RUFFED GROUSE

CONSERVATION PLAN

September 2006

Association of Fish & Wildlife Agencies

Resident Game Bird Working Group

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INTRODUCTION

The Ruffed Grouse Conservation Plan (Plan) has been developed under the auspices of the Resident Game Bird Working Group of the Association of Fish & Wildlife Agencies. The development of this Plan is part of a continuing effort to establish species-specific or species-group-specific conservation strategies to guide resource planning and on-the-ground habitat management initiatives.

This Plan utilizes the North American Bird Conservation Initiative Bird Conservation Regions (BCR) as the geographic assessment unit to ensure consistency with other planning efforts that focus on avian species. BCR boundaries may be viewed at http://www.nabci-us.org/bcrs.html. Assessments are provided for 15 BCRs. Ruffed grouse exist in small numbers in isolated pockets of BCRs 9 and 17 but BCR-wide assessments are not provided for these BCRs.

Plan Objectives

- Provide a comparison of ruffed grouse habitat conditions and populations between the base year (1980) and 2005.

- Identify the habitat availability and management objectives required to sustain populations at, or restore them to the 1980 levels.

Farm abandonment throughout much of the eastern United States in the early- to mid-20th Century may have allowed ruffed grouse populations to reach densities higher than historical norms during this period. Therefore, 1980 was selected as the base year as it likely represents a point in time when these abandoned lands had moved beyond the early-successional stage.

The target year for returning ruffed grouse population densities to 1980 levels is 2025. It will require 10-20 years to implement the required even-aged management treatments and for the resulting habitats to develop into quality ruffed grouse habitat, although this will vary somewhat between BCRs due to varying vegetation growth rates.

Habitat conditions and population densities were based on available data or the expertise of resource professionals knowledgeable of regional conditions and populations. In some BCRs, the lack of forest inventory data for one or more time periods or the lack of published data on population density by forest type compromised the precision of assessments.

SUMMARY

The ruffed grouse is North America's most widely distributed upland game bird. Ruffed grouse are found throughout most of Canada, much of the eastern United States and portions of the Rocky Mountains in the West.

Ruffed grouse populations exhibit a 10-year cycle throughout the northern portion of the bird's range. Populations south of the northern tier of states in the United States exist at relatively low population densities and do not consistently exhibit detectable 10-year population cycles. Population trend data are insufficient throughout much of the West to document the presence or absence of a cycle.

The ruffed grouse is the most popular resident game bird throughout much of eastern North America. Approximately 1,000,000 hunters harvest approximately 2.2 - 2.8 million ruffed grouse throughout North America during a typical year. Available data suggest that ruffed grouse hunting results in annual expenditures exceeding $500 million.

Ruffed grouse are abundant only where young forest habitats (5-15 years old in the East; 10-30 years old in the West) are common. Ruffed grouse can be found in many different forest types in North America, although deciduous or mixed forest types are preferred. Quaking and bigtooth aspen forests can support ruffed grouse population densities that greatly exceed those typically attained in other forest communities.

Historically, young forest habitats were sustained primarily by fire and other disturbance events throughout the ruffed grouse range. Today, in most regions, commercial timber harvests and other proactive habitat management practices must be implemented at regular intervals (approximately every 10 - 15 years) to ensure a continuous supply of quality ruffed grouse habitat on the landscape.

Even-age silvicultural systems (clearcut, seed tree, shelterwood) are the most appropriate methods to create ruffed grouse habitat. These methods remove sufficient canopy from the parent stand to result in enough understory development to provide protective cover for ruffed grouse.

Forest inventory data were used to document species composition by forest size-class for each BCR for 1980 and 2005. Because comparable data from two consecutive inventories are not universally available, trend estimates are not possible for all BCRs. Ruffed grouse population and breeding male density estimates were developed using these forest inventory data. Regional trends vary, but population densities have declined in most eastern regions and have increased in those western regions where estimates are available (Table 1).

Table 1. Historical and current estimates of ruffed grouse breeding population density by Bird Conservation Region.

Bird Conservation Region	1980 Ruffed Grouse Density[1]	2005 Ruffed Grouse Density	% Change
4 – Boreal Forest	na[2]	na	
5 – Northern Pacific Rainforest	0.19	0.28	47
6 – Boreal Taiga Plains	na	14.1	
8 – Boreal Softwood Shield Forest	na	10.3	
10 – Northern Rockies	0.06	0.11	83
12 – Boreal Hardwood Transition	12.8	12.8	0
13 – Lower Great Lakes/ St. Lawrence Plain	9.5	9.1	- 4
14 – Atlantic Northern Forest	9.1	9.8	9
16 – Southern Rockies Colorado Plateau	0.5	0.8	60
22 – Eastern Tallgrass Prairie	4.3	3.2	- 26
23 – Prairie Hardwood Transition	10.9	9.6	- 12
24 – Central Hardwood Forest	1.9	1.7	- 10
28 – Appalachian Mountains	5.3	5.0	- 6
29 – Piedmont	1.9	1.9	0
30 – New England/Mid-Atlantic Coast	6.6	6.3	- 5

[1]Drumming male grouse per square mile (2.6 square kilometers)
[2]Comprehensive data for entire BCR are unavailable

Ruffed grouse population densities are strongly dependent upon the proportion of small-diameter forest habitat on the landscape. The acreage of small-diameter forest required to support ruffed grouse population densities at 1980 levels and the annual acreage of even-age forest management treatments required to do so is presented for each BCR in Table 2.

Table 2. Acres of small-diameter forest and annual management required to sustain ruffed grouse populations at, or restore these populations to 1980 levels by Bird Conservation Region.

Bird Conservation Region	Small-Diameter[1] Forest Objective (acres)	Even-Age Management Annual Objective[2] (acres)
4 – Boreal Forest	na	na
5 – Northern Pacific Rainforest	839,700[3]	42,000[3]
6 – Boreal Taiga Plains	na[4]	na
8 – Boreal Softwood Shield Forest	na	na
10 – Northern Rockies	208,400[3]	10,400[3]
12 – Boreal Hardwood Transition	14,617,000	730,900
13 – Lower Great Lakes/ St. Lawrence Plain	3,543,300	177,200
14 – Atlantic Northern Forest	10,669,300	533,500
16 – Southern Rockies Colorado Plateau	717,000[3]	35,900[3]
22 – Eastern Tallgrass Prairie	354,800	17,700
23 – Prairie Hardwood Transition	2,653,600	132,700
24 – Central Hardwood Forest	523,200	26,200
28 – Appalachian Mountains	7,290,000	364,500
29 – Piedmont	650,600	32,500
30 – New England/Mid-Atlantic Coast	467,400	23,400

[1]Stands of trees $\leq$ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[2]Determined by dividing the Small-Diameter Forest Objective by 20. Assumes minimal small-diameter forest created by natural disturbance.
[3]Deciduous forest only.
[4]Not available due to incomplete forest inventory data.

The use of BCRs provides the ecological foundation for the ruffed grouse population goals and associated habitat management objectives. However, the implementation of the recommendations designed to accomplish these objectives is likely to be coordinated by resource management agencies responsible for specific jurisdictions. Therefore, small-diameter forest objectives and annual treatment targets are provided for each state and province (Table 3).

Table 3. Acres of current annual even-age management, and the small-diameter forest and annual management required to sustain ruffed grouse populations at, or restore populations to 1980 levels by political jurisdiction where historic and current population estimates can be determined.

Political Jurisdiction	Small-Diameter[1] Forest Objective (acres)	Even-Age Management Annual Objective[2] (acres)	Even-Age Management Current Annual Treatment (acres)
Arkansas	159,100	8,000	7,000
California	61,400[3]	3,100[3]	3,400[3]
Colorado	0	0	0
Connecticut	105,500	5,300	4,800
Georgia	515,400	25,800	23,400
Idaho	60,000[3]	3,000[3]	3,000[3]
Illinois	36,200	1,800	1,500
Indiana	287,200	14,400	12,400
Iowa	90,700	4,500	3,600
Kansas	20,900	1,000	800
Kentucky	26,500	26,300	23,900
Maine	4,728,900	236,400	253,700
Maryland	80,700	4,000	3,700
Massachusetts	153,100	7,700	7,200
Michigan	3,674,000	183,700	177,400
Minnesota	4,978,300	248,900	244,600
Missouri	263,700	13,200	10,500
Montana	192,000[3]	9,600[3]	9,600[3]
New Hampshire	406,500	20,300	21,800
New Jersey	247,600	12,400	11,500
New York	2,080,400	104,000	101,100
North Carolina	729,000	36,500	34,100
Ohio	1,013,400	50,700	46,300
Oregon	534,500[3]	26,700[3]	29,100[3]
Pennsylvania	1,992,100	99,600	91,100
Rhode Island	23,600	1,200	1,100
Tennessee	626,900	31,300	28,500
Utah	493,400[3]	24,700[3]	24,700[3]
Vermont	417,500	20,900	22,200
Virginia	962,400	48,100	45,200
Washington	256,800[3]	12,800[3]	13,900[3]
West Virginia	1,060,400	53,000	48,200
Wisconsin	3,544,500	177,200	165,900
Wyoming	60,800[3]	3,000[3]	3,000[3]
New Brunswick	2,613,500	130,700	130,700
Nova Scotia	759,200	38,000	38,000
Ontario[4]	3,321,400	166,100	163,200
Prince Edward Island	113,900	5,700	5,700
Quebec[4]	5,237,100	261,900	266,700

[1]Stands of trees $\leq$ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[2]Determined by dividing the Small-Diameter Forest Objective by 20. Assumes minimal small-diameter forest created by natural disturbance.
[3]Deciduous forest only.
[4]Does not include BCR 8.

ACKNOWLEDGEMENTS

A continent-wide effort of this magnitude would not have been possible without the assistance of many dedicated professionals. We appreciate the leadership of John Frampton and Breck Carmichael, Chairs, of the Resident Game Bird Working Group of the Association of Fish & Wildlife Agencies. We thank the following authors of the individual Bird Conservation Region assessments: Daniel R. Dessecker – Ruffed Grouse Society; Patrick K. Devers – Conservation Management Institute; Michael Donovan – MI Department of Natural Resources; Valerie R. Frawley – MI Department of Natural Resources; Benjamin W. Hunyadi – Ruffed Grouse Society; Dean L. Mitchell – UT Division of Fish and Wildlife; Gary W. Norman – VA Department of Game and Inland Fisheries; Thomas F. Paragi – AK Department of Fish and Game; K. Marc Puckett – VA Department of Game and Inland Fisheries; Douglas W. Schindler – University of Manitoba; Jeffery D. Sole – The Nature Conservancy; C. Alan Stewart – MI Department of Natural Resources; Frank R. Thompson, III – US Forest Service; Scot J. Williamson – Wildlife Management Institute.

Additional assistance was provided by the following:

Cedric Alexander – VT Department of Fish and Wildlife; Tom Allen – WV Department of Natural Resources; Steve Backs – IN Department of Natural Resources; Heloise Bastien – QUE Ministère des Ressources naturelles et de la Faune; Rick Baydack – University of Manitoba; Tom Blankenship – CA Department of Fish and Game; Joe Bohne – WY Game and Fish Department; Brad Carner – AR Game and Fish Commission; Randy Dibblee – PEI Department Fisheries, Aquaculture and Environment; Billy Dukes – SC Department of Natural Resources; Mark Ellingwood – NH Fish and Game Department; Murray Gillespie – Manitoba Conservation; Todd Gosselink – IA Department of Natural Resources; Steve Gordon – New Brunswick Natural Resources and Energy; Stephen Gray – Canadian Forest Service; David Gregory – GA Wildlife Resources Division; Mark Gudlin – TN Wildlife Resources Agency; Stephanie Harmon – US Fish and Wildlife Service; Jon Haufler – Ecosystem Management Research Institute; Mark Hillard – US Bureau of Land Management; Rick Horton – MN Department of Natural Resources; Mike Hubbard – MO Department of Conservation; Jim Kelley – US Fish and Wildlife Service; Robin Lefrancois – Quebec Ministry of Natural Resources; Elizabeth LaPointe – US Forest Service; Rod Maides – Canadian Forest Service; Rob Manes – Wildlife Management Institute; Steve Merchant – MN Department of Natural Resources; Mike Murphy – NY Department of Environmental Conservation; Mike O'Brien – Nova Scotia Department of Natural Resources; Bill Palmer – PA Game Commission; Carol Perry – US Forest Service; Bruce Pollard – Ontario Ministry of Natural Resources; Katja Power – Canadian Forest Service; Mike Reynolds – OH Division of Wildlife; Eric Rickerson – OR Department of Fish and Wildlife; Paul Rothbart – CT Department of Environmental Protection; John Schulz – ND Game and Fish Department; Dave Scott – OH Division of Wildlife; Paul Shelton – IL Department of Natural Resources; Brian Smith – KY Department of Fish and Wildlife Resources; Will Stafford – Saskatchewan Environment; Dave Swanson – OH Division of Wildlife; Otha Terry – US Forest Service; Len Ugarenko – Association of Fish and Wildlife Agencies; John Vissage – US Forest Service; Karen Waddell – US Forest Service; Keith Warnke – WI Department of Natural Resources; Larry Watkins – Ontario Ministry of Natural Resources; Norm Weiland – US Forest Service; Tim White – TN Wildlife Resources Agency; Bill Wichers – WY Game and Fish Department.

Financial support to offset costs associated with the development and delivery of the North American Ruffed Grouse Conservation Plan was provided by the National Fish and Wildlife Foundation, R.K. Mellon Family Foundation, Ruffed Grouse Society and the Wildlife Management Institute.

DISTRIBUTION AND STATUS OF THE RUFFED GROUSE

The ruffed grouse is North America’s most widely distributed upland game bird (Johnsgard 1973). Ruffed grouse are found throughout much of Canada and the eastern United States yet are common only where extensive tracts of forest dominate the landscape (Figure 1.). Ruffed grouse populations are somewhat disjointed in the conifer-dominated forests west of the Great Plains and are typically found only where deciduous or mixed forests are locally abundant.

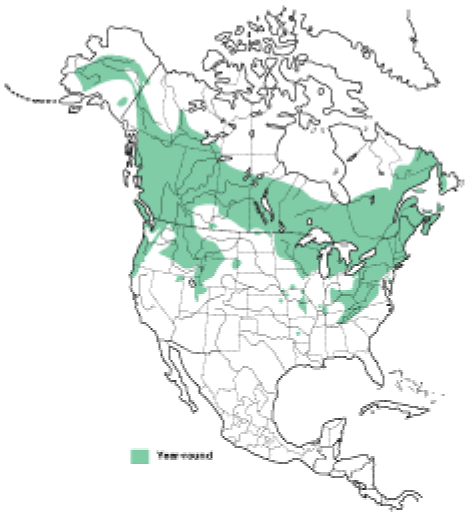


Figure 1. Range of the ruffed grouse.

The southern extreme of the ruffed grouse range coincides with the southern edge of the Appalachian Mountains in northeast Georgia. Ruffed grouse are generally rare below 1,500 feet (460 m) elevation in the southeast portion of their range, although habitats that appear suitable exist in the Piedmont from Louisiana east to Georgia and north through Virginia. The northern extreme of the ruffed grouse range coincides with the northern edge of aspen-birch forest types. Indeed, the range of the ruffed grouse and that of quaking aspen are remarkably similar and the relationship between these two species has been well documented in eastern (Gullion 1984, Kubisiak 1985) and western North America (Stauffer and Peterson 1985).

State fish and wildlife agency Wildlife Action Plans list ruffed grouse as a species of greatest conservation need in Arkansas, California, Connecticut, Delaware, Illinois, Iowa, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, South Carolina and Vermont. Other states list ruffed grouse as a species of special concern. The Delaware Wildlife Action Plan lists ruffed grouse as extirpated and several states have considered listing ruffed grouse as a state threatened or endangered species.

There is no range-wide population survey of ruffed grouse, but some states/provinces monitor populations or harvest rates. Male ruffed grouse drum in the spring to attract females. Drumming male surveys count all males heard in the early morning along 10- or 15-stop routes and can provide an index of local populations (Gullion 1966). Drumming male densities typically reach one to 2 birds/100 acres (40 ha) in the central hardwood forests of the Midwest and the central and southern Appalachians, as well as in northern hardwood forests in the northern tier of states (Thompson and Dessecker 1997). The aspen forests of the Great Lakes region and southern Canada generally support 4–8 drumming males/100 acres (40 ha) (Kubisiak 1985, Manitoba DNR 1994).

Ruffed grouse populations exhibit a 10-year cycle throughout the northern portion of the bird's range. Populations south of the northern tier of states in the United States do not consistently exhibit detectable 10-year cycles. Population trend data are insufficient throughout much of the west to document the presence or absence of a cycle. Existing data show that the 10-year ruffed grouse cycle moves from west to east across North America. Data from Alaska (Paragi, unpubl. data) document that local ruffed grouse populations attain cyclic highs and lows 4-5 years earlier than populations in the East.

THE RUFFED GROUSE AS A GAME BIRD

The ruffed grouse is the most popular resident game bird throughout much of eastern North America. State- or province-level hunter effort and harvest data are collected by only 19 of the 47 jurisdictions where the ruffed grouse is a game species. In several western jurisdictions, ruffed grouse and blue grouse are treated in combination as "forest grouse" for the purpose of season and bag limit regulations. Using available data from state and provincial wildlife management agencies, it is estimated that approximately 1,000,000 hunters pursue ruffed grouse during a typical year.

Where ruffed grouse populations are cyclic, hunter numbers commonly rise and fall with local populations. During the most recent cyclic high in the late 1990s, ruffed grouse hunters numbered approximately 120,000 in each of the states of Michigan, Minnesota, and Wisconsin (Berg 2000, Dhuey 2000, Whitcomb et al. 2000). These hunters spent approximately 1,000,000 days afield in each state. Total annual ruffed grouse harvest likely approaches 1,000,000 birds in each of these states during the peak of the 10-year cycle; approximately 300,000 ruffed grouse are harvested annually during cyclic lows. Using available data from state and provincial wildlife management agencies, it is estimated that approximately 2.2 - 2.8 million ruffed grouse are harvested throughout North America during a typical year.

Indices of ruffed grouse hunter effort and harvest suggest that both are declining throughout the United States and Canada. These data are consistent with survey results documenting a 50% decline in the number of small game hunters in the United States between 1985 and 2001 (US DOI et al. 2002).

Northern and western seasons typically begin in September or early October and end in late December or early January. Seasons in southern states begin and end later than in the north. Data suggest regional variation in the within-season temporal distribution of ruffed grouse hunter effort and harvest. Much of the effort and harvest in the north occurs during the first 4-6 weeks of the season, whereas effort and harvest is commonly high during the later portions of southern seasons. This variation is likely attributable to regional differences in fall/winter weather. Falling mean temperatures as seasons progress render hunting conditions for many hunters less, and more comfortable in the north, and south, respectively. In addition, conflicts with white-tailed deer seasons can also affect ruffed grouse hunter effort and harvest.

Small game hunters spend approximately $500-1,400 annually in Michigan, Minnesota and Wisconsin (US DOI et al. 2002). Because these are "destination" states for ruffed grouse hunters from other states, this figure may overestimate economic impact realized from ruffed grouse hunting across North America. However, if expenditures by ruffed grouse hunters are typical of small game hunters in general, ruffed grouse hunting may result in annual expenditures of over $500 million.

RUFFED GROUSE HABITAT AND FOOD REQUIREMENTS

Ruffed grouse can survive and maintain relatively low-density populations in a variety of forest landscapes. However, ruffed grouse are abundant only where young forest habitats (5-15 years old) are common. The high stem densities characteristic of recently disturbed forest habitats or habitats with abundant tall shrubs provide protection for grouse throughout the year, but are especially important as drumming and brood habitat (Brewer 1980, Gullion 1984, Kubisiak 1985, Dimmick et al. 1998, Stoll et al. 1999). Gullion (1984) suggests that aspen habitats supporting 3,000 – 8,000 stems per acre (1,215 – 3,240 per ha) afford protective cover throughout the year and he identifies 8,000 stems per acre (3,240 per ha) as optimum for brood habitat**.**

Historically, fire caused by Native Americans and lightning was the primary agent of forest disturbance, particularly on relatively xeric sites. Wind, ice, flooding, insects and disease are other agents of disturbance that can lead to the establishment of dense, young forest or shrub-dominated habitats.

