Wisconsin Ruffed Grouse Management Plan 2020–2030

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WISCONSIN
DEPT. OF NATURAL RESOURCES

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- Wisconsin County Forests Association
- Wisconsin Wildlife Federation

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Approved by the Wisconsin Natural Resources Board on: XX/XX/XXXX

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EXECUTIVE SUMMARY

Ruffed grouse are one of the most popular and widely-distributed game birds in the state of Wisconsin, a vital resource for Wisconsin's outdoor enthusiasts and economy, and an important component of Wisconsin's outdoor heritage. Wisconsin consistently ranks as a top state for ruffed grouse harvest, along with Minnesota and Michigan, and is a destination for hunters from throughout the United States. On average, over 90,000 hunters take to the woods in Wisconsin and harvest over 340,000 ruffed grouse each fall (based on hunter and harvest data from 1999-2018).

Given the importance of ruffed grouse in Wisconsin, the intent of this management plan is to provide guidance for addressing both long-term and emerging challenges to ruffed grouse management, to serve as an outreach tool for increasing knowledge and awareness about ruffed grouse, and to provide opportunity to better engage stakeholders and grouse enthusiasts on management of the species. Collaboration and the free-flow of information are essential in effectively addressing the social and biological elements of ruffed grouse management.

Information in this plan is presented in three sections: ruffed grouse biology, ruffed grouse in Wisconsin, and the future of ruffed grouse management. The first section provides an overview of basic ruffed grouse biology to help the reader better understand the ruffed grouse life cycle and habitat relationships. The second section provides historical context and summarizes current management of ruffed grouse in Wisconsin. The final section defines goals, objectives, and strategies to guide species management from 2020–2030.

The mission of the ruffed grouse management program is to: 1) promote early-successional forest habitat on public and private lands; 2) utilize the best available science to sustain a healthy ruffed grouse population; 3) enhance recreational opportunities for ruffed grouse hunting and viewing by wildlife enthusiasts; and 4) inform the public of grouse management efforts, challenges, successes, and opportunities.

To achieve this mission, a comprehensive suite of management plan goals, along with specific objectives and strategies, were identified. Goals of the management plan include:

- General Ruffed Grouse Management
    - Employ a strategic, targeted approach to implementing ruffed grouse habitat management, research and monitoring, partnerships, hunter experience improvement, and outreach efforts. (1 objective, 1 strategy; pages 39–40).
- Habitat
    - Provide adequate, consistent levels of early-successional forest habitat to sustain a healthy and broadly-distributed ruffed grouse population. (3 objectives, 7 strategies; pages 40–41).

- Population
    - Where suitable habitat exists or can feasibly be restored, sustain a healthy and broadly-distributed ruffed grouse population in Wisconsin that provides hunting and other recreational opportunities. (2 objectives, 3 strategies; page 42).
- Partnerships
    - Develop and maintain productive partnerships to promote ruffed grouse and early-successional forest habitat (1 objective, 5 strategies; pages 42–43).
- Research and Monitoring
    - Annually monitor the state's ruffed grouse population, target research to address priority management and population issues, and explore opportunities to collaborate on grouse research and monitoring efforts (6 objectives, 11 strategies; pages 43–44).
- Harvest Management
    - Update ruffed grouse hunting regulations based on current species distribution and input gathered through the ruffed grouse hunter survey (2 objectives; pages 44–46).
- Hunter Experience
    - Optimize the ruffed grouse hunter experience (2 objectives, 3 strategies; page 46–47).
- Outreach and Education
    - Promote ruffed grouse and their habitat to diverse audiences (3 objectives, 5 strategies; page 47).

Actions outlined in this plan integrate both science-based management and public input. Spanning both empirical scientific evidence and public opinion is the crux of ruffed grouse management – early-successional forest habitat. Ruffed grouse are often positioned near the bottom of the food chain and overcome short lifespans with high reproductive rates. Thus, providing adequate habitat to facilitate nesting, brood rearing, and predator avoidance remains the most impactful management action for the species. The vitalness of habitat is emphasized throughout this document, and is thoroughly intertwined within the plan goals, objectives, and strategies. Success of this plan hinges on effective collaboration and communication between the scientists, land managers, stakeholders, and constituents that care for this resource.

SECTION I – RUFFED GROUSE BIOLOGY

Taxonomy

The ruffed grouse (*Bonasa umbellus*) is one of ten grouse species native to North America, and one of four grouse species native to Wisconsin. Between 10 and 15 subspecies of ruffed grouse are found across North America (Johnsgard 1983). Distinction of subspecies is often based on subjective assessment of overall coloration, prominence and color of barring on the chest and belly, and extent of leg feathering (Rusch et al. 2000). Ruffed grouse belong to the order Galliformes and family Phasianidae, along with turkeys, pheasants, chickens, quail, and partridge.

The species name *umbellus* is derived from the Latin word for sunshade and references the umbrella-like ruff of dark, long, shiny feathers on either side of a ruffed grouse's neck. Ruffed grouse are often incorrectly referred to as partridge or other unrelated species.

Physical Description

The ruffed grouse is a ground dwelling chicken-like bird that is about three times larger than a quail but without the long tail of a pheasant (Peterson 1947). Ruffed grouse are one of the smallest of the native grouse species; adults range from 15 to 20 inches long, with a wingspan of about two feet, and weigh from 17 to 25 ounces (approximately 1.5 pounds). Males typically weigh more, however, adult females can be larger than young males.

While at least two different color phases of ruffed grouse exist (gray and red phase), ruffed grouse are monomorphic, meaning that the plumage of males and females are similar. The plumage of both sexes is heavily patterned, peppered with brown, white, and black over the back, and white and horizontal dark brown bars on the breast and underside (Rusch et al. 2000). When examined closely, intricate patterns of grays, blacks, browns, and buffs in the grouse's plumage become apparent. The tail is 4.5 to 7.5 inches long (longer for males), fan-shaped, rounded, and has a dark band between two narrower lighter bands near the outer edge (Figure 1). This subterminal band is unbroken in approximately 77% of males. The remaining 23% have an incomplete band, resembling those of females where this band is broken and faded on the central tail feathers. Both sexes also feature a crest on the top of their heads, with the crest being slightly larger in males. A combination of tail measurements and the appearance of rump feathers and primary wing feathers can be used to determine if birds are male or female and juvenile or adult (Larson and Taber 1980, Gullion 1984*a*). Gender can also be determined by trained observers with internal examination of the sex organs while field dressing a harvested bird (Brenner 1989).

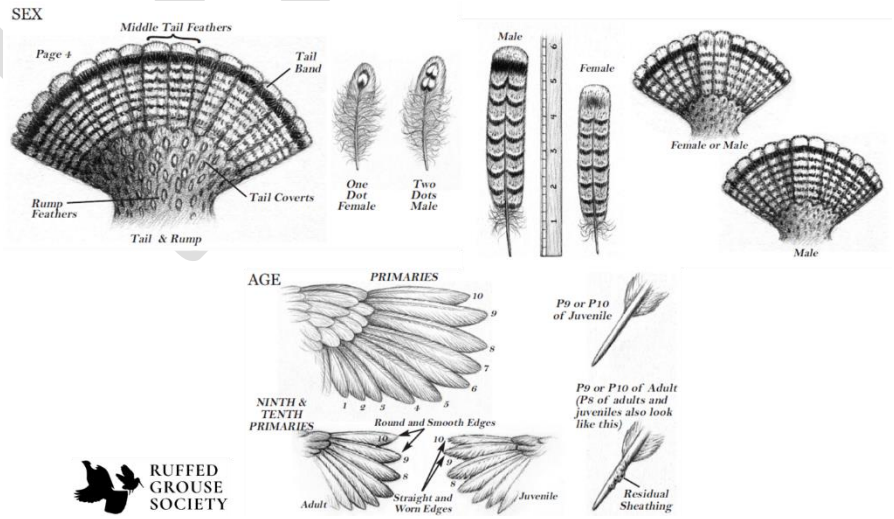

Figure 1. Diagnostic chart to determine ruffed grouse age and sex (courtesy of The Ruffed Grouse Society).

Distribution and Population Status

Ruffed grouse are the most widely distributed non-migratory game bird in North America. They can be found in nearly all Canadian Provinces and in 38 of the 49 continental states (Bump et al. 1947, Johnsgard 1983, Rusch et al. 2000). Distribution is controlled largely by presence of forested habitat, typically young mixed-deciduous forests containing an aspen (*Populous* spp.) component. Present day extent of ruffed grouse increased as a result of past logging and fire practices but has been decreasing over the last half-century with changes in land use, parcelization, and maturation of certain forest types that have resulted in the loss of early-successional forest habitat (DeGraaf and Yamasaki 2003).

While changes in forest cover and land use continue to influence populations, ruffed grouse are currently found throughout much of the forested regions of Canada, the eastern United States, the Great Lakes region, and the western United States where deciduous forest components are found within mixed conifer stands (Figure 2). Ruffed grouse have become established where they were not native in both Newfoundland and Nevada, and restored where they were native in Arkansas, Illinois, Kansas, and Missouri via translocation of wild-trapped birds.

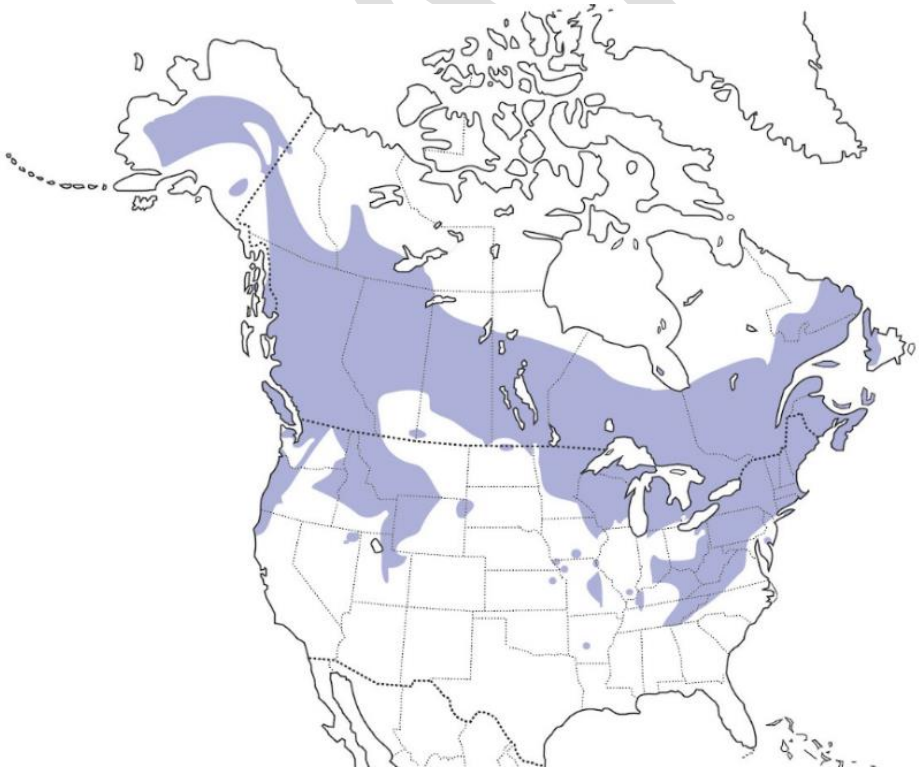

Figure 2. Distribution of ruffed grouse in North America, shown in purple (Rusch et al. 2000).

Habitat Requirements

Ruffed grouse are considered a habitat specialist because of their strong reliance upon young forest habitat throughout their range. Historically, natural ecological processes such as windstorms and fire maintained these early-successional habitats, but timber harvesting has become the main source of early-successional forest habitats. Ruffed grouse thrive in forests kept young and vigorous with periodic timber harvesting, fire, and natural disturbance, which produces an interspersion of diverse forest habitat.

While not solely dependent upon aspen forest communities, ruffed grouse show a strong association with quaking aspen (*Populus tremuloides*) and bigtooth aspen (*P. grandidentata*), especially in the northern part of their range (Rusch et al. 2000). Other major habitats include mixed oak (*Quercus* spp.; Scott et al. 1998), northern hardwood (Fearer and Dean 2004), oak-hickory (*Carya* spp.), mixed hardwood (Fearer and Dean 2004), and mixed conifer-hardwood forests of the eastern United States. Examples of conifer communities occupied include eastern white pine (*Pinus strobus*), red pine (*P. resinosa*), jack pine (*P. banksiana*; Naylor 1994), and spruce-fir (*Picea-Abies*; Martin 1960) communities. In the northern portions of its range, ruffed grouse occur in boreal forests (Rusch et al. 2000).

In Wisconsin, ruffed grouse are most commonly associated with forest habitat where small patches and multiple age classes of mixed aspen intersect, creating varied and diverse forest habitats and age classes (Gullion and Alm 1983, Gullion 1984*b*). This is due to the varied habitat requirements of ruffed grouse during different life stages and because the home range of an adult ruffed grouse may only encompass 10 acres (Gullion 1984*b*). Grouse also utilize mixed oak throughout the state, northern hardwoods in the northern half, and oak-hickory in the Driftless Area, especially where aspen exists as a stand component. In north-central Wisconsin, ruffed grouse have been observed in northern white cedar (*Thuja occidentalis*) and speckled alder (*Alnus incana*) associates, and mixed conifer communities (McCaffrey et al. 1997).

Population Dynamics

Ruffed grouse are a short-lived species that overcome short life expectancy and pressure from predators with high reproductive rates. Annual adult survival is generally 30%, with juveniles experiencing lower survival rates (Rusch and Keith 1971, Small et al. 1991, Yoder et al. 2004). Major sources of mortality include predation, disease, parasites, exposure to the elements, and harvest mortality. Though extremely rare, ruffed grouse have been documented to live up to eight years.

Ruffed grouse populations vary from year to year and across landscapes. In Canada, Alaska, and the Upper Great Lakes region, ruffed grouse populations cycle every 9–11 years. Other grouse population do not exhibit population cycling, particularly in the southern portion of their range. The ruffed grouse population cycle has stimulated many research studies to investigate its causative mechanisms (Keith and Rusch 1989, Balzer 1995, Rusch 2000, Zimmerman et al.

2008). The drivers of this cycle are not well understood, but research suggests that it may be influenced by predator, disease, and/or climate interactions (Pomara and Zuckerberg 2017). The most common suggestion has been that avian predation, particularly from northern goshawks (*Accipiter gentilis*) and great horned owls (*Bubo virginianus*), was most closely linked to the grouse cycle and, hence, may be the mechanism responsible for these ten-year cycles (Rusch et al. 2000).

Recent research has begun to reevaluate the potential mechanisms behind population cycles and have since focused on potential impacts caused by climate variability (Williams et al. 2004, Ims et al. 2008, Zimmerman et al. 2008, Pomara and Zuckerberg 2017). Findings support a close link between the variability of winter weather and cycling of ruffed grouse. The interaction between winter precipitation and temperature, which is indicative of variability in snow cover, appears to be an important driver of winter survival and ultimately cycling (Pomara and Zuckerberg 2017). Explanations for depressed cyclic fluctuations in some portions of the ruffed grouse range, such as southern Wisconsin, have also focused on northward shifts in generalist predator communities in conjunction with declines in winter snow cover and length of winter and spatial patterns of forest fragmentation (Earn et al. 2000, Williams et al. 2004, Ims et al. 2008). Conditions have thus far appeared to remain ideal for ruffed grouse in northern Wisconsin, where cold, snowy winters still support a regular ten-year population cycle. For ruffed grouse in southern Wisconsin, however, lack of cyclic fluctuations may result from highly variable winter weather conditions.

Life Cycle

Breeding Season

Like many species, ruffed grouse partake in yearly courtship and territorial displays for mating. These displays typically take place from early April through May in Wisconsin, starting earlier in southern Wisconsin and progressing northward with the retreat of winter. However, unlike other grouse species, ruffed grouse rely on an entirely non-vocal acoustic display known as drumming. The iconic drum is produced when male ruffed grouse beat their wings, creating a low frequency sound that starts in a slow, rhythmic pattern that rapidly speeds up. This drumming is audible to humans, even in thick cover, as far as a quarter-mile away or more.

