

Missouri Forestry for the Birds



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Birds need our help, and you can make important contributions to their conservation. In this publication, we describe bird species of conservation concern in Missouri and explain how forestry practices can be used to benefit birds. The guidelines presented here can be applied whether your primary objective is to create habitat for bird species of concern, or to manage forests for forest products while incorporating bird conservation as a complementary objective. We present practices that support both bird conservation and the long-term sustainability and productivity of forest resources.

The conservation community, including private landowners and the general public, can make a meaningful difference for birds at both large and small scales. Thoughtful habitat management, combined with the resiliency and adaptability of many bird species, provide the opportunity to achieve significant habitat improvements within as little as a decade or two. Missouri has a strong network of bird conservation partnerships with a proven track record of cooperation and successful project implementation, including the organizations that cooperated to develop this guide.

Missouri's birds play important roles in ecological communities, the economy, human health and enjoyment. Many birds, like warblers, flycatchers and nightjars, eat insects that can damage crops and forests. Species like blue jays and sparrows help spread seeds, aiding forest regeneration. Others, like hummingbirds, contribute to pollinating plants. Woodpeckers excavate cavities in trees for nesting or roosting, and these cavities benefit an array of wildlife when the original owner is done with them. Birds are also valuable indicators of environmental health. Changes in bird populations often reflect broader shifts in habitat quality, pollution levels, or climate conditions. Birdwatching is popular throughout Missouri, especially during migration seasons, and supports local economies through travel, lodging, and gear sales. Nationwide, 96.3 million people watch birds around their home or on trips, generating nearly 100 billion dollars in economic benefits. Game birds like bobwhite quail are central to Missouri's hunting traditions and generate revenue for conservation

through license sales. Birds are also used in environmental education programs across Missouri, helping people of all ages connect with nature.

Despite their importance, birds in Missouri and across the United States are in peril. North America has lost approximately 30 percent of its bird population over the past 50 years. This decline is driven by multiple factors, including habitat loss and fragmentation, large-scale land-use changes, widespread pesticide use that reduces insect prey, and a lack of appropriate land management practices. Together, these threats pose significant challenges to the long-term viability and health of resident and migratory birds not only in Missouri, but across the full annual ranges of species, sometimes at the hemispheric scale.

The outlook for birds is not hopeless. Conservation actions can be effective, particularly when they are intentional, science-based, and implemented at meaningful scales. Forestry practices that consider the needs of birds can play a key role in reversing declines while still meeting management objectives. The following sections provide practical guidance for managing forests in ways that support birds most in need of conservation.

Scope of Missouri Forestry for the Birds

Focal Bird Species

Around 350 species of birds can be seen in Missouri. We focus on 21 focal bird species that are among those in greatest need of conservation in Missouri and responsive to forest management (Table 1). These species were identified by a committee of experts based on their population trend, abundance, distribution, and threats on the breeding grounds and results reported in the [Missouri Bird Conservation Plan](#). Species were assigned a Missouri Conservation Concern Score ranging from 5 to 25; higher numbers indicate greater conservation need (Table 1). It's notable that all but one of these species have large declines in abundance since 1966 based on the North American Breeding Bird Survey (Table 1). Many are

Table 1.

Focal species that benefit from forestry practices, their Missouri Conservation Concern Score, and their percent change in abundance from 1966-2024 in the Central Hardwoods Bird Conservation Region and in North America. Table modified from Missouri Bird Conservation Plan (Missouri Department of Conservation 2019).

Natural Community	Common Name	MO Concern Score ¹	Percent change in abundance 1966-2024 ²	
			Central Hardwoods Region	North America
Savanna, open woodland, young forest, shrubland	Northern Bobwhite	16	-89*	-81*
	Red-headed Woodpecker	17	-16	-45*
	Brown Thrasher	15	-46*	-46*
	Field Sparrow	17	-77*	-75*
	Eastern Towhee	15	-48*	-60*
	Yellow-breasted Chat	13	-57*	-37*
	Blue-winged Warbler	15	-27	-35*
	Prairie Warbler	18	-54*	-67*
Woodland	Yellow-billed Cuckoo	16	-59*	-38*
	Chuck-will's-widow	16	-52*	-58*
	Eastern Whip-poor-will	18	-73*	-67*
	Brown-headed Nuthatch			-15
	Eastern Wood-Pewee	14	-28*	-38*
	Orchard Oriole	13	-55*	-44*
Forest	Ruffed Grouse			4
	Wild Turkey			
	Wood Thrush	14	2	-46*
	Worm-eating Warbler	15	1	-3
	Prothonotary Warbler	13	51	-26*
	Kentucky Warbler	15	6	-30*
	Cerulean Warbler	18	-66*	-69*

1 Species were assigned a Missouri Concern Score ranging 5-25 in the Missouri Bird Conservation Plan; higher numbers indicate greater conservation need.

2 We calculated the total percent change in abundance from 1966-2024 based on percent annual change values reported by the North American Breeding Bird Survey (Hostetler et al. 2025).

* Indicates change values with 95% credible intervals for the percent annual change that do not overlap zero and are considered statistically significant.

Neotropical migrants that breed in Missouri but winter in Mexico, Central America, South America, or the Caribbean. Northern Bobwhite are included because of their precipitous declines and, while primarily a grassland-shrubland species, they are also very responsive to savanna and woodland

management. We also include the Wild Turkey, because it is a great conservation success story, can benefit from forestry practices, and is of interest to many landowners. Ruffed Grouse and Brown-headed Nuthatch are included as special circumstance species due to ongoing efforts to re-establish or

sustain populations of these species in Missouri by bringing birds here from other states, and their success will depend on active forest management. Most landowners should not expect to see these species because of their very limited distribution.

Ecoregions and Habitats

Our focus is on 21 bird species in Missouri. However, these species' ranges do not stop at Missouri state lines, nor do the ecosystems or vegetation communities they use or threats they face. We focus on upland oak and pine-oak communities that are

abundant in the Central Hardwoods Region of Missouri (Figure 1), but these communities extend into the agricultural landscapes of northern Missouri and throughout the Central Hardwoods Region and much of the deciduous forest across the eastern United States. Birds typically respond more strongly to vegetation structure than to specific species of vegetation. While written specifically for Missouri, these guidelines can be applied more generally wherever these species occur in eastern forests dominated by deciduous or mixed deciduous and coniferous trees (Figure 1).

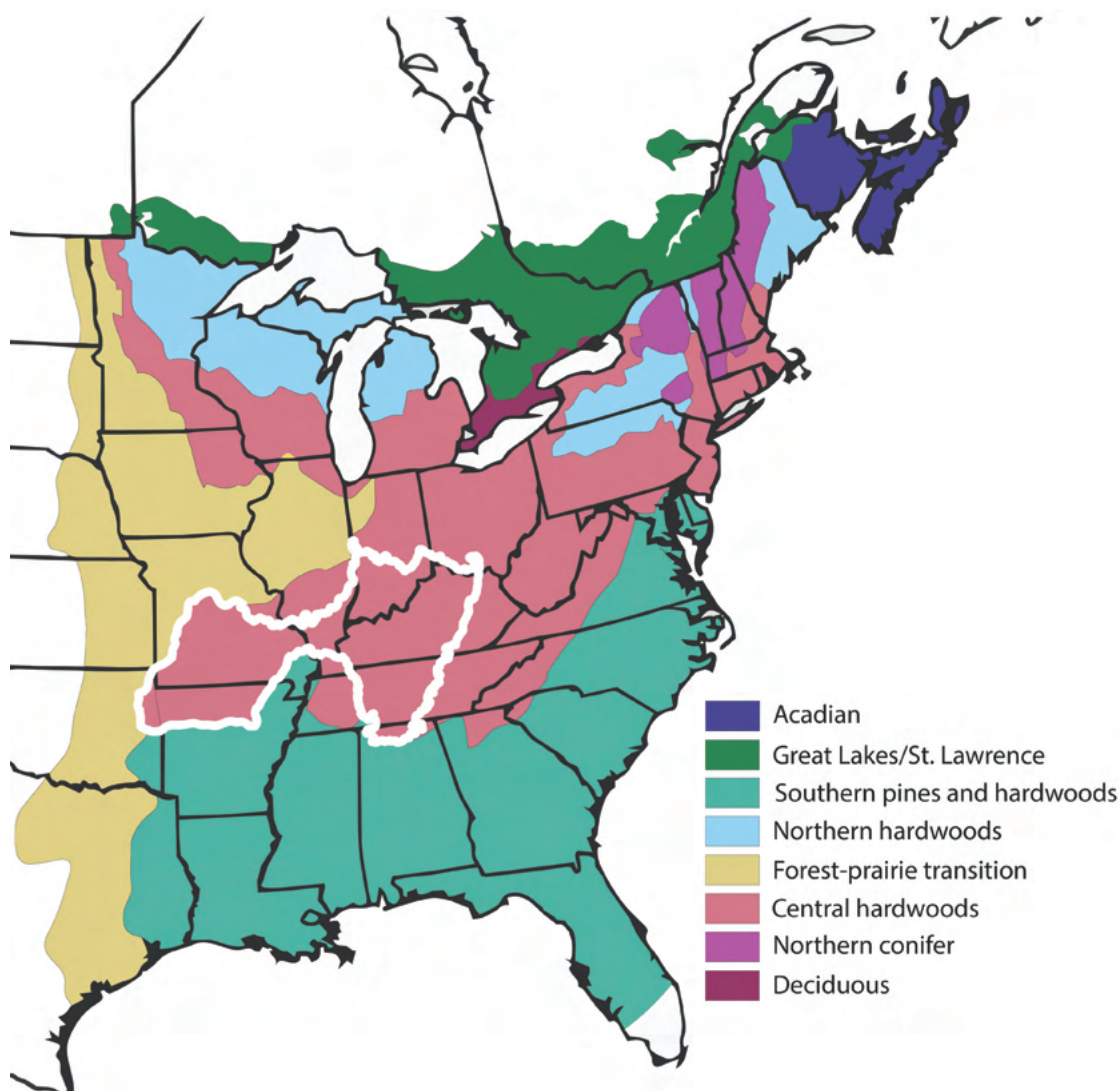


Figure 1. Forest regions of the Eastern United States and the Central Hardwoods Bird Conservation Region outlined in white. Adapted from Dey et al. (2012).

Closed Versus Open Forests

Closed forest is what most people think of as forest—a site where trees fully capture the growing space. A mature closed forest will have 80 to 100% canopy closure along with some shade tolerant midstory and understory trees and sparse shrubs. Little sunlight reaches the ground, so groundcover is primarily leaf litter and sparse shade-tolerant herbaceous plants (Figure 2A). An open forest includes savanna, open woodland, and closed woodland ecosystems (Figure 2B). Savannas typically have less than 30% tree canopy cover, open woodland ranges from 30%-60%, and closed woodland has 60%-80% canopy cover.

Open forests are fire-dependent ecosystems. Periodic low intensity fires modify tree regeneration and inhibit development of a midstory. The combination of a sparse overstory (canopy) and lack of an understory and midstory beneath means substantial sunlight reaches the forest floor. Sunlight allows for a diverse and abundant ground cover of grasses, forbs, and low woody vegetation consisting of shrubs and sprouting trees. Without periodic fire, young trees will become established and grow into the midstory and eventually overstory and the site will succeed to closed forest. For millennia, a mosaic of closed and open forests and grasslands occurred across the Missouri landscape driven by differences in fire regimes

determined in large part by Indigenous fire, native herbivores (bison, elk, deer), and land use. The cumulative result was a diversity of habitats integrated across the landscape that supported the wealth of native species that comprised Missouri's natural heritage. This mosaic is mostly lacking from present day landscapes which consist mostly of middle-aged closed forest due to a lack of disturbance (fire or thinning) or agricultural and developed land uses.

Silviculture of Missouri Forests

Forestry encompasses the science and practice of managing, conserving, and utilizing forests and their resources sustainably for timber, wildlife, water, recreation, and ecosystem health. Silviculture more specifically refers to the practice of establishing, growing, and tending a forest. Silviculture takes what foresters know about how trees grow and interact with their environment and applies that knowledge to produce a forest that best meets the objectives of the landowner.

Silvicultural treatments are management activities that alter forest structure to promote forest growth and health or achieve other objectives such as woodland restoration or wildlife habitat. These management activities are designed within a



Figure 2. Closed forest (A) has a closed and multi layered canopy with understory, midstory, and overstory trees and the forest floor is mostly composed of leaf litter. Open forest, such as this open woodland (B), has a sparser canopy and lack of midstory and understory trees and as a result abundant ground cover consisting of grasses, forbs, and varying amounts of woody sprouts depending on its fire history. Photos courtesy of Robert Pierce.

silvicultural system that consists of a planned series of treatments to achieve a certain level of stand regeneration and development. A stand is an area of forest with similar composition and structure that is being managed for a particular objective and typically is < 40 acres in size. Regeneration treatments are used to establish the next generation of trees in a stand. Intermediate or tending treatments are used to alter the character of a stand by removing some species or trees to produce desired composition and density to meet a landowner objective. Regeneration treatments vary based on the age class structures they create and can be even-aged or uneven-aged.

Even-Aged Silvicultural Practices

Even-aged forests are dominated by a single age class of trees that typically resulted from a large disturbance like a tornado or a clearcut. In more technical terms, an even-aged stand is where the range of tree ages does not exceed 20% of the rotation age. Rotation age is the age at which even-aged stands of trees are harvested and regenerated and is typically 80-100 years in Central Hardwoods oak and pine oak forests. Even-aged methods regenerate a new stand

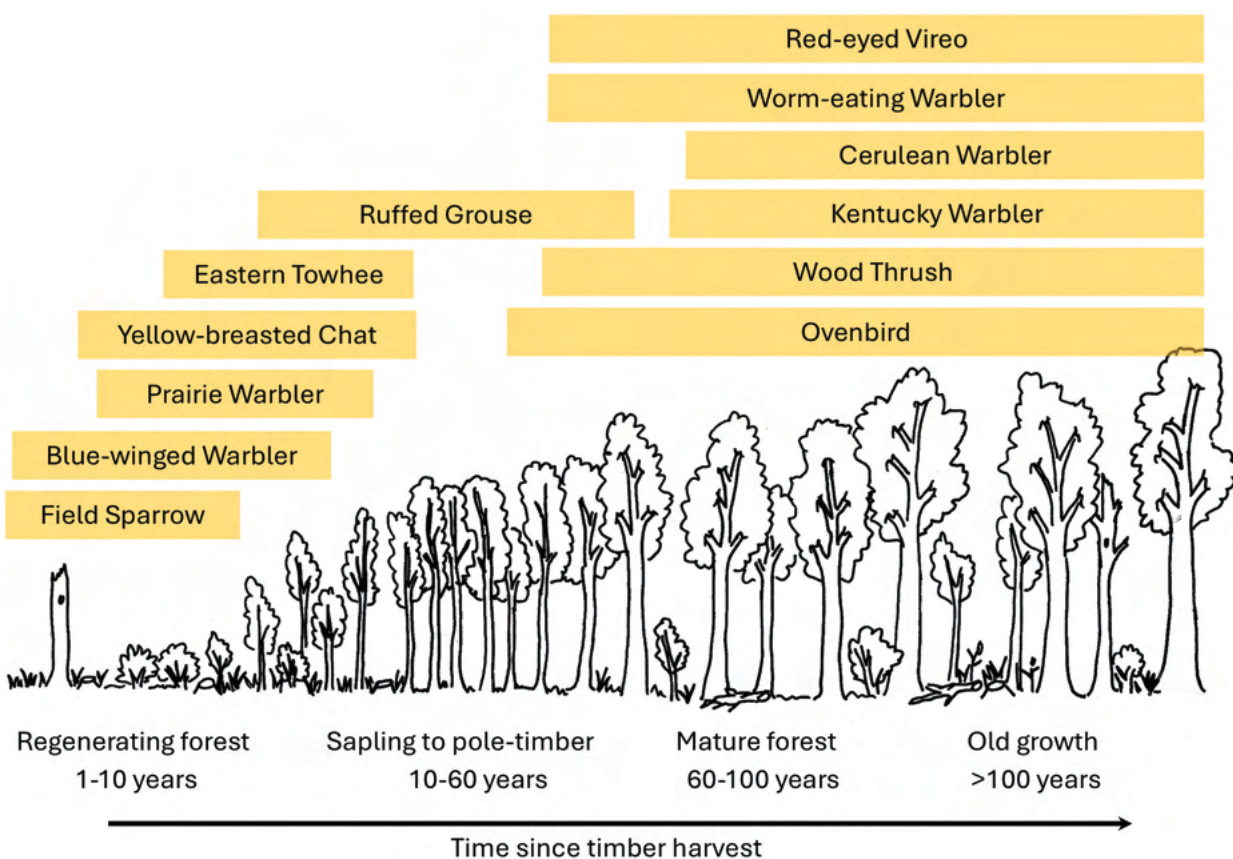


Figure 3. Closed, even-aged forest changes over time after trees are harvested, beginning with a mix of young trees and grasses and forbs. Trees grow and form a closed canopy and dense stand of trees in the sapling stage (trees with diameters less than 4 inches at breast height). Trees grow and increase in diameter and height, but the canopy remains closed in the pole-timber stage (trees with diameters less than 4-10 inches at breast height). Eventually some large trees die, resulting in some canopy openings and an understory forms as the stand opens up. Different bird species are associated with these different stages of succession and forest structures. Other site factors also affect species' occurrence, for example Worm-eating Warbler and Cerulean Warbler are usually found on slopes near streams or rivers.

that then goes through stages of stand development or succession until the next harvest (Figure 3).

With periodic entries into a landscape, such as every 10 years, this can create a shifting mosaic of different aged stands and a sustained flow of wood products and habitats over time. The clearcut, seed-tree, and shelterwood methods are used to regenerate even-aged forests. Some disturbance dependent birds will respond to regeneration cuts as small as 1-3 acres, but larger clearcuts with irregular complex shapes will benefit more species. Species such as the Yellow-breasted Chat and Prairie Warbler will utilize regenerated stands for 6-10 years and then abandon them as the canopy of young trees closes and groundcover thins. Mature forest birds, such as Wood Thrush and Ovenbird, will start to move into these stands after 15-20 years. If your primary objective is

to provide habitat for disturbance-dependent birds, prescribed burning can be used in regeneration cuts to extend the period the habitat remains open and suitable for these species.

Clearcut Method

Clearcutting removes all trees in the stand in a single harvest (Figure 4). The new stand develops from surviving seedlings and saplings (referred to as advanced regeneration), new seedlings, and stump sprouts. Clearcutting is often confused with practices that convert land to some other use. Land conversion results in a complete loss of treed habitat like pasture, housing development, or a mall. Clearcutting results in a new forest.

Clearcutting may be appropriate to regenerate species that need full sunlight for seed germination



Figure 4. A clearcut removes all or most of the trees in a stand; leaving snags and some live trees can be important for wildlife. Figure adapted from Palmer 2000, photo courtesy of Dana L. Morris.

and seedling development or shallow-rooted species and trees growing in exposed locations where trees left standing after a partial cut might be uprooted or damaged by wind. Clearcutting may also be necessary when a forest stand is over-mature and in serious decline, when trees must be salvaged after damage from fire, insects, disease, or wind, or when the goal is to provide habitat for wildlife species that require the dense stem growth and structure of even-aged stands.

Seed-Tree Method

Seed-tree harvests leave trees scattered throughout the area to provide seed for the next stand (Figure 5). Once the new seedlings are established, the seed trees may be harvested or left to grow until the next regeneration cut. The seed-tree method is primarily used with light-seeded species (e.g. pine, maple, ash,

elm). This method has been used to regenerate shortleaf pine in Missouri. Seed tree harvest is sometimes used because it is considered more aesthetically pleasing than a clearcut when some mature trees are retained.

Shelterwood Method

A shelterwood harvest is like the seed-tree method, but more trees are left, and the new stand is established under the partial shade of the overstory trees (Figure 6). The overstory is then removed to release the regeneration. Two cuttings are commonly made, but occasionally three harvests are necessary.

Intermediate Treatments

The commercial harvest in the even-aged system is



Figure 5. A seed-tree harvest leaves some scattered trees to provide seed. Figure adapted from Palmer 2000, photo by Hank Stelzer.



Figure 6. A shelterwood harvest leaves some overstory trees so the new stand can become established under the partial shade of the overstory trees. Figure adapted from Palmer 2000, photo by Jim Downs, Ohio State Extension.

usually only one of a sequence of treatments to promote desired regeneration. For example, often one or a series of treatments precede the commercial harvest to prepare the site for regeneration, control competing vegetation, and manage invasive species. Concurrent with the commercial harvest, other measures are commonly taken to treat non-commercial trees, shrubs, and vines to improve the survival and early growth of desired regeneration. Tending treatments may follow the regeneration harvest in the early years of development to ensure desired trees are free to grow and remain dominant with their competitors. Treatment methods for site preparation, competition control, and the release of regeneration include prescribed fire, mechanical, and chemical practices. The sequence and timing of these practices is planned in the silvicultural prescription to regenerate a forest and manage it to maturity to meet your objectives.

Thinning is perhaps the most common intermediate treatment. In closed forests, it is used to reduce the density of trees in a stand, control stand composition and increase growth of the remaining trees. A critical stage in stand development is at the end of the regeneration phase when the stand is 10- to 15-years old, the tree canopies begin to close, and trees begin to stratify into crown classes from suppressed to dominant. This is a critical time to consider thinning the stand to release the desired trees and keep them dominant. Thinning is used in open-forest management to stimulate growth of ground cover.

Intermediate treatments that focus on improving the growth of commercial timber species are often referred to as timber stand improvement (TSI), while those that focus more on ecosystem health and forest structure and composition as it relates to wildlife habitat or aesthetics are referred to as forest stand improvement (FSI).

Uneven-Aged Silvicultural Practices

Forests are considered uneven-aged if they have three or more age classes of trees. Single-tree and group selection methods produce uneven-aged stands.

Single-Tree Selection

Single-tree selection creates and maintains an uneven-aged stand that contains trees of many ages and sizes. Each tree is evaluated independently from the others in the stand. Individual trees are harvested as they mature (Figure 7). Seedlings and sprouts grow up in the spaces created when mature trees are removed. Periodic harvesting on a 5- to 25-year cutting cycle results in a stand that contains a diversity of tree age and size. Because relatively few trees are harvested at any one time and the canopy remains largely closed, this system favors shade-tolerant tree species, such as red and sugar maple, elm, hornbeam, and dogwood, while limiting the

regeneration of less shade-tolerant species like oaks and hickories. Young oaks and hickories present in the understory often fail to develop under the low-light conditions maintained by this system.

Too often, the single-tree selection system is improperly used, and stands are high-graded. High grading refers to harvesting only large diameter, high-quality trees of marketable species, while leaving trees that are not sellable because of small size, poor quality, or undesirable species. Inferior trees, often with poor genetic characteristics, then make up the next stand.

Single-tree selection may hurt some wildlife species because nut production declines when oaks and hickories are harvested and replaced by other species. Because the canopy remains nearly closed, forage and browse are limited, and the edge habitat important to many wildlife species is largely absent.

Group Selection Method

Group selection harvests small groups rather than individual trees. The openings resemble miniature clearcuts, but the resulting regeneration occupies too small an area (< 1 acre) to be considered an even-aged stand (Figure 8). As in the single-tree system, thinning and harvesting cuttings are done at the same time. The new trees that come up in these small openings are regarded as parts of a larger stand that contains trees of many ages.

Oaks and hickories can be regenerated using group selection. Oaks will grow best near the center of openings where they receive more sunlight. Openings will vary in size from about one-tenth acre to one-half acre based on surrounding tree heights, slope, and aspect. In either single-tree or group selection, frequent harvests are needed to maintain a proper balance of tree ages and sizes.

A combination of treatments may be applied during each cutting cycle including single-tree and group selection and thinning. Uneven-aged management provides a diversity of tree age classes and a sustained



Figure 7. Single-tree selection harvests scattered single trees and favors shade-tolerant trees. Figure adapted from Palmer 2000.



Figure 8. Trees within one-tenth to one-half acre are harvested under group selection, creating scattered small openings in the forest.
Figure adapted from Palmer 2000, photo by Hank Stelzer.

flow of wood products at a smaller scale than even-aged management. A downside of this approach is that small patches of regeneration may not be big enough to attract disturbance dependent birds such as Yellow-breasted Chats or Prairie Warblers. Gap specialists such as Hooded Warblers and Indigo Bunting will make use of single and group selection openings. Mature forest birds that prefer a dense understory, such as the Worm-eating Warbler and Kentucky Warbler, will benefit as well. Many mature forest birds remain abundant throughout the cutting cycle because there are always some mature trees on the site. While uneven-aged systems tend to favor shade tolerant tree species, the group selection method provides some opportunity for trees that are intermediate in shade tolerance to properly develop when competing vegetation is controlled within the larger openings.

