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Under Cover: Wildlife of Shrublands and Young Forest

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Dense shrubs and herbaceous vegetation under a canopy opening/Jon Katz

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For more information on young forest and shrublands and the wildlife that needs these habitats, see **www.youngforest.org.**

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Back Cover: Jonathan Katz.

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Introduction

Scot Williamson, WMI

The term "early successional habitat" describes the shrubs, trees, and other plants that grow back on the land after older vegetation has been removed or cut back. We can visualize this important habitat type as all the stages of plant growth from open grasslands to young forest. Historically, these habitats were created by natural disturbances, extreme physical conditions such as poor soils or harsh climates, the abandonment of agricultural land, and logging. In recent years, human development has greatly reduced the amount of land available to wildlife, and many of the disturbances that once gave rise to early successional habitat – fire, extensive areas of flooding caused by beavers, and heavy logging – have been suppressed (Trani et al. 2001). As a result, populations of wildlife that need early successional habitat have fallen drastically (Litvaitis, 1993; Thompson & Dessecker, 1997).

In addition to grasslands, important early successional habitats include shrublands and young forest.

Shrublands are dominated by sparse-to-dense shrubs intermixed with young trees, vines, and herbaceous vegetation. Shrublands may develop in abandoned fields. They may persist in areas with poor soils or following repeated disturbances such as flooding or fire, although eventually the young trees will outcompete the shrubs as the vegetation inexorably matures to become forest.

Young forest typically has a dense understory where tree seedlings and saplings, woody vines, shrubs, and herbaceous vegetation grow together. If a mature forest canopy is removed – by logging, fire, or windstorm – and an understory of tree seedlings and saplings is left intact, a young forest composed of late-successional tree species will rapidly spring up, and will persist for 10 to 20 years, until the canopies of the maturing trees knit together and block sunlight from reaching the ground.

Because their canopies intercept most of the light, older forests generally do not support a densely vegetated understory. However, mature forests typically will have scattered patches of thick understory growth where small light-admitting gaps have opened in the canopy after trees have died or fallen down. Beneath the more-open forest canopies of certain tree species, higher light levels can spur the growth of different plants, including shrubs and herbaceous vegetation that attract insect pollinators (Bouget and Duelli, 2004). Such forest stands can support high insect populations (Greenberg, 2001), offering important food to birds, mammals, reptiles, and amphibians.

Young forest and shrublands tend to have a greater variety of fruiting shrubs and herbaceous vegetation than mature forests of any species composition. Seasonally or year-round, many kinds of wildlife, including mammals and young birds that have recently left the nest, feed on these plants and the insects they attract (Askins, 2001; Anders et al. 1998; Vega Rivera et al. 1998). Studies have shown that forest habitats with a dense understory can support abundant wildlife (MacArthur & MacArthur 1961; Conner

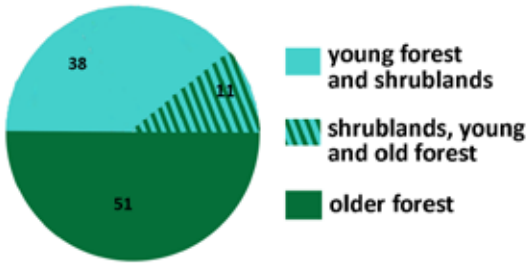
et al. 1983; Rice et al. 1984; Schulte & Niemi, 1998). In general, habitats with a higher structural diversity of cover will support a greater diversity of wildlife.

In the northeastern and northcentral United States, many kinds of wildlife that need young forest and shrublands are becoming scarce; in contrast, the ranges and populations of several mature-forest bird species have increased with the ongoing maturation of old fields, shrublands, and young forests (DeGraaf et al. 2006). States in these two regions have a wide range of percentages of young-forest cover, from 5% of forested land in Massachusetts to 37% in Minnesota (Forest Inventory Analysis, 2011). While mature-forest wildlife can tolerate various disturbances to the overstory, animals of young forest and shrublands are habitat specialists that disappear when a forest stand reaches about 20 years of age (Webb et al. 1977; DeGraaf et al. 2006).

Conservationists have identified 65 birds, mammals, and reptiles as Species of Greatest Conservation Need (SGCN) that depend on young forest or shrubland for their continued existence – habitats that have steadily dwindled over the past century. Habitat management can create young forest for these creatures while still protecting the mature forests that are home to other kinds of wildlife. At the local level, habitat managers and conservationists can identify the wildlife specialists of young forest and shrublands and determine levels for their populations appropriate on a given tract while ensuring that enough habitat remains for mature-forest species (Askins, 2001; Lorimer, 2001).

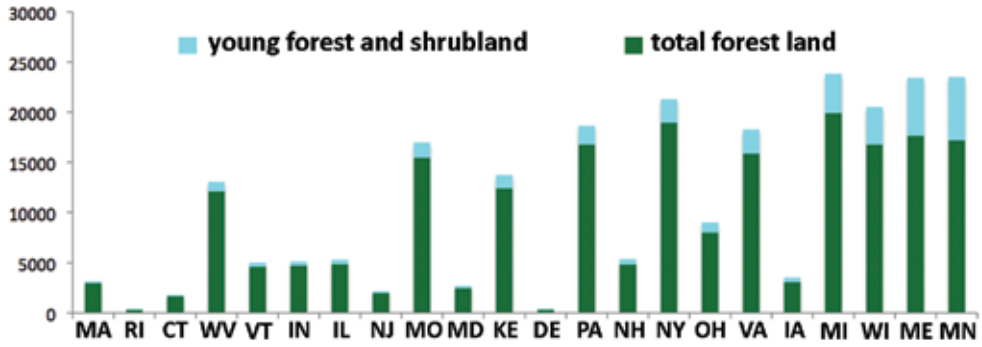
Some animals of shrublands and young forest require the dense vegetation that pushes up following large-scale disturbances, while others prefer a mosaic of different-aged forest and readily move between patches of older and younger woods. (Several birds not described in this document are considered "canopy-gap" species: they prefer small openings in mature forests where the woody understory is dense.)

Number of bird SGCN that primarily use the habitat



Literature on habitat use by bird SGCN from the eastern states was reviewed to determine the primary habitat use. Only birds that primarily used shrublands, young forest, and all older aged forest classeswere considered. While young forest and shrublands account for only 17% of the available forest habitat, they constitute a primary habitat type used by half of the forest bird SGCN in the region.

Forest Cover (thousands of acres) in the Eastern States



Acreages of young forest and shrublands and total forest cover for the eastern states were retrieved using the USDA Forest Inventory Analysis data from 2005 to 2009.

In addition, many other kinds of wildlife need young forest and shrublands during part of their life cycles, such as the newly fledged young of birds that breed in mature woods.

Early successional habitats steadily develop into forest unless the vegetation is periodically removed by disturbances, such as storms, fire, or floods, or through active forest management, including timber harvesting. Without human intervention, wildlife that depend on these habitats can dwindle to levels where local populations and even entire species become vulnerable to extinction. (One such animal is the New England cottontail, a candidate for listing as threatened or endangered by the U.S. Fish and Wildlife Service; see **www.newenglandcottontail.org**. The American woodcock, a popular upland gamebird whose population has fallen dramatically over the last 50 years, is considered a "guild species" representing a much larger suite of associated wildlife; see **www.timberdoodle.org**.)

Using many types of scientific and historical data, conservationists have sought to estimate the extent of early successional habitat on the continent before European settlement. These estimates may not capture the variability of such habitats across the landscape. For example, both small and very large disturbances can be modeled, but it is likely that moderate-sized disturbances created additional early successional habitat not included in the averages (Lorimer & White, 2001). Small disturbances to the tree canopy, such as individual or small groups of trees falling down after wind or disease, probably occurred frequently, opening up small gaps where vegetation regenerated quickly and densely (Angers et al. 2005). Catastrophic fires or storms that affected entire forest stands, although very rare, created extensive areas of early successional habitat that would have lasted longer than the smaller gaps (Lorimer, 2001). Some estimates suggest that shrubland and young forest may have covered 7% of the interior and 15% of coastal areas in pre-settlement eastern North America (Gotie & Jenks, 1982; Lorimer & White, 2003).

The current amount of shrubland and young forest is estimated to be 11% of forested areas in the Northeast and 19% in the Northcentral (Forest Inventory Analysis, 2011). In the Northeast today, 75% of shrublands and young forest are privately owned; as the number of individual landowners has grown over time, these habitats have increasingly become broken up into smaller parcels that are much more difficult to manage regionwide (Trani et al. 2001).

European settlers cleared vast areas of forested land for agriculture and for lumber and fuelwood; by the early 1900s, most of these areas had been allowed to regenerate into old fields, shrublands, and young forests (Lorimer, 2001). At the peak of regeneration, around the middle of the twentieth century, up to 60% of woodlands may have been shrublands and young forest (Brooks, 2003). Populations of many wildlife species increased in response to the abundant habitat, but by 1960 these populations had begun to fall rapidly as the habitat succeeded to become mature forest (Askins, 2001).

In the 1990s, biologists began studying many of the remaining early successional habitats and their associated declining wildlife populations (Oehler, 2003). Since then – even as shrublands and young forest have been shown to benefit a great number of wild species – conservation efforts in the East have focused mainly on preserving older forest. An equally abundant assemblage of wildlife depends on mature forest habitats, and it is clear that conserving mature forest benefits certain species of wildlife. However, as we enter the twenty-first century, disturbances caused by fires, farm abandonment, beaver activities, and clearcut logging are becoming increasingly rare. More and more, conservation professionals agree that we must use habitat management techniques, founded on scientific research and carried out with foresight and care, to keep a significant component of early successional habitat on the landscape.

How much young forest and shrubland should there be? Perhaps the best metric to gauge how much of our woodlands should be managed for this type of habitat is not the estimate of pre-settlement acreage, but rather the acreage needed to conserve rare and declining wildlife (Lorimer, 2001), including the 65 species profiled in this publication.

Table 1: The eastern states for which the shrubland and young forest wildlife are designated as Species of Greatest Conservation Need.

Species	FED	CT	DC	DE	IA	IL	IN	KY	MA	MD	ME	MI	MN	MO	NH	NJ	NY	OH	PA	RI	VA	VT	WI	WV
Alder Flycatcher		X								X									X					X
American Redstart		X		X						X	X							X						
American Woodcock		X	X	X	X	X		X	X	X	X	X	X		X	X	X		X	X	X	X	X	X
Bell's Vireo					X	X		X					X					X					X	
Bewick's Wren					X	X		X		X											X			X
Black-and-white Warbler		X		X	X		X			X	X					X		X		X	X			
Black-billed Cuckoo		X		X	X	X				X	X	X	X			X	X	X	X	X		X	X	X
Blue Grosbeak																		X						
Blue-winged Warbler		X		X	X	X		X	X	X	X	X	X			X	X	X	X	X	X	X	X	X
Brown Thrasher		X	X	X		X			X	X	X	X	X			X	X		X	X	X	X	X	
Canada Warbler		X		X	X			X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	
Chestnut-sided Warbler		X		X						X	X			X				X		X		X		
Dark-eyed Junco		X								X								X						
Eastern Kingbird		X		X							X	X				X				X	X			
Eastern Towhee		X	X	X	X				X	X	X	X			X	X				X	X	X		
Field Sparrow		X	X	X	X	X			X	X	X	X	X			X					X	X	X	
Golden-winged Warbler		X		X	X		X	X	X	X		X	X		X	X	X	X	X		X	X	X	X
Gray Catbird		X														X					X			
Hermit Thrush		X								X								X		X				
Indigo Bunting		X																		X				
Kentucky Warbler			X	X	X	X		X		X		X				X	X		X		X		X	X
Kirtland's Warbler	END						X					X						X			X		X	
Magnolia Warbler		X								X								X						
Mourning Warbler									X	X														
Nashville Warbler										X										X				X
Northern Bobwhite		X	X	X	X	X		X	X	X		X				X	X	X	X	X	X		X	X
Northern Shrike												X												
Olive-sided Flycatcher		X								X	X	X	X			X	X		X			X	X	X
Painted Bunting	SPC													X										
Prairie Warbler		X		X		X		X	X	X	X	X				X	X		X	X	X	X		
Rose-breasted Grosbeak		X						X			X		X			X		X		X	X			
Ruffed Grouse		X		X	X	X			X		X			X	X	X	X			X		X		
Rusty Blackbird					X	X		X			X		X		X	X	X				X	X	X	

continued on page 5

Table 1 - continued from page 4

Species	FED	CT	DC	DE	IA	IL	IN	KY	MA	MD	ME	MI	MN	MO	NH	NJ	NY	OH	PA	RI	VA	VT	WI	WV
Spruce Grouse											X	X	X		X		X					X	X	
Tennessee Warbler											X						X							
Veery		X		X	X					X	X		X		X	X		X				X	X	
White-eyed Vireo		X	X		X							X												
White-throated Sparrow									X		X		X			X								
Willow Flycatcher		X		X	X	X		X	X	X	X		X			X	X		X	X	X		X	
Yellow-billed Cuckoo	CAN	X			X	X					X	X				X		X		X	X		X	
Yellow-breasted Chat		X		X	X	X						X				X	X		X	X	X			
Yellow Warbler																				X	X			
Appalachian Cottontail								X		X									X		X			X
Bobcat		X			X	X	X		X	X					X	X		X		X		X		
Canada Lynx	THR										X	X	X		X		X					X	X	
Eastern Spotted Skunk					X			X		X			X	X					X		X		X	X
Elk													X	X										
Golden Mouse						X								X										X
Moose									X			X			X								X	
New England Cottontail	CAN	X							X		X				X		X			X		X		
Short-tailed Weasel		X																X						
Snowshoe Hare										X		X						X	X	X	X			
Southern Red-backed Vole		X										X						X						
Swamp Rabbit						X	X	X						X										
Woodland Jumping Mouse		X										X						X					X	
Eastern Box Turtle		X	X	X			X		X	X	X	X			X	X	X	X	X	X				
Eastern Massasuaga	CAN				X	X	X					X	X	X			X	X	X				X	
Five-lined Skink		X	X					X					X				X					X		
North American Racer*		X	X						X		X	X	X		X		X					X	X	
North American Rat Snake**		X							X			X	X				X			X		X		
Rough Green Snake			X	X			X											X	X					X
Smooth Green Snake		X			X	X		X				X	X	X	X		X	X	X			X		
Spotted Turtle		X	X	X		X		X	X	X	X	X			X	X	X	X	X	X		X		X
Timber Rattlesnake		X	X		X	X	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X	X
Wood Turtle		X	X		X				X	X	X	X	X		X	X	X		X	X	X	X	X	X

* There are 11 subspecies of North American Racer throughout the eastern states. See Figure 1 for individual ranges.

** The North American Rat Snake was recently moved from the genus *Elaphe* to *Pantherophis* and split into 4 separate species. Currently most Eastern states still use *Elaphe* in their SGCN lists.

Shrubland and Young Forest Birds

Alder Flycatcher

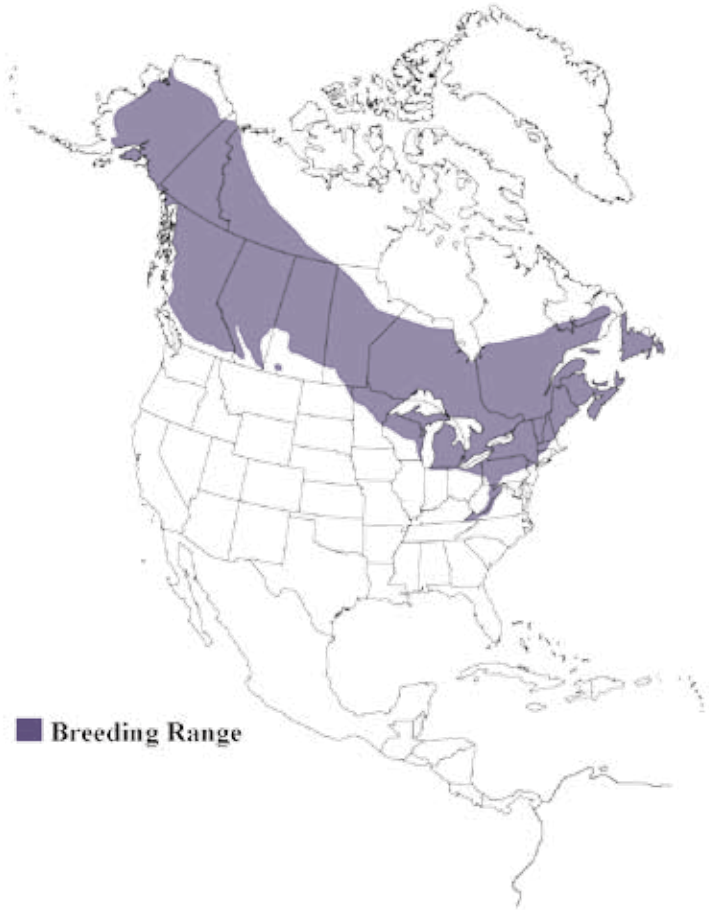
Empidonax alnorum

The Alder Flycatcher closely resembles other *Empidonax* Flycatchers, especially the Willow Flycatcher; the two were recently considered the same species. The Alder Flycatcher has brownish olive upperparts and whitish underparts. The wings are darker with two white wing-bars. Alder Flycatchers have a white eye-ring.

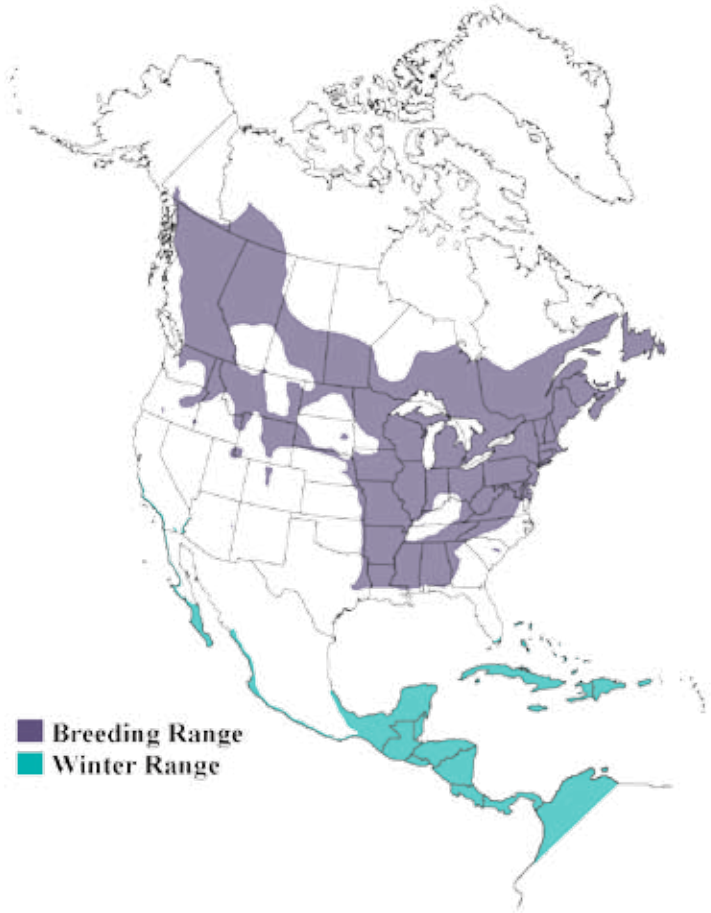
Throughout their breeding range, Alder Flycatchers are found in shrubland habitats or young forests with a high density of young trees or shrubs (Lowther, 1999; Cornell Lab of Ornithology, 2010a). They are usually in moist habitats including riparian thickets (Lowther, 1999). Alder Flycatchers will also breed in damp fields and meadows, typically with scattered to dense shrub cover (Lowther, 1999). The birds place their nests low in multi-stemmed shrubs with dense foliage cover (Cornell Lab of Ornithology, 2010a). During migration and winter, Alder Flycatchers select shrubby habitats usually near water (Lowther, 1999).

There is little information available on current Alder Flycatcher population status. Alder Flycatchers respond well to management of early successional vegetation (Lowther, 1999). Clearcuts produce larger patches of breeding habitat, which may be more appropriate for Alder Flycatchers than smaller group selection cuts (Wynia, 2007). However, they will use smaller cuts, especially those placed adjacent to current forest openings or edges (Maryland Department of Natural Resources, 2011).

Robert Royse



Robert Royse



American Redstart

Setophaga ruticilla

The American Redstart is a boldly patterned warbler that uses its brightly colored wings and tail to startle insect prey. Adult males are glossy black with bright orange patches on the wings, tail and sides. The belly and undertail are white. Adult females have a light grey head, grey to olive back, white underparts and pale yellow patches on the wings, tail and sides.

The breeding habitat preferences of American Redstarts vary throughout their range but retain a general similarity in vegetation structure. Most successful breeding habitats tend to have a dense woody understory component. In the northern and northeastern ranges, American Redstarts are abundant breeders in early successional habitats (Hunt, 1996). These habitats may be woodland edges, small gaps in forests with regenerating vegetation, and second growth woodlands (Sherry & Holmes, 1997). In the southern and western ranges, American Redstarts are found breeding in riparian vegetation characterized by young trees and thickets of shrubs and vines (Sherry & Holmes, 1997). Throughout their range, American Redstarts breed in mature forests as well, but they typically select disturbed areas dominated by early successional vegetation (Sodhi et al. 1999). American Redstarts are found in similar habitats during migration, but tend to use forested habitats during the winter (Sherry & Holmes, 1997).

Survey-wide BBS data show American Redstart populations are significantly declining (Sauer et al. 2008). Degradation and loss of riparian habitat threaten American Redstart habitats in the southern and western portions of their range. Studies in the northeast suggest that loss of forested habitat and loss of early successional habitat negatively affect American Redstart population densities (Hunt, 1996). Some studies have shown that American Redstarts are sensitive to forest fragmentation, therefore,

smaller forest cuts may be the most appropriate method for maintaining regenerating vegetation for this species (Hunt, 1996; Sherry & Holmes, 1997). However, American Redstarts have been documented using clearcuts and forest edges. The most appropriate management techniques for American Redstarts are regionally dependent.

American Woodcock

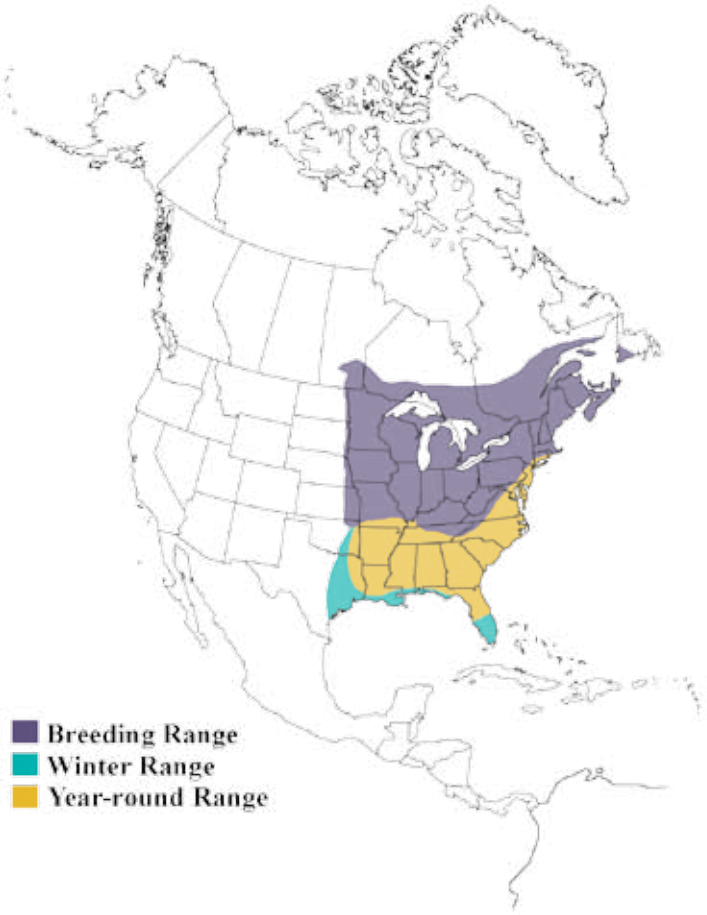
Scolopax minor

The American Woodcock is a cryptic, forest dwelling shorebird and popular game bird. The patterned cinnamon coloring keeps the American Woodcock well camouflaged, and the birds' large eyes sit wide on the head, allowing for a wide arc of vision. These are short, stocky shorebirds, with pinkish legs and a long, prehensile bill used to probe for earthworms.