Being aggressively territorial, male ruffed grouse will conduct drumming year-round to proclaim their territory, which is typically six to ten acres for males. However, this drumming activity intensifies in the spring as male ruffed grouse stake claim to their territory and advertise their location to females seeking a mate. Males will continue to occupy their drumming territory throughout the nesting period and may fertilize several females. Drumming activity diminishes by June; however, males will stay in the general area of their display site and commonly proclaim their territory again in the fall as broods disperse and young males seek to establish their own territory.

The drumming display typically takes place once the male grouse has selected a suitable location atop a drumming log or perch that is about 12 inches above the ground and where he has both cover and the ability to survey his surroundings. The main criterion for grouse to drum or display is the development of dense vertical stem density within a ten-foot radius of the drumming feature. A study of drumming sites in Michigan found that vegetation less than two-feet high was significantly less dense near drumming sites, while stems over eight feet were significantly denser near the logs (Palmer 1967). In Wisconsin, drumming sites are typically found in young aspen stands. In addition to logs, grouse also use large rocks, root balls from uprooted trees, and tree stumps for display and drumming.

Courtship may only last for a matter of seconds, and once complete, female ruffed grouse select a suitable nest site. There is no further interaction between male and females, as males do not assist with incubation or brood rearing. Nesting habitat can be variable, but nests are typically found in dense pole timber stands with open understories where females are able to detect predators in a 50–60-foot radius (Rusch et al. 2000). Nests themselves are nothing more than small depressions of leaf litter, usually at the base of a solid object like a tree, stump, large rock, or in a clump of brush.

A female grouse will lay her clutch of 8–14 eggs over the course of 17 days. In Wisconsin, nests will contain on average 11 eggs (Small et al. 1996) with an incubation period lasting approximately 23–25 days once the last egg is laid. During incubation, hens stay close to the nest with a home range of about 2.5 acres (Maxson 1978). Eggs will synchronously hatch within a few hours of each other in early June. Females will raise one brood per season; however, if the first nest is lost early enough in the season, the hen may re-nest. Clutch size tends to decrease with re-nesting attempts to an average of seven eggs (Small et al. 1996). Overall, nest success rates for ruffed grouse vary between 40–80% based on factors such as age of the hen and whether it is an initial or re-nesting attempt (Small et al. 1996, Larson et al. 2003).

Tucked atop her ground nest, the female ruffed grouse is perfectly camouflaged, though nest predation does still occur. Nest predation or other disturbance that forces a female grouse to abandon her nest are principal drivers of nest failure. Early during incubation, it takes little provocation for a hen to abandon her nest. Later into the nesting period, however, she may become very protective of her nest.

Brood Rearing

After eggs hatch and through the brooding period, the average home range of the hen and her brood will be approximately 30 acres (Godfrey 1975). Chicks will begin flying at about five-days old. A chick's diet will primarily consist of protein-rich insects to facilitate rapid growth and development during the first several weeks post hatch, and transition into a diet of plant material, seeds, fruits, and insects as they mature (Bump et al. 1947). Preferred habitat at this time will be very young, dense aspen stands that provide cover from predators, as well as areas

with a strong forb component for foraging for insects. Forest openings, trails, and forest roads are also used during this time. Brood habitat quality and availability may be a limiting factor for ruffed grouse populations (Jones et. al 2008). Four months post-hatch, the brood will be nearly full-grown and will typically disperse in September (Rusch et al. 2000). For an average ruffed grouse brood, only three to four young-of-the-year birds will survive the summer to fall brood dispersal (Larson et al. 2001).

Fall and Winter

As juveniles disperse in the fall, they will typically travel one to two miles in search of ideal habitat. Females generally travel farther than males (Rusch et al. 2000). Males begin to disperse at 16-weeks old to secure their drumming site they will likely use for the rest of their lives. Adult females will return to their winter range they used the previous year. As adults and juveniles travel during this time, they may pass through poor habitat or end up in unfamiliar sites, which can expose them to predation (Yoder et al. 2004).

A considerable portion of the ruffed grouse range and population cover regions of North America where snow and cold temperatures are part of the winter landscape. Ruffed grouse are well adapted to winter conditions and seemingly thrive at latitudes that do not suit other upland game birds. Primary winter foods consist of buds, twigs, and catkins of aspens, birches (*Betula* spp.), alders (*Aldus* spp.), ironwood (*Ostrya virginiana*), hazels (*Corylus* spp.), and cherries (*Prunus* spp., Vispo 1995). Mature aspen canopies are important as both an important food source and as a roosting site during late fall and winter where unrelated individuals will gather together temporarily to share a food resource and secure cover. This habit is commonly referred to as "budding". This temporary congregation is not considered the equivalent of a covey organization as found in other species like quail.

In addition to budding, ruffed grouse exhibit other unique adaptations to winter. Ruffed grouse develop fringe-like projections on their feet known as pectinations, which increase surface area to act as snowshoes and help grip icy branches while feeding. During cold snaps, ruffed grouse are able to increase their metabolic rate and use of fat reserves, though reserves are limited and regular feeding is required (Thomas et al. 1975). Grouse can also lower heat loss and energy demands by withstanding lower-than-average minimum body temperature and reducing nighttime body temperature (Thompson and Fritzell 1988).

Ruffed grouse can use snow cover as a refuge, burrowing into "snow roosts" for predator avoidance and thermal cover and reducing metabolic heat production by 30% (Thompson and Fritzell 1988). Ruffed grouse will snow roost when snow is at least ten inches deep and light and powdery (Gullion 1984*c*). Temperatures inside a roost can be as much as 50-degrees Fahrenheit warmer than outside temperatures. In areas where snow conditions preclude snow roosting, conifers are considered an important part of winter habitat. In Wisconsin, understory conifers have been positively correlated with over-winter survival (Vispo 1995).

SECTION II – RUFFED GROUSE IN WISCONSIN

Distribution and Habitat Availability in Wisconsin

Ruffed grouse distribution in Wisconsin has shifted with changes in land use and management. Prior to European settlement, forests in the northern half of the state consisted of mature white pine or northern hardwood and generally lacked the understory cover needed to support high ruffed grouse densities. Meanwhile, periodic wildfires in the southern half of the state prior to settlement led to the development of oak-dominated woodlands with heavy brush cover that likely supported high densities of ruffed grouse (Schorger 1945).

After widespread European settlement in the 1850s–1890s, Wisconsin's forests were aggressively harvested and, in many places, converted to agriculture. Due to poor logging practices of the time, wildland fire accompanied the aggressive harvest activities up until the 1930s when the era of widespread fire suppression began. The 1930s also ushered in an era of extensive farm abandonment in northern Wisconsin as land proved poor for agricultural production. After decades of logging, wildfire, and tillage, disturbance-dependent species such as oak, birch, and aspen thrived and quickly colonized these previously disturbed areas in the north, creating near ideal habitat for ruffed grouse and culminating in record-high ruffed grouse populations in the northern forest during the 1970s. In southern Wisconsin, continued changes in land use led to increased ruffed grouse populations through the 1980s, with southwestern Wisconsin having the highest densities in the state, followed by long-term declines.

This management history is largely responsible for the diverse forest types Wisconsin has today; however, many of the forests that began from this disturbance are now roughly 100-years old or older. As these forests continue to age, shade-tolerant species such as red maple (*Acer rubrum*), ironwood, and musclewood (*Carpinus caroliniana*) begin to dominate, reducing habitat suitability for ruffed grouse and other young forest wildlife. A variety of factors are contributing to this forest change including land use conversion, parcelization, and increased length of management intervals (DeGraaf and Yamasaki 2003).

Since the 1980s, Wisconsin has been losing young forest habitat while simultaneously seeing an overall increase in the amount of total forested acres. According to Forest Inventory and Analysis (FIA) data collected by the U.S. Forest Service, Wisconsin has added approximately 1.7 million acres of forest land since 1983 while at the same time losing over 1.3 million acres of forest in the 0–20-year age class (Figure 3). The rate at which young forest habitat is declining varies when looking at five different functional habitat regions in Wisconsin (Figures 4 and 5). The Central Region has seen the largest total change in young forest since 1983, with a total loss of 419,991 acres at an average rate of loss at 16,153 acres per year, followed by the Southwest Region. Since 2008, however, the Northwest Region has seen the greatest change, losing a total of 50,882 acres at a rate of 6,360 acres per year, followed by the Central Region.

This combination of changes in land use and management, and their impact on forest composition and age-class distribution, is likely what drives current distribution of ruffed grouse in Wisconsin. Today, ruffed grouse are considered most abundant in the northern and central forests. They are generally common in the east-central portion of the state, as well as the Driftless Area of west-central and southwest Wisconsin, and are uncommon in the southeast where early-successional forest habitat is scarce.

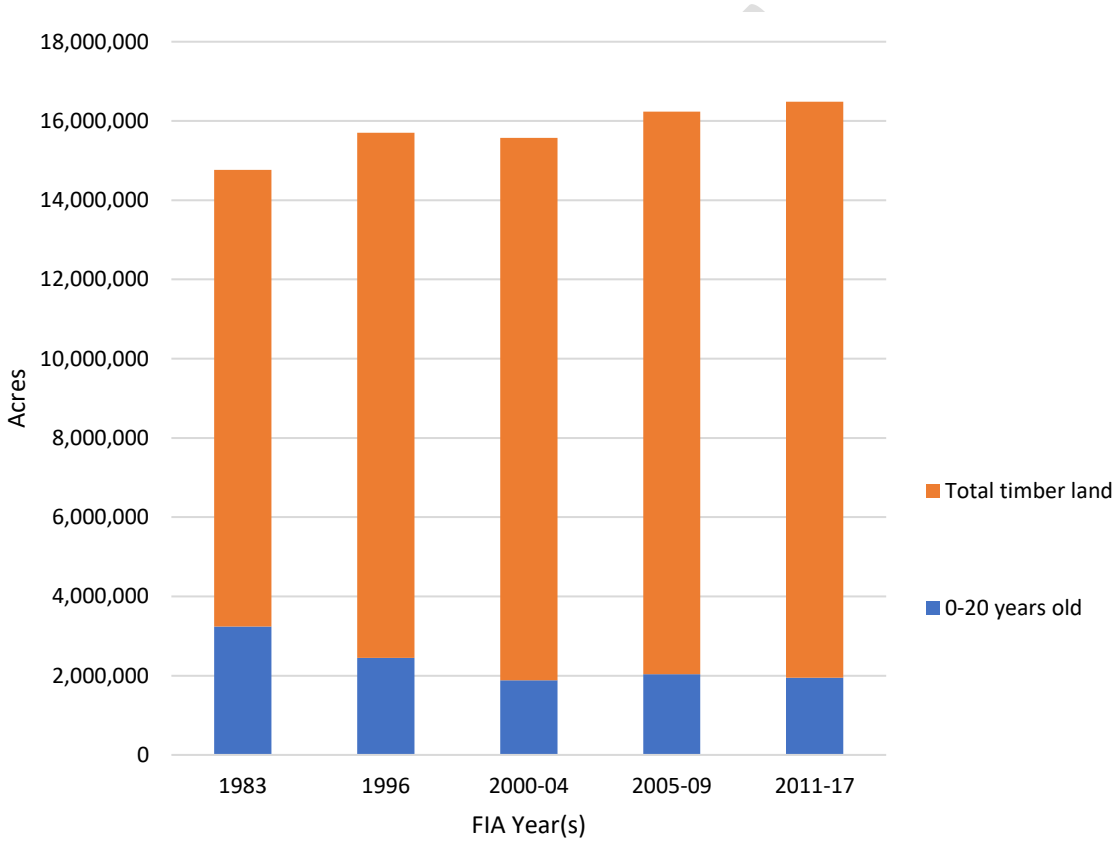

Figure 3. Proportion of Wisconsin forests in the 0–20-year age class based on FIA data, 1983-2017.

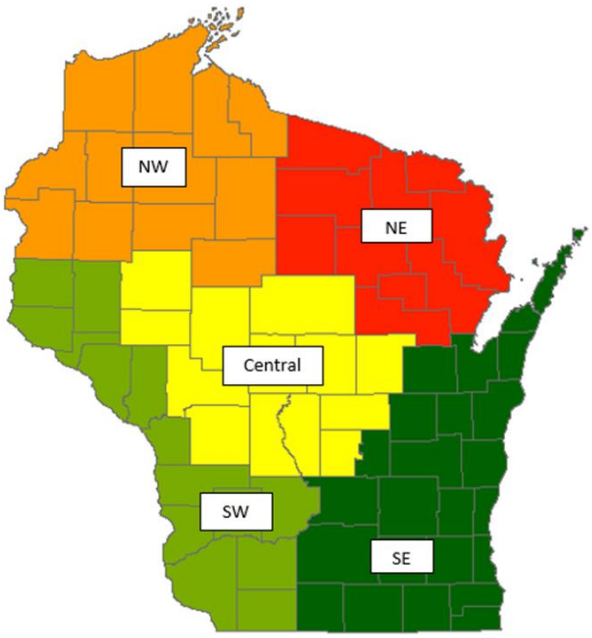

Figure 4. Functional habitat regions of Wisconsin.

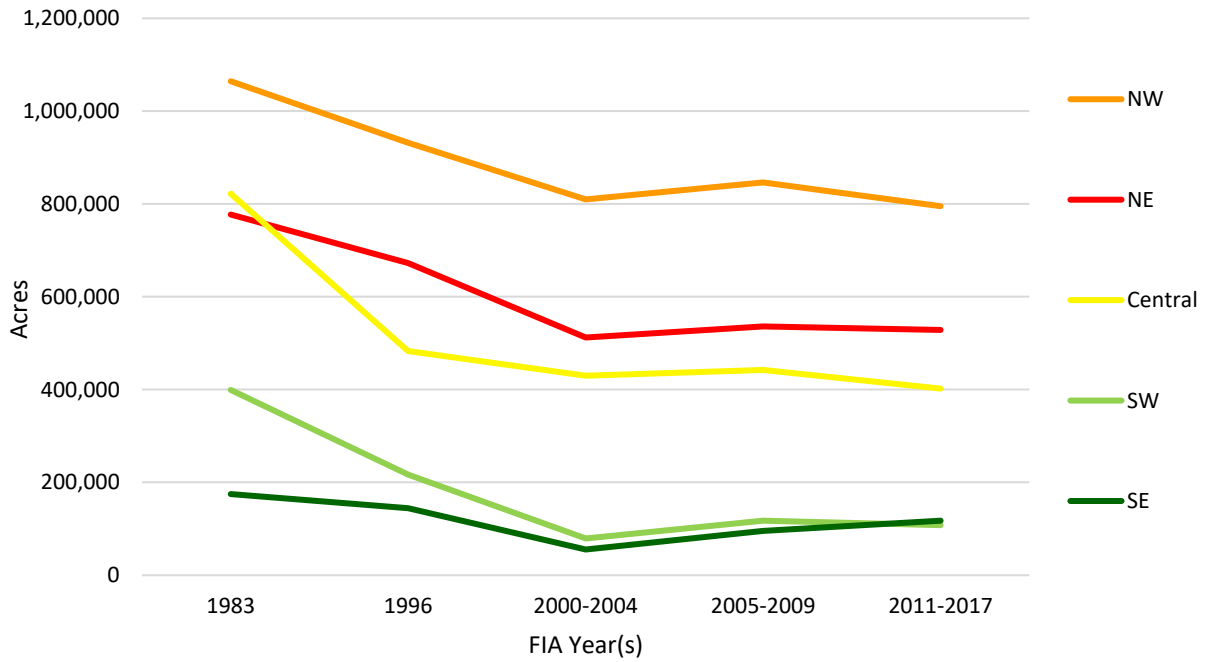

Figure 5. Young forest acres (0–20-year age class) in each functional habitat region of Wisconsin based on FIA data, 1983 ad 2011–2017.

Aspen

Since aspen forests provide critical ruffed grouse habitat, it is important to take careful stock of changes to aspen forests over time. According to FIA data, Wisconsin's aspen resource has decreased from approximately 3.9 million acres in 1983 to 2.9 million acres in 2017 (Table 1). Each landowner designation has seen slightly different rates of loss or gain of aspen acres. However, this net loss of one million acres of aspen is most notable on private lands where approximately 730,000 acres of aspen have either been lost through succession or conversion to other forest types. County forests experienced a similar rate of aspen loss as private lands, while slower rates of decline was observed on federally-owned national forest lands. The State of Wisconsin was the only major landowner group during this time to see a positive increase in aspen acres; however, examining these FIA data only tells part of the story with aspen in Wisconsin.

