Predicted Responses of Wildlife to Silvicultural Treatments

with special focus on

Pine-Oak-Hemlock Types

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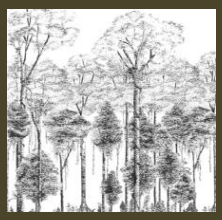
What am I talking about?

OUTLINE

- Overview of the primary factors that determine how wildlife respond to timber harvesting
- Overview of how birds, mammals, reptiles & amphibians select their habitat
- Summary of expected wildlife response following application of silvicultural treatments in pine-oak-hemlock

MY GOAL: Help you become better at predicting how wildlife will respond to the decisions you make when managing forested habitats

When we cut trees,
the response by wildlife is determined primarily by:



- Plant structure following the harvest

- Plant species composition

- The size of the canopy opening

- Whether soils are dry/moist/wet

- Presence/absence of special habitat features

- Habitats in the surrounding landscape

"Plant structure" = presence & density of plants in each forest layer

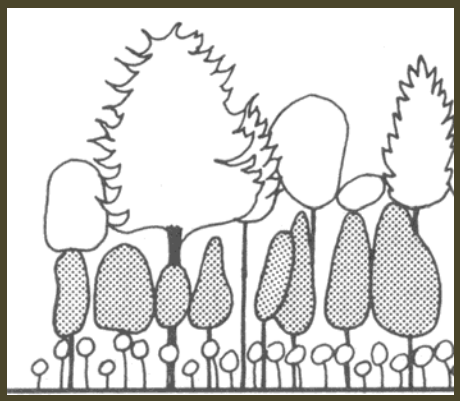
- What plant layers are present?

Canopy layer >30'

Midstory layer 10-30'

Shrub layer 2-10'

Herbaceous layer 0-2'



- How <u>dense</u> are the plants in each layer?

SPARSE	INTERMEDIATE	ABUNDANT/DENSE
< 30% coverage	30-75% coverage	> 75% coverage

Role of plant structure in influencing wildlife use of forest stands

Forest stands comprised of multiple layers

tend to support greater wildlife diversity

than forest stands comprised of few layers

- Dense midstory can inhibit some wildlife
- Dense understory good for some/hard for others
- Stands with limited or no overstory critical

But we don't want all layers present in all forest stands

Role of plant species in influencing wildlife use of forest stands

Plant species composition affects type and seasonal availability of food resources

Fruiting shrubs

Fruiting trees

Nut trees

Nut shrubs

Nectar plants

- Retain unique mast-producers when thinning
- Retain mast producers along edges of groups
- Release understory shrubs to increase mast production when thinning and locating group openings

Plant species influences insect abundant

Role of plant species in influencing wildlife use of forest stands

As a general rule…

Native plants support a greater diversity and abundance of caterpillars than non-native plants

(due primarily to unique chemicals produced by non-native plants)

Habitats composed by a diversity of native plants tend to support diverse insect populations

Table 1. Twenty most valuable plant genera ranked (from most to least) in terms of their ability to support Lepidoptera species in the mid-Atlantic (U.S.A.) region.

Rank	*Plant genus*	*Common name*	*Lepidoptera richness*
1	*Quercus*	oak	534
2	*Prunus*	cherry; plum	456
3	*Salix*	willow	455
4	*Betula*	birch	411
5	*Populus*	poplar; cottonwood	367
6	*Malus*	crabapple	308
7	*Vaccinium*	blueberry; cranberry	294
8	*Acer*	maple	297
9	*Alnus*	alder	255
10	*Carya*	hickory	235
11	*Ulmus*	elm	215
12	*Pinus*	pine	201
13	*Crataegus*	hawthorn	168
14	*Rubus*	blackberry; raspberry	163
15	*Picea*	spruce	150
16	*Fraxinus*	ash	149
17	*Tilia*	basswood	149
18	*Pyrus*	pear	138
19	*Rosa*	rose	135
20	*Corylus*	filbert	131

(Tallamy and Shropshire 2009)

