest and least expensive mulch and may also add more seed to the site. Use 40-80 bales per acre and lightly cover 75-90% of the area. Pieces of brush can be used to prevent hay from blowing away on exposed sites. Hydroseeders will usually use a cellulose (wood fiber) mulch.

MAINTENANCE

One option is to plant it and forget it. However, to maintain grasses and legumes for optimum wildlife values and to reduce the "invasion" of brush and trees, the site must be managed. A soil test for legume, hayland, or pasture conditions is recommended. However, the following guidelines my be used in lieu of testing.

Fertilizer should be applied 1-3 years after planting using 350-500 pounds of 10-10-10, or 200 pounds of 20-10-5, or 250 pounds of 16-16-16, per acre. Fertilizer should then be reapplied every 5-10 years. Lime should be applied at a rate of 1 ton per acre every 5-7 years. Biologists from the Maine Department of Inland Fisheries and Wildlife (MDIFW) have had good results bulk spreading lime on plowed winter roads in March. This allows liming of areas inaccessible in summer, is cheaper than bagged lime, and requires minimal labor. In the future, wood ash from biomass generating plants may be approved for use as a fertilizer. As well as being a good liming agent, wood ash also contains potassium and phosphorus, and is available at little or no cost.

To help control brush, mow, using a sickle bar, flail, or rotary "brush-hog" mower, or burn in spring, at least once every 5-7 years. Site conditions permitting, mow between July 15 and September 1. Burning that removes the thatch, or "duff," exposing mineral soil, can encourage, rather than discourage, wood plants. Periodic reseeding may be necessary unless crownvetch, trefoil, or flatpea are to be added to the stand of grasses and legumes. Inquire at the Soil and Water Conservation District office for special instructions on these species and other plantings for wildlife habitat improvement.

COATED SEED AND THE FERTI-BLAST[R] GUN

Another alternative in seeding is use of seed that has been coated with fertilizer and is spread using a Ferti-blast[R] gun (see Appendix B for sources of the gun and seed). The Maine Bureau of Public Lands (BPL) has been testing the system with excellent results. BPL biologists provided the following information and can be contacted for further information.

The Ferti-blast[R] gun was developed to spread pelleted fertilizer using compressed air. Coating light grass, clover, fescue, and other seeds with lime and fertilizer gives them enough weight to be used with the gun, and helps establish the seed quickly.

The gun requires a compressor that can deliver 55 cubic feet per minute at 95 pounds pressure. If 2 guns are operating at the same time, 125 cubic feet per minute and 100 pounds pressure are needed. The compressor can be put in the bed of a pickup or towed on a trailer. The gun has a range of 35 feet when spreading seed, 75 feet when spreading fertilizer.

Estimated cost (1987 dollars) of using the coated seed-Ferti-blast[R] gun system is $120.00 per acre, including labor, applying 100 pounds of seed per acre. A major portion of the cost is the seed, particularly shipping costs on small orders. A "group purchase" may reduce these costs. If interested, contact the Bureau of Public Lands.

For areas that a pickup cannot get to, BPL has used an electric seed spreader on an ATV, again with good results.

- IV -

MANAGEMENT GUIDELINES FOR SELECTED

WILDLIFE SPECIES

A. DEER WINTERING AREAS

Joseph E. Wiley
Wildlife Biologist
Maine Department of Inland Fisheries and Wildlife
and Bureau of Public Lands

Deer wintering areas (DWAs), commonly referred to as deer yards, are only one component of a deer's seasonal habitat, but their range. Deer move to DWAs when snow depths approach 18 inches or, in the absence of snow, when day length shortens sufficiently. In Maine, these areas are generally characterized as softwood types (spruce, fir, cedar, and hemlock) having >70% crown closure, >100 square feet per acre basal area, and stand heights greater than 35 feet. Relative to more open areas, these softwood stands provide reduced snow depths, overhead thermal cover, higher nighttime temperatures, higher relative humidity, and reduced wind speeds. These factors all serve to reduce heat loss and energy demands placed on the deer in winter when food availability and quality is reduced.

Not all available browse is good quality food for deer in winter. Cedar, red, sugar, mountain, and striped maple, hobblebush, and birch are preferred foods and should be retained and cultivated whenever possible. American yew is also a preferred food, but it is not widely distributed in Maine. Hemlock and balsam fir provide both food and cover.

A general goal in managing for shelter is to maintain at least 50% of the DWA in dense softwood shelter with the characteristics listed above. The remainder of the DWA should be in younger age classes that will provide hardwood browse for about 15 years, and softwood regeneration that will provide shelter in the future. In DWAs, travel corridors, bands of dense softwoods, should be at least 330 feet (5 chains) wide, and maintained to provide deer with sheltered access to all parts of the DWA, preferably along stream or drainage paths.

Timber management systems employed in a DWA depend upon species composition, size and condition of the trees, and landowner objectives. The Maine Department of Inland Fisheries and Wildlife (MDIFW) is developing DWA management guidelines that allow economical wood volume removals, while providing shelter over the long term. These guidelines involve a combination of two types of management. Even-age management, using a 75-year rotation and 15-year cutting interval, is used in most of the DWA to produce 5 age-classes of softwood that will ensure perpetual winter cover (Figure 5). Uneven-aged management is used in a 330 foot (5 chain) riparian strip (travel corridor) using single-tree and group-selection harvesting systems. A harvest of 20% of the DWA is required every 15 years in both the even-aged and uneven-aged portions to bring the DWA into a regular sequence of harvests.

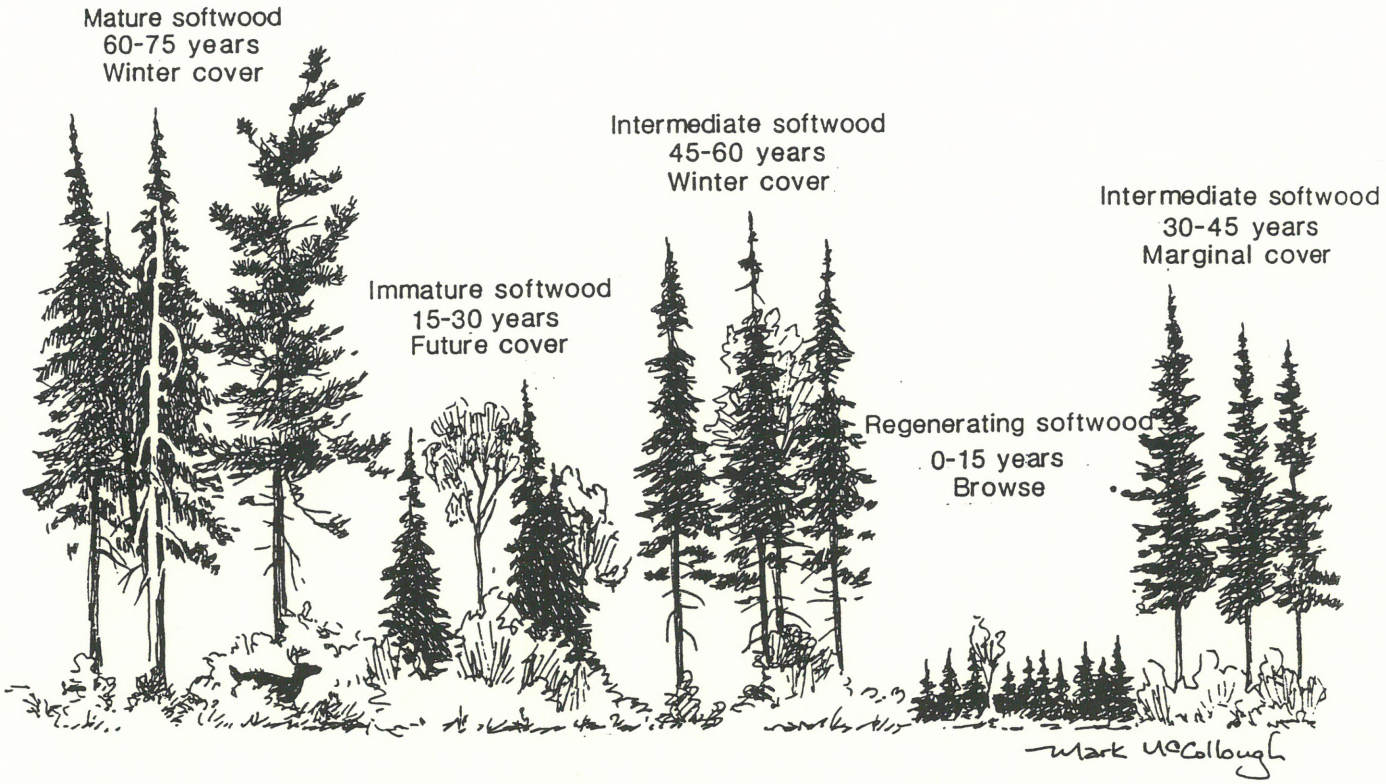


Figure 5. A 75-year rotation with a 15-year cutting cycle will produce five age-classes of softwood, ensuring perpetuation of winter cover for deer.