Despite the loss of total aspen acres, the age-class uniformity appears to have slightly improved over the past 36 years (Figure 6) according to Wisconsin Forest Inventory Reporting System (WisFIRS), a tool used to track forested and non-forested acres on state-owned lands and county forests. Because ruffed grouse prefer interspersion of age classes, this should help provide better quality of habitat where aspen acres currently exist, though there is opportunity to further increase age-class uniformity. Examining age-class distribution on lands managed by the Wisconsin Department of Natural Resources (WDNR) and by counties, and better regulating aspen harvest, could help further improve available habitat (Figure 7).

Table 1. Change in acreages, percent change, and approximate rate of change of aspen in Wisconsin between four major landowner groups based on FIA data, 1983 and 2011–2017.

Ownership	Acres 1983	Acres 2017	% Change	% Change/Year
Private	2,481,849	1,751,922	-29.4%	-0.9%
County and Municipal	859,719	610,346	-29.0%	-0.9%
National Forest	355,880	326,205	-8.3%	-0.2%
State	160,269	209,645	+30.8%	+0.9%
All Ownerships	3,857,717	2,898,118	-24.9%	-0.7%

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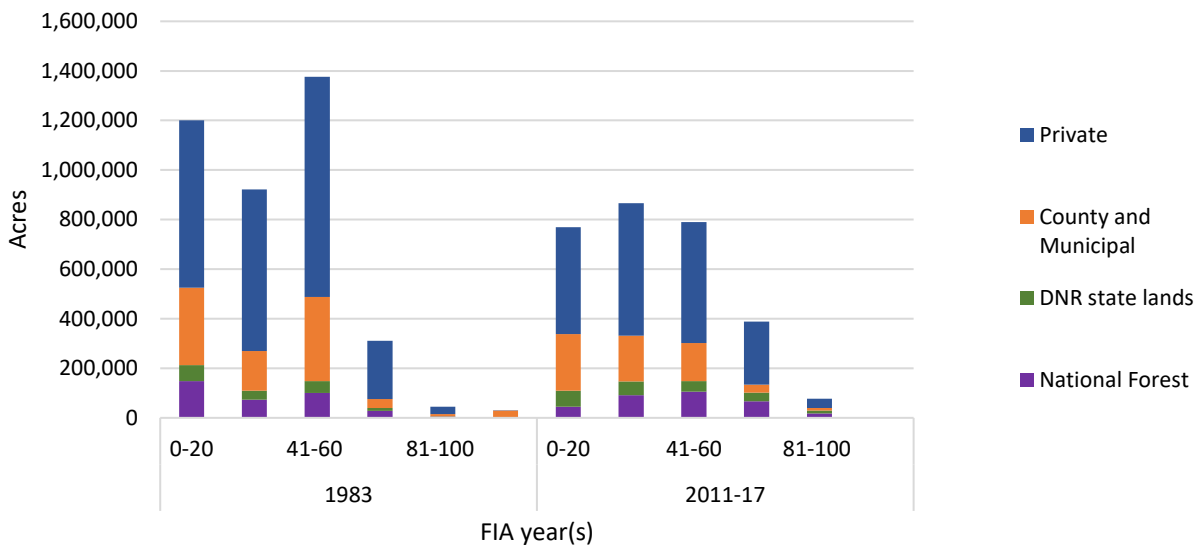

Figure 6. Aspen age-class distribution by ownership based on FIA data, 1983 and 2011–2017.

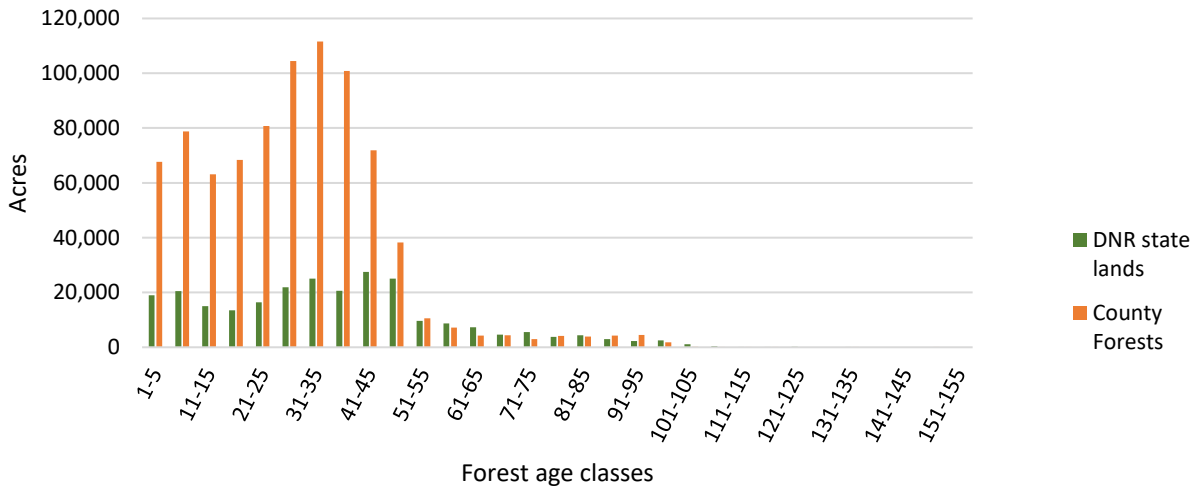

Figure 7. Aspen age-class distribution on WDNR and county-managed lands based on WisFIRS data, 2019.

Oak and Oak Hardwoods

Oak provides an excellent example of a disturbance-dependent species that thrived following historical logging practices, wildfire, and widespread farm abandonment during the early 20th

century. This management history is largely responsible for much of the diverse oak resource Wisconsin has today. However, perhaps no other forest cover type in Wisconsin has seen as much change and maturation as the oak cover type. Because different agencies manage oak over a wide range of ecological landscapes and species groups in Wisconsin, and because inventory standards that delineate the oak cover type are different among these managers and regions, this section will be covering data on the oak, scrub oak, oak-hickory, and oak hardwoods cover types.

According to FIA data, oak age-class distribution has dramatically shifted to older classes since 1983 (Figure 8). This maturation is especially apparent in the 41–100-year age classes. These changes are greatest on private lands, meaning continued emphasis on private landowner engagement is essential to achieve a balanced age-class distribution. While such changes are greatest on private lands, the issue of forest maturation is seen across ownerships and is pronounced on both state and county lands with current oak cover type stand data (Figure 9). However, a completely different scenario exists for the 94,000 acres of scrub oak cover type found on Wisconsin county and WDNR lands (Figure 10). Scrub oak on WDNR-managed lands remains relatively regulated in age-class distribution, whereas county forest lands have more acres falling in young and older age classes, but fewer acres represented in the 40–70-year age range.

While there have been changes in oak age-class distribution, overall acres of young forest age classes of oak remain relatively unchanged, partly due to an increase in acres of this cover type. Since 1983, oak hardwood cover has grown by over 1.46 million acres, indicating that we are seeing recruitment or conversion to this cover type, but the overall oak resource is trending towards older age classes.

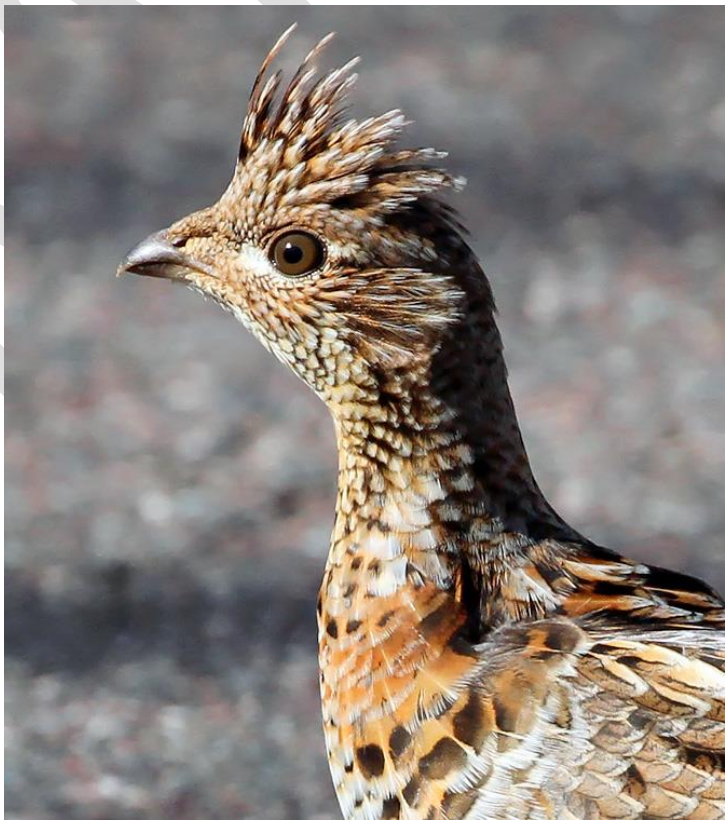

Photo courtesy of Ryan Brady

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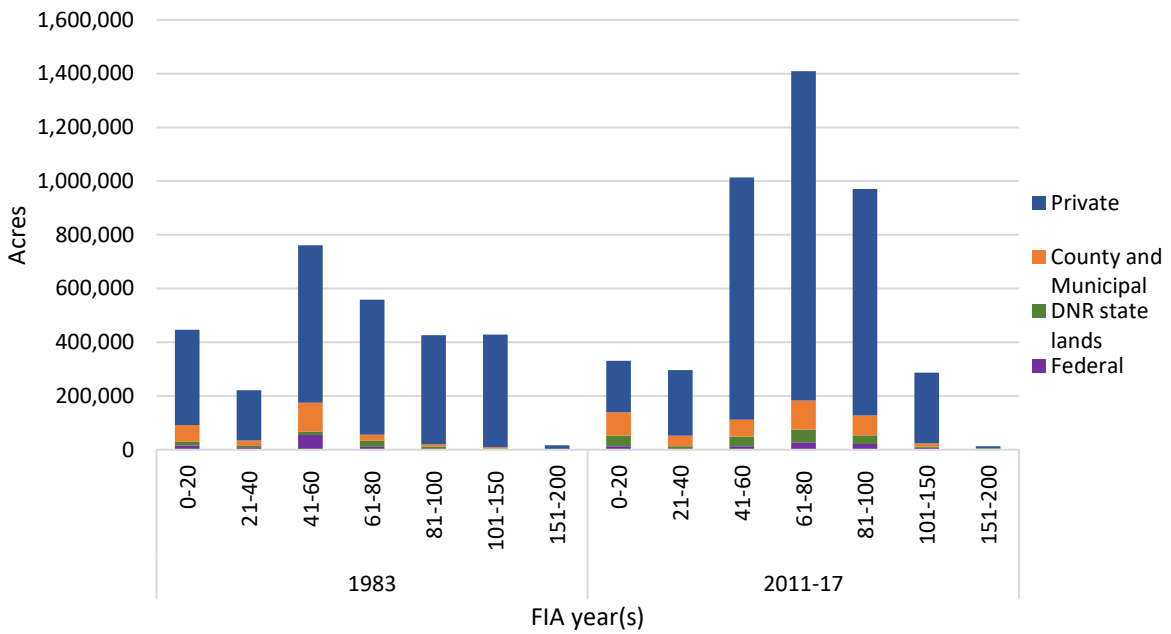

Figure 8. Oak age-class distribution by ownership based on FIA data, 1983 and 2011–2017.

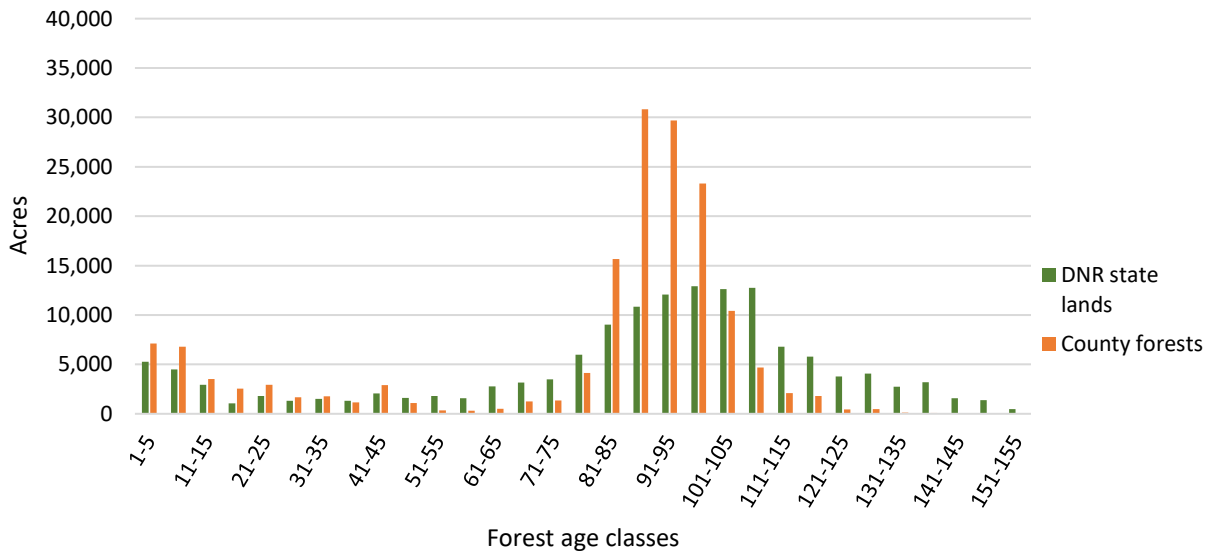

Figure 9. Oak age-class distribution on WDNR and county managed lands based on WisFIRS data, 2019.

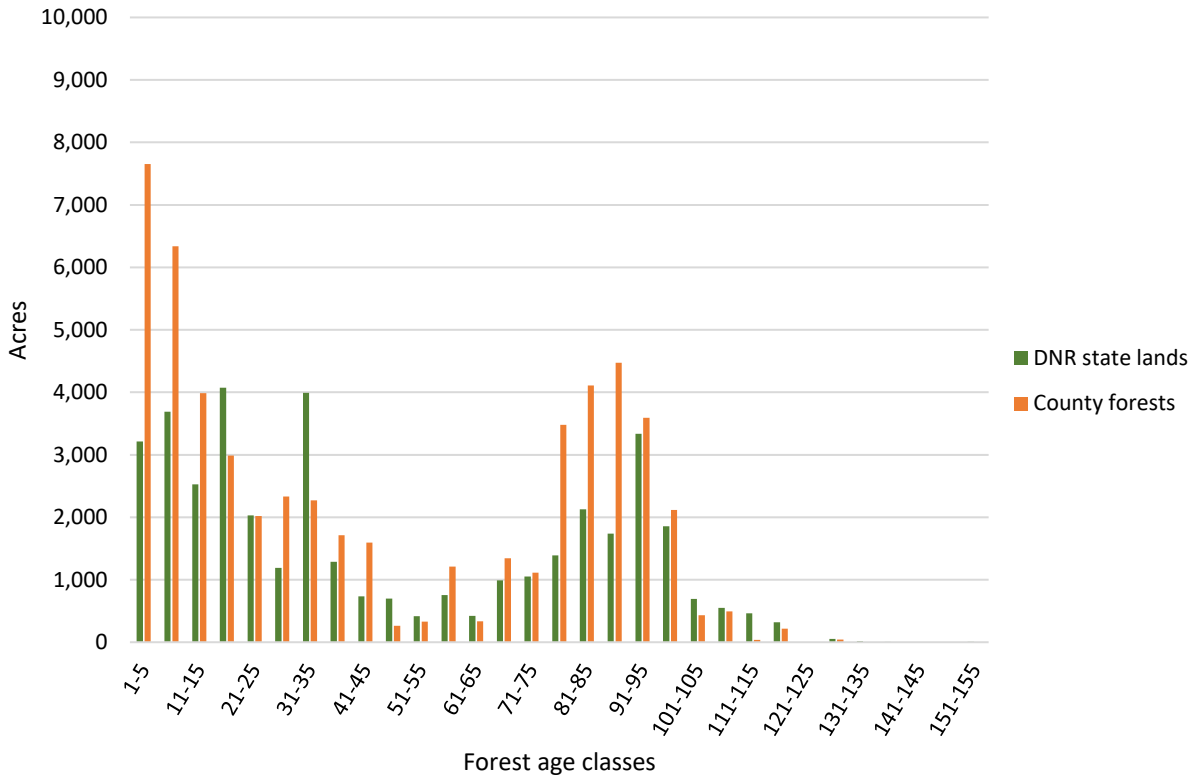

Figure 10. Scrub oak age-class distribution on WDNR and county managed lands based on WisFIRS data, 2019.