Open-Forest Management

Open forest includes savanna and woodlands with less than 80% canopy cover (Figure 9). The extent of open forest in the Eastern United States is only about one-tenth of one percent of its former distribution. There has been widespread increase in tree density over the last 150 years due to past land use practices and fire exclusion. Restoring open forests is a conservation priority for many organizations because of its rarity, valuable wildlife habitat, and great diversity of plants.

Restoring and sustaining open forests requires purposeful management that usually involves selecting appropriate sites and managing with thinning and prescribed fire. Open forests most commonly occur on well-drained, nutrient-poor soils, on sunny, dry ridges and south/west-facing slopes and often form a transitional zone between grasslands and forests. Thinning is used to reduce tree density by removing midstory trees and a portion of the

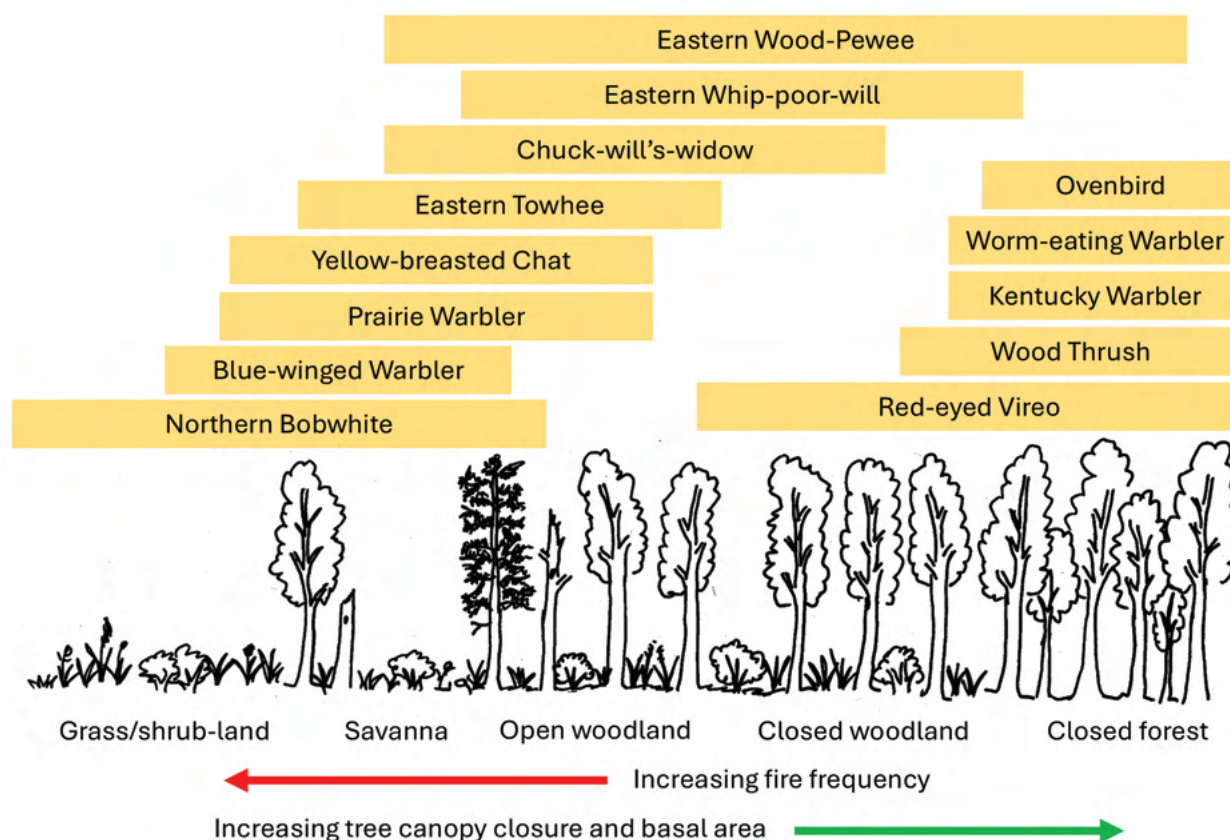


Figure 9. Open forest includes savanna and open and closed woodlands. The frequency of fire often determines the community type but tree thinning can be used to transition closed forests to open forest. Bird species present depend on the degree of openness and frequency of fires, which affects the ground cover and understory plants that many species require for nesting, cover, and foraging.

overstory. The degree of overstory removal is dependent on whether the objective is savanna, open woodland, or closed woodland. Prescribed fire top-kills young trees and prevents them from growing into the midstory and eventually overstory. It also reduces litter and thereby improves regeneration from seed, stimulates the germination of certain species that exhibit thermal or chemical seed dormancy, releases nutrients making them more available to plants, sets back woody competing vegetation, and promotes ground flora. Fire can positively or negatively affect insects, small mammals, and songbirds depending on the species and the timing and intensity of the fire.

For millennia, relatively frequent fire was the major disturbance responsible for open forests and grasslands in Missouri and throughout the eastern

US. It is not only a tool for management, but it is an essential part of the existence, sustainability, and integrity of open forest ecosystems. Fire is so intricately related to the biology of open forest species and their life cycles, either directly or indirectly, that it is impossible to achieve fire's effects on ecosystems with alternative practices. Without fire, trees grow larger in diameter and accumulate thicker bark, which increases their resistance to fire injury. After decades of fire suppression, mature overstory trees are resistant to low intensity, dormant season fires, even of fire sensitive species. This is why frequent fire is needed in the initial stages of restoration, where it is combined with other practices such as tree harvesting or thinning to reduce the density of larger trees. Foresters will inventory a stand and set a target tree stocking level based on the

desired forest community (i.e. savanna, open woodland, closed woodland; Figure 10). Fire is an essential tool to sustain open forests over the long-term. Frequent fire (e.g., every ~3 years) is required to continually top kill sprouting trees, because if allowed to get too big, sprouts will become resistant to fire, and the site will transition to closed forest (Figure 11). On larger properties it is often desirable to only burn a proportion of the area in any year. This creates a mosaic of stands in different stages of regrowth since the last burn that will meet the habitat needs of a diversity of birds.

Importance of Oaks and Shortleaf Pine

Oaks are a keystone species in Central Hardwoods Forests. Half of the forests in the eastern US are oak forest types (>193 million acres). They support an abundance and diversity of insects in their canopies and litter that are a key food source for songbirds. Early in spring, before leaf-out, oak flowers support insects that provide an important food source for migrating songbirds. After oak trees leaf out, they support a diversity and abundance of caterpillars that are a key food for nesting birds and their young. Acorns are an important winter food for Red-headed

Woodpeckers, Blue Jays, and many other animals and invertebrates. Fire suppression and a lack of other disturbance has resulted in increased tree densities, a lack of oak regeneration, and a lack of recruitment of oaks into the overstory – a process referred to as mesophication. Therefore, a focus on oak regeneration and recruitment is often an appropriate silvicultural objective whether you are interested in timber products or wildlife habitat. By managing for oaks, you are also providing for other disturbance dependent birds.

Shortleaf pine also has great value to birds. The seeds found in the cones of shortleaf pine are an important food for Brown-headed Nuthatches, Red-headed Woodpeckers, and other birds. Historically, both shortleaf pine and oaks were associated with open forests such as savannas and woodlands which are important habitat for many disturbance dependent birds such as Northern Bobwhite, Eastern Whip-poor-will, Prairie Warbler, Blue-winged Warbler, and Yellow-breasted Chat. Both oaks and shortleaf pine are well adapted to frequent low-intensity fires associated with open forests. Most of Missouri's open pine and oak forests were heavily logged in the late 1800s and these areas transitioned to closed oak forests after decades of fire suppression. Fire was



Figure 10. Woodlands that are being actively restored may need prescribed burning every 2-5 years to control woody sprouts. By staggering prescribed burning in different stands across years you will have stands with varying amounts of woody sprouts and provide habitat for a diversity of birds. Photos courtesy of Melissa Roach and Robert Pierce.

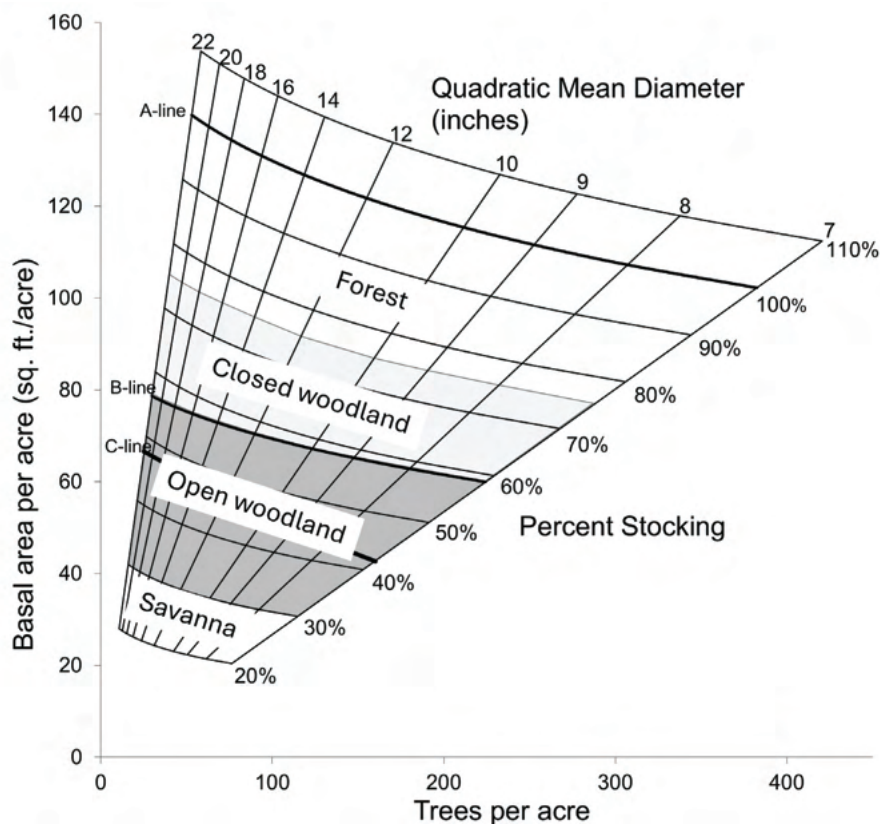


Figure 11. Savanna, woodland, and forest conditions are defined by the extent to which the site's growing space is occupied by trees, a concept referred to as stocking. The stocking level is defined by basal area, trees per acre, and quadratic mean tree diameter. A forester can design treatments, such as a thinning, to achieve the desired structure and resulting habitat. Adapted from Kabrick et al. 2022.

suppressed in these landscapes because of the potential threat to human communities and potential damage to the commercial value of forests. Open oak and pine-oak forests are valuable habitats for many bird species of concern and maintaining them will require purposeful management.

Snag Management

Snags are standing dead trees that provide critical resources for many wildlife species, including food, shelter, nesting sites, and foraging opportunities. Maintaining snags in various stages of decay supports a diversity of cavity-nesting birds. Some species, like Red-headed Woodpeckers, are strong excavators, while others, such as Brown-headed Nuthatches, are weak excavators that rely on softer, decayed wood.

Snags can be a limiting resource because they have a finite lifespan. As they decay, they break apart and eventually fall over. Some snags are also removed during forestry operations because of safety concerns. The relationship between snags and prescribed burning is complex. Fires create snags by killing live trees but can also burn up existing snags (Figure 12). Additionally, snags are often felled near fire lines because they can spread fire from embers blown by wind or by falling across fire lines. Given their high value for wildlife, it will be important to retain existing snags and some live trees as potential future snags while controlling hazard trees. The Missouri Department of Conservation recommends leaving at least seven snags or live den trees > 6 inches dbh per acre.



Figure 12. Snags in the advanced stage of decay, such as those used by Brown-headed Nuthatches, are particularly susceptible to being burned up by fire. Snags can be protected during prescribed burns by removing litter and vegetation from around their base.

Site Conditions

The combined effects of landscape position, soil type, moisture, and climate define a site's potential to produce vegetation and respond to management. The oak-hickory forest type represents approximately 80% of the forest in Missouri. Forest types can range from shortleaf pine, oak-hickory, maple-basswood, and elm, ash, cottonwood along a gradient from dry sites with low quality soils to wet sites with high quality soils. Open forests most commonly occur on well-drained, nutrient-poor soils, on sunny, dry ridges and south/west-facing slopes and often form a transitional zone between grasslands and forests.

Closed forests typically occur on more mesic sites with higher quality soils. Oak and pine forest typically occur on sunny, well-drained, and upland sites, particularly on south- or west-facing slopes. The rocky soils of the Missouri Ozarks are well suited to oaks and pine, while these species are often outcompeted on more mesic and fertile soils in the eastern portion of the Central Hardwoods. A forester can help you understand your site's potential and the forest type and management practices most suited for it. Managing for a forest type not suited for your site will require a lot more effort and may not be successful in the long term.

Landscape Considerations

Your property, whether 1 or 100 acres, is embedded in a landscape that may include a mix of land-uses, vegetation types, and wildlife habitats. Most forest birds will fare better in a patch or stand within a landscape dominated by natural communities, such as savannas, woodlands, and forests. Landscapes dominated by human land uses (i.e. urban, suburban, agriculture) can negatively affect birds through habitat fragmentation, fewer nesting sites, high numbers of predators and nest parasites like Brown-headed Cowbirds, increased collision risks with buildings or other structures, and high densities of predatory feral or free-roaming cats. Brown-headed Cowbirds lay their eggs in other birds' nests and often remove some of the host's eggs; their young also often outcompete the host's young. However, even in highly developed landscapes, managing your property for birds will still offer seasonal benefits to many bird species throughout the year.

A related concept to fragmentation and landscape context is patch size. Many of the songbirds considered in this guide have territory sizes that are 0.5 to 5 acres in size. This means that stands or patches of a particular vegetation type that provides suitable habitat need to be at least this large. Some disturbance dependent birds, like Indigo Bunting, will use small gaps in the forest created by the removal of just a few trees, while other species, like Prairie Warbler, require patches of at least a few acres or more. Some birds only occur in habitat patches that are many times bigger than their territory size—a characteristic referred to as area sensitivity. This is

typical of many mature forest birds, such as Cerulean Warbler, Worm-eating Warbler, and Kentucky Warbler. This doesn't mean that you must own large patches of forest yourself to benefit forest birds. However, if you and your neighbors together have a larger area of closed or open forest, you have more opportunities to benefit forest birds.

A diversity of birds can often be found along edges between plant communities because they represent the intersection of different vegetation types. Edges are sometimes considered to have habitat value for birds; for example, edges between mature forest and open land may have shrubs that provide fruit and protective cover. However, higher quality breeding habitat is usually provided by sufficiently large patches of open forest, young forest, or closed forest interspersed in the landscape that contains relatively little "edge." Some species require different types of habitat at different times of year. For example, Northern Bobwhite prefer native grassland for nesting but some low woody vegetation for thermal cover in hot summers and cold winters. Ruffed Grouse prefer young dense tree saplings for escape cover but older forest for nesting and foraging on mast. Wood Thrush nest in the subcanopy trees of mature forest, but they and their young can move into young forest post-breeding for cover and abundant food resources. These species require a mix of vegetation types in a landscape. However, it is the mosaic of habitats that provides value to birds, rather than the edges between them. In fact, hard edges between forest and human land uses such as agriculture and suburban and urban development often have high numbers of predators.



Savanna, Open Woodland, Young Forest, Shrubland Birds

Northern Bobwhite



Figure 13. Northern Bobwhite is a popular gamebird in Missouri that feeds on a variety of seeds, berries, and insects. Photo by Larry Thompson.

Status

A resident gamebird and priority bird species in Missouri, 89% decline in Central Hardwoods Region, and 81% decline in North America from 1966–2022 (Figures 13, 14).

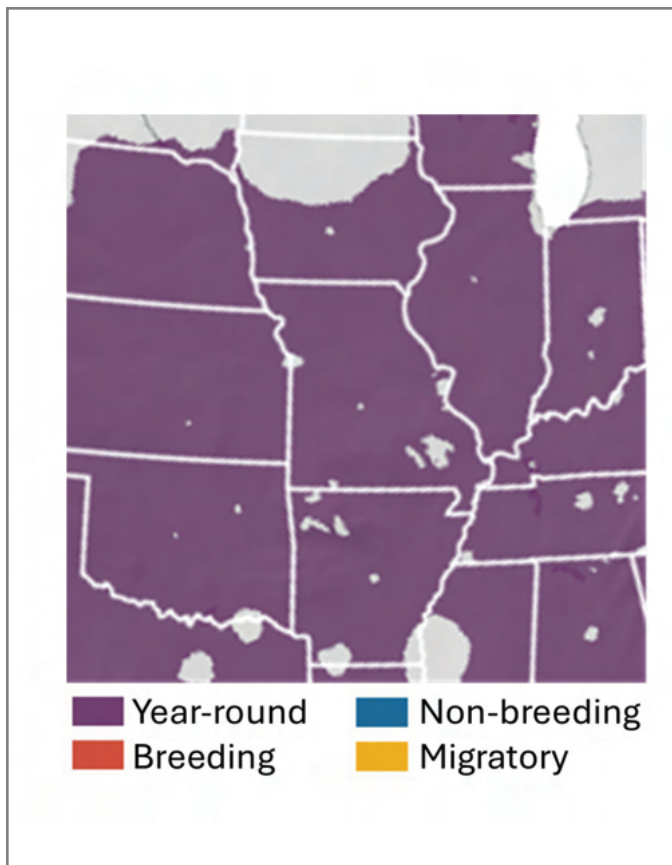


Figure 14. Northern Bobwhite is a resident bird that occurs throughout Missouri where there is sufficient open grassland and shrubland. They are most abundant in Southwest Missouri grasslands and shrubland disturbed by fire and grazing. Image provided by eBird (www.ebird.org) and created January 2026.

Habitat

Primarily a shrubland-grassland bird but can be abundant in savanna and open woodland (Figure 15). Also occurs in agricultural landscapes with sufficient grassland and woody cover. Requires grass cover for nesting, forbs for foraging on seeds and insects, and low woody vegetation for escape and winter cover. Native warm season grasses provide much better habitat than exotic cool season grasses. Nest success, brood survival, and adult survival is greater in large, managed native habitats with grass and forbs and interspersed low woody cover that is periodically disturbed by fire and/or grazing than in traditional small scale, strip cover in agricultural landscapes.

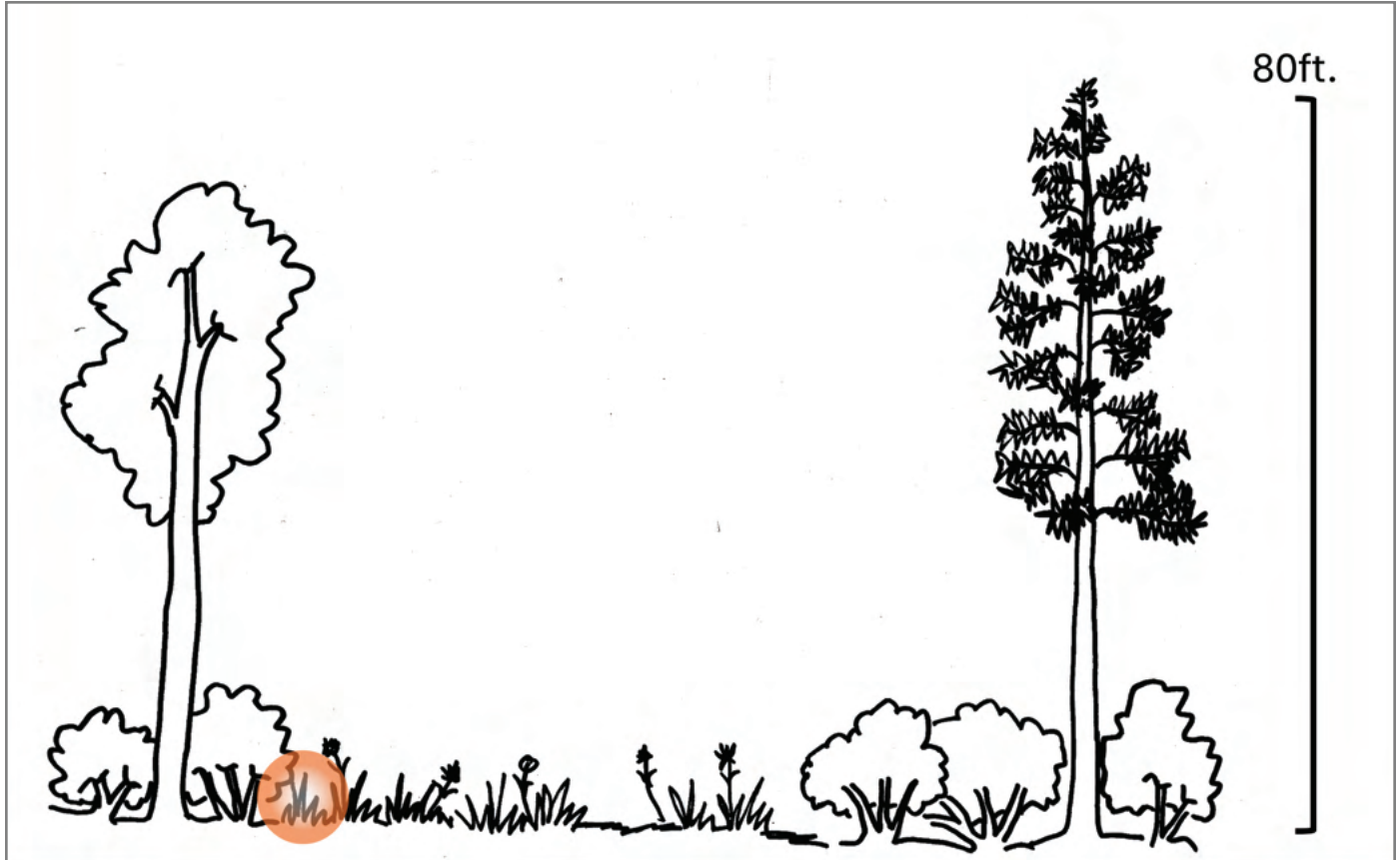


Figure 15. Savanna and open woodland managed with prescribed fire and tree thinning creates abundant grass and forb cover, some low woody cover, and an open canopy that provides habitat for Northern Bobwhite. The orange bubble is a typical nest location.

Associated Species

Red-headed Woodpecker, Brown-headed Nuthatch, Prairie Warbler, Blue-winged Warbler, Eastern Towhee, White-eyed Vireo

Silvicultural practices

Even-aged management: Recent regeneration cuts can provide habitat but usually succeed too quickly to closed forest to be colonized by Northern Bobwhite.

Uneven-aged management: Generally not suitable because patches of young forest created by single-tree or group selection are not large enough and succeed quickly to closed forest. The exception is when it's used in an open forest system; see open-forest management.

Open-forest management: Savanna and open woodland restoration and maintenance through tree thinning and frequent prescribed fire can provide quality habitat. Frequent prescribed fire stimulates growth of grasses and forbs, creating nesting cover and increasing the availability of seeds and insects for food. Fire also encourages sprouting of trees and shrubs, providing low woody cover, while repeated burns prevent the site from developing too much woody cover.

Savanna, Open Woodland, Young Forest, Shrubland Birds

Red-Headed Woodpecker



Figure 16. Red-headed Woodpeckers are cavity nesters that feed mainly on insects but also seeds, berries and small invertebrates. Photo by Brent Barns.

Status

A short-distance migrant that occurs year-round in Missouri (Figures 16, 17). Missouri hosts approximately 5% of the global population during the breeding season but 20% of the global population in winter. A priority bird species in Missouri, 16% decline in Central Hardwoods Region, and 45% decline in North America from 1966–2024.