Ruffed grouse can be found in many different forest types in North America, although deciduous or mixed forest types are preferred. However, quaking and bigtooth aspen forests can support ruffed grouse population densities that greatly exceed those typically attained in other forest communities (Thompson and Dessecker 1997). Regeneration stem densities in recently clearcut or burned aspen forests commonly reach levels that provide excellent protective cover for ruffed grouse.

Ruffed grouse in the mountains of the West also seem limited to deciduous or mixed forest types. Riparian forests with either a deciduous overstory or a significant deciduous understory are important habitats for grouse in the West (Landry 1982, Stauffer and Peterson 1985, Hewitt and Messmer 1996).

The same young forest and shrub-dominated habitats preferred by ruffed grouse are preferred by various other bird species that have been identified as "high priority" or "significant conservation concern" by other conservation assessments. For example, in the northeast United States, state Wildlife Action Plans collectively identify 58 species of Greatest Conservation Need that are dependent upon young forest and shrubland habitats similar to those preferred by ruffed grouse. Ten of these 58 species are state listed as endangered in one or more states, 4 species are state listed as threatened in one or more states and 17 species are state listed as a species of special concern in one or more states. These 58 species include 37 birds, 14 mammals and 7 reptiles.

In the West, riparian area deciduous forests provide important habitats for ruffed grouse and numerous other wildlife species as these forests may provide the only available deciduous habitats. Young, recently regnerated aspen forests in the West are preferred by the MacGillivray's warbler and the white-crowned sparrow, both identified as regionally important species within specific western BCRs by Partners in Flight (PIF).

Habitats used for nesting appear to be variable; nesting hens can be found in a wide variety of habitats, although commonly in forest habitats that are older and more open than those frequented during other times of the year. Relatively open habitats may be selected for nesting because they allow the nesting hen to visually identify potential predators at a distance, which aids the hen in drawing predators away from the nest as she feigns injury - a common tactic.

Ruffed grouse broods are seldom found far from dense cover. Quality brood habitat often includes small forest openings with a substantial shrub component. In the central and southern Appalachians, grouse broods selected areas with abundant herbaceous vegetation and low growing woody shrubs such as huckleberries (Scott 1998, Fettinger 2002, Jones 2005). These habitats can provide an important source of insects for developing chicks during their first 4-6 weeks of life (Hollifield and Dimmick 1995). Brood habitat is often relatively mesic, typically on north or east slopes in hilly terrain, or in riparian areas (Marshall 1946, Godfrey 1975, Kubisiak 1978, Stauffer 1983, Thompson et al. 1987, Whitaker 2003).

During winter as throughout much of the year, dense young forest habitats provide protection for ruffed grouse. In northern and western forests, mature stands of *Populus* are an important component of ruffed grouse winter habitat. Densely-needled conifers or other evergreen plants can be important to ruffed grouse in regions where snow depths are insufficient or snow quality inadequate to allow ruffed grouse to burrow into the snow for protection from predators and inclement weather. Thompson and Fritzell (1988) found that ruffed grouse in Missouri conserved energy by roosting in or under red cedar.

Ruffed grouse use a wide variety of foods throughout the year. Succulent herbaceous vegetation is consumed whenever available. Soft mast is an important source of fall forage. The flower and vegetative buds from a variety of tree and shrub species constitute the primary winter food source in most regions. The dormant flower bud from mature male aspen trees is an important source of food for grouse in winter and early spring throughout the species' range (Gullion and Svoboda 1972, Hewitt and Messmer 1996). Buds from black cottonwood are a preferred winter food in the Pacific Northwest (Brewer 1980).

In the central and southern Appalachians (Norman and Kirkpatrick 1984, Servello and Kirkpatrick 1987) and elsewhere outside of the primary range of *Populus*, winter food availability and quality may be a limiting factor for ruffed grouse populations. Fall hard mast crops (primarily acorns) may regulate ruffed grouse populations in the Appalachians (Long and Edwards 2004, Whitaker et al. 2006). Body fat of female ruffed grouse in spring was related to their intake of acorns (Long and Edwards 2004) and chick survival was positively correlated with hen body fat. Fall and winter home range sizes were inversely related to mast abundance (Whitaker 2003).

RUFFED GROUSE HABITAT MANAGEMENT

Early successional habitats are by nature ephemeral. On landscapes where it is impractical to allow the return of natural fires or introduce prescribed fires, commercial timber harvests and other proactive habitat management practices must be implemented at regular intervals (approximately every 10 years) to ensure a continuous supply of quality ruffed grouse habitat on the landscape (Dessecker and McAuley 2001). Forest types that reach biological or economic maturity more rapidly can be managed using shorter rotations, thereby increasing the amount of ruffed grouse habitat that is available on the landscape at any one time. Reductions in the proportion of a management unit where forest management is practiced can reduce ruffed grouse habitat potential.

Habitat Management Treatments

Even-age silvicultural systems (clearcut, seed tree, shelterwood, two-age) are the most appropriate methods to create ruffed grouse habitat. These methods remove sufficient canopy from the parent stand to result in enough understory development to provide protective cover for ruffed grouse. Group selection treatments can produce stem densities comparable to clearcut regeneration harvests (Weigel and Parker 1995), but patch sizes are generally too small to provide secure cover for ruffed grouse. However, group selection treatments can provide small pockets of adequate brood habitat and can be beneficial to grouse as movement "corridors" between larger patches of quality habitat. Selection methods do not remove sufficient basal area to allow the development of quality ruffed grouse habitat. However, selection treatments may be beneficial in riparian areas or other areas where deciduous understory development is desired yet even-age management is administratively precluded. Selection treatments can also improve ruffed grouse habitat in stands between areas managed using even-age systems.

Recommendations for increasing ruffed grouse in the Appalachian region differ between oak-hickory and maple-beech-birch forest type groups (Whitaker 2003, Devers 2005). Land management in oak-hickory forests should focus on creating interspersion of nest and brood habitat to increase chick survival and recruitment. Additionally, shelterwood, clearcut with reserves and group selection treatments are recommended to improve the amount of hard mast production and the interspersion of adult escape cover and food resources (Whitaker 2003). In mixed-mesic forest types, traditional clearcut treatments are recommended (Whitaker 2003).

Recently, prescribed fire and mechanical shearing or felling have been used to regenerate mature aspen stands in the western United States and Alaska. These treatments can successfully regenerate aspen where no commercial market exists for the wood fiber. However, these treatments are labor intensive and, therefore, costly. Prescribed fire is also used to a limited extent in the East to establish early-successional habitats. Preliminary assessments suggest that fires in stands that have been thinned are more effective than fires in fully-stocked stands.

Conifer encroachment into deciduous forest communities in the West is one result of the interruption of natural fire regimes and can seriously degrade these important ruffed grouse habitats. This encroachment can be halted through the selective removal of the encroaching conifers or the felling of all conifers when the deciduous stands are regenerated.

Residual Trees and Ruffed Grouse Habitat Quality

In general, the greatest amount of overstory removal will yield the greatest degree of understory development. Retention of a limited number of residual trees may not affect regeneration stem densities in developing stands. Smith et al. (1989) found similar stem densities 5 years post treatment in clearcut central hardwood stands and stands with < 25 sq. ft./acre (2.3 sq. m/ha) of residual basal area. In forest types that are moderately shade intolerant, residual basal areas > 25 sq. ft./acre (2.3 sq. m/ha) can reduce regeneration stem densities and should not be maintained within harvest units designed to provide quality habitat for ruffed grouse (Thompson and Dessecker 1997).

Aspen is extremely shade intolerant. Perala (1977) showed that as little as 10 - 15 sq.ft./acre (1 – 1.5 sq. m/ha) of residual basal area can reduce aspen regeneration growth by 40%. Residual basal areas of only 25 sq.ft./acre (2.3 sq. m/ha) can reduce aspen regeneration stem densities after the first growing season by 29% (Stone et al. 2001). Ruffed grouse habitat quality will be reduced if these reduced stem densities remain evident through the first 10 - 15 years of the life of a stand.

Where shelterwood treatments are used to regenerate oak forest types, the amount of residual basal area required to aid in the establishment of adequate oak regeneration is dependent on site quality. On relatively xeric, poor quality sites where oak are dominant in the overstory and advance oak regeneration is typically abundant, 20 – 40 sq.ft./acre (2 – 4 sq. m/ha) will provide an adequate seed source to aid in stand development and still provide relatively dense protective cover for ruffed grouse (Harper et al. 2006). On relatively mesic, good quality sites, additional residual basal area may be required to reduce competition to regenerating oaks from shade intolerant tree species.

A two-age treatment is a variant of the traditional shelterwood harvest. Although the basal area retained is similar to some shelterwood treatments [approximately 25 sq.ft./acre (2.3 sq. m/ha)], the residual basal area is comprised primarily of dominant canopy trees rather than trees from various crown classifications as in a shelterwood treatment.

Shelterwood and two-age treatments can provide both food and cover for ruffed grouse. Research in the central and southern Appalachians suggest that retention of the residual basal area for at least 30-40 years is the most beneficial to ruffed grouse (Whitaker 2003, Harper et al. 2006).

The spatial distribution of residual trees within a harvest unit also can significantly affect regeneration stem densities. Residual basal area maintained in discrete patches will minimize shading of regenerating hardwoods and, therefore, effects of this shade on regeneration stem densities.

Habitat Patch Size

Research in aspen forests managed on a 40-year rotation shows that small harvest units [2.5 – 5 acres (1 – 2 ha)] are more beneficial to ruffed grouse than larger harvest units (Gullion 1984). The small harvest units are designed to provide ruffed grouse with patches of protective cover (6- to 15-year-old stands) interspersed with mature stands that provide male flower buds for grouse during winter. A small-block harvest pattern is also recommended for aspen forest communities in the Central Rocky Mountains (Hewitt and Messmer 1996). However, because aspen forests in the West grow more slowly and live longer than those in the East, 80-year rotations may be more appropriate in the West.

In the central and southern Appalachians, treatments that retain < 25 sq.ft./acre (2.3 sq. m/ha) of residual basal area are recommended for ruffed grouse (Harper et al. 2006). Moderate rotation lengths of 80 years are recommended because they provide a greater proportion (25%) of young (1 – 20 years) forest than 100+ year rotations (20%). Moderate rotation lengths still allow up to 50% of the landscape to support trees of mast bearing age (> 40 years old).

In forest types in the East that are longer lived than aspen and are managed using rotations longer than 40 - 60 years, ruffed grouse can benefit from habitat interspersion but they may not benefit from small-block habitat patches to the same degree as in aspen forests. Scattered small patches of young forest on landscapes dominated by mature forest can provide islands of habitat for ruffed grouse, but these isolated stands likely provide only limited security from predators. However, ruffed grouse densities increased after the establishment of small [2.5-acre (1 ha)] patches of young mixed oak forests in central Pennsylvania where the young forest patches comprised 50% of the study area (Storm et al. 2003).

DATA ANALYSIS

Assessment of Past and Current Ruffed Grouse Habitat Conditions

Forest inventory data were used to document species composition by forest size-class for each BCR. Inconsistencies between forest inventory data collection and reporting protocols between administrative jurisdictions and across time (between successive inventories) complicated efforts to generate comparable assessments. Where inconsistencies occurred, every effort was made to develop assessments that were comparable over time to facilitate the identification of ruffed grouse habitat trends.

Forest Inventory and Analysis (FIA) data for the United States are, in most instances, available at the county level. Although BCR boundaries do not precisely coincide with county boundaries, the use of county-level data provided useful estimates of forest species composition and physical structure within each BCR.

There is substantial variation between forest inventory data available for some states and for Canadian provinces, especially with regard to the species or species group classifications used in different inventories. The Canadian Forest Inventory (CFI), which was initiated in 1986, is useful in estimating forest conditions for BCRs that encompass portions of multiple provinces. However, because data from two consecutive inventories are not universally available using either provincial or CFI inventories, nor FIA data for some states, trend estimates are not possible for all BCRs.

The timing of forest inventory data collection varies widely between jurisdictions in both the United States and Canada. “Current” conditions are defined as those evident using the most recent inventory data, typically mid 1990s to 2002-05. The year 1980 was selected as the target for “past” conditions. However, due to the temporal variation in inventory data collection between jurisdictions, “past” conditions are defined as those evident using the inventory data immediately prior to the most current inventory. These “past” inventory data typically reflect conditions existing during the late 1970s to mid 1980s.

Ruffed grouse do not exist throughout the entirety of some BCRs, particularly BCRs at the periphery of the species’ range. Portions of BCRs where ruffed grouse are not present were not included in the assessment of current or past habitat conditions. Input from state or provincial resource agency personnel was used to delineate the area within each BCR that could reasonably be considered ruffed grouse range.

Ruffed grouse habitat data are presented by size class. Where forest inventory data are reported by age-class, the 1-20 year old age class is considered analogous to the seedling-sapling size (small-diameter) class [trees < 5 inches (12.5 cm) DBH]. The area of small-diameter forest required to support ruffed grouse population densities at the 1980 level was divided by 20 to provide the annual even-age forest management objective for each BCR.

Estimate of Ruffed Grouse Populations

Ruffed grouse drumming male populations are estimated for BCRs for two time periods – 1980 and 2005. These estimates were developed using spring drumming male density data by forest type from published research. Drumming male density varies across space and time. Significant variation can occur between forest types and, where ruffed grouse populations are cyclic, between years. The drumming male density estimates used are representative of "typical" or mid-cycle periods (neither minimum nor maximum density). Breeding Bird Survey data for ruffed grouse were not used because these surveys are conducted well after the peak of ruffed grouse drumming activity.

Estimated drumming male densities by forest type may vary by BCR. BCR authors and other cooperators were encouraged to review drumming male density estimates from published literature and modify these estimates where appropriate based on regional surveys and professional expertise.

For the BCRs in the Great Lakes region, the northeastern United States and eastern Canada, the following drumming male density estimates were used (Bump et al. 1947, Kubisiak and McCaffery 1985, Sousa 1978):

Pine	0.5 drumming males / 100 acres (40 ha)
Spruce - fir	1.0
Oak - pine	0.8
Oak	0.9
Elm - ash - cottonwood	1.1
Maple - beech - birch	0.7[1]
Aspen - birch	3.5

[1] *A drumming male density of 1.0 was used for maple – beech – birch forests in the northeastern United States and eastern Canada due to the greater beech component within these forests than similarly classified forests in the Great Lakes region.*

Quantitative estimates of drumming male densities by forest type are largely unavailable for the western United States and Canada. For BCRs in the western United States and Canada, drumming male density estimates were based on estimates from similar forest types in the east and modified using input from resource professionals with expertise in regional ruffed grouse populations.

For the BCRs in the western United States and Canada, the following drumming male density estimates were used:

Pine	0.0 drumming males / 100 acres (40 ha)
Spruce - fir	0.0
Oak	0.2
Aspen - birch – cottonwood - alder	0.5
Other deciduous	0.1

Forest type classification systems used in Canada differ among provinces and from those used in the United States. Provincial data is available for some jurisdictions only as "hardwood, softwood, and mixed forest." Where possible, area by forest type group is estimated using forest inventory summaries and other sources of information. In some instances, drumming male densities are established for available forest classifications (e.g. drumming male density for "mixed forest" may be the average of density estimates for the predominant softwood and hardwood forest types.)

For the BCRs in eastern Canada where data are available only by forest type group, the following drumming male densities were used:

Softwood:	1.0 drumming males / 100 acres (40 ha)
Mixed forest:	1.5
Hardwood:	2.0

Although ruffed grouse population densities, as represented by drumming male densities, vary be forest type, ruffed grouse populations commonly exhibit a strong preference for the vegetative structure characteristic of seedling-sapling stands (now listed as "small-diameter stands" in Forest Inventory Analysis reports) regardless of vegetative species composition. Drumming male densities in small-diameter stands are often at least twice as high as those found in older forest stands (Gullion 1971, McCaffery et al. 1996, Kubisiak and Rolley 1998). Therefore, to account for the importance of habitat structure as ruffed grouse population estimates were computed, ruffed grouse drumming male density estimates were doubled for that proportion of each forest type in the small-diameter size class. Forest area in the 1-20 year age-class is used as a surrogate for the small-diameter size class when size-class data are unavailable.

The estimated spring drumming male ruffed grouse population (Y) is derived from an index of past (1980) and current (2005) habitat potential and is estimated as:

$$Y = \text{Sum } F_{1\text{-}n} \, [m\,(Fo / 100) + 2m\,(Fy / 100)]^*$$

Where:

Y = Total Drumming Males
F = Forest type
m = Drumming Males / 100 acres (40 ha) for forest type
Fo = Acres of forest type ("old": large- and medium-diameter size class)
Fy = Acres of forest type ("young": small-diameter size class)

*BCR authors had the option to modify the weight applied to small-diameter size class forest if deemed appropriate.

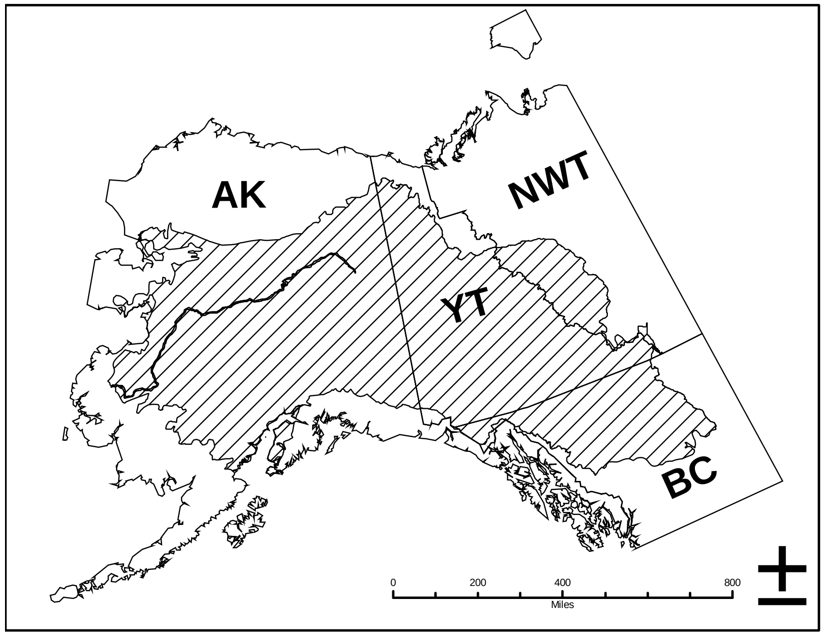
This index may overestimate drumming male population size and density at the periphery of the ruffed grouse range, particularly where forested tracts are highly fragmented.

BCR 4

Boreal Forest

Thomas F. Paragi

Alaska Department of Fish and Game



The Boreal Forest (BCR 4) is typically conifer dominated. This region is characterized by stand-replacement fires that maintain quaking aspen and paper birch as early-mid successional species on uplands, particularly those with a southern aspect. Floodplain disturbance along large rivers maintains willow and balsam poplar as components of white spruce stands. Black spruce and tamarack woodland occur on cold and poorly-drained sites over discontinuous permafrost, with scattered willows or broadleaf species interspersed where terrain provides vertical relief for warm, relatively well-drained sites.

Historic forest inventory data are available only for portions of the jurisdictions within the Boreal Forest. Currently, efforts are underway to expand the spatial coverage of forest inventory data.

Forest management is largely limited to isolated areas near population centers. The primary agent of forest disturbance is wildfire. Extensive wildfires can occur in the Boreal Forest and large-scale fires have increased within the past decade in part due to increased softwood mortality due to insect infestations and warmer and drier weather conditions in recent years. These fires can create vast areas of young coniferous, deciduous, or mixed forest and enhance habitat conditions for ruffed grouse.

Drumming male surveys suggest that aspen forests in the interior of Alaska support approximately 0.9 drumming males per 100 acres (40 ha) at the midpoint of the cycle (range 0.3 – 1.7). Harvest regulations commonly combine ruffed and spruce grouse into a single category such as “forest” grouse. Therefore, species-specific harvest information is unavailable for jurisdictions within the Boreal Forest.