Northern Hardwoods

Wisconsin's northern hardwood forests are aging and are oftentimes not being replaced by younger forests. Since 1983, Wisconsin has lost approximately 400,000 acres of northern hardwoods forest in the 0–20-year age class and about 250,000 acres in the 21–40-year age class (Figure 11). The bubble of the 41–60-year age class has also continued over the period analyzed. While there have been large changes in acres of young forests for northern hardwoods reflected in FIA data, actual and contributing effects may be hard to determine. For example, management techniques for northern hardwoods vary across stands and ownership, making it difficult to examine northern hardwoods age-class distribution on both public and private lands where actual stand age is sometimes unknown.

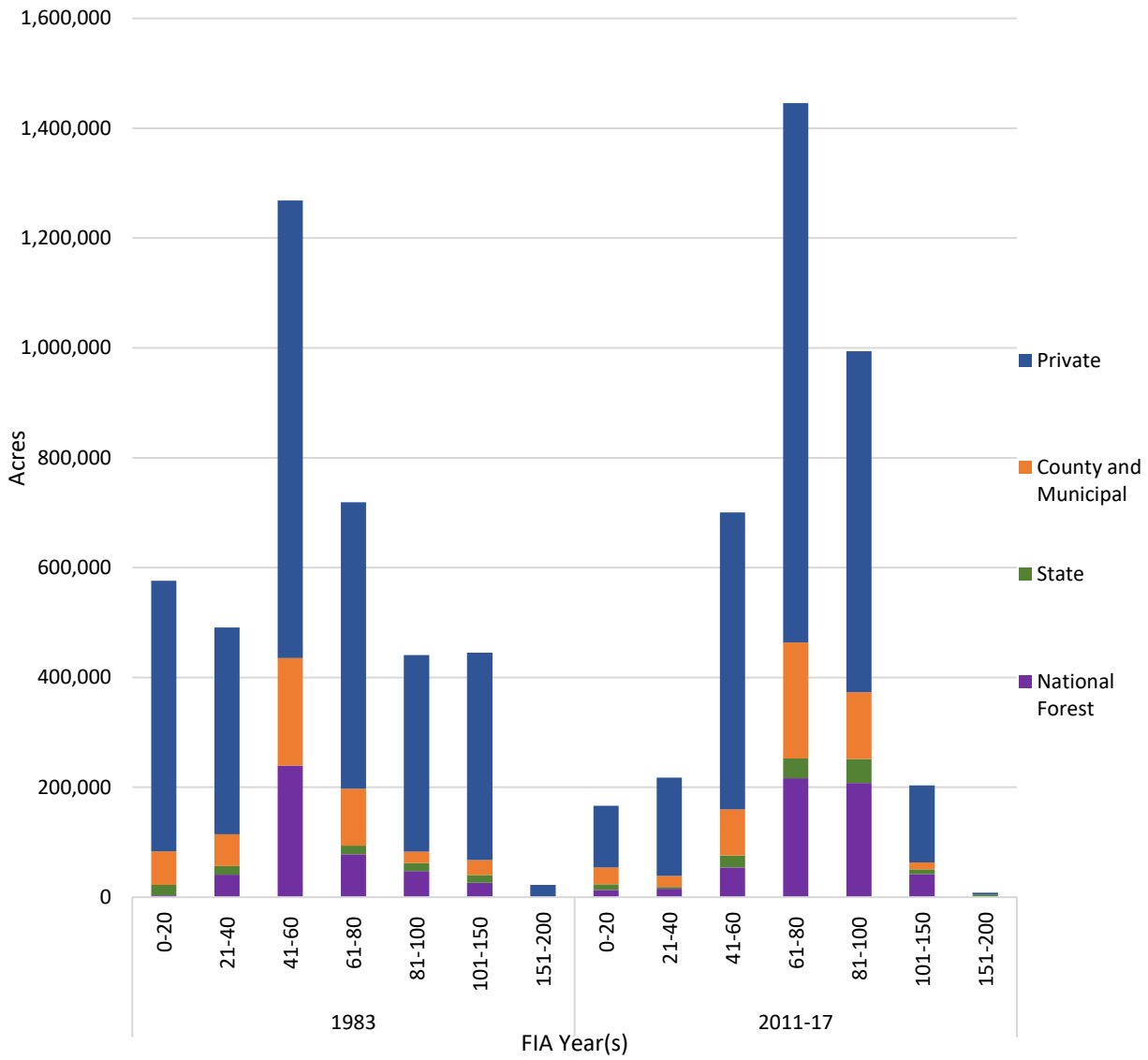

Figure 11. Northern hardwoods age-class distribution by ownership based on FIA data, 1983 and 2011–2017.

Current Habitat Management Efforts

Habitat Management on Public Lands

Current WisFIRS data show a significant increase in aspen timber sales established on WDNR-managed lands, of which over 980,000 acres are forested. From 2009–2018, the average acreage of aspen established for harvest per year exceeded 4,000 acres, compared to approximately 2,200 acres per year during the previous decade. Aspen timber sale establishment is expected to continue to increase over the next 15 years to approximately 5,000 acres per year.

Similar trends are anticipated on county forests, which collectively manage over two million forested acres. The current 15-year average for acres of aspen established for harvest on county forests was 12,491 acres per year. That number is expected to increase to 18,662 acres per year over the next 15 years. This increased yet sustainable aspen harvest on state and county lands will help maintain the early-successional forest habitat that grouse and other young forest wildlife species depend on, while also maintaining a diversity of older age class forests to benefit mid- and late-successional forest wildlife.

When managing forested acres for wildlife, there is extensive collaboration between county forests and WDNR. For example, local wildlife biologists will often review and advise on timber sales. Also, WDNR provides approximately $112,000 per year in funding to the county forests for wildlife habitat management through the Wildlife Habitat Grant, known colloquially as Nickel-an-Acre. These funds can be used for a variety of wildlife habitat management practices that benefit ruffed grouse, such as alder shearing. County foresters will frequently collaborate with local WDNR wildlife biologists to identify priority habitat projects.

In northcentral and northeastern Wisconsin, the U.S. Forest Service manages the Chequamegon–Nicolet National Forest (CNNF), which contains approximately 1.3 million acres of forest lands. Of those forest lands, 290,000 acres contain species like aspen where early-successional forest habitat is emphasized. On average, about 2,000 acres per year are managed through timber harvest on CNNF. The U.S. Forest Service is currently working to implement over 30,000 acres of early-successional forest habitat projects from through 2034. The WDNR works collaboratively with the U.S. Forest Service on a variety of wildlife management issues, including ruffed grouse, sharp-tailed grouse, and turkey habitat management.

Forest Tax Law Programs

Forest tax law programs remain an important incentive for Wisconsin landowners to practice sustainable forestry that promotes ruffed grouse habitat. Enacted in 1985, the Managed Forest Law (MFL) program has grown to over three million acres and is the largest forestry incentive program in the state. The program enrolls private landowners in either a 25 or 50-year commitment to meet program guidelines. The program has seen relatively consistent new enrollments each year since the program's inception; however, in the coming years, there will be an increased number of plans expiring from the program as many will be reaching their 25-year enrollment obligation. This is the result of a large bubble of enrollments in the mid to late 1990s. It is not yet known how these expirations will impact the overall program enrollment.

The MFL program is also an important part of large land ownerships in Wisconsin, as these properties are typically classified as industrial forest lands and are usually owned by forest products companies, large private landowners, or investment companies. These properties are unique because they have continuously seen long-term and professional management for

decades. In the past 20 years, however, there have been changes in the acreage held across these types of ownership, the type of management implemented on these properties, and the total amount of acres large landowners control and manage in Wisconsin. Since 1999, this type of ownership has declined by over 350,000 acres (Table 2).

Table 2. Large ownership acreage enrolled in tax law programs, 1999–2019.

Ownership	1999	2006	2011	2019
Paper Manufacturers	842,535	107,404	85,345	6,503
Sawmills	122,328	118,229	105,338	62,713
Other Private Ownership	83,311	91,884	20,174	51,677
Other Industry	26,783	32,564	29,407	33,939
Tribal Lands	3,722	16,974	16,827	14,458
REITs[a]	0	474,616	198,099	4,070
TIMOs[b]	0	82,279	365,700	548,822
Totals:	1,078,679	923,950	828,890	722,182

[a]Real Estate Investment Trusts

[b]Timber Investment Management Organizations

In a 2017 study, L'Roe and Rissman found that 22.8% of lands removed from large ownership MFL between 2000 and 2014 were parceled into two or more new parcels. They also found that 7.8% of properties were removed from the program altogether after they were transferred to the new, non-industrial private landowner. These rates seemed to be highest in central and northcentral Wisconsin counties where parcels were closest to urban areas, paved roads, and water front. As a result, forested properties that are withdrawn from the state tax program are often parceled and either taken out of active management or become more difficult to manage due to new, smaller parcel size. Recent legislative changes have provided additional flexibility when lands transfer from large owners so that most of the enrolled acreage remains in the programs without penalty or involuntary withdrawal.

Engagement of the private non-industrial land owners in management will become increasingly important as ruffed grouse depend upon a wide range of age-classes and forest composition. Landowner attitudes towards logging, managing smaller parcel sizes, and availability to forest

products markets are all challenges to curbing young forest habitat loss and make balancing age-class distribution more difficult.

Wisconsin Young Forest Partnership

In 2011, WDNR helped to assemble a group of natural resource professionals representing 15 different government agencies, non-governmental organizations, and private businesses in a pilot effort known as the Wisconsin Young Forest Initiative. By 2014, it had become clear to the group that there was a need for coordinated and collaborative early-successional forest habitat management across the landscape resulting in the formation of the Wisconsin Young Forest Partnership (WYFP).

The purpose of the WYFP is to educate and engage landowners on active forest management, with the intention of providing landowners technical and financial assistance needed to create young forest habitat. From 2014–2018, the WYFP contacted 12,140 landowners, conducted 405 site visits, developed 437 contracts impacting 4,786 acres of habitat, and written 783 management plans for 71,107 acres.

Through the WYFP, WDNR and partners have worked directly with private landowners and have played a critical role in outreach efforts. The WYFP benefits not only ruffed grouse and other early-successional species such as American woodcock and golden-winged warbler (a species of greatest conservation need), but has helped bolster the logging and consultant industry, and has been integral in establishing a contract forestry mowing and shearing industry in the north.

Forest Wildlife Specialists Partnership

In 2016, WDNR partnered with Ruffed Grouse Society and USDA – Natural Resource Conservation Service to create a forest wildlife specialist position to promote young forest habitat on private lands across northern Wisconsin. In 2017, a second forest wildlife specialist position was added to northern Wisconsin.

Delivery of technical assistance and Farm Bill conservation program enrollment for forestry practices have increased significantly in the work areas of the forest wildlife specialists. From 2016–2018, the forest wildlife specialists contacted over 500 private landowners regarding programs available to promote active forest management, have participated in or coordinated 25 outreach events, wrote 59 conservation plans, and enrolled 3,591 acres of private land into voluntary conservation programs with incentive payments totaling $1,253,272. In the forest wildlife specialist work areas, the number of forest management plans written for landowners increased 400% and enrollment in Conservation Stewardship Program forestry practices increased 800% in 2018 compared to the previous four-year average under the 2014 Farm Bill.

Ruffed Grouse Society Programs and Partnerships

The Ruffed Grouse Society maintains a variety of programs and partnerships focusing on ruffed grouse and their habitat. The Ruffed Grouse Society's Drummer Fund was established in 2010 for the purpose of funding habitat projects across the state. Local Ruffed Grouse Society chapters raise money from banquets and other fund-raising programs, which is then used for projects within that chapter's state. From 2015–2018, WDNR received nearly $120,000 from the Ruffed Grouse Society drummer fund to improve young forest habitat and hunter access, including improvements on approximately 900 acres of public land and nearly 120 miles of walking trails.

The Ruffed Grouse Society, UW-Madison, and The Sustainable Forestry Initiative sponsor "Coverts", which is a landowner outreach workshop that aims to engage landowners from various backgrounds in an immersive three-day workshop to discuss forest management for wildlife benefits on their private property. Each August, approximately 25 participants go through the free workshop held at UW-Madison Kemp Natural Resources Station near Woodruff, WI. There they hear from a wide range of forest and wildlife professionals, practitioners, and educators from The Ruffed Grouse Society, WDNR, U.S. Forest Service, forest products industry, and academia. Participants learn about a wide range of topics related to habitat and forest management. Landowners are introduced specifically to young forest management that benefits a wide range of wildlife, including ruffed grouse. Participants then bring that information back to their property and communities act as Covert Cooperators, where they share that knowledge with other landowners to increase habitat impacts.

The Ruffed Grouse Society also continues to work collaboratively with WNDR, U.S. Forest Service, and the county forests to create Cooperative Ruffed Grouse Management Areas where young forest management is emphasized. To date, over 85 Grouse Management Areas have been designated across Wisconsin.

Driftless Young Forest Symposium

In 2016, WDNR sponsored the Driftless Young Forest Symposium in La Crosse. The Symposium brought together approximately 80 resource professionals from 16 different agencies/organizations throughout the Driftless Area to develop a collaborative approach for addressing forest health and forest wildlife conservation challenges in the Driftless Area, where forest maturation has led to significant declines in grouse numbers.

Following the symposium, a Driftless Young Forest Steering Committee was formed, along with three subcommittees: Private Lands, Forest Practices, and Landscape. The mission of the Steering Committee is to "coordinate activities to facilitate active forest management that increases the amount of young oak, hickory, and aspen forest within the Driftless Area."

This effort is still in its early stages, but it provides a collaborative and strategic approach to revitalizing active forest management in the Driftless Area. Some of the initial work includes developing geospatial tools to identify focal areas to manage and regenerate oak.

Ruffed Grouse Hunting in Wisconsin

Harvest Management

Historically, as with many wildlife species, ruffed grouse were hunted for both subsistence and market hunting. Although not as favored as other upland game birds, notably the greater prairie-chicken (*Tympanuchus cupido*) and sharp-tailed grouse (*Tympanuchus phasianellus*), market hunters were getting as much as $1.25 per dozen ruffed grouse by 1845 (Schorger 1945). Market hunting and loss of habitat in the early 1800s caused dramatic declines in many game bird populations, and in 1851 Wisconsin instituted its first closed season on upland game birds, including ruffed grouse, from February 1 through August 1 (Schorger 1945).

Since the first closed season for ruffed grouse in 1851, hunting season structure and other restrictions underwent frequent and sometimes annual changes. Nests were protected in 1867 and nets, traps, and snares were outlawed in 1874. The sale of upland game birds was briefly made illegal in 1853, and all sales were eventually banned in 1903 (Rusch et al. 2000). The first daily bag limit for Wisconsin was set at 25 grouse in 1905 and was gradually reduced to five grouse by 1921 (DeStefano and Rusch 1982).

It is likely that fluctuations in early game laws were a reflection of annual variations in ruffed grouse populations and a lack of understanding of harvest impacts on upland game bird populations. The cyclic nature of ruffed grouse was not well documented at the time, much less understood, and abrupt declines were often attributed to gun harvest, so season closures were logical management remedies. The first statewide year-long season closure occurred in 1917 and lasted for four years. In 1921, the ruffed grouse season was reopened, but only from October 4 to October 8. The annual four-day season was in effect until year-long season closures went into effect in 1929 and 1930, and again in 1936 and 1937 (DeStefano and Rusch 1982).