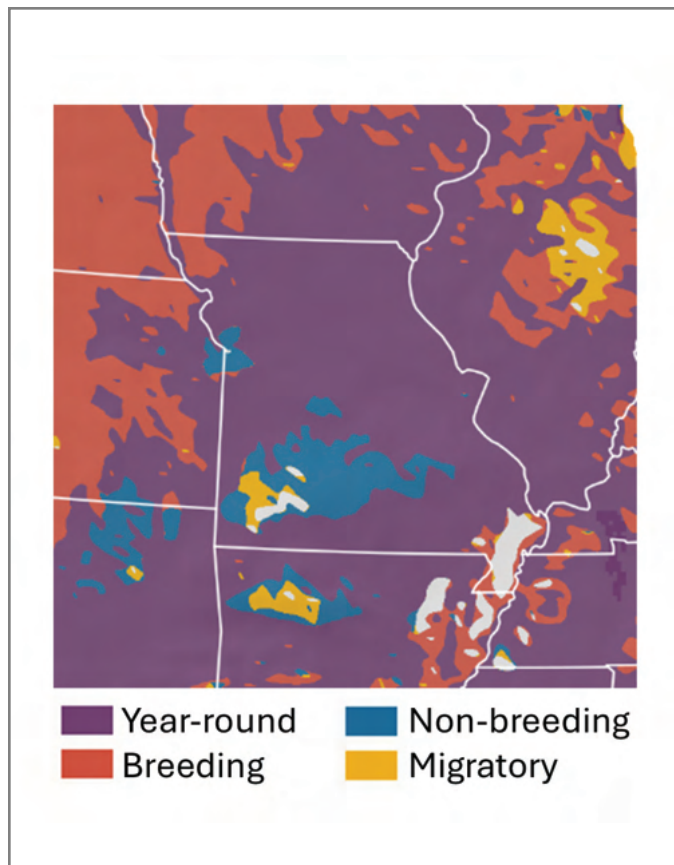


Figure 17. Red-headed Woodpeckers occur year-round in Missouri and many individuals from the northern part of their range winter in Missouri. Image provided by eBird (www.ebird.org) and created January 2026.

Habitat

Savanna and open park-like woodland and forest recently opened by disturbance or timber harvest (Figure 18). Requires large dead snags for foraging and nesting. Feeds on insects and seeds, including pine seeds and acorns. Key habitat needs include semi-open sites with scattered large live and dead trees and mast producing trees. Red-headed Woodpeckers excavate their own cavities for nesting and roosting in large snags.

Associated Species

Northern Bobwhite, Brown-headed Nuthatch, Prairie Warbler, Blue-winged Warbler, Prothonotary Warbler, Eastern Towhee, White-eyed Vireo



Figure 18. Savanna and open woodland managed with prescribed fire and tree thinning, that creates open forest with a modest overstory and large snags, provides habitat for Red-headed Woodpeckers. The orange bubble is a typical nest location.

Silvicultural practices

Even-aged management: Recent regeneration cuts provide habitat as long as snags are retained. Retention of some mature live trees can provide a source of future large snags. Heavy thinning of older stands may provide some habitat.

Uneven-aged management: Small patches of young forest created by single-tree or group selection are not large enough to provide the semi-open conditions preferred by this species but if combined with heavy thinning may provide some habitat.

Open-forest management: Ideal habitat is savanna and open woodland. Restoration and maintenance through tree thinning and frequent prescribed fire provides quality habitat. Fire prevents redevelopment of a midstory and periodically kills trees that provide large snags.

Savanna, Open Woodland, Young Forest, Shrubland Birds

Brown Thrasher



Figure 19. The Brown Thrasher is usually found in dense, shrubby cover where it feeds on berries or forages on the ground for insects and other small invertebrate and vertebrate prey. Photo by Tim Zurowsk.

Status

A short-distance migrant, this species breeds in Missouri, and some individuals also winter in the state (Figures 19,20). A priority bird species in Missouri with a 46% decline in the Central Hardwoods Region and 46% decline in North America from 1966–2024.

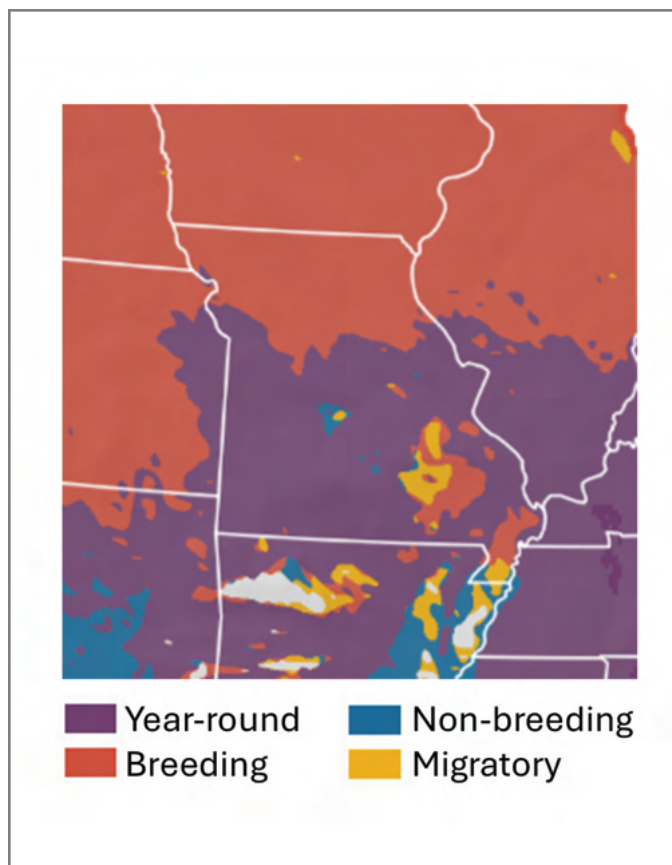


Figure 20. Brown Thrashers breed throughout Missouri in dense shrubby cover and open canopy and occur year-round in southern Missouri. Image provided by eBird (www.ebird.org) and created January 2026.

Habitat

Dense shrubby habitat along forest edges, in savanna and open woodland, regenerating clearcuts, shrublands and old fields, and shrubby fencerows (Figure 21). Key features of its habitat are an open canopy and dense shrub layer. Dense low shrubs and young trees provide cover for nests and foraging substrates for insect prey during the breeding season and fruit in the post breeding and migratory seasons. Taller trees provide song perches. Nests low to the ground in shrubs or forbs.

Associated Species

Prairie Warbler, Blue-winged Warbler, Eastern Towhee, Indigo Bunting, White-eyed Vireo



Figure 21. Brown Thrasher habitat consists of low, dense woody cover along forest edges and fencerows and in open forest, even-aged regeneration cuts, and old fields. The orange bubble is a typical nest location.

Silvicultural practices

Even-aged management: Recent regeneration cuts provide high quality habitat but as canopy closes birds abandon these sites, typically 6-10 years post-harvest. Periodic regeneration cuts (~ every 10 years) in a landscape can create a shifting mosaic of habitat. Thinning does not create a large enough disturbance to create habitat.

Uneven-aged management: Generally not suitable because patches of young forest created by single-tree or group selection are not large enough to provide habitat and the encouragement of tree recruitment into the midstory and overstory prevents adequate sunlight from reaching the forest floor.

Open-forest management: Savanna and open woodland restoration and maintenance through tree thinning and frequent prescribed fire provides quality habitat.

Savanna, Open Woodland, Young Forest, Shrubland Birds

Field Sparrow



Figure 22. Field Sparrows prefer open habitat with a variety of perch sites where they sing and search for insect prey and seeds. Photo by Frode Jacobsen.

Status

A short-distance migrant, this species breeds in Missouri, and some individuals also winter in the state (Figures 22,23). They are a priority bird species in Missouri with a 77% decline in Central Hardwoods Region and 75% decline in North America from 1966–2024.

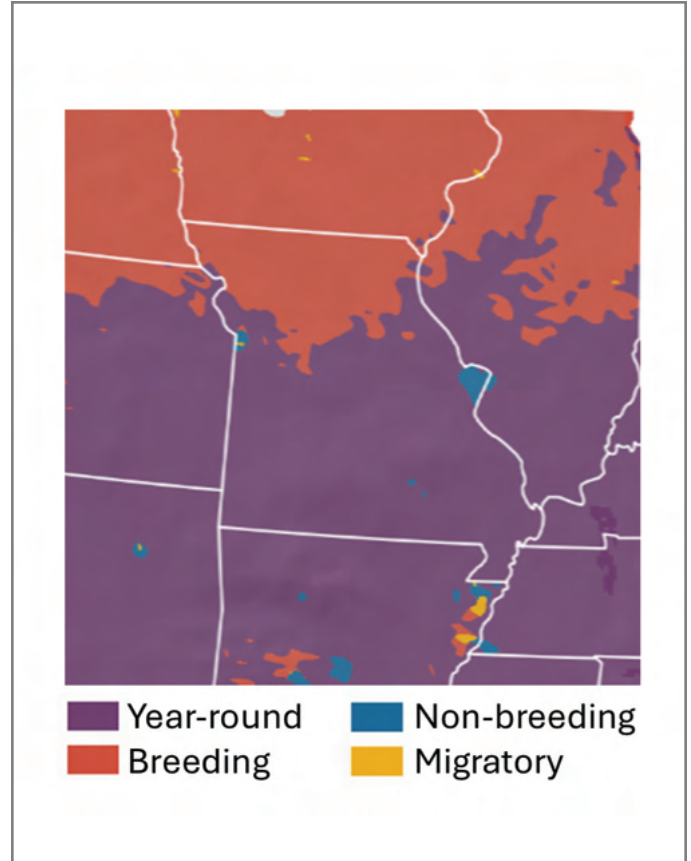


Figure 23. Field Sparrows breed throughout Missouri and some birds winter in southern Missouri. Image provided by eBird (www.ebird.org) and created January 2026.

Habitat

Savanna and open woodland, regenerating clearcuts, shrublands and old fields, and to a lesser extent forest edge (Figure 24). Key features of its habitat are open areas with grasses and forbs and sparse cover of shrubs and small trees. Field Sparrows nest and forage for insects and seeds on or near the ground in grass and forbs.

Associated Species

Prairie Warbler, Blue-winged Warbler, Eastern Towhee, Indigo Bunting, White-eyed Vireo

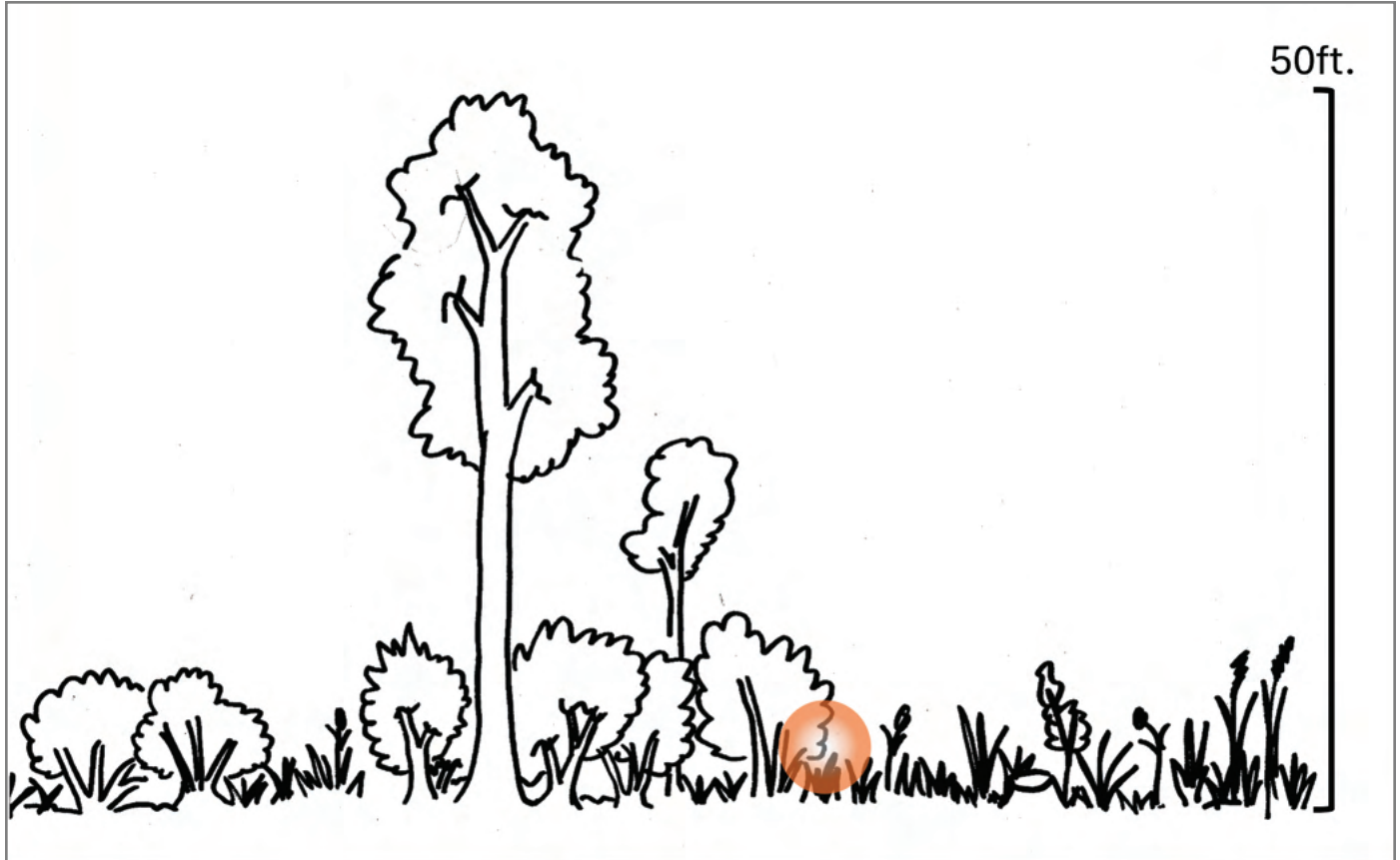


Figure 24. Field sparrow habitat consists of a mix of grasses, forbs, and low woody cover which can be provided in open forest or recent even-aged regeneration cuts. The orange bubble is a typical nest location.

Silvicultural practices

Even-aged management: Recent regeneration cuts provide high quality habitat, but as woody vegetation begins to dominate, birds abandon these sites, typically 3-5 years post-harvest. Periodic regeneration cuts in a landscape can create a shifting mosaic of habitat. Thinning does not create a large enough disturbance to create habitat but when used along field edges is sometimes referred to as edge feathering and can provide habitat.

Uneven-aged management: Generally not suitable because patches of young forest created by single-tree or group selection are not large enough to provide habitat and the encouragement of tree recruitment into the midstory and overstory prevents adequate sunlight from reaching the forest floor.

Open-forest management: Savanna and open woodland restoration and maintenance through tree thinning and frequent prescribed fire provides quality habitat.

Savanna, Open Woodland, Young Forest, Shrubland Birds

Eastern Towhee



Figure 25. The Eastern Towhee is usually seen on the ground or in low shrubs where it feeds on insects, seeds and berries. Photo by Michael Stubblefield

Status

A short-distance migrant, this species breeds in Missouri, and some individuals also winter in the state (Figures 25, 26). Towhees are a priority bird species in the Missouri Bird Conservation Plan with a 48% decline in the Central Hardwoods Region and 60% decline in North America from 1966 to 2022.

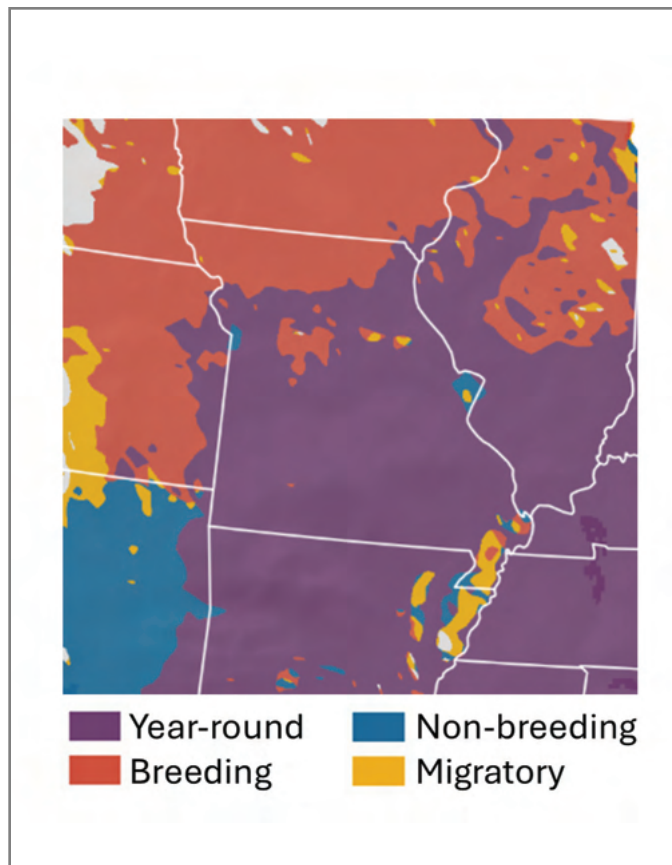


Figure 26. Eastern Towhees breed throughout Missouri wherever there is dense shrubby cover and an open canopy. Birds from further north winter here as well. Image provided by eBird (www.ebird.org) and created January 2026.

Habitat

Savanna and open woodland, regenerating clearcuts, shrublands and old fields, and to a lesser extent forest edge (Figure 27). Key features of its habitat are an open canopy and dense shrub layer. Dense low shrubs and young trees provide cover for nests and foraging substrates for insect prey during the breeding season and fruit in the post breeding and migratory seasons. Nest in leaf litter or slightly above ground in shrubs.

Associated Species

Prairie Warbler, Blue-winged Warbler, Indigo Bunting, White-eyed Vireo, Field Sparrow

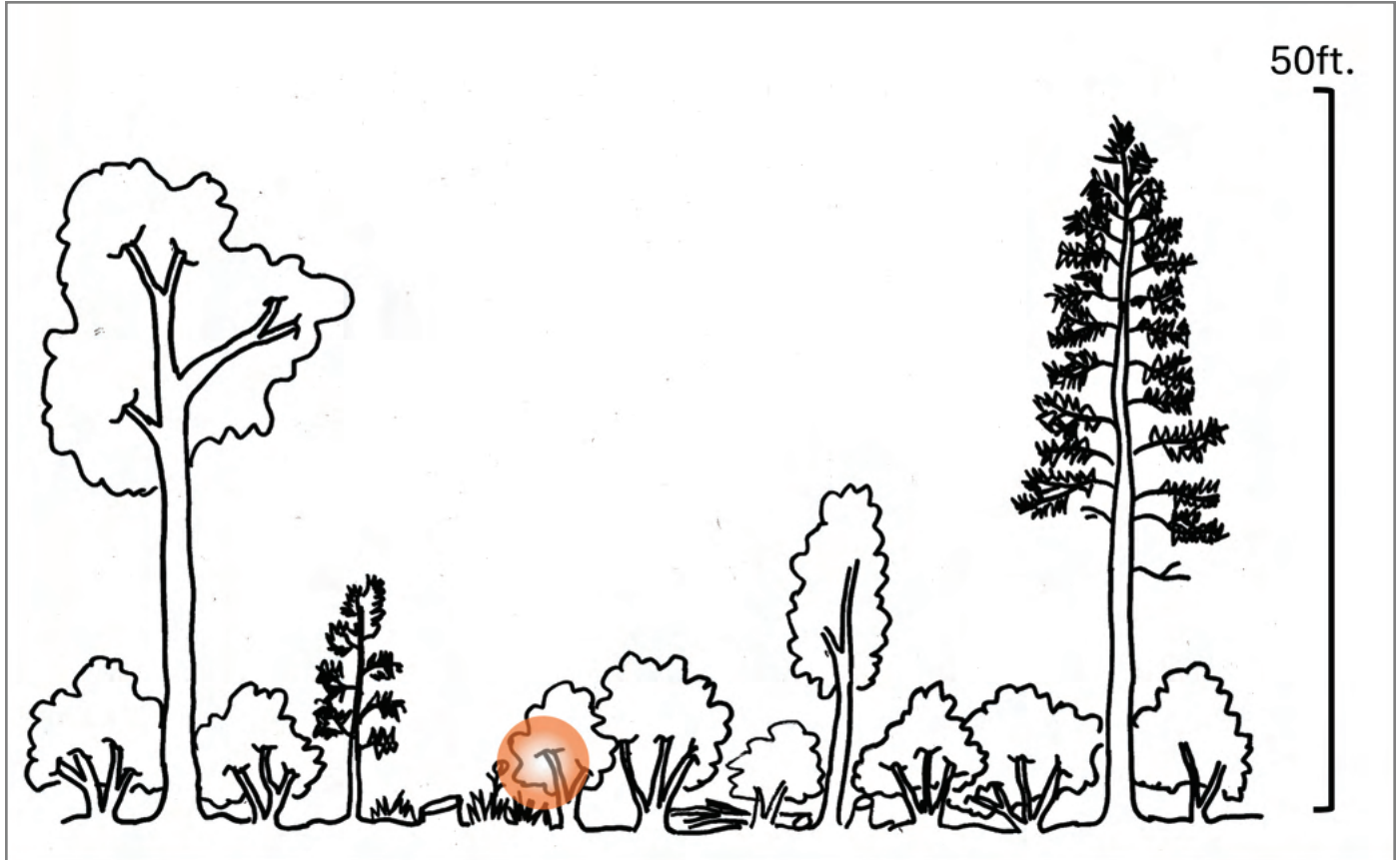


Figure 27. Eastern Towhee habitat consists of mix of grasses, forbs, and low woody cover which can be provided in open forest or recent even-aged regeneration cuts. Males use small to mid-size trees as song perches. The orange bubble is a typical nest location.

Silvicultural practices

Even-aged management: Recent regeneration cuts provide high quality habitat but as canopy closes, birds abandon these sites, typically 6-10 years post-harvest. Periodic regeneration cuts (~ every 10 years) in a landscape can create a shifting mosaic of habitat. Thinning does not create a large enough disturbance to create habitat.

Uneven-aged management: Generally not suitable because patches of young forest created by single-tree or group selection are not large enough to provide habitat and the encouragement of tree recruitment into the midstory and overstory prevents adequate sunlight from reaching the forest floor. Larger group selection openings combined with a heavy thinning may provide some habitat.

Open-forest management: Savanna and open woodland restoration and maintenance through tree thinning and frequent prescribed fire provides quality habitat.

Savanna, Open Woodland, Young Forest, Shrubland Birds

Yellow-breasted Chat



Figure 28. Male Yellow-breasted Chats can often be seen singing from an elevated song perch on a snag or tree and eat insects and berries.
Photo by Tess Nickels

Status

A Neotropical migrant that breeds in Missouri (Figures 28, 29). A priority bird species in Missouri that experienced a 57% decline in the Central Hardwoods Region and 37% decline in North America from 1966–2024.

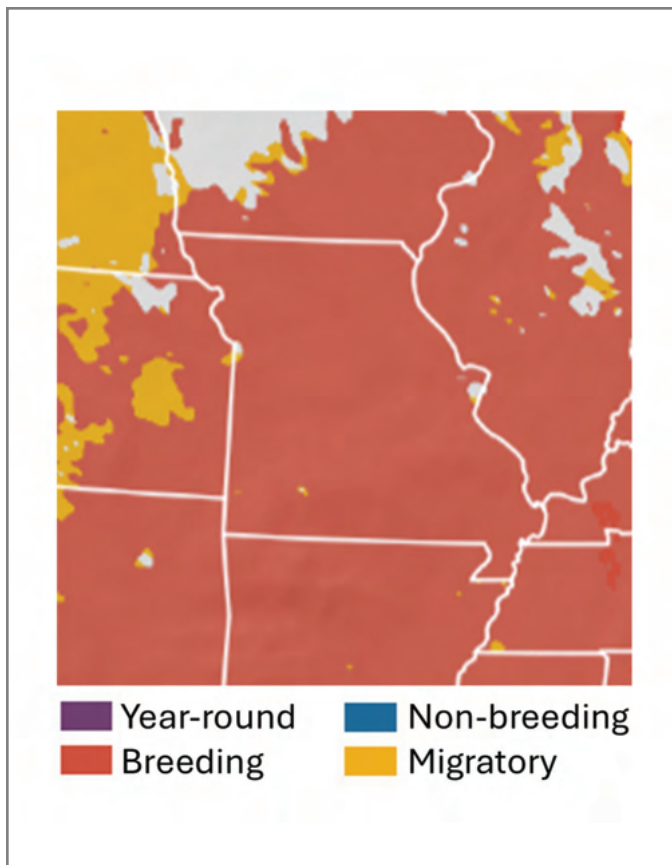


Figure 29. Yellow-breasted Chats breed throughout Missouri wherever there is sufficient open habitat with abundant shrubs and young trees. Image provided by eBird (www.ebird.org) and created January 2026.