American Woodcock use multiple habitat types throughout their range, depending on the season and during different activities (Woodcock management plans WMI). Their optimal habitat needs are met through a mosaic of habitat types, but the birds consistently depend on early successional habitats such as young forests and dense shrub understories (Dessecker & McAuley, 2001). It is the structure of these habitats – the density of stems – that the birds select more than the composition of the plant species. However, mixed or hardwood forests are most frequently used. Moist soils are also a necessary component of woodcock habitat, because 80% of their diet consists of earthworms (Dessecker & McAuley, 2001).

The American Woodcock has declined significantly across its range (Cooper and Parker, 2010). The major cause of population decline is most likely habitat loss and degradation (Dessecker & McAuley 2001). Suitable, early successional habitat for American Woodcock has been created in the past through natural or man-made disturbances, such as fire, insect infestations, wind, and abandoned

Tim Flanigan



agricultural fields (Keppie & Whiting, 1994). Today, forest management practices can be implemented to maintain the young forest habitats woodcock require. This may include small clearcuts, selective harvests, controlled burns and possibly grazing (Dessecker & McAuley 2001). For regional habitat management information on Woodcocks, visit timberdoodle.org.

Bell's Vireo

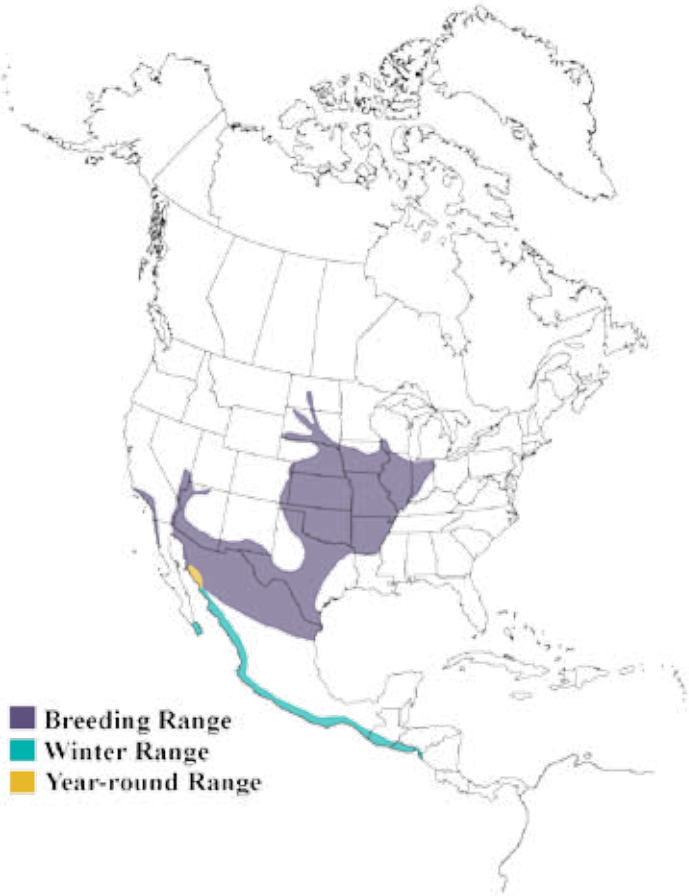
Vireo bellii

The Bell's Vireo is a small vireo with faint markings such as a broken eye-ring and light wing-bars. The back and wings are grey to grey-green and the belly is white to pale yellow.

Across its range, Bell's Vireo inhabits similar habitat during the summer and winter – dense thickets along stream corridors (Cornell Lab of Ornithology, 2010a). They typically occupy early successional vegetation in riparian brushy fields, created by disturbances that provide canopy openings in the forests (Hunter, 2001; Kus et al. 2010). The Bell's Vireo places its nest low in shrubs well concealed by thick vegetation; dense cover may help reduce parasitism by cowbirds (Sharp & Kus, 2006).

BBS data show a significant annual decline of Bell's Vireo populations, and in many states they are listed as SGCN (Table 1; Sauer et al. 2008). Habitat loss, predation and parasitism by cowbirds are believed to be major causes of their decline (Kus et al. 2010). Maturation of early successional habitats may reduce Bell's Vireo habitat if the dense undergrowth is reduced as the overstory canopy increases. Therefore, forest management practices that encourage early successional growth should benefit the Bell's Vireo (Kus et al. 2010).

Robert Royse



Bewick's Wren

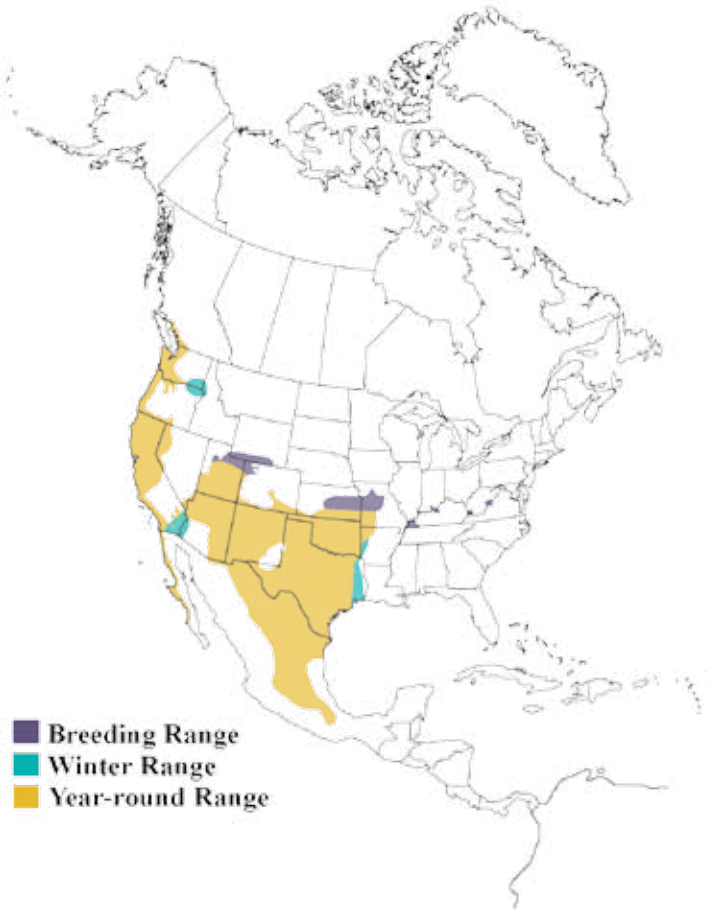
Thryomanes bewickii

The Bewick's Wren is a medium sized, active songbird. The upper body is medium-brown and the belly and throat are white. The characteristic marks of the Bewicks Wren are its bold, white eyebrow stripe and white, fringed tail.

Throughout their range, Bewick's Wrens prefer areas with scattered, dense vegetation or debris among an otherwise open canopy. Bewick's Wrens select dense understory vegetation in open woodlands or fields, typically in regenerating areas after a disturbance such as fire or timber removal (Hunter, 2001, Rosenberg & Wells, 2005). They nest in natural or artificial cavities found in trees, thickets, and brush piles (Powers, 2001). The eastern subspecies of Bewick's Wrens are commonly found in overgrown suburban environments and farms, where they will occupy shrubby fields, woodland edges, unkempt fences and piles of junk (James & Green, 2009).

Bewick's Wrens were once common in many Eastern and Midwestern states, but have declined from these areas and are now listed as SGCN in several states within their range (Table 1; Powers, 2001; Rosenberg & Wells, 2005). These wrens expanded their ranges and population densities during the mid 1800s with fragmentation of forests and creation of farms (Powers, 2001). Their decline in this portion of their range is believed related to a combination of factors, primarily habitat loss and competition with the range expanding house wren (Powers, 2001). Forest harvests, especially clearcuts that leave behind slash piles should increase Bewick's Wren breeding habitat (James & Green, 2009).

Robert Royse



Black-and-white Warbler

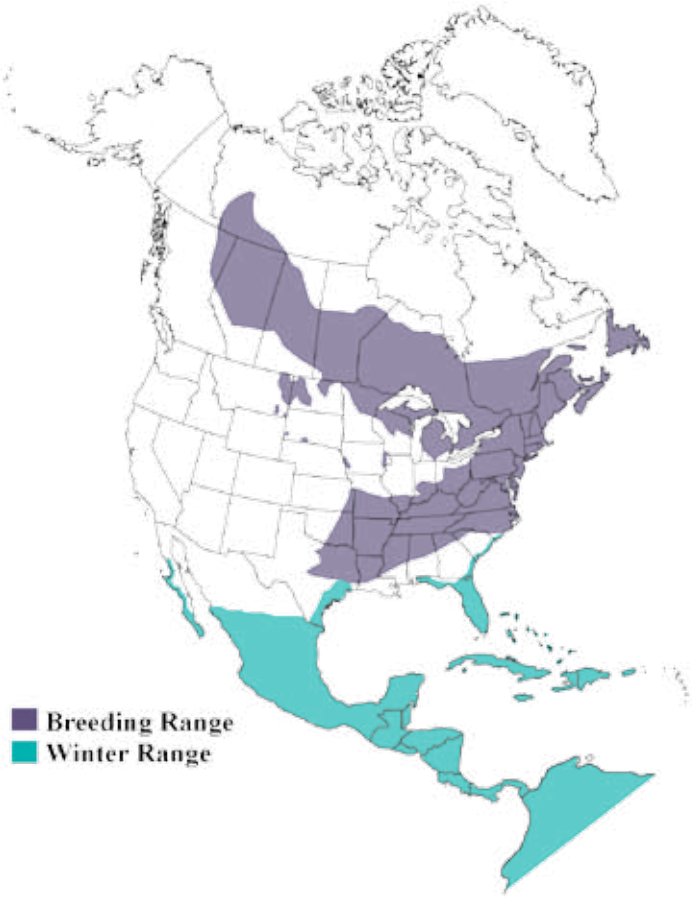
Mniotilta varia

The appropriately named Black-and-white Warbler has black and white streaks throughout the body, including a white eye-ring and a striped head. Females are similar to males but with less contrasting markings. Black-and-white Warblers have long hind toes and claws that allow them to creep along tree trunks and branches in search of insects. These small warblers are considered especially aggressive among warblers.

Black-and-white Warblers will breed in deciduous and mixed forests, in both young and old forests, as well as disturbed and undisturbed habitats (Cornell Lab of Ornithology, 2010a). Because of this broad use of habitat types, Black-and-white Warblers are often considered habitat generalists. However, many studies have shown they have specific habitat requirements such as a dense understory of shrubs or young trees during the breeding and post-fledgling seasons (Collins et al. 1982; Thompson et al. 1992; Anders et al. 1998). Black-and-white Warblers can tolerate both closed and open canopies if the understory is well developed (Schulte & Niemi, 1998; DeGraaf & Yamasaki, 2003) however they are most often found breeding in young forests, especially the sapling stage up to pole stage (Thompson et al. 1992; DeGraaf & Yamasaki, 2003).

Population trends for Black-and-white Warblers vary across their breeding range, and some states designate them as SGCN (Table 1). This species responds to many types of forest management because these warblers can utilize a variety of forest types and ages. However, in New England and the Central United States, Black-and-white Warblers respond positively to forest harvests, occupying newly regenerating and young forest habitats (Chadwick et al. 1986, Thompson et al. 1992; Annand & Thompson, 1997).

Robert Royse



Black-billed Cuckoo

Coccyzus erythropthalmus

The Black-billed Cuckoo is a tall, slender bird with a long tail. The Black-billed Cuckoo has a red eye-ring, a brown head and back, and a white underside. Underneath the tail is lighter gray, with narrow white tips. Cuckoos are furtive, forest dwelling birds skilled at navigating through dense, brushy forests in search of insects. The Black-billed Cuckoo will lay its eggs in the nest of other Black-billed Cuckoos, and less frequently is a brood parasite of other bird species (Cornell Lab of Ornithology, 2010a).

The Black-billed Cuckoo is commonly found in deciduous and mixed woodlands, forest edges, and thickets, usually near lakes, streams, wetlands and bogs (Hughes, 2001). Optimal Black-billed Cuckoo habitat is young deciduous and evergreen forests that develop a dense, vertical structure to provide cover during nesting and foraging (DeGraaf & Yamasaki, 2001).

Black-billed Cuckoos are considered early successional habitat specialists and SGCN across many states (Table 1, DeGraaf & Yamasaki, 2003). Population densities of Black-billed Cuckoos vary sharply year to year in response to fluctuation in insect outbreaks (Cornell Lab of Ornithology, 2010a). Because of their dependency on noxious caterpillars, cuckoos may be susceptible to accumulation of pesticide-residue (Hughes, 2001). Habitat fragmentation and alteration may cause cuckoo population declines, however, there is little information on forest management recommendations for this species (Hughes, 2001).

Garth McElroy

Robert Royse

Blue Grosbeak

Passerina caerulea

The Blue Grosbeak is a large bunting with striking plumage. Males are mostly purplish blue, with two brown wing-bars and black patches surrounding the eyes and bill. Females are brown overall with a bluish tinge that varies among individuals. Females also have brown wing-bars that are visible against slightly darker wings.

Blue Grosbeaks are considered early successional specialists throughout their range, inhabiting shrubby fields or edges between open fields and woodlands (Irwin & Peek, 1983; Conner & Dickson 1997). Blue Grosbeaks are commonly found in regenerating clearcuts created by forest disturbances such as windthrow, insect infestation, or timber harvesting (Hunter, 2001; Conner & Dickson, 1997). Young, regenerating habitats provide the low, dense vegetation such as young trees or shrubs that Blue Grosbeaks use for nesting and foraging areas (Cornell Lab of Ornithology, 2010a; Strelke & Dickson, 1980). Larger trees are also utilized by Blue Grosbeaks for singing perches, therefore, openings adjacent to woodlands or forests may be especially good habitat (Strelke & Dickson, 1980). Blue Grosbeaks are often associated with riparian areas, where they breed in dense thickets or vine tangles.

Blue Grosbeaks are widespread but occur at locally small population densities (Ingold, 1993). Survey data indicate an overall increase survey-wide, however populations may be decreasing in some parts of their range (Ingold, 1993). Blue Grosbeaks are not well studied, but habitat loss or degradation and cowbird parasitism are believed to be the greatest threats to this species (Ingold, 1993). Blue Grosbeaks respond positively to habitat management for early successional habitat (Ingold, 1993), for example they readily use clearcuts of many sizes (Krementz & Christie, 2000).

Blue-winged Warbler

Vermivora cyanoptera

The Blue-winged Warbler is a brightly colored, small and active warbler. Both sexes have a yellow head and underparts, a black eye-line, and blue grey wings with 2 white wing-bars. Females have a paler yellow coloration.

Blue-winged Warblers occupy early to mid-successional habitats, characterized by dense undergrowth that is shaded by overstory trees. They are considered to be habitat generalists because they will use open fields with dense herbaceous vegetation as well as open woodlands with a dense shrubby understory. They are common in regenerating fields and clearcuts, or in disturbance caused openings in mature forests but not abundant in mature forests with closed canopies (Thompson et al. 1992; Askins, 1994; Hunter, 2001; Thompson & DeGraaf, 2001).

Blue-winged Warblers show an annual decline across their range, though it is not significant (Sauer et al. 2008). As noted in the Golden-winged warbler section above, Blue-winged and Golden-winged Warblers interbreed which also may be contributing to their decline. Studies have shown Blue-wing Warbler populations respond positively to clearcuts that maintain the canopy openings and dense undergrowth this species needs (Thompson et al. 1992; Thompson & DeGraaf, 2001).

Robert Royse

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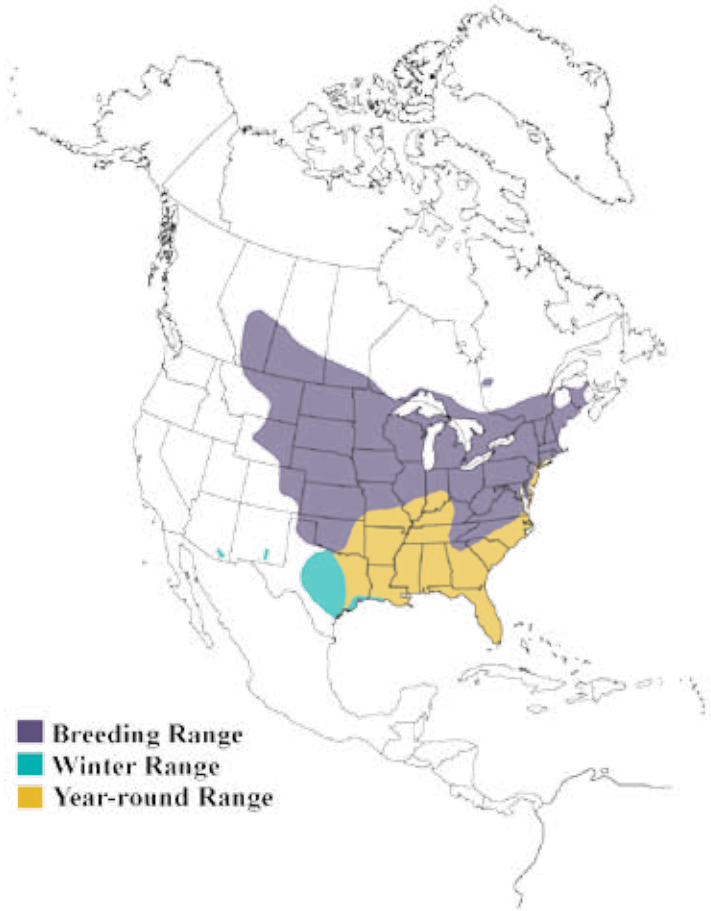


Brown Thrasher

Toxostoma rufum

The Brown Thrasher is a large bird with a long tail, bright rufous coloring above, buffy with black streaking below, yellow eyes and a dark bill that curves down. The Brown Thrasher is a mimic known for its impressive song repertoire.

Brown Thrashers use similar habitats year round throughout their range. They select fields, woodlands or forests with dense vegetation at low heights, such as thick shrubs, low trees, or heavy herbaceous vegetation (Hunter, 2001; Cornell Lab of Ornithology, 2010a). Typically, this vegetation structure is found in young woodlands, openings in forests created from disturbance, or edges of woodlands (Stauffer & Best, 1980).

The BBS surveys for Brown Thrasher indicate a significant annual decline, and many states classify this species as a SGCN (Table 1; Sauer et al. 2008). Like many early successional species, habitat loss is a major threat to current populations. Forest management techniques that encourage dense, shrubby growth have proven beneficial for this species. Brown Thrashers increase where management practices increase the density of shrubs, such as thinning of the overstory canopy (Stauffer & Best 1980). Brown Thrashers also respond to clearcuts in the forest, reaching highest densities at 3 years following the cuts (Conner & Adkisson, 1975).

Canada Warbler

Cardellina canadensis

The Canada Warbler is a rarely studied warbler with unique markings that warrant the nickname, "the necklaced warbler." The males have black markings that contrast with the brightly colored yellow throat and neck, along with a black crown, white eye-ring and slate black wings and back. Females are similar, though more olive overall with a less distinct necklace.

Throughout their range, Canada Warblers prefer openings in mixed forests where understory growth is dense, especially along streams and wetlands. Their preferred habitat is created by disturbances in large forests that encourage dense undergrowth (Hunter, 2001). While they most commonly use young, regenerating vegetation, they may be found in older forests where understory vegetation remains dense (Hagan et al. 1997; Lambert & Faccio, 2005).

Population trends for the Canada Warbler indicate the species is declining across its range (Sauer et al. 2008). Habitat loss of both breeding and wintering grounds may be contributing to their decline. Habitat fragmentation is a likely threat, because of the increase in predation in fragmented forests. Canada Warblers respond well to forest management practices, especially clearcuts that retain scattered residual trees (Thompson & DeGraaf 2001; Flaspohler et al. 2002; Lambert & Faccio, 2005).

Robert Royse

Chestnut-sided Warbler

Setophaga pensylvanica

The Chestnut-sided Warbler is a medium sized warbler common in early successional habitats. They are unique in appearance with chestnut sides, a white belly, a yellow cap and a black mustache.

Chestnut-sided Warblers specialize in early successional habitats throughout their range and during breeding, migration and winter seasons (Cornell Lab of Ornithology, 2010a). Specifically, these warblers prefer old fields with a high density of shrubs, saplings and low ground cover, or young forests of second growth hardwood (DeGraaf & Yamasaki, 2003). Chestnut-sided Warblers frequently select areas that have been disturbed from logging or burning (Hunter, 2001; DeGraaf & Rudis 1986; DeGraaf & Yamasaki 2003). Chestnut-sided Warblers use the dense understory cover for nest concealment (DeGraaf & Yamasaki, 2003).

Chestnut-sided Warblers increased in abundance between the late 1800s and early 1900s in response to regenerating vegetation following extensive clearing of forests (Litvaitis, 1993). Since the mid 1900s, these warblers have slowly but steadily declined, most likely in response to loss of habitat from maturation of forests and agricultural and urban development (Litvaitis, 1993; Sauer et al. 2008).

Chestnut-sided Warblers respond positively to forest management techniques that increase early successional habitats within mature forests, especially when structural complexity is maintained by retaining scattered live and standing dead trees as well as shrubs in the clearings (Connor & Adkisson, 1975; Niemi and Hanowski 1984).

Robert Royse

The Post-fledgling Period

Populations of several species of migratory birds have declined sharply. Conservation recommendations are often based on results from studies of breeding habitat, where birds establish territories, build nests, and care for dependent young. Recent studies have brought attention to the time period after young birds gain independence from their parents and before young and adults migrate. This post-fledgling period can last several months and is believed to have a major impact on the overall population, as young and adult birds must avoid predation and accumulate fat reserves for their upcoming migration.

