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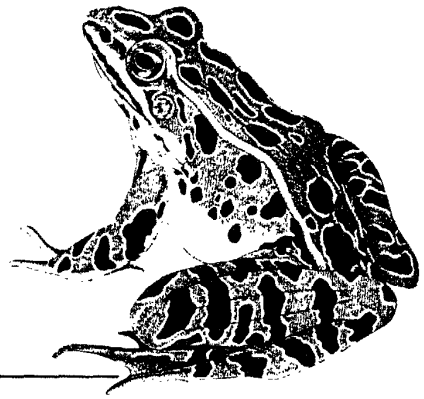
**Northeastern Forest
Experiment Station**

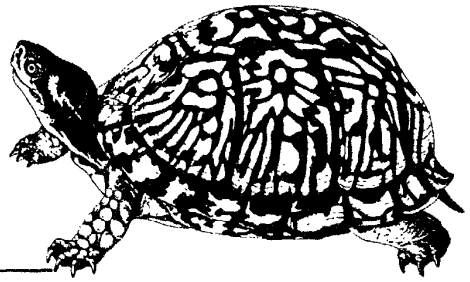
General Technical
Report NE-108

# New England Wildlife:
## Habitat, Natural History, and Distribution

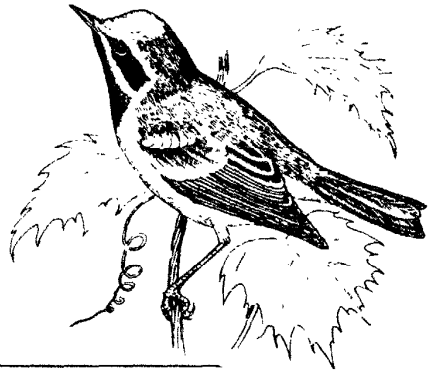
Richard M. DeGraaf
Deborah D. Rudis



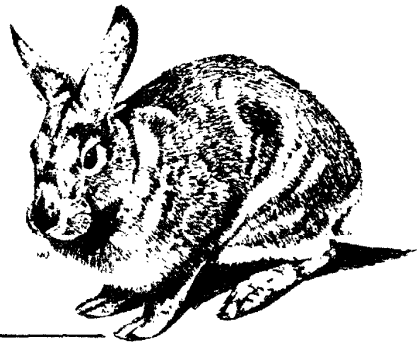
*Amphibians*



*Reptiles*



*Birds*



*Mammals*

## ABSTRACT

Describes natural history profiles of New England wildlife species and their associations with forested and nonforested habitats. Provides a data base that will enable forest managers or wildlife biologists to describe the species or groups to be found in a given habitat.

## THE AUTHORS

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## ACKNOWLEDGMENTS

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## PREFACE

This report is a contribution to the Wildlife and Fish Habitat Relationships Program of the U.S. Department of Agriculture, Forest Service. Professional concerns for wildlife community, management, as well as recent legislation, such as the National Forest Management Act of 1976, have given impetus to the Program, which seeks to maintain viable populations of all existing native vertebrates on lands administered by the Forest Service. To achieve this broad goal, the habitats, life histories, and distributions of all vertebrates that potentially inhabit management units must be compiled in a standard habitat classification scheme. When species occurrences have been verified for the area under consideration, management indicator species can be monitored to detect population changes. Indicator species must include federally listed endangered species; species whose special habitat components may be affected by management practices; species commonly hunted, fished, or trapped; and, finally, species whose population changes likely reflect the impacts of management activities on other wildlife species in the community. While routine monitoring of indicator species to detect population changes of other species is a future goal, all efforts toward the development of such a procedure must be based on accurate biological knowledge and habitat associations. Thus this report, the stimulus for which came from the development of guidelines for the management of wildlife in the Blue Mountains of Oregon and Washington (Thomas 1979). The format closely follows that of Verner and Boss (1980) in order to contribute to a national compilation of forest-wildlife habitat relationships.

Our approach was to compile the available information on the life history, distribution, and habitat for each inland vertebrate occurring in New England and then obtain critical reviews by known experts. This report is based partly on information that was originally available in three separate volumes on northeastern wildlife. The original volumes were limited and were intended for USDA Forest Service use in wildlife habitat management on the Green Mountain and White Mountain National Forests:

DeGraaf, R.M.; Witman, G.M.; Lanier, J.W.; Hill, B.J.; Keniston, J.M. Forest habitat for birds of the Northeast. Milwaukee, WI: Forest Service, Eastern Region; 1980. 589 p.

DeGraaf, R.M.; Witman, G.M.; Rudis, D.D. Forest habitat for mammals of the Northeast. Milwaukee, WI: U.S. Department of Agriculture, Forest Service, Eastern Region; 1981. 182 p.

DeGraaf, R.M.; Rudis, D.D. Forest habitat for reptiles and amphibians of the Northeast. Milwaukee, WI: U.S. Department of Agriculture, Forest Service, Eastern Region; 1981. 239 p.

We trust that this information contributes to the sound management of forest wildlife communities in New England and elsewhere. We urge researchers to field check the information in the species/habitat matrices; such work is vital before the application of indicator species to wildlife management.

## INTRODUCTION

New England's forests provide a diversity of habitats that support a range of wildlife communities. Now mostly forested, the New England landscape has changed dramatically in the last 350 years. Once covered by the primeval forest, the land was cleared for agriculture, slowly until about 1750, then at an increased pace until 1820, when 75 percent of the arable land in southern and central New England was in farm crops and pasturage. A century later, these figures were reversed, and New England was about 75 percent forested — the result of an era of farm abandonment that began in 1830 with the opening of rich farmlands in Ohio via the Erie Canal. The building of railroads, the Civil War, and even the California gold rush all contributed to the exodus of farmers from the stony hills so arduously brought under cultivation.

The reversion of the land to forest began at once, producing the "old field" pine stands that reached harvestable size just after the turn of the 20th century. Today, New England supports a diversity of forest cover types. Major types include eastern white pine/northern red oak/red maple, red spruce, paper birch, northern hardwoods, spruce-fir, (Fig. 1). In some areas, admixtures of aspen, paper birch, red maple, hemlock, as well as many open, wetland, and other habitats occur.

Forest management activities — primarily timber harvest, fuelwood management, and road building — are the dominant influences on wildlife habitats. This publication presents the habitat associations of all inland species of New England wildlife in one habitat classification scheme. This information will provide forest managers, wildlife biologists, and other resource specialists with a ready source of information on the habitat needs of all forest wildlife species in New England, and thereby will assure the continued existence of all important, appropriate wildlife habitats in the managed forests of New England. The key to planning the management of all wildlife species is to know their habitat requirements and to provide them in a variety of combinations that meet the needs of as many species as possible. To this end, wildlife must be viewed as wildlife communities that respond over time to habitat changes.

Management of wildlife on public lands is a responsibility shared by various state and federal land management agencies. By agreement, states generally manage or regulate wildlife populations and federal agencies manage habitats. Naturally, close cooperation is required to meet wildlife management goals. This manual provides only habitat information — wildlife population goals must be developed through the coordination or activities of all involved agencies.