Habitat

Savanna and open woodland, regenerating clearcuts, shrublands and old fields, and to a lesser extent forest edge (Figure 30). Key features of the species' habitat are a mix of shrubs, small trees and patches of herbaceous ground cover. Dense low shrubs and trees provide nesting cover, while low woody and herbaceous vegetation offer foraging opportunities for insects and fruit. Occasional taller trees or snags serve as elevated song perches, which are heavily used by male chats. Nests in low, dense vegetation.

Associated Species

Prairie Warbler, Blue-winged Warbler, Eastern Towhee, Indigo Bunting, White-eyed Vireo

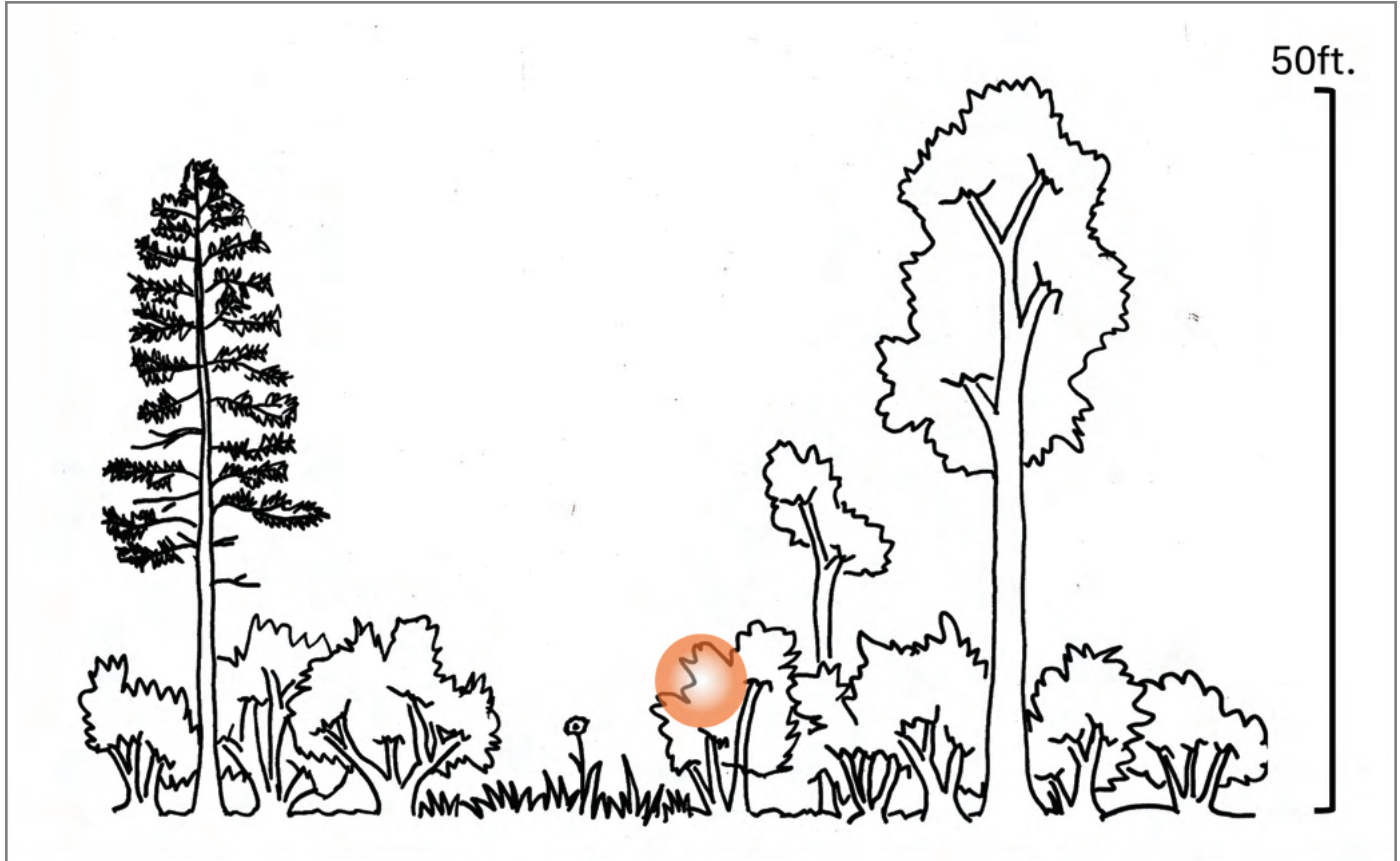


Figure 30. Yellow-breasted Chat habitat consists of a mix of grasses, forbs, and low woody cover which can be provided in open forest or recent even-aged regeneration cuts. The orange bubble is a typical nest location.

Silvicultural practices

Even-aged management: Recent regeneration cuts provide high quality habitat but as canopy closes birds abandon these sites, typically 6-10 years post-harvest. Periodic regeneration cuts (~ every 10 years) in a landscape can create a shifting mosaic of habitat. Thinning does not create a large enough disturbance to generate habitat.

Uneven-aged management: Generally not suitable because patches of young forest created by single-tree or group selection are not large enough to provide habitat and the encouragement of tree recruitment into the midstory and overstory prevents adequate sunlight from reaching the forest floor. Larger group selection openings combined with a heavy thinning may provide some habitat.

Open-forest management: Savanna and open woodland restoration and maintenance through tree thinning and frequent prescribed fire provides quality habitat. Abundance is greatest at less than 60% canopy cover.

Savanna, Open Woodland, Young Forest, Shrubland Birds

Blue-winged Warbler



Figure 31. Male Blue-winged Warblers often sing from exposed perch sites in shrubs or young trees and forage for insects. Photo by Frode Jacobsen.

Status

A Neotropical migrant that breeds in Missouri (Figures 31, 32). A priority bird species in Missouri that experienced a 27% decline in Central Hardwoods Region and 35% decline in North America from 1966–2024.

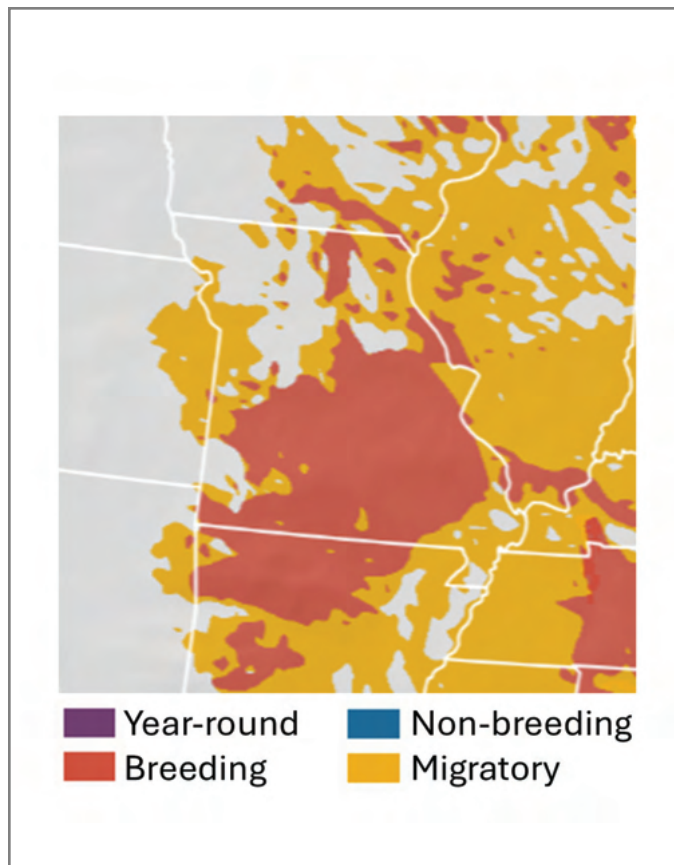


Figure 32. Blue-winged Warblers can breed in much of Missouri where there is suitable habitat consisting of large patches of open canopy and a mix of shrubs, young trees, and herbaceous ground cover. Image provided by eBird (www.ebird.org) and created January 2026.

Habitat

Savanna and open woodland, regenerating clearcuts, shrublands and old fields (Figure 33). Key features of its habitat are a mix of shrubs and small trees and patches of herbaceous ground cover. Dense, low shrubs and trees provide cover for nests, while low woody and herbaceous vegetation provide foraging habitat for insect prey. Requires habitat patches at least three acres in size. Nests on or near the ground, at the base of or within a clump of herbaceous or woody vegetation.

Associated Species

Yellow-breasted Chat, Prairie Warbler, Eastern Towhee, Indigo Bunting, White-eyed Vireo



Figure 33. Blue-winged Warbler habitat consists of a mix of grasses, forbs, and low woody cover which can be provided in open forest or recent even-aged regeneration cuts. The orange bubble is a typical nest location.

Silvicultural practices

Even-aged management: Recent regeneration cuts provide high quality habitat but as canopy closes birds abandon these sites, typically 6-10 years post-harvest. Thinning does not create a large enough disturbance to create habitat.

Uneven-aged management: Generally not suitable because patches of young forest created by single-tree or group selection are not large enough to provide habitat and the encouragement of tree recruitment into the midstory and overstory prevents adequate sunlight from reaching the forest floor.

Open-forest management: Savanna and open woodland restoration and maintenance through tree thinning and frequent prescribed fire provides quality habitat. Abundance is greatest at less than 60% canopy cover.

Prairie Warbler



Figure 34. Prairie Warblers (male shown) forage for invertebrate prey on branches and leaves of young trees and shrubs. Photo by Frode Jacobsen.

Status

A Neotropical migrant that breeds in Missouri (Figures 34, 35). A priority bird species in Missouri with a 54% decline in Central Hardwoods Region and 67% decline in North America from 1966–2024.

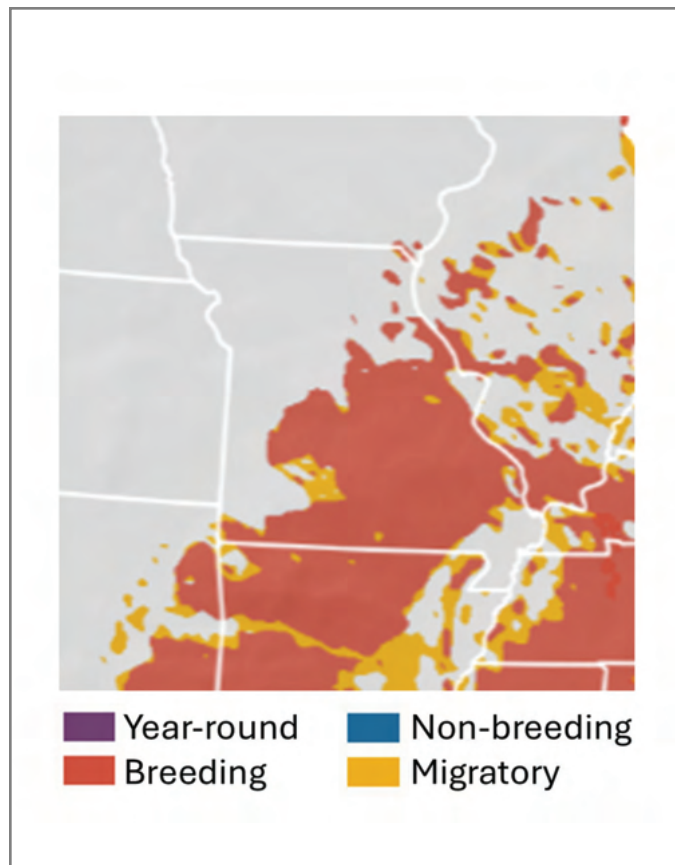


Figure 35. Prairie Warblers can breed anywhere in Missouri where there is suitable habitat consisting of large patches of open canopy and a mix of shrubs, young trees, and herbaceous ground cover. Image provided by eBird (www.ebird.org) and created January 2026.

Habitat

Savanna and open woodland, regenerating clearcuts, shrublands and old fields (Figure 36). Key features of its habitat are a mix of shrubs and small trees and patches of herbaceous ground cover. Prairie Warblers nest in low trees and shrubs (often < 3 ft tall) and forage for insects in low woody and herbaceous vegetation. Requires habitat patches at least three acres in size.

Associated Species

Yellow-breasted Chat, Blue-winged Warbler, Eastern Towhee, Indigo Bunting, White-eyed Vireo

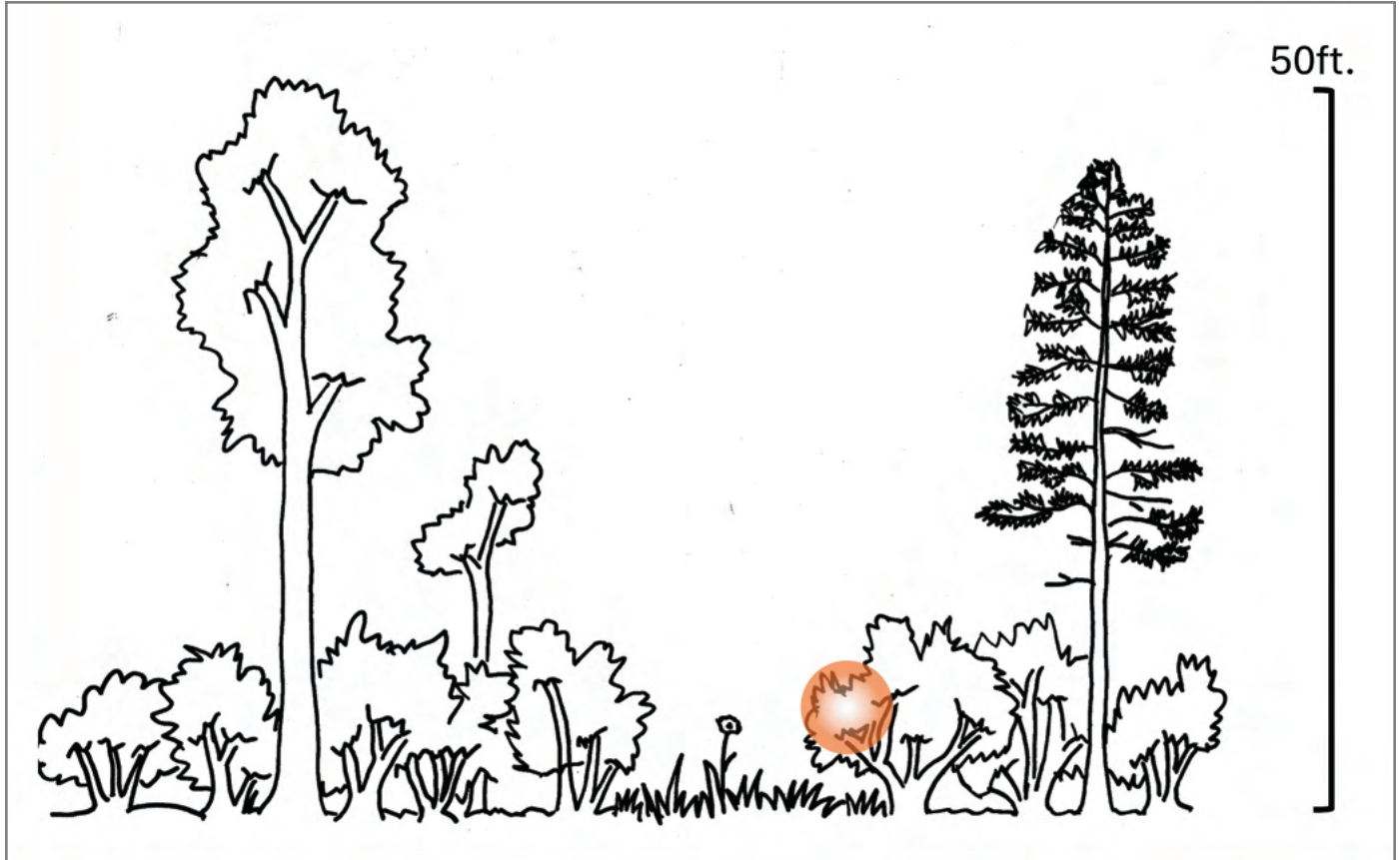


Figure 36. The mix of grasses, forbs, and low woody cover found in open forest or recent even-aged regeneration cuts provides habitat for the Prairie Warbler. The orange bubble is a typical nest location.

Silvicultural practices

Even-aged management: Recent regeneration cuts provide high quality habitat but as canopy closes birds abandon these sites, typically 6-10 years post-harvest. Thinning usually does not create a large enough disturbance to create habitat.

Uneven-aged management: Mostly not suitable because patches of young forest created by single-tree or group selection are not large enough to provide habitat and the encouragement of tree recruitment into the midstory and overstory prevents adequate sunlight from reaching the forest floor.

Open-forest management: Savanna and open woodland restoration and maintenance through tree thinning and frequent prescribed fire provides quality habitat. Abundance is greatest at less than 60% canopy cover.

Woodland Birds

Yellow-billed Cuckoo



Figure 37. Yellow-billed Cuckoos feed on caterpillars, insects, and berries in dense shrub cover. Photo by Michael J. Parr.

Status

A Neotropical migrant that breeds in Missouri (Figures 37, 38). A priority bird species in Missouri with a 59% decline in Central Hardwoods Region and 38% decline in North America from 1966–2024. The Western U.S. population is being considered for endangered species status.

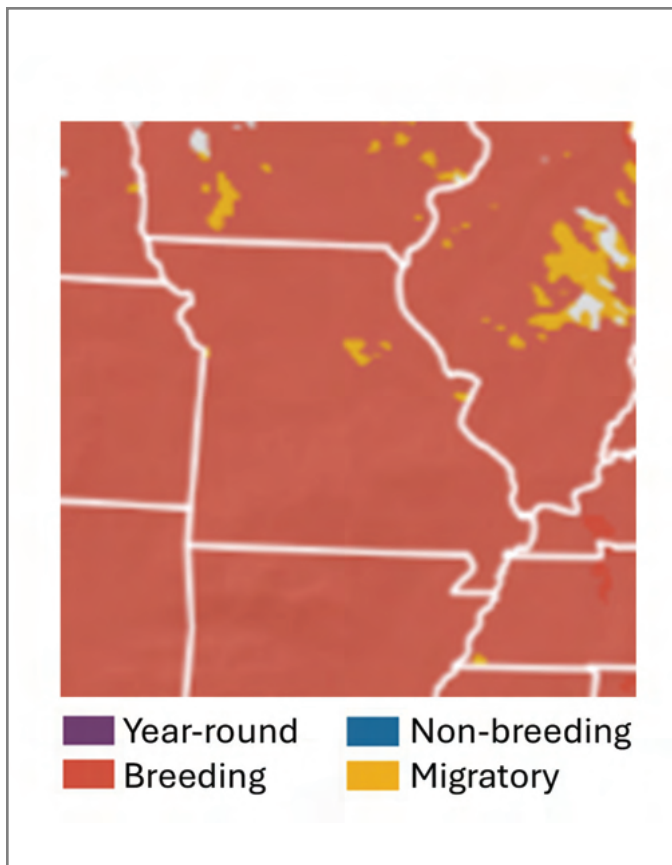


Figure 38. The Yellow-billed Cuckoo breeds throughout Missouri. Image provided by eBird (www.ebird.org) and created January 2026.

Habitat

Woodland and forest, often associated with riparian areas and clearings with low, dense, scrubby vegetation (Figure 39). Key habitat features include some mature tree cover combined with dense low cover or shrubs, particularly near streams or marshes. Nest in the tree canopy where adequate cover is present, sometimes in thickets of grapevine.

Associated Species

Eastern Wood-Pewee, Kentucky Warbler, Yellow-breasted Chat, Blue-winged Warbler, Eastern Towhee, Indigo Bunting, White-eyed Vireo



Figure 39. Yellow-billed Cuckoo habitat consists of mature tree cover combined with dense low cover or shrubs, particularly near streams or marshes. The orange bubble is a typical nest location.

Silvicultural practices

Even-aged management: Shelterwood and seed-tree regeneration cuts that retain some live mature trees along with shrubs and young trees provide quality habitat.

Uneven-aged management: Provides quality habitat consisting of mature overstory trees and patches of dense scrubby vegetation in group openings.

Open-forest management: Savanna and open woodland restoration and maintenance through tree thinning and periodic prescribed fire resulting in patches of shrubs and young trees along with some mature overstory trees provides quality habitat.

Woodland Birds

Chuck-will's-widow



Figure 40. Chuck-will's-widow chase after aerial prey like moths and beetles at night and benefit from open woodland where they can maneuver and see better. Photo by Michael Stubblefield

Status

A Neotropical migrant that breeds in Missouri (Figures 40, 41). A priority bird species in Missouri with a 52% decline in Central Hardwoods Region and 58% decline in North America from 1966–2024.

Habitat

Pine and oak-hickory woodland and forest, regenerating clearcuts, edges and openings near woodland and forest (Figure 42). Key features of its habitat are forest and woodland with low to moderate canopy cover and tree basal area and an open midstory and understory, typically maintained by fire. Most abundant in landscapes with a mix of forest or woodland (~ 60%) and open areas because openings are used for foraging. Nests directly on leaf or pine

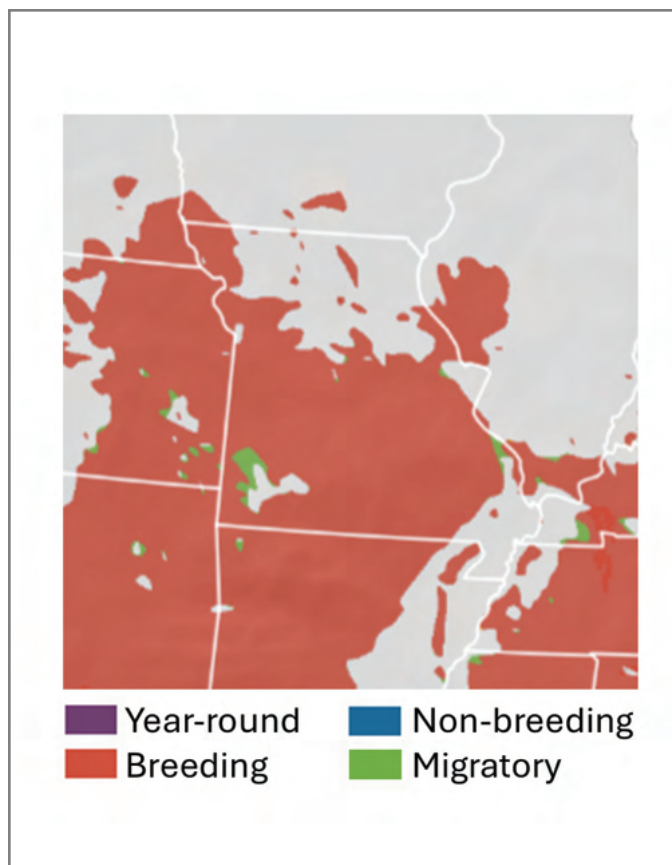


Figure 41. Chuck-will's-widow breeds in the southern two-thirds of Missouri. Image provided by eBird (www.ebird.org) and created January 2026.

litter or bare dirt and relies solely on camouflage of eggs and plumage. A statewide study is underway to better understand the species' distribution in Missouri and identify forest management practices that provide the most suitable habitat.