Ruffed grouse were transplanted from their native range in the interior of Alaska to the Matanuska-Susitna River Valley in south-central Alaska in the late 1980s. This transplant effort is considered a success as ruffed grouse have consistently been encountered and recovered at numerous locations up to 75 miles from the original release site (Steen, pers. comm.).

Given recent increases in the occurrence and extent of wildfires, ruffed grouse populations may, likewise, be increasing. However, the lack of forest inventory or ruffed grouse population data for the BCR 4 precludes any definitive assessment.

Table 1. Acres of forest by stand size class in 1990 by jurisdiction within those portions of the Boreal Forest (BCR 4) that were inventoried (inventory incomplete). Ruffed grouse drumming male population was not estimated due to inadequate forest inventory and drumming male density data.

Jurisdiction	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
AK[3]	**2,936,300**	1,210,000	1,736,300	59.1
YK TERR	**3,833,500**	3,828,600	4,900	0.1
NW TERR	**No data**			
Total	**6,779,800**	**5,038,600**	**1,741,200**	**25.7**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Tanana Valley (Eastern Interior)

Table 2. Acres of forest by forest type group and stand size class in 1990 in the Boreal Forest (BCR 4).

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**3,721,500**	2,830,100	891,400	24.0
Deciduous-Spruce	**1,321,900**	640,900	681,000	51.6
Pine	**935,000**	930,700	4,300	0.5
Aspen-Birch	**208,800**	208,800	na[3]	na
Uncl. Deciduous	**593,500**	429,000	164,500	27.7
Total	**6,779,800**	**5,038,600**	**1,741,200**	**25.7**

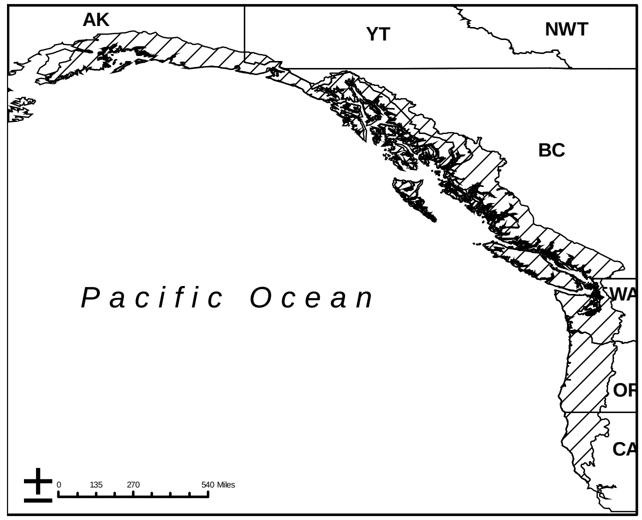
[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Comprehensive data are unavailable.

BCR 5

Northern Pacific Forest

Scot J. Williamson

Wildlife Management Institute



The Northern Pacific Forest (BCR 5) is characterized by heavy precipitation and mild temperatures typical of a maritime climate. Much of the regions terrain is steeply sloped from sea level up to 3,300 feet (1,000 m) in elevation, but large expanses of relatively level terrain are evident along historic or existing riparian areas.

Sitka spruce and coastal redwood forests dominate the coast, while a mosaic of western red cedar, western hemlock, and Douglas-fir blanket inland areas. Douglas-fir plantations are prevalent on lands managed for forest products. Red alder and other deciduous species are found along river drainages. Spruce-fir, pine-hemlock and Douglas fir together account for >60% of the BCR acreage.

Between 1980 and 2005, in the portions of BCR 5 with comparative data, acreage of timberland remained largely unchanged while acreage of small-diameter forest decreased by 4% (Tables 1 and 3). Over 80% of the small-diameter forest occurs in spruce/fir or pine types (Table 4). Under the assumption that small-diameter forests within deciduous forest types represent quality ruffed grouse habitat, less than 3% of the BCR can be classified as quality ruffed grouse habitat (Table 4). However, changes in forest composition suggest an improvement in ruffed grouse habitat availability. Deciduous forest types are becoming more abundant in BCR 5, particularly the aspen-red alder-cottonwood forest type group. The flower buds from black cottonwood can be an important source of winter food for ruffed grouse in BCR 5.

Large scale natural disturbances are rare within BCR 5. Bark beetle outbreaks are a locally important disturbance factor.

Ruffed grouse distribution within BCR 5 is not uniform. Ruffed grouse are absent from Alaskan portions of the BCR except for the Ketchikan region of southeastern Alaska (Rusch et al. 2000) and transplant sites on the Kenai Peninsula (Steen undated final report, Alaska Department of Fish and Game). Ruffed grouse are also absent from the Olympic Range in Washington (Rusch et al. 2000).

Comprehensive ruffed grouse population and harvest data are unavailable for most jurisdictions within BCR 5. Ruffed grouse hunter numbers and harvest fluctuate consistent with the population cycle in this region. Since 1990 in British Columbia, ruffed grouse hunter numbers have declined by 36%, but harvest appears relatively stable. Since 1980 in Oregon, ruffed grouse hunter numbers have declined by 34%, but harvest appears to be stable or slightly increasing.

Within jurisdictions where forest data are available for 1980 and 2005, the estimated ruffed grouse drumming male population density has increased 100% during this interval (Tables 1 and 3). All jurisdictions in this region have experienced an increase in population density but densities are uniformly low (Table 3).

Within jurisdictions in BCR 5 where forest data are available for both 1980 and 2005, the ruffed grouse drumming male population density could be sustained at the 1980 level even with a reduction in small-diameter deciduous forest of approximately 12%, to 994,900 acres (402,800 ha).

Table 1. Acres of forest by stand size class and estimated drumming male grouse population in 1980 by jurisdiction in the Northern Pacific Rainforest (BCR 5).

Jurisdiction	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
AK						
BC						
CA	**7,530,000**	6,865,700	664,300	8.8	2,600	0.22
OR	**14,141,300**	11,589,900	2,551,400	18.0	4,700	0.21
WA	**7,047,200**	5,159,300	1,887,900	26.8	1,400	0.13
Total	**28,718,500**	**23,614,900**	**5,103,600**	**17.8**	**8,700**	**0.19**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 2. Acres of forest by forest type group and stand size class in 1980 in the Northern Pacific Rainforest (BCR 5).

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**17,804,900**	14,156,400	3,648,500	20.0
Pine-Hemlock	**4,647,800**	4,317,600	330,200	7.1
Oak	**934,100**	697,400	236,700	25.3
Aspen-Birch	**26,100**	12,800	13,300	50.9
Uncl. Deciduous	**5,305,600**	4,430,700	874,900	16.5
Total	**28,718,500**	**23,614,900**	**5,103,600**	**17.8**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

Table 3. Acres of forest by stand size class and estimated drumming male grouse population in 2005 by jurisdiction in the Northern Pacific Rainforest (BCR 5). Acreages may differ from Table 4 due to varying inventory protocols.

Jurisdiction	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
AK	**958,800**	824,200	134,600	14.0	0	0
BC	**14,793,400**	13,955,700	837,700	5.7	1,700	0.07
CA	**8,113,000**	7,286,300	826,700	10.2	6,300	0.50
OR	**13,213,200**	11,074,300	2,138,900	16.2	9,600	0.46
WA	**7,142,800**	5,216,700	1,926,100	27.0	1,800	0.16
Total	**44,086,200**	**38,357,200**	**5,729,000**	**13.2**	**19,400**	**0.28**

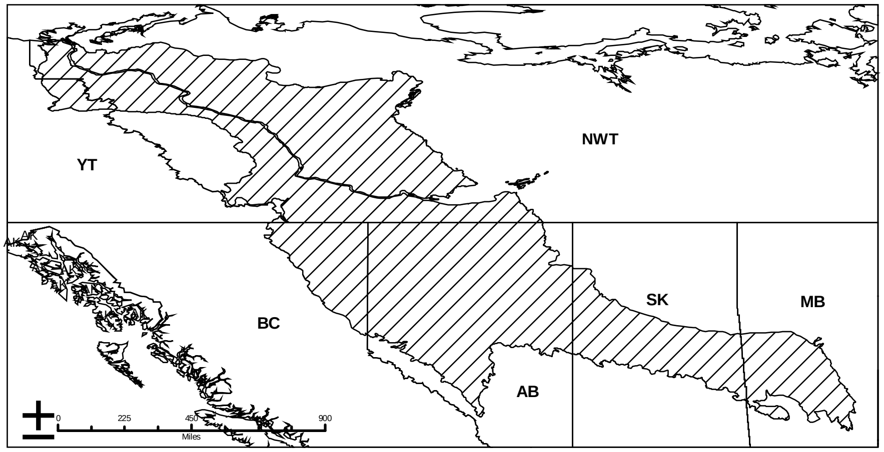
[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 4. Acres of forest by forest type group and stand size class in 2005 in the Northern Pacific Rainforest (BCR 5). Acreages may differ from Table 3 due to varying inventory protocols.

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**20,832,900**	17,884,900	2,948,000	14.2
Pine-Hemlock	**16,204,000**	14,418,600	1,785,400	11.0
Oak	**3,319,700**	2,819,300	500,400	15.1
Aspen-Birch	**1,599,500**	1,375,400	224,100	14.0
Uncl. Deciduous	**2,265,000**	1,858,900	406,100	17.9
Total	**44,221,100**	**38,357,100**	**5,864,000**	**13.3**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

BCR 6



Boreal Taiga Plains

Douglas W. Schindler

University of Manitoba

The Boreal Taiga Plains (BCR 6) is the transition zone between the Aspen Parklands to the south and the western Canadian Boreal Shield to the north. Based on 1995 Canadian Forest Inventory data there are 61 million acres (24.7 million hectares) of forested habitat in the region (Tables 1 and 2). Historic forest inventory data are available only for portions of the jurisdictions within BCR 6 and varying inventory protocols preclude temporal comparisons. Currently, efforts are underway to expand the spatial coverage and the uniformity of forest inventory data.

Forestland in the northern portion of BCR 6 is dominated by open, coniferous (primarily black spruce) forest, whereas the southern portion of this region is typified by both coniferous and mixed-forests of white and black spruce, lodgepole pine (in the west), jack pine and black spruce (in the east) with quaking aspen, balsam poplar, and paper birch occurring throughout.

The distribution and abundance of forest types and forest size-classes is assumed to be shifting toward a higher proportion of both deciduous forest and small-diameter forest in this region. These changes should provide an increase in quality habitats for ruffed grouse. These changes are largely the result of increased localized intensive forest management; changes that are not necessarily of a landscape scale.

In the western and northern portions of BCR 6, forest management, petroleum extraction and mining are altering the forest landscape and are increasing human access to relatively large areas. Although agricultural expansion has declined in recent years, forested areas in the southern portion of the BCR contain highly productive soils and continue to be cleared and converted to cropland.

Ruffed grouse hunter numbers and harvest fluctuate consistent with the population cycle in BCR 6. Since the mid-1980s in Alberta, ruffed grouse hunter numbers appear to have decreased slightly while harvest has remained relatively stable. Since 1990 in British Columbia, ruffed grouse hunter numbers have declined by 36%, but harvest appears relatively stable. The assumed increase of deciduous forest and small-diameter forest is likely beneficial to regional ruffed grouse populations.

The lack of historic forest inventory or ruffed grouse population data for BCR 6 precludes a definitive assessment of temporal trends. However, the assumed recent trend toward an increasingly deciduous and increasingly young forest should lead to stable or increasing ruffed grouse populations.

Table 1. Acres of forest by stand size class and estimated drumming male grouse population in 2005 by province in the Boreal Taiga Plains Forest (BCR 6).

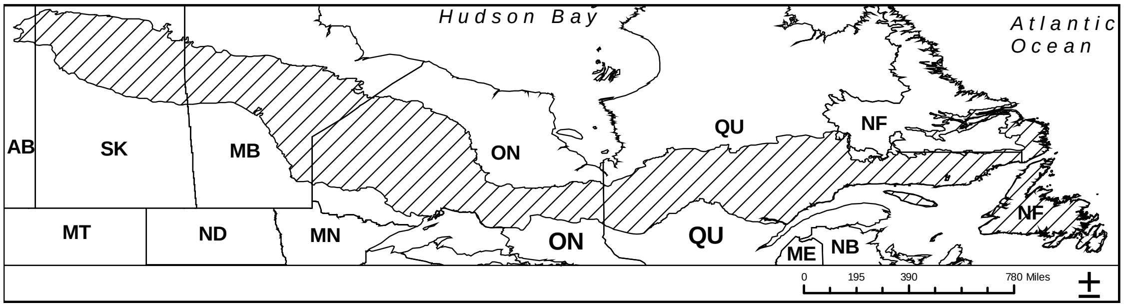
Province	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
ALB	**36,911,500**	31,914,800	4,996,700	13.5	946,200	16.4
BC	**24,057,700**	23,260,600	797,100	3.3	396,100	10.5
NWT	**(no data)**					
Total	**60,969,200**	**55,175,400**	**5,793,800**	**9.5**	**1,342,300**	**14.1**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 2. Acres of forest by forest type group and stand size class in 2005 in the Boreal Taiga Plains Forest (BCR 6).

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**23,917,600**	21,311,300	2,606,300	10.1
Pine	**9,189,600**	7,322,200	1,867,400	20.3
Maple-Birch	**6,700**	6,500	200	2.8
Aspen-Birch	**27,855,300**	26,535,400	1,319,900	4.7
Total	**60,969,200**	**55,175,400**	**5,793,800**	**9.5**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.



BCR 8

Boreal Softwood Shield Forest

Douglas W. Schindler; University of Manitoba

The Boreal Softwood Shield Forest (BCR 8) is contained entirely within the Canadian Boreal Forest. Based on 1993 Canadian Forest Inventory data there are 190 million acres (77 million hectares) of forestland in the region (Tables 1 and 2). The absence of historic forest inventory data for virtually all of BCR 8 and current forest inventory data for significant portions of this region precludes temporal comparisons.

Forestland in BCR 8 is dominated by vast tracts of conifer forest. Typical forest vegetation communities include black spruce, jack pine, white spruce and balsam fir. Quaking aspen is the predominant deciduous species, although balsam poplar and paper birch are locally abundant. Mixed forests containing spruce, pine, fir and various deciduous species are found throughout the region. Lowland areas dominated by black spruce and tamarack are dispersed throughout this landscape on low, poorly drained organic soils.

Considerable forestland in the southern portions of BCR 8 is allocated to various forest industries through a Forest Management License. In some areas, intensive forest management has had a significant impact on forest structure, age-class distribution and tree species composition. Age-class and species distribution may be shifting to a greater percentage of younger stands, as well as a higher composition of deciduous species, which would be favorable to ruffed grouse. Loss of forestland through agricultural development can be locally significant. Harvest of deciduous forest, primarily aspen, in some portions of this region has increased in the last 10 years, likely enhancing local habitat conditions for ruffed grouse.

Comprehensive ruffed grouse population and harvest data are unavailable for much of BCR 8. Ruffed grouse populations are cyclic throughout this region (Rusch 1975) and drumming male densities are similar to those documented in adjacent BCRs with similar forest types (Manitoba DNR 1994). Since the early 1970s in Manitoba, ruffed grouse harvest has fluctuated with the population cycle, but has remained comparable during comparable points in the cycle. It is likely that the majority of the forested areas in this region will remain forested and that increased forest harvest will increase the availability of small-diameter forest, thereby enhancing habitat conditions for ruffed grouse.

The lack of historic forest inventory or ruffed grouse population data for BCR 8 precludes a definitive assessment of temporal trends. However, the assumed recent trend toward an increasingly deciduous and increasingly young forest should lead to stable or increasing ruffed grouse populations.

Table 1. Acres of forest by stand size class and estimated drumming male grouse population in 2005 by province in the Boreal Softwood Shield Forest (BCR 8).

Province	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
QUE	**84,877,900**	76,205,000	8,672,900	10.2	1,294,900	9.8
ONT	**65,846,900**	62,594,200	3,252,700	4.9	1,000,400	9.7
MAN	**23,874,300**	16,104,100	7,770,200	32.6	465,600	12.5
SASK	**16,065,100**	15,784,600	280,500	1.8	314,300	12.5
NF/LAB	**10,647,000**	9,686,500	960,500	9.0	127,900	7.7
Total	**201,311,200**	**180,374,400**	**20,936,800**	**10.4**	**3,203,100**	**10.2**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 2. Acres of forest by forest type group and stand size class in 2005 by province in the Boreal Softwood Shield Forest (BCR 8).

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**128,905,100**	117,371,600	11,533,500	8.9
Pine	**28,244,900**	23,410,000	4,834,900	17.1
Oak	**25,600**	19,400	6,200	24.4
Elm-Ash	**38,700**	38,500	200	0.5
Maple-Beech-Birch	**2,416,100**	1,961,900	454,200	18.8
Aspen-Birch	**41,680,800**	37,573,000	4,107,800	9.9
Total	**201,311,200**	**180,374,400**	**20,936,800**	**10.4**

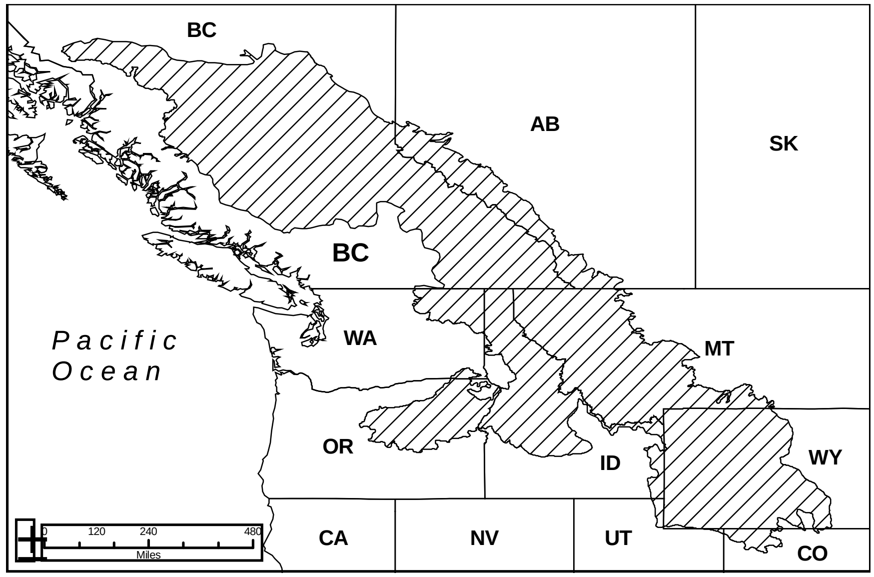
[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

BCR 10

Northern Rockies

Scot J. Williamson

Wildlife Management Institute



The Northern Rockies (BCR 10) includes the Northern Rocky Mountains and outlying ranges in the U. S. and Canada. Ruffed grouse are present throughout the region (Rusch et al. 2000). Forest vegetation is primarily coniferous. Tree species composition varies due to the influence of climate, which is more moist in the west than in the east, and elevation.

Spruce-fir and pine-hemlock are the dominant forest types, together accounting for approximately 95% of the forestland in BCR 10. Dry sites at low elevations support ponderosa pine; mid-slopes are dominated by Douglas fir and lodgepole pine and high elevations support primarily Engelmann spruce and subalpine fir. Western larch, grand fir, western red cedar, and western hemlock predominate on the relatively moist sites in the western portion of this region.

Recent large-scale fires have dramatically altered forest species composition and physical structure in some locales. The conversion of mature forest to young forest resulting from these disturbance events has likely increased potential quality habitat for ruffed grouse in this region.

Between 1980 and 2005, in the portions of BCR 10 with comparable data, area of forest decreased 4% while area of small-diameter forest increased 33% (Tables 1 and 3). Approximately 93% of the small-diameter forest occurs in spruce/fir or pine types (Table 4). Under the assumption that small-diameter forests within deciduous forest types, especially aspen, represent quality ruffed grouse habitat, less than 1% of the BCR can be classified as quality ruffed grouse habitat (Table 4).