Ruffed grouse populations in Michigan, Minnesota, and Wisconsin were at low levels during the early 1940s (Erickson 1951), and Minnesota and Wisconsin responded with statewide season closures in 1944 and 1945, respectively. Hunting seasons remained open in Michigan, and in 1948, when seasons in Minnesota and Wisconsin were again opened, estimated ruffed grouse harvest for all three states were nearly identical (DeStefano and Rusch 1982). Minnesota and Wisconsin had given up grouse hunting and gained very little as grouse populations continued to rise and fall with apparently little impact from the presence or absence of hunters. In Wisconsin, changes in ruffed grouse hunting regulations continued (Table 3), but year-long season closures were abandoned after 1947 (except Waukesha County in 1978–1980). As research added to managers understanding of harvest impacts on ruffed grouse survival and

abundance, a change in management policy took place where ruffed grouse seasons were maintained, and even liberalized, despite continued population fluctuations (DeStefano and Rusch 1982, Rusch et al. 2000, Dhuey 2018). Over the ensuing decades, researchers found that while hunting may add to natural mortality in areas with high harvest rates (Kubisiak 1984) and can lead to localized declines in fragmented habitat (Small et al. 1991), regulated fall hunting does not appear to impact grouse abundance at a population level and tends to only remove grouse that are in excess of winter carrying capacity (Dorney and Kabat 1960, Clark 2000, Devers et al. 2007).

Photo courtesy of Beverly Engstrom

Table 3. Changes and alterations to Wisconsin ruffed grouse harvest regulations, 1936–2018.

Year(s)	Daily bag limit	Approximate season length	Comments
1936–1937	0	Statewide season closure	
1938	4	2 weeks (15 Oct–28 Oct)	
1939–1940	4	6 weeks (23 Sep–3 Nov)	
1941	4	7 weeks (20 Sep–7 Nov)	
1942–1943	4	8 weeks (19 Sep–15 Nov)	
1944	4	2 weeks (21 Oct–5 Nov)	
1945–1947	0	Statewide season closure	
1948	3	2 weeks (23 Oct–5 Nov)	
1949–1950	4	5 weeks (1 Oct–4 Nov)	
1951	5	7 weeks (22 Sep–11 Nov)	
1952–1953	5	6 weeks (4 Oct–16 Nov)	
1954–1955	5	11 weeks (2 Oct–19 Dec)	
1956	5	12 weeks (1 Oct–23 Dec)	North, East, and West Zones created.
1957–1960	5	12 weeks (1 Oct–22 Dec)	Central Zone added in 1957.
1961–1962	3	12 weeks (1 Oct–17 Dec)	Bag limit reduced to 3 in all zones in 1961.
1963–1964	3	North: 7 weeks (28 Sep–11 Nov) South: 11 weeks (28 Sep–15 Dec)	Zones consolidated to North Zone and South Zone.
1965	3	North: 6 weeks (2 Oct–16 Nov) South: 11 weeks (2 Oct–19 Dec)	Season shortened to 6 weeks in North Zone.
1966	3	North: 4 weeks (1 Oct–31 Oct) South: 11 weeks (1 Oct–18 Dec)	Season shortened to 4 weeks in North Zone.
1967	3	North: 4 weeks (30 Sep–31 Oct) South: 13 weeks (30 Sep–31 Dec)	Season extended to 13 weeks in South Zone.
1968–1969	3	North: 6 weeks (28 Sep–10 Nov) South: 13 weeks (28 Sep–31 Dec)	Season extended to 6 weeks in North Zone.
1970	4	North: 6 weeks (3 Oct–17 Nov) South: 13 weeks (3 Oct–31 Dec)	Bag limit increased to 4 birds.
1971–1972	5	North: 6 weeks (2 Oct–16 Nov) South: 13 weeks (2 Oct–31 Dec)	Bag limit increased to 5 birds.
1973–1977	5	Southwest: 17 weeks (29 Sep–31 Jan) Statewide: 13 weeks (29 Sep–31 Dec)	Zones consolidated to Southwest Zone and remainder of state.

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1978–1979	5	Southwest: 17 weeks (30 Sep–31 Jan) Statewide: 13 weeks (30 Sep–31 Dec)	Yearlong season closure in Waukesha County.
1980	5	North: 13 weeks (4 Oct–31 Dec) South: 17 weeks (4 Oct–31 Jan)	Zone realignment to North and South Zones. Yearlong season closure in Waukesha County.
1981–1982	5	North: 13 weeks (3 Oct–31 Dec) South: 17 weeks (3 Oct–31 Jan)	Season reopened in Waukesha County.
1983–1990	5	North: 15 weeks (17 Sep–31 Dec) South: 19 weeks (17 Sep–31 Jan)	Season extended to 15 weeks in North Zone and 19 weeks in South Zone in 1983.
1991–2006	Zone A: 5 Zone B: 5 Zone C: 2	Zone A: 15 weeks (14 Sep–31 Dec) Zone B: 20 weeks (14 Sep–31 Jan) Zone C: 7 weeks (19 Oct–11 Dec)	Zones realigned to Zones A, B, and C, each with different bag limits and season lengths.
2007–2017	Zone A: 5 Zone B: 2	Zone A: 20 weeks (15 Sep–31 Jan) Zone B: 7 weeks (20 Oct–8 Dec)	Zones consolidated to Zones A and B, each with different bag limits and season lengths.
2018	Zone A: 5 Zone B: 2	Zone A: 15 weeks (15 Sep–31 Dec) Zone B: 7 weeks (20 Oct–8 Dec)	Season shortened by 1 month in Zone A due to emergency rule.

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Hunter Recruitment, Retention, and Reactivation

For many years, the WDNR and partner organizations have engaged in Learn to Hunts and other hunter, angler, and shooting sports recruitment, retention, and reactivation (R3) efforts. In recent years, the effectiveness of these R3 efforts have been evaluated with the conclusion that the agency needed a more focused and strategic approach. As a result, an R3 team has been established to promote a Wisconsin outdoor lifestyle that includes robust hunting, angling, and trapping participation through strong partnerships and support for shooting sports participation. This centralized coordination allows for strategic program development, implementation, and evaluation with strategies designed to address each "R" in ways that are measurable, achievable, and adaptive.

R3 strategies focus on outcomes. The expected outcomes are to recruit new participants to the point where they will continue hunting with no further support needed, retaining current participants, reactivating lapsed hunters, anglers, and trappers, and recruiting and training current participants to mentor novices.

Ruffed grouse and ruffed grouse hunters fit best into the R3 action strategy which includes expanding the popular Hunt for Food program and mentor programs to train adults and families to hunt. There is one Hunt for Food – Ruffed Grouse program currently being offered in the Antigo area, with opportunities to expand with interest from new participants and certified instructors.

Ruffed Grouse Surveys

Abundance Surveys

Spring drumming surveys are the principle index of abundance for ruffed grouse in Wisconsin. While results of this survey can be found as far back as 1954, transects have been run routinely since the spring of 1964. Transects were originally established in 32 counties near the best available grouse habitat in the county. They were conducted from April 20–May 10, beginning 30 minutes before sun rise. Transects consisted of 15 four-minute stops spaced approximately one mile apart and were usually run twice, with three to ten days between surveys. The total number of drums and the number of drumming males was counted at each stop. Only the higher of the two counts was used in analysis. As time progressed, the survey effort increased to 51 routes being run in 42 counties by the spring of 1994 (Kubisiak 1994).

Survey transects were updated in 1994 and survey starting points were randomly located to better understand ruffed grouse distribution across the entire state. Transects started within one mile of the random point and could go in any direction. They were to contain ten listening points spaced one to two miles apart and locations of the stops were selected to minimize potential noise interference and safety issues. Other methodological changes included only recording the total number of drums heard and only running the route once per season. Stops

on the transect continued to be four minutes long and start 30 minutes before sunrise. Transects that had zero drums heard for three consecutive years were considered to have no birds and were designated as "zero routes", which are then run once every three years. If a drum is heard on a "zero route", the transect is run annually until three consecutive years of zero detections occurs again. Transects south of Highway 64 were to be conducted April 10–May 5, and those north of Highway 64 were conducted from April 20–May 15. Both the "old" transects and the "new" grouse drumming transects were run for three consecutive years before the "old" transects were discontinued. This was done to establish a relationship factor so as not to lose the connection to the historical data that had been collected for 30 years prior.

Drumming surveys have helped biologists and grouse enthusiasts track the grouse population cycle. In Wisconsin, cyclic peaks of ruffed grouse abundance tend to occur in years ending in a nine, zero, or one (e.g., 2019, 2020, or 2021). Lows points of the cycle usually occur during years ending in a four, five, or six (Figure 12). At a statewide level, there has been a general decline in ruffed grouse distribution and abundance since the surveys inception. Grouse highs are not as high as they have been in past cycles and the amplitude of the change from low to high seems to be decreasing. This change in grouse abundance is likely a result of the aging of Wisconsin's forest and the overall loss of aspen and young forest types throughout the state.

The ruffed grouse drumming survey continues to be the most important survey for measuring grouse abundance in Wisconsin's primary range, which includes the central and northern forest regions of the state. Other measures of grouse abundance may have to be developed and employed if it is deemed necessary to measure grouse abundance and distribution in other less suitable habitats in the state. The drumming survey as currently performed is poorly suited for measuring grouse abundance at low densities.

WDNR personnel also report brood observations for a ten-week period (second week in June through third week in August) each summer for gray partridge (*Perdix perdix*), ring-necked pheasant (*Phasianus colchicus*), eastern wild turkey (*Malleagris gallopavo sylvestris*), and ruffed grouse. Data from these observations are used to monitor game bird brood production during the summer and make a prediction for the upcoming fall season. While peaks and low points of brood observation data tend to follow the same pattern of the drumming count and the grouse population cycle, the relationship between grouse production and the following years drumming counts is not always evident (Figure 13), possibly a result of weather during the brood-rearing season or variability in survey effort.

Private landowners also assist in monitoring Wisconsin's ruffed grouse population. In late August, 5,000 rural landowners from across the state owning five or more acres are sent a questionnaire known as the Summer Wildlife Inquiry which asks them to document occurrences of wildlife on their land, including ruffed grouse. Abundance of grouse as reported by these landowners is on a long-term general decline, with the years of peak grouse abundance

during the cycle showing a bit of an uptick in abundance or as a reduced decline (Figure 14). These data mirror those of the drumming survey showing a general decline in statewide grouse abundance over the past several decades.

Complete counts of males at drumming logs have been conducted at the Stone Lake Experimental Area in the north central part of the state and on the hunted and non-hunted portions of the Sandhill Wildlife Area in central Wisconsin. Crews of surveyors go out during the same periods of time as the statewide drumming survey, listen for drumming males, and then proceed toward the male on foot to locate the drumming log. Once the log is located, it is denoted on a map and flagging tape is used to mark the location. This procedure is repeated over several mornings until all drumming males on the area are located, and density estimates of breeding males are made for each area. Results show somewhat similar trends to the statewide drumming data (Figure 15), but since methodologies are not the same, comparison between these surveys should be done with caution.

WDNR has a long history of using varied survey methods for collecting ruffed grouse abundance data. The following methods have been used by the department at various times in the past, though all are currently retired from use: 1) field biologist records of the number of ruffed grouse flushed and the number of winter roosts found while cruising deer yards in late winter/early spring; 2) flush counts of grouse in late summer to measure brood success and summer survival prior to the start of the fall hunting season (Lemke 1954); 3) flush surveys in early summer to estimate peak hatch dates; 4) spring surveys of rural landowners to monitor winter survival and spring breeding grouse; and 5) rural mail carriers reports of ruffed grouse seen in spring while performing their mail routes.

While many of these now defunct surveys may have collected useful data based on our knowledge of ruffed grouse biology at the time, they were discontinued due to workloads, budget constraints, and a better understanding of ruffed grouse biology and population dynamics.

Photo courtesy of Ryan Brady

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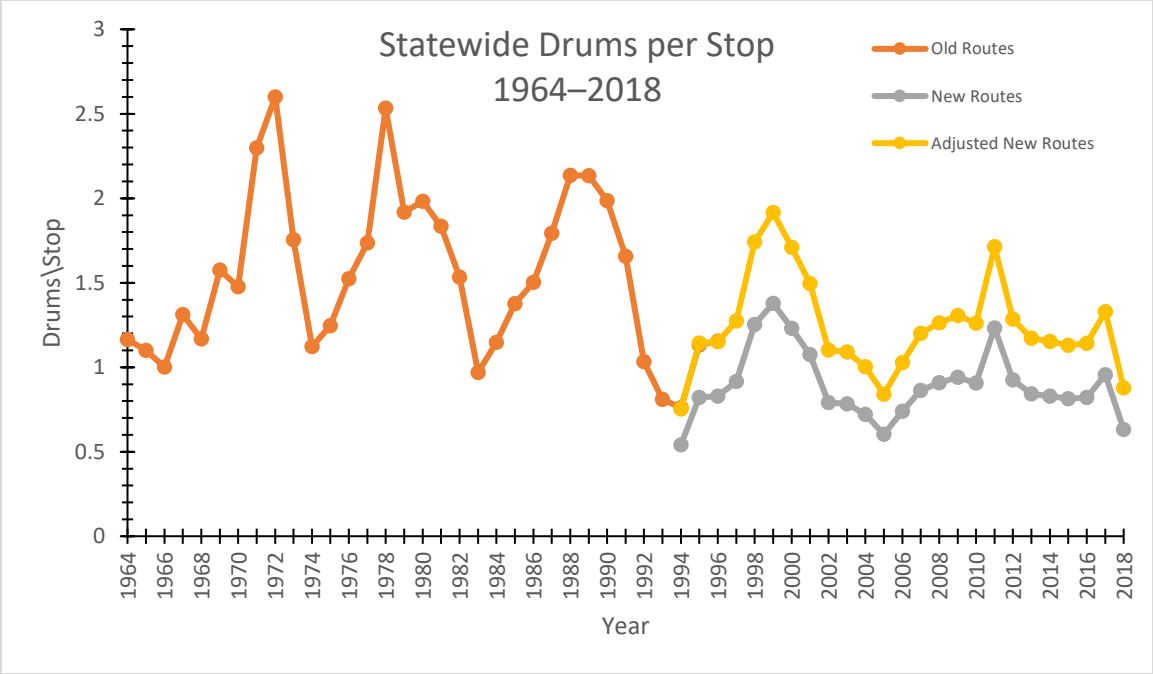

Figure 12. Statewide spring drumming survey results (drums/stop) for ruffed grouse (1944–2019) with associated 95% confidence intervals (1994–2019).

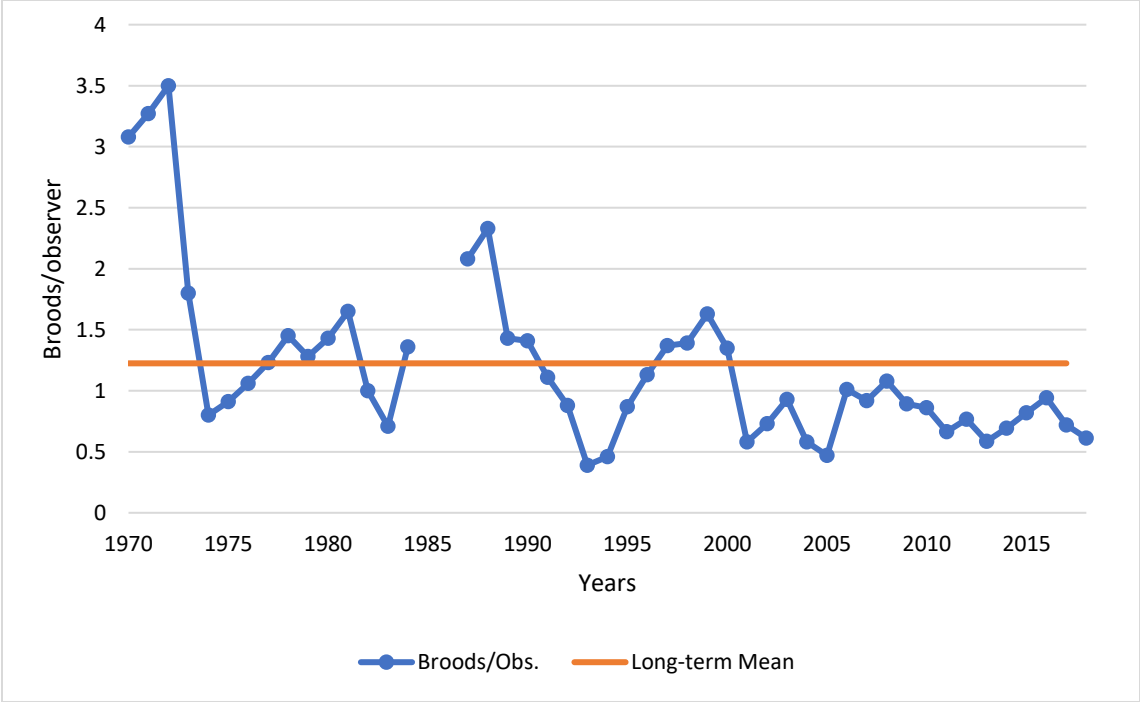

Figure 13. Number of ruffed grouse broods seen per observer, 1970–2017.