Traditionally, wildlife management — whether on federal, state, or private lands — was concerned primarily with game species. The reason for this emphasis is simple — the basic sources of funds for wildlife management were derived from hunters' expenditures, purchase of licenses, and payment of an excise tax on sporting arms and ammunition through the Pittman-Robertson Act, otherwise known as the "Federal Aid to States in Wildlife Restoration Act" (P.L. 75-415, as amended).

Recent legislation has mandated that ecological considerations have an important role in forest management and related resource-use decisions. These statutes that require that land management practices recognize all wildlife include:

*Fish and Wildlife Coordination Act (16 U.S.C. 661-666c, 1934 as amended):* Seeks to protect fish and wildlife habitats by requiring the U.S. Fish and Wildlife Service and the National Marine Fisheries Service to review and report on proposed water and associated land development projects. Evaluations cover projects receiving funds through the Federal River and Harbor Act of 1899, Sections 402 and 404 of the Federal Water Pollution Control Act as amended 1972, and other appropriate Acts.

*Multiple Use and Sustained Yield Act of 1960 (P.L. 86-517):* Directs the USDA Forest Service to consider all renewable resources in conjunction with one another.

*National Environmental Policy Act of 1969 (P.L. 91-190):* Encourages productive harmony among man and his environment; requires that any federally financed project be evaluated and environmental impacts, including those on fish and wildlife, and alternative opportunities, be identified.

*Endangered Species Act of 1973 (P.L. 93-205):* Calls for conservation of endangered and threatened species, and of the ecosystems supporting them. Critical habitats required to assure survival and restoration of endangered species are identified, delineated, and maintained.

*Sikes Act of 1974 (P.L. 93-452):* Calls for new directions and cooperation with the states in planning and management of wildlife habitat on federal lands.

*Forest and Rangeland Renewable Resources Planning Act of 1974 (P.L. 93-378):* Directs the USDA Forest Service to inventory natural resources in the National Forest System and provide comprehensive plans for their management.

*Federal Land Policy and Management Act of 1976 (P.L. 94-579):* Established national policy to retain rather than dispose of the National Resource Lands, and directs that those lands be inventoried, uses be planned on a multiple-use and sustained-yield basis, and that lands be managed on a sound ecological basis, with habitat provided for fish and wildlife. Land use plans and regulations must include protection of public land areas of critical en-

Figure 1.—Forest cover types—aspen, paper birch, northern hardwoods, red maple, northern red oak, white pine/northern red oak/red maple, balsam fir, eastern white pine, red spruce/balsam fir, red spruce, and eastern hemlock.

ASPEN

win Mountain, New Hampshire
ugust 1985

West Milan, New Hampshire
August 1985

## PAPER BIRCH

Gorham, New Hampshire
August 1955

SUGAR MAPLE - BEECH -- YELLOW BIRCH

Berlin, New Hampshire
July 1984

RED MAPLE

Amherst, Massachusetts
July 1985

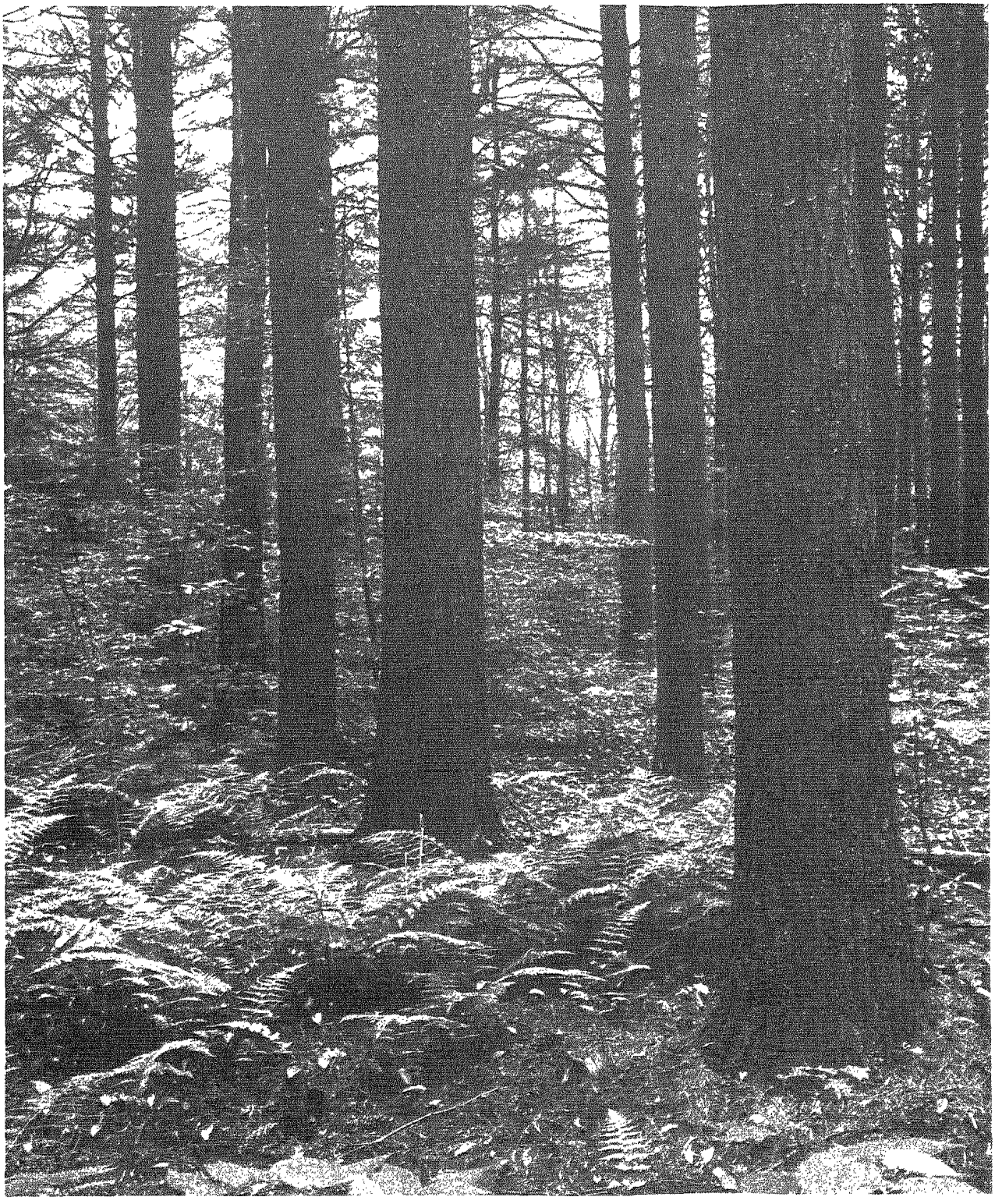
WHITE PINE – NORTHERN RED OAK – RED MAPLE