Light group- or single-tree selection harvest at each entry into the riparian strip will create small openings that will regenerate softwood and provide hardwood browse. These openings should be at least 150 feet apart. Average basal area for trees 6 inches and greater dbh should be at least 100 square feet within any 2-acre block.

The combination of riparian strip and residual untreated stands will maintain at least 50% of the DWA in softwood shelter. Pre-commercial treatments, such as herbicide spraying or manual weeding, may be used to bring young stands into cover sooner, if necessary to meet the 50% criteria.

Within the harvest blocks, clearcuts should be a maximum of 5 acres in DWAs that are less than 400 acres, and a maximum of 10 acres in DWAs over 400 acres. Larger clearcuts may be acceptable if they are narrow and irregularly-shaped. A minimum 330 foot (5 chain) wide uncut strip should separate these clearcuts.

This guideline represents one of several possible harvest schedules for DWAs. Currently, MDIFW is in the process of

developing long-term DWA management plans. When finalized, those site-specific plans will replace these general guidelines. Any softwood area that shows use by deer (ie. tracks, trails, beds, droppings) during January, February, or March should be examined by the regional wildlife biologist (see list in Appendix C) to obtain specific timber harvest recommendations prior to cutting.

Figure 6 illustrates one of many possible DWA harvesting plans. This one uses the two-stage shelterwood system to ensure adequate softwood regeneration prior to the final harvest. Stand entries are made every 15 years with half of the cutting blocks scheduled for harvest getting a regeneration cut and the other half getting a removal cut at each entry. The key to this system is well distributed cutting blocks. Log yards should be located outside the zoned DWA if skidding distance is not prohibitive.

Note that the riparian strip (travel corridor) is harvested a every entry using both the single tree and group selection method to remove 15 percent of the volume evenly distributed throughout the area. The riparian corridor combined with the mature blocks must always equal 50 percent of the area of the yard.

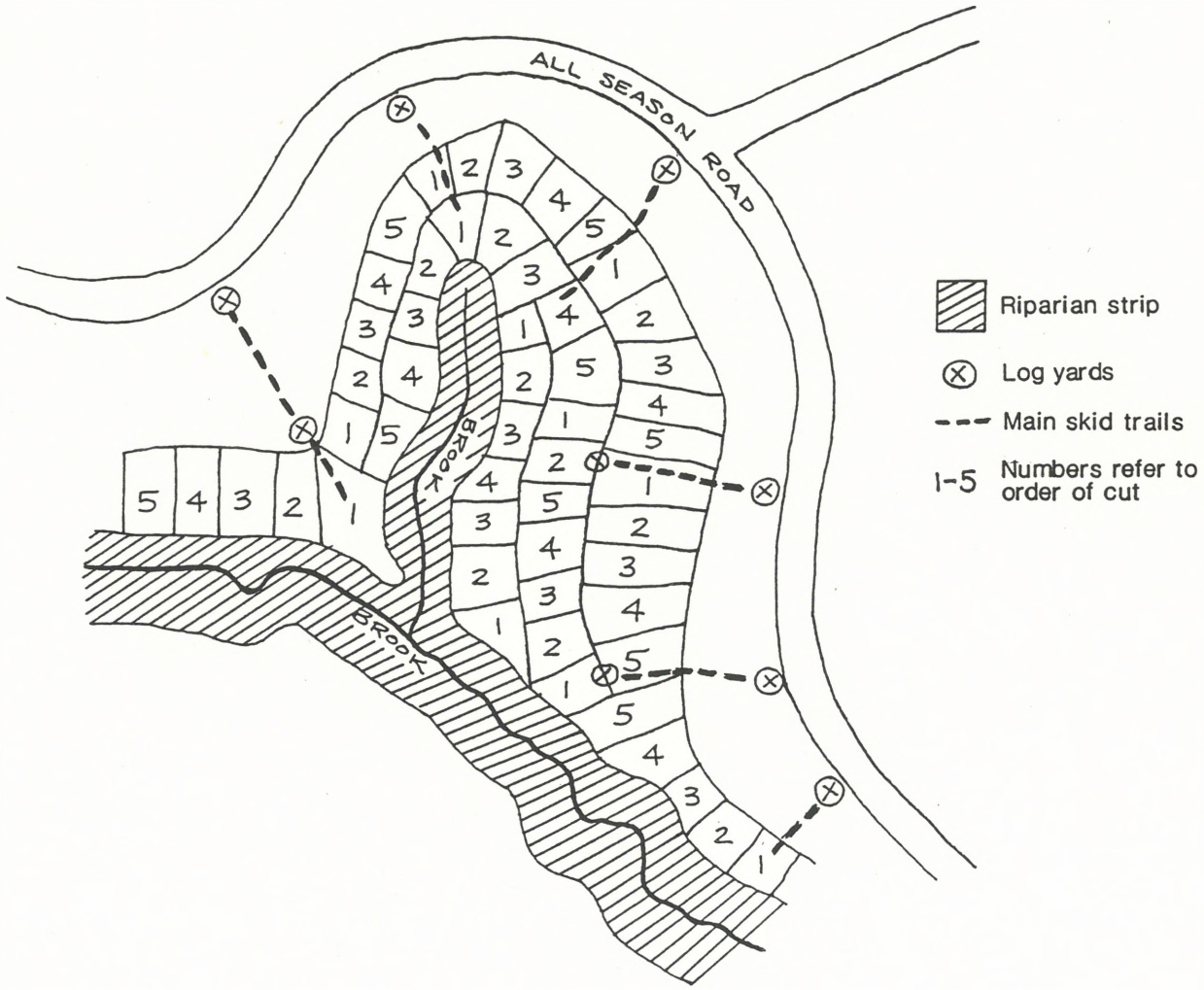


Figure 6. An example of a deer wintering area management scheme. See text for explanation.

B. BEAVER AND WETLANDS

Duane R. Diefenbach
Graduate Student
Department of Wildlife
University of Maine

Sandra J. Lovett
Wildlife Biologist
Maine Department of Inland
Fisheries and Wildlife

Ray B. Owen, Jr.
Professor and Chair
Department of Wildlife
University of Maine

The activities of beaver in a forested landscape create a series of habitats from new flowage, to stagnant pond, to open meadow. Initially, the flowage is extremely productive. For about seven years, nutrients are released from the soil into the water, supporting a diverse plant and animal community. Productivity declines slowly as organic matter accumulates and eliminates the soil-water interface. This decline is reversed when beaver eventually abandon the flowage, water levels drop, and the organic matter decomposes. Grasses and forbs then invade the newly exposed soil and a beaver meadow develops.

Beaver ponds are focal points for wildlife in a forested environment. Economically important furbearers such as muskrat, raccoon, mink, otter, and, of course, beaver thrive in this habitat. Black ducks, wood ducks, and other waterfowl depend greatly on beaver flowages for nesting and brood-rearing habitat. Wood ducks, hooded mergansers, and American goldeneye are cavity nesters and use the dead and dying trees created when flooding occurs, as do woodpeckers and tree swallows. Many birds, such as swallows and flycatchers, are attracted because of the abundant insect populations and convenient perch sites, and still others, such as yellow warblers, are attracted to the diverse vegetation of the wetland edge. Eagles, ospreys, and herons frequent these habitats for feeding and nesting. Early "green up" along the margins of wetlands and old beaver meadows attract deer, moose, and bear in spring. Fish populations often increase initially after flooding but can decline as water temperatures increase and oxygen is depleted. Also, dams can prevent fish migration on small streams.