Associated Species

Nocturnal: Eastern Whip-poor-will; Diurnal: Orchard Oriole, Yellow-billed Cuckoo, Eastern Wood-Pewee, Wood Thrush, Yellow-breasted Chat, Blue-winged Warbler, Eastern Towhee, Indigo Bunting, White-eyed Vireo

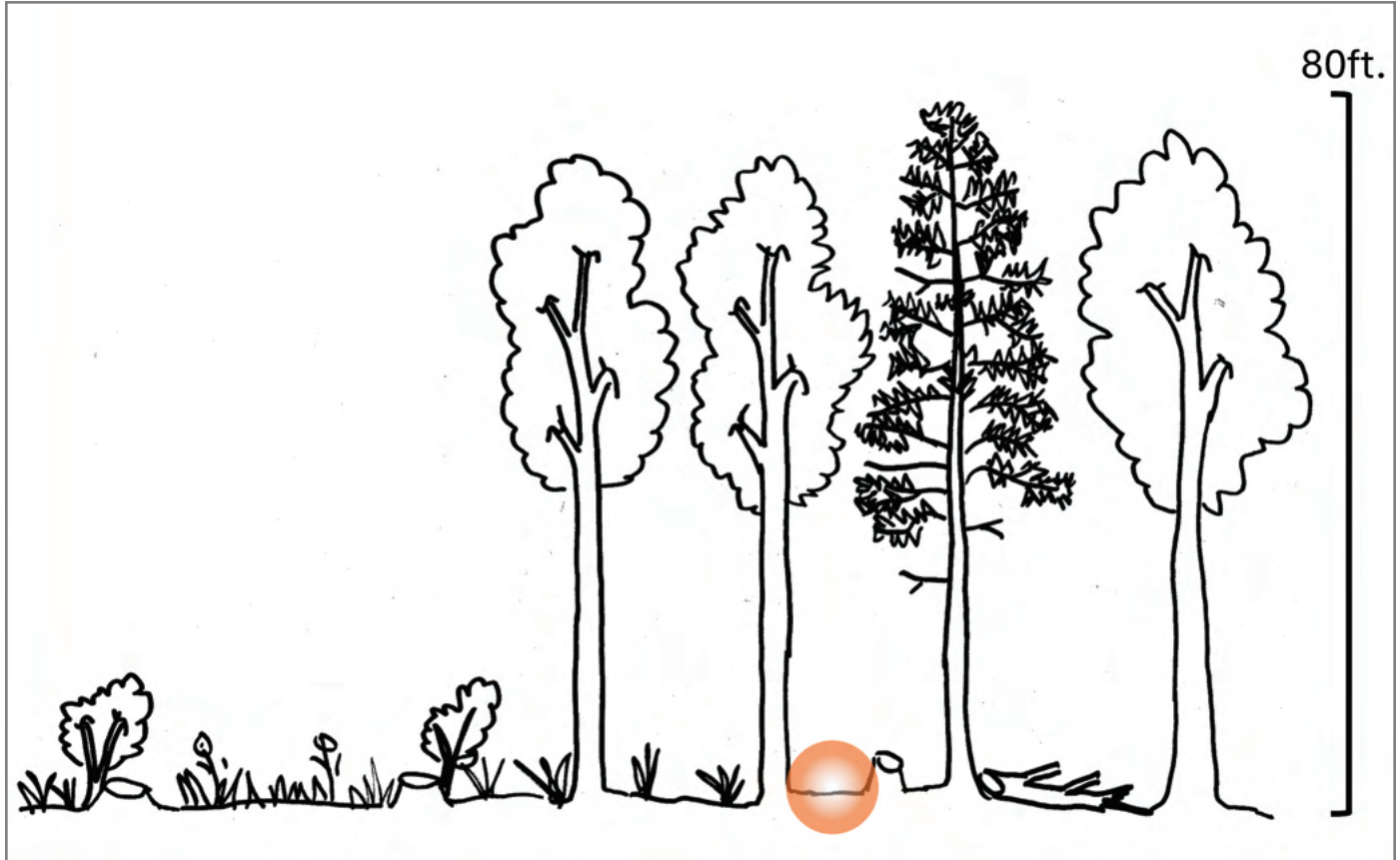


Figure 42. Chuck-will's-widow habitat includes woodland, regenerating clearcuts, and forest edges with low to moderate canopy cover and open understory. The orange bubble is a typical nest location.

Silvicultural practices

Even-aged management: Recent regeneration cuts provide openings used by birds for display and foraging. Fully stocked or closed canopy mid- and late-successional even-aged forest tend to be too dense to provide quality habitat. Thinning can create more open forest that provides suitable habitat, especially in conjunction with prescribed fire.

Uneven-aged management: Generally not suitable in fully stocked stands because maintaining multiple age classes in the understory and midstory prevents the open stand conditions needed for foraging. Openings created by single-tree or group selection are usually not large enough for foraging, and the canopy quickly closes in these small openings. If used as part of open-forest management with lower tree densities

and prescribed fire, the variable canopy structure is favored by birds.

Open-forest management: Savanna and open woodland restoration and maintenance through tree thinning and frequent prescribed fire provides quality habitat. Abundance is greatest in woodlands with lower tree basal area (9-10 m²/ha) or canopy cover. Prescribed fire is an important tool for maintaining open stand conditions and ideally should be rotated among management units on a 2-3-year rotation so not all sites are burned in the same year.

Woodland Birds

Eastern Whip-poor-will



Figure 43. Eastern Whip-poor-will is a close relative to Chuck-will's-widow and also chases after aerial prey like moths and beetles at night, and benefits from open woodland where it can maneuver and see better. Photo by Frode Jacobsen.

Status

A Neotropical migrant that breeds in Missouri (Figures 43, 44). A priority bird species in Missouri with a 73% decline in Central Hardwoods Region and 67% decline in North America from 1966–2024.

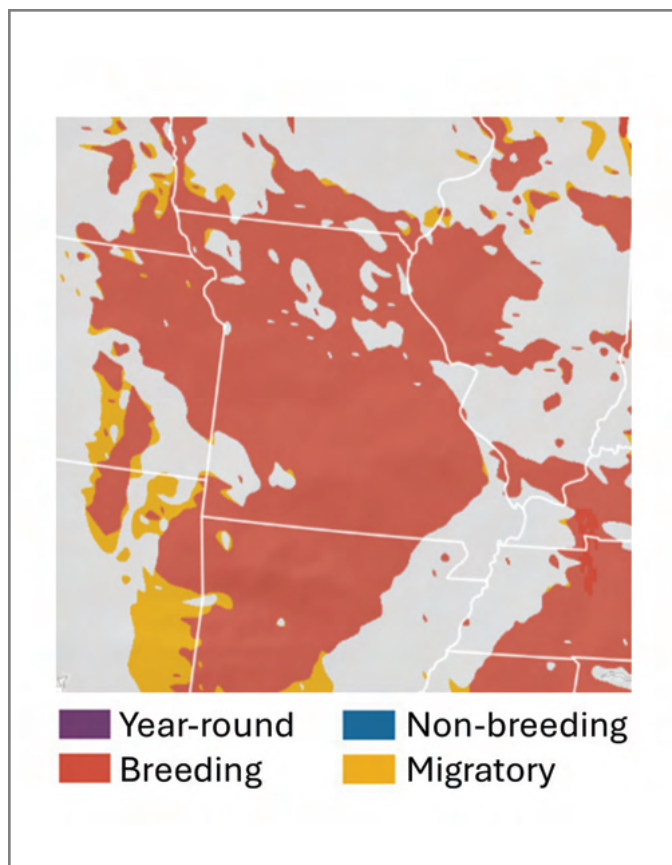


Figure 44. Eastern Whip-poor-will breeds throughout Missouri. Image provided by eBird (www.ebird.org) and created January 2026.

Habitat

Oak-hickory and pine woodland and forest, regenerating clearcuts, edges and openings near woodland and forest (Figure 45). Key features of its habitat are forest and woodland with low to moderate canopy cover and tree basal area and an open midstory and understory with few small trees, typically maintained by fire. Will use openings for foraging but tends to be found in more heavily forested landscapes (> 60%) than Chuck-will's-widow. Nests directly on leaf or pine litter sometimes near downed woody debris (e.g. large downed branches). A statewide study is underway to better understand the species' distribution in Missouri and identify forest management practices that provide the most suitable habitat.

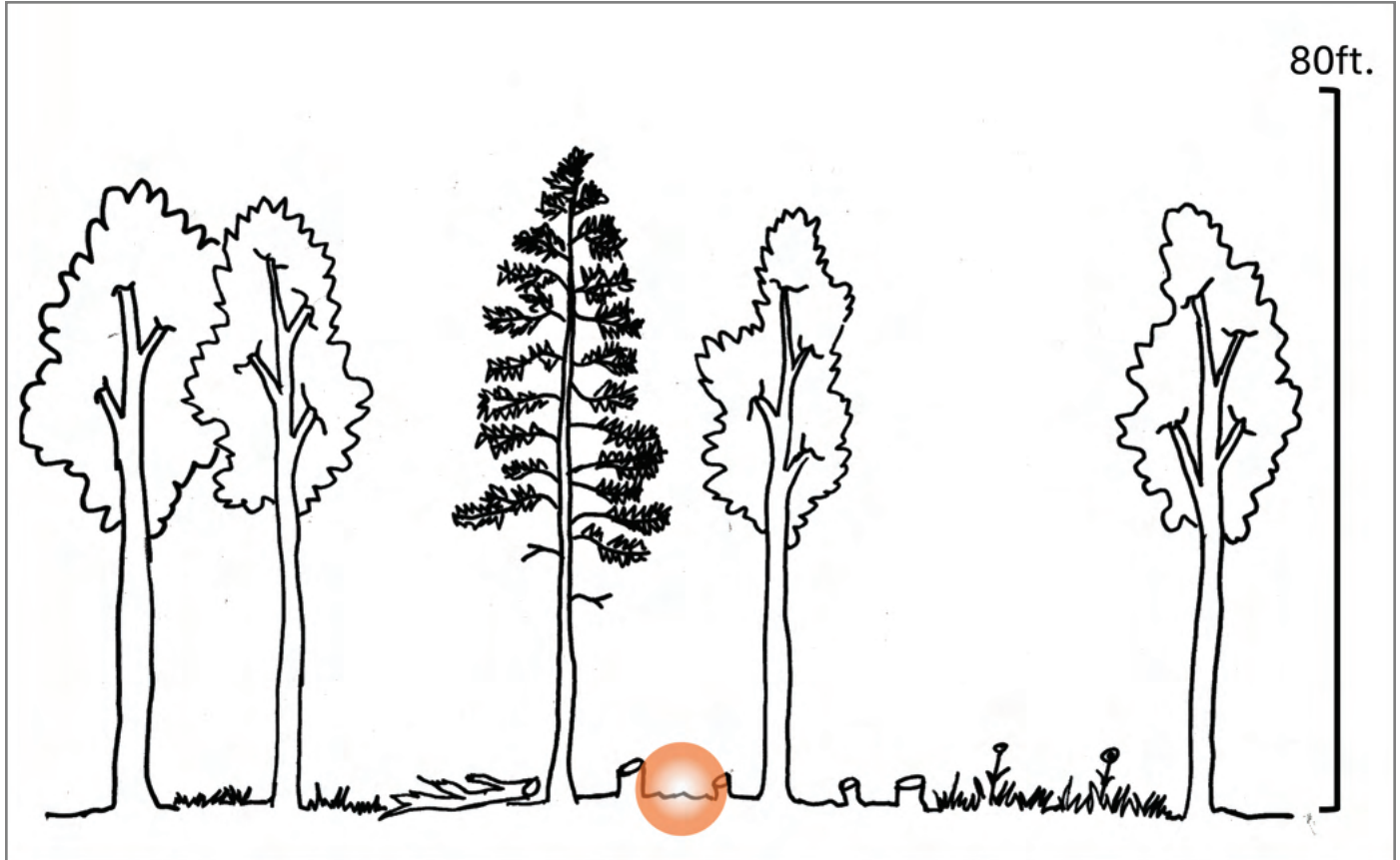


Figure 45. Eastern Whip-poor-will habitat consists of woodland with low to moderate canopy cover and an open understory and midstory along with some openings created by recent regeneration cuts. The orange bubble is a typical nest location.

Associated Species

Nocturnal: Chuck-will's-widow; Diurnal: Orchard Oriole, Yellow-billed Cuckoo, Eastern Wood-Pewee, Wood Thrush, Yellow-breasted Chat, Blue-winged Warbler, Eastern Towhee, Indigo Bunting, White-eyed Vireo

Silvicultural practices

Even-aged management: Recent regeneration cuts provide openings used by birds for display and foraging. Fully stocked or closed canopy mid- and late-successional even-aged forest tends to be too dense to provide quality habitat. Thinning can create more open forest that is suitable habitat, especially in conjunction with prescribed fire.

Uneven-aged management: Generally not suitable if used to maintain fully stocked stands because

maintaining multiple age classes in the understory and midstory prevents the open stand conditions needed for foraging. Openings created by single-tree or group selection are usually not large enough for foraging, and the canopy quickly closes in these small openings. However, if lower tree densities are maintained in conjunction with fire, birds are attracted to the variable canopy structure.

Open-forest management: Savanna and open woodland restoration and maintenance through tree thinning and frequent prescribed fire provides quality habitat. Abundance is greatest in woodlands with lower tree basal area (9-10 m²/ha) or canopy cover. Prescribed fire is an important tool for maintaining open stand conditions and ideally should be rotated among management units on a 2-3-year rotation so not all sites are burned in the same year.

Woodland Birds

Eastern Wood-Pewee



Figure 46. Eastern Wood-Pewee catches insects in the air by launching from an exposed perch in the canopy of woodlands. Photo by Agami Photo Agency.

Status

A Neotropical migrant that breeds in Missouri (Figures 46, 47). A priority bird species in Missouri with a 28% decline in Central Hardwoods Region and 38% decline in North America from 1966–2024. It is relatively abundant in Missouri but has declined across its range, and Missouri is important to sustaining the global population.

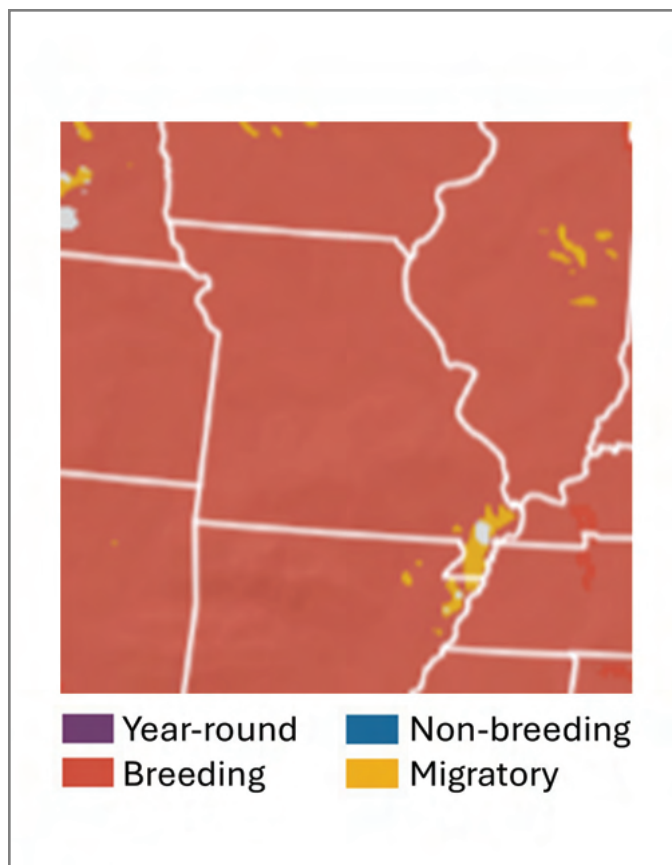


Figure 47. The Eastern Wood-Pewee breeds throughout Missouri. Image provided by eBird (www.ebird.org) and created January 2026.

Habitat

Open savanna, woodland, and forest (Figure 48). Key habitat features include openings in the canopy or an open midstory for sallying (aerial foraging) and large, sprawling mature trees for nesting sites. Will nest across a gradient of very open savanna to closed-canopy forest. Nests in the canopy in forks of deciduous tree limbs far from the trunk.

Associated Species

Yellow-billed Cuckoo, Kentucky Warbler, Yellow-breasted Chat, Blue-winged Warbler, Eastern Towhee, Indigo Bunting, White-eyed Vireo, Wood Thrush

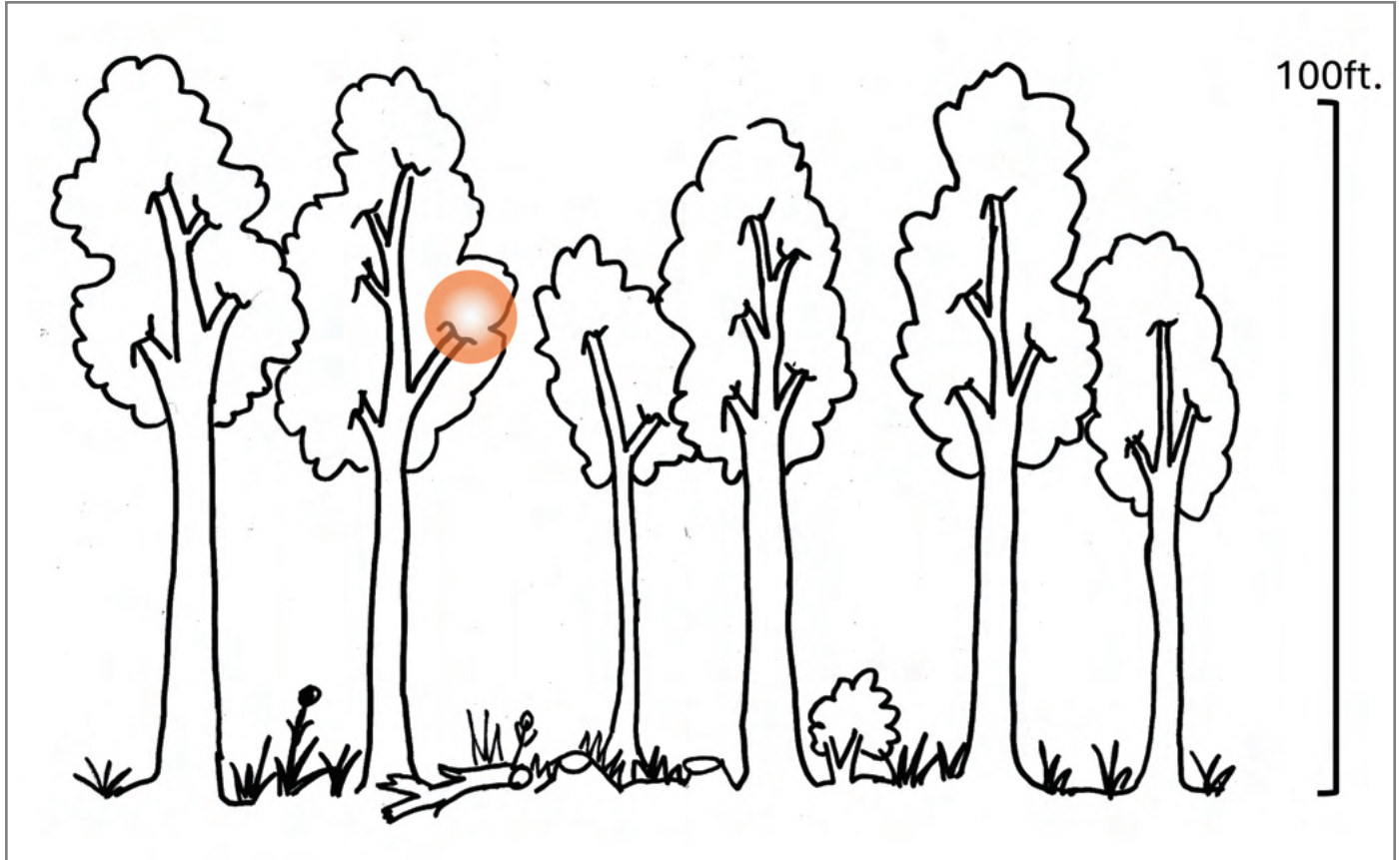


Figure 48. Eastern Wood-Pewee habitat consists of large mature trees in savanna, woodland, and forest with openings in canopy or an open midstory. The orange bubble is a typical nest location.

Silvicultural practices

Even-aged management: Recent clearcuts do not provide habitat, but seed tree and shelterwood cuts can provide good habitat. Thinning mature even-aged stands will improve habitat.

Uneven-aged management: Provides suitable habitat over time because it maintains mature trees and creates openings or a multilayered canopy that provides foraging opportunities.

Open-forest management: Savanna and woodland restoration and maintenance through tree thinning and frequent prescribed fire provides quality habitat by creating a semi-open canopy and open midstory that supports foraging. Maintenance of large, mature, semi open-grown, deciduous trees provides nest sites.

Woodland Birds

Orchard Oriole



Figure 49. Orchard Orioles eat a variety of invertebrate prey plus fruit and nectar. Photo by John L. Asher

Status

Neotropical migrant that breeds in Missouri (Figures 49, 50). A priority bird species in Missouri with a 55% decline in Central Hardwoods Region and 44% decline in North America from 1966–2024.

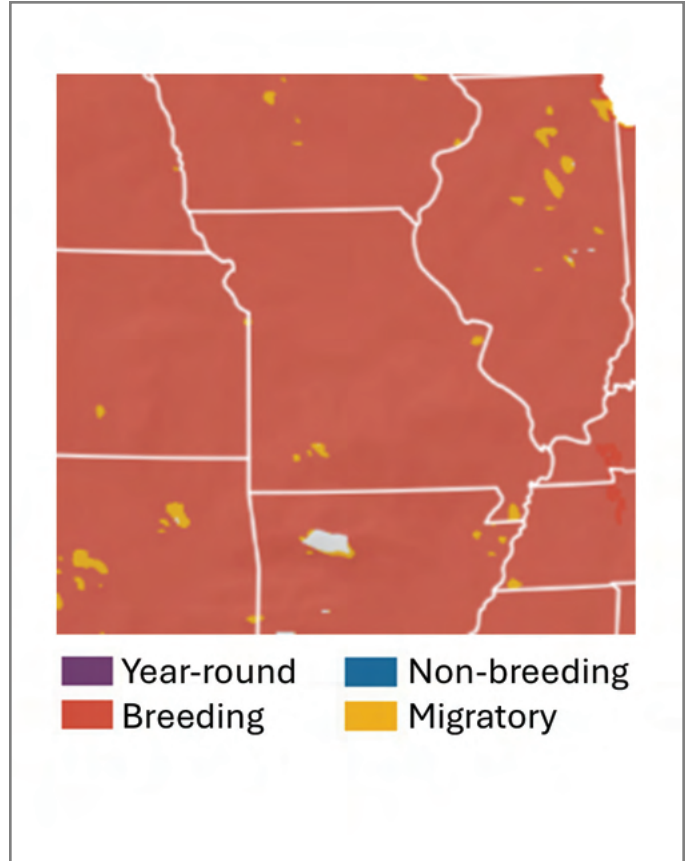


Figure 50. The Orchard Oriole breeds throughout Missouri. Image provided by eBird (www.ebird.org) and created January 2026.

Habitat

Savanna and open woodland, open shrublands, and fencerows on farms, orchards, wooded riparian areas, and treed wetland edges (Figure 51). Key features of its habitat are scattered trees often associated with some shrub and small tree cover. Nests in dense clumps of small trees and large mature trees.