Role of plant species in influencing wildlife use of forest stands

Plant species affects the quality of nesting cover

- Plants with thorns can provide better nesting sites during years when small mammal populations are high
- Shrubs that grow very dense and visually conceal nests from predators are the best

Plant species affects the quality of seasonal cover

- Hemlock superior to pine in providing thermal protection in winter

Role of plant species in influencing wildlife use of forest stands

A diverse plant community supports a diverse wildlife community

Forest stands with layers comprised of many plant species can support more wildlife than those with layers comprised of few plant species

i.e., we don't want all layers to be beech

Properties & landscapes comprised of diverse plant communities attract and support the greatest variety of wildlife over the most months of the year

Always consider how your parcel "fits" into the surrounding landscape

Opening size affects wildlife response primarily by influencing:

- Plant structure
- Plant species composition
- Minimum area requirements

Single-tree

- Maintains greatest overstory
- Multi-layered over time, but plant richness low
- Primarily supports "mature forest wildlife"
- Least likely to attract wildlife not already on the property

Groups ¼ to < 2 ac

- Effective way to quickly diversify plant structure in mature forest
- Plant diversity increases with opening size
- Can "pull in" a limited number of "young-forest wildlife"
- Primarily enhances cover & foraging opportunities for wildlife already on property

Clearcuts > 3 ac & Low Density Shelterwood

- Reduced/removed overstory creates greatest change in structure
- Potential significant change in shrubs & herb composition
- Greatest shift in wildlife species following harvesting
- Required to support diverse "young forest" wildlife

Soils affect wildlife response primarily by affecting:

- Plant species composition
- Ground foraging & nesting conditions

Moist/enriched sites more diverse herb & shrub response to cutting

Woodcock, small mammals on wet margins

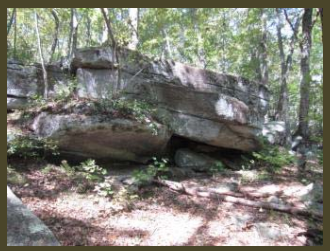
Towhees, brown thrashers in dry sites

Turtle nesting sites where soils exposed

Importance of special habitat features

Large (>18") cavity trees

Hard mast stands



Rocky den sites

Vernal pools

Surrounding landscape influences what wildlife are in your "neighborhood" and most likely to respond to your management

Example: If your goal is to attract and support "young forest" wildlife…

Openings in a landscape of mature forest may need to be ≥ 5 acres to even attract young forest wildlife to area

Openings < 3 acres here may attract young forest wildlife already in neighborhood

Occurrence of reptiles & amphibians determined by location of required wetland habitats

Annual & seasonal deer density influences: regeneration, risk of non-native plant invasion, habitat quality for other wildlife

How different groups of wildlife select their habitat (A ridiculously abbreviated primer)

Birds

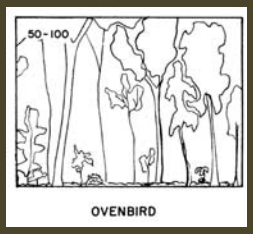
Mammals

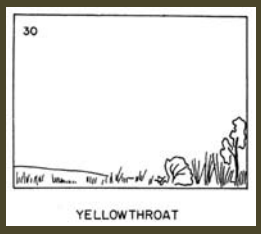
Reptiles

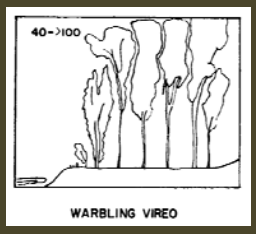
Amphibians

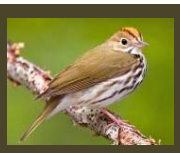
Birds are first and foremost – "slaves of structure"

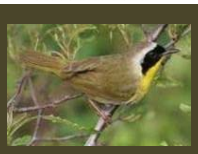
The species of birds using a stand is determined largely by the plant structure of the stand prior to/following the harvest











Birds perhaps more sensitive to plant structure than other wildlife groups (wings allow different species to exploit niches within all forest layers)