The activities of beaver benefit more than wildlife. Their dams reduce erosion by trapping sediments, thus recycling nutrients that would otherwise be washed downstream. Wetlands can retard spring run-off, decrease downstream flooding, and aid in groundwater recharge.

Because beaver drastically change the habitat, their activities sometimes conflict with those of humans. They can flood roads and agricultural fields, and destroy harvestable timber. However, management techniques applied to both populations and individual beaver can reduce the conflict between

beaver and humans. Regional wildlife biologists with the Maine Department of Inland Fisheries and Wildlife (MDIFW, see Appendix C) should be contacted for technical assistance with beaver problems. Permission from MDIFW must be received prior to trapping beaver or disturbing their dams.

There are three types of beaver control:

(1) Controlled water passage and water level manipulation. Beaver control does not necessarily require the removal of problem animals. Problems with beaver most often occur when flowages are created by plugging culverts. Fencing constructed in a semi-circular fashion around the culvert mouth will usually prevent beaver from plugging the culvert and flooding the road (Figure 7.A). In other situations, drain pipes placed in the dam will lower water levels but keep the dam intact. These long "culverts", made of boards or PVC pipe, are placed in the dam, extend into the pond, and empty downstream (Figure 7.B).

(2) Direct removal of beaver. In some instances, direct removal may be the only solution. Live-trapping of nuisance beaver can be accomplished by use of the Hancock or Bailey "beaver live-traps." Live-trapped beaver can be moved to other localities where beaver are desired.

(3) Legal trapping through existing regulations. Lethal removal of beaver is recommended only as a last resort. MDIFW opens and closes townships to trapping based on harvest data and the number of nuisance complaints. Contact your Regional Wildlife Biologist (Appendix C) for information about trapping regulations.

Removal of beaver from an area, using either lethal or non-lethal methods, is generally a short-term solution. Allowing the beaver to stay and concentrating on controlling the water level will provide a long-term solution as well as diverse, productive wildlife habitat. Solutions to beaver problems can be time consuming, but the productivity of beaver-created wetlands makes the commitment of time and money worth the effort.

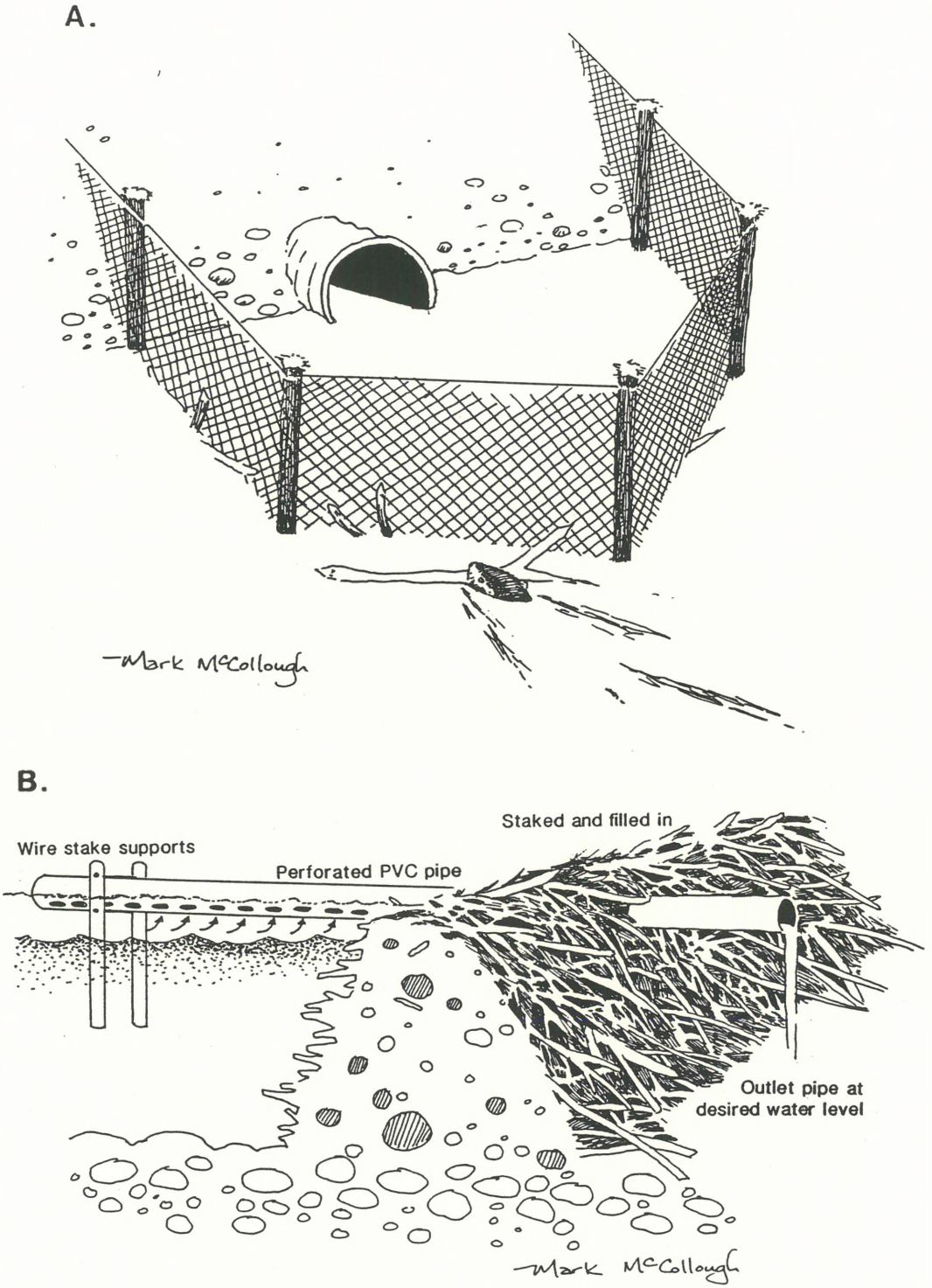


Figure 7. Structures used to control water level in beaver flowages.
A. Fencing to prevent plugging of culverts.
B. Cross-section of PVC drain pipe set into dam to maintain water at desired level. Large dams may require the use of two or more ten-foot pipes joined together.

C. HARE, GROUSE, AND WOODCOCK

William B. Krohn, Leader
Maine Cooperative Fish
and Wildlife Research Unit
University of Maine

R. Bradford Allen
Wildlife Biologist
Maine Department of Inland
Fisheries and Wildlife

Three of Maine's most important small game species are the snowshoe hare, ruffed grouse, and American woodcock. Although these species vary in their specific habitat requirements, all three are most abundant in young forests.