Belchertown, Massachusetts
August 1985

NORTHERN RED OAK

Ware, Massachusetts
August 1985

## EASTERN WHITE PINE

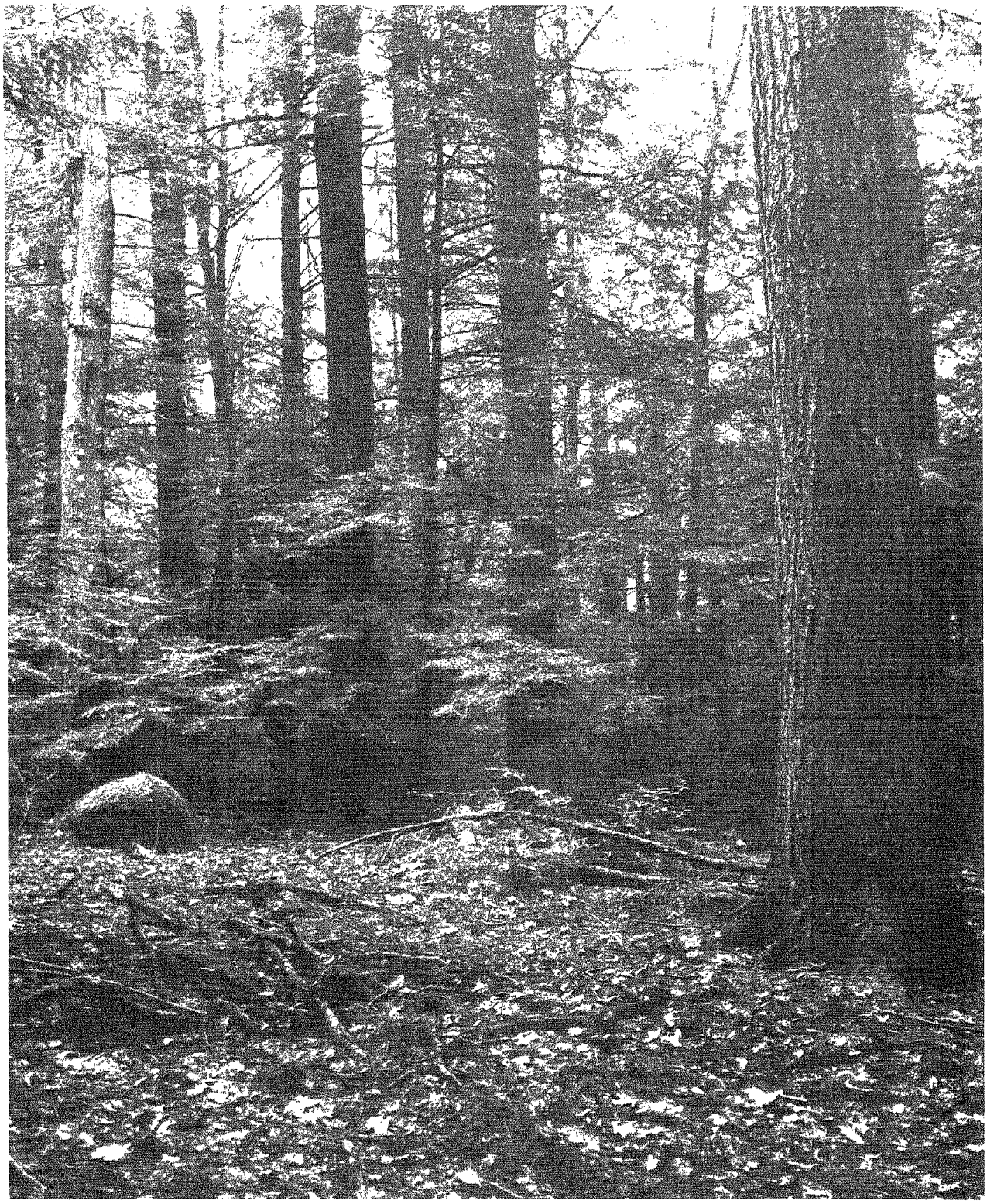


Sunderland, Massachusetts
July 1985

Berlin, New Hampshire
August 1985

Mt. Tabor, Vermont
June 1948

EASTERN HEMLOCK



Petersham, Massachusetts
August 1985

vironmental concern. This refers to delineated areas of public lands where special management attention is required to protect and prevent irreparable damage to important fish and wildlife resources or other natural systems or processes. In resource inventories, priority shall be given to designation and protection of areas of critical environmental concern.

*National Forest Management Act of 1976 (P.L. 94-588):* Requires, among other things, that research be conducted to ensure that land management systems will not substantially impair land productivity.

Wildlife habitat improvement continues to be an integral part of the management of the national forests. All wildlife species have important roles — functions — in ecosystems, and so, must be considered in land management practices. The broad objective of the wildlife habitat program of the Eastern Region of the Forest Service is to maintain a diversity of habitats to ensure that populations of all native wildlife species and communities continue to be represented on the national forests.