If you can accurately recognize and describe stand structure, you can usually predict most of the birds that will be present/absent

(James 1971)

Helps to consider two primary groups of birds…

Birds that NEST in Young Forest/Shrublands

"young-forest birds" or "shrubland-dependent birds"

Birds that NEST in Mature Forest

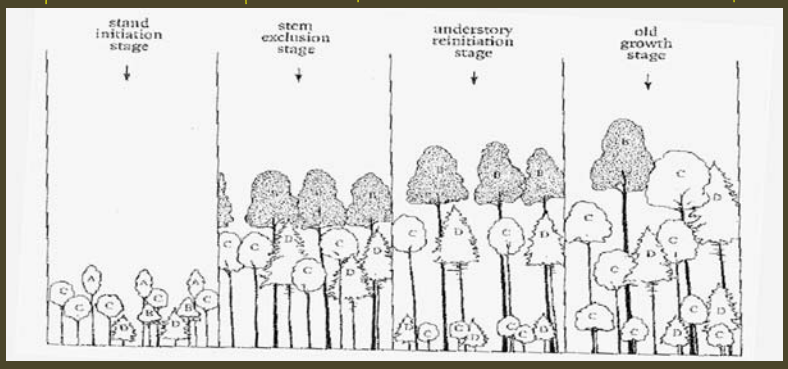
"mature-forest birds" or "forest interior birds"

Birds in each group looking for the vegetation structure specific to each forest age class for nesting

Birds from both groups will forage in young forest during & after the nesting season

Successional stages typical of "young forest" and "forest interior" birds during the nesting season

"young-forest birds" "mature-forest birds"

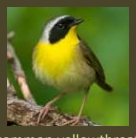


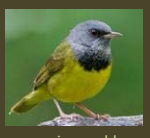
- Open/limited canopy
- Absent/sparse mid-story
- Dense shrub layer
- Herbaceous plants
- Exposed soil

- Closed canopy/small gaps
- Tall overstory trees
- Sparse to dense mid-story
- Sparse to dense shrub layer
- Cavity trees & snags

36 species of YOUNG-FOREST BIRDS regularly breed in New Hampshire

American woodcock
Alder flycatcher
Willow flycatcher
House wren
Gray catbird
Brown thrasher
Blue-winged warbler
Tennessee warbler
Nashville warbler
Yellow warbler
Chestnut-sided warbler
Prairie warbler
Palm warbler
Mourning warbler
Common yellowthroat
Eastern towhee
Field sparrow
Song sparrow
Lincoln's sparrow
White-throated sparrow
Northern cardinal
Indigo bunting
American goldfinch
Wilson's snipe
Yellow-billed cuckoo
Whip-poor-will
Ruby-throated hummingbird
Cedar waxwing
Magnolia warbler
Black-and-white warbler
Canada warbler
Dark-eyed junco
Rusty blackbird
Carolina wren
Ruffed grouse
Northern mockingbird


common yellowthroat


mourning warbler


chestnut-sided warbler


magnolia warbler


song sparrow


Canada warbler

Schlossberg and King. 2007

27 species of MATURE-FOREST BIRDS regularly breed in New Hampshire

Pileated woodpecker
Eastern wood-pewee
Great crested flycatcher
Yellow-throated vireo
Blue-headed vireo
Red-eyed vireo
Red-breasted nuthatch
Brown creeper
Golden-crowned kinglet
Ruby-crowned kinglet
Hermit thrush
Wood thrush
Northern parula
Black-throated blue warbler
Yellow-rumped warbler
Black-throated green warbler
Blackburnian warbler
Pine warbler
Ovenbird
Scarlet tanager
Louisiana waterthrush

Northern waterthrush
Sharp-shinned hawk
Cooper's hawk
Northern goshawk
Red-shouldered hawk
Broad-winged hawk


blackburnian warbler


great crested flycatcher


black-throated blue warbler


black-throated green warbler


red-eyed vireo


ovenbird


American redstart

Typical change in bird species composition with successional progression in Northern Hardwood forest