SNOWSHOE HARE

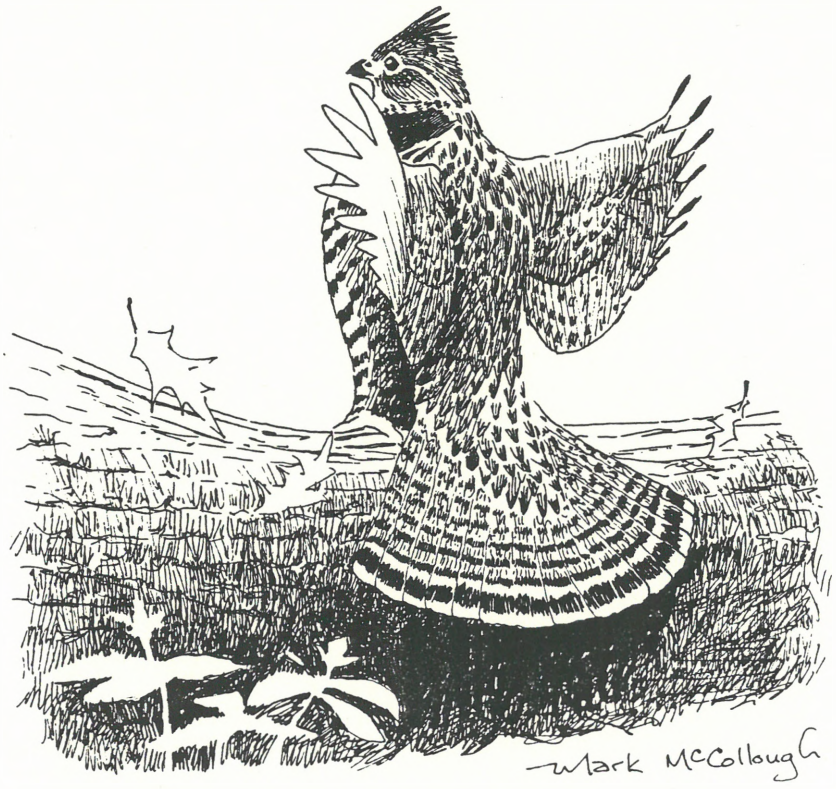
Survival and population densities of snowshoe hare in Maine are directly related to understory density. Dense softwood understories of 8,000-10,000 stems per acre and 8-15 feet tall provide good thermal and escape cover and are especially important during the winter months. Hardwood understories of similar stem density and height provide food. Therefore, optimal hare habitat consists of stands with a large percentage of regenerating softwood interspersed with young hardwoods.

Snowshoe hare habitat can be provided in mature forests by making small (<20-acre) clearcuts. In spruce-fir regeneration, hare begin using these stands 6-7 years after cutting and continue use until the stand is 25-30 years old. When managing habitat for hare, cutting practices should be planned to provide four age classes of softwoods over the rotation. Grasses and forbs can be planted in logging roads and landings to provide spring and summer food (see Section III.B). Small, isolated islands of softwoods within large clearcuts will not be used because hares are reluctant to cross large open areas.

RUFFED GROUSE

Ruffed grouse use a wide range of forest types in Maine but generally achieve greatest densities in young hardwood stands. The density of a grouse population is directly related to the composition and arrangement of cover types. Studies in the Lake States have shown a strong relation between ruffed grouse and aspen. Grouse populations in that region reach greatest densities in aspen forests managed with an even-aged system. Aspen forests managed for grouse are usually harvested using a 20-acre management unit containing four 5-acre sub-units. Each unit is cut on a 40-year rotation with one sub-unit cut every 10 years. Northern hardwood forests, which typically lack the aspen component, are cut in a similar fashion but with longer rotations. Grouse habitat can be further enhanced by releasing over-topped apple trees (see Appendix H) and by seeding logging roads and landings (see Section III.B). To prevent regular concentrations of grouse and hence increased predation, managed apple trees and seeded areas must be dispersed, yet fairly abundant.

Aspen dominates few sites in Maine and commercial harvest is limited. However, ensuring the presence of aspen as a component of grouse habitat in Maine is important. Aspen stands with stem densities of 2,000 to 8,000 per acre provide good cover. Stands with densities in excess of 8,000 stems per acre are important as drumming, breeding, and brood habitats. The flower buds of mature male aspen provide critical winter food. Openings with a rich herbaceous ground cover are also an important component of grouse habitat. Clearcutting adjacent to openings such as power lines and old fields will enhance the use of managed hardwood stands by grouse.

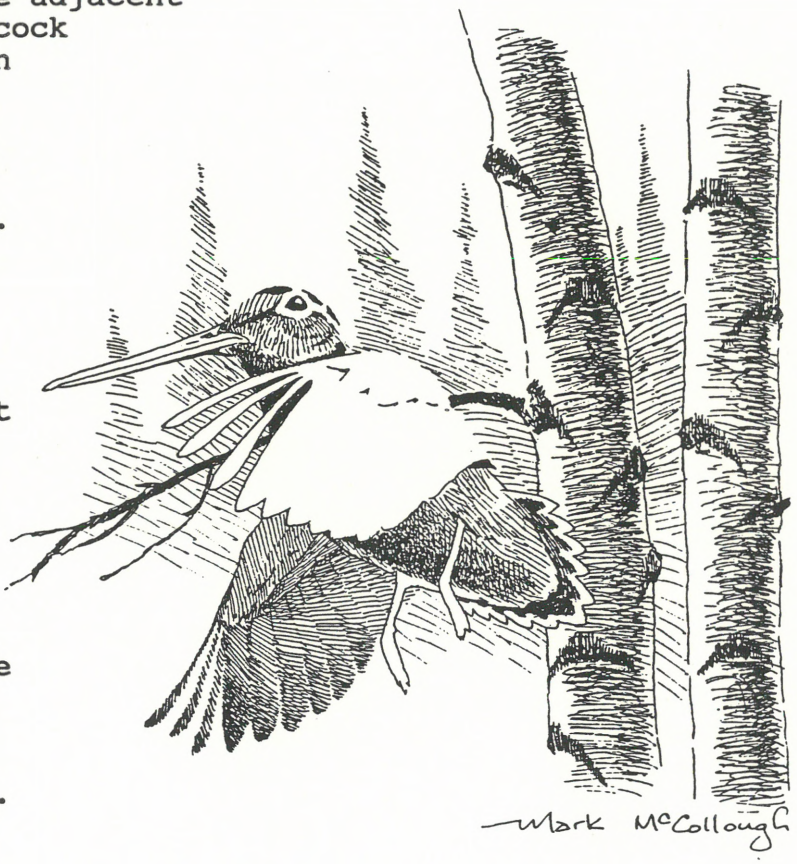


WOODCOCK

Woodcock require four distinct types of habitat. Clearings, which may be quite small (<1 acre), are necessary for spring courtship. Young second-growth hardwoods provide brood-rearing cover when sapling size and nesting cover when pole size. Feeding covers are generally dense (10,000-15,000 stems per acre) stands of alders or young hardwoods on moist soil. And finally, woodcock require large openings (>1 acre) for night roosting. Like hare and grouse, woodcock rarely use mature forests.

Woodcock eat mainly earthworms; hence optimal feeding habitats are those sites where earthworms are most available. Soils that were previously tilled, regardless of present forest stand characteristics, usually support adequate earthworm densities. Thus, previously farmed areas should be given special consideration when managing woodcock habitats.

Commercially harvested woodlands produce openings suitable for singing-grounds and night roosting, but unless these clearings are adjacent to feeding cover, use by woodcock will be limited. Openings can be created by cutting small blocks of forest, especially adjacent to potential feeding areas such as alder-lined streams or aspen on wet sites. In general, 100-foot-wide (1.5-chain) clearcuts separated by uncut strips of 400 feet in width (6 chains) are readily used. Whenever possible, strips should be cut across wet areas because the differences in soil moisture within the strip results in varying growth rates and densities of regeneration and provides a supply of earthworms even during dry periods. New strips should be cut next to old strips every 4-5 years. Thus, the entire cover would be cut and regenerated every 20-25 years.



D. FORESTLAND RAPTORS AND HERONS

William B. Krohn, Leader
Maine Cooperative Fish
and Wildlife Research Unit
University of Maine

Ray B. Owen, Jr.
Professor and Chair
Department of Wildlife
University of Maine

RAPTORS

Maine's forest-nesting raptors use habitats ranging from bottomland to upland sites, and from mature stands to recent clearcuts (see Appendix I for details). In this respect, forest management and raptor habitat management are not in conflict. Raptor communities vary with forest management practices. The key to maintaining a diversity of forestland raptors is to maintain a mixture of forest types, at a large enough scale, in various successional stages. For example, mixedwood forests recently cut in large blocks are occupied mainly by open-country raptors, such as kestrels and red-tailed hawks, whereas the same forest type in an uncut condition is used by broad-winged and red-shouldered hawks.

The area used by a nesting pair is generally related to body size. Large raptors, such as goshawks or great horned owls, require 3,000 to 5,000 acres per nesting pair, whereas smaller hawks, such as broad-wings and kestrels, have breeding home ranges of 1,000 acres or less. Some raptors have a strong affinity to a previously used nest tree, whereas others select a new nest tree within the previously used nesting area (Appendix I). Woodland raptors, such as goshawks and red-shouldered hawks, might have two or more nests that they use on a rotating basis over years, and even decades. Barred owls and great horned owls use old raven, crow, or hawk nests.