Ruffed grouse hunter numbers and harvest fluctuate consistent with the population cycle in BCR 10. Species-specific assessments of hunter effort and harvest are unavailable for some jurisdictions because ruffed, blue and spruce grouse are lumped together as "forest grouse". Since the mid-1980s in Alberta, ruffed grouse hunter numbers appear to have decreased slightly while harvest has remained relatively stable. Since 1990 in British Columbia, ruffed grouse hunter numbers have declined by 36%, but harvest appears relatively stable. Since 1980 in Oregon, ruffed grouse hunter numbers have declined by 34%, but harvest appears to be stable or slightly increasing.

Within jurisdictions where forest data are available for 1980 and 2005, the estimated ruffed grouse drumming male population density has increased by 83% during this interval. However, densities are low throughout the region. This increase is due primarily to an increase in deciduous forest types.

The presence of approximately 513,600 (208,000 ha) acres of small diameter deciduous forest should sustain the ruffed grouse drumming male population density at the 1980 level in BCR 10. Increases in deciduous forest types and small-diameter forest between 1980 and 2005 are due largely to natural disturbance, primarily wildfire. If this level of disturbance continues, the ruffed grouse drumming male population density could be sustained at the 1980 level even with little or no active habitat manipulation.

Table 1. Acres of forest by stand size class and estimated drumming male grouse population in 1980 by jurisdiction in the portion of the Northern Rockies (BCR 10) that supports ruffed grouse. Acreages may differ from Table 2 due to varying inventory protocols.

Jurisdiction	**Total**	Large Diameter[2]	Small Diameter[3]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[4]
BC/ALB	**(no data)**					
CO	**79,200**	76,600	2,600	3.3	100	0.81
ID	**13,787,700**	11,879,200	1,908,500	13.8	1,300	0.06
MT	**13,131,700**	11,002,600	2,129,100	16.2	1,300	0.06
OR	**4,362,200**	3,715,800	646,400	14.8	< 100	0.01
UT	**71,900**	56,300	15,600	21.7	200	1.78
WA	**2,975,000**	2,583,800	391,200	13.2	300	0.06
WY[1]	**257,200**	205,100	52,100	20.3	500	1.24
Total	**34,664,900**	**29,519,400**	**5,145,500**	**14.8**	**3,700**	**0.07**

[1]Not including Yellowstone National Park.
[2]Stands of trees > 5 inches (12.5 cm) d.b.h.
[3]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[4]Drumming male grouse per square mile (2.6 square kilometers)

Table 2. Acres of forest by forest type group and stand size class in 1980 in the portion of the Northern Rockies (BCR 10) that supports ruffed grouse. Acreages may differ from Table 1 due to varying inventory protocols.

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**21,300,100**	18,157,000	3,143,100	14.8
Pine-Hemlock	**13,472,900**	11,521,100	1,951,800	14.5
Aspen-Birch	**806,800**	628,500	178,300	22.1
Uncl. Deciduous	**30,100**	20,800	9,300	31.0
Total	**35,609,900**	**30,327,400**	**5,282,500**	**14.8**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

Table 3. Acres of forest by stand size class and estimated drumming male grouse population in 2005 by jurisdiction in the portion of the Northern Rockies (BCR 10) that supports ruffed grouse.

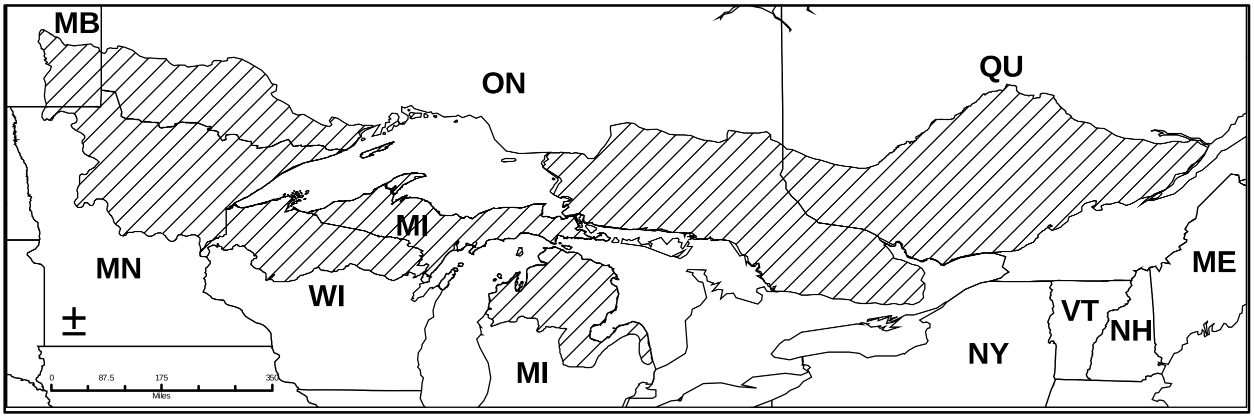
Jurisdiction	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
BC/ALB	**68,361,900**	63,524,300	4,837,600	7.1	19,600	0.18
CO	**82,700**	82,700	0	0.0	300	2.33
ID	**13,909,500**	10,786,300	3,123,300	22.5	2,400	0.11
MT	**12,718,500**	10,059,100	2,659,400	20.9	2,700	0.14
OR	**3,839,200**	3,121,400	717,800	18.7	100	0.02
UT	**64,500**	60,900	3,600	5.6	200	1.98
WA	**2,575,500**	2,302,900	272,600	10.6	100	0.02
WY	**3,900,700**	3,298,800	601,900	15.4	3,400	0.56
Total	**105,452,500**	**93,236,400**	**12,216,200**	**11.6**	**28,800**	**0.17**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 4. Acres of forest by forest type group and stand size class in 2005 in the portion of the Northern Rockies (BCR 10) that supports ruffed grouse.

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**56,151,100**	49,312,500	6,838,700	12.2
Pine-Hemlock	**44,298,400**	39,822,100	4,476,300	10.1
Aspen-Birch	**4,868,100**	4,014,900	853,200	17.5
Uncl. Deciduous	**134,900**	86,900	48,000	35.6
Total	**105,452,500**	**93,236,400**	**12,216,200**	**11.6**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.



BCR 12 Boreal Hardwood Transition

Daniel R. Dessecker; Ruffed Grouse Society

The Boreal Hardwood Transition (BCR 12) is comprised of 77.6 million acres (31.4 million ha) of forest, slightly greater than the total forest area in 1980 (Tables 1 and 3). Landforms in the region are typically flat to gently rolling.

BCR 12 is a transitional forest landscape between deciduous-dominated forests to the south and coniferous-dominated forests to the north. Predominant forest types include pine, spruce-fir, maple-beech-birch, and aspen-birch.

Aspen-birch and maple-beech-birch forests represent 33%, and 24%, respectively, of the forest area inventoried to the forest type or forest type group level. Since 1980, the area of maple-beech-birch forests have increased commensurate with a slight loss of aspen-birch forest (Tables 2 and 4), although this rate of change varies by jurisdiction. Because of the relatively high proportion of aspen-birch forest within BCR 12, this region could reasonably be considered the heart of the ruffed grouse range in North America.

Small-diameter size class forest has increased by 20% since 1980. This increase is largely a result of extensive forest management on public and industrial forests in Minnesota, Ontario and Quebec, primarily in the spruce-fir and aspen-birch forest types.

Ruffed grouse hunter numbers and harvest fluctuate consistent with the population cycle in BCR 12. Available data document an increase in hunter numbers from the 1950s to the mid 1970s. Since the mid 1970s, hunter numbers have declined by approximately 40-50% in Michigan, Minnesota and Wisconsin. Ruffed grouse harvests appear to have declined slightly throughout this region during the past 3 – 4 decades. Harvest in each of the states of Michigan, Minnesota, and Wisconsin range from approximately 300,000 birds during cyclic lows, to 1 million birds during cyclic highs.

The estimated ruffed grouse drumming male population density for BCR 12 has remained stable since 1980 (Tables 2 and 4), although trends vary by jurisdiction. Ruffed grouse populations exhibit a 10-year cycle throughout this region. This cyclic tendency confounds efforts to delineate population trends. Drumming survey data for MI, MN, and WI show no definitive trend, although cyclic "highs" and "lows" in WI are both lower in recent decades than in the past.

To sustain the ruffed grouse drumming male population density in BCR 12 at the 1980 level will require maintaining 14,617,000 acres (5,917,800 ha) of small-diameter forest. Maintaining this amount of small-diameter forest will require annual even-age treatments on 730,900 acres (295,900 ha). The relatively high proportion of aspen-birch forest will aid in sustaining the regional ruffed grouse population density at or above the 1980 level in this region.

Table 1. Acres of forest by stand size class and estimated drumming male grouse population in 1980 by jurisdiction in the Boreal Hardwood Transition (BCR 12).

Jurisdiction	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
MI	**13,469,100**	10,223,000	3,246,100	24.1	249,400	11.8
MN	**10,975,700**	8,193,500	2,782,200	25.3	309,900	18.0
WI	**7,813,900**	5,715,800	2,098,100	26.9	179,300	14.5
ONT	**13,251,000**	12,204,200	1,046,800	7.9	265,600	12.8
QUE	**29,513,700**	26484,300	3,029,400	10.3	498,300	10.8
Total	**75,023,400**	**62,820,800**	**12,202,600**	**16.3**	**1,502,500**	**12.8**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 2. Acres of forest by forest type group and stand size class in 1980 in the Boreal Hardwood Transition (BCR 12).

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**9,242,000**	6,845,100	2,396,900	25.6
Pine	**5,338,800**	4,485,800	853,000	16.0
Oak	**1,380,100**	1,068,500	311,600	22.6
Elm-Ash-Cottonwood	**1,992,000**	1,521,300	470,700	23.6
Maple-Beech-Birch	**10,599,200**	9,430,200	1,169,000	11.0
Aspen-Birch	**16,957,000**	12,986,900	3,970,100	23.4
Uncl. Coniferous	**7,888,900**	6,588,600	1,300,300	16.5
Uncl. Deciduous	**10,536,900**	9,861,500	675,400	6.4
Uncl. Mixed Forest	**11,088,500**	10,032,900	1,055,600	9.5
Total	**75,023,400**	**62,820,800**	**12,202,600**	**16.3**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

Table 3. Acres of forest by stand size class and estimated drumming male grouse population in 2005 by jurisdiction in the Boreal Hardwood Transition (BCR 12).

Jurisdiction	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
MI	**14,043,000**	11,121,000	2,922,000	20.8	230,800	10.5
MN	**11,822,900**	7,407,100	4,475,800	37.7	345,900	18.6
WI	**8,470,700**	6,282,000	2,188,700	25.8	180,700	13.7
ONT	**13,688,400**	12,306,200	1,382,200	10.1	273,800	12.8
QUE	**29,548,300**	25,899,300	3,649,000	12.3	516,300	11.2
Total	**77,633,300**	**63,015,600**	**14,617,700**	**18.8**	**1,547,500**	**12.8**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 4. Acres of forest by forest type group and stand size class in 2005 in the Boreal Hardwood Transition (BCR 12).

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**9,483,000**	6,466,200	3,016,800	31.8
Pine	**6,063,600**	5,081,300	982,300	16.2
Oak-Pine	**819,100**	597,600	221,500	27.0
Oak	**1,937,000**	1,540,300	396,700	20.5
Elm-Ash-Cottonwood	**2,001,500**	1,413,000	588,500	29.4
Maple-Beech-Birch	**11,713,400**	10,749,400	964,000	8.2
Aspen-Birch	**16,066,900**	11,267,700	4,799,200	29.9
Uncl. Coniferous	**6,701,600**	5,787,100	914,500	13.7
Uncl. Deciduous	**10,410,000**	9,538,000	872,000	8.4
Uncl. Mixed Forest	**12,436,900**	10,575,400	1,861,500	15.0
Total	**77,633,000**	**63,016,000**	**14,617,000**	**18.8**

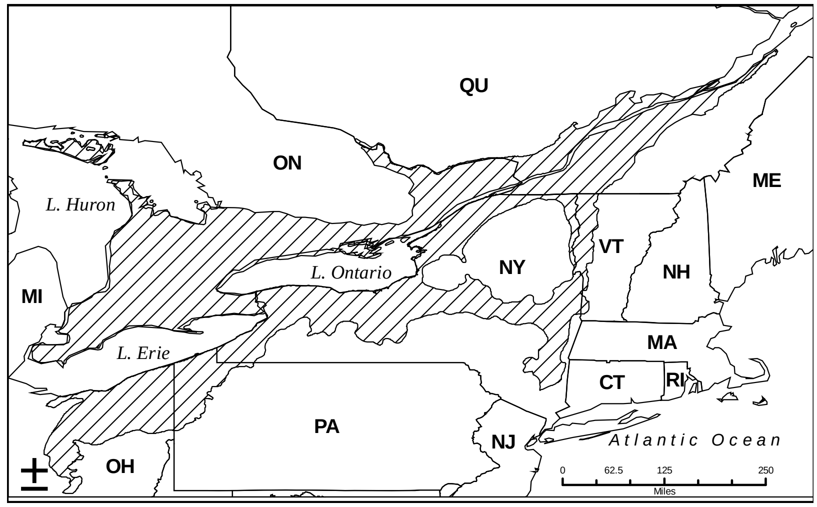
[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

BCR 13

Lower Great Lakes/ St. Lawrence Plain

Scot J. Williamson

Wildlife Management Institute



The Lower Great Lakes/St. Lawrence Plain (BCR 13) encompasses low-lying areas along the St. Lawrence River drainage. In western Pennsylvania, northern Ohio and southwestern New York, this region is characterized by low rounded hills, scattered end moraines, kettles and wetlands. In northern New York and western Vermont, this region generally contains minimal topographic relief and greater agricultural activity and population density than adjacent regions. Primary forest types in the region include maple-beech-birch, spruce-fir, aspen-birch, pine and oak (Table 4).

Large scale disturbances were likely historically rare on mesic sites within BCR 13. Fires caused by lightning or native Americans may have played an important role in shaping vegetative communities on xeric, sandy sites. Beaver were locally important in providing small-diameter forests with historic populations much higher than current. Insects and diseases are an important contemporary natural disturbance. Gypsy moth, beech bark disease, chestnut blight, Dutch elm disease and hemlock woolly adelgid, among others, affect forest composition and structure.

Ruffed grouse originally inhabited much of BCR 13, but populations were likely sparse in those areas covered by relatively large blocks of mature forest. During European settlement in the early 1800s, grouse populations increased as mature forest was converted to agricultural land, some of which was abandoned and developed into shrub dominated or young forest stands – quality ruffed grouse habitat. As settlement progressed, large-scale deforestation greatly reduced and isolated regional grouse populations. In the early-mid twentieth century, farmland abandonment again provided increased habitat for expanding grouse populations in the 1970s and early 1980s. Ruffed grouse populations have recently declined to low levels as forests have matured.

Between 1980 and 2005, BCR 13 gained 852,000 acres of forestland, primarily due to reforestation of abandoned agricultural fields (Tables 1 and 3). Forestland in this region is increasingly mature. The proportion of total forest comprised of small-diameter stands has declined 30% in this region (Tables 1 and 3). The U.S. portions of this region have lost 1.4 million acres of small diameter size classes while Canadian portions of the region have gained 90,000 acres of small-diameter forest.

Only 3 jurisdictions within BCR 13 have long-term comprehensive grouse population, hunter or harvest estimates. Since 1972 in Ohio, ruffed grouse drumming survey data demonstrate a 68% decline in the population. Since 1990 in New York, ruffed grouse hunters and harvest have both declined by 45%. Since 1980 in Pennsylvania, ruffed grouse hunters and harvest have both declined by 71%. In 2000, Pennsylvania and New York estimated hunter numbers as 162,000, and 63,000, respectively. Approximately one grouse is harvested annually per hunter in Pennsylvania and New York.

The estimated ruffed grouse drumming male population density in BCR 13 decreased by 5 % between 1980 and 2005 (Tables 2 and 4). All states in this region have experienced declines in their ruffed grouse populations. Ruffed grouse populations in Quebec and Ontario are likely either stable or increasing slightly. Density of drumming males has decreased in all jurisdictions except Ontario.

To restore the ruffed grouse drumming male population density in BCR 13 to the 1980 level will require a 28% increase in small-diameter forest to 4,795,375 acres (2,073,072 ha). Sustaining this amount of small-diameter forest will require annual even-age treatments on 239,768 acres (99,903 ha).

Table 1. Acres of forest by stand size class and estimated drumming male grouse population in 1980 by jurisdiction in the portion of the Lower Great Lakes/St. Lawrence Plain (BCR 13) that supports ruffed grouse.

Jurisdiction	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
NY	**6,289,500**	4,116,900	2,172,600	34.5	95,100	9.7
OH	**553,900**	425,200	128,700	23.2	5,800	6.7
ONT	**12,274,000**	10,478,300	1,795,700	14.6	192,200	10.0
PA	**755,700**	627,200	128,500	17.0	10,500	8.9
QUE	**1,403,700**	1,185,300	218,400	15.6	14,200	6.5
VT	**516,200**	395,000	121,200	23.5	7,100	8.7
Total	**21,793,000**	**17,227,900**	**4,565,100**	**20.9**	**324,900**	**9.5**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 2. Acres of forest by forest type group and stand size class in 1980 in the portion of the Lower Great Lakes/St. Lawrence Plain (BCR 13) that supports ruffed grouse.

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**1,076,000**	929,600	146,400	13.6
Pine	**1,940,000**	1,572,200	367,800	19.0
Oak-Pine	**36,700**	19,600	17,100	46.6
Oak	**488,900**	390,800	98,100	20.1
Elm-Ash - Cottonwood	**700,000**	262,200	437,800	62.5
Maple-Beech-Birch	**10,027,600**	8,026,700	2,000,900	20.0
Aspen-Birch	**2,470,000**	2,005,900	464,100	18.8
Uncl. Coniferous	**1,723,100**	1,271,900	451,200	26.2
Uncl. Deciduous	**2,768,400**	2,275,400	493,000	17.8
Uncl. Mixed Forest	**562,400**	473,700	88,700	15.8
Total	**21,793,100**	**17,227,900**	**4,565,200**	**21.0**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

Table 3. Acres of forest by stand size class and estimated drumming male grouse population in 2005 by jurisdiction in the portion of the Lower Great Lakes/St. Lawrence Plain (BCR 13) that supports ruffed grouse.

Jurisdiction	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
NY	**6,638,300**	5,693,500	944,800	14.2	84,500	8.1
OH	**574,100**	562,200	11,900	2.1	5,600	6.2
ONT	**12,568,700**	10,686,100	1,882,600	15.0	200,800	10.2
PA	**783,500**	663,200	120,300	15.4	9,000	7.4
QUE	**1,619,800**	1,400,700	219,100	13.5	16,300	6.4
VT	**461,000**	415,600	45,400	9.9	5,800	8.0
Total	**22,645,400**	**19,421,300**	**3,224,100**	**14.2**	**322,000**	**9.1**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers).

Table 4. Acres of forest by forest type group and stand size class in 2005 in the portion of the Lower Great Lakes/St. Lawrence Plain (BCR 13) that supports ruffed grouse.