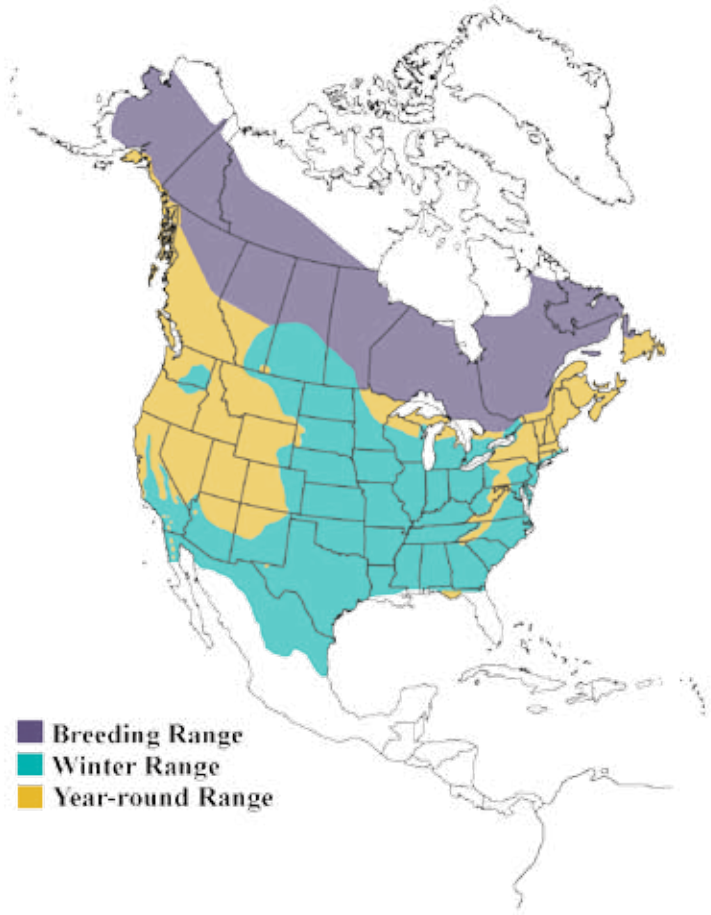
Several studies have shown that many late successional forest breeding birds significantly change habitat use during the post-fledgling period, and seek early successional and other more open habitat types. In the Appalachian mountains of Virginia and West Virginia, adults and young of half of the bird species considered late successional breeders were frequently captured in regenerating clearcuts 1 to 7 years old during the post-fledgling period (Marshall et al. 2003). In Ohio during this period, mature forest breeding bird species made up one-third of bird captures in early regenerating forests (Vitz & Rodewald, 2006). Juvenile wood thrush in Missouri dispersed from their mature forest breeding grounds most often into early and mid successional forests, mature riparian forests, and forest/field edges, even though mature forest was the most abundant habitat available (Anders et al. 1998).

Mature forest breeders may increase their survival rates by shifting into early-successional habitats because of greater cover and food resources (Anders et al. 1998; Pagen et al. 2000; Streby, 2010). During the post-fledgling period, both adults and young go through a prebasic molt which inhibits their ability to fly. Furthermore, young birds are inexperienced at avoiding predators (Anders et al. 1997). The habitats used by birds in studies of the post-fledgling period are described as vertically complex, with dense shrubs and tree saplings (Anders et al. 1998; Vega Riveira et al. 1998; Vitz & Rodewald, 2006). This structure can provide cover from predators, especially raptors, while allowing the birds to move about quickly on the ground (Vitz & Rodewald, 2006). Prior to migrating, birds must obtain enough food to store fat. Fruiting shrubs ripen earlier in more open forests, and may also attract a higher abundance of insects (Anders et al. 1998; Vitz & Rodewald, 2006). In Virginia, young birds initially dispersed into early successional habitats rich in shrubs and young trees, and then moved back into late-successional forests later in the season when fruits were ripening in these areas (Vega Riveira et al. 1998).

Habitat management for birds that breed in late successional forests typically promotes the protection of large forested areas and minimal harvesting. However, recent studies suggest that patches of regenerating habitat are important resources for both adult and young birds during the post-fledgling period (Vitz & Rodewald, 2006). It may be important to manage for early successional habitat types for mature forest breeders, especially if birds are forced to seek post-fledgling habitat in areas with more roads or lower quality resources (Vega Riveira et al. 1998). Mosaics of forest ages within large forests have the potential to benefit both late successional and early successional forest birds.

Worm-eating Warblers breed in mature habitats but use young forests during the post-fledgling period./Robert Royse

Robert Royse



Dark-eyed Junco

Junco hyemalis

The Dark-eyed Junco is a medium sized sparrow with several subspecies throughout its wide range. Though the color patterns vary by subspecies, in general Dark-eyed Juncos are dark grey overall with a pink bill, white wing-bars and white outer tail feathers.

Throughout their range, Dark-eyed Juncos use multiple forested habitats during the breeding season that share a similar vegetation structure. They prefer forest openings or edges with a dense woody understory and sufficient ground cover (Cornell Lab of Ornithology, 2010b; Boreal Songbird Initiative (BSI), 2011). Dark-eyed Juncos will inhabit an area shortly after a disturbance such as a fire or logging (Cornell Lab of Ornithology, 2010b; BSI, 2011). Low, woody vegetation is used by the juncos for nesting and cover (BSI, 2011). During the winter, Dark-eyed Juncos use a wider variety of habitats, including open fields, suburban parks and agricultural fields (Gottfried & Franks, 1975).

While the Dark-eyed Junco is still abundant over much of its wide range, populations are declining annually (Sauer et al. 2008). Maturation of forests contributes to the decline in available nesting habitat. Dark-eyed Juncos respond well to forest management practices that maintain early successional vegetation. The birds increase in abundance in areas that have been logged or burned and have regenerating, low woody vegetation (BSI, 2011).

Eastern Kingbird

Tyrannus tyrannus

The Eastern Kingbird is a large, dark flycatcher with a blue-grey back and black wings. The throat, belly and underside of tail are white. Eastern Kingbirds have white wing stripes and a white tip to the tail.

The Eastern Kingbird is considered an early successional habitat generalist, because of its use of a range of habitats including old fields, shrubby openings, and savannas with widely spaced trees and shrubs (Stauffer & Best, 1980; Murphy, 2001; Kreitinger & Paulios, 2010). Throughout their range, habitats with shrubs and young trees are important breeding grounds, because Eastern Kingbirds commonly place their nests low in woody vegetation (Kreitinger & Paulios, 2010). A mosaic of savannas, shrublands and open fields provide both breeding and foraging areas (Murphy, 2001).

Eastern Kingbirds are considered common throughout most of their range. However, BBS data indicate a significant decrease that is more pronounced in the northeast (Sauer et al. 2008). Studies of Eastern Kingbirds suggest that habitat development and maturation of early successional habitats are major threats to their populations (Kreitinger & Paulios, 2010). Management practices that thin the woody canopy and encourage shrub or herbaceous growth are recommended for increasing Eastern Kingbird habitat (Staffer & Best, 1980; Murphy, 2001).

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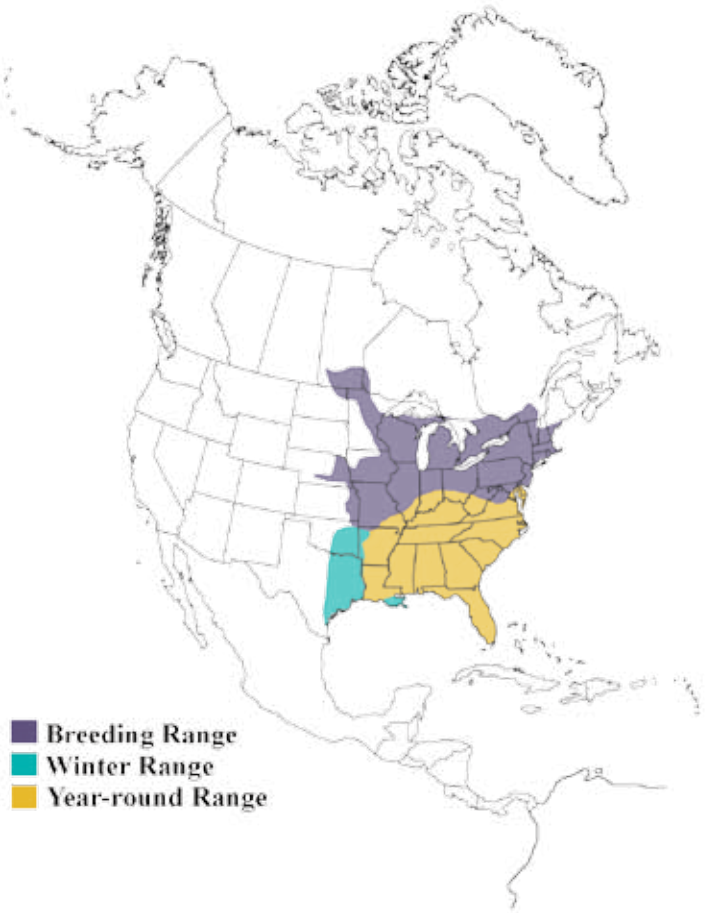

Eastern Towhee

Pipilo erythrophtalmus

The Eastern Towhee was previously known as the Rufous-sided Towhee, until the Western Spotted Towhee and the Eastern Towhee were found to be separate species. It is a large sparrow that is mostly black above, with a white belly and rufous sides. These towhees have white markings on the tail and wing margins.

Across its range and throughout the year, the Eastern Towhee can be found in dense, shrubby habitat (Hagen, 1993; Cornell Lab of Ornithology, 2010a). If well-developed, woody understory vegetation is available, Eastern Towhees will use a variety of wooded and forested areas and can be found in forest interiors and edges (Hagen, 1993). Typically, they tend to select areas with few large trees and an open canopy, because these conditions allow the shrub layer to become dense and diverse. Such openings are common after natural or human caused disturbances, and the regenerating vegetation is suitable habitat for Eastern Towhees until the trees mature and the canopy closes (Hagen, 1993; Hunter, 2001). Eastern Towhees forage under the cover of thick shrubs, and place their nests on or near the ground under the cover of shrubby vegetation. During winter and migration, the towhees will use smaller brush patches than during the breeding season.

Though the Eastern Towhee is still considered a common species throughout its range, it has been rapidly declining in the east, especially in the northeast region (Hagen, 1993). Habitat loss in both the breeding and wintering grounds are likely significant causes, especially in the northeast where many early successional habitats continue to mature into closed canopy forests. Clearcuts in forested areas should allow Eastern Towhee populations to increase (Bell & Whitmore, 1997).

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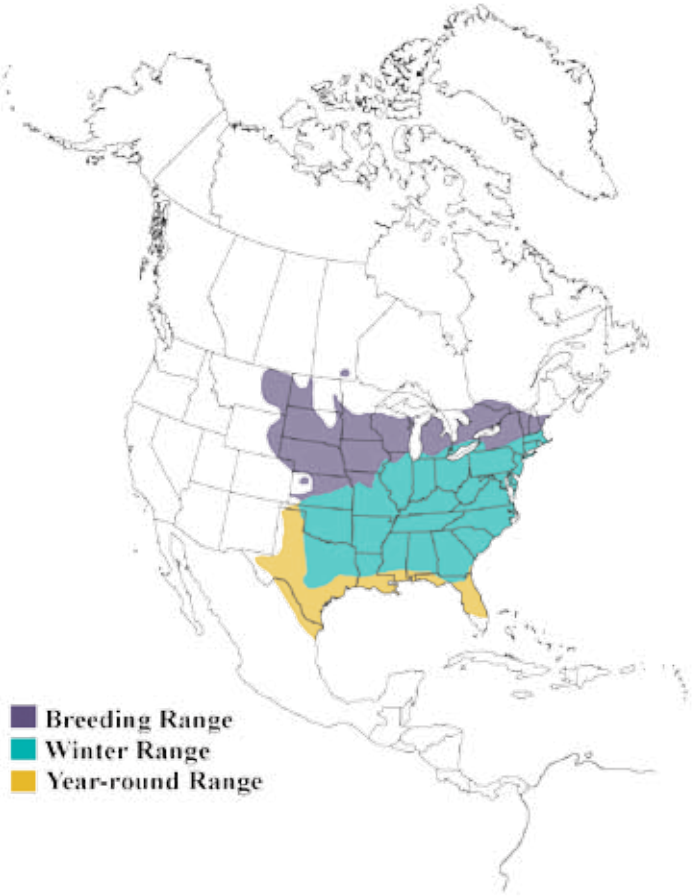

Field Sparrow

Spizella pusilla

The Field Sparrow is a small and secretive sparrow, dull brown overall with indistinct markings. Field Sparrows have a red cap, pink bill, grey face, thin white eye-ring and an unmarked chest.

Field Sparrow breeding and wintering habitats are similar throughout their range. Their preferred habitat is early successional shrub habitats (DeGraaf & Yamasaki, 2001). They commonly use grasslands, but select areas with at least some low woody vegetation (USFWS, 2001). Field Sparrows are ground nesters, and use low shrubby vegetation for nest cover and protection from predators while foraging for insects and seeds (Cornell Lab of Ornithology, 2010a). Field Sparrows commonly use forest edges, hedgerows, abandoned agricultural fields, and woodland openings (USFWS, 2001).

Throughout their range, Field Sparrow populations have significantly declined (Sauer et al. 2008). The biggest threat to Field Sparrows is loss or degradation of habitat from development and maturation of forests (DeGraaf & Yamasaki, 2001). Field Sparrows respond well to forest management practices that create early successional habitats (Shugart & James, 1973; Thompson & DeGraaf, 2001; Yahner, 2003). Studies have shown that Field Sparrows increase in abundance after clearcuts in deciduous forests, especially once shrubs and young saplings regenerate (Shugart & James, 1973; Thompson & DeGraaf, 2001).

Golden-winged Warbler

Vermivora chrysoptera

The Golden-winged Warbler is a petite warbler with striking breeding plumage. Both sexes have grey plumage along their backs with lighter grey coloring underneath. The male is brightly marked with a yellow crown and wings, a black eye-mask, and a black bib covering the chin, throat and upper chest. The female has similar markings in grey.

The Golden-winged Warbler specializes in early successional habitats during the spring and summer throughout its range (Confer & Knapp, 1981), and winters in tropical forests. Golden-winged Warblers breed in fields heavily vegetated with herbs and a low to moderate density of shrubs, typically along a forest edge or with scattered trees (Confer & Knapp, 1981; Hunter 2001; Cornell Lab of Ornithology, 2010a).

Golden-winged Warblers are sensitive to the maturation of early successional fields and young forest, especially in the northeast (Litvaitis, 1993). The species shows significant annual population declines throughout its range (Sauer et al. 2008). As the Golden-winged Warbler populations decline, the closely related Blue-winged Warbler is expanding its range and possibly displacing golden-winged warblers. These two species interbreed, which could be decreasing the amount of genetically distinct Golden-winged Warblers (Vallender et al. 2007). Additionally, the Blue-winged Warbler is more of a habitat generalist than the Golden-winged, and able to use older forests with a greater proportion of trees (Confer & Knapp, 1981). Brown-headed cowbirds pose additional threats to the species, especially because they parasitize more nests in the earliest successional habitats where the Golden-wing Warblers experience less negative effects from the Blue-winged Warblers (Confer et al. 2003).

The Golden-winged Warbler depends on disturbances to maintain the supply of young, regenerating shrublands and young forests they require (Hunter, 2001). They respond well to forest management practices that focus on creation of early successional habitat, such as burning or logging that leaves residual trees (Hunter, 2001). Clearcuts are also suitable for Golden-winged Warblers, which begin using the areas once herbaceous and shrubby vegetation have become established and remain optimal until around 10 years post-harvest (Hunter, 2001; Roth & Lutz, 2004).

Robert Royse

Gray Catbird

Dumetella carolinensis

The Gray Catbird is a medium sized member of the mockingbird family. Like other mimics, catbird songs include notes copied from other birds, frogs and mechanical sounds. As their name implies, their calls sound like a cat meowing. Gray Catbirds are slate-gray with a black cap and tail and reddish feathers underneath the tail.

Gray Catbirds breed in low, dense vegetation such as shrubs, young trees, vine tangles or thickets (Cornell Lab of Ornithology, 2010a). These habitats are found in forest clearings or edges, along river floodplains, or in developed areas with sufficiently dense vegetation (Stauffer & Best, 1980; Yahner 1993). Adequate ground cover is required by Gray Catbirds for nest building and foraging. During migration and winter Gray Catbirds use similar habitats as well as forest interiors (Cornell Lab of Ornithology, 2010a).

Gray Catbirds are considered common throughout their range but they are declining in some states (Sauer et al. 2008). Gray Catbirds are tolerant of human development to some degree, but large clearings for agriculture could threaten catbird populations. Studies have shown that Gray Catbirds will breed within clearcuts once dense, woody vegetation has regenerated (Yahner, 1984; Yahner, 1991).

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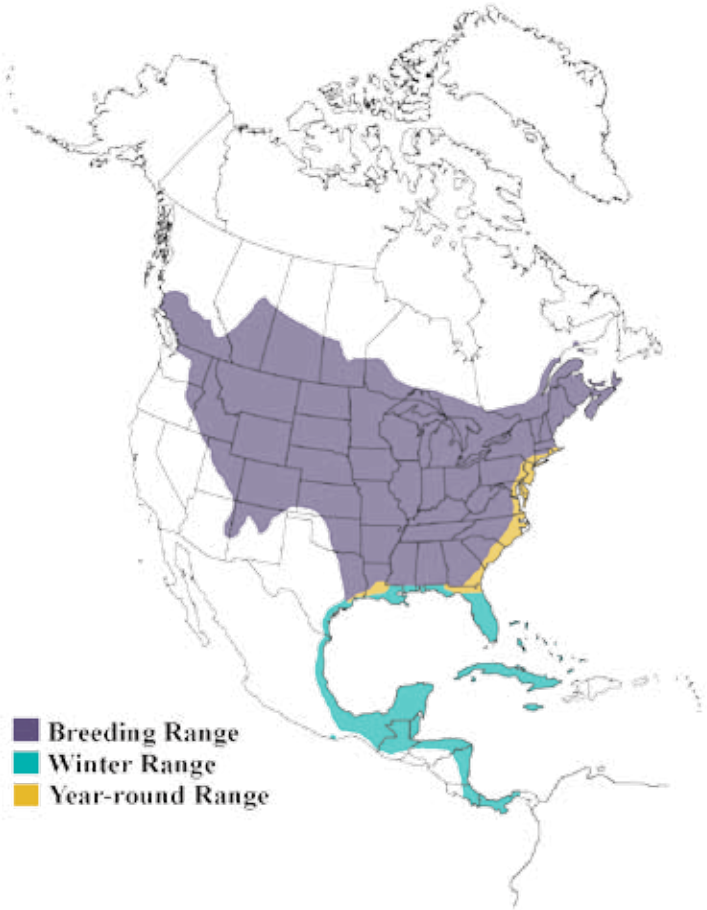


Hermit Thrush

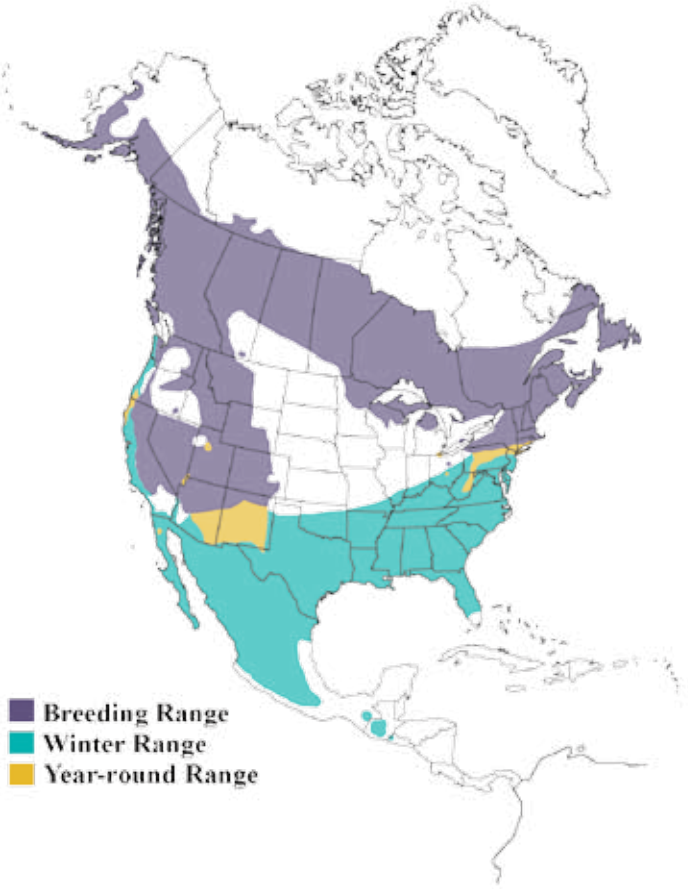
Catharus guttatus

The Hermit Thrush is probably best known for its ethereal, flute-like song. This medium sized thrush is grey-brown to olive-brown above, and white below with grey sides. The Hermit Thrush has dark breast spots, a white eye-ring, and pink legs.

During the breeding season, the Hermit Thrush occupies forest or woodland habitat, with preferences for mixed, coniferous or deciduous communities varying throughout their range (Cornell Lab of Ornithology, 2010a). Often, coniferous trees make up a considerable component of breeding habitat (Rosenberg, 2003). The Hermit Thrush is consistently associated with large patches of forested habitat, though within these forested areas they are usually associated with interior edges and small openings (Jones & Donovan, 1996; Rosenberg, 2003; Cornell Lab of Ornithology, 2010a). Sun filled openings allow an early successional layer of vegetation to develop within the forest. Low, dense woody vegetation such as shrubs or sapling conifers provide typical nesting substrate for Hermit Thrush (Jones & Donovan, 1996). The Hermit Thrush also depends on early successional vegetation during migration and winter, when a majority of the diet is composed of fruiting shrubs and vines (Jones & Donovan, 1996; Rosenberg, 2003).

Surveys of breeding Hermit Thrush indicate they are stable and increasing throughout their range (Sauer et al. 2008). However this species is extremely sensitive to habitat loss or forest fragmentation. They are most abundant in large, contiguously forested habitats (Rosenberg, 2003). Hermit Thrush may be particularly sensitive to loss of wintering habitat, because high winter mortality decreases the number of returning breeding birds (Holmes et al. 1986). The Hermit Thrush responds negatively to large clearcuts and positively to smaller harvests and burns (Schulte & Niemi 1998; Brown et al. 2002; Rosenberg, 2003). The management of early successional vegetation such as fruiting shrubs and vines for winter forage should benefit populations. The Hermit Thrush benefits from management and protection of large mature forested areas with a diverse vertical structure and patches of early successional vegetation.

Robert Royse



Indigo Bunting

Passerina cyanea

The Indigo Bunting is a small but brilliantly colored songbird. Breeding males are bright blue overall. They have a black patch in front of the eyes and dark wings that are edged in blue. Females are brown overall but may have blue tinged wings, tail and rump.

Range-wide, Indigo Buntings breed in early successional habitats, ranging from herbaceous fields to shrublands and young forests (Payne, 2006; Cornell Lab of Ornithology, 2010a). These habitats are found along woodland edges, regenerating clearcuts and old fields, and forest openings (Hunter, 2001). Indigo Buntings are frequently found near brushy wetland, swamps or rivers that maintain dense thickets of vegetation because of frequent floods (Stauffer & Best, 1980). They place their nests close to the ground in thick herbaceous vegetation, shrubs or saplings (Payne, 2006). Mating birds also require thick, upright woody vegetation for song perches (Payne, 2006). During migration and winter, Indigo Buntings use additional habitat types such as grazed and cultivated lands (Payne, 2006; Cornell Lab of Ornithology, 2010a).