When a tree with a large stick nest is located before or during a selection cut, it should be surrounded by an uncut buffer area of at least 66 feet (1 chain), and no harvesting should occur within 330 feet (5 chains) of the nest during the nesting period (April-June). In a clearcut operation, when possible, a 330-foot (5-chain) buffer should surround all raptor nests but selective thinning, retaining most mature trees, can occur within the outer 264 feet (4 chains) during the non-nesting period. Uncut strips, especially in riparian areas, often provide good nesting locations.

When areas larger than 50 acres are being clearcut, a group of several large trees should be left standing for each 5-10 acres harvested. It is unlikely that scattered trees (or small stands of old-growth) will get immediate use by woodland raptors, but these trees will help ensure the future availability of mature trees for nesting. Cavity trees, dead as well as living,

are critical to kestrels, barred owls, and saw-whet owls and should be left standing (see Appendix I and Sections II.B and II.C).

Appropriate foraging habitat should be provided around the nest site over the rotation period. When planning future cuts, large blocks (>50 acres) of representative forest types in a full range of successional stages, including older growth stands (>60 years) should be retained for hunting habitat.

Nest management for bald eagles and golden eagles involves concentric buffer zones centered on the nest site (Figure 8), each with land-use limitations that become less restrictive at greater distances from the nest. Buffer zones encompass a radius of 1,320 feet (20 chains) around an eagle nest. An inner zone with a radius of 330 feet (5 chains) is maintained as a sanctuary where only those actions essential to protect the site are permitted, and must be conducted during the non-nesting period (early September to late January). Single-tree selection or small patch cutting is permitted in the second zone of 330-660 feet (5-10 chains) from the nest if conducted during the non-critical period when the birds are in residence. Care should be taken to maintain all potential nest and perch trees within this zone. In the outer zone, 660-1,320 feet (10-20 chains) from the nest center, all activities are again curtailed during the nesting period (February to August), but there are no timber-harvesting restrictions other than preserving roost trees or potential nest trees.

HERONS

Great blue herons also deserve special management considerations because they are colonial nesters that rely on large, mature forest stands close to the aquatic habitat where they feed. In inland Maine great blue herons prefer stands of tall trees, such as supra-dominant white pine, for nesting. A colony site will be reused and should continue to support herons as long as the site and birds remain undisturbed and adjacent wetlands remain productive.

Management of great blue heron colonies involves buffer zones similar to those recommended for eagles (Figure 8). The inner zone should extend 330 feet (5 chains) from the edge of the colony. Within this zone, and within the colony itself, there should be no tree harvesting or disturbance except that essential to maintaining the colony and the site; any such activities must be conducted during the non-nesting period (September to March). Recreational activities of all forms are prohibited during the nesting period (early April to late-August) within the colony and inner zone. In the second zone of 330-660 feet (5-10 chains) from the edge of the colony, limited selection or patch cutting can occur during the non-nesting period. Care must be taken to protect all potential nest trees and ensure their wind firmness. Within the outer zone of 660-1,320 feet (10-20 chains) from the edge of the colony, high-disturbance

activities, such as road construction, harvesting, and site preparation, are prohibited during the nesting period.

For management of species listed by state or federal authorities as endangered or threatened (see Appendix I) or significant heron colonies (>30 nests), consultation with a wildlife biologist is strongly recommended (see Appendix C).

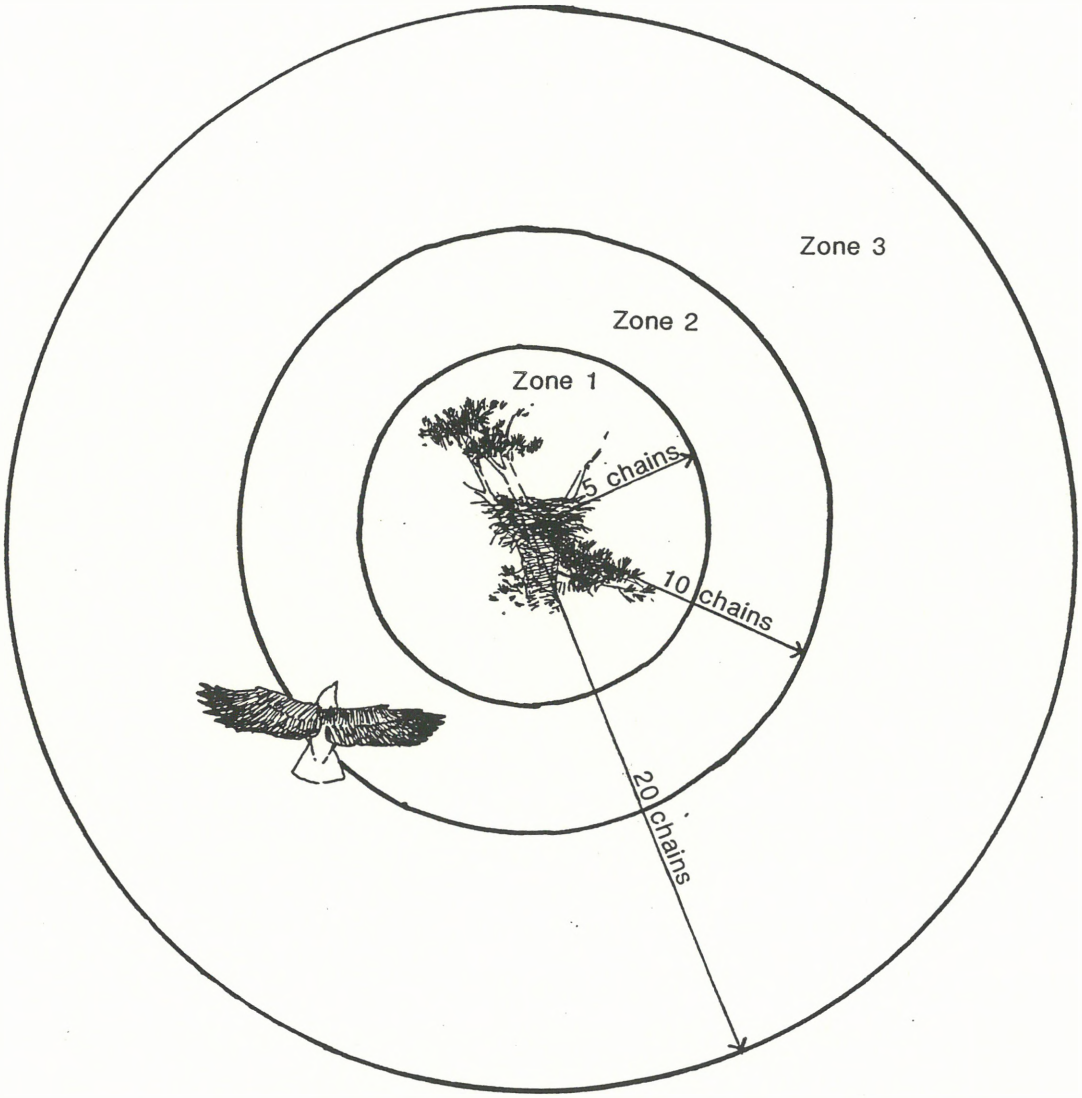
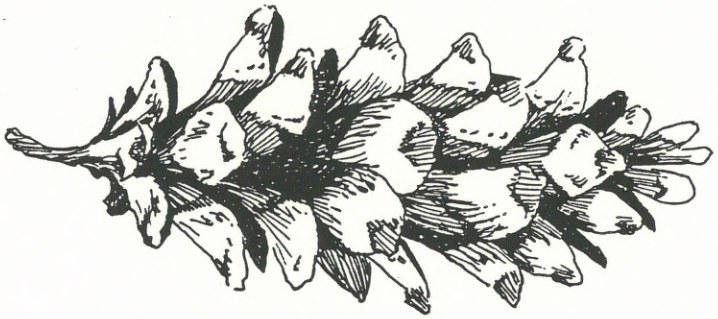


Figure 8. Nest management zones for bald eagles, golden eagles, and great blue herons. Distances are measured from the nest for eagles, and from the edge of the colony for herons. For each species, management recommendations within each zone are explained in the text.