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**971,900**	878,800	93,100	9.6
Pine	**1,814,700**	1,554,600	260,100	14.3
Oak-Pine	**253,900**	240,600	13,500	5.3
Oak	**1,197,700**	1,089,300	108,400	9.1
Elm-Ash-Cottonwood	**104,900**	84,500	20,400	19.4
Maple-Beech-Birch	**8,331,700**	7,604,200	727,400	8.7
Aspen-Birch	**2,740,300**	2,357,600	382,700	13.9
Uncl. Coniferous	**1,950,400**	1,429,200	521,200	26.7
Uncl. Deciduous	**4,343,700**	3,359,400	984,300	22.7
Uncl. Mixed Forest	**936,200**	823,100	113,000	12.1
Total	**22,645,400**	**19,421,300**	**3,224,100**	**14.2**

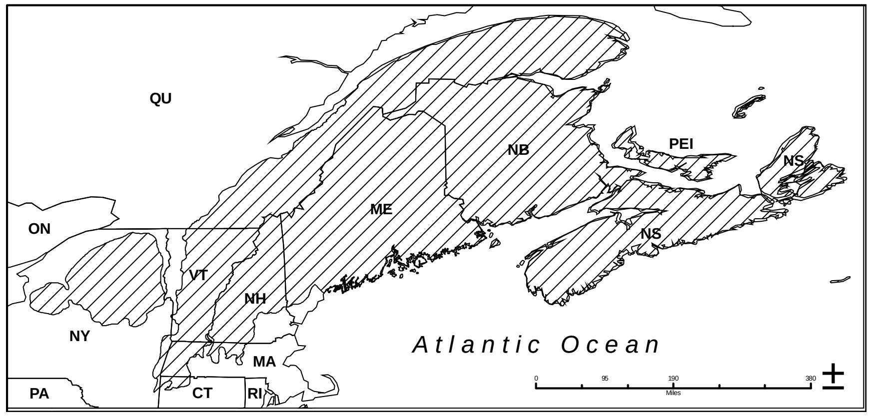
[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

BCR 14

Atlantic Northern Forest

Daniel R. Dessecker

Ruffed Grouse Society



The Atlantic Northern Forest (BCR 14) is comprised of 63.5 million acres (25.7 million ha) of forestland, slightly greater than the total forest area in 1980 (Tables 1 and 3). Landforms in the region range from coastal plains to the 4,000 – 6,000 foot (1,200 – 1,800 m) peaks of the Green and White Mountains.

BCR 14 is a transitional forest landscape between deciduous-dominated forests to the south and coniferous-dominated forests to the north. Predominant forest types include spruce-fir and maple-beech-birch. Maple-beech-birch forests have increased by 27% since 1980. Although aspen-birch forests comprise only 8% of the current forest, aspen-birch forest has increased by 32% since 1980 and much of this increase has been in the small-diameter size class (Tables 2 and 4).

The increase in aspen and other deciduous forests, particularly in the small-diameter size class, is largely a result of extensive forest management on industrial forests in Maine and New Brunswick. Deciduous tree species are often a component of conifer-dominated forests in this region. After harvest, the deciduous regeneration can out-compete the coniferous regeneration, which can lead to forest type conversion. However, this conversion from coniferous to deciduous is often interrupted by selecting against deciduous regeneration through the use of herbicides or mechanical treatment, thereby negatively affecting potential ruffed grouse habitat. In addition, pre-commercial thinning of recently regenerated aspen (5- to- 10-year-old stands) is a relatively common practice on some industrial ownerships. This practice can significantly reduce stem densities and ruffed grouse habitat quality.

The estimated ruffed grouse drumming male population density for BCR 14 has increased by 9% since 1980 (Tables 1 and 3). This increase is largely a result of the increase of small-diameter size class forests in Maine and New Brunswick and may be an overestimate due to the factors referenced above. Population trends for other jurisdictions are variable. Available data suggest that ruffed grouse populations exhibit a 10-year cycle in the northern portion of this region, yet not in the southern portion thereof.

Most jurisdictions within this region do not collect data on ruffed grouse populations, hunter numbers, or harvest. Since 1990 in New York, ruffed grouse hunters and harvest have both declined by 45%. Since the early 1970s in Prince Edward Island hunter numbers have declined by approximately 60% while harvest has remained stable.

A 7% reduction in small-diameter forest to 10,669,300 acres (4,319,600 ha) would allow for the maintenance of the 1980 ruffed grouse population density in BCR 14. This amount of small-diameter forest could be sustained through annual even-age treatments on 533,500 acres (216,000). The relatively high proportion of forest owned and managed by the forest products industry in Maine (43%), New Brunswick (19%) and Nova Scotia (18%) will aid in sustaining regional ruffed grouse populations at or above the 1980 level in this region.

Table 1. Acres of forest by stand size class and estimated drumming male grouse population in 1980 by jurisdiction in the Atlantic Northern Forest (BCR 14).

Jurisdiction	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
CT	**414,200**	335,700	78,500	19.0	4,300	6.6
MA	**822,100**	753,900	68,200	8.3	8,700	6.8
ME	**16,643,000**	14,770,800	1,872,200	11.2	220,500	8.5
NH	**4,306,500**	3,809,200	497,300	11.5	48,500	7.2
NY	**3,345,400**	2,637,300	708,100	21.2	48,500	9.3
VT	**3,900,200**	3,442,500	457,700	11.7	45,100	7.4
NB	**14,684,600**	12,523,600	2,161,000	14.7	249,500	10.9
NS	**9,696,700**	8,842,600	854,100	8.8	127,000	8.4
PEI	**666,100**	542,000	124,100	18.6	9,800	9.4
QUE	**8,475,900**	7,047,000	1,428,900	16.9	135,400	10.2
Total	**62,954,700**	**54,704,600**	**8,250,100**	**13.1**	**897,300**	**9.1**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 2. Acres of forest by forest type group and stand size class in 1980 in the Atlantic Northern Forest (BCR 14).

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**18,863,100**	16,695,900	2,167,200	11.5
Pine	**4,548,000**	4,198,000	350,000	7.7
Oak-Pine	**542,900**	501,100	41,800	7.7
Oak	**1,048,900**	937,100	111,800	10.7
Elm-Ash-Cottonwood	**450,000**	310,000	140,000	31.1
Maple-Beech-Birch	**15,480,200**	13,748,800	1,731,400	11.2
Aspen-Birch	**3,653,000**	2,910,000	743,000	20.3
Uncl. Coniferous	**3,832,800**	3,360,200	472,600	12.3
Uncl. Deciduous	**1,665,000**	1,366,000	299,000	18.0
Uncl. Mixed Forest	**12,870,800**	10,677,500	2,193,300	17.0
Total	**62,954,700**	**54,704,600**	**8,250,100**	**13.1**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

Table 3. Acres of forest by stand size class and estimated drumming male grouse population in 2005 by jurisdiction in the Atlantic Northern Forest (BCR 14).

Jurisdiction	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
CT	**426,600**	418,200	8,400	2.0	3,900	5.9
MA	**808,500**	777,700	30,800	3.8	8,200	6.5
ME	**17,000,000**	11,679,500	5,020,500	30.1	294,400	11.3
NH	**4,209,700**	3,780,400	429,300	10.2	46,500	7.1
NY	**3,308,000**	2,937,200	370,800	11.2	41,700	8.1
VT	**4,021,500**	3,622,900	398,600	9.9	48,900	7.8
NB	**15,104,300**	12,294,100	2,810,200	18.6	252,800	10.7
NS	**9,571,500**	8,755,200	816,300	8.5	125,600	8.4
PEI	**601,200**	478,700	122,500	20.4	12,700	13.5
QUE	**8,775,400**	7,310,400	1,465,000	16.7	140,800	10.3
Total	**63,526,700**	**52,054,300**	**11,472,400**	**18.1**	**975,500**	**9.8**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 4. Acres of forest by forest type group and stand size class in 2005 in the Atlantic Northern Forest (BCR 14).

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**17,949,700**	13,879,900	4,069,800	28.3
Pine	**3,592,600**	3,401,100	191,500	5.7
Oak-Pine	**801,800**	756,900	44,900	1.3
Oak	**1,114,100**	1,028,900	85,200	1.8
Elm-Ash-Cottonwood	**559,000**	345,800	213,200	0.9
Maple-Beech-Birch	**19,601,200**	16,795,300	2,805,900	30.8
Aspen-Birch	**4,836,800**	3,034,200	1,802,600	7.6
Uncl. Coniferous	**3,834,100**	3,331,800	502,300	6.0
Uncl. Deciduous	**1,530,100**	1,285,000	245,100	2.4
Uncl. Mixed Forest	**9,707,300**	8,195,400	1,511,900	15.3
Total	**63,526,700**	**52,054,300**	**11,472,400**	**18.1**

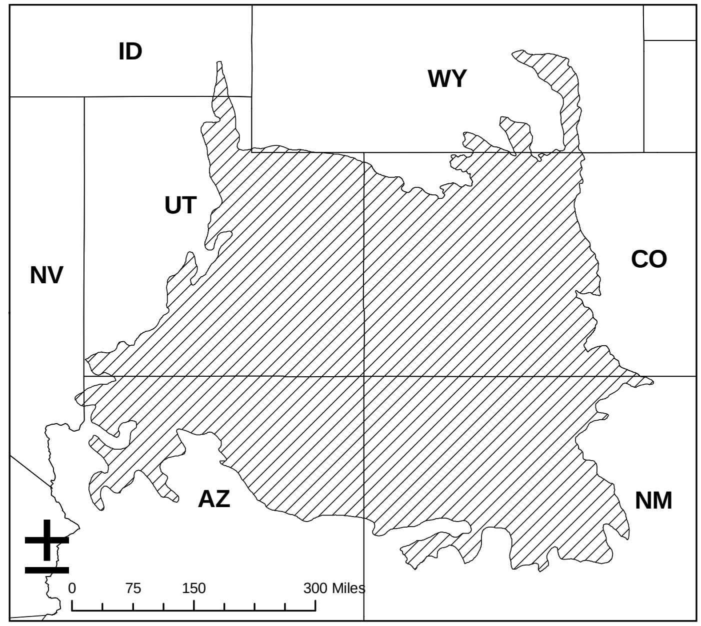
[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

BCR 16

Southern Rockies Colorado Plateau

Dean L. Mitchell

UT Division of Wildlife Resources



The Southern Rockies Colorado Plateau (BCR 16) is situated just east of the Great Basin Desert and west of the Great Plains. Ruffed grouse occur in Idaho, Utah, Wyoming and possibly Northwestern Colorado in BCR 16 (Rusch et al. 2000). The assessment of current and historical habitat conditions pertains only to those portions of BCR 16 in Utah and Wyoming. The small portion of BCR 16 in Idaho is not included because no entire counties in Idaho are found within BCR 16 and forest inventory data are unavailable for resolutions smaller than the county level.

BCR 16 is composed of a variety of forest types. Fremont and narrowleaf cottonwood is prevalent in lowland riparian areas giving way to juniper, pine-juniper and oak woodlands on low-elevation and dry upland sites. Mid-elevation sites are dominated by quaking aspen, Douglas fir, white fir, mahogany and lodgepole pine. High elevations are dominated by Engelmann spruce and subalpine fir.

Forests in this portion of BCR 16 are predominantly spruce-fir (68%) (Table 4). Oak and aspen account for 12%, and 11%, of the forest, respectively. Ruffed grouse in BCR 16 seldom use spruce-fir-dominated forests and are found at very low densities in most oak-dominated forests. Ruffed grouse in this portion of BCR 16 seem to prefer mid-elevation sites along the aspen-fir ecotone.

Since 1980, the total area of forest and small-diameter forest in BCR 16 increased 23%, and 141%, respectively (Tables 1 and 3). However, approximately 24% of the small-diameter forest occurs in spruce-fir or pine types and 57% occurs in the oak type (Table 4); neither of which are quality ruffed grouse habitat. Small-diameter aspen and unclassified forest provide quality habitat for ruffed grouse and currently account for only 19% of this portion of BCR 16 (Table 4). Aspen and unclassified small-diameter forests have increased by 78% since 1980 (Tables 2 and 4). The slight increase in deciduous forest types and the sizeable increase in small diameter forest during the forest inventory survey period are due largely to natural disturbance, primarily wildfire, and to a limited extent to recent aspen restoration management activities throughout BCR 16.

The estimated ruffed grouse drumming male population density in BCR 16 increased 56% between 1980 and 2005 (Tables 2 and 4), although population densities are low. In Utah, an average of 14,805 hunters harvested an average of 14,606 ruffed grouse annually since 1980. In Wyoming, an average of 2,178 hunters harvested 5,279 ruffed grouse annually since 1990. These are statewide data for both states and are not exclusive to BCR 16. However, interest in ruffed grouse hunting in Utah has increased recently. From 1980-1993, an average of 14,337 hunters were afield for 39,259 days, while from 1994-2005, an average of 16,758 hunters were afield for 62,197 days.

If this level of disturbance and management continues, the ruffed grouse drumming male population density could likely be sustained at the 1980 level in BCR 16 even without additional active habitat manipulation. Increases in active habitat manipulation may be necessary to satisfy increasing demands for ruffed grouse hunting opportunity in Utah and perhaps elsewhere throughout BCR 16.

Table 1. Acres of forest by stand size class and estimated drumming male grouse population in 1980 by state in the portion of the Southern Rockies Colorado Plateau (BCR 16) that supports ruffed grouse.

State	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
UT	**11,876,500**	10,631,600	1,244,900	10.5	9,200	0.50
WY	**143,000**	121,700	21,300	14.9	200	0.90
Total	**12,019,500**	**10,753,300**	**1,266,200**	**10.5**	**9,400**	**0.50**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 2. Acres of forest by forest type group and stand size class in 1980 in the portion of the Southern Rockies Colorado Plateau (BCR 16) that supports ruffed grouse.

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**8,980,100**	8,430,900	549,200	6.1
Pine	**1,055,300**	887,000	168,300	15.9
Oak	**473,900**	252,100	221,800	46.8
Aspen	**1,261,400**	971,800	289,600	23.0
Uncl. Deciduous	**248,800**	211,500	37,300	15.0
Total	**12,019,500**	**10,753,300**	**1,266,200**	**10.5**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

Table 3. Acres of forest by stand size class and potential drumming male grouse population in 2005 by state in the portion of the Southern Rockies Colorado Plateau (BCR 16) that supports ruffed grouse.

State	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
UT	**14,663,000**	11,649,600	3,013,400	20.6	17,800	0.78
WY	**114,800**	79,400	35,400	30.8	200	1.11
Total	**14,777,800**	**11,729,000**	**3,048,800**	**20.6**	**18,000**	**0.78**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 4. Acres of forest by forest type group and stand size class in 2005 in the portion of the Southern Rockies Colorado Plateau (BCR 16) that supports ruffed grouse.

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**10,089,100**	9,449,500	639,600	6.3
Pine	**900,400**	803,100	97,300	10.8
Oak	**1,832,900**	103,500	1,729,400	94.3
Aspen	**1,620,000**	1,158,600	461,400	28.5
Uncl. Deciduous	**335,400**	214,600	120,800	36.0
Total	**14,777,800**	**11,729,300**	**3,048,500**	**20.6**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

BCR 22

Eastern Tallgrass Prairie

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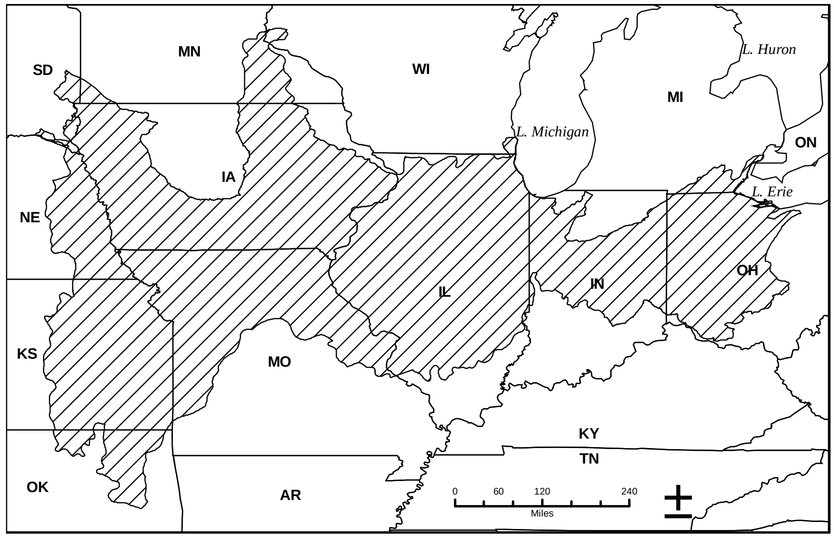

The Eastern Tallgrass Prairie (BCR 22) was formerly composed of tall grasslands in the western portion of the region and beech-maple forests in the eastern sections, while oak dominated woodlands and savannahs characterized the ecotones between the two. Although there have been small increases in the amount of forest in the region due to abandonment of agricultural lands, the modern landscape is dominated by agriculture. Threats to forest wildlife include urbanization, recreational development, loss of shrubland and early-successional forest habitats, and a declining dominance of oaks as the current forest lands are largely not managed or managed by methods that favor reproduction of shade-tolerant species.

Grouse have generally been most abundant in the more extensive forests along major rivers in the region. Historically grouse were locally abundant during settlement as lands were cleared and then abandoned, creating grouse habitat (Lewis et al. 1968). Grouse were nearly extirpated from most of this region in the early 1900s as a result of forest clearing, burning, open range practices, and unregulated hunting (Lewis et al. 1968, Lewis 1971). As forest habitat conditions improved; Illinois, Indiana, Iowa, Ohio and Missouri initiated efforts to restore ruffed grouse to portions of their former range. These efforts had limited success. Where good habitat existed as a result of forest management grouse became locally abundant. During the last 20 years, however, grouse numbers have declined (Thompson and Dessecker 1997, Dessecker and McAuley 2001) and this decline parallels declines in early-succession forest habitat (Trani et al. 2001.

The total area of forest in BCR 22 has increased 6% since 1980 (Tables 1 and 3). However, during the same period, area of small-diameter forest has declined by 24% (Tables 1 and 3). Within some portions of BCR 22, the reclamation of surface mines to grassland has decreased the availability of small-diameter forest habitat and has increased forest fragmentation, thereby reducing habitat for ruffed grouse.

Data documenting ruffed grouse densities are largely unavailable for BCR 22. Drumming male densities in oak forest in Missouri ranged from 3.6-10 males/100 acres (40 ha) in small-diameter forest and 0.08-1.25 males/100 acres (40 ha) in mature forest. These densities were documented after ruffed grouse restoration efforts; we suspect these densities are in the upper range of what occurs throughout the region.

To estimate the grouse population in BCR 22 we assumed lower densities than reported above. We used very low density estimates for most mature forest types because of our belief that grouse are absent form most mature forest in the region.

Largely as a result of this decrease in the area of small-diameter forest, the estimated ruffed grouse drumming male population density has declined by 26% since 1980 (Tables 1 and 3). These estimates are likely higher than actual population densities and underestimate actual declines because the area from which the forest inventory statistics were compiled is greater than the actual occupied grouse range. Ohio drumming survey data document a significant long-term decline of approximately 65%. Drumming survey data from Indiana document a 73% population decline since the mid 1980s. Ruffed grouse hunter numbers and harvest in Indiana have declined approximately 75% since the mid 1970s.

The restoration of the ruffed grouse drumming male population density in BCR 22 to the 1980 level will require increasing the current proportion of small-diameter forest by approximately 36% to 354,800 acres (143,700 ha). Maintaining this amount of small-diameter forest will require annual even-age treatments on 17,700 acres (7,200 ha).

Table 1. Acres of forest by stand size class and estimated drumming male grouse population in 1980 by state in the portion of the Eastern Tallgrass Prairie (BCR 22) that supports ruffed grouse.

State	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population[3]	Estimated drumming male grouse density[4]
IA	**248,600**	218,400	30,200	12.1	1,100	2.9
IL	**11,800**	11,800	0	0.0	0	0
IN	**113,300**	98,400	14,900	13.2	700	3.8
KS	**53,500**	36,500	17,000	31.8	600	7.7
MI	**82,800**	53,000	29,800	36.0	1,200	6.2
MN	**128,600**	127,000	1,600	1.2	200	1.1
MO	**1,053,700**	932,300	121,400	11.5	5,600	3.4
OH	**537,400**	407,100	130,300	24.2	5,500	6.6
Total	**2,229,700**	**1,884,500**	**345,200**	**15.5**	**14,900**	**4.3**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Small-diameter forest drumming male density estimates [males/100 acres (40 ha)]: 4.0 in oak-mixed oak and maple-beech-birch-cherry; 5.0 in aspen-birch; 2.5 in elm-ash-maple-cottonwood-cypress and cedar; 1.5 in pine. Large-diameter forest drumming male density estimates [males/100 acres (40 ha)]: 0.1 in oak-mixed oak and maple-beech-birch-cherry; 0.3 in aspen-birch; 0.1 in elm-ash-maple-cottonwood-cypress; 0.5 in cedar; 0.0 in pine.
[4]Drumming male grouse per square mile (2.6 square kilometers)

Table 2. Acres of forest by forest type group and stand size class in 1980 in the Eastern Tallgrass Prairie (BCR 22).