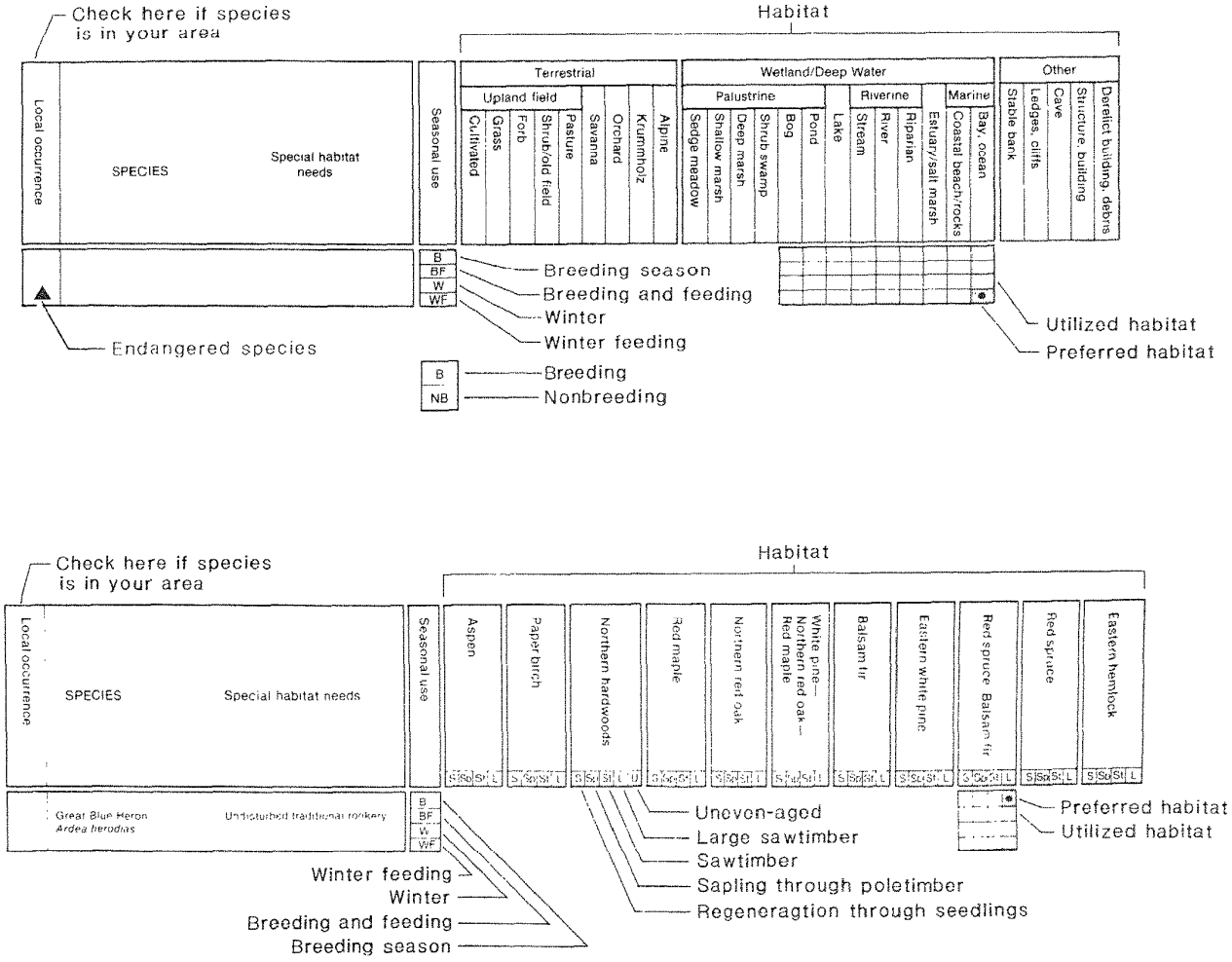
## Species Included

Notes on life history and habitat associations of 338 inland (nonmarine) species, grouped into sections by taxonomic class, are included in this report. Species within each class are arranged in phylogenetic order. Special status designations for certain species are listed in the Appendix. Additional groups of strictly coastal, migratory, and accidental species are not covered in detail but are also listed in the Appendix.

## Species/Habitat Matrices

Species habitat matrices present summary information in a simple, condensed, tabular form (Fig. 2). These matrices are the most important parts of the report. Familiarize yourself with their arrangement and the ele-

Figure 2.—The key to elements in the species/habitat matrices.



ments that they contain. Two sets of matrices are provided, one for forest cover types, another for nonforest types — terrestrial, wetlands, and other habitats.

### Special Habitat Features

Special habitat features are listed for many species. These features are considered to be essential for that species to occur regularly or to reproduce. Many species are generally associated with a given forest type or group of types — cavity-nesting waterfowl, for example. But the special habitat feature — here it is water — must also be present. Thus, the species/habitat associations must be viewed as a complex of within-stand or special habitat requirements occurring in species' overall or general habitat. Some special habitat features can be provided through forest management — the aforementioned cavities, for example, either by delayed rotation or streamside buffer strips where timber harvest is prohibited — but the stream or pond cannot.[1] The special habitat features entered in the matrices are taken from the larger classification below.

*Aquatic*

Open water
Shallow marsh 1.5 feet (0.5 m)
Moderate depth 1.5 to 6 feet (6.5 to 1.8 m), at least 1 acre (0.4 ha)
Deep marsh > 6 feet (1.8 m)
Submerged vegetation — typically coontail (*Ceratophyllum*)
Floating vegetation — typically spatterdock (*Nuphar*) or pond lily (*Nymphaea*)
Emergent vegetation — cattail (*Typha*) or bulrush (*Scirpus*)
Shrubs at water's edge
*Dead standing trees 6 to 8 inches (1.5 to 20 cm) d.b.h.
*Dead standing trees 9 to 12 inches (23 to 30 cm) d.b.h.
*Dead standing trees 13 to 19 inches (33 to 48 cm) d.b.h.
*Dead standing trees > 20 inches (51 cm) d.b.h.
Down and decaying trees at present
Islands present
Springs
Stream banks — grass — topped, (stable)
Banks
Relatively stable water level
Intermittent stream flow
Small stream < 10 feet (3 m) wide
River
*Light shade on water — 10 to 25 percent
*Moderate shade on water — 25 to 75 percent
*Deep shade > 75 percent
Bedrock bottom
Boulder bottom
Cobble bottom
Gravel bottom
Sand bottom
Mud bottom
Organic bottom
Flow < 50 cubic feet per second (1.5 $m^3$ per second) mean annual flow
Flow between 50 to 1,000 cubic feet per second mean annual flow (1.5 to 28 $m^3$ per second)
Flow between 1,000 to 5,000 cubic feet per second mean annual flow (28 to 142 $m^3$ per second)
Flow > 5,000 cubic feet per second mean annual flow (140 $m^3$ per second)
Water temperature 32 °F to 50 °F (0 °C to 10 °C)
Water temperature 51 °F to 70 °F (11 °C to 21 °C)
Water temperature 71 °F to 80 °F (22 °C to 27 °C)
Water temperature > 81 °F (27 °C)
High $0_2$ concentrations — > 9 ppm (9 mg/L)
Moderate $0^2$ concentrations — 6 to 9 ppm (6 to 9 mg/L)
Low $O_2$ concentrations — < 6 ppm (6 mg/L)
High pH level — > 8.4
Moderately high pH level — 7.1 to 8.4
Neutral pH — 7.0
Moderately low pH — 6.9 to 5.6
Low pH — < 5.6

*Terrestrial characteristics (stand area)*

* 1 to 10 acres (0.4 to 4 ha)
* 11 to 50 acres (4.5 to 20 ha)
* 51 to 200 acres (21 to 80 ha)
*201 to 500 acres (81 to 200 ha)
*501 to 1,000 acres (22 to 400 ha)

*Locators*

*Forest interior
Aquatic — terrestrial ecotone
*Opening — shrub land ecotone
*Opening — wood and ecotone
*Shrubland — forest ecotone
*In opening interior

*Canopy features*

*None
Scattered < 1 percent to 4 percent closure
*Open 5 percent to 30 percent closure
*Moderately closed 30 percent to 60 percent
*Closed > 60 percent closure

*Dead trees*

* < 6 inches (15 cm)
*6 to 8 inches (15 to 20 cm)
*9 to 12 inches (23 to 30 cm)
*13 to 19 inches (33 to 48 cm)
* > 20 inches (51 cm)

[1]Special habitat features that can be provided through forest management are marked with an asterisk (*).