Associated Species

Blue-winged Warbler, Eastern Wood-Pewee, Summer Tanager, White-eyed Vireo, Indigo Bunting, Dickcissel, Eastern Meadowlark

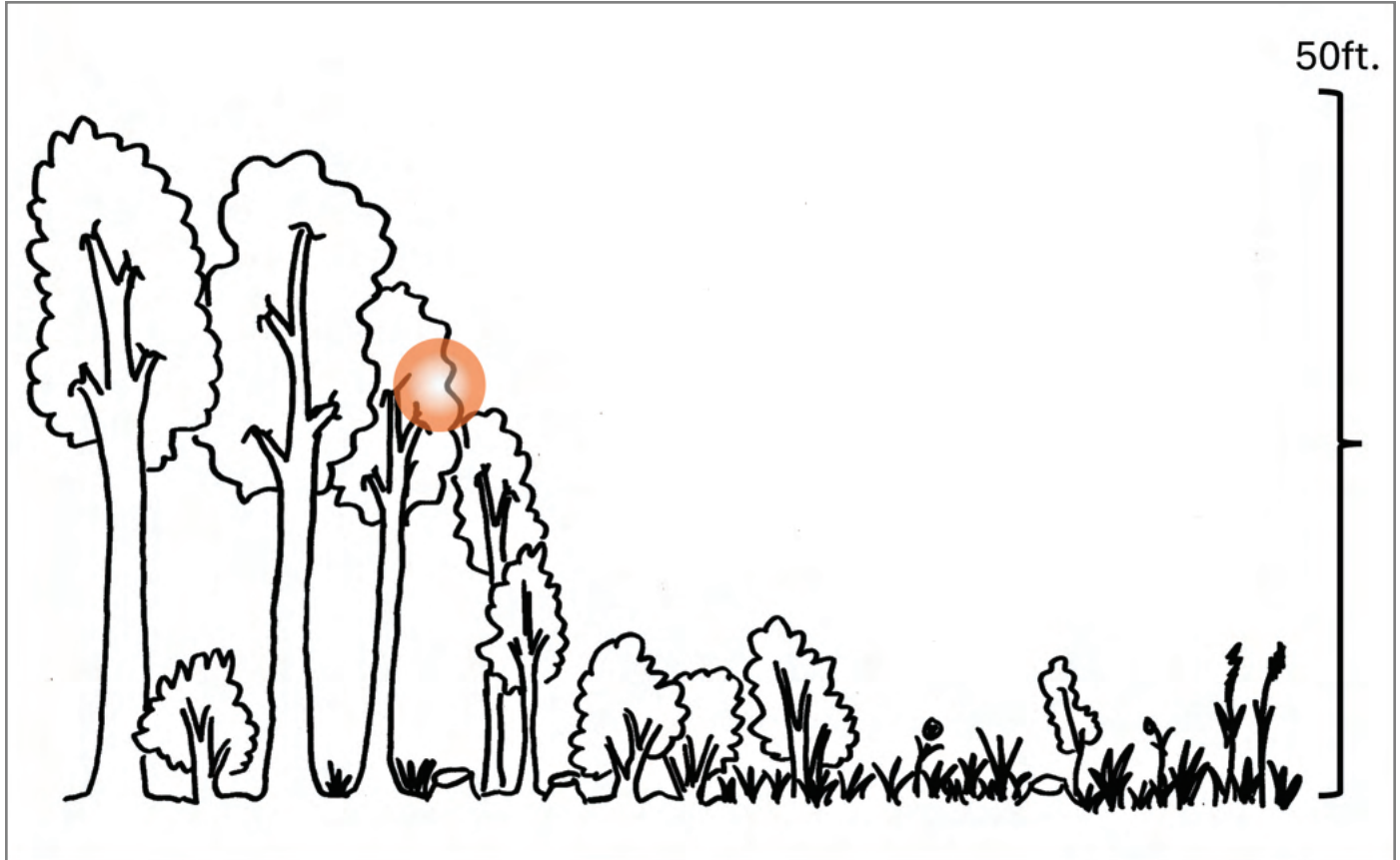


Figure 51. Orchard Oriole habitat includes open woodland, shrublands, and fencerows on farms, orchards, and wooded riparian areas with scattered large trees and some shrub and small tree cover. The orange bubble is a typical nest location.

Silvicultural practices

Even-aged management: Regeneration cuts that create a mix of dense shrubby cover and young trees, while retaining some mature trees, provide suitable habitat. Middle-aged and mature even-aged stands with closed canopies are not suitable habitat.

Uneven-aged management: Generally not as suitable as other management options with the possible exception of large group selection openings that have sufficient shrub and young tree cover.

Open-forest management: Savanna and open woodland restoration and maintenance through tree thinning and periodic prescribed fire provide a mix of dense shrub and young tree cover in areas that have not burned recently, along with scattered mature trees, creating suitable habitat.

Forest Birds

Wild Turkey



Figure 52. Wild Turkey eat a variety of hard and soft mast (i.e. acorns and fruits), seeds, and invertebrates. Photo by Jeff Powelson.

Status

The Wild Turkey is a resident game bird that occurs throughout the state (Figures 52, 53). The restoration of the Wild Turkey is one of the great successes of modern wildlife management in Missouri and elsewhere in the United States. It has increased from a couple thousand birds in only 14 counties in Missouri in the 1950's to several hundred thousand birds and a statewide distribution now.

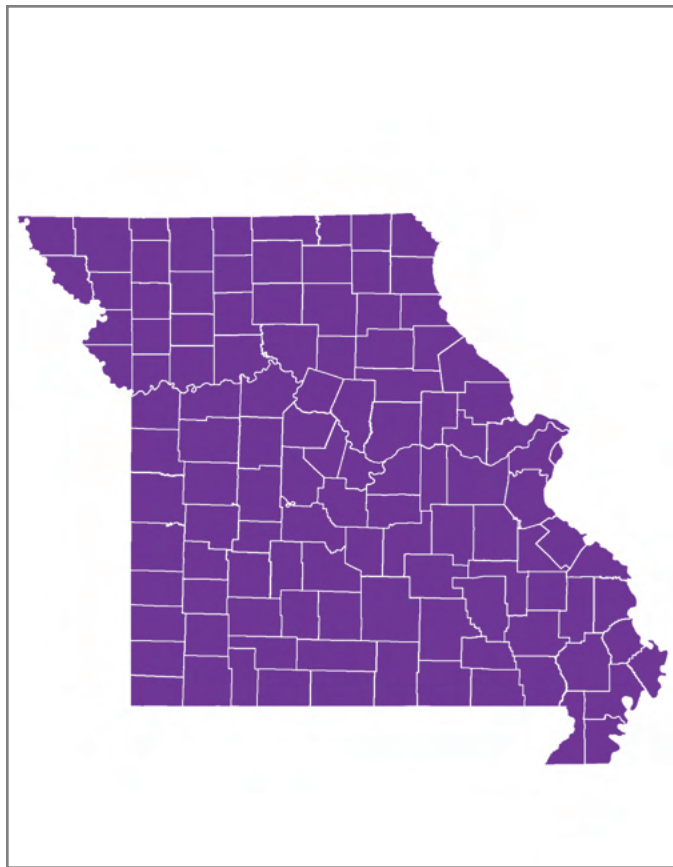


Figure 53. The Wild Turkey occurs year-round throughout Missouri.

Habitat

Dense cover for hens to hide their nest but open enough for them to escape from predators. Poults require ground cover consisting of forbs that host the insects they feed on along with some overhead cover for protection from predators while not impeding their movement. Mature oaks provide acorns, an important food for adults. A landscape mosaic that includes some form of tree harvest that permits sunlight to reach the forest floor, prescribed fire that stimulates forbs while preventing ground cover from becoming too dense, and some mature forest for mast are ideal (Figure 54).

Associated Species

Yellow-breasted Chat, Prairie Warbler, Eastern Towhee, Wood Thrush, Acadian Flycatcher, Worm-eating Warbler



Figure 54. Mature oak or pine forest provide acorns and seeds for turkeys to feed on and regeneration cuts provide forbs for poults to feed and hide in and dense cover for hens to hide nests. The orange bubble is a typical nest location.

Silvicultural practices

Even-aged management: Recent regeneration cuts provide brood cover due to the mix of herbaceous and woody cover, and nesting cover as woody cover becomes denser. Older stands produce mast, which provides food. These year-round habitat needs can be met by a rotation of periodic small clearcuts to create a diversity of forest age classes in a landscape.

Uneven-aged management: Maintains mast-bearing trees throughout the rotation because mature trees are present at all times. Group selection openings initially provide herbaceous cover for poults to feed and hide and later provide dense woody cover for hens to hide nests.

Open-forest management: Provides quality habitat because mature oaks and pines produce acorns and seeds for food, herbaceous ground provides foraging habitat and cover for poults, and patches of dense woody cover from shrubs and sprouts provides nest cover.

Forest Birds

Wood Thrush



Figure 55. Wood Thrush forage on invertebrates in leaf litter on the forest floor and also berries in summer and fall. Photo by Michael J. Parr.

Status

A Neotropical migrant that breeds in Missouri (Figures 55, 56). A Priority bird species in Missouri, 2% increase in Central Hardwoods Region and 46% decline in North America from 1966–2024. Even though it shows a small increase in the Central Hardwoods Region, it is a priority species because of the importance of this region to help offset range-wide declines.

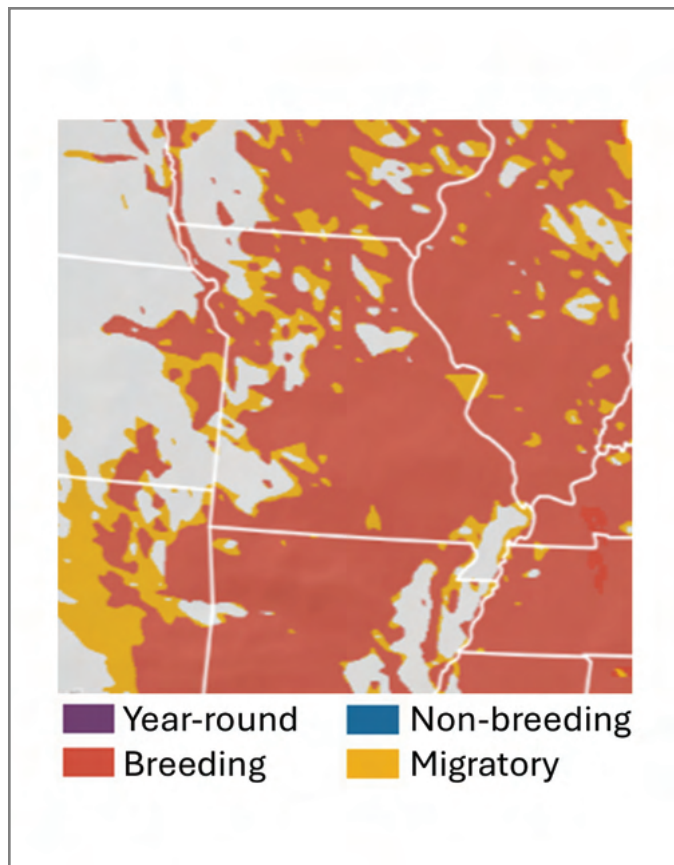


Figure 56. Wood Thrush breed throughout Missouri wherever there is sufficient forest habitat. Image provided by eBird (www.ebird.org) and created January 2026.

Habitat

Nesting habitat is primarily closed-canopy mature forest on moister sites dominated by deciduous trees (Figure 57). Wood Thrush nest in sapling to pole-sized (4-10 inch diameter) understory and midstory trees and forage in leaf litter on the forest floor. Nesting success is greater in large forest tracts, and they may experience higher nest predation and parasitism by Brown-headed Cowbirds in small forest patches.

Wood Thrush will not nest in young, regenerating forest but will begin to occupy forest as it matures and the forest canopy closes, usually 15-20 years post-harvest. Ideal breeding habitat is older stands of mature forest with a closed canopy, understory and midstory trees for nesting, and a forest floor

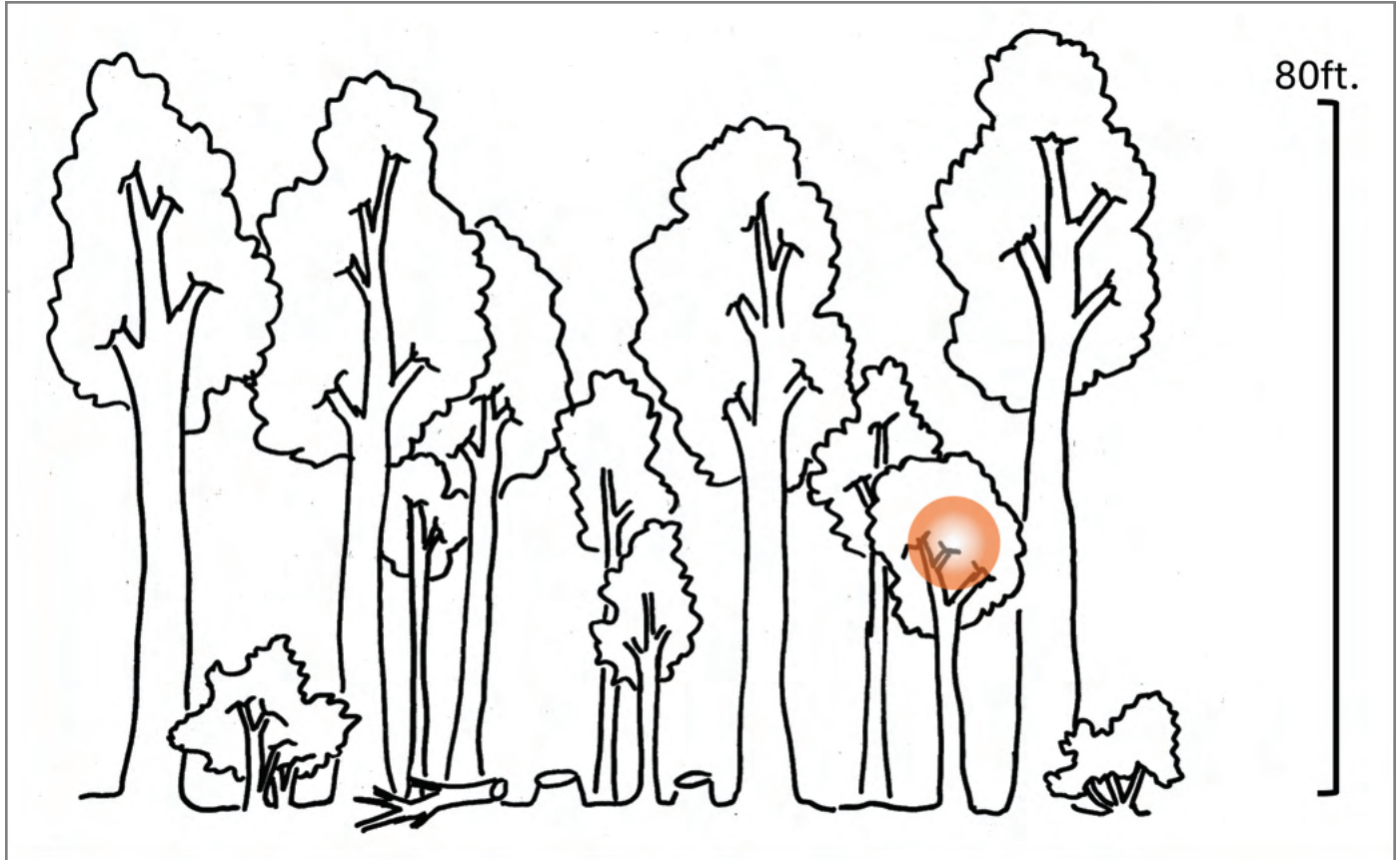


Figure 57. Wood Thrush breed in closed canopy mature forest with midstory trees for nesting and ground cover dominated by leaf litter for foraging. The orange bubble is a typical nest location.

dominated by leaf litter. Post-breeding adults and juveniles will use forest edges and young forest to forage on fruits and insects and for its dense protective cover, as well as mature forest.

Associated Species

Acadian Flycatcher, Worm-eating Warbler, Ovenbird, Red-eyed Vireo, Eastern Wood-Pewee

Silvicultural practices

Even-aged management: Mature even-aged stands with understory and midstory trees provide nesting habitat. Recent regeneration cuts are not suitable for nesting but provide post-breeding habitat for adults and young due to abundant cover and food. Thinning can encourage the development of understory and midstory trees for nesting 20+ years after harvest.

Uneven-aged management: Single-tree selection and group selection maintain mature forest trees and encourage development of understory and midstory trees for nesting. Regeneration patches provide post-breeding habitat prior to migration.

Open-forest management: Generally not suitable because of dense groundcover, shrubs and small trees, and an open canopy. Frequent prescribed fire does not benefit Wood Thrush because it removes leaf litter and prevents the development of midstory trees where they nest.

Forest Birds

Worm-Eating Warbler



Figure 58. Worm-eating Warbler Forage for caterpillars and invertebrates in low branches and leaves of trees and understory shrubs. Photo by Eleanor Briccetti.

Status

A Neotropical migrant that breeds throughout Missouri (Figures 58, 59). A priority bird species in Missouri with a 1% increase in Central Hardwoods Region and 3% decline in North America from 1966–2024. While its abundance is stable in the Central Hardwoods Region, Missouri is in the core of its range, so it is important to manage for high abundance here.

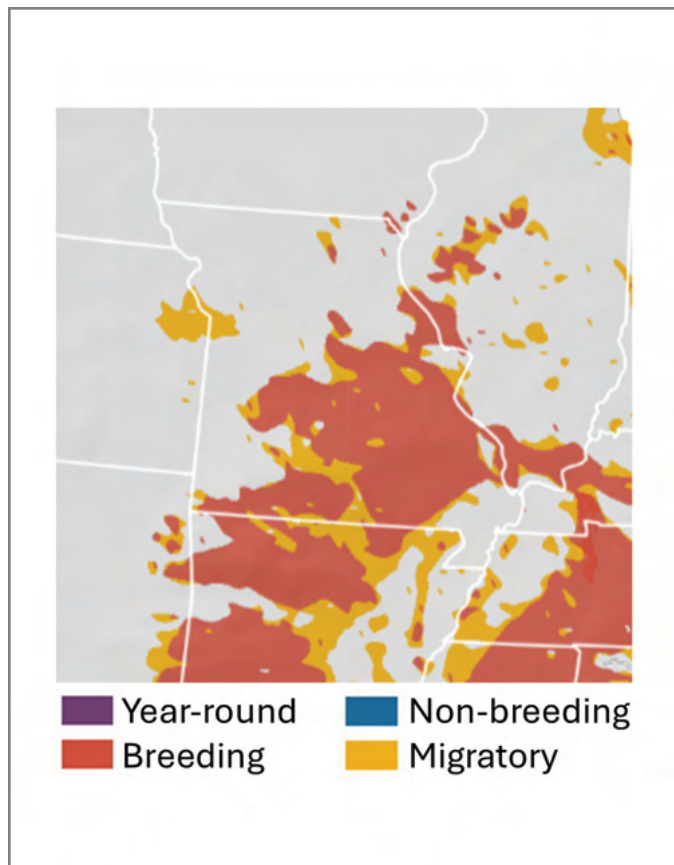


Figure 59. The Worm-eating Warbler breeds in the heavily forested regions of Missouri. Image provided by eBird (www.ebird.org) and created January 2026.

Habitat

Breeding habitat is primarily closed-canopy mature, deciduous forest on moist sites with leaf litter as the dominant ground cover, typically on the lower half of steep slopes (Figure 60). These areas are often associated with shade-tolerant understory shrubs that provide vertical structure while remaining open at ground level. May begin to re-occupy regenerated stands >15 years post-harvest when canopy has closed and ground cover is shaded out. Post-breeding birds and their young may use denser cover such as 7-10-year-old regenerating forest created by clearcutting or shelterwood cutting. Avoids small forest patches or highly fragmented forests. Nests on slopes on the ground in leaf litter.

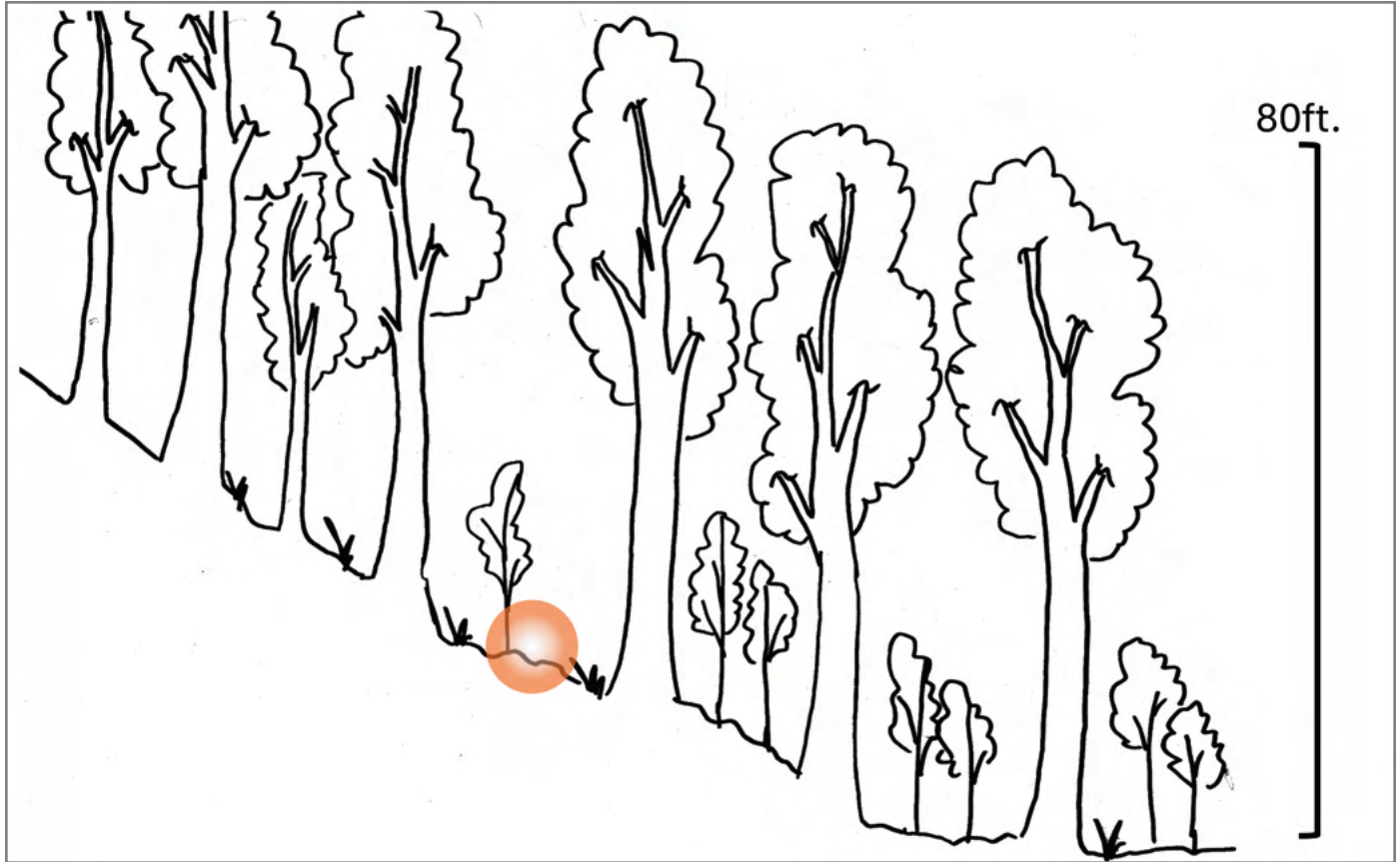


Figure 60. Worm-eating Warbler habitat is primarily closed-canopy mature, deciduous forest on moist sites with leaf litter as the dominant ground cover, typically on the lower half of steep slopes. The orange bubble is a typical nest location.

Associated Species

Acadian Flycatcher, Ovenbird, Black-and-white Warbler, Kentucky Warbler, Red-eyed Vireo, Wood Thrush

Silvicultural practices

Even-aged management: Mature even-aged stands with closed canopy and ground cover dominated by leaf litter and some shade-tolerant understory shrubs provide excellent habitat, especially on lower slopes. Recent regeneration cuts are not suitable for nesting but provide post-breeding habitat before migration.

Uneven-aged management: Single-tree selection and group selection maintain mature forest trees and can create suitable habitat except where recent regeneration cuts result in dense ground cover and

tree regeneration. Regeneration patches provide post-breeding habitat for adults and young.

Open-forest management: Not suitable because open forests usually occur on drier sites and have dense groundcover, shrubs and small trees, and an open canopy. Prefers moister sites with a closed canopy and groundcover dominated by leaf litter. Prescribed fire can have short-term negative effects by removing leaf litter.

Forest Birds

Prothonotary Warbler



Figure 61. The Prothonotary Warbler eats a variety of invertebrates often gleaned from leaves and near water. Photo by Michael J. Parr.

Status

A Neotropical migrant that breeds in bottomland forest throughout Missouri and a priority bird species in Missouri (Figures 61, 62). While increasing 51% in the Central Hardwoods Region, it has declined 26% in North America from 1966–2024.

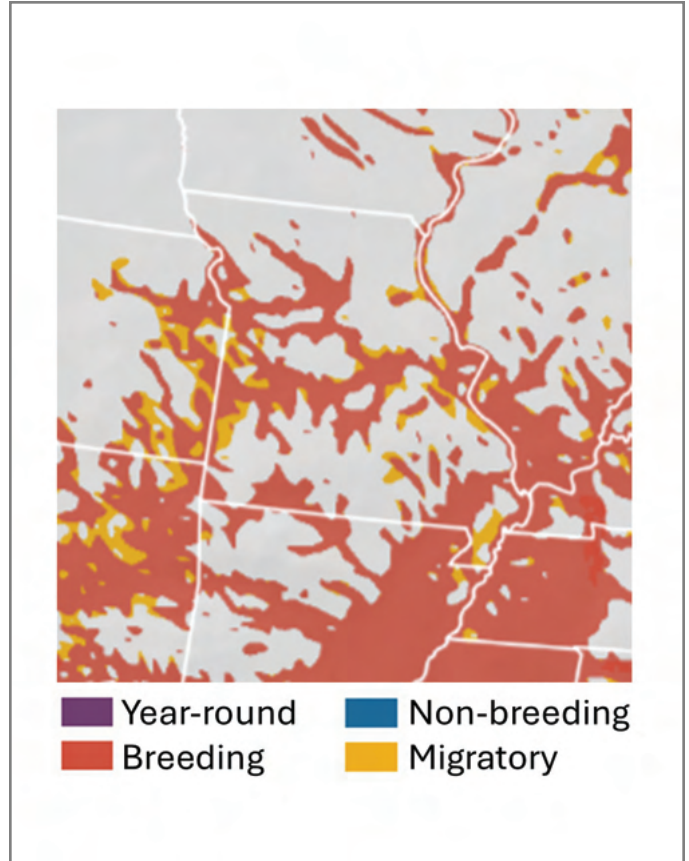


Figure 62. The Prothonotary Warbler breeds along major rivers throughout Missouri. Image provided by eBird (www.ebird.org) and created January 2026.