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Pine	**10,100**	3,800	6,300	62.4
Cedar	**122,300**	82,300	40,000	32.7
Oak-Mixed Oak	**1,467,800**	1,311,200	156,600	10.7
Elm-Ash-Maple Cottonwood-Cypress	**216,500**	194,600	21,900	10.1
Maple-Beech Birch-Cherry	**390,600**	277,700	112,900	28.9
Aspen-Birch	**22,400**	14,900	7,500	33.6
Total	**2,229,700**	**1,884,500**	**345,200**	**15.5**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

Table 3. Acres of forest by stand size class and estimated drumming male grouse population in 2005 by state in the portion of the Eastern Tallgrass Prairie (BCR 22) that supports ruffed grouse.

State	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population[3]	Estimated drumming male grouse density[4]
IA	**275,600**	245,700	29,900	10.8	1,400	3.2
IL	**33,200**	22,100	11,100	33.5	300	5.9
IN	**139,800**	125,800	14,000	10.0	700	3.1
KS	**125,900**	110,500	15,400	12.2	600	3.2
MI	**110,700**	97,900	12,800	11.5	700	4.2
MN	**139,200**	120,000	19,200	13.8	700	3.3
MO	**1,103,100**	991,100	112,000	10.2	5,300	3.1
OH	**425,400**	378,900	46,500	10.9	1,900	2.8
Total	**2,352,900**	**2,092,000**	**260,900**	**11.1**	**11,600**	**3.2**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Small-diameter forest drumming male density estimates [males/100 acres (40 ha)]: 4.0 in oak-mixed oak and maple-beech-birch-cherry; 5.0 in aspen-birch; 2.5 in elm-ash-maple-cottonwood-cypress and cedar; 1.5 in pine. Large-diameter forest drumming male density estimates [males/100 acres (40 ha)]: 0.1 in oak-mixed oak and maple-beech-birch-cherry; 0.3 in aspen-birch; 0.1 in elm-ash-maple-cottonwood-cypress; 0.5 in cedar; 0.0 in pine.
[4]Drumming male grouse per square mile (2.6 square kilometers)

Table 4. Acres of forest by forest type group and stand size class in 2005 in the Eastern Tallgrass Prairie (BCR 22).

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Pine	**28,200**	27,200	1,000	3.7
Cedar	**219,500**	153,200	66,300	30.2
Oak-Mixed Oak	**1,483,800**	1,363,500	120,300	8.1
Elm-Ash-Maple Cottonwood-Cypress	**278,900**	234,300	44,600	16.0
Maple-Beech Birch-Cherry	**320,500**	292,600	27,900	14.8
Aspen-Birch	**22,000**	21,200	800	3.5
Total	**2,352,900**	**2,092,000**	**260,900**	**11.1**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

BCR 23

Prairie Hardwood Transition

C. Alan Stewart
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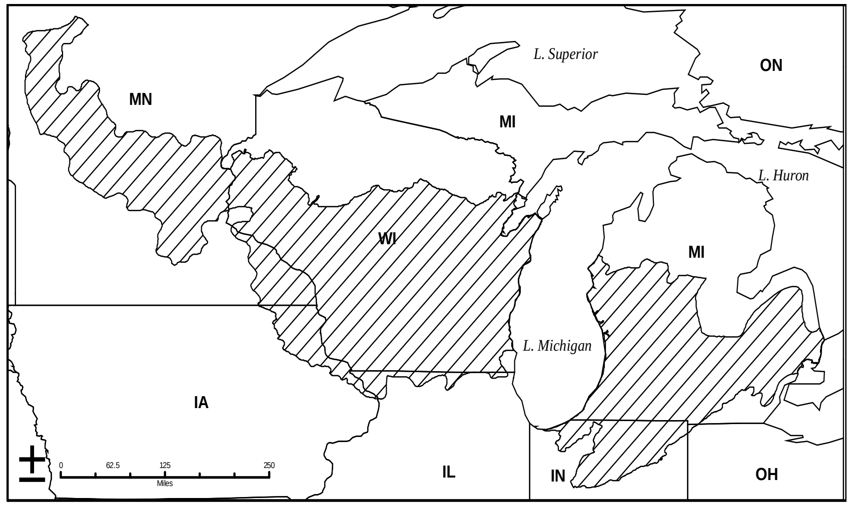
Michigan Department of Natural Resources



The Prairie Hardwood Transition (BCR 23) is comprised of 14 million acres (5.7 million ha) of forest, a 9% increase since 1980 (Tables 1 and 3). Landforms in the region are composed of morainal hills and dissected plateaus ranging in typography from level to steep.

BCR 23 is a transitional landscape between prairies to the west and south and deciduous-dominated forests to the east and north, separated by oak savannah. Predominant forest types include oak-hickory, and maple-beech-birch or aspen-birch. Elm-ash-cottonwood types are common in riparian zones.

Oak or oak-pine, maple-beech-birch and aspen-birch represent 41%, 23%, and 11% respectively, of the forestland in BCR 23. Aspen-birch forest has declined by 28% since 1980 and small-diameter forest has decreased by 25% during this same interval. Declines in active forest management and traditional clearcut regeneration harvests are occurring throughout much of this region, resulting in these declines of aspen-birch and small-diameter forests.

Ruffed grouse populations exhibit a 10-year cycle throughout this region, although not as consistently as in more northerly latitudes. This cyclic tendency confounds efforts to delineate population trends. Drumming survey data for MI, MN, and WI show no definitive trend, although cyclic “highs” and “lows” in WI are lower in recent decades than in the past.

The estimated ruffed grouse drumming male population density for BCR 23 has decreased by 12% since 1980 (Tables 1 and 3), though trends vary by state. These estimates are likely higher than actual population densities and underestimate actual declines because the area from which the forest inventory statistics were compiled is significantly greater than the actual occupied grouse range.

Ruffed grouse hunter numbers and harvest fluctuate consistent with the population cycle in BCR 23. Available data document an increase in hunter numbers from the 1950s to the mid 1970s. Since the mid 1970s, hunter numbers have declined by approximately 40-50% in Michigan, Minnesota and Wisconsin and ruffed grouse harvests appear to have declined slightly in these states during the past 3 – 4 decades.

The restoration of the ruffed grouse drumming male population density in BCR 23 to the 1980 level will require a 20% increase in small-diameter forest to approximately 2,653,600 acres (1,074,300 ha). Maintaining this amount of small-diameter forest will require annual even-age treatments on 132,700 acres (53,700 ha). The regeneration of existing stands of aspen-birch through traditional clearcut harvest treatments will aid in this restoration effort.

Table 1. Acres of forest by stand size class and estimated drumming male grouse population in 1980 by state in the portion of the Prairie Hardwood Transition (BCR 23) that supports ruffed grouse.

State	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
IL	**53,000**	49,000	4,000	7.5	500	6.5
IN	**209,200**	184,900	24,300	11.6	2,400	7.2
IA	**321,900**	279,700	42,200	13.1	3,700	7.4
MI	**3,484,300**	2,471,800	1,012,500	29.1	57,600	10.6
MN	**1,935,900**	1,706,500	229,400	11.8	38,000	12.5
WI	**6,785,100**	5,162,300	1,622,800	23.9	115,600	10.9
Total	**12,789,400**	**9,854,200**	**2,935,200**	**22.9**	**217,800**	**10.9**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 2. Acres of forest by forest type group and stand size class in 1980 in the portion of the Prairie Hardwood Transition (BCR 23) that supports ruffed grouse.

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**358,500**	224,900	133,600	37.3
Pine	**963,000**	715,000	248,000	25.8
Oak	**4,257,700**	3,700,800	556,900	13.1
Elm-Ash-Cottonwood	**1,681,800**	1,300,800	381,000	22.7
Maple-Beech-Birch	**3,302,100**	2,444,500	857,600	26.0
Aspen-Birch	**2,226,300**	1,468,200	758,100	34.1
Total	**12,789,400**	**9,854,200**	**2,935,200**	**23.0**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

Table 3. Acres of forest by stand size class and estimated drumming male grouse population in 2005 by state in the portion of the Prairie Hardwood Transition (BCR 23) that supports ruffed grouse.

State	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
IL	**92,700**	92,700	0	0.0	1,400	9.7
IN	**200,300**	169,700	30,600	15.3	3,500	11.3
IA	**403,000**	361,300	41,700	10.3	4,400	6.9
MI	**4,062,500**	3,450,300	612,200	15.1	54,700	8.6
MN	**2,177,000**	1,780,000	397,000	18.2	43,000	12.6
WI	**7,063,100**	5,933,300	1,129,800	16.0	103,200	9.4
Total	**13,998,600**	**11,787,300**	**2,211,300**	**15.8**	**210,200**	**9.6**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 4. Acres of forest by forest type group and stand size class in 2005 in the portion of the Prairie Hardwood Transition (BCR 23) that supports ruffed grouse.

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**404,900**	268,800	136,100	33.6
Pine	**1,178,200**	997,400	180,800	15.3
Oak-Pine	**445,300**	352,500	92,800	21.0
Oak	**5,295,300**	4,798,600	496,700	9.4
Elm-Ash-Cottonwood	**1,906,400**	1,551,900	354,500	18.6
Maple-Beech-Birch	**3,172,400**	2,753,000	419,400	13.2
Aspen-Birch	**1,596,100**	1,065,100	531,000	33.3
Total	**13,998,600**	**11,787,300**	**2,211,300**	**15.8**

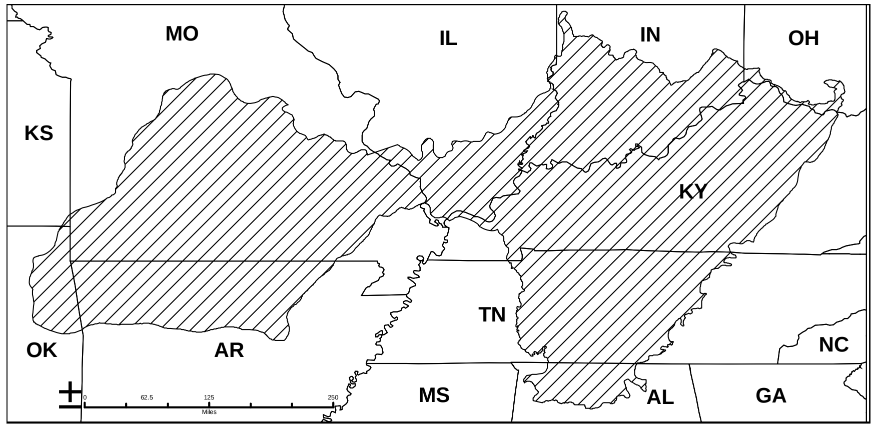
[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

BCR 24

Central Hardwood Forest

Jeffery D. Sole

The Nature Conservancy



The Central Hardwood Forest (BCR 24) consists of fragmented transitional forest between the maple-beech-birch and oak-hickory dominated forests of the Southern Appalachians to the east, pine dominated forests to the south, grassland/cropland dominated landscapes to the west, and northern forest types to the north. Oak and oak-pine forests account for 72% of the forestland in this region and have increased 16% since 1980.

Ruffed grouse and other forest wildlife are negatively affected by the conversion of forest to other land uses and the fragmentation of remaining forest tracts in BCR 24. Much of this region's original forestland has been converted to agricultural land. Although total forestland in this region has increased 10% since 1980, the area of small-diameter forest has declined by 56% (Tables 1 and 3).

Ruffed grouse historically occurred throughout most of BCR 24. However ruffed grouse were eliminated from much of the region during the mid- to late-1800's due to market hunting and habitat losses that occurred with European settlement. Several states within this region (Arkansas, Illinois, Indiana, Kentucky, Missouri, Tennessee) have attempted to restore ruffed grouse to portions of their former range. Some of these restoration efforts were successful in the short term. However, the declines in young forest habitats subsequent to these reintroduction efforts likely negatively affected their long-term success.

The estimated ruffed grouse drumming male population density has declined by 10% since 1980. These estimates are likely higher than the actual population densities and underestimate actual declines due to the highly fragmented nature of the forest landscape and because the area from which the forest inventory statistics were compiled is significantly greater than the actual occupied grouse range. Drumming survey data from Indiana document a 73% population decline since the mid 1980s.

Because of very low ruffed grouse population densities, BCR 24 supports little ruffed grouse hunter effort or harvest. Comprehensive ruffed grouse hunter number and harvest data are unavailable for most jurisdictions within BCR 24. Ruffed grouse hunter numbers and harvest in Indiana have declined approximately 75% since the mid 1970s.

The restoration of the ruffed grouse drumming male population density in BCR 24 to the 1980 level will require increasing the current proportion of small-diameter forest by approximately 14% to 523,200 acres (211,800 ha). Maintaining this amount of small-diameter forest will require annual even-age treatments on 26,200 acres (10,600 ha).

Table 1. Acres of forest by stand size class and estimated drumming male grouse population in 1980 by state in the portion of the Central Hardwood Forest (BCR 24) that supports ruffed grouse.

State	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population[3]	Estimated drumming male grouse density[4]
AR	**1,339,900**	1,017,600	322,300	24.1	4,200	2.0
IL	**706,300**	566,800	139,500	19.8	2,100	1.9
IN	**2,337,800**	1,847,800	490,000	21.0	7,100	1.9
MO	**627,900**	535,200	92,700	14.8	1,800	1.8
Total	**5,011,900**	**3,967,400**	**1,044,500**	**20.8**	**15,200**	**1.9**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male density estimates are 0.25 per 100 acres (40 ha) of large-diameter forest and 0.5 per 100 acres (40 ha) of small-diameter forest.
[4]Drumming male grouse per square mile (2.6 square kilometers)

Table 2. Acres of forest by forest type group and stand size class in 1980 in the portion of the Central Hardwood Forest (BCR 24) that supports ruffed grouse.

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Pine	**238,000**	159,000	79,000	33.2
Red Cedar	**38,400**	29,500	8,900	23.2
Cedar–Hardwood	**75,000**	46,100	28,900	38.5
Oak–Pine	**203,900**	141,500	62,400	30.6
Oak	**3,192,500**	2,622,000	570,500	17.9
Elm–Ash-Cottonwood	**490,500**	379,900	110,600	22.5
Maple-Beech-Birch	**773,600**	589,300	184,300	23.8
Total	**5,011,900**	**3,967,400**	**1,044,500**	**20.8**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

Table 3. Acres of forest by stand size class and estimated drumming male grouse population in 2005 by state in the portion of the Central Hardwood Forest (BCR 24) that supports ruffed grouse.

State	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population[3]	Estimated drumming male grouse density[4]
AR	**1,574,000**	1,434,400	139,600	8.9	4,300	1.7
IL	**756,500**	738,000	18,500	2.5	1,900	1.6
IN	**2,418,200**	2,215,100	203,100	8.3	6,500	1.7
MO	**746,200**	648,500	97,700	13.1	2,100	1.8
Total	**5,494,900**	**5,036,000**	**458,900**	**8.4**	**14,800**	**1.7**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male density estimates are 0.25 per 100 acres (40 ha) of large-diameter forest and 0.5 per 100 acres (40 ha) of small-diameter forest.
[4]Drumming male grouse per square mile (2.6 square kilometers)

Table 4. Acres of forest by forest type group and stand size class in 2005 in the portion of the Central Hardwood Forest (BCR 24) that supports ruffed grouse.

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Pine	**147,400**	128,400	19,000	12.9
Red Cedar	**18,900**	15,700	3,200	16.9
Cedar–Hardwood	**356,700**	288,800	67,900	19.0
Oak–Pine	**140,100**	123,200	16,900	12.1
Oak	**3,810,800**	3,531,600	279,200	7.3
Elm–Ash-Cottonwood	**429,700**	385,100	44,600	10.4
Maple-Beech-Birch	**587,100**	560,500	26,600	4.5
Aspen	**4,200**	2,700	1,500	35.7
Total	**5,494,900**	**5,036,000**	**458,900**	**8.4**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

BCR 28

Appalachian Mountains

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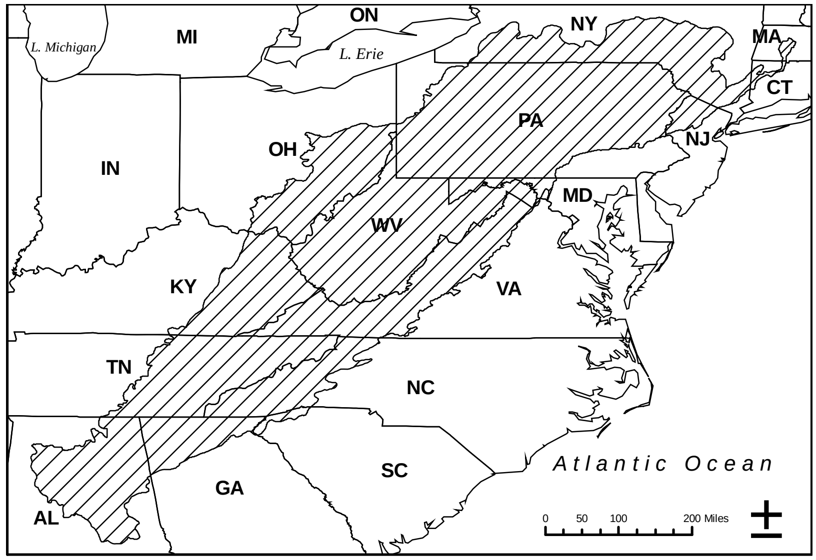


The Appalachian Mountains region (BCR 28) is characterized by relatively rugged terrain and encompasses the Blue Ridge Mountains, the Ridge and Valley province, the Allegheny Plateau, the Ohio Hills, and the Cumberland Plateau. Valley bottoms are typically dominated by agricultural or suburban land uses.

BCR 28 is comprised of various deciduous forest type groups, the two most important to ruffed grouse being oak and maple-beech-birch forest type groups. Oak and maple-beech-birch forests account for 67%, and 23%, of the forest of this region, respectively. Oak forests are predominant in the southern portion of the region and on relatively dry sites; maple-beech-birch forests are common in the northern portion of the region and on relatively moist sites characteristic of higher elevations and north and east exposures. Coniferous species including pine, eastern hemlock, spruce and fir are also present at higher elevations and can be important to regional ruffed grouse populations..

Since 1980, total forest area in BCR 28 has increased slightly (Tables 1 and 3). However, the area of small-diameter forest has decreased by 34% during this same time period (Tables 1 and 3). Within some portions of BCR 28, the reclamation of surface mines to grassland has decreased the availability of small-diameter forest habitat and has increased forest fragmentation, thereby reducing habitat for ruffed grouse.

In general, oak forests provide lower quality habitat for ruffed grouse, particularly in years of poor acorn production, than forest types characteristic of more moist sites, such as maple-beech-birch and pine or spruce-fir. The area of small-diameter oak forest and small-diameter maple-beech-birch forest has declined by 34%, and 40%, respectively, since 1980 (Tables 1 and 3).

The estimated ruffed grouse drumming male population density has declined by 6% since 1980. However, the significant loss of small-diameter forest throughout BCR 28 would suggest grouse populations should have decreased substantially. Results from the Appalachian Cooperative Grouse Research Project also suggest a relatively substantial decrease in regional ruffed grouse populations (Devers 2005). Ruffed grouse drumming survey data are available for an extended period only from Ohio. Ohio drumming survey data document a significant long-term decline of approximately 65%.

Flush-rate data from cooperating volunteers indicate significant long-term declines in North Carolina and West Virginia. Flush-rate data for Kentucky, Pennsylvania and Virginia show annual variation, but no significant trends. Both ruffed grouse hunter numbers and hunter harvest have declined significantly in Maryland, New York and Virginia.

The restoration of the ruffed grouse drumming male population density in BCR 28 to the 1980 level will require increasing the current proportion of small-diameter forest by approximately 10% to 7,290,000 acres (2,951,400 ha). Maintaining this amount of small-diameter forest will require annual even-age treatments on 364,500 acres (147,600 ha).

Table 1. Acres of forest by stand size class and estimated drumming male grouse population in 1980 by state in the Appalachian Mountain Region (BCR 28).