- V -

APPENDICIES



APPENDIX A

A FORESTER'S GUIDE TO MANAGING WILDLIFE HABITATS IN MAINE

RESPONSE FORM

(1) Please check all that apply to you:

Occupation:

_____ Professional forester
_____ Professional wildlifer
_____ Other _____
(please specify)

Employer:

_____ Federal government
_____ State government
_____ University
_____ Cooperative Extension Service
_____ Forest industry
_____ Private consultant
_____ Other _____
(please specify)

(2) Where did you obtain this publication:

_____ Maine Chapter of The Wildlife Society
_____ Maine Cooperative Extension Service
_____ Maine Department of Inland Fisheries and Wildlife
_____ Workshop sponsored by _____
_____ Office copy
_____ From a colleague
_____ Other _____
(please specify)

(3) What sections in this guide has been most useful to you?

(4) What sections in this guide has been least useful to you?

(5) What information would you like to see added to this guide?

(6) What wildlife habitat management practices have you or will you be implementing as a result of using this guide?

(7) Other comments or suggestions?

(8) If you are willing to answer questions about the responses you have given here, please fill in your name and phone number:

Name _____
Daytime phone _____

Thank you for your time and assistance in helping to make this publication useful to you and others.

Return to: Catherine A. Elliott
Wildlife and Fisheries Specialist
Maine Cooperative Extension Service
234 Nutting Hall, UM
Orono, ME 04469

APPENDIX B

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HERBACEOUS SEEDING

Many variables affect the success of berbaceous seeding. Conditions such as soil type, moisture, slope, and spect, vary from site to site and so too will the seed mix best suited to each site. For further information and tehnical assistance consult your local Soil Conservation Service office (Appendix E) and the SCS Field Office Technical Guide.

FERTI-BLAST^{R} GUN AND COATED SEED

Ferti-blast gun available from:

Federal Brass Manufacturing Company
165 Cedar Street
Corning, NY 14830

Coated seed:

developed by: CelPril Industries, Inc.
P.O. Box 276
Hermiston, OR 97838

available from: Willamette Seed and Grain Company
P.O. Box 791
Albany, OR 97321

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Note: A half-hour video titled "Woodcock Woodlands," on the management of habitat for woodcock is available, at modest cost, from the Ruffed Grouse Society, 1400 Lee Drive, Coraopolis, PA 15108.

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APPENDIX C

STATE AND FEDERAL WILDLIFE AGENCIES

MAINE DEPARTMENT OF INLAND FISHERIES AND WILDLIFE
284 State Street, Station #41
Augusta, Maine 04333
289-3286 or 289-3651

REGIONAL OFFICES

Region A
RR #1, 328 Shaker Road
Gray 04039
657-2345

Region B
8 Federal Street
Augusta 04330
289-2536

Region C
68 Water Street
Machias 04654
255-3266

Region D
RFD #3, Box 3770
Farmington 04938
778-3324

Region E
Box 551
Greenville 04441
695-3756

Region F
Box 66
Enfield 04433
732-4131

Region G
P. O. Box 416
Ashland 04732
435-3231

WILDLIFE RESEARCH SECTION - P.O. Box 1298
Bangor 04401
941-4466

USDI - FISH AND WILDLIFE SERVICE

REGIONAL OFFICE - One Gateway Center, Suite 700
Newton Corner, MA 02158
617-965-5100

USDA - ANIMAL AND PLANT HEALTH INSPECTION SERVICE/ANIMAL DAMAGE CONTROL (APHIS/ADC)

Wildlife Assistance Office
P.O. Box 800
Augusta, ME 04330
622-8263

APPENDIX D

UNIVERSITY OF MAINE
COOPERATIVE EXTENSION SERVICE

100 Winslow Hall, UM
Orono, Maine 04469

NATURAL RESOURCES PROGRAM

Program Leader - 100 Winslow Hall, UM
Orono, Me 04469
581-3194

Forestry, Wildlife, and Fisheries Specialists -
103 Nutting Hall, UM
Orono, Me 04469
581-2892

COUNTY OFFICES

Androscoggin-Sagadahoc County
277 Minot Ave., Auburn 04210
786-0376

Aroostook County
13 Hall Street, Fort Kent 04743
834-3905

Aroostook County
P.O. Box 727, Presque Isle 04769
764-3361

Aroostook County
P.O. Box 8, Houlton 04730
532-6548

Cumberland County
96 Falmouth St., Portland 04103
780-4205

Franklin County
P.O. Box 670, Farmington 04938
778-4650

Hancock County
RFD #5, Boggy Brook Road
Ellsworth 04605
667-8212

Kennebec County
125 State St., Augusta 04330
622-7546

Knox-Lincoln County
375 Main St., Rockland 04841
594-2104

Oxford County
RFD 2, Box 1735, S. Paris 04281
743-6329

Penobscot County
Court House Annex, Bangor 04401
942-7396

Piscataquis County
Court House Complex,
Dover-Foxcroft 04426
564-3301

Somerset County
P. O. Box 98, Showhegan 04976
474-9622

Waldo County
RFD 2, Box 641, Belfast 04915
342-5971/2

Washington County
P. O. Box 189, Machias 04654
255-3345

York County
Court House Complex,
Alfred 04002
324-2814

APPENDIX E

SOIL AND WATER CONSERVATION DISTRICT

AND SOIL CONSERVATION SERVICE OFFICES

Androscoggin Valley
27 Westminster Street
Lewiston, ME 04240
783-9196

Central Aroostook
Agricultural Center Building
744 Main Street
Presque Isle, ME 04769
764-4153/4154

Southern Aroostook
RR 3, Box 45
Houlton, ME 04730
532-2087

Cumberland County
587 Spring Street
Westbrook, ME 04092
856-6108

Franklin County
2 Park Street
Farmington, ME 04938
778-4767

Hancock County
Federal Building
41 Main Street
Ellsworth, ME 04605
667-8663

Kennebec County
Federal Building
Western Avenue
Augusta, ME 04330
622-8289

Knox-Lincoln County
RR 1, Box 15
Waldoboro, ME 04572
832-4292

Oxford County
1 Main Street
South Paris, ME 04281
743-7019

Penobscot County
89 Hillside Avenue
Bangor, ME 04401
947-6622

Piscataquis County
Rte. 15
Dover-Foxcroft Plaza
Dover-Foxcroft, ME 04426
564-2321

St. John Valley
96 Market Street
Fort Kent, Me 04743
834-3311

Somerset County
7 High Street
Skowhegan, ME 04976
474-8324

Waldo County
69 Northport Avenue
Belfast, ME 04915
338-2320

Washington County
Federal Building
49 Court Street
P.O. Box 121
Machias, ME 04654
255-3995

York County
160 Cottage Street
Sanford, ME 04073
324-7015

APPENDIX F

Table F.1. Wildlife species using dead and dying woody material in Maine.

Species	Use			
	Shelter Resting	Nest Den	Forage Perch	Display Bask
BIRDS				
+Wood duck		x		
+Common goldeneye		x		
+Hooded merganser		x		
+Common merganser		x		
Ruffed grouse		x		x
+American kestrel		x	x	
+Barred owl	x	x		
+Saw-whet owl	x	x		
*Pileated woodpecker	x	x	x	
*Hairy woodpecker	x	x	x	
*Downy woodpecker	x	x	x	
*Black-backed woodpecker	x	x	x	
*Three-toed woodpecker	x	x	x	
*Northern flicker	x	x	x	
*Yellow-bellied sapsucker	x	x	x	
+Chimney swift		x		
+Great crested flycatcher		x	x	
+Tree Swallow		x		
+Purple martin		x	x	
*Black-capped chickadee	x	x	x	
*Boreal chickadee	x	x	x	
*Red-breasted nuthatch		x	x	
+White-breasted nuthatch		x	x	
+Brown creeper		x	x	
+House wren		x		
+Winter wren		x	x	
+Eastern bluebird		x	x	
Ovenbird			x	x
Common Yellowthroat		x	x	x
Rufous-sided towhee		x	x	x
+Starling		x		
White-throated sparrow			x	x
Lincoln's sparrow		x	x	x
Song sparrow		x	x	x
+House sparrow		x	x	x

* Primary cavity excavators
\+ Secondary cavity users

Table F.1. (continued).