Indigo Buntings are common throughout much of their range (Payne, 2006). While survey wide BBS data show a significant annual increase for this species, they are decreasing in the northeast (Sauer et al. 2008). Habitat development and loss of early successional habitats to forest maturation may be affecting Indigo Bunting populations (Payne, 2006). Studies suggest Indigo Buntings respond positively to forest harvest techniques that create early successional habitats, especially clearcuts (Costello et al. 2000).

Robert Royse

Kentucky Warbler

Geothlypis formosa

The Kentucky Warbler is a small but stout bird with long legs and a short tail. It is yellow underneath with an olive green back. Black sideburns extend down the face and throat, and the dark face is marked by yellow eye-stripes.

Throughout their spring and summer range, Kentucky Warblers use moist forests such as bottomland deciduous and riparian forests. They are often considered to be interior species that require large patches of forest (Kreitinger & Paulios, 2010; McShea et al. 2010). They can be found in both young and mature forests, but consistently select habitats with well developed understory vegetation underneath a moderately open canopy or along forest edges (McShea et al. 1995; Cornell Lab of Ornithology, 2010b). Kentucky Warblers place their nests under dense shrubs and well-developed ground cover. Fledgling Kentucky warblers seek cover under early successional habitats (Pagen et al. 2000).

Kentucky Warblers are decreasing significantly throughout their range (Sauer et al. 2008). Loss of large patches of mature forest contributes to their decline, and increasing deer populations are considered a major threat because they over browse the woody understory. Selective cuts and forest thinning practices that encourage woody understory growth in forests can increase habitat for Kentucky Warblers (Mcdonald, 1998).

Robert Royse

Kirtland's Warbler

Setophaga kirtlandii

The Kirtland's Warbler is one of the rarest wood warblers in the United States. This large warbler has a bright yellow chest and belly, with dark streaking along the sides. The face is marked with a dark mask and white eye-ring. Females are lighter overall and do not have a mask.

The Kirtland's Warbler is dependent on early successional jack pine forests (Michigan DNRE, 2010). This forest community is fire adapted; large, hot fires remove old trees and encourage seed germination and development (Michigan DNRE). Kirtland's Warblers begin to occupy regenerating burned or cleared patches a few years after the disturbance (Hunter, 2001; Michigan DNRE, 2010). Kirtland's Warblers commonly nest in the lower, living branches of young jack pines (Michigan DNRE, 2010). As the pines grow and the lower branches die, Kirtland's Warblers leave the habitat patch (Michigan DNRE, 2010). The dense cover of grasses, herbaceous plants and shrubs under the canopy gaps are also an important structural feature of Kirtland's Warbler habitat, because these areas provide protective cover during foraging (Michigan DNRE, 2010).

Kirtland's Warblers only nest in limited portions of Michigan, Wisconsin and Ontario (Michigan DNRE, 2010). The warbler would likely be extinct today if it weren't for extensive jack pine forest management on state and Federal lands. Kirtland's Warblers respond to rotational harvests and replanting efforts that provide consistent nesting habitat (Michigan DNRE, 2010).

Robert Royse

Robert Royse

Magnolia Warbler

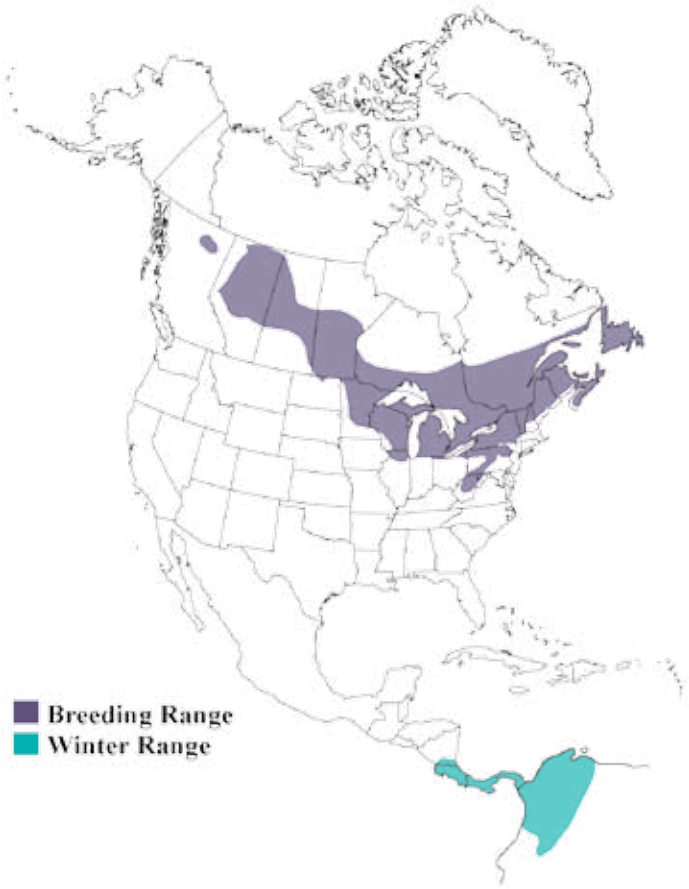
Setophaga magnolia

The Magnolia Warbler is conspicuous in both appearance and behavior; these strikingly patterned wood warblers sing loudly in low, open perches. Adults have a yellow throat and chest with a black necklace and stripes that extend down the sides. The upperparts are grey, and both the wings and black tipped tail have white patches. Males have a black mask with a white eyebrow stripe.

Breeding Magnolia Warblers are usually found in moist, young conifer forests or mixed forests with a heavy conifer component (Cornell Lab of Ornithology, 2010a). They prefer early successional forests because of the dense understory structure, but Magnolia Warblers will also breed in mature forests with a well-developed woody understory (Collins et al. 1982; Litvaitis, 1993; Cornell Lab of Ornithology, 2010a; Kreitinger & Paulios, 2010). Young conifers retain branches at lower heights, which are lost as the tree matures. Magnolia Warblers forage and build their nests in these lower branches of young trees (Cornell Lab of Ornithology, 2010a). Magnolia Warbler breeding habitat is often in disturbed patches of forest or along forest edges (Hunter, 2001; Kreitinger & Paulios, 2010). During migration and winter, Magnolia Warblers appear to separate by sex, with males occupying more mature forests and females most common in shrub habitats (Lopez Ornat & Greenberg, 1990).

Magnolia Warblers are considered common throughout their range, and appear to be increasing in population (Sauer et al. 2008). Local populations will decline where habitat is lost to development, and where cowbird densities are great. Magnolia Warblers use regenerating forests following clearcuts, especially when heavy re-growth of conifers is encouraged (Kreitinger & Paulios, 2010).

Robert Royse



Mourning Warbler

Geothlypis philadelphia

The Mourning Warbler is a small songbird with a distinctive warbling song. Adults have a complete gray hood, plain olive back and wings and yellow undersides. The chest is marked with a broken black patch. Males and females are similar in appearance though females are duller overall.

Across their northern breeding range, Mourning Warblers are typically found in young, regenerating forests following a disturbance (Pitocchelli, 1993; Hunter, 2001; Cornell Lab of Ornithology, 2010a). Mourning Warblers breed in mixed forests with moderate canopy closure and a dense understory of shrubs and herbaceous vegetation (Pitocchelli, 1993; Cornell Lab of Ornithology, 2010a). Mourning Warbler densities increase as shrub diversity and density increases but decline once trees mature and the tree canopy becomes too thick (Probst et al. 1992; Hobson & Schieck, 1999). Mourning Warblers will however breed in mature forests if a thick understory layer is present (Probst et al. 1992). During migration, Mourning Warblers continue to inhabit dense vegetation, especially moist thickets (Pitocchelli, 1993).

Mourning Warblers are considered common across their range, though survey wide BBS data indicate a significant population decline (Sauer et al. 2008). Mourning Warblers may benefit from some human activities, such as forest harvesting and road construction (Pitocchelli, 1993; King & DeGraaf, 2000; Cornell Lab of Ornithology, 2010a). However, development and agricultural lands reduce the available breeding habitat, which could negatively affect Mourning Warbler population densities. Several studies have provided evidence that the management of early successional habitat through silviculture, especially clearcuts, can increase the breeding densities of Mourning Warblers (Probst et al. 1992; Hobson & Schieck 1999; King & DeGraaf 2000).

Nashville Warbler

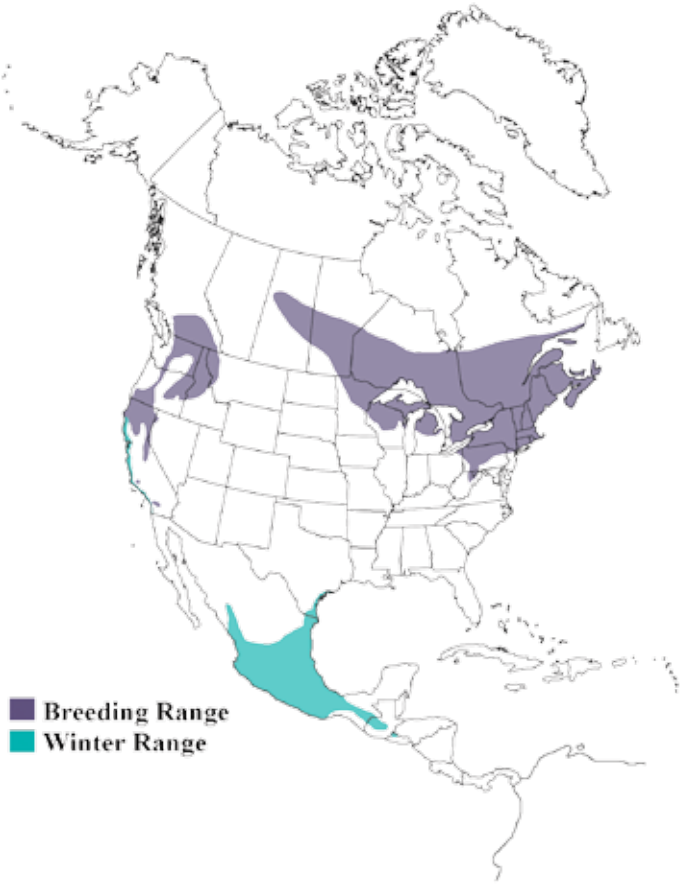
Oreothlypis ruficapilla

The Nashville Warbler is a medium-sized, active wood-warbler. Adults have a gray head and a prominent white eye-ring. The upperparts are olive, and it is yellow below except for a white belly. Females are duller overall, and males have an inconspicuous rusty crest.

Nashville Warblers inhabit second-growth, coniferous, deciduous or mixed forests during the breeding season (Williams, 1996; Cornell Lab of Ornithology, 2011). In the northern and eastern ranges of the United States, Nashville Warblers are common in coniferous dominated bogs, and further south breed in drier, more deciduous habitats (Williams, 1996). They are common in forest openings or edges where there is plenty of light penetration to support dense undergrowth of shrubs (Williams, 1996). Frequently, ideal habitat is created by a disturbance such as fires or clearcuts that allow thick vegetation to regenerate (Williams, 1996; Hunter, 2001). Nashville Warblers place their nests on the ground under the cover of shrubs or small trees (Williams, 1996).

Nashville Warbler populations are probably stable across their range, though in some regions populations are increasing where cleared forests are regenerating, and in other regions populations decrease where forests are maturing (Williams, 1996). Nashville Warblers respond positively to forest openings created by burning or forest harvests (Hunter, 2001).

Robert Royse



Northern Bobwhite

Colinus virginianus

The Northern Bobwhite is a medium sized upland game bird. This quail has reddish-brown body feathers that are mottled with black and white. Males have a black head with a long white eyebrow stripe and a white throat; females have the same patterning but with a buffy stripe and throat.

Northern Bobwhites are dependent on a matrix of early successional communities, including grasslands, herbaceous fields, and shrublands (Quail Forever, 2011). Typically, they select habitats with a woodland edge (Roseberry & Sudkamp, 1998). Northern Bobwhites do not require large expanses of habitat if they can acquire all the food and cover they need. Their habitat is usually created after a disturbance such as fire or timber removal, which allows early successional vegetation to develop (Ellis et al. 1969; Hunter, 2002). Nesting bobwhites require tall herbaceous vegetation that allows them to move easily across the ground while providing enough overhead cover from predators (Roseberry & Sudkamp, 1998). While brooding, the quail use similar habitat so long as there is a sufficient variety herbaceous plants and bare ground for feeding. Scattered woody vegetation, such as young trees or shrubs, provides protective and thermal cover. During the late summer and fall, patches of dense woody vegetation can become important activity centers (Pierce & Gallagher, 2003). Even larger, denser thickets are used during winter for protection from harsh weather and predators (Pierce & Gallagher, 2003).

Northern Bobwhites are decreasing throughout their range (Sauer et al. 2008). The major threats to Northern Bobwhites are habitat degradation caused by succession and land use intensification or development (Roseberry & Sudkamp, 1998; Quail Forever, 2011). Northern Bobwhite quail respond quickly and positively to forest management practices that increase the amount of early successional habitats, including prescribed burns and forest harvests (Ellis et al. 1969; Pierce & Gallagher, 2003; Quail Forever, 2011).

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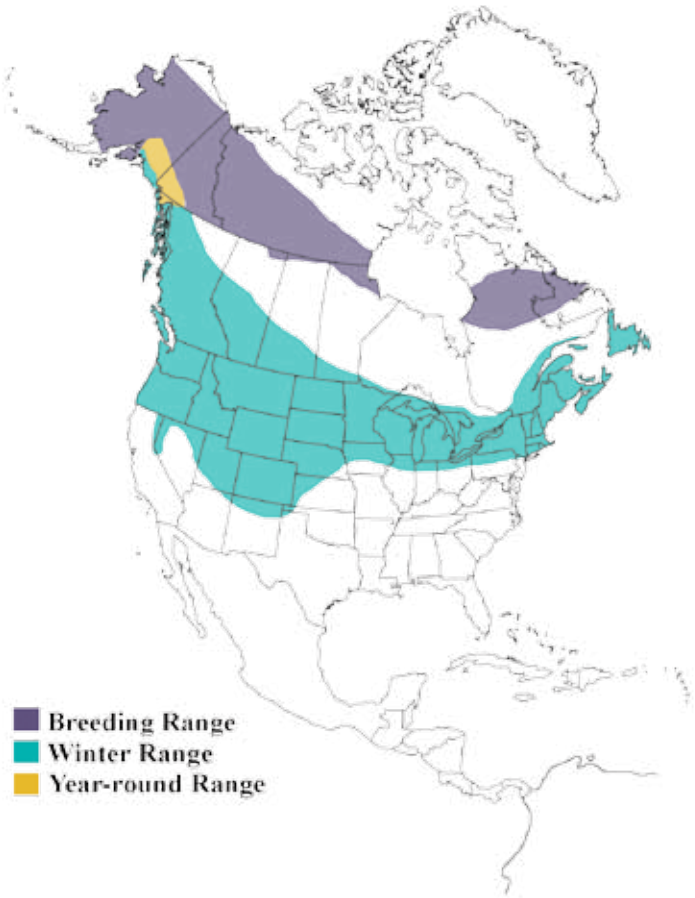

Northern Shrike

Lanius excubitor

The Northern Shrike is a medium-sized, predatory songbird. These shrikes have a gray back, white throat and chest and black mask. The wings are black with a white patch and the tail is black with white outer feathers.

Northern Shrikes winter in forested portions of North America; migration, breeding and summer habitats are in Canadian and Alaskan tundra and taiga. During the winter they occupy open, early successional habitats with shrubs and scattered trees (Atkinson, 1993; Cornell Lab of Ornithology, 2010a). Northern Shrikes hunt for large invertebrates, small mammals and songbirds by perching on shrubs, trees or utility poles and scanning the landscape, or by flying low through tall herbaceous vegetation and shrubs to flush out prey (Atkinson, 1993). Northern Shrikes frequently use dense riparian thickets as winter nighttime roosts and daytime resting areas (Atkinson, 1993). Highly branched woody vegetation provides both thermal cover and protection from raptor predators. Shrubs on hunting grounds are also used for protection from predators. Northern Shrikes select shrub habitats for hunting grounds more often than open agricultural fields, possibly because shrub habitats support a higher prey density or offer better protection (Atkinson, 1993).

The population status of Northern Shrikes is difficult to determine because of their obscure breeding grounds and rarity across wintering grounds (Atkinson & Cade, 1993). Habitat conditions on Northern Shrike wintering grounds most likely affect their overall population status (Atkinson, 1993). Threats to Northern Shrikes on wintering grounds include pesticide use, habitat alteration and competition for prey (Cade & Atkinson, 2002). Protection and management of a wide variety of early successional habitats would likely increase foraging and roosting habitat for wintering Northern Shrikes.

Olive-sided Flycatcher

Contopus cooperi

The Olive-sided Flycatcher is a stocky bird with a large bill and short tail. The back is olive-gray-brown with similar colored streaks down the sides, with a buffy white underside. The Olive-sided Flycatcher is known for its song, "quick THREE BEERS!" and is commonly found perching and hawking insects from snags or dead branches.

Olive-sided Flycatchers nest in mid-to high elevation conifer, mixed and deciduous forests (Cornell Lab of Ornithology, 2010a). They are usually near moist areas such as streams, lakes, meadows and bogs. Forest openings are frequently used, including patches of young forest vegetation if large snags and scattered tall trees are present (Altman & Sallabanks, 2000). They become abundant within the first couple of years in openings created by high intensity fires or selectively harvested forests (Evans & Finch, 1994; DeGraaf & Yamasaki, 2003; Robertson & Hutto, 2007). In mature forests, disturbed patches from flooding or fire create ideal nesting habitat because these types of disturbances leave behind large trees or snags. Additionally, the presence of burns may increase the density of insects eaten by Olive-sided Flycatchers (Altman & Sallabanks, 2000).

Trends from the Breeding Bird Survey show a significant range wide decline of Olive-sided Flycatchers (Sauer et al. 2008). A primary threat to Olive-sided Flycatchers is deforestation across their wintering grounds, which span from Southern Mexico into South America (Altman & Salabanks, 2000). Within the eastern US, the major threat to Olive-sided Flycatchers is a reduction in suitable nesting habitat, as large openings and patches of young forest habitat mature (DeGraaf & Yamasaki, 2003). Populations of Olive-sided Flycatchers increase rapidly in response to forest clearcuts and decline within a few years as the forest matures (DeGraaf & Yamasaki, 2003).

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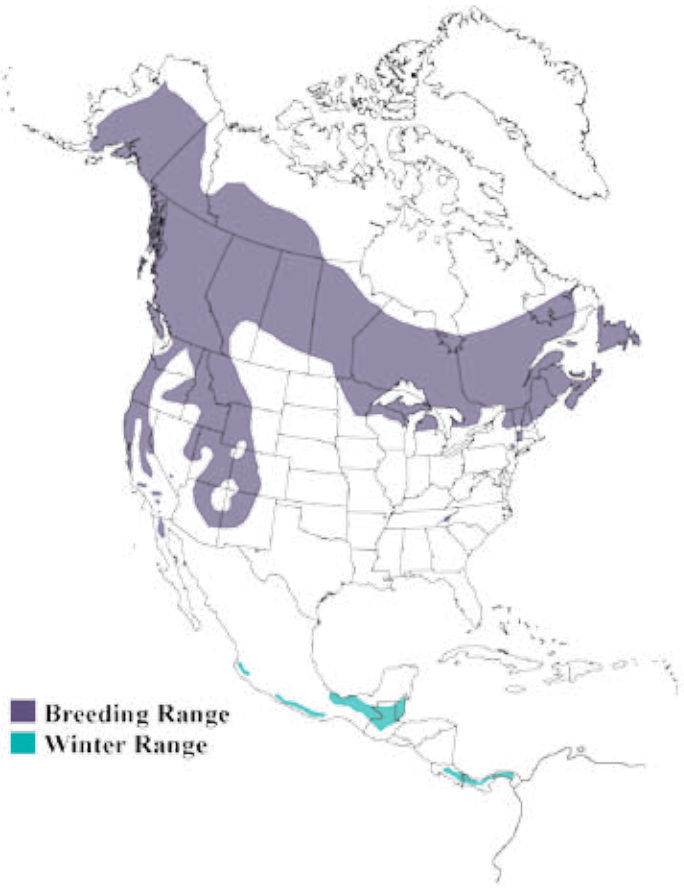


Painted Bunting

Passerina ciris

The Painted Bunting is one of the most colorful birds in North America. Males have a bright blue head, red chest and a green back. Females are also brightly colored with olive-green upperparts and yellow-green underparts, occasionally with blue head feathers.

Painted Buntings breed in dense thickets, shrublands, woodland edges, and hedgerows, often associated with coastal or riparian areas (Kopachena and Crist 2000, Hunter, 2001; Cornell Lab of Ornithology, 2010a). Painted Buntings forage on the ground for grass seeds and nest in low, dense woody vegetation. Once early successional habitats begin to be dominated by trees, they abandon the area.

Painted Buntings have experienced a long term, range wide decline (Sauer et al. 2008). They are a Federal Species of Concern. The reasons for the Painted Bunting population declines are not well understood, but habitat loss due to development and natural succession into mature forests are likely a significant threat to the species. The eastern populations are particularly sensitive to development of prime coastal thickets (Lowther et al. 1999b). Management recommendations for Painted Buntings include conservation of suitable breeding habitat through burning, disking and logging.

Jim Zipp

Prairie Warbler

Setophaga discolor

The Prairie Warbler is a small, active warbler often seen wagging its tail. Adults have olive-green upperparts and a bright yellow throat and belly. The sides are streaked with black. Males have bright yellow faces with a black stripe above and curved black stripe below the eye. Females are paler overall.

The Prairie Warbler does not prefer open prairies as its name suggests. These warblers occupy shrubby habitats formed after a disturbance opens up the forest canopy (Nolan et al. 1999; Hunter, 2001). Prairie Warblers breed in openings with patches of dense woody understory vegetation, such as overgrown fields with shrubs or young second-growth forests (Nolan et al. 1999). Nests are placed low in dense thickets or shrubs, and adults forage in the cover of shrubby vegetation (Nolan et al. 1999).

Prairie Warbler populations have declined throughout most of their range, and the warbler receives protection as State Endangered in Michigan and a SGCN in several other states (Table 1). The primary reasons for decline are most likely habitat development and maturation of young, open habitats into closed canopy forests (Nolan et al. 1999). Forest management methods that increase early successional habitat such as large clearcuts benefit warbler populations (Annand & Thompson, 1997; Brawn et al. 2001).

Robert Royse

Robert Royse

Rose-breasted Grosbeak

Pheucticus ludovicianus

The Rose-breasted Grosbeak is a stocky, medium-sized songbird with a thick, pale bill and white patches on the wings. Males are brightly colored, with a black head, red chest and white belly. Females are dull overall, with a brown, streaky back, brown face with a white eyebrow stripe, cream undersides, a brown tail and two white wing-bars.

The preferred breeding habitats of Rose-breasted Grosbeaks vary regionally throughout their range. Additionally, they are somewhat habitat generalists, and can be found in many habitat types. They breed in deciduous and mixed savannas, forests, orchards, and parks. They may be found in forest interiors and edges. A common structural feature of Rose-breasted Grosbeak breeding habitat is a dense shrubby layer below small openings in the overstory canopy (Stauffer & Best 1980; Hunter, 2001; King et al. 2001). Rose-breasted Grosbeaks nest in this dense layer, and the fruits and berries provided by shrubs are an important food source, especially for juveniles (Wyatt & Francis, 2002). In aspen forests in Michigan and Minnesota, grosbeaks reached their highest densities in stands with tree heights ranging from 1.9 to 4.0 m and were absent in stands shorter than 1.9 m and taller than 8.0 m (Probst et al. 1992).