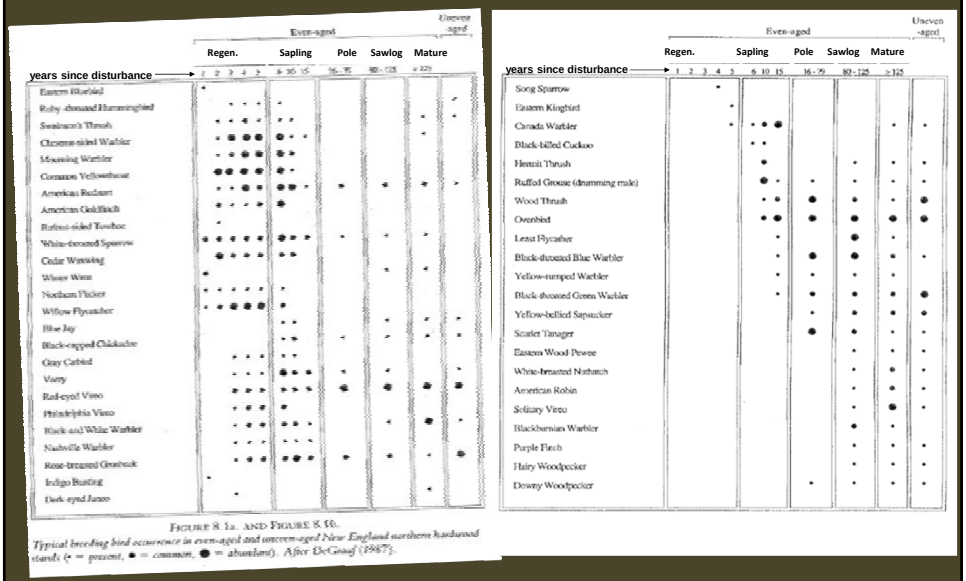


FIGURE 8.1a AND FIGURE 8.1b.
Typical breeding bird occurrence in even-aged and uneven-aged New England northern hardwood stands (+ = present, • = common, ● = abundant). After DeGraaf (1987).

(DeGraaf 1991)

Typical canopy gap/opening size of each silvicultural treatment strongly predicts what birds will use the resulting stand

Many young-forest and mature-forest birds appear "area sensitive"

= they don't NEST in forest blocks/openings smaller than a minimum acreage

Three primary reason why some birds area sensitive

1) Habitat blocks need to be large enough to provide all the microhabitats each species requires

- Nesting
- Foraging
- Breeding
- Cover

2) Area-sensitive species often avoid habitat edges when nesting

- may be result of increased predation risk at edges

Three primary reason why some birds area sensitive

3) May require social cues from conspecifics (others of their kind)

- Mate selection?
- Access to multiple mates?

female and male eastern towhee

Larger opening/forest block accommodates more territories

How "Big" is Big Enough?

How much mature forest do mature-forest birds need?

We don't have a good handle on how small a forest stand can be before habitat quality declines for mature-forest birds

Suggested minimum acreage varies among studies:

- Less than 100 acres to over 250 acres for sustainable breeding population of individual species
- >250 acres likely required to accommodate all forest-interior species that breed within an area

Largest blocks probably required in agriculture/suburban-dominated landscapes

Does not mean NO timber harvesting

Single-tree & small groups can enhance nesting and/or foraging habitat

(e.g., Anderson and Robbins 1981, Robbins 1989, Thomas 1979)

How big must openings be for young-forest birds?

chestnut-sided warblers

mourning warblers

common yellowthroats

These three species will use openings as small as 0.3 acres

However, these species are really the exceptions…

(Costello et al. 2000)