*Structure*

*Canopy only
*Canopy with one intermediate layer
*Canopy with two intermediate layers

*Other features (man made)*

Abandoned buildings
Dumps
Railroad grades
Power lines
Manure piles
*Sawdust piles
Mine spoils

*Ground cover type*

Exposed soil
Moss
Litter
Rocks
*Fallen logs
*Slash piles
Herbaceous vegetation
Vines
Brambles
Fence rows
*Ericaceous shrubs
*Coniferous shrubs
*Deciduous shrubs
*Mixed shrubs

*Ground cover density*

*Very light, 10 percent or less
*Light, 11 percent to 30 percent
*Medium, 31 percent to 50 percent
*Moderately high, 51 percent to 70 percent
*High, 71 percent

*Opening type*

Lawn, golf course, and so on
Cultivated
Fallow field
Pasture
*Log landing
*Abandoned road
Gravel pit
Fire
*Blowdown
Wet meadow

*Soil texture*

Bedrock — outcrops
Boulders
Cobbles
Gravel
Sand
Loam
Silt
Clay

*Soil permeability*

Rapid
Moderate
Slow

*Soil pH*

Strongly acid, < 4.5 to 5.0
Medium acid, 5.1 to 6.5
Neutral, 6.6 to 7.3
Medium alkaline, 7.4 to 8.4
Strongly alkaline, 8.5 +

**Forest Cover Types**

The forest cover types used to describe forest habitats are based on those in *Forest Cover Types of the United States and Canada* (Eyre 1980). Similar types are grouped, especially when they reflect similarities in wildlife species distribution and habitat selection. We have included descriptions of the types as they pertain to New England. The translation of these types into two other major vegetation classifications is shown in Figure 3. Forest development is indicated by size class as follows:

S — *Regeneration through seedlings*: Live trees and associated vegetation less than 1.0 inch (2.5 cm) d.b.h. and at least 1 foot (30 cm) in height.

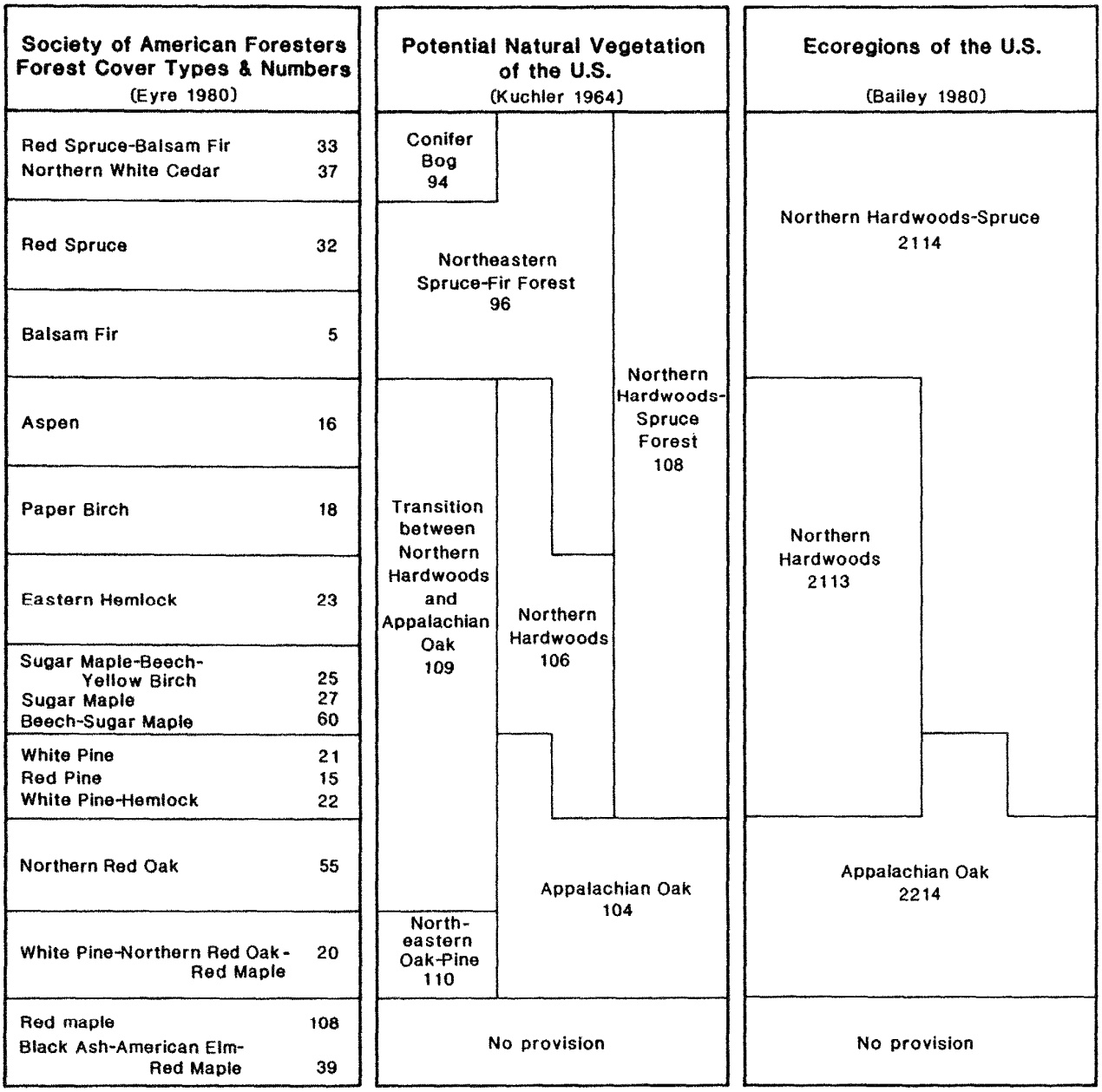
Sp — *Sapling through poletimber*: Saplings are live trees 1.0 to 3.9 inches (2.5 to 9.9 cm) d.b.h.; poles are live trees 4.0 to 8.9 inches (10.0 to 22.0 cm) d.b.h. for softwoods and 4.0 to 11.9 inches (10.0 to 30.0 cm) d.b.h. for hardwoods. The matrix assumes that stands are fully stocked, that is, contain approximately 75 square feet of basal area per acre.

St — *Sawtimber*: A stand with at least half of the stocking in sawtimber-size trees — at least 9.0 inches (23 cm) d.b.h. for softwoods or 12.0 inches (31 cm) for hardwoods.

L — *Large sawtimber*: A stand with at least half of the stocking in large-sawtimber trees — at least 20 inches (51.0 cm) d.b.h. for softwoods and 24 inches (61.0 cm) d.b.h. for hardwoods.

U — *Uneven-aged*: Stands of northern hardwood-cover types that contain trees of all size classes.

Figure 3.—Translation of the Society of American Forester's cover types into two other major vegetation classifications used in New England.




These apply to all forest cover types *under even-age management,* with one exception. Only in the northern hardwoods cover-type group do we list wildlife habitat associations for uneven-aged stands.

Common and scientific names of trees follow Little's (1979) *Checklist of United States Trees.* Names of understory plants follow *Gray's Manual of Botany* (Fernald 1950).

The forest cover types and groups are:

• *Aspen*: This type includes quaking aspen (*Populus tremuloides*) and bigtooth aspen (*Populus grandidentata*) but in New England, quaking aspen is more likely to occur in pure stands. Common associates are paper birch (*Betula papyrifera*) and pin cherry (*Prunus pensylvanica*), which when occurring in admixture, die out

early. These species occur on a variety of sites and soil types. The aspen type occurs on most soil types except very dry sands or very wet swamps. Aspen is unique in that almost all stands originate as suckers arising from existing root systems. It will sometimes reproduce from seed on burns, clearcuts, and other scarified sites.