Rose-breasted Grosbeaks have declined significantly across their range (Sauer et al. 2008). Habitat loss and fragmentation are likely threats to Rose-breasted Grosbeak populations, because small habitat patches are used but may act as sinks (Burke & Nol, 2000). Additionally, maturation of forests and a lack of natural disturbances reduce the amount of secondary growth and dense shrubs that the grosbeaks require. Studies of songbird response to forest management indicate Rose-breasted Grosbeaks respond positively to clearcuts and reach highest densities in regenerating, young forests (Steffen, 1985; King et al. 2001; DeGraaf & Yamasaki, 2003).

Ruffed Grouse

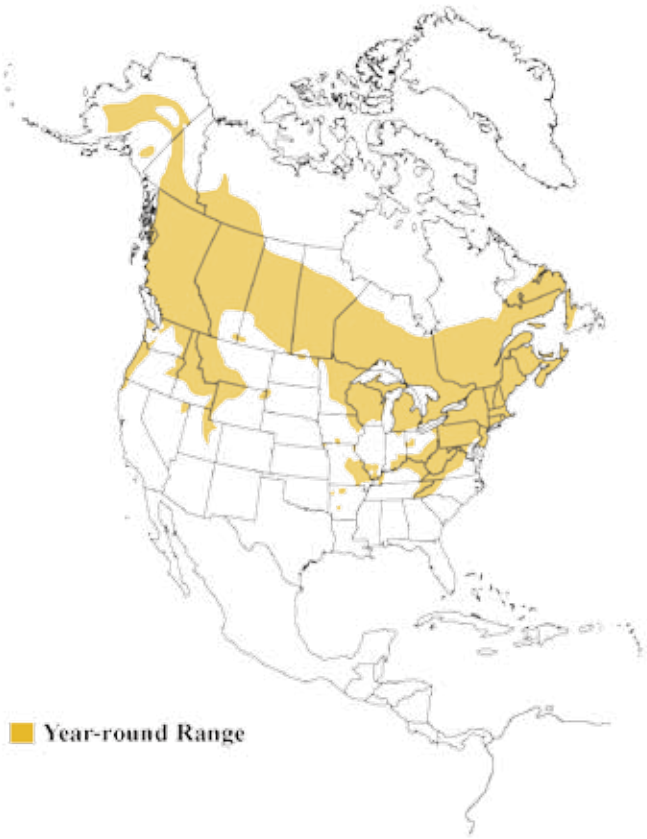
Bonasa umbellus

The Ruffed Grouse is a popular upland game bird, though its cryptic coloration and slow movement help keep it well hidden. Ruffed Grouse are thick bodied and medium sized chicken-like birds. They have a head crest, long rounded tails and rounded wings. Overall the birds are mottled grey, brown, white and black. Males have large black neck ruffs and a dark band across their tails. Females have a less distinct tail band and smaller crests and neck ruffs.

Across their range, Ruffed Grouse specialize in mixed or deciduous young forest habitats. After a clearcut, dense stands of young trees provide optimal habitat for about 20 to 50 years, depending on the tree species and region (Dessecker & McAuley, 2001; Dessecker at al. 2006). During the breeding season, males select display areas that contain dense overhead protection from predators but sparse ground cover for adequate movement and visibility (Michigan DNRE, 2010). Woody debris such as fallen logs or stumps is a critical component of male breeding territories (Minnesota DNR, 2010). Nesting females may use slightly older and more open areas that contain plenty of canopy cover. During brooding, old fields with a variety of herbaceous plants and fruiting shrubs provide food resources for developing fledglings (Virginia DGIF, 2010). In the winter, Ruffed Grouse roost in young forests, and frequently select areas with dense thickets and softwood stands that provide thermal cover. Ruffed Grouse populations may benefit the most from young aspen stands. These trees regenerate quickly and at high densities, and the catkins provide a winter source of food (Minnesota DNR, 2010). Ideal Ruffed Grouse habitat is a matrix of regenerating forest stands and shrublands that contain the different resources needed throughout the year.

BBS data indicate a survey wide significant negative trend, and hunter harvest data show that populations are decreasing in the eastern United States (Dessecker & McAuley 2001; Sauer et al. 2008). Ruffed Grouse are primarily suffering from habitat loss or fragmentation. Forest management techniques can ensure a continuous supply of Ruffed Grouse habitat. Clearcuts are most likely better for Ruffed Grouse populations because they create large patches of habitat, whereas group selection cuts may be too small (Dessecker & McAuley, 2001).

Robert Royse



Rusty Blackbird

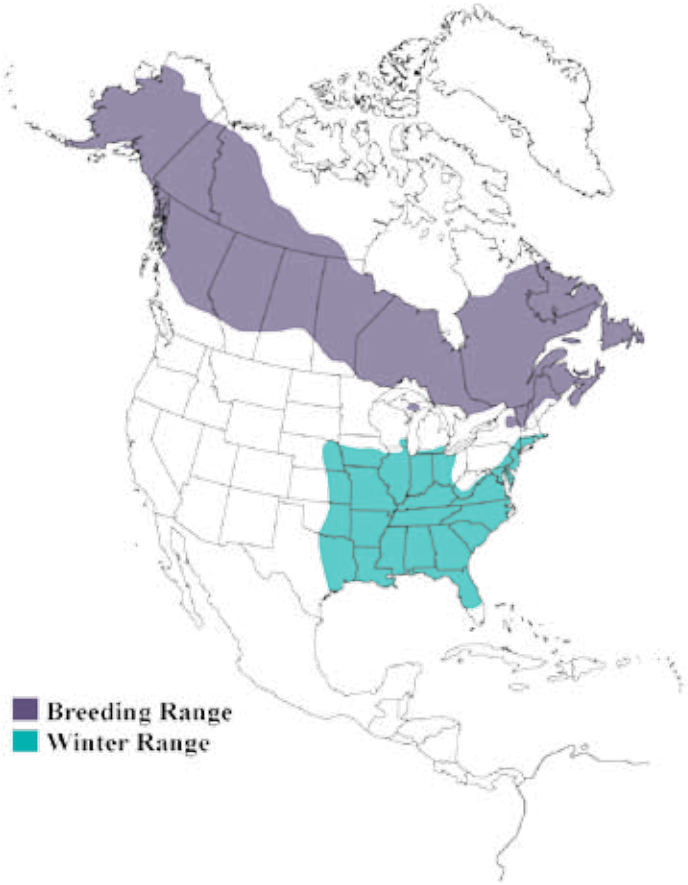
Euphagus carolinus

Rusty Blackbirds are mostly black with rusty fringes throughout the wings and body. Females are overall rustier than males. Both sexes have striking pale yellow eyes in contrast to their dark plumage.

Rusty Blackbirds breed in wet, wooded habitats, such as swamps, wooded bogs, beaver ponds, and the edges of streams and lakes (Greenberg & Droege, 1999). They frequently nest near water, selecting small openings in the canopy where shrubby vegetation is dense (Hobson & Schieck, 1999; Powell, 2008). Rusty Blackbird habitat has best been studied in New England. Nesting habitat in this region is described as openings in moist boreal forest created from floods or fires, where young, regenerating forest is abundant (Powell, 2008). Wintering grounds are also moist wooded areas, such as wooded vegetation along streams, river bottomlands and flooded woodlands.

Once common across their range, Rusty Blackbird populations are declining rapidly throughout their range, and are currently listed as a SGCN in several states (Table 1). Significant losses of wintering grounds in the southeast may be a primary cause of the population decline, as well as acidification of breeding wetlands caused from heavy industrial use in the northeast (Greenberg & Droege, 1999). Rusty Blackbird response to forest management practices is not well studied. While the birds do increase at least initially in response to forest harvests (Hobson & Schieck, 1999), overall nest success in one New England study was lower in harvested areas than in uncut forests (Powell, 2008). The size of breeding wetlands is an important indicator of rusty blackbird nest success. Small, selective forest harvests may be more beneficial for this species than large clearcuts (Powell, 2008).

Garth McElroy



Spruce Grouse

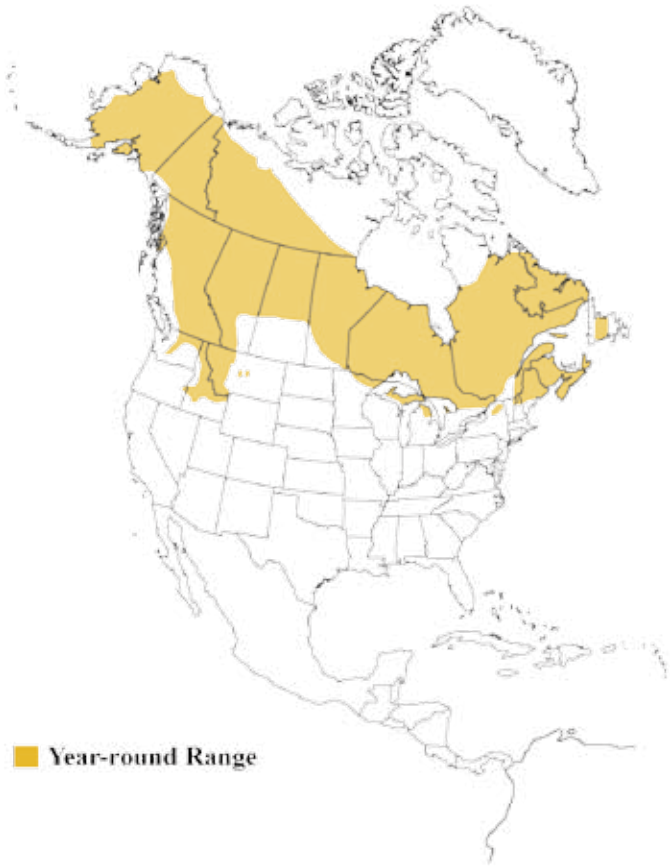
Falcipennis canadensis

Spruce Grouse are inconspicuous birds of northern forests. The Spruce Grouse is a stocky, medium-sized, chicken-like bird with round wings, a short neck and a long tail. Both sexes are grey or rufous with cryptic, white speckling and black tails. Males have red eyebrows, a black throat, white lines on the face and distinctive white spots on the tail. Males are larger than females.

Spruce Grouse are year-round residents throughout their range, making only very small migrations (< 10 miles) between summer and winter grounds (Cornell Lab of Ornithology, 2010a). They breed in a variety of forest types, including boreal forest, wet spruce forests, pine forests, mountain ridge forests to low elevation softwoods and bogs. Wintering habitat is dense, early successional jack pine forests and spruce bogs (Kreitinger & Paulios. 2010). Conifers are a critical component of wintering habitat because they eat mostly pine needles in the winter (Bouta, 1991). During the summer they also eat leaves, berries, seeds and insects (Bouta, 1991). Throughout the year, Spruce Grouse prefer habitats with live branches at low heights and dense vegetation at ground height, including a variety of shrubs and herbaceous plants. They commonly select forests where fires maintain openings with dense vegetation (Boag & Schroeder, 1992; Hunter, 2001). Once an overhead canopy is too developed and shady, trees self-prune the lower branches preferred by Spruce Grouse (Kreitinger & Paulios, 2010).

Though Spruce Grouse are widely distributed over their range, development of their habitat has caused substantial declines over the southern portion of their range, and they are listed as SGCN in several states (Table 1). The Spruce Grouse has not been intensively studied, but it is believed that habitat loss from development and a lack of natural disturbances have contributed to population declines (Gregg et al. 2004). Protection of short-needle pine and spruce forests are especially important for this species (Williamson et al. 2008). Because of their preference for a mosaic of forest ages, a rotation of even-aged harvests should be implemented (Bouta, 1991; Williamson et al. 2008; Kreitinger & Paulios, 2010).

Khanh Tran



Robert Royse

Tennessee Warbler

Oreothlypis peregrina

Tennessee Warblers are distinguished from other warblers primarily by their dull plumage. These small to medium warblers are grey green above and slightly yellow below, with indistinct wing-bars and a dark eye-stripe underneath a yellow eyebrow mark.

The breeding range of the Tennessee Warbler is predominately the Canadian boreal forests, extending slightly into the northeastern United States. In this region, Tennessee Warblers are associated with young forests with openings that promote shrub and herbaceous growth (Rimmer & Mcfarland, 1998; Ferris, 1979; Rangen et al. 2000). In the northern US, they prefer coniferous bogs dominated by young trees and shrubs, and to a lesser extent the thickets of riparian scrub (Rimmer & Mcfarland, 1998). Migrating warblers stop over in scrubby, moist habitats.

Populations of the Tennessee Warbler flux significantly in response to outbreaks of spruce budworm, and there is no clear range-wide population trend (Rimmer & Mcfarland, 1998). In the US, this warbler is listed as a SGCN in Maine and New York, although range wide, the population seems stable. Tennessee Warblers may benefit from forest harvests that create regenerating vegetation, especially smaller cuts (Rimmer & Mcfarland, 1998; Hunter et al. 2001).

Veery

Catharus fuscescens

The Veery is an interior forest species that can be difficult to locate but is well known for its beautiful song. The Veery is the least spotted of the American spotted thrushes, with a tawny back and wings, buffy throat and chest, and indistinct reddish brown spots on the throat. This thrush forages on the forest floor, primarily eating insects and occasionally fruit.

The Veery is considered an interior forest bird species that uses early successional habitat (Bevier et al. 2005). Veery habitat is described as damp, deciduous or mixed forest or woodlands (Cornell Lab of Ornithology, 2010a). Generally, Veery select younger stands and second growth areas with a dense understory under a variable canopy (Bevier et al. 2005). Riparian shrublands and thickets adjacent to streams are frequently selected for nesting sites. A well-developed shrub layer is important during nest building (Bevier et al. 2005). In a study of northern hardwood forests, Veery were more common breeders in disturbed forests than in mature forests (Bevier et al. 2005).

Veery populations have declined by 30% across their range since 1966 (Sauer et al. 2008; Cornell Lab of Ornithology, 2010b). Habitat fragmentation is the biggest threat to the Veery because of its preference for large forest patches and avoidance of edge habitat (Cornell Lab of Ornithology, 2010b). The Veery is extremely vulnerable to cowbird parasitism, which commonly occurs in smaller forest patches and patches with a higher proportion of edge to interior habitat (Cornell Lab of Ornithology, 2010a). Conservation of the Veery focuses on protecting large forested areas (Herkert, 1995). The Veery has shown mixed responses to forest management techniques such as prescribed burns and managed forest harvesting that can stimulate the regeneration of young forest habitat (Hagan et al. 1997; Dellinger et al. 2007; Holmes & Pitt, 2007).

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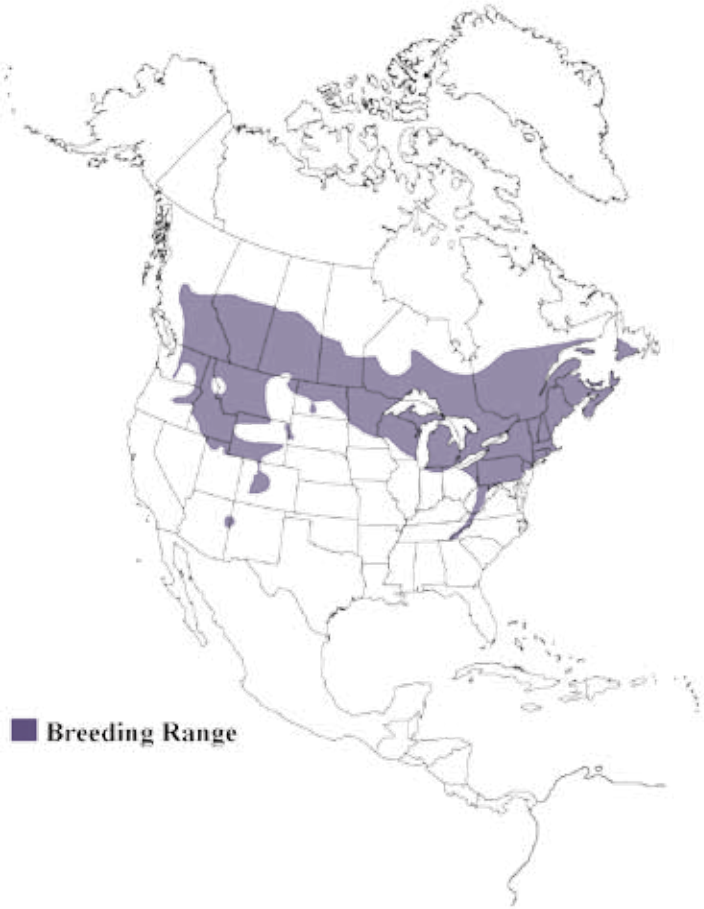

White-eyed Vireo

Vireo griseus

The White-eyed Vireo is a small, cryptic bird most often recognized by its complex repertoire of songs. It has olive-green upperparts, yellow sides, a white throat, dark wings with two white wing-bars, and a dark tail. The white eyes are framed with yellow spectacles.

White-eyed Vireos specialize in secondary deciduous shrub habitat, or early successional habitat with a heavy woody component (Askins, 1990; North Carolina Partners in Flight (NC PIF), 2010). They nest and take cover in dense shrubs or thickets. They may also be found in young forest habitat where canopy openings have been created by disturbances or at the edges where the understory vegetation is well developed (Hunter, 2001; NC PIF, 2010). During the winter they will use a wider range of habitats, but continue to select shrubby habitats.

In some portions of their range, such as the northeast, BBS data indicate that White-eyed Vireos are significantly decreasing (Sauer et al. 2008). Studies of forest management practices throughout their range suggest that White-eyed Vireo populations increase in response to forest openings created through both group selection and clear cuts (Robinson & Robinson, 1999; Moorman & Guynn, 2001; Gram et al. 2003). They may also respond well to prescribed burning (Burger et al. 1998). Some researchers stress that shrubby vegetation is best for White-eyed Vireos and recommend continued maintenance to allow shrub species to establish in forest openings (Askins, 2001).

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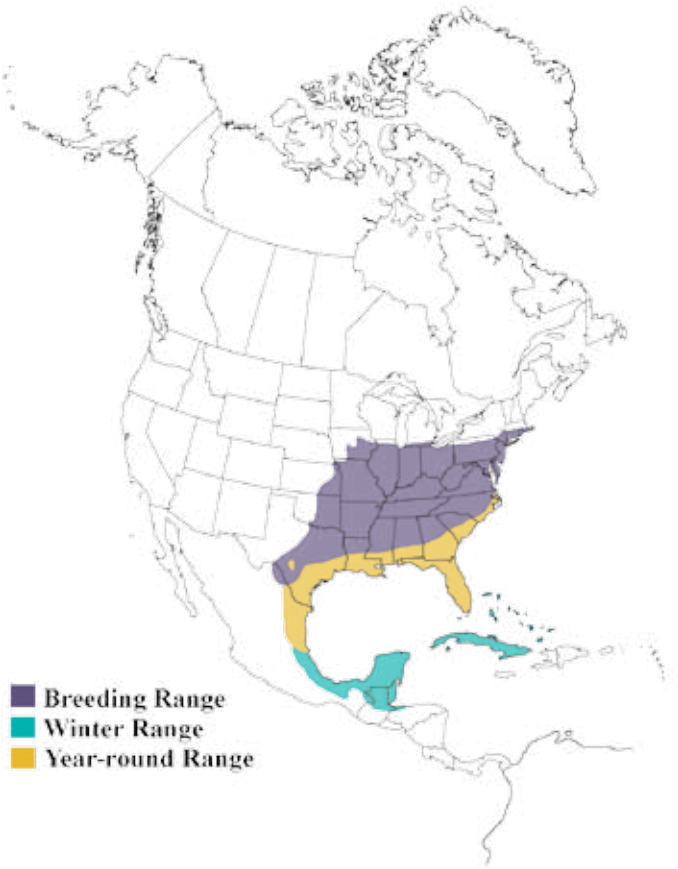

White-throated Sparrow

Zonotrichia albicollis

White-throated Sparrows are full-bodied birds with a large bill, long legs and a long, narrow tail. They are brown above and grey below, with a black eye-stripe, yellow patch between the bill and eye, and a white throat bordered by a black whisker stripe.

White-throated Sparrows use similar habitat year-round throughout their range. They commonly use conifer or mixed forest edges and openings with a dense understory (Cornell Lab of Ornithology, 2010a). They are associated with forest disturbances that create canopy gaps or clearings (Hunter, 2001). Within these forest openings, White-throated Sparrows nest in the dense, shrubby understory (Cornell Lab of Ornithology, 2010a). White-throated Sparrows forage for seeds and fruits among shrubby vegetation primarily during the breeding season, and rely more on insects during the winter.

White-throated Sparrows are widespread and currently abundant throughout their range. However, they are declining significantly each year in many parts of their range (Sauer et al. 2008). These birds quickly increase in abundance in the openings created by disturbances or forest management practices such as logging and burning (Hagen et al. 1997; Costello et al. 2000; Flaspohler et al. 2002; Campbell et al. 2007).

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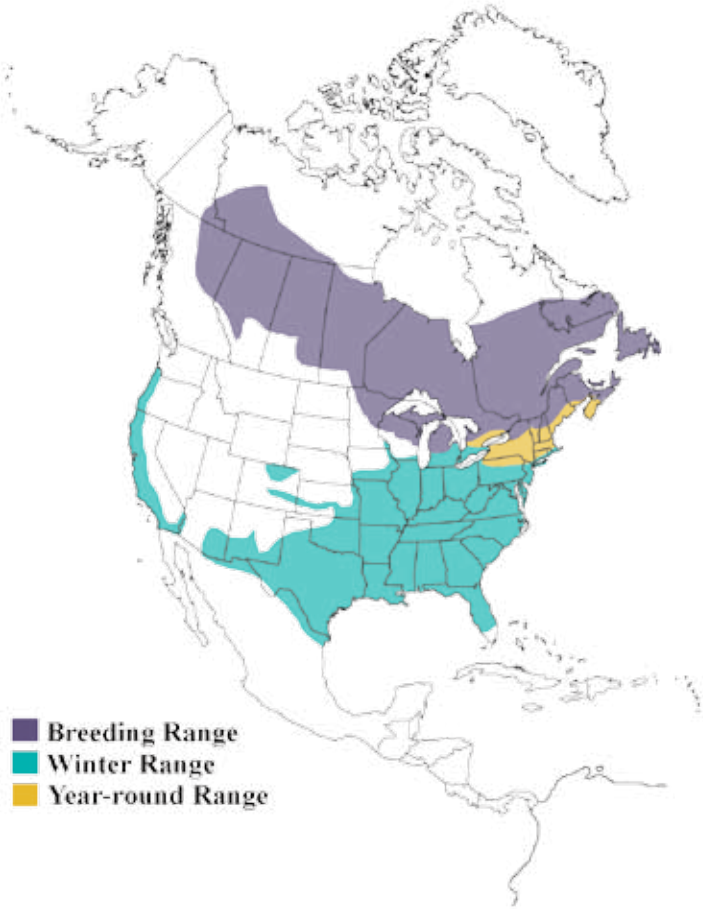

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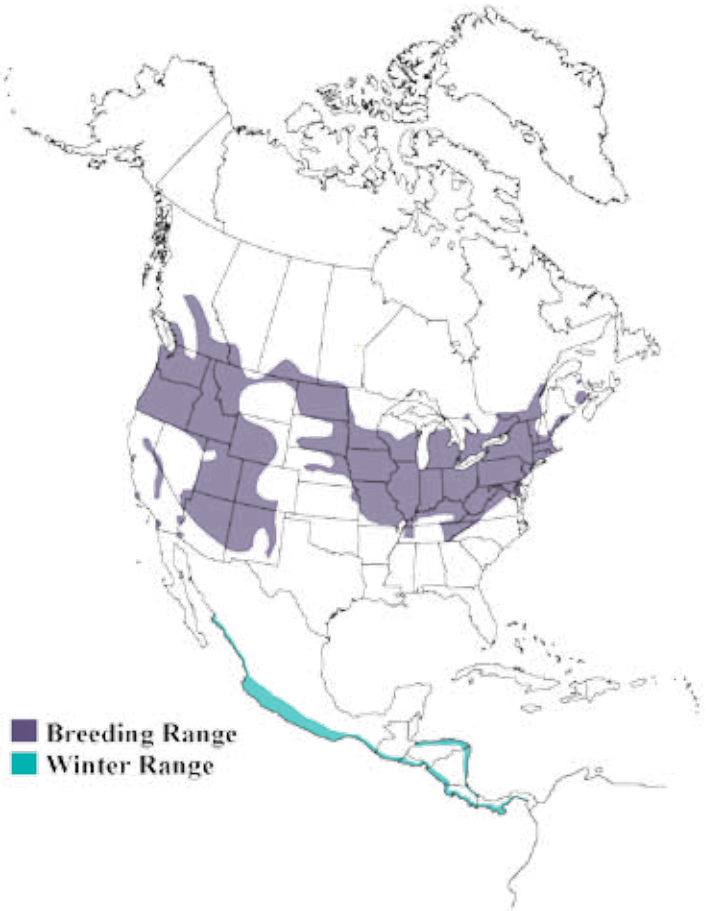


Willow Flycatcher

Empidonax traillii

The Willow Flycatcher is a small flycatcher with a medium-dark olive to gray back and head, light underneath with a brown-olive breast band and two light wing-bars. Willow Flycatchers are insectivores and occasionally eat small fruits.