Most young-forest birds don't occur in openings less than 2 acres in size

alder flycatcher

field sparrow

eastern bluebird

eastern towhee

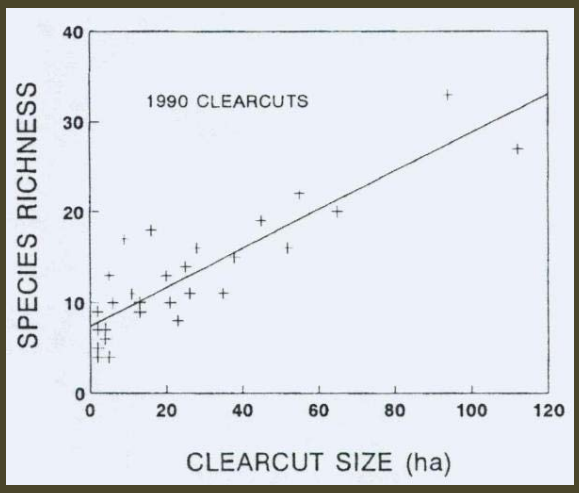
brown thrasher

prairie warbler

Presence of most young-forest species is more predictable in openings at least 5 acres in size

(Askins et al. 2007, Schlossberg and King 2007, Tarr and Shoe unpublished data)

In Maine, bird species richness increased as clearcut size increased to +120 acres



Larger openings inherently contain a greater diversity of micro-habitats than smaller openings

Larger openings support a greater diversity of young forest species

(Rudnicky and Hunter 1993)

Once in habitat of the correct structure, birds direct their feeding & nesting activities toward specific plant species

Branching pattern and leaf structure of plants influences foraging efficiency of foliage gleaning birds

- Small amounts of alien plants mixed with native plants can enhance foraging and nesting opportunities
- Habitats comprised of near-monocultures of alien plants support depauperate bird communities

Diverse plant communities support diverse bird communities

(Rotenberry 1985, Holmes and Robinson 1981, Whelan 2001, Tarr 2017)

Maintaining inclusions of softwoods in hardwood stands/hardwoods in softwood stands can enhance bird diversity

(Holmes and Robinson 1981)

Black-throated green warbler

Blackburnian warbler

Inclusions of only a few conifer trees within hardwood stands can attract: blue-headed vireo, blackburnian warbler, black-throated green warbler, hermit thrushes

A number of factors combine to determine how small mammals are distributed across the landscape:

- substrate moisture
- microclimate (esp. humidity)
- food availability
- amount and type of cover (debris and vegetation)

redback vole

white-footed mouse

masked shrew

star-nosed mole

Small mammals selecting microhabitats within larger habitat patches

- thick leaf litter
- damp pockets
- fallen logs, rotting stumps, slash, rocks, other debris
- dense shrubs, herbs
- moist, well drained soil (burrowers)

Small mammals may be present if required features are present, regardless of overstory cover type, forest age class

= Larger mammalian and avian predators concentrate feeding activities around these microhabitats

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Most forest small mammals occur in highest abundance in hardwood stands

Hardwoods stands tend to support well-developed leaf litter layers and more shrubs than softwood stands:

Maintaining hardwoods inclusions in softwood stands may be important for maintaining small mammal diversity

- Thick leaf layer maintains higher soil moisture
- Higher litter pH than conifer litter
- Stands with established shrub layers maintain higher air humidity
- Shrubs provide important fruits and seeds…

Greater moisture and food diversity in hardwood stands

(Miller and Getz 1977, Haaguar and Amundsen 1981, DeGraaf et al. 1991)

Increase Plant Species Diversity = Increase Small Mammal Diversity

Most small mammals eat plant seeds or fruits, or invertebrates associated with leaf litter

As plant diversity increases, more small mammal species can meet their food requirements

(Miller and Getz 1977)

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Mature seed-producing trees critical habitat features for tree squirrels to be present

gray squirrel
-mast-producing trees
-tall trees for nests

red squirrel
-mature conifer trees

flying squirrels
-mature woodland with cavity trees

Retention and distribution of mast-producing trees and cavity trees following harvest will strongly dictate use of the stand by squirrels

(DeGraaf and Yamasaki 2004)

Larger/wider-ranging mammals piecing multiple forest/non-forest stands together to meet daily & seasonal requirements