Habitat

Breeding habitat is primarily mature bottomland forest with moderate canopy cover (50-75%) and sparse ground cover or understory due to flooding (Figure 63). Nests in cavities over or near standing or slow-moving water, typically in seasonally flooded bottomland hardwood forests. Abundance is often related to cavity availability, which can be supplemented with nest boxes.

Associated Species

Great Crested Flycatcher, Yellow-throated Warbler, Black-and-white Warbler, Louisiana Waterthrush, Ovenbird, Red-eyed Vireo, Warbling Vireo

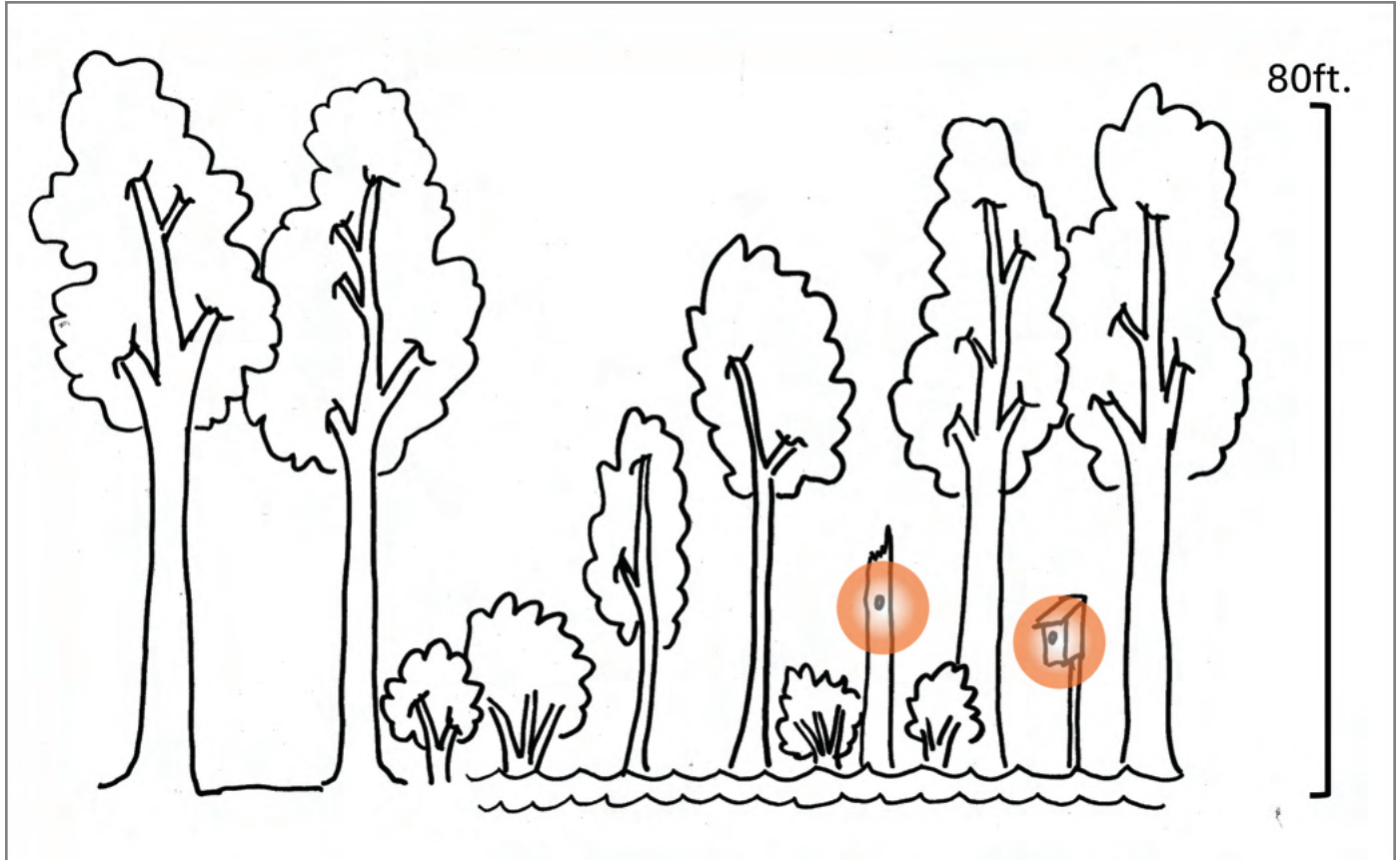


Figure 63. Prothonotary Warblers nest in cavities or nest boxes in mature bottomland forest with moderate canopy cover and sparse ground cover or understory due to flooding. The orange bubbles are typical nest locations.

Silvicultural practices

Even-aged management: Mature even-aged stands provide habitat on bottomland sites. Pole-sized stands can also provide habitat if suitable cavities are present or supplemented with nest boxes.

Uneven-aged management: Single tree selection and group selection maintain mature forest trees and can provide suitable habitat on bottomland sites, especially if care is taken to maintain cavity trees.

Open-forest management: Not suitable because open forests are associated with dry sites.

Forest Birds

Kentucky Warbler



Figure 64. The Kentucky Warbler foragers for invertebrates in leaf litter on the forest floor and shrubs, vines, and the lower parts of trees.
Photo by Ray Hennessy.

Status

A Neotropical migrant that breeds throughout Missouri where there is sufficient forest (Figures 64, 65). A Priority bird species in Missouri, 0% change in Central Hardwoods Region and 33% decline in North America from 1966–2022.

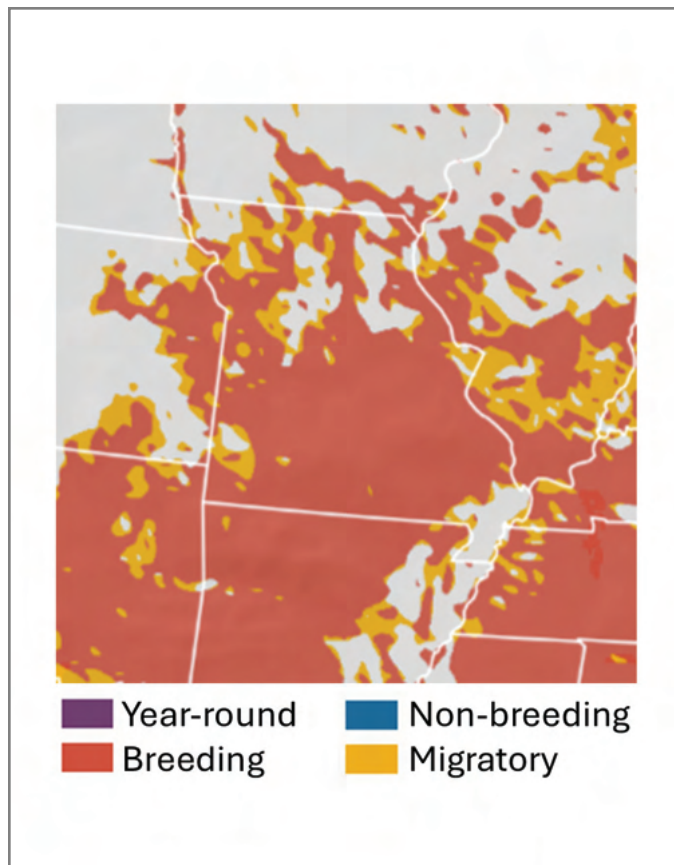


Figure 65. The Kentucky Warbler breeds throughout Missouri where there is sufficient forest. Image provided by eBird (www.ebird.org) and created January 2026.

Habitat

Breeding habitat is primarily closed-canopy forest on moister sites with well-developed groundcover and understory (Figure 66). Can include mature closed canopy forest or even- or uneven-aged regenerated stands with at least some residual mature trees and dense understory and ground cover. Avoids small forest patches or highly fragmented forests. Nests on or near the ground at the base of a small shrub.

Associated Species

Acadian Flycatcher, Ovenbird, Worm-eating Warbler, Red-eyed Vireo, Wood Thrush

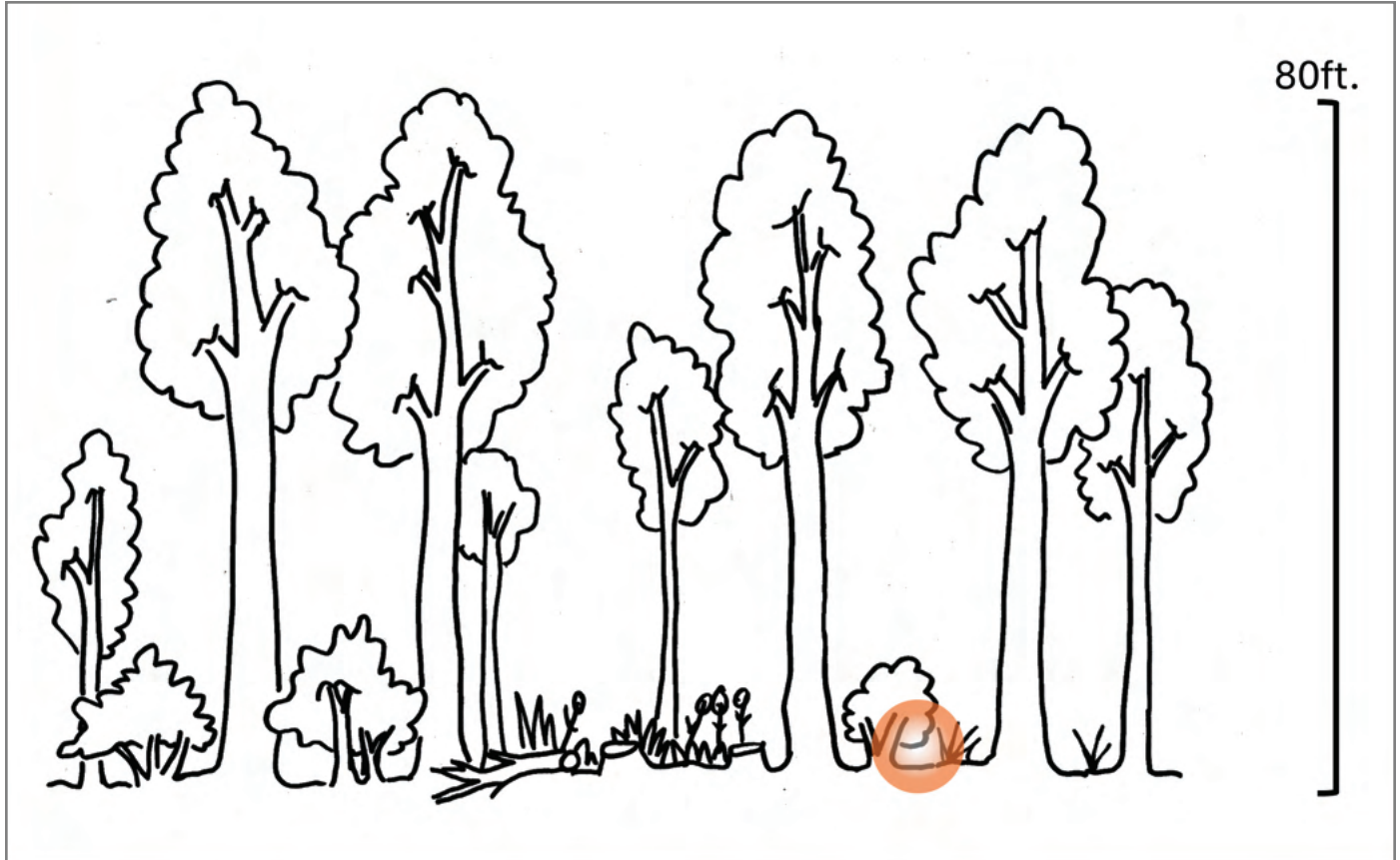


Figure 66. Kentucky Warbler breeding habitat is mature deciduous forest on moister sites with some disturbance to encourage groundcover and understory vegetation. The orange bubble is a typical nest location.

Silvicultural practices

Even-aged management: Recent regeneration cuts provide habitat because of the combination of residual trees and dense understory and ground cover. Mid-successional sapling and pole-sized stands do not provide habitat because ground cover and low shrub cover is shaded out. Mature stands in which the understory and ground cover has developed provide suitable habitat.

Uneven-aged management: Single tree selection and group selection create and maintain good habitat where small shrubs and saplings are relatively abundant.

Open-forest management: Generally not suitable because open forests are associated with drier sites and lack an understory.

Forest Birds

Cerulean Warbler



Figure 67. The Cerulean Warbler forages on insects high in the canopy.
Photo by Frode Jacobsen.

Status

A Neotropical migrant that breeds in Missouri (Figures 67, 68). A priority bird species in Missouri with a 66% decline in Central Hardwoods Region and 63% decline in North America from 1966–2024.

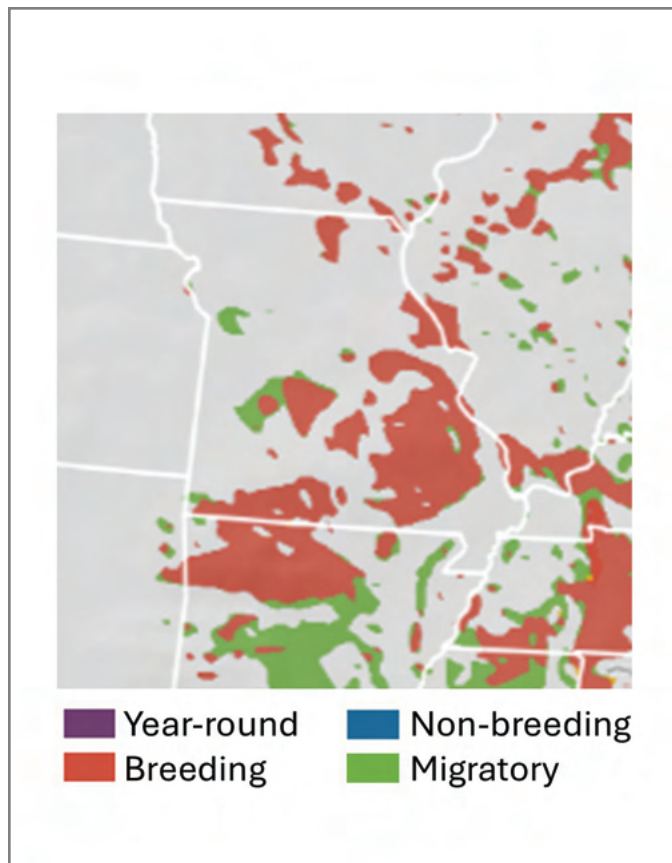


Figure 68. The Cerulean Warbler breeds in heavily forested regions of the state often along rivers. Image provided by eBird (www.ebird.org) and created January 2026.

Habitat

In Missouri, most often found along Ozark streams or on mesic slopes with large deciduous trees and canopy gaps (Figure 69). These gaps may result from natural slope, tree falls, flooding disturbances in bottomlands, or forest management. Nests high in the canopy of mature trees.

Associated Species

Yellow-throated Warbler, Ovenbird, Hooded Warbler, Scarlet Tanager, Wood Thrush, Louisiana Waterthrush

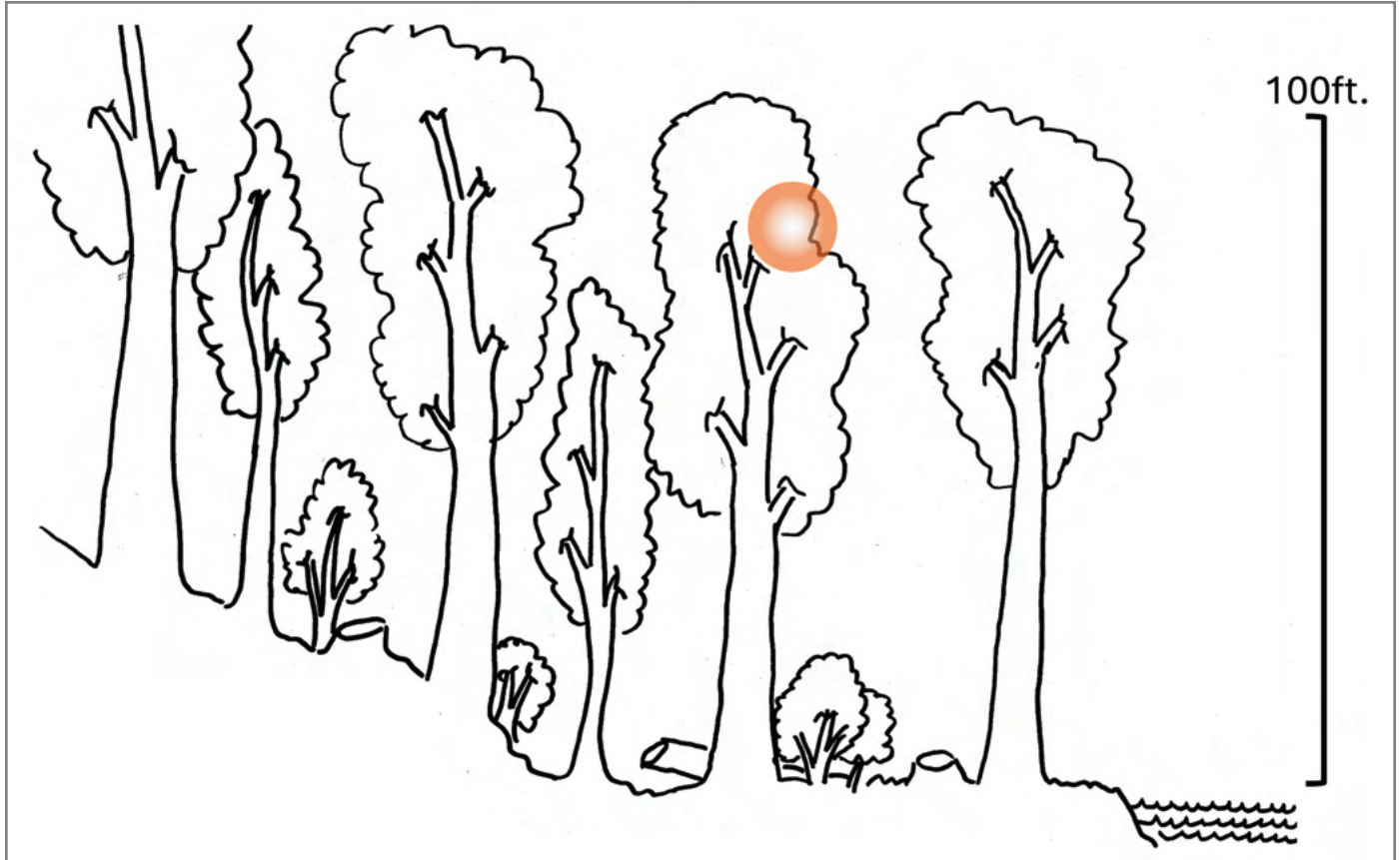


Figure 69. Cerulean Warblers occur in mature forest on moist sites with large deciduous trees and canopy gaps, typically on slopes or riparian areas. The orange bubble is a typical nest location.

Silvicultural practices

Even-aged management: Recent regeneration cuts or middle-aged stands are not suitable because Cerulean Warblers prefer tall, large-diameter trees and broken canopies that only develop after 80 years or so in even-aged stands.

Uneven-aged management: Single-tree selection and group selection maintain mature forest trees and canopy gaps that can provide good habitat.

Open-forest management: Not suitable because Cerulean warblers are associated with large trees on moist sites.

Special Circumstance Species

Brown-headed Nuthatch



Figure 70. The Brown-headed Nuthatch forages in pine tree needles, branches, and trunks for insects and on the cones for seeds.
Photo by Noppadol Paothong, Missouri Department of Conservation.

Status

Year-round resident. Extirpated from Missouri in the early 1900s but reintroduced in 2020–2026 on the Mark Twain National Forest in Carter County. Birds have spread to surrounding pine woodlands in Carter and Shannon counties, but it is too early speculate on the long-term success of this bird in Missouri (Figures 70, 71). The species is not threatened across its established breeding range from northwest Arkansas through southeastern states.

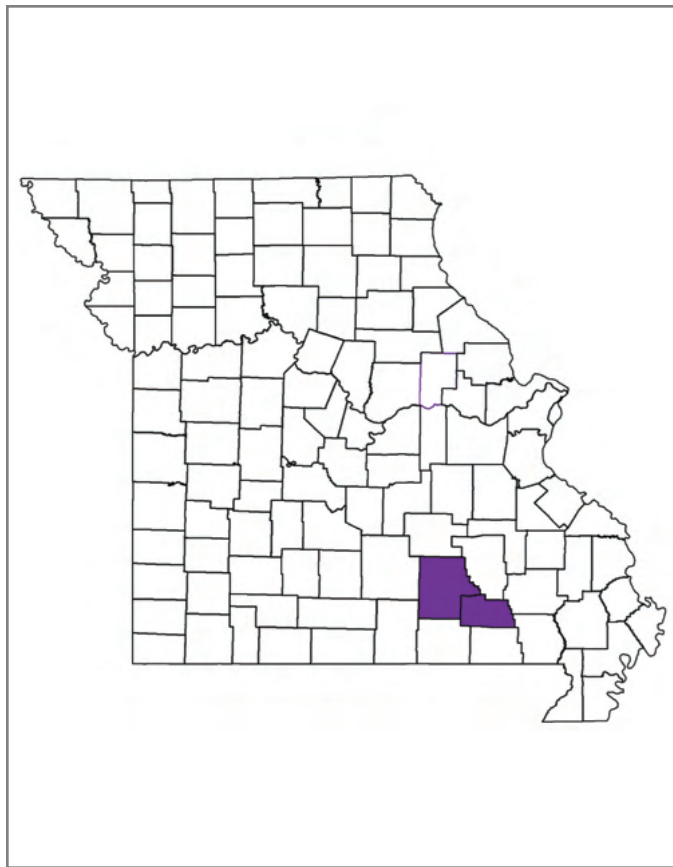


Figure 71. The Brown-headed Nuthatch was reintroduced in Carter County and some birds have spread into adjacent Shannon County (shown in purple) and occurs year-round.

Habitat

Open shortleaf pine woodlands with standing snags (Figure 72). Key habitat features include mature pines for foraging in the cones and bark and well-decayed pine snags for birds to excavate nest cavities.

Associated Species

Pine Warbler, Red-headed Woodpecker, Prairie Warbler, Yellow-breasted Chat, Eastern Towhee, Indigo Bunting, White-eyed Vireo



Figure 72. Brown-headed Nuthatch habitat consists of open pine savanna and woodland with large, mature pine trees and decaying snags that are soft enough for cavity excavation. The orange bubble is a typical nest location.

Silvicultural practices

Even-aged management: Fully stocked, closed-canopy pine stands regenerated and maintained by even-aged management are usually too dense and not suitable. Thinning mature even-aged stands to create open woodland can provide habitat that can be maintained through periodic prescribed fire. Maintenance and recruitment of well-decayed pine snags is essential.

Uneven-aged management: Fully stocked, closed-canopy pine stands regenerated and maintained by uneven-aged management are generally too dense and not suitable. However, if used in combination with prescribed fire to maintain open woodland it can provide habitat. Maintenance and recruitment of well-decayed pine snags is essential.

Open-forest management: Pine savanna and open woodland restoration and maintenance through tree thinning and frequent prescribed fire provides quality habitat. Large mature pine trees for foraging and maintenance and recruitment of well-decayed, standing pine snags is essential.

Special Circumstance Species

Ruffed Grouse



Figure 73. Ruffed Grouse eat hard and soft mast, buds, catkins, and invertebrates. Photo by Photo Larry Master.