Willow Flycatchers select large patches of dense, shrubby thickets for breeding habitat, often near standing or running water. They winter in similar shrubby clearings and young forest habitat (Cornell Lab of Ornithology, 2010a). Willow Flycatchers will use edge habitat and transitions between young and mature forests (Sedgwick, 2000).

Willow Flycatcher populations are decreasing range-wide, based on data from BBS surveys (Sedgwick, 2000). The primary threats to Willow Flycatcher are loss of habitat, through development or maturation of young forests, and parasitism by cowbirds. Willow Flycatchers respond to forest management practices that create early successional patches within mature forests (DeGraaf & Yamasaki, 2003). Because of their preference for large patches of habitat, Willow Flycatchers may benefit from large clearcuts over smaller selective harvesting methods.

Yellow-billed Cuckoo

Coccyzus americanus

The Yellow-billed Cuckoo is a medium sized bird with a long tail and downward curving bill. The plumage is uniform grey-brown on the head and back with dull white underparts. The underside of the tail has two rows of large white circular patches.

During the breeding season, Yellow-billed Cuckoos select open forests or woodlands with a dense shrubby understory (Hunter, 2001; Kreitinger & Paulios, 2010). Typically they prefer moist forests and often nest in close proximity of water. The dense understory vegetation structure preferred by Yellow-billed Cuckoos is best maintained by disturbances to the canopy such as burning or timber harvests (Hunter, 2001). During the winter, they seek habitats similar in structure to tropical forests and scrublands.

Yellow-billed Cuckoos are a Federal Candidate species, and are listed as SGCN in several states. Like black-billed cuckoos, populations of Yellow-billed Cuckoos vary annually, possibly in response to strong fluctuations in insect outbreaks (Kreitinger & Paulios, 2010). Major threats to Yellow-billed Cuckoo populations include habitat loss, and poisoning from heavy use of pesticides. While early successional understory development is an important component of Yellow-billed Cuckoo habitat, intact mature forests are also used, and this species may respond best to smaller timber harvests such as group selection cuts instead of large clearcuts (Annand & Thompson 1997).

Robert Royse

Yellow-breasted Chat

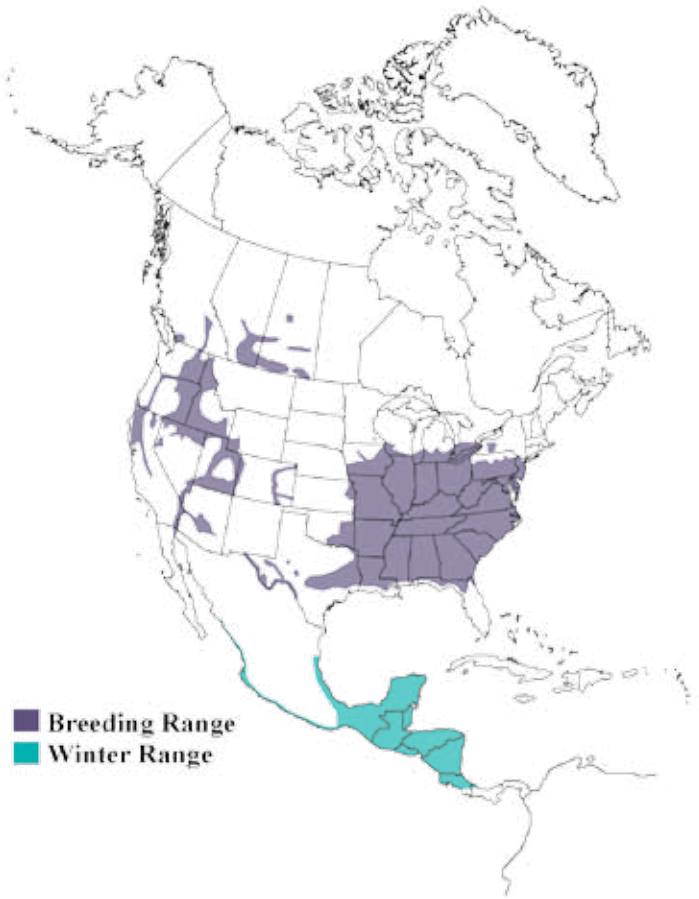
Icteria virens

The Yellow-breasted Chat is brightly colored and has a loud song, yet can be hard to find skulking in its dense habitat. The back, tail and wings are olive-green, the throat and breast are bright yellow, and the belly and undertail are white. They have black patches in front of their eyes, which are bordered by white spectacles.

Across their wide breeding range, Yellow-breasted Chats select a similar habitat of dense shrubby tangles. Thorny vines or briars are a common component of these thickets. Chats will use both moist, streamside brushy areas and upland shrub-scrub communities. Typically these habitats are created by natural or managed disturbances such as burns or clearcuts. If too many trees invade the regenerating vegetation and begin to form a closed canopy, Yellow-breasted Chats will no longer use the habitat (DeGraaf & Yamasaki, 2003).

Yellow-breasted Chats are a species of concern in several states throughout their range (Table 1). Threats to Yellow-breasted Chat are mainly loss of habitat from development and regeneration of shrubby areas into mature forests. Management for this species can be effective if large patches of forest are cleared so that early successional vegetation can regenerate (Hunter, 2001). Though somewhat sensitive to habitat area, Yellow-breasted Chats may successfully nest in fragmented habitat if the surrounding landscape includes additional shrubby habitat.

Robert Royse



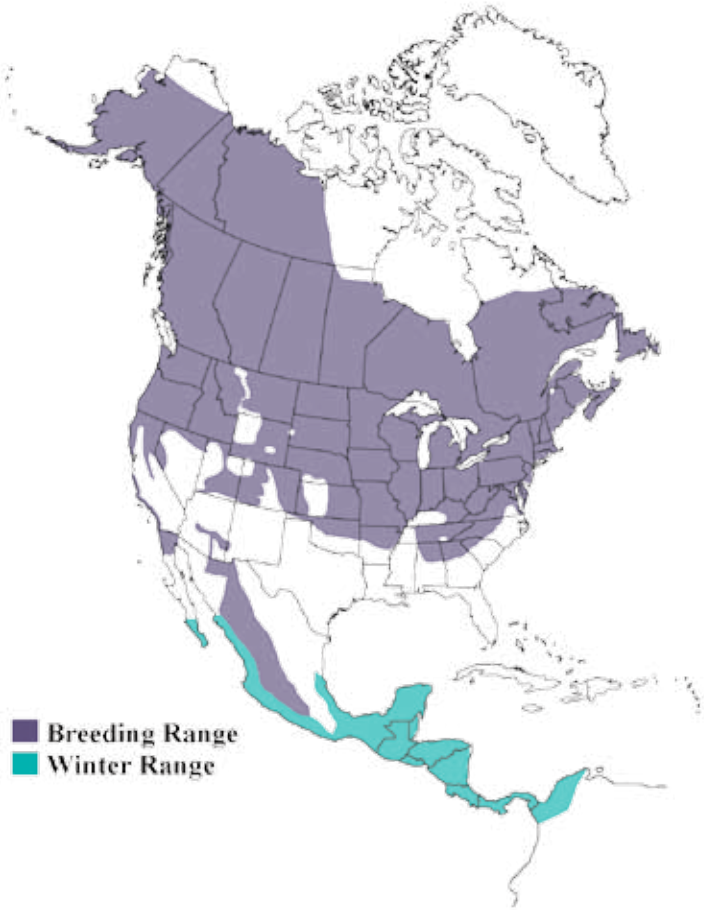
Yellow Warbler

Setophaga petechia

True to its name, the Yellow Warbler is among the brightest and most strikingly yellow wood-warblers. These warblers are yellow overall with indistinct wing-bars, olive upperparts and a prominent dark eye on the otherwise unmarked face. The many subspecies of Yellow Warblers exhibit a variable amount of chestnut streaking on the breast and head.

Garth McElroy

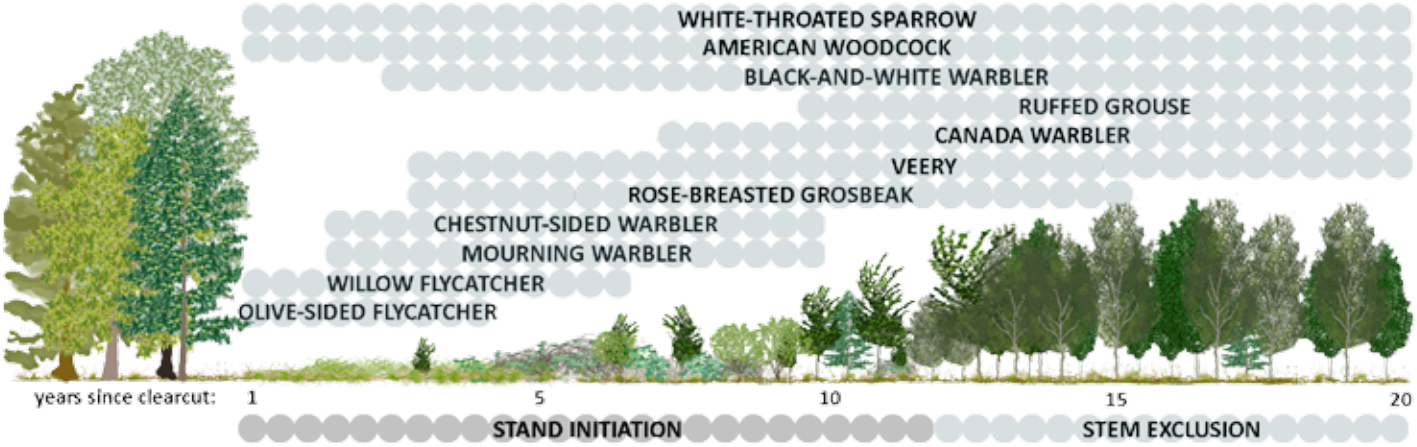
Yellow Warblers breed throughout most of North America. Across their range the most typical breeding habitat is shrub-dominated wetlands, but Yellow Warblers also frequently breed in wet or dry old fields, shrublands, young forests and woodlands (Schroeder, 1982; Lowther et al. 1999a; Bachynski & Kadlec, 2003). Yellow warblers typically select breeding grounds under an open canopy with a well-developed woody understory (Collins et al. 1982). They are common in patchy and edge habitats (Stauffer & Best, 1980; Saab, 1999). Willows (Salix spp.) typically dominate the breeding grounds (Schroeder, 1982; Lowther et al. 1999a; Bachynski & Kadlec, 2003). During migration and winter, sites with thick, low-growing vegetation are selected, and more forested or residential areas are also used (Lowther et al. 1999a).



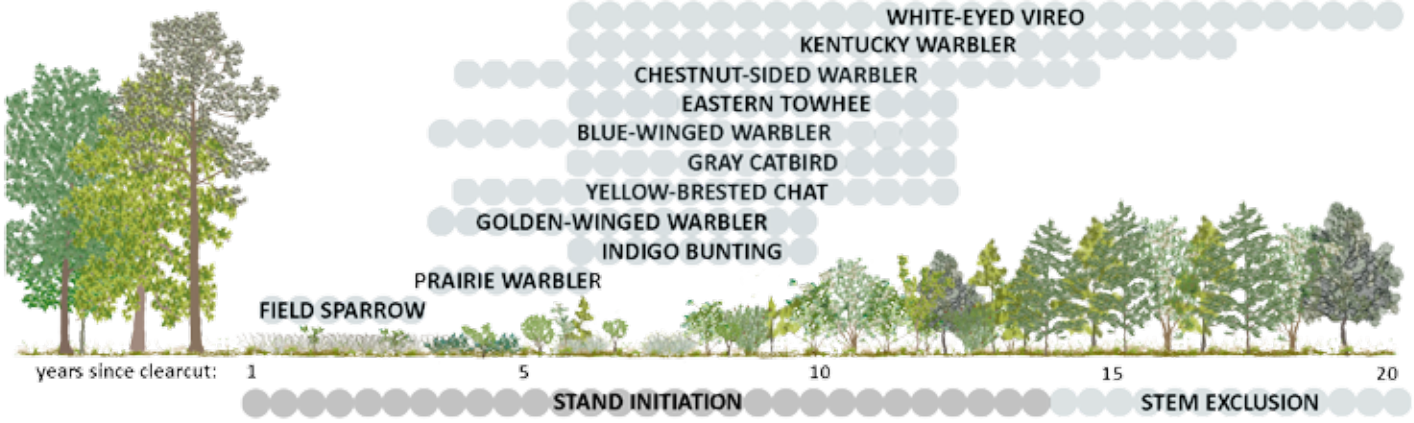
The Yellow Warbler is widespread and abundant across much of its range, however populations are declining in the southwestern portions (Bachynski & Kadlec, 2003; Myers 2011). Populations of Yellow Warblers are sensitive to loss of riparian habitats from development, flood control and intensive grazing (Schroeder, 1982; Lowther et al. 1999a). In the Western United States, management for this species that protects riparian areas by limiting grazing and encouraging the growth of dense vegetation has helped stabilize Yellow Warbler populations (Lowther et al. 1999a; Bachynski & Kadlec, 2003). Forest harvests that create openings in forest canopies have also been predicted to increase Yellow Warbler breeding habitat (Stauffer & Best, 1980).

Bird use of regenerating vegetation after a clearcut in Eastern and Central Hardwood Forests

Eastern Hardwood Forest



Central Hardwood Forest



Different species of birds will breed in a site after a clearcut at varying stages of vegetation regeneration. Herbaceous plants, shrubs, vines and tree saplings grow rapidly during the stand initiation period following the harvest. Many bird species begin nesting in the site at this stage because of the dense woody and zerbaceous understory that provides cover and nesting substrate. Once the saplings begin forming a closed canopy during stem exclusion, the woody understory decreases, and some species stop nesting in the site. (Oliver & Larson, 1996; Thompson et al. 1996; DeGraaf & Yamasaki, 2003).

Birds shown to respond positively to forest harvests

BLACK-AND-WHITE WARBLER
KENTUCKY WARBLER
YELLOW-BILLED CUCKOO

Single Tree Cut: typically between 0.002 and 0.03 ha

INIDGO BUNTING
KENTUCKY WARBLER
WHITE-EYED VIREO
YELLOW-BILLED CUCKOO
YELLOW BREASTED CHAT

Group Selection Cut: Typically between 0.04 and 0.81 ha

ALDER FLYCATCHER
BLUE-WINGED WARBLER
CHESTNUT-SIDED WARBLER
DARK-EYED JUNCO
EASTERN TOWHEE
FIELD SPARROW
INDIGO BUNTING
PRAIRIE WARBLER
RUFFED GROUSE
WHITE-EYED VIREO
WHITE-THROATED SPARROW
WOODCOCK
YELLOW-BREASTED CHAT

Clear cut: Typically between 4 and 30 ha

Single tree cuts in mature forests create small openings and cause minimal disturbance to the mature bird community, but promote low levels of vegetation regeneration. Group selection cuts create much larger openings that promote greater regeneration of early successional vegetation while maintaining much of the mature forest. Clearcuts create large openings that encourage denses vegetation growth, providing habitat for many early successional species. Only birds profiled here were used in the figure; several other birds respond positively to harvests, including mature forest species and birds not designated as a SGCN. (Thompson et al. 1996; Annand & Thompson, 1997; Thompson & Dessecker, 1997; Robinson & Robinson, 1999; Costello et al. 2000; Dessecker & McAuley, 2001; Moorman, 2001; DeGraaf & Yamasaki, 2003; Gram et al. 2003)

Shrubland and Young Forest Mammals

Appalachian Cottontail

Sylvilagus obscurus

The Appalachian Cottontail was recently recognized as a separate species from the New England Cottontail. Like all cottontails, these rabbits have a rounded tail that is white underneath. Appalachian Cottontails have grey cheeks, rusty-brown fur with black hairs, a rusty-orange patch at the nape of the neck and a dark saddle across their backs. The ears are slightly rounded and have dark margins.

The Appalachian Cottontail is found at higher elevations throughout a portion of the Appalachian Mountains. They are most often associated with mountain heath habitats within coniferous forests (Russell et al. 1999). Appalachian Cottontails require dense, woody understory vegetation such as briars, vines and multi-stemmed shrubs for both cover and forage (Stevens & Barry, 2002). This habitat is found in clearings and gaps of conifer and mixed forests, where young, regenerating vegetation is present. These cottontails have large home ranges and are believed to be sensitive to forest fragmentation (Stevens & Barry, 2002). Where Appalachian Cottontails ranges overlap with Eastern cottontails, they may be forced into more mature sections of forest (Russell et al. 1999; Virginia Department of Game and Inland Fisheries (VDGIF), 2010).

Appalachian Cottontails are uncommon throughout their range. Recently observed population declines have been attributed to habitat loss, fragmentation and maturation of early successional patches (Russell et al. 1999). To increase the amount of young regenerating vegetation in mature forests, moderate tree harvests are recommended instead of large clearcuts because it takes sufficient growth of vegetation before Appalachian Cottontails can use the habitat (Russell et al. 1999; VDGIF, 2010). Large clearcuts can also be detrimental if Eastern cottontails are present because they could establish their populations in the habitat and outcompete the Appalachian Cottontails (Russell et al. 1999; VGDIF, 2010).

Will Cook

Bobcat

Lynx rufus

The Bobcat is a medium-sized wildcat, usually between 15 and 30 pounds, with a short bobbed tail, furry sideburns, and black ear tufts. The fur varies from beige to brown with dark spots or lines marking the body. Though they are the most common wildcat in North America, they are mostly nocturnal, rarely vocalize, and are not frequently observed.

The Bobcat is certainly a habitat generalist throughout its range, common in deserts, rocky bluffs, bottomland hardwoods and conifer forests, where these habitat types are abundant (Lovallo & Anderson, 1996). In their northern and eastern North American ranges, Bobcats primarily use matrices of forest, woodlands, shrublands, and open fields (Fuller & DeStefano, 2003). Their large home ranges include a variety of microhabitats (Litvaitis, 2003). However, especially in the northeast, they have a strong preference for early successional habitats with dense understories, as these areas support their primary prey items, hares and rabbits (Litvaitis 1993). While Bobcats can shift their dominant prey to more mature forest species, their population densities have declined most sharply following loss of early successional habitats that provided resources for hares and rabbits (Litvaitis, 1993; Fuller & DeStefano 2003).

Only one subspecies of Bobcat receives Federal protection, but they are SGCN across much of their eastern range (Table 1). Declines of Bobcats are attributed primarily to habitat loss, but fragmentation of suitable patches exposes Bobcats to roads where vehicles can be a major source of mortality (Litvaitis, 2003). In their northern and eastern ranges, Bobcats should benefit from land management practices that protect large forested areas and encourage patches of early successional habitat.

Gerald and Buff Corsi @ California Academy of Sciences

Canada Lynx

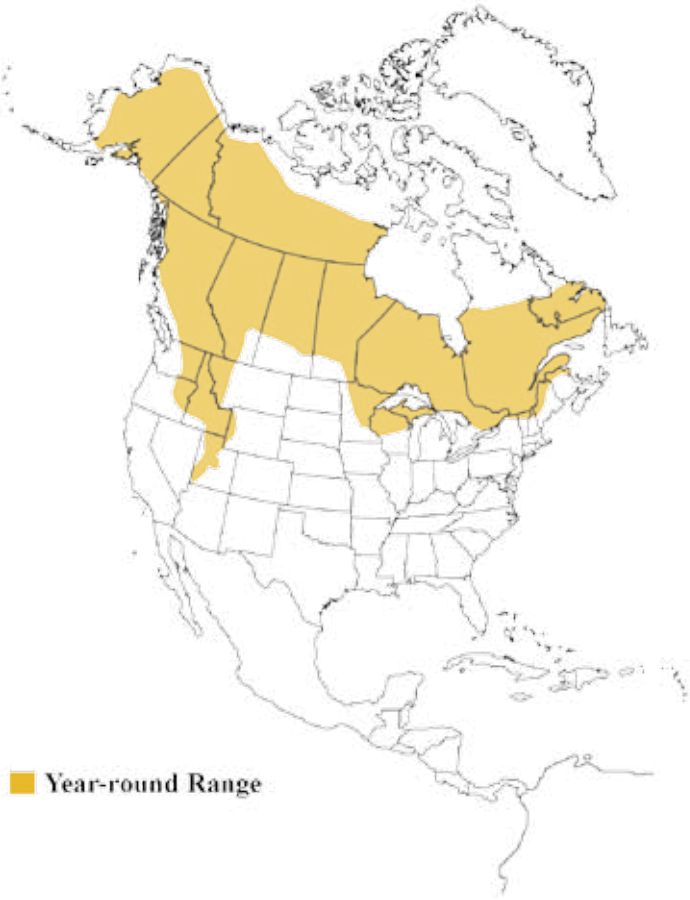
Lynx canadensis

Canada Lynx are forest dwelling cats of northern latitudes and high mountains. They are medium sized cats, weighing 17 to 28 pounds (Minnesota DNR, 2010). Canada Lynx have brown or grey backs with grey or white bellies, long ear tufts, a pronounced goatee, and large furry feet.