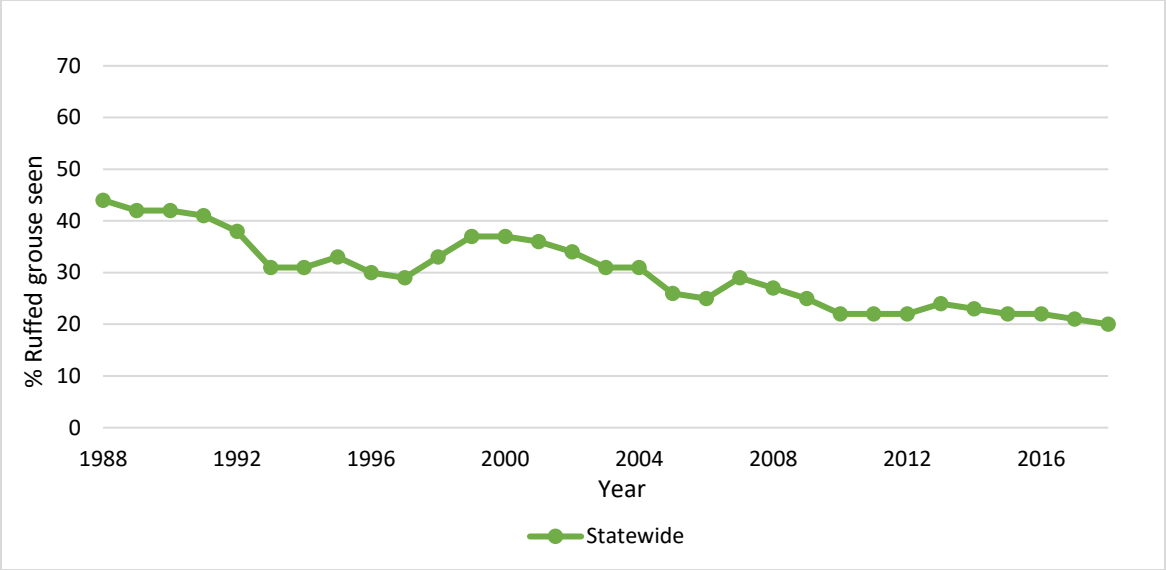

Figure 14. Percent of rural landowners reporting ruffed grouse on their property, 1988–2018.

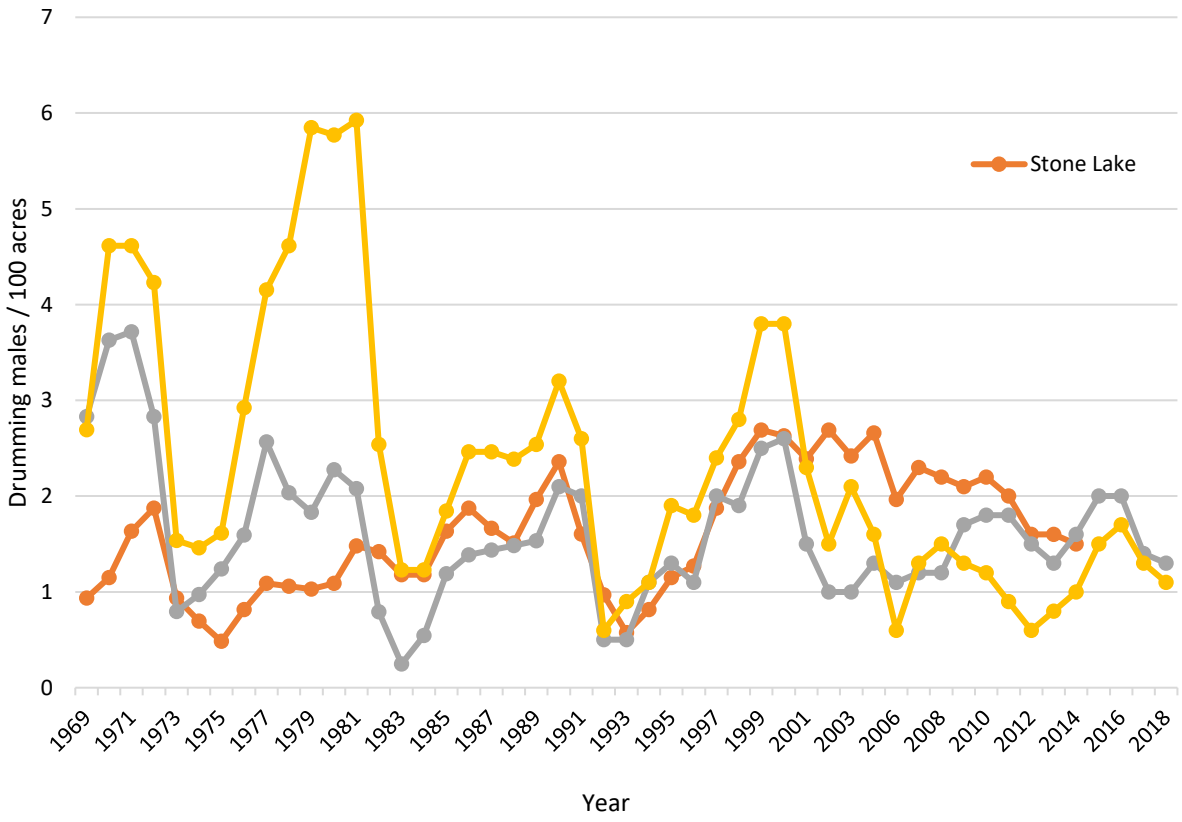

Figure 15. Densities of drumming male grouse per 100 acres on Stone Lake Experimental Area and Sandhill Wildlife Area, 1969–2018.

Hunter Surveys

In 1899, Wisconsin began requiring hunters to purchase a hunting license before pursuing game of any kind. Small game licenses were established in 1951 and were separated from other license types – deer and bear. The first estimates ruffed grouse harvest were made in the early 1930s. Estimates of harvest for most small game species were obtained from voluntary game census cards that were attached to the license and were to be completed at the end of the hunting season and returned to the department. Initial response rates were good but declined as interest ebbed and fell to a low of 8% in 1958. Starting in 1959 a new method of surveying small game hunters was introduced, whereby a questionnaire was mailed to 30,000 individuals at the end of the season who were randomly selected from the previous year's list of licensed hunters. The number of hunters surveyed varied over time with 10,000 surveys mailed from 1960–1971, then 20,000 surveys mailed from 1972–1976, then back down to 10,000 surveys mailed thereafter to the present day. The response rate varies from year to year but was 34% in 2018.

License data show an increasing trend in small game license sales from their inception until a peak in 1980. Since then, the number of small game license buyers has been on a decline of about 1.7% annually (Figure 16). While not all small game license buyers intend to pursue ruffed grouse, the four-decade decline is concerning particularly as our hunting public ages and is not replaced by a younger cohort. Harvest estimates varied greatly from year to year, but generally followed license sales with an increasing trend from the 1930s through about 1980. Higher harvests would occur during peaks in the grouse cycle. Since that time, ruffed grouse harvest has been generally declining with increases during the cyclic highs, but not reaching levels seen during previous highs (Figure 17).

Since 1983, the hunter survey has been used to derive an estimate of the number of active ruffed grouse hunters, their days afield in pursuit of grouse, and an estimate of their harvest. These data correspond well to the small game license sales data in that the estimated number of ruffed grouse hunters, days afield, and harvest have declined since the early 1980s (Figure 18). Using small game hunter surveys to measure hunter participation, effort, and success has been valuable to resources managers when gauging hunters' use of the ruffed grouse resource. It is imperative that a measure of these parameters continue. To ensure that these measures of hunter activities continue to provide meaningful results, surveyors should monitor survey participation rates and use all means of scientifically valid methods and techniques to ensure that response rates do not drop to levels that do not yield reliable results.

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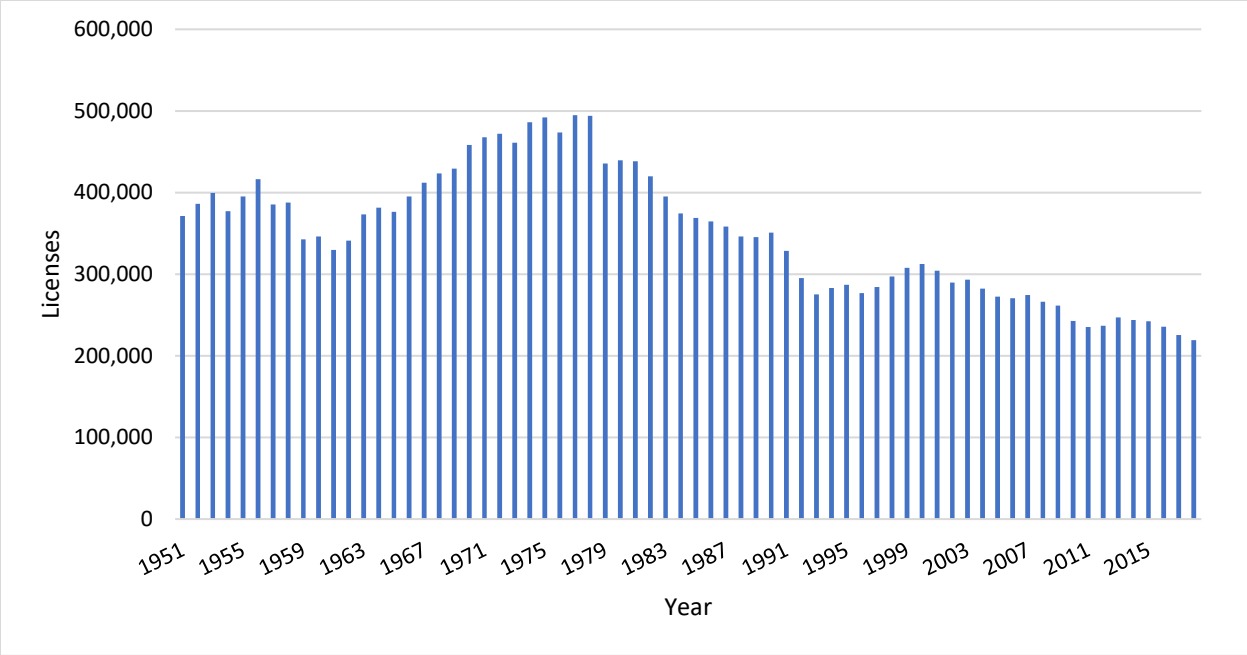

Figure 16. Total small game license sales data by year, 1951–2018.

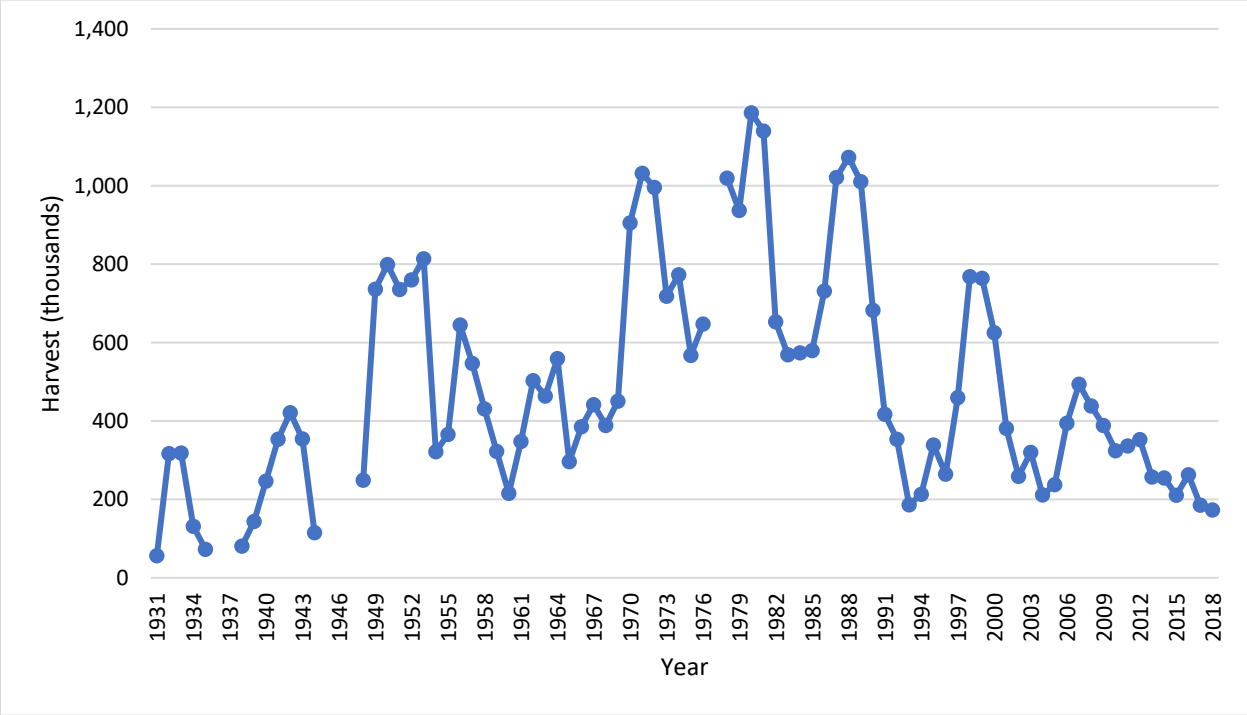

Figure 17. Ruffed grouse harvest estimates, 1931–2015.

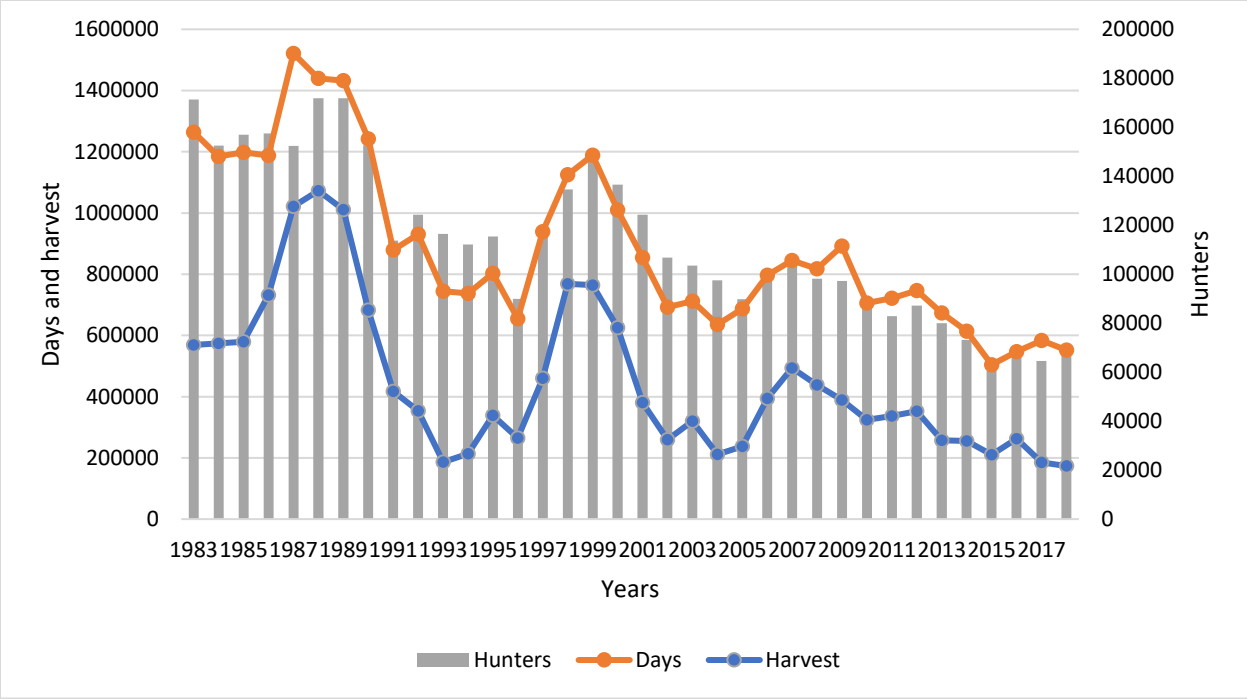

Figure 18. Ruffed grouse hunters, days afield, and harvest from the small game survey, 1983–2018.