Species	Use			
	Shelter Resting	Nest Den	Forage Perch	Display Bask
MAMMALS				
Masked shrew	x	x	x	
Pygmy shrew	x		x	
+Little brown bat	x	x		
+Keen's bat	x	x		
+Silver-haired bat	x	x		
+Big brown bat	x	x		
Deer mouse	x	x	x	
White-footed mouse	x	x	x	
Red-backed vole	x	x	x	
Woodland jumping mouse	x	x	x	
+Red squirrel	x	x	x	
+Northern flying squirrel	x	x	x	
Eastern chipmunk	x		x	
+Porcupine	x	x		
Cottontail rabbit	x			
Snowshoe hare	x			
Short-tailed weasel		x	x	
+Long-tailed weasel		x	x	
Mink		x	x	
+Pine marten	x	x	x	
+Fisher	x	x	x	
Striped skunk	x	x	x	
Raccoon	x	x	x	
Coyote		x	x	
Red fox		x	x	
Grey fox		x	x	
Lynx		x	x	
Bobcat		x	x	
Black bear		x	x	

* Primary cavity excavators
+ Secondary cavity users

Table F.1. (continued).

Species	Use			
	Shelter Resting	Nest Den	Forage Perch	Display Bask
REPTILES				
Northern brown snake	x		x	
Northern redbelly snake	x		x	
Eastern garter snake	x		x	
Northern ringneck snake	x		x	
Eastern milk snake	x		x	
Spotted turtle				x
Eastern painted turtle				x
Wood turtle				x
AMPHIBIANS				
Trembaly's salamander	x		x	
Blue-spotted salamander			x	
Spotted salamander	x		x	
Red-backed salamander	x		x	
Four-toed salamander	x		x	
Red-spotted newt (juvenile)	x		x	
Grey tree frog	x		x	

* Primary cavity excavators
+ Secondary cavity users

APPENDIX G

SNAG REQUIREMENTS OF PRIMARY CAVITY EXCAVATORS

There are 10 species of cavity nesting birds in Maine that are primary excavators, that is, they excavate their own tree cavities. Other wildlife species that use cavities, called secondary users, must use those that occur naturally or rely on the primary excavators to provide suitable cavities. It has been reasoned that by providing for the needs of the primary excavators, one can be reasonably sure that the needs of most cavity-using species will be met.

To determine more specifically how many snags per acre must be provided for each species, it is necessary to know: (1) territory size, (2) number of snags used per pair per year, and (3) minimum dbh required. An allowance must also be made for snags that are present within a territory but are unsuitable or unused. These data are presented in Table G.1 for 9 of the 10 primary excavators. Not enough is known about territory size and number of cavities excavated per year for the red-breasted nuthatch to include it.

To meet the needs of the 9 species requires 2 snags >22" dbh, 62 snags >12" dbh, 40 snags >8" dbh, and 17 snags >4" dbh per 10 acres. Knowing that larger trees can substitute for smaller ones, and that more than one species will use the same tree (but only 1 pair of a single species), this requirement can be reduced. Providing 2 snags >22" dbh per 10 acres will take care of the need for 2 of the snags >12" dbh. By also providing 60 snags >12" dbh per 10 acres, the total of 62 snags per 10 acres will meet the need for all 40 snags >8" dbh and all 17 snags >4" dbh.

Table G.1. Calculation of snag requirements of primary excavators in Maine.

Species	Minimum snag diameter (inches)	Average territory size (acres)	Territories per 10 acres	Cavities excavated per year per pair	Snags per pair per 10 acres*
Pileated woodpecker	22	150	0.067	3	2
Common flicker	12	5	2	1	20
Yellow-bellied flycatcher	12	7.5	1.33	1	14
Hairy woodpecker	12	15	0.67	3	20
Three-toed woodpecker	12	75	0.133	3	4
Black-backed woodpecker	12	75	0.133	3	4
Downy woodpecker	8	5	2	2	40
Black-capped chickadee	4	10	1	1	10
Boreal chickadee	4	15	0.66	1	7

* Snags required per 10 acres = (Number territories per 10 acres) x (Number cavities excavated per year) x (Allowance for unsuitable and unused trees). From information in the literature, an allowance of 10 unused trees per excavated tree was determined and used in this calculation. Values for number of snags required per pair per 10 acres were rounded up to the nearest snag.

APPENDIX H

This appendix is a reprint of a bulletin produced by the New Hampshire Cooperative Extension Service. Pocket-sized copies can be obtained by writing to NH-CES, Pettee Hall, UNH, Durham, NH 03824.

CARE OF WILD APPLE TREES

David Olson and Clarence Langer
New Hampshire Cooperative Extension Service
Extension Folder 70

Wild apple trees are one of the important wildlife food plants in New England. They are used by many game species including white-tailed deer, ruffed grouse, snowshoe hare, cottontail rabbit, and gray squirrels. Apples or apple seeds have been found in the stomachs of fox, fisher, porcupine, bobcat, and red squirrel. Apple trees also provide good habitat for woodcock and many songbirds including bluebirds, flycatchers, robins, and orioles. New England is fortunate in having many apple trees growing naturally in the wild, but many wild apple trees are being lost each year.

Wild apple trees normally become established in clearings or on the edges of fields, and as the forests grow up these trees are crowded by shrubs and shaded by over-topping trees. Prolonged periods of crowding and shading will cause a decline in vigor and eventually death and loss of these apple trees for wildlife use. The length of life, vigor, and yield of these wild apple trees can be improved with some simple techniques that are commonly used by foresters and orchardists today. This bulletin describes these simple techniques in a step by step procedure.

COMMENTS

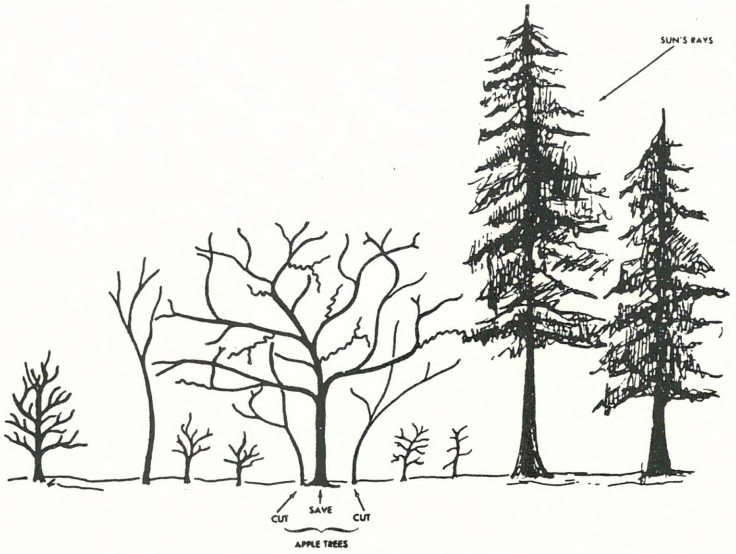
A lightweight chain saw, a pruning saw with a ten-foot handle, and long-handled pruning shears are useful tools for working on wild apple trees.

The brush, apple tree branches, and trees that are removed can be piled to form a brush pile for wildlife cover. For deer, ruffed grouse, and snowshoe hare, there is little need to pile the brush.