Canada Lynx use a wide range of habitats within their extensive territories. Lynx use mature evergreen and hardwood forests with ample downed wood for denning sites and protection of cubs, and hunt in shrublands or young forests (Conservation Northwest, 2010). Their primary prey is the Snowshoe Hare, especially in the northern portions of their range in Alaska and Canada. Further south across the northern United States, lynx include small mammals and game birds in their diet (National Wildlife Federation, 2010). Snowshoe Hare are most abundant in young forests and shrublands with dense understories that offer adequate protection from predators (Litvaitis, 2001). Population densities of Canada Lynx have been shown to cycle in response to Snowshoe Hare densities, especially in the northern portion of their range (Federal Register, 2009). Because of the strong connection between Canada Lynx population densities and Snowshoe Hare abundance, the US Fish and Wildlife Service recognize Snowshoe Hare habitat as a critical component of Canada Lynx habitat (Federal Register, 2009).

Canada Lynx are a Federally Threatened species, and SGCN in several northern states. Trapping in the 1900s severely affected lynx populations, and continued habitat fragmentation and alteration threaten existing populations. The large furry paws of Canada Lynx allow them to hunt in deep snows where they have an advantage over their competitors. However, increased traffic, trails and roads fragment the high country hunting grounds and improve the access of remote hunting grounds to Mountain Lion and Coyote (predators of Canada Lynx) and Bobcat (competitors with Canada Lynx) by creating packed snow pathways. Both protection of mature forests and creation of early successional habitats within these forests are the major recommendations for managing lynx populations (Federal Register, 2009; Conservation Northwest, 2010).

Gerald and Buff Corsi @ California Academy of Sciences



Eastern Spotted Skunk

Spilogale putorius

The Eastern Spotted Skunk is about 20 inches long and 2 pounds, with black and white marks throughout its medium length fur (Minnesota DNR, 2010). Spotted Skunks are smaller overall and more slender bodied than the more familiar Striped Skunk, *Mephitis mephitis*.

Throughout its range, the Eastern Spotted Skunk selects habitats with high vertical structural diversity (Lesmeister et al. 2008). Denning sites are commonly in areas of dense, shrubby vegetative cover in rock piles, crevices, downed wood, brush piles and in burrows of other animals (Nilz & Finck, 2008). The Eastern Spotted Skunk selects areas with increased vegetative cover for foraging, denning and rearing in areas that will provide thermal regulation and protective cover from predators (Lesmeister et al. 2008).

The Eastern Spotted Skunk was once common across many eastern states, but a region wide decline is observable from pelt harvest records in the early to mid 1900s (Gompper & Hackett, 2005). The most commonly cited reasons for decline of the Eastern Spotted Skunk include habitat change and pesticide use (Gompper & Hackett, 2005). Eastern Spotted Skunks currently receive protection from several states (Table 1). Management recommendations for the Eastern Spotted Skunk include maintaining young forests and shrublands though prescribed burning and timber management to provide a complex woody understory structure (Nilz & Finck, 2008).

Jon Katz

Elk

Cervus elaphus

Elk are large deer – cows typically weigh 500 lbs and bulls average 700 lbs (Rocky Mountain Elk Foundation RMEF, 2010). Elk are red to tawny throughout most of their torso, with darker manes and lighter rumps. Only males have antlers.

Elk have the ability to adapt to a range of food and cover sources (RMEF, 2010). Primarily they graze in open, early successional habitats such as grasslands, forest openings, shrublands, and young forests in a matrix with dense, mature forests (Minnesota Department of Natural Resources (DNR), 2010). Primary forage for Elk consists of grasses and forbs, but they commonly browse woody plants, especially willows (*Salix* spp.) and aspen (Populus spp.). Typically, Elk forage during warmer months in habitats with a light canopy and a dense shrub or herbaceous layer (Irwin & Peek, 1983). During winter, Elk use more mature forests for thermal protection and cover.

Once widespread throughout much of their range, Elk are currently listed as a SGCN in several states across their range (Table 1). Decline in Elk populations has occurred primarily from excessive hunting in the 1800s, but also extensive habitat loss and alteration. Development has fragmented large patches of young forest and shrubland habitat in the eastern United States. Additionally, many of the young forest habitats that Elk use for foraging have matured into dense forests with limited foraging substrate such as young woody plants. Elk respond well to habitat management plans that increase the amount of early successional habitat. Such practices include prescribed burns, brush shearing, and selective timber harvesting (Minnesota DNR, 2010).

Golden Mouse

Ochrotomys nuttalli

The Golden Mouse is a small mouse with golden cinnamon fur, a white belly and white feet. The highly arboreal Golden Mouse has a semi-prehensile tail that helps it climb trees and vines.

Throughout their range, Golden Mice are found in forests or woodlands with a dense, woody understory (Wagner et al. 2000; Morzillo et al. 2003; Linzey & Brecht, 2005). Typically, they occupy moist areas, such as lowland forests or streamside thickets. Golden Mice select habitats with thick vegetation and extensive vine cover in disturbed or young forests (Wagner et al. 2000). A variety of understory shrubs and vines provide seeds and cover during foraging as well as nesting substrates (Wagner et al. 2000; Morzillo et al. 2003).

The Golden Mouse is well distributed throughout its range, yet tends to form small populations. It is a protected species in the states at the periphery of its range. Studies of golden mice suggest that creating early successional habitat could increase population densities, since the mice appear to decline as forests mature (Morzillo et al. 2003; Linzey & Brecht 2005). The Golden Mouse is arboreal and uses trees, therefore smaller forest cuts are recommended over clearcuts (Wagner et al. 2000).

James Parnell

Moose

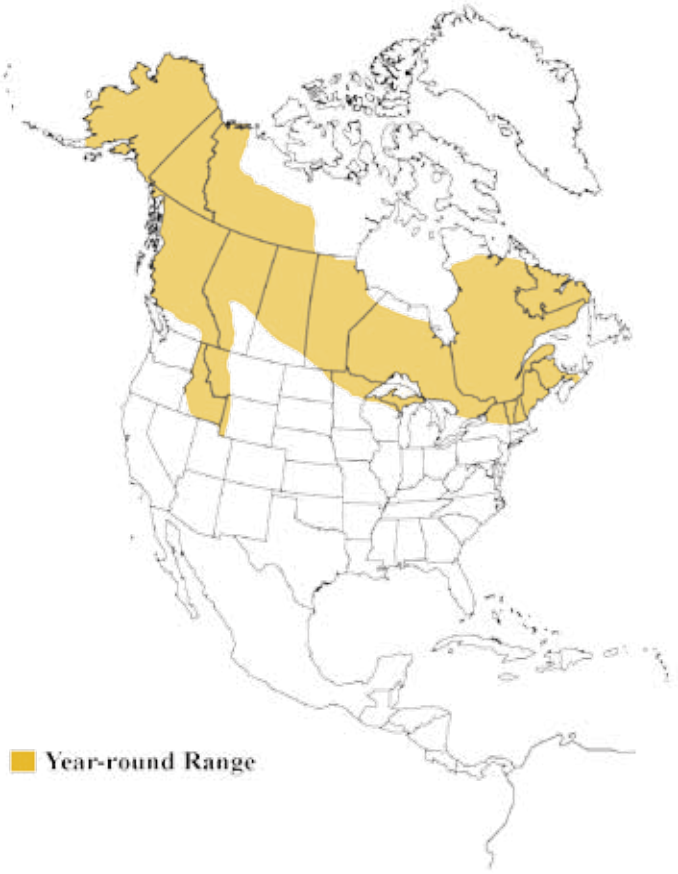
Alces alces

Moose are the largest member of the deer family and the tallest mammals in North America. Moose have several distinctive features. Covered in thick brown fur, Moose have long legs and a heavy torso with powerful shoulders that create a humpbacked appearance. They have long heads with a large upper lip and nostrils and small ears, and a dewlap that hangs from the throat. Males grow large, flat antlers each summer that fall off once mating season ends in late fall.

As large animals, Moose home ranges are vast and cover a variety of habitat types in order to meet their resource needs. Throughout their range, Moose are associated with densely forested areas with varying patches of successional stages near water (Alaska Department of Fish and Game (ADF&G), 1998; Smith et al. 2003; Dussault et al. 2005). Moose require mature, closed canopy forests for protection and cover in winter and younger successional stages for browsing (Smith et al. 2003; Dussault et al. 2005). Moose home ranges include a variety of habitat types that allow them to balance foraging needs with protection from harsh weather and predation of Moose calves from wolves and bears, along with maneuverability through deep snow (Schwartz & Franzmann 1991; Dussault et al. 2005). Many studies have found browsing opportunities to be the most important habitat feature influencing Moose movements (Collins & Helm 1997; Smith et al. 2003). Ideal Moose foraging habitat is young trees or shrubs regenerating in small canopy gaps of mature forests or along forest edges (Smith et al. 2003; Dussault et al. 2005). These areas allow Moose to forage in openings close to protective cover.

Moose are considered stable across their range, though they are a SGCN in a few states (Table 1). Moose populations decreased with European settlement and clearing of forests, spread of deer populations and associated parasites, and hunting. Studies suggest that Moose populations should respond to management practices such as group cuts and clearcuts that create early successional browsing patches in forests (Schwartz & Franzmann 1991; Collins & Helm 1997; Dussault et al. 2005; Stephenson et al. 2006).

Gerald and Buff Corsi @ California Academy of Sciences



New England Cottontail

Sylvilagus transitionalis

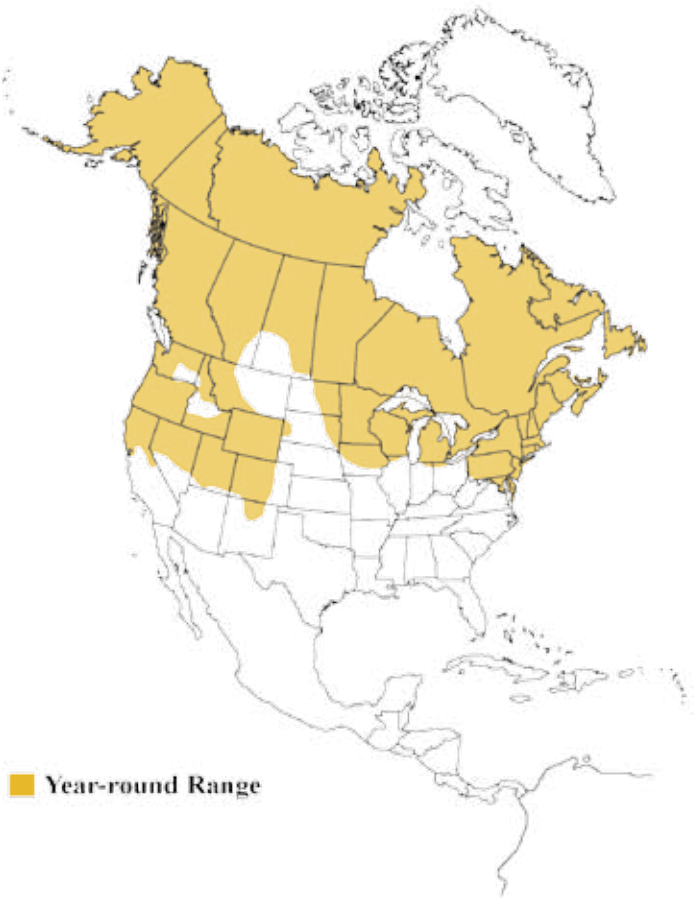
The New England Cottontail is a medium sized rabbit about 2.2 to 3 pounds and 15 to 17 inches (Arbuthnot, 2008). These cottontails have a buffy coat of fur that is black at the tips. The inside of the ears are lined with black fur, and most have a black patch between the ears. Unlike Snowshoe Hares, New England Cottontails remain brown throughout the winter.

New England Cottontails exclusively inhabit early successional vegetation including shrub thickets and young, regenerating forest (USFWS, 2007; Arbuthnot, 2008). The dense vegetation structure is more important to New England Cottontails during habitat selection than the plant species composition, though a variety of native plants is necessary to provide the best food and cover (Arbuthnot, 2008). New England Cottontails are heavily predated by foxes, coyotes, Bobcats, fishers, domestic cats and owls, and must have large patches of dense protective vegetative cover (Arbuthnot, 2008). The rabbits rarely venture far from protective cover for foraging (USFWS, 2007). During the winter, habitats with evergreen species are particularly important because they provide much greater cover than deciduous species that lose their leaves (USFWS, 2007).

The range of the New England Cottontail has greatly decreased over the past several decades, and overall rabbit populations are shrinking (USFWS, 2007). The New England Cottontail is a Candidate Species for Federal Protection, and is protected in several states throughout its range (Table 1). Loss of habitat to development has negatively affected the New England Cottontail. Additionally, much of the young, dense vegetation of the northeast continues to mature beyond the stage that provides cottontail habitat (Litvaitis, 2001). Management for this species requires continued maintenance of early successional habitats, through harvesting or prescribed burns, emphasizing management on private lands that support rabbit populations (USFWS, 2007).

Linda Cullivan

Gerald and Buff Corsi @ California Academy of Sciences



Short-tailed Weasel or Ermine

Mustela erminea

The Short-tailed Weasel is between 7 to 13 inches in length, with a tail that can be up to a third of the body length. Males can be twice the size of females. During the summer, Short-tailed Weasels are medium brown above and buffy white below. The coat changes to solid white by winter, though the tip of the tail remains black year-round.

Short-tailed Weasels must consume sufficient prey to keep up with their fast metabolisms. Their home ranges focus on habitats with dense populations of small vertebrates, particularly rodents. Short-tailed Weasel habitat can range from grasslands to woodlands, though they are most common in open canopy areas with dense understory cover, such as forest clearings or edges (Mowat & Poole, 2005; Vermont Fish and Wildlife (VT F&W), 2010). Male Short-tailed Weasels are likely to use older, cone-producing forests that attract squirrels, but females are typically too small to easily kill squirrels and search for smaller prey in open areas (Lisgo, 1999). Often Short-tailed Weasels live near water, possibly because these areas attract sufficient prey. Weasels build their dens underground in used animal burrows, in fallen logs, or under thick woody cover.

Short-tailed Weasels can adapt to multiple habitats with an adequate prey supply, but they likely suffer from habitat loss. Studies have shown these weasels are more abundant in forest clearings or thinned forests than in closed, mature forests (Wilson & Carey, 1996; Hansson, 1994). Therefore, forest management practices that increase early successional vegetation within or adjacent to forests could be used to create additional Short-tailed Weasel habitat.

Snowshoe Hare

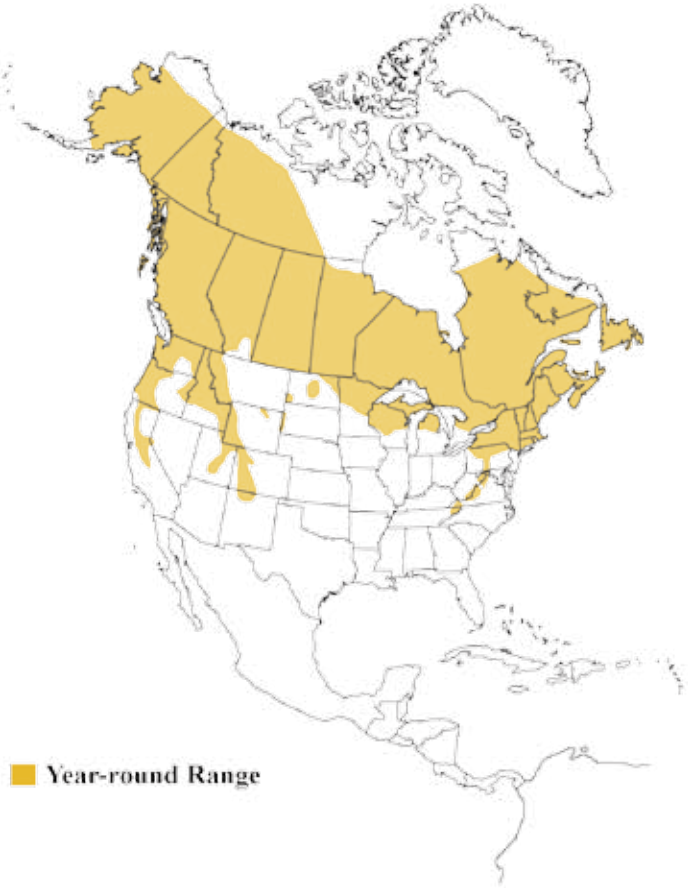
Lepus americanus

The Snowshoe Hare is a medium sized rabbit with large, fur covered hind feet that act like snowshoes to help the hare travel across snow. During the spring and summer, Snowshoe Hares are a rusty, grey brown, but during the fall they begin to develop their white winter coat. The full white pelage takes about 10 weeks to form.

Snowshoe Hares can be found in a variety of habitats throughout their range, occupying both moist, lowland areas and high elevation boreal forests (Wise, 1986; US Fish and Wildlife (USFWS), 1985). Snowshoe Hare habitat consistently includes early successional vegetation, primarily a well-developed woody understory and open fields of herbaceous vegetation (USFWS, 1985; Litvaitis, 2001). Early successional vegetation provides both protective cover and foraging material for Snowshoe Hares (Litvaitis et al. 1985; USFWS, 1985; Koehler & Brittel 1990). While summer foraging needs can be met with herbaceous vegetation and shrubs, during the winter Snowshoe Hares must forage on taller shrubs and young trees that are not covered by snow (Koehler & Brittel, 1990). Young conifer stands are frequently used during the winter because of the dense thermal cover they provide (USFWS, 1985; Wise, 1986; Koehler & Brittel, 1990). Snowshoe Hares seek out dense thickets for protection from predators. In fact, protective cover is typically the most important feature of Snowshoe Hare habitat, as the hares will go without food during intense predation pressure (Koehler & Brittel, 1990).

Snowshoe Hares are common throughout most of their range, but in a handful of states, Snowshoe Hares receive special status (Table 1). In the northern part of their range, Snowshoe Hares exhibit extreme population cycles, while southern populations are more stable (Wolff, 1980). Snowshoe Hares benefit from management practices such as clearcuts and group selection cuts. The best Snowshoe Hare habitat management plans create a matrix of regenerating vegetation patches within large forests (USFWS, 1985; Wise, 1986; Koehler & Brittel, 1990).

Mike Hodgson



Southern Red-backed Vole

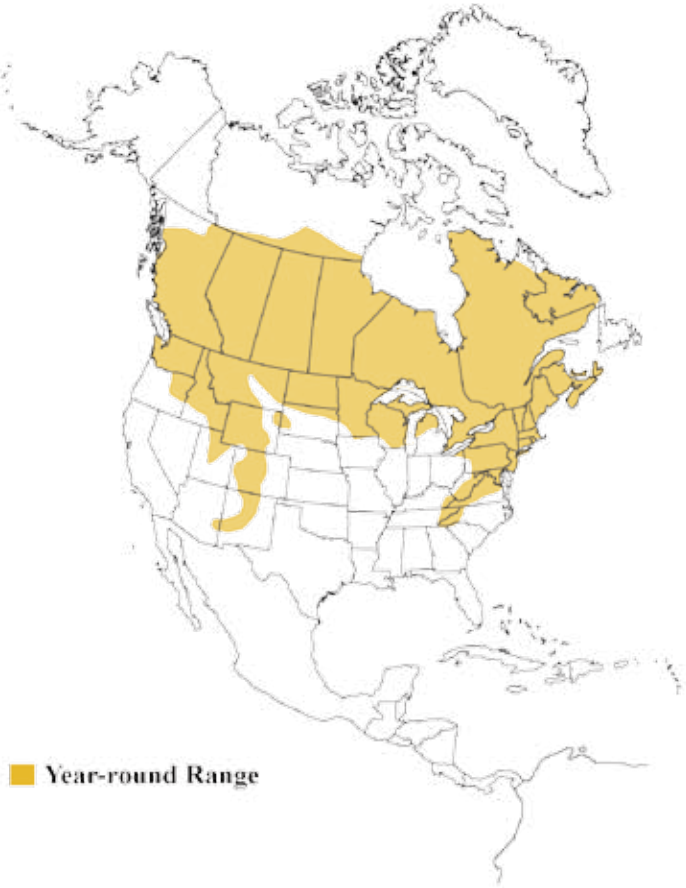
Clethrionomys gapperi

The Southern Red-backed Vole is a slender vole with large, round ears. These voles can be separated from similar species by a reddish stripe extending down the back from head to tail, grey sides and white to grey undersides. (Nature Works, 2010).

Southern Red-backed Voles are found in both open and closed canopy coniferous and mixed forests throughout their range. They are frequently associated with moist habitats, rocky areas, and habitats rich with moss and fungi (Smithsonian National Museum of Natural History, 2010; Nature Works, 2010). Southern Red-backed Voles require cover for nesting and protection from predators. They nest and seek cover under woody or herbaceous vegetation and within rotten logs and other woody debris. Western populations tend to be associated with mature coniferous forests with abundant fallen logs and ectomycorrhizal fungi (Allen, 1983, Keinath & Hayward, 2003). However, studies of eastern populations indicate a preference for habitats with dense shrubs and herbaceous vegetation (Allen, 1983). In the eastern United States, Southern Red-backed Voles are commonly associated with habitats that have a well-developed woody understory (Healy & Brooks, 1988; Nordyke & Buskirk 1991; DeGraaf et al. 2006). The habitat structure these eastern populations prefer is found in forest openings and in seedling to sapling aged forests (Healy & Brooks, 1988; Menzel et al. 1999; DeGraaf et al. 2006).

Southern Red-backed Voles are common throughout much of their range, however they are SGCN in Connecticut, Ohio and Michigan. Studies of small mammal response to clearcuts have shown an increase in vole abundance within regenerating vegetation, especially in small to intermediate cuts (Healy & Brooks, 1988; Hayward et al. 1999; Menzel et al. 1999). In the eastern United States, Southern Red-backed Voles respond better to forest harvests than western species, possibly because the eastern populations are less dependent on fungi, which do not fruit until trees reach the pole-sapling stage (Allen, 1983).

Phil Myers



Swamp Rabbit

Sylvilagus aquaticus

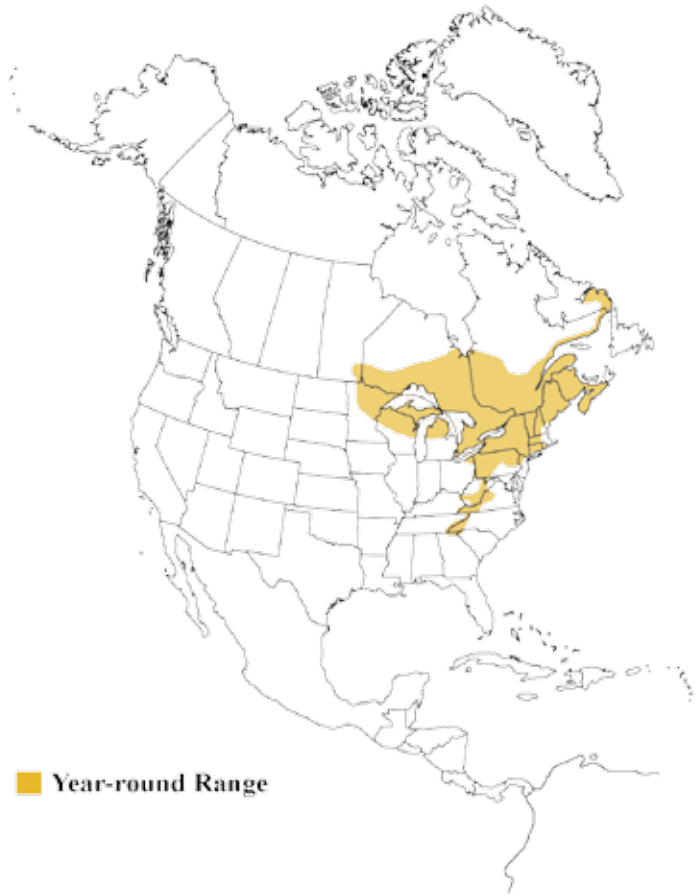
The Swamp Rabbit is a large cottontail and excellent swimmer. Adults have short, coarse fur that is brownish gray mottled with black. The belly and underside of the tail is buffy white, and the feet are rust colored.