Ruffed Grouse Health

Monitoring the Health of Ruffed Grouse in Wisconsin

The department maintains a Wildlife Health program that investigates reports of sick or dead birds when an unusual morbidity or mortality event occurs. When an unusual morbidity or mortality event is identified, carcasses and/or samples are collected and submitted for necropsy and/or disease testing. If a significant health event is suspected or determined to be negatively affecting ruffed grouse populations, actions may include outreach to partners and stakeholders, collection of additional carcasses and samples where appropriate, and collaboration with researchers to further investigate and inform a timely, appropriate, and science-based response.

No disease agent has been documented to cause significant declines in Wisconsin's ruffed grouse population. As ruffed grouse are relatively solitary birds and rarely interact directly with other birds both wild and domestic, infection with diseases that require close contact for transmission are less likely to impact populations. Not all health-related issues require direct contact for disease to occur. As with other species, it is very important that biologists, hunters, and outdoor enthusiasts notify the state Wildlife Health program if they notice ruffed grouse acting abnormally or if they observe sick or dead animals.

Prompt identification of the cause of ruffed grouse morbidity and mortality informs not only identification of the cause but helps to inform decisions on next steps. This section briefly

describes diseases that have been identified in ruffed grouse, some of which have been detected in Wisconsin.

West Nile Virus

West Nile virus (WNV) is a disease caused by an arbovirus. These viruses can cause inflammation in the brain (encephalopathy), heart, or other organs. The West Nile virus is transmitted through the bite of certain species of mosquitos and is maintained and replicated in some birds and possibly small mammals, also known as reservoir species. Once the concentration of virus in the blood reaches a certain threshold in these reservoir species, it can be picked up by mosquitos and transmitted to a new animal. Not all animals that are exposed to the virus develop the disease or are adequate hosts for the viruses to replicate. Often infection does not result in any clinical signs. In cases that do result in disease, birds can show neurological signs such as tremors, head tilting, lethargy, and loss of coordination.

West Nile virus was introduced to North America from Africa. It was first identified in the eastern United States in 1999 with an outbreak that caused high mortality in crows. This was likely the initial introduction to the continent. It was first detected in Wisconsin in 2001 with the first human infections occurring in 2002 (WDHS 2019). Since then, reported cases of the disease fluctuates annually. Cases of WNV peak when mosquito populations are high in late summer and early fall. Some species of birds are more susceptible to WNV than others, including corvids (crows and jays) and raptors (hawks, owls, and eagles). Corvids are used as sentinels in monitoring for virus activity within Wisconsin because they are more susceptible to clinical disease and live near human developments.

Some research has suggested that WNV may be an additive-stressor to mortality and is potentially exacerbating long-term reductions in ruffed grouse numbers driven primarily by declining habitat availability in Pennsylvania (Stauffer et al. 2018). Results from the eastern United States may not apply to the Upper Great Lakes region, however, given regional variability in habitat availability and other factors that can influence the impacts of disease on a population. In response to the interest from this study and current lack of research on WVN impacts on ruffed grouse in the Upper Great Lakes region, a multi-year study including Wisconsin, Minnesota, and Michigan was initiated to gather baseline data on WNV exposure. Hunters play a vital role in the study by submitting samples from harvested birds.

Ruffed grouse that were observed sick or found dead were also collected and submitted for necropsy to look for evidence of viral exposure and any clinical disease. The virus was detected in three of sixteen sick or dead ruffed grouse that were submitted for necropsy during the 2018 ruffed grouse hunting season. Only one of these birds had clinical signs consistent with disease caused by an arbovirus, however, this bird was also infected with Eastern equine encephalitis. The clinical signs of these two viruses are not specific enough to determine which virus was associated with the clinical findings. This was the first documented detection of WNV in ruffed grouse in Wisconsin. However, testing for WNV in Wisconsin ruffed grouse prior to this focused effort was limited by the species' secretive nature and few reports to WNDR staff

of sick or dead ruffed grouse. Research and monitoring of WNV in ruffed grouse in Wisconsin are ongoing and current efforts may inform future research needs.

Eastern Equine Encephalitis

Eastern equine encephalitis (EEE) is also an arbovirus and is spread in a similar fashion to WNV. The virus is considered native to North America and was first identified in wild bird populations in Wisconsin in the 1950s (Karstad, et al 1960). Eastern equine encephalitis has caused die-offs in species exotic to the United States including ring-necked pheasants, house sparrows (*Passer domesticus*), and pigeons. Signs in these species are mainly neurological and include tremors, lethargy, voice changes and paralysis of the legs or neck. A survey of Wisconsin wild birds and mammals conducted in 1957 found that 50% of the sampled ruffed grouse had antibodies for EEE virus, indicating that they had been exposed to the virus and developed an antibody response (Karstad, et al 1960). Clinical EEE was identified in a ruffed grouse for the first time in 2018, though it was also found in non-clinical birds. Similar to WNV, testing has been limited; however, the historical antibody data, population indices, and the detection of viral segments in non-clinical birds suggest that this virus may affect individual birds but has not caused population level impacts in the past. Opportunistic surveillance for EEE in ruffed grouse in Wisconsin is ongoing.

Avian Pox

Avian pox is caused by a virus that produces wart-like lesions on the featherless areas of affected birds. Nearly all wild bird species are susceptible, though it is more commonly reported in certain species of songbirds, upland gamebirds, and marine birds. It is primarily spread when a mosquito feeds on an infected individual and then feeds on an individual susceptible to the virus. It can also be spread when the virus gets in through the mucous membrane or an open wound through direct contact. The disease can spread rapidly when birds are in close proximity to one another, such as in captivity or at bird feeding stations.

This disease has two forms: wet (internal) and dry (external). While both cause the wart-like nodules, the wet pox develops moist, necrotic lesions affecting the birds' internal organs, while the dry pox primarily affects the skin. Though dry pox is reported more frequently due to the highly visible nature of the skin lesions, wet pox can cause more detrimental lesions affecting respiration and ingestion. Most dry pox lesions die back and leave the bird with only minor scarring, though multiple lesions can cluster and negatively affect vision, breathing, and food intake resulting in mortality of the individual. Avian pox is frequently reported in wild turkeys but has been rarely reported in Wisconsin's ruffed grouse population.

Parasites

Cecal worms (*Heterakis gallinarum*) are a nematode parasite commonly found in the cecum of galliform birds, including ruffed grouse. An infestation of cecal worms occasionally has negative impacts on the health of the host, but the parasite is often utilized by the protozoan parasite

Histomonas meleagridis as a form of entry into its host. This protozoan parasite causes histomoniasis or "blackhead disease" named for the occasional discoloration of the skin on the head of the infected bird. Clinical signs include lethargy, fluffed feathers and sulfur-yellow feces generally occurring early in the disease. It can cause high mortality rates in most captive gallinaceous birds, including grouse, but has not been documented to cause large losses in wild grouse.

Other parasites reported in ruffed grouse include internal parasites such as roundworms (*Ascaridia bonasae*), gapeworms (*Syngamus trachea*), gizzard worms (*Dispharynx* spp.), and coccidia (protozoan parasite). In Wisconsin, hunters often report finding hippoboscid louse flies, or "keds", within the feathers of harvested birds. Generally, these internal and external parasites do not cause problems unless a bird is debilitated or stressed.

Climate Change and Ruffed Grouse

Mounting evidence suggests that long-term population fluctuations of winter-adapted species are influenced by changes in weather and climate variability. In high-latitude environments, including Wisconsin, biotic interactions and population dynamics are often mediated by direct and indirect effects of winter weather (Williams et al. 2004). Winter-adapted species, such as ruffed grouse, must cope with variability in seasonality and changes in the depth, quality, and persistence of snow cover. However, winter landscapes are changing, and snow cover is becoming more variable throughout winter. Additionally, forest characteristics such as cover type, canopy closure, and distance to forest patch edge can influence snow accumulation and persistence, leading to differences in snow depth across the landscape.

Though ruffed grouse are capable of handling temporary stressors such as food shortages and cold snaps, chronic stress can have fitness consequences, including reduced reproductive output. There is evidence that poor winter conditions can elevate stress hormones in birds. Recent research has indicated a strong relationship between corticosterone concentrations, a common stress hormone in birds, and ambient air temperature, whereby cold temperatures increased stress in grouse (A. Shipley, University of Wisconsin-Madison, unpublished data). Importantly, evidence also showed that roosting in snow burrows mediated the effect of temperature on corticosterone levels – in other words, at the coldest temperatures, using snow burrows reduced stress in grouse. Evidence further suggested that corticosterone levels decreased with increasing snow depth (A. Shipley, University of Wisconsin-Madison, unpublished data).

Winter snow roosting is not currently considered critical to survival, but that could change as winter weather patterns are altered. Loss of snow cover is predicted for Wisconsin in the future, which will likely limit the ability of grouse to use snow burrows and avoid cold winter temperatures (Pomara and Zuckerberg 2017). Increased air temperatures may moderate winter precipitation; however, the resulting reduction in snowfall would increase exposure to freezing

rain, cold temperatures, and predators. The exposure risk to grouse could be compounded if these changes are accompanied by increase wind speeds and duration (Pomara and Zuckerberg 2017). Increased or chronic cold stress due to the inability to snow burrow could result in lowered survivorship and reproductive output of ruffed grouse (Gullion 1970). In areas where snow conditions are not regularly suitable for snow burrowing, ruffed grouse may need to seek out low, dense conifers for roosting sites. Dense conifer cover reduces wind speed and thermal radiation loss, and though conifers would provide less thermal benefit than snow burrows, they would provide more thermal benefit compared to deciduous roosts (Thompson and Fritzell 1988).

Additionally, aspen is considered highly vulnerable to predicted changes in climate. By the end of the next century, projected temperatures may exceed the physiological limits of aspen, as Wisconsin lies near the southernmost extent of the aspen range. Vulnerability is increased with aspen dominated stands, single age structure stands, disease, and deer browsing, (Handler et al. 2019). Given the importance of aspen forests for ruffed grouse in Wisconsin, the potential impacts of climate change on ruffed grouse have the potential to be significant. Additional research is needed to better understand how predicted changes in climate will influence ruffed grouse and their habitat.

Predators

Many species prey on ruffed grouse, and the relative importance of predators changes seasonally and geographically. In Wisconsin, medium-sized mammalian predators – particularly red fox (*Vulpes vulpes*), striped skunk (*Mephitis mephitis*), and raccoon (*Procyon lotor*) – are primarily nest predators, although weasels and mink (*Mustela* spp.), opossums (*Didelphis virginiana*), and coyotes (*Canis latrans*) will also depredate nests. Avian predators of nests are uncommon, but American crows (*Corvus brachyrhynchos*) may occasionally take eggs.

Primary predators of chicks are not well known but likely include most mesopredators and raptors. Cooper's hawks (*Accipiter cooperii*), sharp-shinned hawks (*A. striatus*), northern goshawks, red-tailed hawks (*Buteo jamaicensis*), great horned owls, and barred owls (*Strix varia*) are common avian predators of ruffed grouse. Cooper's and sharp-shinned hawks likely have their greatest impact on grouse chicks, whereas goshawks and great horned owls are important predators on grouse of all ages (Keith and Rusch 1989, Rusch 2000). Foxes and bobcats (*Lynx rufus*) are common mammalian predators and kill grouse of all ages.

Predation accounts for a majority of all ruffed grouse mortality in Wisconsin. The leading cause of adult ruffed grouse mortality is avian predation, with peak predation rates occurring during spring and fall raptor migrations (Keith and Rusch 1989). In Wisconsin, among 563 radio-marked grouse with known fates, 29.8% were killed by hunters, 46.2% by hawks and owls, and 20.4% by mammals (Rusch et al. 2000). Both avian and mammalian predators kill ruffed grouse, but grouse generally not in numbers that will significantly reduce populations. Ruffed grouse

overcome pressure from predators through high reproductive rates, and will generally maintain good populations despite the occurrence of predators when high-quality habitat is present.

Ruffed Grouse and Wild Turkey Interactions

Many who enjoy time in the woods have noted dramatic declines in ruffed grouse populations while wild turkey populations have simultaneously thrived in certain areas where their ranges overlap. For some, this is evidence enough to conclude that turkeys are negatively impacting ruffed grouse populations. The pervasiveness of this belief was evident in the Wisconsin Ruffed Grouse Hunter Survey results. When asked about the potential for wild turkeys to impact ruffed grouse populations, 43% of respondents felt that turkeys have a moderate to great impact, 37% felt turkeys had little to no impact, and 20% were unsure.

When examining the research and ecology of the species, however, there is virtually no evidence to suggest that turkeys have any measurable impact on ruffed grouse populations (Bauman 2002). First, the differences in habitat and diet would suggest minimal competition between the species. Turkeys tend to inhabit edges where mature forest meets openings such as grasslands or agricultural fields (Porter 1992, Pollentier 2012). Their diet is highly varied, as turkeys are opportunistic feeders, and includes seeds, grains, grasses, acorns, buds, fruits, nuts, insects, and occasionally larger animals such as frogs or lizards (Hurst 1992). Ruffed grouse inhabit areas with mixed age-classes of aspen or hardwoods that is predominantly dense, young forest habitat (Gullion and Alm 1983). Their diet consists primarily of buds, twigs, catkins, leaves, seeds, fruits, and insects (King 1969, Servello and Kirkpatrick 1987).

It has also been suggested that turkeys limit ruffed grouse production by depredating eggs and chicks. This speculation likely stems, at least in part, from a single observation made by a researcher in Florida during the 1930s that documented a turkey destroying a bobwhite quail nest. Researchers have never documented a turkey eating ruffed grouse eggs or chicks despite decades of extensive research on turkey nutrition and ruffed grouse reproduction and survival conducted in areas where the species' ranges overlap. Turkeys are opportunistic feeders – while it is certainly possible that a turkey would eat a grouse egg or even a newly hatched chick if it encountered one, it is extremely unlikely that depredation by turkeys is occurring at a scale that would have population-level impacts on ruffed grouse.

As emphasized throughout this management plan, the primary factor driving ruffed grouse populations is the availability of young forest habitat that meets the needs for the various stages of the grouse life cycle. Across Wisconsin, we have seen a decline in young forest habitat with the greatest loss occurring in southwestern and central portions of the state. The relative decline in regional ruffed grouse populations in Wisconsin mirrors this change in young forest habitat availability.

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SECTION III – FUTURE MANAGEMENT OF RUFFED GROUSE: GOALS, OBJECTIVES, AND STRATEGIES

Ruffed Grouse Management Program Mission

The overarching mission of the ruffed grouse management program in Wisconsin is to:

- Promote early-successional forest habitat on public and private lands.
- Utilize the best available science to sustain a healthy ruffed grouse population.
- Enhance recreational opportunities for ruffed grouse hunting and viewing by wildlife enthusiasts.
- Inform the public of grouse management efforts, challenges, successes, and opportunities.

This plan outlines a diverse suite of goals, objectives, and strategies that provide a framework for linking the broad mission of the ruffed grouse management program to specific actions. These strategies will guide and focus ruffed grouse management efforts for WDNR, as well as willing partners, from 2020–2030.

General Ruffed Grouse Management

- **Goal:** Employ a strategic, targeted approach to implementing ruffed grouse habitat management, research and monitoring, partnerships, hunter experience improvement, and outreach efforts.
    - **Objective:** Identify regions within Wisconsin where overall benefits derived from ruffed grouse habitat management, research and monitoring, partnerships, hunter experience improvement, and outreach efforts will be optimized.
        - **Strategy:** Identify three broad Ruffed Grouse Priority Regions in the northern forest, central forest, and Driftless Area of Wisconsin (Figure 19). Further analyses can inform step-down approaches for more targeted efforts related to habitat management, research and monitoring, partnerships, hunter experience improvement, and outreach efforts.