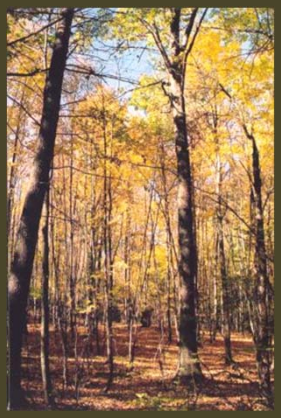
Concentrate their time in stands containing micro-habitats/ special habitat features that allow them to meet their needs

Factors Affecting Acorn Production

Many factors combine to determine how much acorns will be produced by a tree and how much of those acorns will be available to wildlife

The most important factors include:

- Masting cycles
- Weather
- Genetics
- Insects
- Tree Age
- Tree Dominance (light)



Managers can realistically control only:

- Tree Age
- Tree Dominance (light)

But, let's consider genetics…

Role of Genetics in Mast Production

The genetics of each individual tree determines:

- how often that tree produces abundant mast crops
- how large the average mast crop of that tree will be

Some individual trees have the genetic makeup to be good producers that produce good mast crops most (but not all) years

Some trees are genetically poor acorn producers and will always be poor producers, regardless of what you do to the tree

In a typical, unmanaged oak stand more than 50% of the trees may be poor acorn producers

Thinning oak stands without first identifying and retaining the best producers will reduce, as often as it increases, acorn production in the stand

(McShea and Healy 2003)

Improve acorn production by working with what you can control

1) Allow crop tree oaks to attain optimum age and diameter required for greatest mast production:

50 – 200 yrs. old 18-20" DBH

2) Provide growing room to dominant and co-dominant trees with well-rounded crowns by removing competitors on at least 3 sides

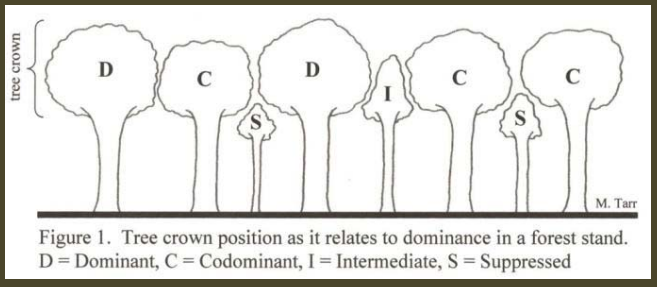


Figure 1. Tree crown position as it relates to dominance in a forest stand. D = Dominant, C = Codominant, I = Intermediate, S = Suppressed

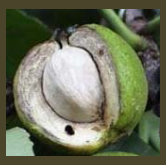
Goal:

Maintain full sunlight in upper ½ of tree crown where most seed is produced

Tree & Shrub Diversity is key for maximizing mast availability to wildlife


White oak


Red oak


Hickory


Beech


Cherry


Maples & Ash


Blueberry & Huckleberry


Dogwoods


Viburnums


Rubus

Allows you to:

- Provide mast nearly all seasons
- Buffer poor mast years among species
- Attract a variety of wildlife species

Locate single-tree openings and groups to release understory mast-producing shrubs

Minimum tree diameters for some cavity-using wildlife species

(adapted from *Good Forestry in the Granite State*)
*https://extension.unh.edu/**goodforestry/***

8”
black-capped chickadee
downy woodpecker
boreal chickadee
tufted titmouse
winter wren
eastern bluebird

12”
northern saw-whet owl
hairy woodpecker
yellow-bellied sapsucker
nuthatches
brown creeper
flying squirrels
ermine
northern long-eared bat
Indiana bat

12-18”
three-toed woodpecker
northern flicker
great crested flycatcher

>18”
wood duck
hooded merganser
common merganser
turkey vulture
barred owl
pileated woodpecker
silver-haired bat
gray squirrel
red squirrel
porcupine
marten
fisher
long-tailed weasel

>24”
little brown bat
big brown bat
gray fox
black bear
raccoon

Cavity trees >18” in diameter benefit the greatest variety of wildlife species

How many snags are enough?