Swamp Rabbits are found in bottomland hardwood forests throughout their range, occupying both the floodplains and upland forests (Scharine et al. 2009). Swamp Rabbits prefer early successional, dense woody understory vegetation under canopy gaps, and closed canopy forests with an open understory and significant downed woody debris (Zollner et al. 2000; Scharine et al. 2009). While the rabbits forage in multiple vegetation structures, they take cover from predators and inclement weather such as flooding under dense woody thickets, shrubs and saplings found under canopy gaps (Zollner et al. 2000). Closed canopy forests are also important habitat types, because Swamp Rabbits deposit fecal pellets on top of downed logs in moist, shaded forests, and these fecal deposition sites are a form of communication among the rabbits (Terrel et al. 1972; Zollner et al. 2000).

Swamp Rabbits were once considered common throughout their range, but now appear to be declining, especially along the periphery of their range (Scharine et al. 2009). Swamp Rabbits may be sensitive to habitat fragmentation, and they face extensive loss of wetland forest habitat (Terrel et al. 1972). They also lose habitat when early successional habitats mature into closed canopy forests (Scharine et al. 2009). Wildlife biologists have recommended forest management practices that create canopy gaps within mature forests to enhance Swamp Rabbit habitat (Zollner et al. 2000; Scharine et al. 2009).

Dave Welling

Michael Patrikeev/Wild Nature Images



Woodland Jumping Mouse

Napaeozapus insignis

The Woodland Jumping Mouse is a medium sized mouse with a large hind limbs and a long, white-tipped tail. The mice have a dark streak of fur down the middle of the light brown back and buffy orange fur along the sides. They are creamy white underneath. When startled, the Woodland Jumping Mouse can leap 3 to 6 feet.

Throughout their range, Woodland Jumping Mice are found in mixed, moist forests at high elevations (Kirkland & Griffin 1974; Saunders, 1988; DeGraaf et al. 1991). Woodland Jumping Mice are most often associated with a dense woody understory and thick herbaceous cover (Kirkland & Griffin, 1974; DeGraaf et al. 1991). The mice may be common in deciduous forests or openings in coniferous forests, but are rarely found under the closed canopy of conifer forests where understory vegetation is minimal (Yamasaki et al. 1999). An abundance of thick woody vegetation, woody debris or rock piles are also important features the mice use to build well-hidden nests (Saunders, 1988; Brannon, 2005).

Woodland Jumping Mice populations are considered stable across their range, but local, small populations have caused a couple states to list the mice as SGCN (Table 1). Loss of habitat is probably the biggest threat to Woodland Jumping Mice populations. In the eastern United States, Woodland Jumping Mice have responded positively to clearcuts that promote growth of early successional vegetation (Harlow et al. 1997).

Shrubland and Young Forest Reptiles

Eastern Box Turtle

Terapene carolina carolina

The Eastern Box Turtle is the most common terrestrial turtle in the Eastern United States. Individuals have a highly variable shell shape, pattern and coloration. In general, these turtles have a high, dome-shaped carapace and are dark brown to olive in color with bright orange or yellow patterns. Eastern Box Turtles can be very long lived, frequently documented to be 50 years old.

Eastern Box Turtles need access to water, forests, and open areas with low-growing vegetation. They over-winter in forests buried under soil, leaf litter, woody debris or in old mammal burrows (Willey, 2010). During the spring, turtles move into open areas to bask in sunlight, preferring areas with dense patches of shrubby or herbaceous vegetation for protective cover and shade (Willey, 2010). The turtles forage and mate in open habitats such as forest edges, fields, power-line corridors and other early successional habitats (Willey, 2010). Eastern Box Turtles eat a variety of plant and animal matter, including fruiting shrubs and vines. Nesting females select open, sandy areas that receive direct sunlight, typically near the forest edge and with herbaceous or woody vegetation nearby the nest site (Kipp, 2003; Willey, 2010). Turtles either remain in shrubby vegetation throughout the Fall or return to the forest (Willey, 2010).

Populations of Eastern Box Turtles have declined significantly over the past several decades (Donaldson & Echternacht, 2005). Eastern Box Turtles are slow to reach sexual maturity and naturally experience high rates of nest failure, therefore population success is dependent on long term survival of adults (MA Division Fish & Wildlife, 2011). Because turtles require a mosaic of habitat

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types, many are killed by roads or increased threats from suburban environments as they travel to meet their resource needs (Iglay et al. 2007). Studies suggest that the presence of early successional habitats may benefit turtle populations, and that management plans should emphasize open areas with understory vegetation such as fruiting shrubs and herbaceous plants (Nazdrowicz et al. 2008; MA Division Fish & Wildlife, 2011).

Eastern Massasauga

Sistrurus catenatus catenatus

The Eastern Massasauga is a small, thick-bodied rattlesnake with large, dark blotches throughout the back and smaller brown blotches along the sides against a grayish background. This venomous snake has a triangular shaped head, vertical pupils, pits between the eyes and nostrils, and rattles at the tip of its tail.

The Eastern Massasauga utilizes a few key habitat types throughout its range. A common feature of Eastern Massasauga habitat is wetlands. During winter, the snakes hibernate in wetlands, in burrows or under thick vegetation (USFWS 1999). When not hibernating, Eastern Massasauga snakes move between moist lowlands and upland sites with early successional vegetation. They are typically more common in upland sites with a high density of herbaceous vegetation and a moderate to low density of shrubs, with very few trees. The openness of the lowland and upland sites allow plenty of places for the snakes to thermoregulate, and the presence of dense understory vegetation must be nearby for protective cover (USFWS 1999).

The Eastern Massasauga is a Federal Candidate Species and listed as a SGCN in every state of its range (Table 1). The loss and degradation of wetland habitats and maturation of early successional upland habitats are likely the biggest cause of Eastern Massasauga declines (Reinert & Buskar, 1993; Yahner, 2003). Fragmentation of wetland and upland habitats by roadways or developed areas are also detrimental to these snakes, because of their limited movements and home ranges (Bissell, 2006). There is some evidence that the Eastern Massasauga benefits from management activities that encourage early successional growth and reduce overstory canopy (Johnson & Breisch 1993; Reinert & Buskar, 1993). However, snakes are vulnerable to mowing and burning, unless these activities take place during winter hibernation.

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Five-lined Skink

Eumeces fasciatus

As its name implies, the Five-lined Skink has five, cream-colored lines extending the length of its greenish black body. Juveniles have bright blue tail tips that eventually fade to bronze with age.

Five-lined Skinks use both closed and open canopy habitats, often found along edges between dense forests and shrubby or herbaceous fields (Vanwormer, 2002). Rocks and woody debris are important habitat characteristics for Five-lined Skinks across their range (Clawson et al. 1984; Quirt et al. 2006). These structures are used for protective cover, and the skinks spend the majority of their time seeking refuge (Hecnar & M'Closkey, 1998). Another consistent structural feature of skink habitats is the presence of dense understory cover, such as shrubs and especially forbs (Clawson et al. 1984). Five-lined Skinks require openings in forest canopies where this dense vegetation can form. These skinks are also frequently found in disturbed areas that have been burned or logged (Vanwormer, 2002).

Five-lined Skinks are broadly distributed and common in parts of their range, but rare or declining in many states. Habitat loss or degradation is a major cause of population declines, along with predation and collection for pet trade (Hecnar and M'Closkey, 1998). Because Five-lined Skinks are abundant in areas following burning or logging disturbances, they would likely respond to the use of forest management practices that encourage a variety of successional stages (Vanwormer, 2002).

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North American Racer

Coluber constrictor

There are 11 subspecies of North American Racer, and three - Northern Black Racer, Blue Racer, and Yellow-bellied Racer - are SGCN in the Eastern United States (Table 1, page 3). All racers are fast moving, non-venomous diurnal snakes. Most subspecies are solid colored above and all have light coloration along the belly.

North American Racers are mostly terrestrial snakes that prefer a variety of open habitats throughout their range. Open, sunny areas allow racers to thermoregulate. Depending on the region and season, they may be more likely to use either grasslands or shrublands, but typically they are found in habitats with little overstory canopy cover and plenty of woody and herbaceous understory cover (Hastings, 2002; Minnesota DNR, 2010; Michigan Department Natural Resources and Environment (DNRE), 2010; Keller & Heske, 2000). Racers are found in a variety of early successional habitats, occupying old fields, shrublands and young forests (Goulet & Marchand, 2005). They use edge habitats such as the borders of forests and shrublands or old fields. Racers are also associated with disturbed areas such as clearcuts or burned areas, where vegetation is regenerating (Goulet & Marchand, 2005).

Racers are large snakes that require large patches of habitat (Kjoss and Litvaitis, 2001). Though common in much of their range, Racers are declining in the northeast and Midwest (Goulet & Marchand, 2005; Michigan DNRE, 2010). In the northeast there has been significant loss of early successional habitats, both from residential development and forest maturation (Kjoss and Litvaitis, 2001). Fragmentation, especially by roads, negatively affects racer populations because of their preference for large habitat patches and increased road mortality. Management recommendations for racers encourage restoration and maintenance of early successional habitats with a focus on connectivity and size of patches (Kjoss and Litvaitis, 2001).

North American Rat Snake

Pantherophis spp.

The North American Rat Snake is a long, powerful constrictor reaching up to 6 feet in length. Adults are mostly black or brown with white, yellow or red in between the scales. The undersides are mostly white with dark blotches. The Rat Snakes were recently moved from the genus *Elaphe* to *Pantherophis* and split into four separate species (Utiger et al. 2002; Burbrink and Lawson 2007; Figure 1).

North American Rat Snakes use a mosaic of forest, woodland and open field habitats (Weatherhead & Charland, 1985). They forage in trees and on the ground for small mammals in forest edges, open woodlands, herbaceous and shrubby habitats, and use forest interiors for refuge (Durner & Gates, 1993). Gravid females spend more time in habitats with low overstory canopy cover, most likely because of the availability of basking sites for thermoregulation (Blouin-Demers & Weatherhead, 2001).

Throughout their wide range, Rat Snakes are declining in many states. Populations are threatened by habitat alteration, collection for pet trade, roads, and increasing homogeneity of habitats from clearing or maturation of abandoned fields (Blouin-Demers & Weatherhead, 2001). The best land management practices for improving Rat Snake habitat are those that create a mosaic of forested and open habitats (Weatherhead & Charland, 1985).

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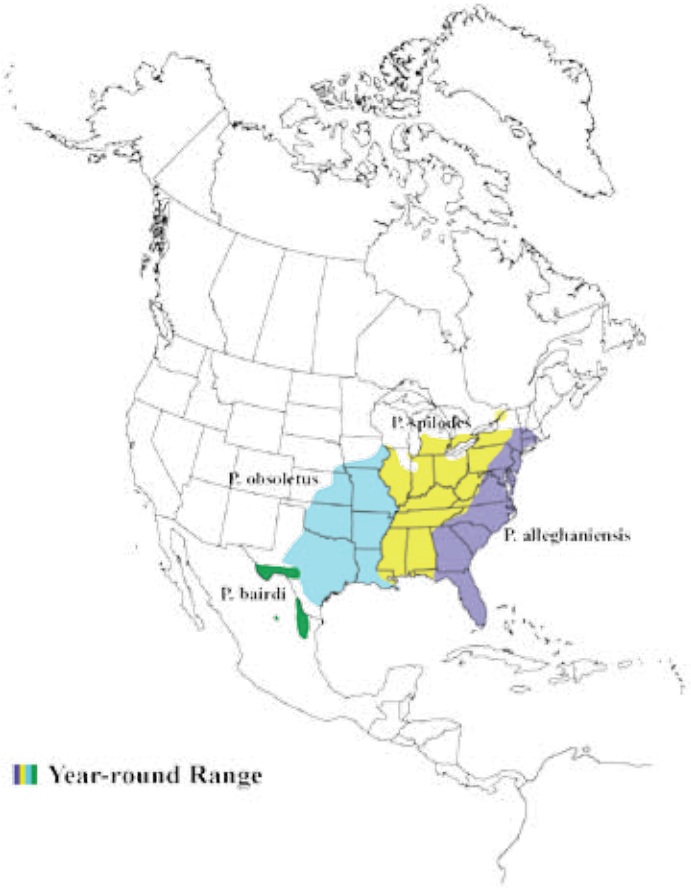

Rough Green Snake

Opheodrys aestivus

The Rough Green Snake is a long and slender snake, well adapted to its arboreal habits. These snakes are bright green with yellow or white bellies. Their scales have a central keel, which separate them from the closely related Smooth Green Snake.

Rough Green Snakes are most common along the edges of streams, wetlands, or forests in dense vegetation (Plummer, 1981; Plummer, 1997). Rough Green Snakes are usually found within a few meters from the water in riparian thickets (Plummer, 1981; Plummer, 1997). They prefer a microhabitat of dense shrubs or small trees, with a highly branched structure (Plummer, 1981). Rough Green Snakes spend most of their time moving through woody branches, and are rarely seen moving along the ground (Plummer, 1997). Rough Green Snakes avoid open areas and stands of single trunked, large trees (Plummer, 1981; Plummer, 1997).

Rough Green Snakes are secretive and difficult to observe, but believed to be common throughout much of their range. Their populations appear to be declining throughout their range, and are SGCN in several states (Table 1). Both wetland and riparian habitat loss and fragmentation are threats to Rough Green Snake populations. Protected wetland and riparian systems that retain a natural hydrologic regime should be able to maintain the dense, woody understory vegetation structure preferred by Rough Green Snakes.

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Smooth Green Snake

Opheodrys vernalis

The Smooth Green Snake is a beautiful and brightly colored small snake with a long and streamlined tail. It is a brilliant, grass-green snake with a yellow to cream colored belly and no additional markings. The scales are smooth. Smooth Green Snakes are accomplished climbers and while active during the day, they remain well concealed.

Smooth Green Snakes are sometimes called grass snakes, and they are typically found in moist, lush habitats with plenty of green herbaceous cover and access to direct sunlight (Redder et al. 2006; UMassAmherst, 2011). Their preferred habitats are often high elevation and include old fields, wet meadows, shrub swamps, open woodlands and clearings in forests (Minnesota DNR, 2010; HerpNet.net, 2011; UMassAmherst, 2011). Smooth Green Snakes forage primarily for arthropods by moving through tall grass and small shrubs (HerpNet.net, 2011). Though less arboreal than Rough Green Snakes, Smooth Green Snakes climb into shrubs, especially in very wet habitats (Virginia DGIF, 2010; INHS, 2011). Eggs are placed under woody debris, rocks, or clumps of vegetation (HerpNet.net, 2011). The snakes overwinter underground in animal burrows, under rock crevices and sometimes in ant mounds (Minnesota DNR, 2010). While travelling from denning sites to nesting habitats, riparian corridors are especially important habitats that provide thick vegetative cover (Redder et al. 2006).

The Smooth Green Snake is not a well-studied species, but local accounts indicate that populations are declining and increasingly limited to isolated, higher elevation habitats (Mitchell, 2006; Redder et al. 2006). Loss of wetland habitats and fragmentation by roads are major reasons for their decline (Redder et al. 2006; INHS, 2011). Due to their dietary dependence on insects, extended use of pesticides have also likely reduced snake populations (HerpNet.net, 2011). The most important conservation action for these snakes is protection of existing habitats and creation of vegetated corridors to connect isolated snake populations (Redder et al. 2006). Management recommendations for this species in some portions of their range stress maintenance of grasslands through burning, while others encourage growth of shrubby vegetation (Mitchell, 2006; Redder et al. 2006).

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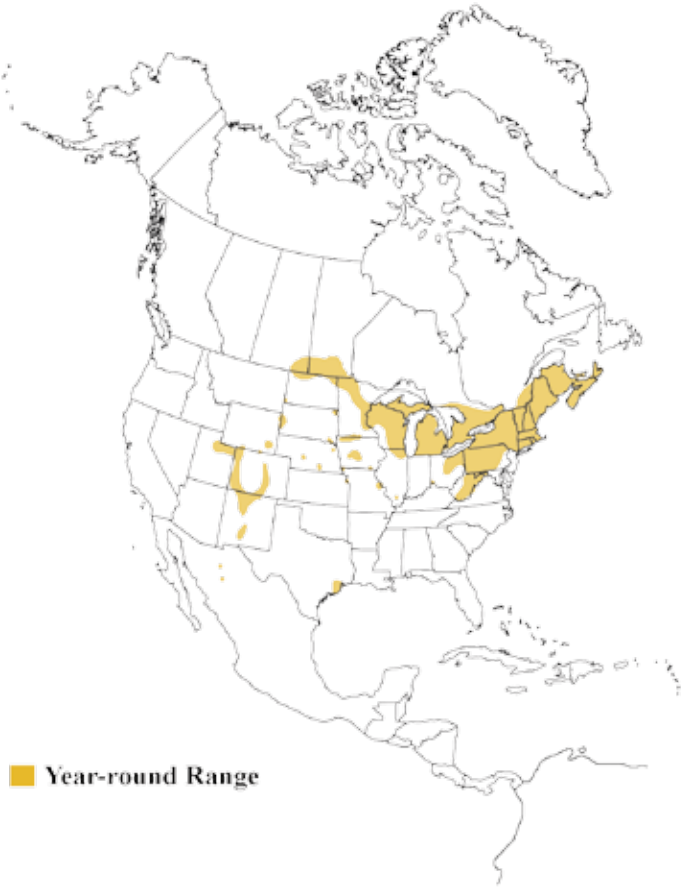

Spotted Turtle

Clemmys guttata

The Spotted Turtle is a small, black turtle with yellow or orange spots marking its smooth carapace. The number of spots is variable and changes with age; hatchlings typically have one spot per plate, while adults may have more than 100. Yellow or orange markings also cover the turtle's dark head, neck and limbs. Though the Spotted Turtle is considered a semi-aquatic turtle, it spends considerable time on land.

Spotted Turtles require both wetland and upland terrestrial habitats throughout the year. They have been found using a variety of wetland habitats: marshes, bogs, shrub swamps, forested wetlands, and seasonal ponds, and terrestrial uplands: open fields, woodlands, forests, and edges or ecotones (Milam & Melvin, 2001; Center for Reptile and Amphibian Management, 2011). Spotted Turtles hibernate during the winter in wetland habitats under the cover of dense clumps of herbaceous vegetation or within cavities created by the roots of trees or shrubs (Ward et al. 1976; Milam & Melvin, 2001; Litzgus & Mousseau, 2004). In early Spring, the turtles emerge and travel extensively through wetland and upland habitats where they seek burrowing sites often within dense understory vegetation (Ward et al. 1976; Milam & Melvin, 2001; Litzgus & Mousseau, 2004). Spotted Turtles return often to bodies of water to avoid desiccation, though it is thought they occasionally remain in dry, open sites to purge their shells of leeches and fungus (Milam & Melvin, 2001). The turtles seem to forage for food exclusively in water (Center for Reptile and Amphibian Management, 2011). Females select nest-sites in warm, open areas such as old fields and recent forest clearings (Litzgus & Mousseau, 2004; Center for Reptile and Amphibian Management, 2011). The upland sites used by turtles during the Spring, Summer and Fall typically contain a well-developed understory of herbaceous and woody shrubs and vines (Litzgus & Mousseau, 2004).

The Spotted Turtle is declining throughout the Eastern United States and receives protection from most states within its range (Joyal et al. 2002; Litzgus & Mousseau, 2004). Loss of wetland habitats is believed to be the biggest threat to these turtles, especially because wetland protection rarely includes a large enough terrestrial border to encompass the full range of their habitat requirements (Joyal et al. 2002; Center for Reptile and Amphibian Management, 2011). Protecting wetlands with a generous upland buffer could be the most significant conservation action for Spotted Turtles.

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Timber Rattlesnake

Crotalus horridus

The Timber Rattlesnake is a large and stocky snake between 3 and 4.5 feet long with a broad, triangular head. These venomous snakes are typically unaggressive and secretive, remaining well hidden with their cryptic coloration. Two color phases are common; the yellow phase snakes have dark crossbands against a light background, and dark phase snakes have dark crossbands against a dark background.

Timber Rattlesnakes are deciduous or mixed forest species that require large patches of mature forest with adequate openings in the canopy (Fitch, 2006; Rittenhouse et al. 2007). Gravid females seek more open areas because of the exposed basking opportunities (Reinert, 1984). These basking sites are typically near protective cover such as patches of dense vegetation and fallen woody debris (Reinert & Zappalorti, 1988). Thick understory vegetation is an important habitat component in both closed and open canopy areas (Reinert & Zappalorti, 1988). Timber Rattlesnakes primarily eat small mammals, and will forage for small mammals in both closed and open canopy forests. Rocky hillsides with southern exposure and low, dense vegetation are used as winter denning locations (Brown, 1993).

Timber Rattlesnakes were once common throughout their range, but now are protected species in many states, existing in small, isolated populations. The major threats to these snakes are game and commercial hunting or persecution from fear, as well as habitat loss and fragmentation (Brown, 1993). Timber Rattlesnakes may decline in mature forests where canopy closure has increased (Fitch, 2006). Canopy openings created by harvest techniques could improve Timber Rattlesnake habitat by creating foraging opportunities and basking locations for gravid females.

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Wood Turtle

Glyptemys insculpta

Adult Wood Turtles are between 5 to 8 inches long, and males are larger than females. The shell has a rough appearance, a rich brown color and yellow or orange undertones. The skin of the Wood Turtles is mostly brown, but becomes bright yellow or orange along the limbs and neck close to the shell.

Wood Turtles require a range of habitats in deciduous or mixed forests throughout the year. Wood Turtles are sometimes described as riparian forest generalists because of the multiple habitat types they can be found using (Compton et al. 2002). However, each habitat type they use provides a necessary resource. They overwinter in slow moving, medium sized streams with sandy bottoms and densely vegetated banks (Compton et al. 2002). In the spring and summer, they nest on open sandy banks or gravel bars (Compton et al. 2002). Wood Turtles forage in both closed and open canopy sections of forest, to obtain the fruits, earthworms, insects, carrion and fungi that comprise their diets (Compton et al. 2002). Openings or gaps in the canopy with patches of dense, low vegetation are important for Wood Turtles because they must have basking areas for thermoregulation near protective cover (Kaufmann, 1992).

The Wood Turtle is one of the most endangered freshwater turtles in North America. Degradation and loss of riparian forests are major threats to populations (Kaufmann, 1992). Roads between habitat mosaics used by Wood Turtles are a significant source of mortality (Gibbs & Shriver, 2002). Forestry practices can improve Wood Turtle habitat by creating canopy openings with dense shrub growth that provides both foraging and basking sites (Kaufmann, 1992). However, heavy forestry equipment can cause direct mortality unless the clearing can take place when Wood Turtles are overwintering (Gibbs & Shriver, 2002).

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Aspen patch./Charles Fergus

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Yellow-billed Cuckoo/Jonathan Mays