State	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
GA	**2,888,900**	2,312,400	576,500	19.6	24,300	5.4
KY	**5,893,100**	4,242,600	1,650,500	28.0	52,800	5.7
MD	**587,900**	534,100	53,800	9.2	4,500	4.9
NJ	**460,900**	448,300	12,600	2.7	3,300	4.6
NC	**3,291,100**	3,011,600	279,500	8.5	25,000	4.9
NY	**5,338,900**	3,785,200	1,553,700	29.1	48,200	5.8
OH	**4,050,700**	3,051,800	998,900	24.7	43,100	6.8
PA	**14,510,900**	12,315,500	2,195,400	15.1	116,900	5.2
TN	**5,710,000**	4,759,900	950,100	16.6	46,600	5.2
VA	**5,478,700**	4,878,500	600,200	11.0	42,600	5.0
WV	**11,900,300**	10,687,100	1,213,200	10.2	91,800	4.9
Total	**60,111,400**	**50,027,000**	**10,084,400**	**16.8**	**499,100**	**5.3**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 2. Acres of forest by forest type group and stand size class in 1980 in the Appalachian Mountain Region (BCR 28).

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**263,500**	144,100	119,400	45.0
Pine	**5,104,500**	4,137,500	967,000	18.9
Oak	**37,123,400**	31,801,900	5,321,500	14.3
Oak-Pine	**3,617,000**	2,913,300	703,700	19.5
Elm-Ash-Maple Cottonwood	**1,004,900**	702,200	302,700	30.1
Maple-Beech Birch-Cherry	**12,497,200**	10,041,300	2,455,900	19.6
Aspen-Birch	**500,900**	286,700	214,200	42.8
Total	**60,111,400**	**50,027,000**	**10,084,400**	**16.8**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

Table 3. Acres of forest by stand size class and estimated drumming male grouse population in 2005 by state in the Appalachian Mountain Region (BCR 28).

State	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
GA	**2,714,200**	2,245,700	468,500	17.3	22,300	5.3
KY	**5,624,900**	5,146,300	478,600	8.5	42,700	4.9
MD	**546,800**	479,300	67,500	12.3	4,300	5.0
NJ	**460,400**	436,000	24,400	5.3	3,400	4.7
NC	**3,219,400**	2,755,800	463,600	14.4	25,800	5.1
NY	**5,679,800**	4,974,000	705,800	12.4	44,700	5.0
OH	**4,656,300**	4,018,400	637,900	13.7	37,100	5.1
PA	**14,986,900**	13,322,800	1,664,100	11.1	116,600	5.0
TN	**5,591,200**	5,021,300	569,900	10.2	43,100	4.9
VA	**5,595,500**	5,012,500	583,000	10.4	43,200	4.9
WV	**11,797,000**	10,833,000	964,000	8.2	89,300	4.8
Total	**60,872,400**	**54,245,100**	**6,627,300**	**10.9**	**472,500**	**5.0**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 4. Acres of forest by forest type group and stand size class in 2005 in the Appalachian Mountain Region (BCR 28).

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**353,300**	224,800	128,500	36.4
Pine	**4,043,100**	3,351,900	691,200	17.1
Oak	**37,431,600**	33,901,100	3,530,500	9.4
Oak-Pine	**3,184,400**	2,747,700	436,700	13.7
Elm-Ash-Maple Cottonwood	**1,214,800**	1,067,600	147,200	12.1
Maple-Beech Birch-Cherry	**14,272,100**	12,786,400	1,485,700	10.4
Aspen-Birch	**373,100**	165,600	207,500	55.6
Total	**60,872,400**	**54,245,100**	**6,627,300**	**10.9**

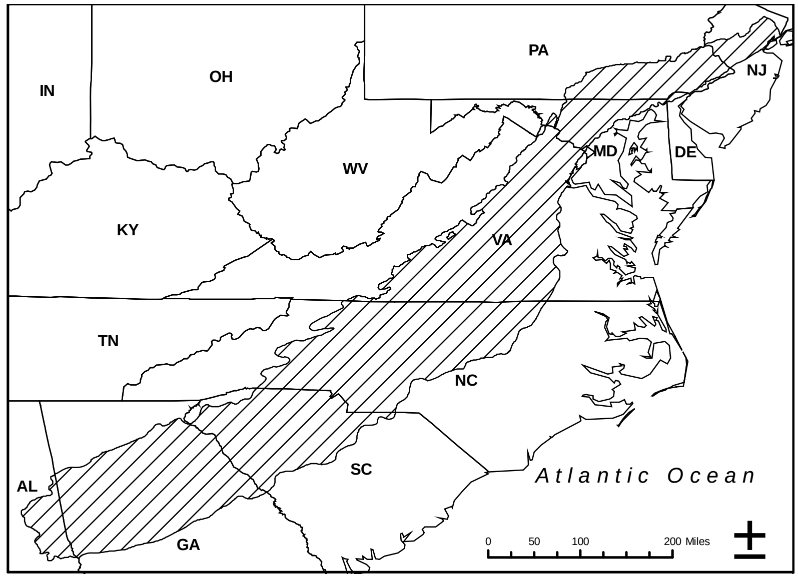
[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

BCR 29

Piedmont

K. Marc Puckett

Virginia Department of Game and Inland Fisheries



The Piedmont (BCR 29) is a transition zone between the Appalachian Mountains to the west and the coastal plain to the east. This region occurs from northeastern Alabama to north central New Jersey. Elevation varies from 90 feet (27 m) in the east to as high as 1200 feet (366 m) on the western edge. This region supports a wide variety of forest types due to the broad geographic area encompassed and the variation in elevation.

BCR 29 borders some of the most populated geographic regions in the United States. Much of the eastern portion of this region has experienced rapid growth, suburban sprawl and a loss of farmland. Much of the farmland abandoned during the mid-1900s that has not yet been developed is now mature forest or commercial pine plantation. Only approximately 4,000,000 acres (1,619,400 ha), or the western 8% of this region support ruffed grouse populations.

Since 1980, total forest area has decreased by 4% and area of small-diameter forest has increased by 7% (Tables 1 and 3). This increase in small-diameter forest can probably be attributed to a relatively active pulpwood market. Changes in the area of small-diameter forest have varied widely by state. Maryland and Pennsylvania have lost substantial small-diameter forest, while New Jersey and North Carolina have seen substantial increases. The most notable change in forest composition is the decline in the mixed-mesic deciduous small-diameter size class, where total acreage declined by 43% since 1980 (Tables 2 and 4). Small-diameter mixed-mesic deciduous habitats are the most productive habitats for ruffed grouse in the relatively dry forests of this region.

Ruffed grouse flush-rate data from cooperating volunteers indicate significant long-term declines in North Carolina. Flush-rate data for Pennsylvania and Virginia show annual variation, but no significant trends. Both ruffed grouse hunter numbers and hunter harvest have declined significantly in Maryland. The estimated ruffed grouse drumming male population density appears stable, although very low (Tables 1 and 3).

The ruffed grouse drumming male population density in BCR 29 could be sustained at the 1980 level by maintaining 650,600 acres (263,400 ha) of small-diameter forest. Maintaining this amount of small-diameter forest will require annual even-age treatments on 32,500 acres (13,200 ha).

Table 1. Acres of forest by stand size class and estimated drumming male grouse population in 1980 by state in the portion of the Piedmont (BCR 29) that supports ruffed grouse.

State	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
MD	**116,800**	92,700	24,100	20.6	400	2.2
NJ	**246,300**	231,700	14,600	5.9	700	1.8
NC	**995,500**	831,500	164,000	16.5	2,800	1.8
PA	**580,800**	501,900	78,900	13.6	1,700	1.9
VA	**2,015,100**	1,685,800	329,300	16.3	5,900	1.9
Total	**3,954,500**	**3,343,800**	**610,700**	**15.4**	**11,500**	**1.9**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 2. Acres of forest by forest type group and stand size class in 1980 in the portion of the Piedmont (BCR 29) that supports ruffed grouse.

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Plantation Pine	**514,700**	380,400	134,300	26.0
Oak	**3,071,300**	2,667,200	404,100	12.5
Mixed mesic Deciduous[3]	**224,800**	164,500	60,300	26.8
Other	**143,700**	131,700	12,000	17.4
Total	**3,954,500**	**3,343,800**	**610,700**	**15.4**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Includes primarily maple-dominated forest types.

Table 3. Acres of forest by stand size class and estimated drumming male grouse population in 2005 by state in the portion of the Piedmont (BCR 29) that supports ruffed grouse.

State	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
MD	**93,700**	87,300	6,400	6.9	300	2.0
NJ	**270,600**	204,200	66,400	24.5	800	1.9
NC	**918,600**	699,600	219,000	23.8	2,800	2.0
PA	**554,100**	516,400	37,700	6.8	1,500	1.7
VA	**2,014,200**	1,693,100	321,100	15.9	5,800	1.9
Total	**3,851,200**	**3,200,600**	**650,600**	**16.9**	**11,200**	**1.9**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees $\leq$ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 4. Acres of forest by forest type group and stand size class in 2005 in the portion of the Piedmont (BCR 29) that supports ruffed grouse.

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Plantation Pine	**504,900**	381,200	123,700	24.5
Oak	**2,987,800**	2,558,700	429,100	13.4
Mixed mesic Deciduous[3]	**163,600**	129,300	34,300	20.9
Other	**194,900**	131,400	63,500	32.5
Total	**3,815,200**	**3,200,600**	**650,600**	**17.1**

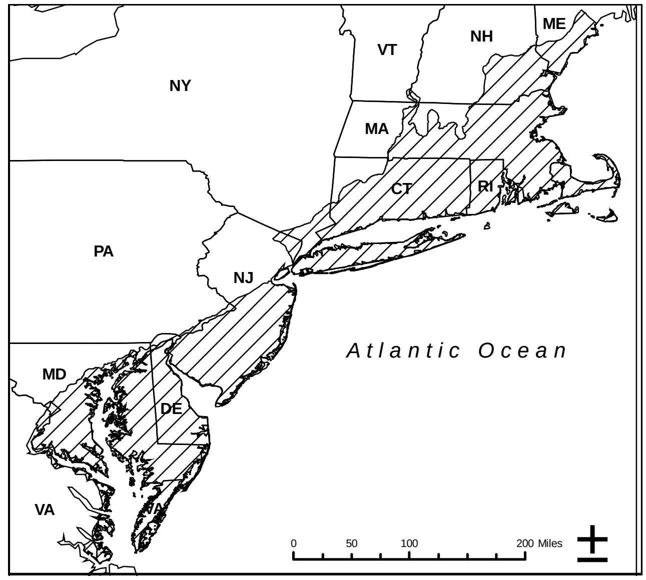
[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees $\leq$ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Includes primarily maple-dominated forest types.

BCR 30

New England/Mid-Atlantic Coast

Scot J. Williamson

Wildlife Management Institute



The New England/Mid-Atlantic Coast (BCR 30) includes the coastal portions of New England and the mid Atlantic states. Ruffed grouse do not exist in the BCR on Long Island, New York, Delaware, Maryland and Virginia, so those portions of the BCR are excluded from the analysis.

Primary forest types in BCR 30 include maple-beech-birch, oak and oak-pine forest. Dominant forest types change on a north to south gradient. The northern-most portions of BCR 30 in Maine and New Hampshire are composed equally of maple-beech-birch, oak and white-red-jack pine forest type groups. In the southern portions of BCR 30, oak forests become increasingly abundant while maple-beech-birch and pine forest type groups decline.

Fire played an important role in shaping BCR 30 forest habitats, particularly in the maintenance of oak types and pitch pine barrens. Insects and diseases are important natural disturbance factors, especially exotic varieties. Gypsy moth, beech bark disease, chestnut blight, Dutch elm disease and hemlock woolly adelgid, among others, affect forest composition and structure.

By the early 1900s, roughly 70% of the land had been cleared for agriculture or settlement. Farm abandonment resulted in a temporary increase in early-successional habitats in the mid 1900s. Since then, urbanization and maturation of forests have resulted in steady declines in availability of small-diameter forest.

Since 1980, over 500,000 acres (202,430 ha) of forest has been converted to some other land use (Tables 1 and 3), primarily suburban or commercial development. Small-diameter forests have declined by 35% and currently account for only 7.5% of the forest landscape (Tables 1 and 3). This recent decline is overshadowed by the significant decline in small-diameter forest and shrub-dominated habitats between the 1960s and 1980. The ongoing loss of small-diameter forest is occurring throughout this region. Due to their dominance within BCR 30, maple-beech-birch and oak types support the majority of small-diameter forest (27% and 37%, respectively) (Table 4).

The estimated ruffed grouse drumming male population density has declined by 5% since 1980 (Tables 1 and 3). Estimated declines in population density are greatest in New Hampshire, New Jersey and Rhode Island (Table 3). Estimated ruffed grouse populations have declined since 1980 in all states within the region except Maine. Short-term drumming survey data and hunter observations from New Hampshire suggest either a stable or slightly declining trend in grouse numbers since the mid 1990s.

Few data on ruffed grouse hunter numbers or harvest are available. New Jersey estimates that ruffed grouse hunter numbers and harvest have declined by 84%, and 77%, respectively.

The restoration of the ruffed grouse drumming male population density in BCR 30 to the 1980 level will require increasing the current proportion of small-diameter forest by approximately 11% to 467,400 acres (189,200 ha). Maintaining this amount of small-diameter forest will require annual even-age treatments on 23,400 acres (9,500 ha).

Table 1. Acres of forest by stand size class and estimated drumming male grouse population in 1980 by state in the portion of the New England/Mid-Atlantic Coast (BCR 30) that supports ruffed grouse.

State	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
CT	**1,400,300**	1,282,300	118,000	8.4	14,300	6.6
MA	**2,168,900**	1,989,400	179,500	8.3	21,100	6.2
ME	**513,500**	513,500	0	0.0	5,600	7.0
NH	**505,500**	463,400	42,100	8.3	5,900	7.4
NJ	**1,149,500**	917,500	232,000	20.2	11,800	6.6
RI	**356,100**	278,100	78,000	21.9	4,000	7.3
Total	**6,093,800**	**5,444,200**	**649,600**	**10.7**	**62,700**	**6.6**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees $\leq$ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 2. Acres of forest by forest type group and stand size class in 1980 in the portion of the New England/Mid-Atlantic Coast (BCR 30) that supports ruffed grouse.

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**8,300**	8,300	0	0.0
Pine	**1,600,300**	1,428,700	171,600	10.7
Oak	**1,133,000**	1,014,600	118,400	10.5
Oak-Pine	**441,700**	402,700	39,000	8.8
Elm-Ash-Maple Cottonwood	**316,000**	244,700	71,300	22.6
Maple-Beech-Birch	**2,153,100**	1,947,800	205,300	9.5
Aspen-Birch	**76,300**	47,100	29,200	38.3
Uncl. Coniferous	**238,700**	223,900	14,800	6.2
Uncl. Deciduous	**126,300**	126,300	0	0.0
Total	**6,093,700**	**5,444,100**	**649,600**	**10.7**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees $\leq$ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

Table 3. Acres of forest by stand size class and estimated drumming male grouse population in 2005 by state in the portion of the New England/Mid-Atlantic Coast (BCR 30) that supports ruffed grouse.

State	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter	Estimated drumming male grouse population	Estimated drumming male grouse density[3]
CT	**1,262,600**	1,174,600	88,000	7.0	12,700	6.4
MA	**1,881,400**	1,769,200	112,200	6.0	18,300	6.2
ME	**499,500**	445,600	53,900	10.8	5,800	7.4
NH	**468,700**	462,100	6,600	1.4	4,200	5.7
NJ	**1,130,600**	991,500	139,100	12.3	10,500	5.9
RI	**339,700**	318,400	21,300	6.3	3,200	6.0
Total	**5,582,400**	**5,161,300**	**421,100**	**7.5**	**54,700**	**6.3**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[3]Drumming male grouse per square mile (2.6 square kilometers)

Table 4. Acres of forest by forest type group and stand size class in 2005 in the portion of the New England/Mid-Atlantic Coast (BCR 30) that supports ruffed grouse.

Forest Type Group	**Total**	Large Diameter[1]	Small Diameter[2]	% Small Diameter
Spruce-Fir	**68,300**	59,400	8,900	13.0
Pine	**988,700**	932,600	56,100	5.7
Oak	**2,185,100**	2,028,900	156,200	7.1
Oak-Pine	**624,200**	587,900	36,300	5.8
Elm-Ash-Maple Cottonwood	**231,900**	221,400	10,500	4.5
Maple-Beech-Birch	**1,342,700**	1,229,700	113,000	8.4
Aspen-Birch	**69,800**	34,800	35,000	50.2
Uncl. Coniferous				
Uncl. Deciduous	**71,700**	66,600	5,100	7.1
Total	**5,582,400**	**5,161,300**	**421,100**	**7.5**

[1]Stands of trees > 5 inches (12.5 cm) d.b.h.
[2]Stands of trees ≤ 5 inches (12.5 cm) d.b.h. and nonstocked stands.

RANGEWIDE ASSESSMENT

Comparable data from two consecutive inventories are not universally available; therefore, trend estimates are not possible for all BCRs. Regional trends vary, but population densities have declined in most eastern regions and have increased in those western regions where estimates are available (Table 1).

Table 1. Historical and current estimates of ruffed grouse breeding population density by Bird Conservation Region.

Bird Conservation Region	1980 Ruffed Grouse Density[1]	2005 Ruffed Grouse Density	% Change
4 – Boreal Forest	na[2]	na	
5 – Northern Pacific Rainforest	0.19	0.28	47
6 – Boreal Taiga Plains	na	14.1	
8 – Boreal Softwood Shield Forest	na	10.3	
10 – Northern Rockies	0.06	0.11	83
12 – Boreal Hardwood Transition	12.8	12.8	0
13 – Lower Great Lakes/ St. Lawrence Plain	9.5	9.1	- 4
14 – Atlantic Northern Forest	9.1	9.8	9
16 – Southern Rockies Colorado Plateau	0.5	0.8	60
22 – Eastern Tallgrass Prairie	4.3	3.2	- 26
23 – Prairie Hardwood Transition	10.9	9.6	- 12
24 – Central Hardwood Forest	1.9	1.7	- 10
28 – Appalachian Mountains	5.3	5.0	- 6
29 – Piedmont	1.9	1.9	0
30 – New England/Mid-Atlantic Coast	6.6	6.3	- 5

[1]Drumming male grouse per square mile (2.6 square kilometers)
[2]Comprehensive data for entire BCR are unavailable

Ruffed grouse population densities are strongly dependent upon the proportion of small-diameter forest habitat on the landscape. The acreage of small-diameter forest required to support ruffed grouse population densities at 1980 levels and the annual acreage of even-age forest management treatments required to do so is presented for each BCR in Table 2.

Table 2. Acres of small-diameter forest and annual management required to sustain ruffed grouse populations at, or restore these populations to 1980 levels by Bird Conservation Region.

Bird Conservation Region	Small-Diameter[1] Forest Objective (acres)	Even-Age Management Annual Objective[2] (acres)
4 – Boreal Forest	na	na
5 – Northern Pacific Rainforest	839,700[3]	42,000[3]
6 – Boreal Taiga Plains	na[4]	na
8 – Boreal Softwood Shield Forest	na	na
10 – Northern Rockies	208,400[3]	10,400[3]
12 – Boreal Hardwood Transition	14,617,000	730,900
13 – Lower Great Lakes/ St. Lawrence Plain	3,543,300	177,200
14 – Atlantic Northern Forest	10,669,300	533,500
16 – Southern Rockies Colorado Plateau	717,000[3]	35,900[3]
22 – Eastern Tallgrass Prairie	354,800	17,700
23 – Prairie Hardwood Transition	2,653,600	132,700
24 – Central Hardwood Forest	523,200	26,200
28 – Appalachian Mountains	7,290,000	364,500
29 – Piedmont	650,600	32,500
30 – New England/Mid-Atlantic Coast	467,400	23,400

[1]Stands of trees $\leq$ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[2]Determined by dividing the Small-Diameter Forest Objective by 20. Assumes minimal small-diameter forest created by natural disturbance.
[3]Deciduous forest only.
[4]Not available due to incomplete forest inventory data.