Aspen is a relatively short-lived pioneer type — it does not reproduce under its own shade. On dry sites it is replaced by red pine, red maple, or oaks, on mesic sites by white pine, and on fertile sites by northern hardwoods, and on fertile wet sites by balsam fir (Brinkman and Roe 1980).

• *Paper birch*: Paper birch is pure or dominant. Associated species include quaking and bigtooth aspen, balsam fir, red spruce (*Picea rubra*), white pine (*Pinus strobus*), yellow birch (*Betula alleghaniensis*) and, in southern New England, hemlock (*Tsuga canadensis*). The type pioneers on burned areas and clearcuts, and grows best on deep, fertile, well-drained sites. Raspberries and blackberries (*Rubus* spp.) make up a high proportion of the ground cover at the time of establishment of paper birch stands. These are shaded out in about 10 years, but pin cherry can persist for 30 or more years. Paper birch is succeeded by spruce-fir in northern parts of its range, and to the south by northern hardwoods and hemlock on fertile, well-drained sites (Safford 1980).

• *Northern hardwoods* (including sugar maple, sugar maple/beech/yellow birch, and beech/sugar maple): True northern hardwoods are dominated by sugar maple (*Acer saccharum*), beech (*Fagus grandifolia*), and yellow birch and occur widely as a pure type in northern New England. It grades into a mixed hardwood or transition type in southern New England; associated species throughout the region include basswood (*Tilia americana*), red maple (*Acer rubrum*), hemlock, white ash (*Fraxinus americana*), white pine, balsam fir, black cherry (*Prunus serotina*), paper birch, sweet birch (*Betula lenta*), and red spruce. Northern hardwood is the basic hardwood type in northern New England, and occurs to an elevation of 2,500 feet (760 m). It prefers fertile loamy soils and good moisture conditions. Striped maple (*Acer pensylvanicum*), witch-hazel (*Hamamelis virginiana*), and hobblebush (*Viburnum alnifolium*) are common in the understory throughout the region. Best development of the type occurs on moist, fertile, well-drained loamy soils. On drier sites, beech becomes more prominent. On wet sites, the type blends into a red/yellow birch/hemlock or a red spruce mixture. The type tends to be climax. From New England to Pennsylvania, the beech-nectria complex has gradually reduced the proportion of beech in many stands (Berglund 1980).

• *Red Maple*: Red maple (*Acer rubrum*) is pure or dominant. In New England, red maple and associated species are common on wet sites; the type is essentially pure in southern New England. Associates are yellow birch, balsam fir, and sugar maple in northern New England; black gum (*Nyssa sylvatica*), sycamore (*Platanus occidentalis*), and silver maple (*Acer saccharinum*) in southern New England. In New England and the Upper Peninsula of Michigan, it occupies moist to wet muck or peat soils in swamps, depressions of slow drainages or along sluggish streams, and so is often found as an inclusion in northern hardwoods on wetter sites (Powell and Erdmann 1980). It can be differentiated readily from northern hardwoods by the absence of beech and the increased proportion of yellow birch and red spruce.

• *Northern red oak*: Northern red oak (*Quercus rubra*) accounts for a majority of the stocking. Associates vary according to site and locale, and include black oak (*Quercus velutina*), scarlet oak (*Quercus coccinea*), and chestnut oak (*Q. prinus*), hickories (*Carya spp.*), and red maple. In New England, the type has a spotty distribution, occupying ridge crests and upper north slopes. On better sites, associates are black cherry, sugar maple, white ash (*Fraxinus americana*), and American beech. The type is rare in northern New England and reaches best development in New England in western Massachusetts and northern Connecticut on loam and silt-loam soils. The type is sub-climax — shade tolerant species such as beech and sugar maple increase in proportion over time (Trimble 1980).

• *White Pine/Northern Red Oak/Red Maple:* northern red oak, Eastern white pine (*Pinus strobus*), and red maple predominate; white ash is the most common associate, but others include paper birch, yellow birch (*B. alleghaniensis* ), and sweet birch (*B. lenta*), sugar maple, beech, hemlock, and black cherry. Occurs across southern and central New England to an elevation of 1,500 feet (450 m), generally on deep, well-drained fertile soils.

This type is common in the transition between northern hardwoods and spruce-fir types in northern New England, and between northern hardwoods and oak types — characteristic of central types — in southern New England. The type often follows "old field" white pine in New England, where hardwood seedlings and saplings form the understory (Baldwin and Ward 1980). Common understory shrubs include witch-hazel, alternate-leaf dogwood (*Cornus alternifolia*), mapleleaf viburnum (*Viburnum acerifolium*), mountain-laurel (*Kalmia latifolia*).

• *Balsam fir*: Balsam fir (*Abies balsamea*) is characteristically pure or predominant. There are many associates mostly on moist or wet-site soils in northern New England; these include paper birch, quaking and bigtooth aspen, red spruce, and in swamps northern white-cedar (*Thuja occidentalis*). In southern New England, hemlock and red maple are common associates. The type is common in northern New England, occurring on upland sites, on low-lying moist flats and in swamps. Pure stands result (usually) from heavy cutting, blowdown, or following infestation of spruce budworm. This type is common in northern New England, and may be climax in the zone

below timberline. Only black spruce (*Picea mariana*) grows above it (Westveld 1953).

The type occurs extensively in Quebec, where five distinct subtypes are recognized. In the United States, the type is not as complex; however, balsam fir is an important component in the following types in northern New England: red spruce/balsam fir, black spruce, aspen, and paper birch. Common understory species include speckled alder (*Alnus rugosa*), mountain maple (*Acer spicatum*), and pin cherry (*Prunus pensylvanica*) among large shrubs and small trees. Low understory plants include Canada yew (*Taxus canadensis*), red raspberry (*Rubus idaeus var. strigosus*), blueberries (*Vaccinium spp.*), and hobblebush (Frank et al. 1980).

• *Eastern White Pine*: Eastern white pine is pure or usually predominant. We include red pine (*Pinus resinosa*) which has a spotty distribution throughout New England on sandy, gravelly or sandy loam soils, and white pine/hemlock, a common subtype in central and southern New England, where it occupies a range of soil types in cool locations such as ravines and north slopes (in the southern parts of its range). These other pine types are included primarily because they support similar wildlife communities.

Eastern white pine frequently occurs in pure stands; common New England associates on light soils are pitch pine (*P. rigida*), gray birch (*Betula populifolia*), quaking and bigtooth aspen, red maple, and white oak (*Quercus alba*). On heavier soils, paper birch, sweet birch, yellow birch, white ash, black cherry, northern red oak, sugar maple, hemlock, red spruce, and northern white cedar are associated in New England, but none are characteristic. The type is widespread in central New England from sea level to an elevation of 2,500 feet (760 m). This type occurs over a wide range of conditions and sites; establishment is often easier on poor sites because hardwood competition is less. Once established on better sites, white pine will usually grow faster than hardwoods.