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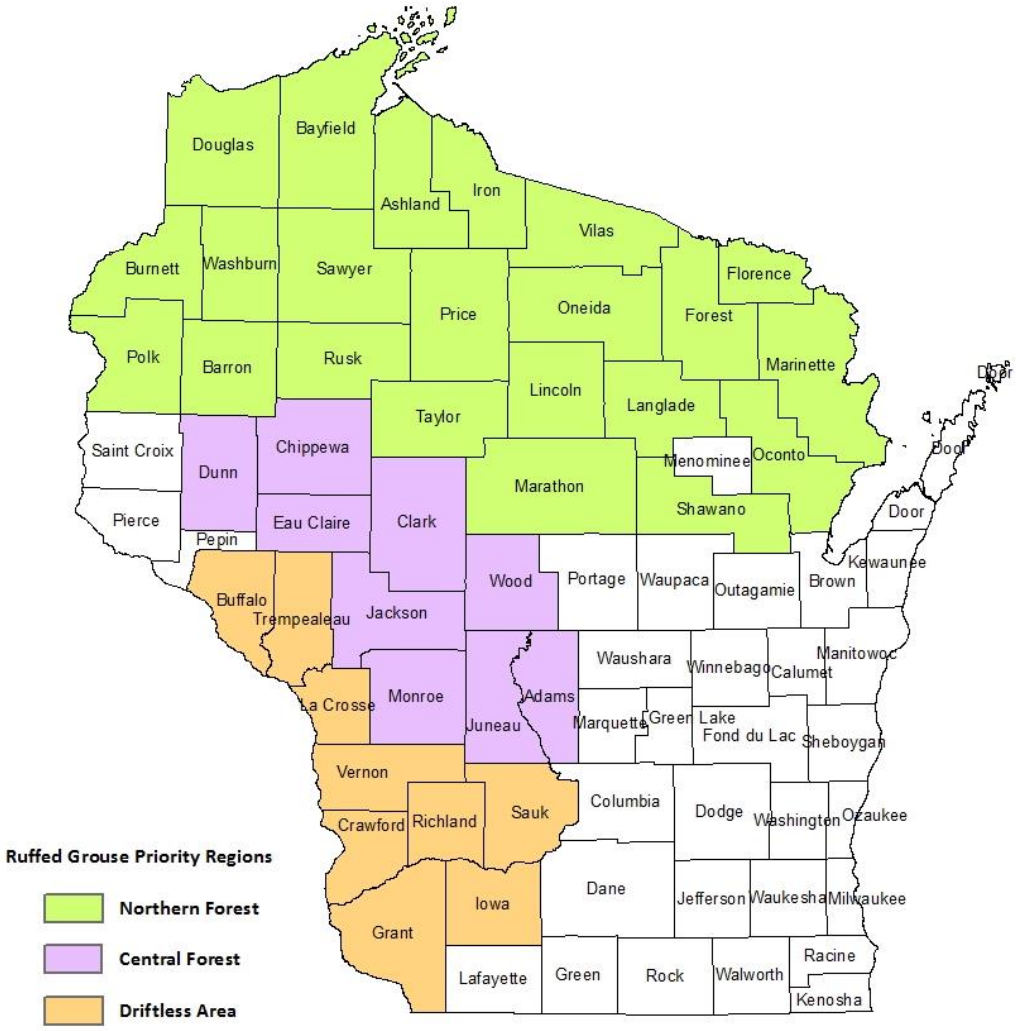

Figure 19. Ruffed Grouse Priority Regions.

Habitat

- **Goal**: Provide adequate, consistent levels of early-successional forest habitat to sustain a healthy and broadly-distributed ruffed grouse population.
    - **Objective:** Emphasize early-successional forest habitat work within Priority Regions across ownership.
        - **Strategy:** Within two years of plan approval, develop Ruffed Grouse Focal Areas to strategically direct ruffed grouse habitat management efforts and maximize benefits to the population. Ruffed Grouse Focal Areas will fall within the broader Ruffed Grouse Priority Regions. The process of defining Focal Areas will include identifying optimum conditions and best management practices for ruffed grouse by priority

cover type (i.e., aspen, oak, and northern hardwoods) and developing new analyses and processes or supporting ongoing efforts to prioritize and effectively target ruffed grouse habitat management within priority cover types. Targets will be established for each Ruffed Grouse Focal Area to measure success and may include processes such as identifying and maintaining core areas of aspen and/or targeting critical areas for oak regeneration.

    - **Strategy**: Within Focal Areas, add early-successional forest habitat work to WDNR wildlife biologist and wildlife technician position descriptions and/or annual work plans. This work will be guided by best management practices for local cover types and tied to local habitat priorities (e.g., oak regeneration within the Driftless Area, young aspen forest management in the northern forest) as determined by the Wildlife Leadership Team with input from stakeholders.
    - **Strategy**: Work collaboratively with willing partners, both internal and external, to incorporate best management practices for ruffed grouse into forest management plans across public and private land ownership within Priority Regions. This could include county, state, and national forest management plans, Managed Forest Law plans, and forest management plans for private lands enrolled in the Deer Management Assistance Program or Farm Bill conservation programs.
- **Objective**: Analyze ruffed grouse habitat availability within Priority Regions as to inform management actions.
    - **Strategy**: Forest Inventory and Analysis (FIA) data, which provide a broad view of forest cover and age, are updated every five years. As these data become available, quantify early-successional forest habitat within each Priority Region to assess trends and potential impacts to ruffed grouse.
    - **Strategy**: Analyze timber harvest data across county, state, federal, and Managed Forest Law lands to assess trends and potential impacts to ruffed grouse. Results may influence the implementation of habitat management, as well as the development of Focal Areas, partnerships, proposed research, and outreach efforts.
- **Objective**: Provide technical guidance on ruffed grouse habitat management to resource professionals and private landowners.
    - **Strategy**: Consolidate and update existing guidance documents that provide best management practices and site-level considerations for meeting ruffed grouse life history requirements and make these resources available to the public and land managers.
    - **Strategy**: Create guidance for salvage techniques to benefit ruffed grouse following natural disturbances such as fire, blowdowns, or disease or forest pest outbreaks.

Population

- **Goal:** Where suitable habitat exists or can feasibly be restored, sustain a healthy and broadly-distributed ruffed grouse population in Wisconsin that provides hunting and other recreational opportunities.
    - **Objective:** Utilize population indices in conjunction with public input to annually monitor the ruffed grouse population and hunter success.
        - **Strategy:** The WDNR Ruffed Grouse Advisory Committee will review population indices and public input and will recommend management actions to the Wildlife Leadership Team as needed.
    - **Objective**: Monitor unusual morbidity or mortality events and diagnose the probable cause when feasible.
        - **Strategy**: Utilizing the processes outlined in the "Monitoring the Health of Ruffed Grouse in Wisconsin" section of this plan (page 33), the department will work with partners and members of the public to monitor population indices and public reports for unusual morbidity or mortality events and respond when appropriate.
        - **Strategy**: Increase public awareness about disease and environmental stressors that can lead to increased mortality in ruffed grouse, the annual disease monitoring that is conducted by the State of Wisconsin, and how the public can contribute to these disease monitoring efforts through the development of web and social media content and other communications.

Partnerships

- **Goal**: Develop and maintain productive partnerships to promote ruffed grouse and early-successional forest habitat.
    - **Objective:** Maintain current partnerships and create new partnerships, pending available funding, that help promote early-successional forest habitat, increase coordination between land management agencies and stakeholders, and disseminate information on active forest management for ruffed grouse and other wildlife to the public.
        - **Strategy**: In partnership with Natural Resource Conservation Service and the Ruffed Grouse Society, continue to support forest wildlife specialist positions in the Northern Forest Priority Region to promote active forest management on private lands. Track demand for technical assistance and accomplishments of forest wildlife specialists and determine if there is a need and opportunity for expanding the program, including to other Priority Regions.
        - **Strategy**: Maintain a liaison within the Bureau of Wildlife Management to work with the Natural Resource Conservation Service on Farm Bill conservation programs, policy, and partnerships relating to forest management practices on private lands.

        - **Strategy**: Continue department involvement in the Wisconsin Young Forest Partnership and look for opportunities to expand the program or department involvement.
        - **Strategy**: Engage the U.S. Forest Service and the Wisconsin County Forests Association on new partnership opportunities, including the creation of partner positions, to advance shared missions and goals relating to early-successional forest habitat, pending available funding.
        - **Strategy**: Designate a WDNR Wildlife Management representative to work collaboratively with partners and WDNR Forestry staff on private lands forest management.

Research and Monitoring

- **Goal:** Annually monitor the state's ruffed grouse population, target research to address priority management and population issues, and explore opportunities to collaborate on grouse research and monitoring efforts.
    - **Objective**: Survey ruffed grouse populations annually to provide population and recruitment indices.
        - **Strategy**: Maintain drumming, brood, and hunter harvest surveys and explore opportunities to improve effectiveness and/or efficiency of surveys.
        - **Strategy**: Evaluate the utility of current drumming surveys in southeastern counties that consistently have few or no grouse detections (Brown, Calumet, Columbia, Dane, Dodge, Fond du Lac, Green, Green Lake, Jefferson, Kenosha, Lafayette, Manitowoc, Ozaukee, Rock, Sheboygan, Walworth, Waukesha, Washington, and Winnebago). Pilot the use of alternative monitoring methods such as trail cameras or acoustic detection as a more efficient survey method in areas where grouse may occur in low densities (e.g., Kettle Moraine).
    - **Objectives:** Continue to assess if mosquito-borne diseases are impacting the ruffed grouse population.
        - **Strategy:** Continue to collect sick and dead bird observations and submit carcasses for necropsy to gather baseline information on sources of mortality for ruffed grouse in Wisconsin, including testing for West Nile virus and Eastern Equine Encephalitis virus.
        - **Strategy**: Continue to study regional exposure of ruffed grouse to West Nile virus in collaboration with Minnesota and Michigan Departments of Natural Resources, Ruffed Grouse Society, and the Wisconsin Conservation Congress by utilizing hunter-provided samples. Use results of the regional exposure study to evaluate the need for future monitoring or research of mosquito-borne diseases.
    - **Objective**: Investigate new citizen science opportunities.

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        - **Strategy**: Explore new citizen science opportunities to involve the public in collecting ruffed grouse population and harvest data, and whether these citizen science opportunities could extend to other species through the development of a comprehensive data collection tool, such as a mobile application.
    - **Objective:** Conduct research as needed to address specific questions related to ruffed grouse populations and management.
        - **Strategy:** Conduct a sensitivity analysis for ruffed grouse to prioritize future research needs by identifying which vital rates most influence population growth rates. The WDNR Ruffed Grouse Advisory Committee will review results of the sensitivity analysis and identify future research needs. Future research projects will be carried out by WDNR or in collaboration with an external partner (e.g., university), pending available funding.
        - **Strategy:** Using available drumming survey and land cover data, develop a species distribution model for ruffed grouse to better predict their distribution across the state and within Priority Regions. The model will also allow the Ruffed Grouse Advisory Committee and habitat managers to assess habitat quantity and quality and evaluate potential impact of management actions.
        - **Strategy:** Investigate the susceptibility of ruffed grouse to the projected impacts of climate change, including variability in winter conditions and vulnerability of aspen to increasing temperatures.
        - **Strategy:** Utilize available metrics such as snow depth to assess how winter conditions may influence the ruffed grouse population in a given year.
    - **Objective:** Quantify the economic impact of ruffed grouse and ruffed grouse hunting.
        - **Strategy:** Working with social scientists and economists, conduct an in-depth analysis to determine the economic impact of ruffed grouse in Wisconsin.
    - **Objective:** Explore new opportunities for collaboration amongst ruffed grouse biologists throughout North America.
        - **Strategy**: With partner support, establish a Ruffed Grouse Technical Committee comprised of grouse biologists from throughout North America. Host a national ruffed grouse symposium in Wisconsin to discuss current research, conservation strategies, and research needs.

Harvest Management

- **Goal**: Update ruffed grouse hunting regulations based on current species distribution and input gathered through the ruffed grouse hunter survey.

- **Objective**: Update ruffed grouse management zones to better reflect the population's current distribution and the availability of suitable habitat (Figures 20 and 21).
- **Objective**: Revise the ruffed grouse season dates from the Saturday nearest September 15 through January 31 to the Saturday nearest September 15 through the Sunday nearest January 6. Closing the season on the Sunday nearest January 6 creates consistency with other hunting seasons, such as pheasant and fall turkey, and more closely mirrors neighboring states' ruffed grouse season frameworks. Based on 2019 ruffed grouse hunter survey data, 67% of ruffed grouse hunters support closing the season on the Sunday nearest January 6.

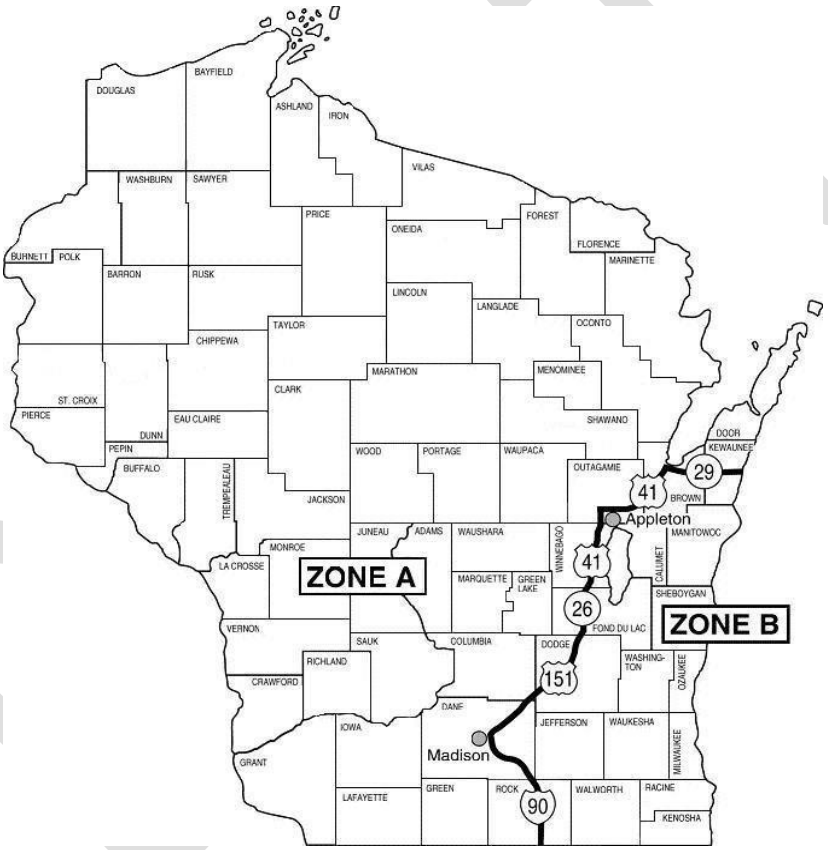

Figure 20. Ruffed grouse management zones, 2019.

Figure 21. Proposed ruffed grouse management zones.

Hunter Experience

- **Goal:** Optimize the ruffed grouse hunter experience.
  - **Objective**: Regularly assess ruffed grouse hunter opportunity and satisfaction.
    - **Strategy**: Explore potential methods to better target ruffed grouse hunters with survey efforts to gather feedback on grouse hunting and management in Wisconsin.
    - **Strategy**: Create a ruffed grouse hunter survey to collect and assess trends in hunter opportunity and satisfaction to be conducted as needed for management decisions.
  - **Objective**: Consolidate online tools available to public land ruffed grouse hunters.
    - **Strategy**: Create a single online mapping application that identifies areas suitable for grouse hunting across county forests, state lands, and national

forest and utilize the tool to promote Wisconsin as a ruffed grouse hunting destination for hunters from throughout the United States.

Outreach and Education

- **Goal:** Promote ruffed grouse and their habitat to diverse audiences.
    - **Objective:** Work with WDNR Law Enforcement on ruffed grouse hunter recruitment, retention, and reactivation issues.
        - **Strategy:** Identify limitations to grouse hunters and determine if or how the department could help overcome those hurdles.
        - **Strategy:** Determine if there is opportunity to expand Learn to Hunt Ruffed Grouse events.
    - **Objective:** Target non-consumptive users in outreach and communication efforts.
        - **Strategy:** Promote ruffed grouse and the value of early-successional forest habitat to a broader audience through online and social media tools, including exploring a nest or drumming log webcam and targeting communications towards non-consumptive users as well as hunters.
        - **Strategy:** Provide resources for viewing ruffed grouse and other early-successional forest habitat species to birdwatchers and wildlife photographers.
    - **Objective:** Develop classroom tools for teachers related to ruffed grouse.
        - **Strategy:** Work with WDNR wildlife educators and partners to develop a ruffed grouse lesson for youth, and work with schools to incorporate the lesson in science curricula.

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