The use of BCRs provides the ecological foundation for the ruffed grouse population goals and associated habitat management objectives. However, the implementation of the recommendations designed to accomplish these objectives is likely to be coordinated by resource management agencies responsible for specific jurisdictions. Therefore, small-diameter forest objectives and annual treatment targets are provided for each state and province (Table 3).

Table 3. Acres of small-diameter forest and annual management required to sustain ruffed grouse populations at, or restore these populations to 1980 levels by political jurisdiction where population data are available.

Political Jurisdiction	Small-Diameter[1] Forest Objective (acres)	Even-Age Management Annual Objective[2] (acres)
Arkansas	159,100	8,000
California	61,400[3]	3,100[3]
Colorado	0	0
Connecticut	105,500	5,300
Georgia	515,400	25,800
Idaho	60,000[3]	3,000[3]
Illinois	36,200	1,800
Indiana	287,200	14,400
Iowa	90,700	4,500
Kansas	20,900	1,000
Kentucky	526,500	26,300
Maine	4,728,900	236,400
Maryland	80,700	4,000
Massachusetts	153,100	7,700
Michigan	3,674,000	183,700
Minnesota	4,978,300	248,900
Missouri	263,700	13,200
Montana	192,000[3]	9,600[3]
New Hampshire	406,500	20,300
New Jersey	247,600	12,400
New York	2,080,400	104,000
North Carolina	729,000	36,500
Ohio	1,013,400	50,700
Oregon	534,500[3]	26,700[3]
Pennsylvania	1,992,100	99,600
Rhode Island	23,600	1,200
Tennessee	626,900	31,300
Utah	493,400[3]	24,700[3]
Vermont	417,500	20,900
Virginia	962,400	48,100
Washington	256,800[3]	12,800[3]
West Virginia	1,060,400	53,000
Wisconsin	3,544,500	177,200
Wyoming	60,800[3]	3,000[3]
New Brunswick	2,613,500	130,700
Nova Scotia	759,200	38,000
Ontario	3,321,400	166,100
Prince Edward Island	113,900	5,700
Quebec	5,237,100	261,900

[1]Stands of trees $\leq$ 5 inches (12.5 cm) d.b.h. and nonstocked stands.
[2]Determined by dividing the Small-Diameter Forest Objective by 20. Assumes minimal small-diameter forest created by natural disturbance.
[3]Deciduous forest only.

HABITAT MANAGEMENT RECOMMENDATIONS

Ruffed grouse response to habitat manipulation has been well documented in various forest types throughout much of the eastern portion of the grouse range. However, data documenting ruffed grouse response to habitat change caused either by man or by natural disturbance in the West are largely unavailable. The following habitat management recommendations were developed using the available scientific literature and the regional expertise of wildlife professionals where empirical data are lacking.

- In areas where ruffed grouse habitat development is a priority, promote the use of even-age forest management prescriptions.

- Sustain aspen-birch forest types wherever possible.

    - In aspen-birch forests, if residual trees are to be retained in clearcut patches, residual basal area should be ≤ 10-15 sq. ft. /acre (1 – 1.5 sq. m/ha) and residual trees should be clumped.

- In oak- or maple-dominated or other moderately shade-intolerant forests, if residual trees are to be retained in clearcut patches, residual basal area should be ≤ 25 sq. ft. /acre (2.3 sq. m/ha) and residual trees should be clumped.

- In Appalachian oak forests, maintain a mosaic of young stands (< 20 years old) well interspersed with mature stands (> 40 years old) to provide both protective cover and a source of hard mast.

- In western forests, sustain aspen and other deciduous forest types along and adjacent to riparian corridors by eliminating encroaching conifers and regenerating mature and over mature stands.

- Promote small-patch habitats [2.5 – 10 acres (1 – 4 ha)] where possible, but note that large-patch habitats may be more beneficial on landscapes where small-diameter forest is both rare and spatially isolated or where ungulate browsing may hinder the survival of regenerating stems.

- Distribute habitat patches spatially so that food sources and important protective habitats are in close proximity to one another or connected by corridors or small patches of adequate protective cover.

- In regions with relatively flat topography, target management efforts in the ecotone between upland and lowland sites as these habitats typically support a dense shrub understory and abundant herbaceous ground vegetation.

- In regions with substantial topographic relief in the East, target habitat development on north and east exposures and at low-elevations as these sites are generally relatively moist and support a dense shrub understory and abundant herbaceous ground vegetation. Because drumming males often establish drumming sites on upper slopes, mid-elevation habitats can act as important travel corridors for males between drumming and foraging sites.

- In high-elevation forests of the West or the boreal forests of Canada and Alaska, target habitat development on south and west exposures to take advantage of relatively warm microclimates in these cool regions.

- Where small spring seeps or other moist pockets are present, reduce canopy cover to promote the establishment of a shrub understory and herbaceous food plants. This may be especially important in the West where warm and dry summer weather can reduce the availability of succulent herbaceous forage. However, care must be taken to retain sufficient canopy cover to sustain adequate soil moisture.

- Retain clumps of dense-needled conifers (spruce, fir, balsam, cedar) or ericaceous shrubs to provide protection from inclement winter weather where such protection is limited.

- Seed and maintain clover or some other legume on log landings, skid trails and other forest openings to provide a source of insects and herbaceous vegetation.

- "Daylight" forest roads by removing overstory trees within 30 – 50 feet on one or both sides of the road to provide protective travel corridors of small-diameter forest.

- Release sources of soft mast from competition by overtopping trees and shrubs to enhance food production.

- Incorporate shrub and tree seedling plantings into surface mine reclamation practices.

CHALLENGES AND OPPORTUNITIES IN RUFFED GROUSE CONSERVATION

Various challenges affect the ability of resource managers and private landowners to develop and maintain habitats beneficial to ruffed grouse. Some of these challenges result from incomplete information on ruffed grouse ecology and management and others are the result of changes in forest management policy or regulation. The following is a list of the primary challenges affecting ruffed grouse conservation and potential opportunities to resolve some of these challenges.

- **Public misunderstanding of the ecological role of forest disturbance**

  There is relatively widespread misunderstanding in the public of the importance of disturbance (primarily active forest management in the East and fire in the West) in the establishment and maintenance of disturbance-dependent forest communities and small-diameter forest habitats. This misunderstanding can lead to opposition and subsequent policies that complicate efforts to sustain these communities and habitats.

  This is a significant challenge that can only be resolved through long-term and consistent educational efforts geared toward the general public and policy makers.

- **Availability of commercial markets for wood fiber**

  In the East, the vast majority of small-diameter forest is established as a result of commercial timber harvest. However, in many locales, there is a very limited market for small- and medium-diameter trees and a common management practice is to remove only those trees of sufficient size to be economically viable. This can result in the retention of too many residual trees to allow a dense, small-diameter habitat to develop. In the West, most commercial timber harvest is within coniferous forest types that provide little habitat benefit to ruffed grouse.

  Additional markets for small- and medium-diameter trees in the East and deciduous tree species in the West would aid in the establishment of habitats suitable for ruffed grouse. The forest products industry is increasing its use of small- and medium-diameter trees as it strives to increase the efficiency of each individual harvest operation. In addition, the emerging interest in biofuels may provide opportunities to establish markets for wood fiber of all sizes.

- **Forest fragmentation**

  Throughout much of the range of the ruffed grouse, the fragmentation of large blocks of forest habitat into smaller parcels through conversion to other land uses is a common occurrence and has a negative effect on ruffed grouse habitat quality. In addition, the fragmentation of “functional” forest due to residential sprawl or the construction of second homes has a similar negative effect on ruffed grouse habitat.

- **Forest ownership fragmentation**

  The number of privately owned forested tracts is increasing in many regions due to large forested parcels being divided into smaller tracts. This has the potential to negatively affect future ruffed grouse habitat availability because owners of small tracts of forest are less likely to implement forest management treatments than are owners of large tracts.

- **Intensive silviculture**

  Pre-commercial thinning

  Although not yet common in most regions, there appears to be an increase in the practice of thinning 5- to- 10-year-old stands of aspen by mowing strips within these stands to concentrate growth on the remaining stems, thereby shortening the eventual rotation. In other young forest stands, eventual crop trees of high-value species are sometimes released by felling all competing stems. Currently these practices are primarily implemented on forest industry owned lands in the East. The effects of this type of thinning on ruffed grouse populations have not been documented, but “opening” these stands in this manner at precisely the age when they are beginning to provide quality habitat for ruffed grouse may reduce local population densities.

  Use of herbicides to release young conifers

  Small-diameter deciduous shrubs and trees are often a significant component of stands resulting from the natural regeneration of mixed forests or the establishment of conifer plantations on some sites. The application of herbicides to 2- to- 5-year-old stands to release the conifers from deciduous competition can dramatically reduce eventual habitat quality for ruffed grouse.

  Ruffed grouse habitat quality on all or portions of these sites could be maintained if the application of herbicides was delayed until deciduous stem densities have been reduced, through natural thinning, to levels that provide less than quality ruffed grouse habitat.

- **Overly restrictive riparian area management guidelines**

  Guidelines affecting the management of forested riparian areas are increasingly proscriptive with regard to the removal of overstory vegetation through active forest management. Such guidelines complicate efforts to establish small-diameter forest habitats on these inherently productive moist soil sites; habitats that are very important to ruffed grouse across North America.

  Riparian areas unquestionably warrant special consideration during the planning and implementation of active forest management. However, small-diameter forest and shrubland habitats in riparian areas are important to ruffed grouse and other wildlife and should be incorporated as a component of riparian area management. The potential negative impacts of management activities can be mitigated by the use of light-on-the-land harvest equipment and timing activities to coincide with frozen-ground conditions where applicable.

- **West Nile Virus**

  The potential for West Nile Virus to affect the ecology of gallinaceous birds was demonstrated in Wyoming where it killed a high percentage of nesting sage grouse. In 2004, wildlife disease experts from the US Geological Survey collected samples from ruffed grouse harvested at the Ruffed Grouse Society's National Ruffed Grouse and Woodcock Hunt in northern Minnesota to determine if West Nile Virus was present in the local population. The results from this initial effort were mixed due in part to still-evolving sample collection procedures. Additional sampling was conducted in 2005. The virus itself was not isolated from the 2005 sample, but antibodies to the virus were found in a single bird. This suggests that the virus is present in the local population, although the incidence thereof can't be determined. However, the fact that antibodies were present suggests that ruffed grouse can successfully defend themselves against this virus although, again, the degree to which they can do so can't yet be determined. Coordinated efforts to evaluate the prevalence of the virus in other regions are needed.

- **Ungulate browsing**

  Browsing by wild and domestic ungulates on regenerating deciduous tree and shrub species can negatively affect stem densities and growth and, therefore, habitat quality for ruffed grouse. In the eastern portion of the ruffed grouse range, high-density white-tailed deer populations in some regions are confounding efforts to establish shrub-dominated or small-diameter forest habitats. Likewise, in the West, the regeneration of aspen forests is complicated by browsing pressure from domestic livestock and native ungulates, particularly where regenerating aspen stands are located along migration corridors or within wintering areas.

- **Population ecology and management data needs.**

  Few political jurisdictions collect data on ruffed grouse populations, hunter numbers or harvest. This lack of data precludes attempts to quantify the status or trends of these parameters or to understand the effects of management decisions.

  Within those jurisdictions where the ruffed grouse is an important game species, resource management agencies should institute monitoring programs to assess the status and trends of ruffed grouse populations, hunter numbers and harvest. The use of the ruffed grouse drumming survey along randomly selected routes is encouraged to monitor ruffed grouse populations.

  In the central and southern Appalachians, acorn and beech nut production should be monitored using a standardized protocol. This would enable jurisdictions to share data to assess local and regional patterns of production.

  Empirical data on ruffed grouse ecology and management are lacking for some regions, particularly in the West. Research is needed to document ruffed grouse population dynamics and population response to the modification of various forest types by mechanical treatments and fire.

  Traditional clearcut regeneration harvests are being abandoned in many areas, particularly on public forestlands, in response to public concerns regarding aesthetics. The retention of substantial basal area in harvest units, particularly in shade-intolerant forest types, can reduce resulting regeneration stem densities and ruffed grouse habitat quality. Research is needed to document ruffed grouse response to these changes in forest habitat management practices.

- **Climate change.**

  A continental climate significantly warmer than historical norms could affect the geographic distribution of forest types and associated understory vegetation. These changes could cause a northward shift in forest types of importance to ruffed grouse and, thereby, high density ruffed grouse populations.

COORDINATED PLAN IMPLEMENTATION

The implementation of this Plan should be tiered to similar opportunities identified through numerous existing and pending species and species-group conservation initiatives. For example, resource agencies, private landowners, non-governmental organizations and others are working through the Atlantic Coast Joint Venture to implement bird conservation plans developed by Partners in Flight (PIF) for specific Physiographic Areas, including Physiographic Area 9 (Southern New England).

Southern New England covers a geographic area consistent with approximately the northern half of BCR 30. The PIF bird conservation plan for Southern New England identifies the American woodcock, golden-winged warbler, blue-winged warbler and prairie warbler as high priority species and establishes a habitat objective of 210,000 acres (85,000 ha) of "shrubland" to sustain these species, which is approximately half of the small-diameter forest objective established by this Plan to sustain ruffed grouse in BCR 30 [467,400 acres (189,200 ha)].

Likewise, the restoration of aspen forest habitats in the west is generating increasing interest from a broad range of stakeholders. In Idaho, the newly formed Eastern Idaho Aspen Working Group is a collaborative effort initiated by various Idaho state agencies, including the Department of Fish and Wildlife, and the US Forest Service and US Bureau of Land Management. The objective of the Working Group is to sustain aspen forest habitats within the state in recognition of their value to wildlife. This Plan emphasizes the importance of aspen habitats to ruffed grouse in BCR 10, which includes Idaho. The Coordinated Bird Conservation Plan of the Intermountain West Joint Venture classifies aspen forest as a Priority A habitat type. The PIF bird conservation plan for the Central Rocky Mountains Physiographic Area, which includes Idaho, emphasizes the importance of aspen forest habitats to two high priority species, the Williamson's sapsucker and red-naped sapsucker.

This consistency in the prioritization of important habitat types and recommended habitat objectives between different conservation assessments reinforces the value of these assessments and can aid in the effective and efficient deliver of multiple resource benefits through joint ventures or similar collaborative processes. Other such assessments relevant to at least a portion of the ruffed grouse range include the Northern Bobwhite Conservation Initiative and the pending Woodcock Conservation Plan.

Opportunities exist for nonindustrial private forest landowners in the United States to secure cost-share assistance to establish and improve habitats beneficial to ruffed grouse and other wildlife through a variety of federally funded cost-share programs. These programs include the Environmental Quality Incentive Program (EQIP), the Wildlife Habitat Incentive Program (WHIP) and the Conservation Security Program (CSP) of the 2002 Farm Bill. These programs are coordinated by the US Department of Agriculture Natural Resources Conservation Service.

EQIP, WHIP and CSP provide cost-share assistance for habitat development and improvement practices to private forest landowners in exchange for landowner agreement to sustain the habitats for a specified period of time, generally 10–15 years. Priority habitats and habitat management practices are identified through local processes coordinated by the NRCS State Technical Committee and State Conservationist. One element of CSP that differs from EQIP and WHIP is the ability to generate cost-share support for ongoing conservation practices, whereas EQIP and WHIP emphasize the implementation of new practices.

Additional federally funded cost-share programs are coordinated by the US Department of Agriculture Forest Service. These programs include the Forest Stewardship Program (FSP), the Forest Land Enhancement Program (FLEP) and the Forest Legacy Program (FLP). FSP provides technical and financial support to private forest landowners to assist in the preparation of forest stewardship plans that outline recommended forest resource management activities. Through FLEP, landowners receive technical and financial assistance to implement the recommended practices outlined in the forest stewardship plans developed through FSP. Both FSP and FLEP are delivered through the State Forester or equivalent state agency. FLP is designed to protect environmentally sensitive privately owned forest lands through either direct acquisition or, more commonly, the establishment of a conservation easement with a willing landowner.

The US Department of the Interior Fish & Wildlife Service provides technical and financial assistance to private forest landowners through the Private Stewardship Grant Program (PSGP). PSGP specifically targets the conservation of federally listed, proposed or candidate species, or other at risk species. PSGP grants are awarded annually. The Healthy Forests Reserve Program (HFRP), which is administered by the US Department of Agriculture Forest Service, likewise provides technical and financial assistance to enhance the conservation of federally listed species, candidates for federal listing, state listed species or species of special concern.

Additional information on these programs can be found at:

EQIP:	www.nrcs.usda.gov/programs/eqip/
WHIP:	www.nrcs.usda.gov/programs/whip/
CSP:	www.nrcs.usda.gov/programs/csp/
FSP:	www.fs.fed.us/spf//coop/programs/loa/fsp.shtml
FLEP:	www.fs.fed.us/spf//coop/programs/loa/flep.shtml
FLP:	www.fs.fed.us/spf//coop/programs/loa/flp.shtml
PSGP:	www.fws.gov/endangered/grants/private_stewardship/index.html

In addition, many states offer cost-share assistance, often in the form of reduced property tax rates, to nonindustrial private forest landowners who develop and implement a resource management plan for their forestland. These programs differ by state but generally require that a percentage of the land be managed to produce marketable forest products or to provide important wildlife habitat benefits. These programs typically require landowner agreements of 10–25 years and the agreement often stays with the property even if the landowner changes. Responsibility for the administration of these programs generally resides within the state agency responsible for other forestry programs and activities.

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APPENDIX A: SCIENTIFIC NAMES OF SPECIES REFERENCED

gypsy moth	*Lymantria dispar*
hemlock wholly adelgid	*Adelges tsugae*
ruffed grouse	*Bonasa umbellus*
American woodcock	*Scolopax minor*
Williamson's sapsucker	*Sphyrapicus thyroideus*
red-naped sapsucker	*Sphyrapicus nuchalis*
Canada warbler	*Wilsonia Canadensis*
golden-winged warbler	*Vermivora chrysoptera*
prairie warbler	*Dendroica discolor*
blue-winged warbler	*Vermivora pinus*
MacGillivray's warbler	*Oporornis tolmiei*
yellow-breasted chat	*Icteria virens*
eastern towhee	*Pipilo erythrphthalmus*
white-crowned sparrow	*Zonotrichia leucophrys*
white-tailed deer	*Odocoileus virginianus*
chestnut blight	*Cryphonectria parasitica*
Dutch elm disease	*Ophiostoma ulmi*
alder, red	*Alnus rubra*
ash	*Fraxinus spp.*
aspen, quaking	*Populus tremuloides*
aspen, bigtooth	*Populus grandidentata*
balsam poplar	*Populus balsamifera*
beech	*Fagus spp.*
birch	*Betula spp.*
birch, paper	*Betula papyrifera*
cottonwood, Fremont	*Populus fremontii*
cottonwood, narrowleaf	*Populus angustifolia*
cherry	*Prunus spp.*
clover	*Trifolium spp.*
cypress	*Taxodium distichum*
elm	*Ulmus spp.*
fir, balsam	*Abies balsamea*
fir, Douglas	*Pseudotsuga menziesii*
fir, grand	*Abies grandis*
fir, subalpine	*Abies lasiocarpa*
fir, white	*Abies concolor*
hemlock, eastern	*Tsuga Canadensis*
hemlock, western	*Tsuga heteropylla*
huckleberry	*Gaylussacia spp.*

juniper	*Juniperus spp.*
larch, western	*Larix occidentalis*
mahogany	*Cercocarpus spp.*
maple	*Acer spp.*
oak	*Quercus*
pine, jack	*Pinus banksiana*
pine, lodgepole	*Pinus contorta*
pine, pitch	*Pinus rigida*
pine, ponderosa	*Pinus ponderosa*
pine, red	*Pinus resinosa*
pine, white	*Pinus strobus*
red cedar, eastern	*Juniperus virginiana*
red cedar, western	*Thuja plicata*
redwood	*Sequoia sempervirens*
spruce, black	*Picea mariana*
spruce, Engelmann	*Picea engelmannii*
spruce, Sitka	*Picea sitchensis*
spruce, white	*Picea glauca*
tamarack	*Larix laricina*
willow	*Salix spp.*