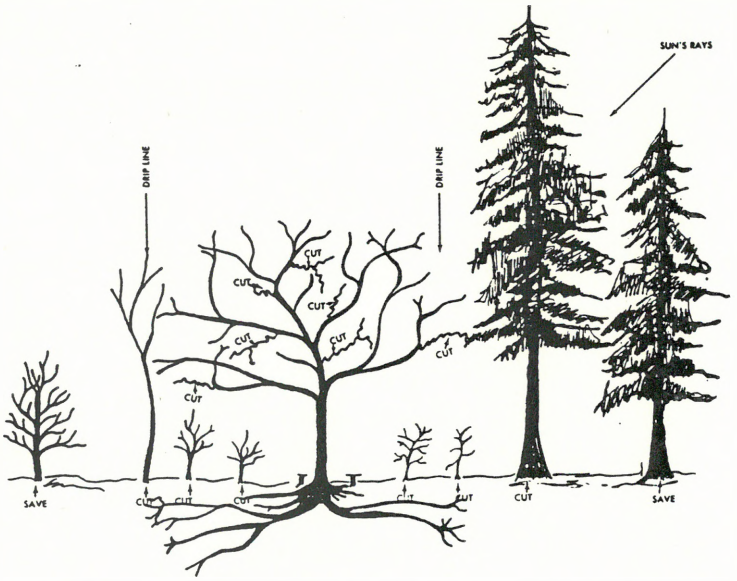
If there are very large trees to be removed, it may be faster and safer to girdle the tree and leave it standing. Girdling is accomplished by cutting completely through the bark in a ring around the tree. Do not use chemical sprays on apple tree stumps as they may be connected to the roots of the tree you wish to save.

The effects of fertilizing will last approximately three years.

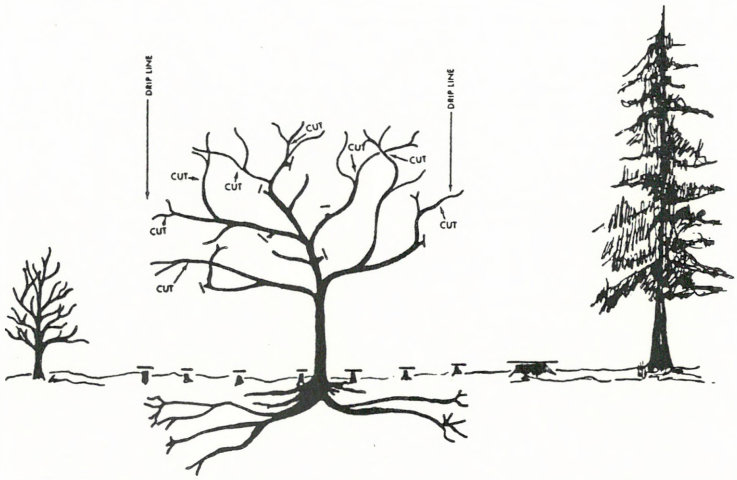
The minimum size clearing for the health and vigor of the apple tree has been described in these instructions. Most species of wildlife benefit from clearings in brushy or wooded areas and would benefit from larger clearings around apple trees.



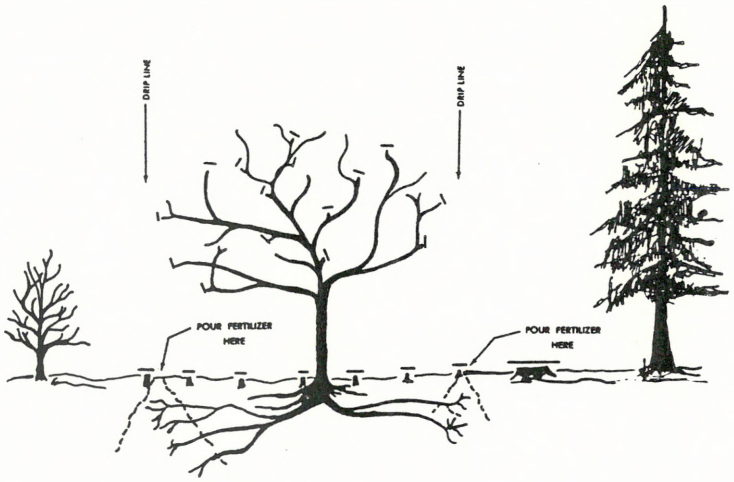
STEP 1. Carefully examine the apple tree. Look for dead branches, diseased wood in the trunk, and the presence of more than one stem. If there is more than one stem, select the largest and most vigorous and remove the smaller competing stems by cutting them off as near the ground as possible. If the largest stem is badly diseased or broken, remove it and select the next largest, most vigorous stem for improvement.



STEP 2. Remove all other shrubs and trees back to the drip line of the apple tree. If the tree is shaded by large over-topping trees, remove these on at least three sides especially towards the south. Remove all the dead branches from the apple tree. Cut these off with a pruning saw or pruning shears as close to the living branches as possible.



STEP 3. Remove approximately one third of the remaining live growth. In so doing, attempt to open up thick clusters of branches. Clip off one to two feet from the ends of vigorous side branches or vertical sucker shoots. Do not remove the short spur branches that grow on the sides of larger branches because these are the fruit-bearing branches. If the tree is a young sapling with few side branches, the top may be cut off to encourage branching.



STEP 4. Fertilize the tree by pouring a liquid solution of calcium nitrate or ammonium nitrate fertilizer in a narrow band around the tree directly below the drip line. Fertilizer in this narrow band will spread out and become available to the feeder roots as it seeps into the ground. Use five pounds of fertilizer for a large tree and three pounds for a medium tree. For very small trees or saplings use one pound of fertilizer at least three feet from the base of the tree.

APPENDIX I

Table I.1. Status and habitat requirements of Maine's forestland raptors and herons.

Species State status[a] Breeding status[b]	Habitat use[c]		Habitat fidelity[d]	
	Nesting	Hunting	Nest tree	Breeding area
Sharp-shinned hawk SSC Common C, N	Dense SW Nest tree: dbh=8-12" ht=55' ba=125 ft^2/ac	Dense SW Second growth HW	L	M
Cooper's hawk TH Uncommon C, S	Dense SW, HW Nest tree:[e] dbh=15" ht=60-80' ba=118 ft^2/ac	HW, SW, M Mature & broken Dense shrub 2,500 acres[f]	V	V
Goshawk - Uncommon to common	Open older M, sparse sapling Nest tree: dbh=15" ht=75' ba=140-160 ft^2/ac	Extensive HW, SW, M 5,000 acres	H	H
Red-tailed hawk - Common N	Large trees on ridges Nest tree: dbh=22" ht=75-100' ba=80-115 ft^2/ac	Variable 1,250 acres	H	H
Red-shouldered hawk SSC Uncommon to rare	Large trees Bottomland Dense shrubs Nest tree: dbh=19" ht=70-90' ba=120-160 ft^2/ac	Large tracts, mature, bottomland 1,250 acres	H	H
Broad-winged hawk - Common	Large trees Nest tree: dbh=17" ht=70-75' ba=100-140 ft^2/ac	Old second-growth HW,SW Near water 1,000 acres	M	H
American kestrel - Common	Cavities, edge, or clearings	Openings	M	M

Table I.1. (continued).

Species State status[a] Breeding status[b]	Habitat use[c]		Habitat fidelity[d]	
	Nesting	Hunting	Nest tree	Breeding area
Peregrine falcon E, FE Rare	Cliffs	Variable	H	H
Great horned owl - Common	Uses nests of other species in large trees or snags Nest tree:[e] see red-shouldered/ red-tailed hawk	Old, mature forests often with openings 4,000 acres[f]	M	M
Barred owl - Common	Large snags or cavities Nest tree: dbh=26"; ht=63' ba=60-130 ft^2/ac	HW bottomlands or hemlock/pine 2,250 acres	H	H
Saw-whet owl - Common	Cavities: woodpecker or natural	HW, SW, M 30+ years	Unknown	Unknown
Osprey - Common	Dead snags Often near water	Wetlands	H	H
Bald eagle E, FE Common C, E	Dominant, supra-dominant trees Pine preferred Near water	Coast, lakes, rivers, wetlands	H	H
Golden eagle E Very rare	Cliffs, dominant or supra-dominant trees; pine preferred	Wetlands, openings	H	H
Great blue heron - Common S, Uncommon C, N	Mature pine, hardwoods Near water	Wetlands, rivers, lakes	H	H

a SSC=species of special concern; TH=threatened; E=endangered; FE=Federally endangered.
b C=central; N=north; S=south; E=east; W=west.
c HW=hardwood; SW=softwood; M=mixedwood.
d L=low; M=medium; H=high; V=variable.
e dbh=diameter breast height; ht=height; ba=basal area.
f Minimum home range