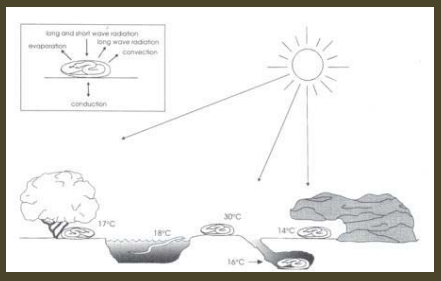
To support the greatest diversity of cavity-using wildlife species:

- 6 snags/acre
  - 1>12”
  - 1>18”
- Leave cavity trees & snags uncut whenever possible
- A few large diameter trees are as valuable as many smaller trees
- Retain variety of tree types
- Retain snags in multiple locations

(Tubbs et al. 1987)

Forest stand use by amphibians & reptiles influenced by:

- Location of required wetland habitats



- Suitable microhabitats for thermoregulation, location of prey

- Nesting sites

Major wetland types and associated reptiles & amphibians:

Beaver Ponds

- Painted turtle
- Snapping turtle
- Musk turtle
- Blanding's turtle
- Spotted turtle
- Spotted newt
- Spotted salamander
- Bull frog
- Green frog
- Pickerel frog
- Spring peeper
- Northern water snake
- Ribbon snake
- Garter snake

Vernal Pools & Forested Wetlands

- Painted turtle
- Snapping turtle
- Blanding's turtle
- Spotted turtle
- Spotted salamander
- Blue-spotted/Jefferson's salamander
- Marbled salamander
- Wood frog
- Spring peeper
- Gray tree frog
- Pickerel frog
- Ribbon snake
- Garter snake

Rivers & Streams

- Painted turtle
- Snapping turtle
- Wood turtle
- Spotted salamander
- Two-lined salamander
- Spring salamander
- Dusky salamander
- Green frog
- Northern water snake
- Ribbon snake
- Garter snake

(DeGraaf and Yamasaki 2000)

Timber harvesting considerations for amphibians & reptiles

Comprehensive recommendations provided in Good Forestry in the Granite State (https://extension.unh.edu/goodforestry/)

- Shading maintains water temperature and oxygen content
- Fallen leaves and branches provide important structure and nutrients

Consider "Micro-group" openings (3-5 trees) along wetland drainages to increase wetland shrub and herb cover to enhance foraging and dispersal

Follow BMP's to avoid rutting and altered wetland drainage patterns

Maintain as much tree cover currently shading the wetland as possible

Most amphibians can be found within 950 feet of the vernal pool

Area within +/-200 feet of the pool:

- important shelter for young amphibians emerging from pool
- buffers nutrient/sediment inputs into the pool

Between +/-200-950 feet from pool:

- critical feeding and overwintering habitat for most of pool's amphibian population – <u>especially the females</u>

If overstory removal creates hot, dry soil conditions it can cause a temporary reduction in forest amphibians until regeneration provides shade in the opening

Methods for speeding recovery of forest amphibian populations in group openings and clearcuts

When silvicultural objectives allow:

- retain existing mid-story, shrub, and herb layer cover to provide shade and minimize soil/ substrate drying within the stand

Slash retained in openings can serve as important refugia for amphibians until herbs and shrubs grow to provide shade

Other special micro habitats typical of dry oak-pine forests

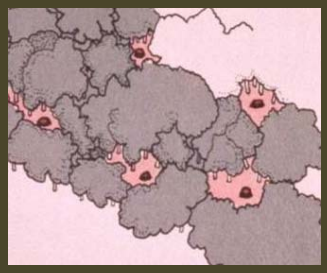
Rocky outcrops and dry ridges

- Snake hibernacula and basking (historic timber rattlesnake den sites)
- Bobcat & porcupine dens
- Whip-poor-will nesting in oak savannah –type structure
- Historic shrublands on ridge tops due to fire history?