White pine commonly pioneers on abandoned agricultural land in New England. The type seldom succeeds itself, but on dry sandy soils it may persist a long time and even approach permanence. On heavier soils, white pine is usually succeeded by northern hardwoods, white pine/hemlock, or white oak.

Eastern white pine is a major component of two other New England forest cover types — white pine/northern red oak/red maple, and white pine/hemlock — and occurs in various proportions in other types throughout the region.

In pure or almost pure white pine stands, the understory is composed primarily of ericaceous shrubs such as blueberries, huckleberries (*Gaylussacia* spp.), azaleas (*Azalea* spp.), and mountain-laurel. In New England, common ladyslipper (*Cypripedium* spp.) is common on light soils and highbush blueberry (*V. corymbosum*) on wetter sites (Wendel 1980).

• *Red Spruce/Balsam Fir*: The type may consist of red spruce and balsam fir or together they may predominate in a mixture of associates — the composition varies by site and disturbance history. We include here the northern white-cedar type and associates, which are commonly associated in northern New England. This is a northern New England type, occupying moderately to poorly drained flats, but not swamps. Associates are red maple, paper and yellow birch, and aspens, primarily, but also white pine, hemlock, and occasionally black spruce and tamarack (*Larix laricina*).

The type occurs near sea level in eastern Maine, from an elevation of 2,400 to 4,500 feet (730 to 1,370 m) in the White Mountains of New Hampshire, from an elevation of 2,500 to 3,800 feet (760 to 1,160 m) in the Green Mountains of Vermont, and occurs on the tops of some of the higher Berkshire Hills in western Massachusetts.

The type occurs on two kinds of sites in New England: (1) poorly drained flats and ridges or benches at lakeshores, streams, and swamps and bogs, and (2) well-drained to dry, shallow soils on steep, rocky, upper mountain slopes.

Stands are usually very dense; the ground may be essentially devoid of plants except for mosses and few seedlings of red spruce and balsam fir. Regenerated stands, however, produce a thick growth of blueberry (*V. angustifolium*), creeping snowberry (*Symphoricarpos mollis*), mountain-holly (*Nemopanthus mucronata*), raspberry (*Rubus* spp.), and downy serviceberry (*Amelanchier arborea*), among others (Griffin 1980).

• *Red spruce*: Red spruce is pure or accounts for a majority of the stocking; common associates in northern New England are balsam fir, paper and yellow birch, others include sugar maple, red maple, mountain-ash (*Sorbus americana*), eastern white pine and eastern hemlock. Red spruce occurs near sea level in eastern Maine and from an elevation of 1,500 to 4,500 feet (450 to 1,370 m) inland throughout northern New England on moderately well-drained to poorly drained flats (but not true swamps), and on well-drained slopes, including thinly soiled upper slopes. Red spruce pioneers on abandoned fields and pastures in northern New England, and on these fairly well-drained sites it is usually replaced by shade tolerant hardwoods, especially sugar maple and beech. Red spruce is long-lived; barring major disturbance is very stable, and older stands develop an uneven-aged character even though of even-aged origin. The understory is frequently sparse, or even absent; the ground beneath stands of red spruce is covered with tree litter and patches of short-lived red spruce seedlings.

Old-field red spruce contain a ground cover of bunchberry (*Cornus canadensis*) on wet sites and hobblebush on well-drained sites. Regenerated stands usually produce raspberries in abundance (Blum 1980).

• *Eastern Hemlock*: Eastern hemlock is pure or predominant over any associate, but associates are numerous; these commonly include beech, sugar maple, yellow birch, red maple, black cherry, white pine, northern red oak, white oak, sweet birch, and in northern New England, paper birch, balsam, fir, and red spruce. In southern New England the type prefers cool locations such as moist ravines and north slopes; in the northern parts of its New England distribution, warmer drier sites are tolerated. Occurs from sea level to an elevation of 3,000 feet (915 m) in New England.

Eastern hemlock is very shade-tolerant. Its long life span and ability to respond to release after almost two centuries of suppression have allowed the type to persist; early logging, and the fires that followed, greatly reduced the occurrence of this shallow-rooted climax species. Under mature stands, understory development is sparse; openings to admit light commonly produce striped maple, hobblebush, mapleleaf viburnum, among others. False lily-of-the-valley (*Maianthemum canadense*) is probably the most common herb (Wiant 1980).

### Terrestrial, Wetland, and Other Nonforest Habitat Types

The matrix of wildlife species occurrence in nonforest habitats includes entries for terrestrial, wetland, and other habitat types. Many wildlife species that occur in forest habitats either prefer or require one or more nonforest habitats, usually for breeding. For example, eastern American toads (*Bufo a. americanus*) and mole salamanders (*Ambystoma* spp.) occur throughout many woodlands, except for brief, critical breeding periods in wetlands.

The nonforest habitat types are:

• *Terrestrial:*

Upland Fields

Cultivated — tilled agricultural cropland

Grass — hayfields, etc.

Forb — broadleaved herbaceous cover, e.g., goldenrod (*Solidago*), sensitive fern (*Onoclea*), etc.

Old fields — abandoned agricultural fields reverting to forest, characterized by grasses, shrubs, small trees

Pastures — usually too wet or rocky for cultivation

Savanna — grasslands with shrubs and widely, irregularly scattered trees, resulting from either soil-moisture regimes or disturbances such as fire or grazing

Orchards — fruit trees, grassy ground cover

Krummholz zone — the transition zone from subalpine forest to alpine tundra characterized by dwarfed, deformed, wind-sheared trees

Alpine zone — elevated slopes above timberline characterized by low, shrubby, slow-growing woody plants and a ground cover of boreal lichens, sedges, and grasses.

• *Wetland/Deep Water*: In general, wetlands are lands where saturation with water largely determines the nature of soil development and the types of plant and animal communities living in the soil and on its surface. The dominant plants are hydrophytes. The single feature that most wetlands share is soil or substrate that is at least periodically saturated or covered by water.

Wetlands are transitional sites between terrestrial and aquatic systems where the water table is usually at or near the surface, or where the land is covered by shallow water.

Deepwater habitats are permanently flooded lands lying below the deepwater boundary of wetlands. Deepwater habitats include environments where surface water is permanent and often deep, so that water, rather than air, is the principal medium within which the dominant organisms live, whether or not they are attached to the substrate. As in wetlands, the dominant plants are hydrophytes; however, the water is generally too deep to support emergent vegetation.

Palustrine — non-tidal wetlands dominated by emergent mosses, lichens, persistent emergents, shrubs, or trees (Cowardin et al. 1979).

Sedge meadow — dominated by sedges (*Carex*), cattails (*Typha*) etc.; surface water depths to 6 inches (15 cm) in winter and early spring; soil surface exposed but saturated in summer

Shallow marsh — characterized by persistent emergent vegetation and water depths to 1.5 feet (0.5 m)

Deep marsh — characterized by emergent and floating-leaved plants and water depths to 6 feet (2 m)

Shrub swamp — dominated by woody vegetation less than 20 feet (6 m) tall, soil seasonally or permanently flooded to a depth of 1 foot (30 cm)

Bog — characterized by peat accumulation due to cold, acidic conditions; (usually) a floating mat of vegetation; generally sundew (*Drosera*) and pitcher plant (*Sarracenia*) are common.