Status

Ruffed grouse are a resident game bird that declined in abundance throughout the 1900s due to the loss of young forest in Missouri. Repeated attempts have been made to restore populations through habitat management with releases of wild trapped birds from other states. These efforts have had mixed success and currently the only portion of the state where Ruffed Grouse are potentially found is the River Hills Region of Callaway, Montgomery, and Warren counties (Figures 73, 74). Most landowners cannot expect to see these birds even if they manage for them, however, management for Ruffed Grouse will benefit a number of associated species.



Figure 74. Ruffed Grouse have a very limited distribution in Missouri (shown in purple) and are most likely to occur in the River Hills Region of Callaway, Warren, and Montgomery counties.

Habitat

A key component of habitat is overhead cover from avian predators and visibility at ground level to see approaching predators on the ground. Young forest consisting of dense saplings provide protective cover for adults, especially displaying (drumming) males. Females nest on the ground in mature forest where they can see approaching predators. Forest openings and young forest with abundant ground cover provide insects for growing chicks. Mature forest can provide acorns, an important winter food. These varying habitat needs mean that a diversity of forest habitats are required to meet their needs throughout the year (Figure 75).

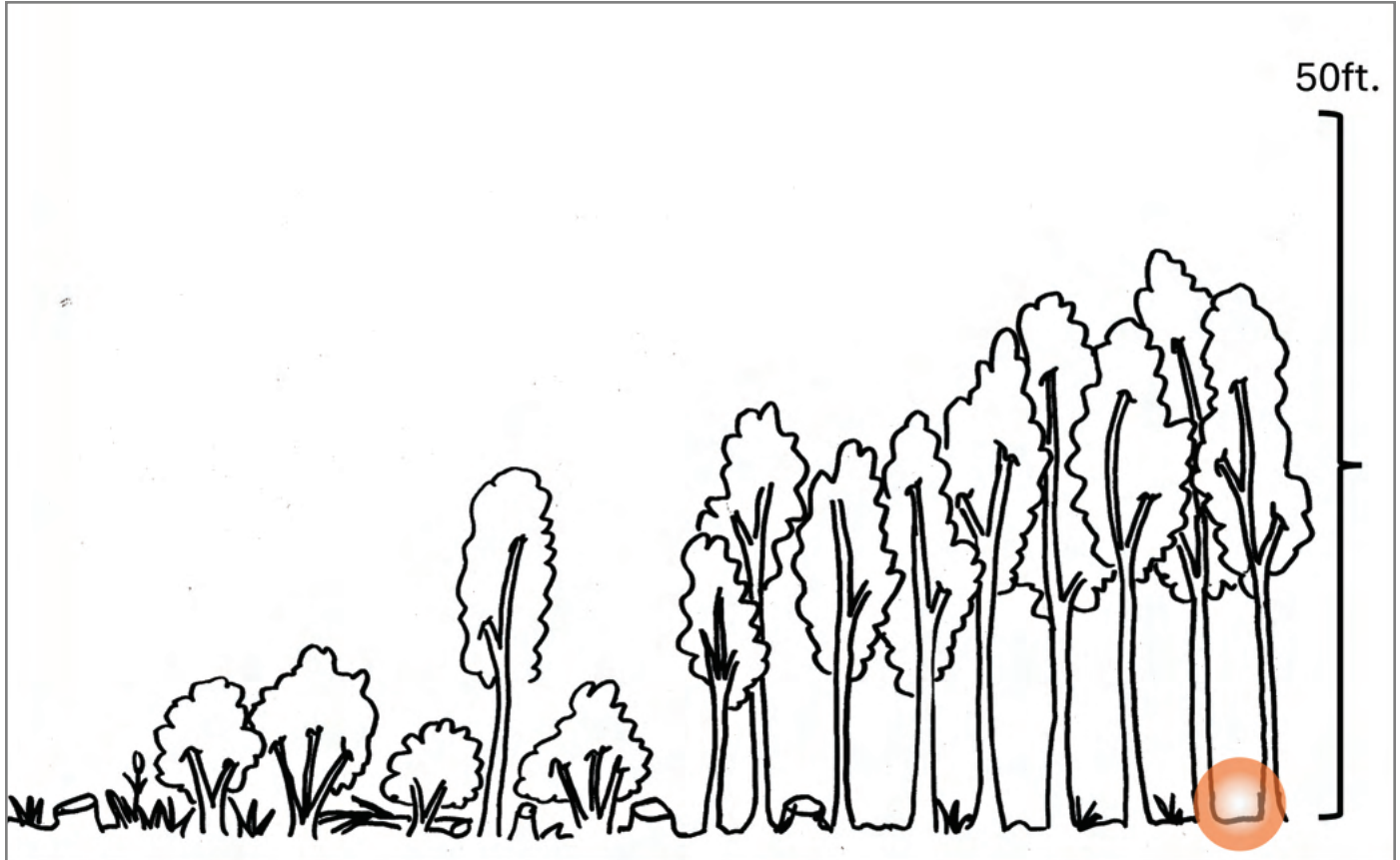


Figure 75. Young, regenerating forest with a mix of forbs, young trees, and shrubs provides foraging habitat for Ruffed Grouse broods but adults require dense sapling or pole-sized trees for escape cover from predators. Mature forest provides mast for food and nesting habitat. The orange bubble is a typical nest location.

Associated Species

Yellow-breasted Chat, Prairie Warbler, Eastern Towhee, Wood Thrush, Acadian Flycatcher, Worm-eating Warbler

Silvicultural practices

Even-aged management: Recent regeneration cuts provide brood cover due to the mix of herbaceous and woody cover. Once the canopy closes at about 10 years these stands provide protective cover for adults until the stands begin to naturally thin at around 20 years old. Older stands provide nesting cover and acorns for food. These year-round habitat needs are best met by a rotation of periodic small clearcuts to create a diversity of forest age classes in a landscape.

Uneven-aged management: Single tree selection generally does not result in the dense woody cover preferred by grouse. Group selection can provide patches of dense woody cover but large patches created through even-aged management provide more suitable habitat.

Open-forest management: Not suitable because of the lack of overhead cover due to low tree density. Some open forest in the landscape could provide brood cover because of the rich ground cover and abundant insect prey—if adjacent to dense woody cover for overhead protection from predators.

Summary of Birds and Forest Communities

We focused on 21 focal bird species that are among those in greatest need of conservation in Missouri and responsive to forest management. As shown in the species accounts above, these birds are found in a range of forest communities. Below we provide a summary table of their distribution across these communities (Table 2). It is important to recognize that most of these species are found in communities that require active forest management to sustain!

Table 2. Distribution of bird species across forest communities in Missouri.

High abundance
 Moderate abundance
 Mostly absent

Common Name	Savanna	Open woodland	Closed woodland	Young even-aged forest	Mature even-aged forest	Uneven-aged forest
Northern Bobwhite	High abundance	High abundance	Mostly absent	Mostly absent	Mostly absent	Mostly absent
Red-headed Woodpecker	High abundance	High abundance	Moderate abundance	Moderate abundance	Mostly absent	Mostly absent
Brown Thrasher	High abundance	High abundance	Moderate abundance	High abundance	Mostly absent	Mostly absent
Field Sparrow	High abundance	High abundance	Moderate abundance	High abundance	Mostly absent	Mostly absent
Eastern Towhee	High abundance	High abundance	Moderate abundance	High abundance	Mostly absent	Mostly absent
Yellow-breasted Chat	High abundance	High abundance	Moderate abundance	High abundance	Mostly absent	Mostly absent
Blue-winged Warbler	High abundance	High abundance	Moderate abundance	High abundance	Mostly absent	Mostly absent
Prairie Warbler	High abundance	High abundance	Moderate abundance	High abundance	Mostly absent	Mostly absent

Yellow-billed Cuckoo	Mostly absent	Moderate abundance	High abundance	Mostly absent	High abundance	High abundance
Chuck-will's-widow	Moderate abundance	High abundance	High abundance	Moderate abundance	Moderate abundance	Moderate abundance
Eastern Whip-poor-will	Moderate abundance	High abundance	High abundance	Moderate abundance	Moderate abundance	Moderate abundance
Brown-headed Nuthatch	High abundance	High abundance	Moderate abundance	Mostly absent	Mostly absent	Mostly absent
Eastern Wood-Pewee	High abundance	High abundance	High abundance	Moderate abundance	Moderate abundance	Moderate abundance
Orchard Oriole	High abundance	High abundance	Moderate abundance	High abundance	Mostly absent	Mostly absent

Wild Turkey	High abundance	High abundance	High abundance	High abundance	High abundance	High abundance
Ruffed Grouse	Mostly absent	Mostly absent	Mostly absent	High abundance	Moderate abundance	Moderate abundance
Wood Thrush	Mostly absent	Mostly absent	Moderate abundance	Moderate abundance	High abundance	High abundance
Worm-eating Warbler	Mostly absent	Mostly absent	Mostly absent	High abundance	High abundance	High abundance
Prothonotary Warbler	Mostly absent	Mostly absent	Mostly absent	Mostly absent	High abundance	High abundance
Kentucky Warbler	Mostly absent	Mostly absent	Mostly absent	High abundance	High abundance	High abundance
Cerulean Warbler	Mostly absent	Mostly absent	Mostly absent	Mostly absent	High abundance	High abundance

Develop and Implement a Plan

You can manage your property for both wood products and enhanced wildlife habitat because forest and wildlife management are not mutually exclusive; they are interrelated. Properly implemented management practices can enhance both wildlife habitat and improve forest productivity. Even small improvements can have a sizable impact on your land's health, productivity and the surrounding wildlife. However, managing your property to sustainably produce timber products and provide wildlife habitat requires an active forest-wildlife management plan and continual effort over time, it's not a one and done practice. Below are some steps to help with plan development and implementation.

- 1. Define your goals and objectives.** Communicate your goals (income, recreation, wildlife) explicitly when working with a conservation planner(s); don't assume they know what you want to accomplish. Examples of objectives include: restoring and maintaining open forest communities because of their value to many bird species, eliminating invasive plants that interfere with native tree and shrub regeneration, maintaining large diameter trees to provide nesting, roosting, and feeding habitat, as well as future snags, cavities, and downed woody material and/or timber production. Objectives addressing wildlife, recreation, scenic beauty, forest health, and financial benefits can be compatible, especially over the long term. However, you may have to assess trade-offs and prioritize objectives because you can't maximize all of these at the same time in the same place.
- 2. Get to know your land.** Know your property boundaries, deeds, and history of land use. Complete an overall assessment of your property at the stand, property, and landscape levels. For instance, a forest inventory can include estimating snag abundance and dying trees for cavity-nesting birds. Getting to know the birds on your property can help you understand how they utilize forest features. How healthy are the trees in your forest? What kind of habitat does the forest provide, and how much quality habitat is used by birds and other wildlife? Is there structure that is missing?

3. Work with your conservation planner to understand the desired future conditions of your forest and what practices must be implemented to achieve them. What conditions are possible? What bird species are using the forest and what species will benefit from additional management? Ask what the woods will look like immediately after thinning or harvest, and in five, ten, or twenty years. The initial disturbance can seem severe if you are seeing it for the first time, so ask questions to better understand the treatments. It is also important to consider what the forest might look like if there is no management. Forests are dynamic and will change even in the absence of management; intentional management helps ensure they change in a way that meets your objectives.

4. Create a forest management plan that includes bird-friendly silviculture practices. When both the landowner and conservation planner or forester "see the forest for the birds," collaboration becomes easier, and bird habitat enhancements can be effectively integrated into the forest management plan. Incorporate a wildlife or bird monitoring protocol into the plan that involves you as the landowner. This will help you see and understand the results of implemented practices. Conducting post management monitoring of plant and animal response will help you and the conservation planner assess outcomes and adjust plans as necessary.

5. Implement the plan. The conservation planner or forester should work with you to oversee timber harvests, forest stand improvement, prescribe burning and other practices outlined in the plan. Contractors must be guided by your forest management plan through communication with the conservation planner or forester. Communication among the conservation planner or forester, contractors, and you is essential to meeting your goals.

6. Assess outcomes. It's important to assess how successful forest management activities were in achieving your goals. Were the expected results achieved? Are there follow-up actions that could take place, and on what? If changes are needed to achieve goals, revisit the planning timeline and adjust accordingly. Continue to work with your planner(s) to make future prescriptions when needed.

Private landowners own 93 percent of the land in Missouri. Approximately one-third of Missouri is forested, and over 80 percent of that forestland is privately owned. This means private landowners in Missouri have a great opportunity to influence wildlife, forests and other natural resources. People own forested land for many reasons, but the most common reasons are to enjoy beauty or scenery, to protect or improve wildlife habitat, and to protect nature or biological diversity.

Tools are available to Missouri landowners to help meet their forest and wildlife management goals. Technical assistance is available to help write forest management plans and provide guidance on all aspects of land and wildlife management. An estimated 36 percent of family-owned forest land has benefitted from technical assistance in the previous 5 years. The most popular topics were timber management, wildlife management, land transfer, invasive plants, and unwanted insects or diseases. Landowners report that written materials and talking with an expert are their preferred methods for receiving information.

Although Missouri offers many programs, policies and practices to support sustainable forest management, most family forest owners are unfamiliar with them and do not participate. Less than 10 percent of privately owned forested acres in Missouri have a written forest management plan. The following conservation agencies, nonprofit conservation groups, universities, professional groups and private organizations can provide education, workshops, technical assistance, written materials and, in some cases, financial support to help landowners throughout Missouri improve forest health and habitat conservation on their properties.

Where to Get Help

Missouri Department of Conservation (MDC)

<https://mdc.mo.gov/contact-engage>

The MDC protects and manages the fish, forest and wildlife resources of the state. The MDC has staff that cover every county throughout Missouri to assist landowners with wildlife, forest and woodland management and natural resource concerns on their properties. MDC staff provide landowners with technical assistance designed to help them meet their land and wildlife management goals. Technical assistance can take the form of in-person site visits, workshops, literature, and writing forest and wildlife management plans. MDC staff can also help landowners identify financial assistance programs to help defer the cost of recommended management practices.

Natural Resources Conservation Service (NRCS)

<https://www.nrcs.usda.gov/contact/find-a-service-center?state=&county=>

The NRCS helps farmers, ranchers and forest landowners make critical investments in their operations and local communities by providing the financial and technical assistance needed to harness America's wealth of natural resources to feed and clothe a growing world. The NRCS deliver practical, voluntary and locally led conservation solutions that help producers conserve natural resources, strengthen agriculture production, and keep working lands productive for generations to come.

- Conservation Practice 666: Forest Stand Improvement <https://efotg.sc.egov.usda.gov/api/CPSFile/49497/>
- Conservation Practice 612: Tree and Shrub <https://efotg.sc.egov.usda.gov/api/CPSFile/53854/>
- Conservation Practice 338: Prescribed Burning <https://efotg.sc.egov.usda.gov/api/CPSFile/53830/>

- Conservation Practice 315: Herbaceous Weed Treatment <https://efotg.sc.egov.usda.gov/api/CPSFile/37290/>

Missouri Department of Natural Resources (DNR)

<https://dnr.mo.gov/land-geology/soil-water-conservation>

The DNR provides services to protect and improve the air, land and water resources in Missouri. The DNR also provides financial opportunities and technical assistance to Missouri's agricultural community and landowners throughout the state through the Soil and Water Conservation Districts.

USDA Forest Service Northern Research Station (NRS)

<https://research.fs.usda.gov/nrs>

The NRS provides science, data, and research that informs land management decisions, rather than direct financial or technical assistance to individual landowners. However, the research and data they provide support the programs and services offered by other agencies to Missouri landowners. The NRS develops web-based tools and publishes research findings in peer-reviewed journals and technical reports that are available to the public and land managers.

University of Missouri (MU) Forestry Extension

<https://extension.missouri.edu/topics/forestry>

MU Forestry Extension provides science-based education, workshops and resources to private landowners that promote sustainable forest management, enhance natural resources and support the state's forest economy.

Missouri Woodland Steward Program

<https://extension.missouri.edu/programs/forest-ecology-and-management/missouri-woodland-steward>

The Missouri Woodland Steward Program helps landowners better understand basic woodland ecology and forest management principles, giving them the confidence to care for their woodland acres. The program supports both new and experienced landowners, helping them connect with other woodland owners to build a community of like-minded people. Participants also have the opportunity to engage with public and private professional foresters who assist landowners in their region. The program covers a wide variety of topics, such as tree identification, selecting and planting forest tree seedlings, rehabilitating neglected woodlands, chainsaw safety, selling your timber, and keeping your forest in the family.

Women Owning Woodlands (WOW)

<https://extension.missouri.edu/programs/forest-ecology-and-management/women-owning-woodlands>

The WOW is a program developed from a national effort to bring natural resources education to women forest owners. The WOW mission is to empower women landowners to feel confident in actively managing their woodlands by providing relevant forestry information and resources. WOW works to build a welcoming community for women to share experiences, receive support, and learn together.

MU Extension Wildlife Ecology and Management Program

<https://extension.missouri.edu/programs/wildlife-ecology-and-management>

This MU Extension Program provides educational assistance to landowners and Missouri citizens that can be used to help achieve their wildlife habitat management goals and objectives on their property or within their community. Educational programs and publications are offered on integrating wildlife habitat management practices with forest and woodland management, agriculture production, and within urban environments.

Missouri Consulting Foresters Association (MCFA)

<https://www.missouriforesters.com/>

The MCFA mission is to improve and expand the management of Missouri forests through the actions of qualified professional foresters. The MCFA is an organization of technically trained professional foresters that each provide competent forest management advice or assistance to landowners on a fee or contract basis.

Forest and Woodland Association of Missouri (FWAM)

<https://forestandwoodland.org/>

The FWAM promotes healthy, productive and sustainable forests. FWAM administers the Missouri Tree Farm System, part of a national program for woodland owners who are committed to sustainably managing their forested property for wood, water, wildlife and recreation.

University of Missouri Center for Agroforestry

<https://centerforagroforestry.org/>

The Center for Agroforestry helps landowners intentionally integrate trees and shrubs with crops or livestock. Agroforestry practices help landowners create multifunctional working landscapes to provide a wide range of benefits, including diversification of products, markets and farm income, protection and improvement in soil, water and air quality, enriched habitat diversity, and improved human health and well-being.

National Wild Turkey Federation of Missouri (NWTf)

<https://www.nwtf.org/chapters/missouri-state-chaptermo>

The MO State NWTf Chapter offers landowners technical guidance, resources for habitat improvement and financial assistance through programs like the National Forest Initiative. NWTf field foresters assist landowners with forest management plans, cost-share funds for specific projects, equipment, educational workshops, and tools like the Wild Turkey Habitat Evaluation Guide designed to benefit wildlife and enhance recreational opportunities.

Call Before You Cut

<https://callb4ucut.com/missouri/>

The Call Before You Cut campaign is a coordinated effort by the Missouri Department of Conservation and the Missouri Chapter of the Society of American Foresters, the U.S. Forest Service Northeastern Area State and Private Forestry, and the Missouri Tree Farm Program. The Call Before You Cut program encourages woodland owners to consult with professional foresters or a Professional Timber Harvester or Master Logger before they make decisions about their forestland. A toll-free telephone number has been established through which landowners may request information about caring for their woods and contacting a professional forester or trained logger.

Glossary

Age class. A distinct group of trees originating from a single event in time.

Basal area (BA). The cross-sectional area of all trees in a stand measured at 4.5 ft (1.37m) above the ground and expressed per unit of land area (e.g. square feet per acre or square meters per hectare). BA indicates how much of a site is occupied by trees, influencing competition for resources and light reaching the forest floor and is used to determine thinning needs and habitat structure.

Canopy (canopy cover). The foliar cover in a forest stand consisting of one or several layers. The overhead branches and leaves of trees.

Canopy closure. The point at which the vertical projections of tree crown perimeters within a canopy touch.

Clearcut. A timber harvest method that removes most or all trees in a stand to regenerate an even-aged forest.

Closed forest. An ecosystem where trees fully capture the growing space. A mature closed forest will have 80 to 100% canopy cover along with some shade tolerant midstory and understory trees and sparse shrubs. Little sunlight reaches the ground, so groundcover is primarily leaf litter and sparse shade tolerant herbaceous plants.

Codominant tree. A tree that makes up the general, average level of the canopy, receiving full light from directly above but relatively little from the sides. Their crowns are part of the main canopy, growing alongside, but not significantly overtopping, neighboring dominant trees.

Closed woodland. A woodland with 60%–80% canopy cover and no midstory, which allows some sunlight to reach the forest floor and a diversity of forbs and grasses. Periodic fire prevents the development of a woody understory and mid-story and succession to a closed forest.

Crown class. A category of tree based on its crown position relative to those of adjacent trees.

Dominant tree. A tree in a forest stand with a crown extending above the general canopy level, allowing it to receive full sunlight from above and partly from the sides. This tree is typically the tallest, most vigorous, and structurally superior tree in the forest, crucial for overall forest health and productivity.

Even-aged stand. A stand of trees composed of a single age-class in which the range of tree ages is usually within 20 percent of the stand's rotation age.

Group selection. A regeneration method where small patches of trees are periodically removed to maintain an uneven-aged forest

Habitat. All the resources needed in an area to support a species. In practice it is often equated with a plant community or ecosystem that supports a species.

High-grading (high-graded). The removal of the most commercially valuable trees leaving a stand composed of trees of poor species composition, condition and/or adaptability.

Intermediate tree. A tree with a crown that occupies a subordinate position in the main canopy. Shorter than codominant trees, this tree receives limited direct light from above and none from the sides, often having smaller, crowded crowns.

Midstory. The layer of trees in a forest or woodland consisting of trees and saplings growing beneath the main canopy (overstory) but above the lowest woody undergrowth (understory). These trees are typically 15 to 50 feet tall, filling the vertical space between the forest floor and the tallest canopy trees.

Neotropical migrant bird. A bird that breeds in the United States and Canada and migrates to Central America, South America, or the Caribbean for the winter.

Open forest. Collectively refers to savanna and woodland ecosystems characterized by 10%–80% canopy cover and widely spaced trees with broad crowns, which allow ample sunlight to reach the ground. These are typically fire dependent ecosystems.

Open woodland. A woodland with 30%–60% canopy cover and no midstory, which allows sunlight to reach the forest floor and support diverse and abundant groundcover consisting of forbs and grasses. Periodic fire stimulates growth of groundcover and prevents the development of a woody understory and mid-story and succession to a closed forest.

Quadratic mean diameter. The diameter at breast height (as measured 4.5 feet above ground level) of a tree with the average basal area in a stand, providing a more accurate representation of average tree size for volume estimations than the arithmetic mean. It is calculated by taking the square root of the mean squared diameter.

Regeneration. Renewing tree cover on a site by establishing new trees naturally or artificially.

Rotation age. The age at which even-aged stands of trees are harvested and regenerated and is typically 80–100 years in Central Hardwoods oak and pine oak forests.

Savanna. A mixed woodland-grassland ecosystem characterized by an 10–30% tree canopy with scattered trees, allowing sunlight to reach the ground and support a continuous, dense understory of grasses.

Seed-tree method. A regeneration method in which trees are left after a harvest for the purpose of providing seed for the next forest.

Shade-tolerant tree. A tree that can grow in low light levels.

Shelterwood method. A regeneration method that removes most trees but leaves some to produce sufficient shade to establish a new age class of trees in a moderated microenvironment.

Short-distance migrant bird. Species that breed and winter in the United States and Canada, often only migrating relatively short distances from their breeding range to winter range.

Single-tree selection. A regeneration method where individual trees are periodically removed to maintain an uneven-aged forest.

Stand. A forest stand is a contiguous area with trees sufficiently uniform in species, age, arrangement, and condition to be distinguished from adjacent areas. It is the basic management unit for forestry.

Stocking. A measure of the density and distribution of trees within a forest stand compared to an ideal standard, indicating if the site's growth potential is fully utilized. It helps determine if a stand is overstocked (too dense), understocked (too sparse), or fully stocked for management goals like timber production.

Succession. The progressive change in the structure and composition of a plant community over time moving from pioneer or early successional species to a late successional species. A disturbance, such as fire, flood, or timber harvest, resets succession back to an earlier stage.

Suppressed tree. A tree whose crown is entirely below the main canopy level, receiving no direct light from above or the sides. It has low vigor, slow growth rates, and small, sparse crowns, often dying due to extreme competition for light, water, and nutrients.

Understory. Shade-tolerant, small trees typically less than 15 feet tall that grow beneath the midstory. These trees play a crucial role in ecological diversity by providing food, shelter, and structure for wildlife.

Uneven-aged stand. A stand with trees of three or more distinct age classes, either intimately mixed or in small groups.

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