Turtle nesting sites in dry landings

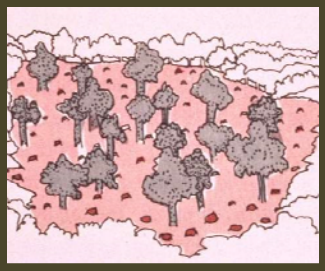
- Landings with dry sandy, gravelly soils within ½ mile of water potential nesting sites
- Consider allowing dry sites to regenerate naturally (i.e., don't seed to revegetate)
- Experimenting with sand editions to enhance turtle nesting (NRCS & NHF&G)

Summary of Expected Wildlife Response to Silvicultural Treatments

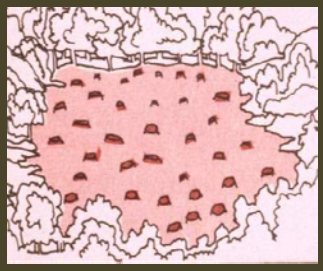


Single tree/crop tree thinning

Group selection



Shelterwood



Clearcutting

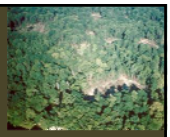
Summary of Wildlife Response to Single-Tree Selection (including crop-tree thinning & "micro-groups" of 3-5 trees)

Used to enhance foraging and cover options for wildlife already using the stand, unlikely to attract wildlife not already on the property

Valuable for:

- Improving mast production of trees
- Releasing mast producing shrubs growing in understory
- A primary method for managing hemlock deer wintering areas
  - Especially valuable for growing hemlock wen openings located over advanced HE regen
  - Increasing dense hemlock cover for hares
- Developing shrub layer to enhance nesting cover for mature forest birds that nest on the ground or in understory shrubs
- Maintains mature forest conditions favored by many mature-forest birds for nesting

Summary of Wildlife Response to Group selection (Groups ¼ acre, up to 2 acres)



Primarily enhances foraging and cover options for wildlife already using the stand, can attract a limited number of young-forest wildlife

Valuable for:

- Increasing tree, shrub, herb diversity within mature forest stands
- Increasing plant diversity to support increased insect diversity
- Nesting habitat for turkey, common yellowthroat, chestnut-sided warbler, veery, hermit thrush, red-eyed vireo, gray catbirds, northern cardinals
- Abundant insects, fruit, cover provide foraging habitat for young-forest and mature-forest birds
  - Also supports small and medium-size mammals, snakes
- Hunting areas for barred owls, broad-winged hawk, ermine, bobcat, coyote, gray fox
- Foraging openings for bats
- Browse areas for deer, moose, hare

Summary of Wildlife Response to Clearcutting (Openings ≥ 5 acres in size)

Results in largest shift in wildlife community from closed-canopy conditions, supports the greatest diversity of young-forest birds

Valuable for:

- Usually most effective method for creating large blocks of young-forest structure required by young-forest nesting birds
  - Larger openings support greater variety of microhabitats (dry/moist, sunny/shaded, hardwood/softwood, short/tall) required to support the greatest diversity of wildlife
- Ideal for creating suitable shrubland openings that minimize predation for New England cottontails on contemporary landscapes (> 10 acres)

Are there natural analogues to true silvicultural clearcuts in New England???

Summary of Wildlife Response to Shelterwood Harvests (Including "low-density thinning")

Tend to support the greatest combination of young-forest and mature forest species

Valuable for:

- Mimicking structure of pine barrens that likely served as historic "source" habitat for many young-forest birds in New England
- Developing diverse shrubland habitat when residual trees are spaced widely enough to not inhibit regeneration
  - Can support entire suite of young-forest birds if stand is > 10 acres, overstory is low density, soils are diverse
- Retained cavity trees can support eastern bluebirds, tree swallows, flickers, pileated woodpeckers, bats
- Residual overstory can support scarlet tanagers, great crested flycatchers, rose-breasted grosbeaks
- Foraging habitat for young-forest and mature-forest birds
- Residual hardwoods can provide source of mast