Pond — permanent palustrine water body, characterized by emergent and/or floating-leaved plants, up to 20 acres (8 ha) in size

Lacustrine — deepwater habitats with all of the following characteristics: (1) situated in a topographic depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30 percent areal coverage; and (3) total area exceeds 4 ha (10 acres)

Lake — characterized by water depth of 6.5 feet (2 m)

Riverine — wetlands and deepwater habitats contained within a channel through which the water flows

Stream — intermittent or permanent up to 30 cubic feet (0.0283 $m^3$) per second, at high flow

River — at least 30 cubic feet (0.0283 $m^3$) per second at low flow

Riparian Zone — stream and river banks and associated vegetation

Estuarine — deepwater tidal habitats and adjacent tidal wetlands that are usually semienclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land.

Marine habitats

Coastal beaches and rocks

Bay, ocean

- *Other:*

Stable banks - excavated sand on gravel banks or naturally cut stream banks topped by an overhanging grassy top

Ledge,cliff

Cave

Structure, building

Derelict building, debris — abandoned building, etc.

**Species Activities/Season of Occurrence**

Habitat utilization by species is rated separately for life history activities and seasons as follows for birds and mammals:

B — Breeding season (for mammals, refers to the period when young are born and being nurtured).

BF — Breeding season, feeding

W — Winter

WF — Winter feeding

For amphibians and reptiles, habitat use is shown for breeding (B) and nonbreeding (NB) seasons only, because, with few exceptions, they are inactive during winter, and overwinter underground or in bottom sediments, etc.

Consult the species accounts for the time periods of these activities.

**Habitat Suitability**

The suitability (quality) of each community type for a given species was based on ratings by the experts acknowledged, and on our field experience. Although they are subjective, they represent the best estimates currently available. On the matrix, the light shading indicates utilized habitat, and the dark shading with bullet indicates preferred habitat.

**Species Accounts/Distribution Maps**

Life history details are summarized in accounts for each species. We assembled this information from the available literature, expert reviews, and continuing field research. Distribution maps for each species have been compiled from numerous sources. Approximate continuous range in New England is shown and may include areas where a species has not been found, but is presumed to occur where its required habitat components are present.

Life history information is arranged as follows: Range, Relative Abundance in New England, Habitat, Special Habitat Requirements, Reproductive Habits (inclusions vary with classes of vertebrates), Territory/Home Range, Sample Densities, Foraging Habits, Economic Status, Comments, and Key References.

The range description includes the animal's distribution throughout the United States and Canada.

The relative abundance indicated in each species account is an approximation of the species occurrence in New England. Included in the habitat section are details of the requirements for breeding or hibernation, where applicable. If specific habitat components are required by a species for its regular occurrence, these are listed under special habitat requirements. Reproductive, home range, sample densities, and foraging information was taken from studies conducted in New England when such references were available. Where information from states outside the region is included, the locality of the research is noted in the text. The comments section includes additional information to acquaint the user with each species.

Frequently, life history information was unavailable; further research is needed to fill these gaps. Key references are key life history references among those that we consulted; they are the most complete general references available, but not necessarily the most recent.

## USING THE PUBLICATION

The compilation of natural history and habitat information for the inland (nonmarine) wildlife of New England can aid foresters and forest wildlife biologists in assessing the potential effects of proposed habitat management practices on wildlife species. It would also aid land managers in developing and evaluating resource management planning alternatives. All inland species are presented in terms of practical habitat classification schemes for forested and nonforested habitats, so that management objectives can be set and evaluated and costs assessed.

### Application of Information

The information can be used for considering the potential responses of amphibians, reptiles, birds, and mammals to habitat alterations through forest management in New England. We stress the word *potential.* There is no substitute for sound field work and judgment in assessing the impacts of a specific project or proposed management action. From a research standpoint, the habitat associations provided here are essentially a set of hypotheses that can and should be tested further. The information in this publication is most useful for land management and project planning; the larger the unit considered, the more accurately the species occurrence can be predicted. Large areas will likely contain more of the special habitat requirements, more edges due to the interspersion of habitats, and more successional stages, hence more species. Conversely, the smaller (more site-specific) an area, the less accurate will be assumptions or predictions of species occurrence, and the greater the need for biological experience and detailed field work.

Users of this publication are urged to identify the species applicable to their area of interest or responsibility. These species can be checked in the local occurrence column on the matrix.

If questions on individual species remain unanswered, consult the references in the species accounts.

A list of species potentially affected by a given project can be prepared by looking down the columns of habitat descriptions under consideration, and, at each entry encountered, checking to see whether that species has a special habitat requirement listed. If so, and if the proposed project site does not contain that requirement, the species likely will not occur there. This two-stage elimination of species not occurring in the project area and of species whose special needs do not occur on the site, will facilitate the development of a list of species inhabiting the site. Such a process implies familiarity with the site — it should be visited, and its features — streams, marshes, snags, and so on — noted before a list of species is prepared.

Last, each species response to the proposed alternative can be identified by noting whether it will be positively or negatively affected by a project. If the nature of the resulting change in vegetation is known, examination of the size class or successional entries in a given forest type will at least reveal those species that are associated with earlier or later stages. If the direction of habitat alteration is known, a good judgment can be made on the likely effects on wildlife species.

Obviously, if threatened or endangered species are likely to be affected by a project, consultation with the Regional Endangered Species Coordinator, Fish and Wildlife Service, U.S. Department of Interior, is required.

### Accuracy of Information

This publication must be considered the beginning effort to assemble the natural history and habitat associations to enable sound management of New England wildlife. The data base needs to be expanded to other nonforested habitats, and entries need to be field checked to improve accuracy. The limitations of the information point up some cautions:

- This publication is not a substitute for professional field work, nor for thoroughly checking each site proposed for management. At the very least, managers need field information on the special habitat requirements present or lacking on each site proposed for management.

- This publication lists the species potentially occurring in a given habitat. More are listed than will likely occur — the smaller the site, the fewer the actual species that will occur of those potentially able to occur. Factors other than habitat features affect a given species occurrence on a given area. This effect diminishes with increasing area of consideration. Still, several site visits will be required to determine whether a given species actually occurs on a given site.

- No information is included on habitat size. The best clue to help determine whether a given species will occur, after checking whether its special habitat requirements are present, is to compare its territory or home-range size with that of the proposed project. No detailed information, therefore, is provided here on how many of a given species will occur on a given area. Merely dividing the project area by the territory/home range area of a species is not recommended, because not all parts of a habitat patch will be occupied, and density will be overestimated. For an elaboration on these cautionary notes, see Verner and Boss (1980). We have provided sample densities when such information was reported. Note localities when consulting these entries.

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