Birds of Wisconsin Pine and Oak Barrens

by Michael J. Mossman, Eric Epstein, and Randy M. Hoffman

In the mid 1800s, surveyors of the General Land Office Survey crisscrossed the Wisconsin landscape, creating the section lines that would provide the basis of legal land descriptions for the settlers, loggers, and speculators that followed. In much of northern and central Wisconsin they encountered extensive sandy areas which they collectively referred to as "barrens." These were dominated by open areas of grasses and low shrubs or "heath," such as sweet fern (*Myrica asplenifolia*) and blueberry (*Vaccinium* spp.), sparsely timbered with pine and "scrub" oak, and sometimes with tall shrubby vegetation. The surveyors were not generally impressed with the utility of the barrens to early settlers, typically describing the soils as "third rate" and the timber "worthless." They sometimes remarked on the evidence of recent wildfires, which were essential to maintaining the barrens community, and which could burn thousands of acres during a single event.

Over the ensuing decades, countless attempts were made to eke agricultural and economic benefits from these landscapes, only to confirm the doubts of the early surveyors. By the end of the Great Depression these regions had been ravaged by wildfires and drought, and farming and forestry held even less promise than in the early settlement days. Yet some of the barrens landscape survived intact. The barrens region of northwest Wisconsin was then described as:

> ". . . coniferous forests and open expanses of sweet fern dwarf into insignificance the few evidences of man's present occupancy and use of the land . . . Jack pine [*Pinus banksiana*] predominates in the forests, either in pure stands of thickly set trees, or mixed with the useless, ubiquitous scrub oak. Great piles of jack pine bolts [small logs] in clearings along the railroads or at railway stations await the call of the pulp mills of Central Wisconsin, and clumsy truck loads of similar logs are met jogging along the two-rut, sand roads which crisscross the Barrens. The grassy and sweet fern barrens bear no mark of present utilization, but are desolate open tracts where only an occasional charred stump, a cluster of jack pines, or a scrub oak bush, breaks the monotonous sweep of the rolling, thinly clad ground surface.

> At rare intervals small cultivated areas with isolated tar paper shacks or log cabins interrupt the continuity of forest and barrens. . . . Typically, the farmstead scene does not include children playing around the house and barns. There are some large families, of course, but the region is characteristically one of people past middle age—weatherworn old Scandinavians who came here with their wives and children many years ago. The children have grown up and gone. The barrens does not hold its younger generation. No new settlers are moving in, and one gets the impression that when the present hardy survivors pass on there will be none to take their places. . . . Almost as numerous as the occupied farms are the abandoned, tumbled-down farmhouses surrounded by fields going to waste. Sometimes only a few stones and a patch of quack grass remain to mark the site of a former home, and to give the impression of poor land and unsuccessful farming." (Murphy 1931)

Oddly enough, those difficult times brought the dawn of a new appreciation of barrens, and an understanding that one of their best uses was as wildlife habitat, particularly for upland game such as Sharp-tailed Grouse. The reversion of tax delinquent lands to public ownership and new developments in the field of game management would eventually put control of several barrens tracts into the hands of public conservation agencies. Barrens are certainly one of the more resilient natural communities in Wisconsin, and management was successful, with the help of prescribed burning, in protecting and restoring some of these landscapes. By the 1960s, for example, it could be said of Crex Meadows Wildlife Area, an important complex of barrens and wetlands in the northwest:

> "In its history, Crex Meadows has been drained, logged, plowed, burned, and its soils depleted and abandoned. . . . Sometimes man does not seem to recognize what is best ecologically for the land. Crex Meadows is an example of the land winning out despite all of man's efforts to change it. Here man has had to learn to live in harmony with his land and to respect the inherent ecological principles of this sand country. The first surveyors called Crex Meadows 'third rate—soil and timber worthless.' But now, in terms of birds, plants, and wildlife, Crex Meadows is of priceless value . . ." (Vogl 1964)

The distinctive birdlife of today's pine and oak barrens remain unfamiliar to many birdwatchers and naturalists. This stands to reason, for most barrens are rather isolated in the far northwestern and northeastern sections of the state, accessible only by long, dusty roads, and during the breeding season they tend to be well endowed with deer flies and ticks. Yet, apart from the state's large wetlands, barrens include some of the few sizeable tracts of relatively natural, wild, open lands with engaging vistas that invite exploration. There are not many richer ornithological experiences than to be out in a large barrens early on a June morning, totally surrounded by the lazy singing of Clay-colored Sparrows and calls of Rufous-sided Towhees, with perhaps some chuckling of sharptails lingering on a nearby lek, and the wolf-whistle of an Upland Sandpiper high overhead.

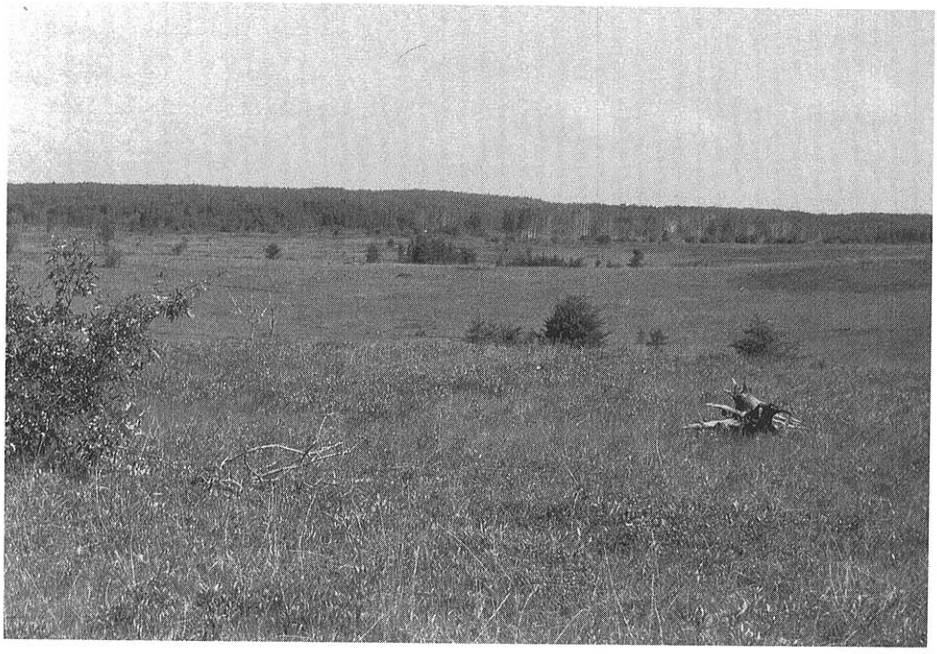
This birdlife is dependent on the varied structural characteristics of the barrens landscape, which warrants our discussion at this point. Prior to settlement, barrens habitats were widespread in Wisconsin, always associated with coarse-textured sandy or gravelly

soils. The most extensive barrens were in large areas of sandy glacial outwash, or in the sandy beds of extinct glacial lakes, but they also occurred on river terraces, old dune systems, gravelly moraine, and sandspits. Geographically, areas of extensive barrens were concentrated in northeastern, north-central, northwestern, and central Wisconsin. They were also common on the extensive outwash terraces along the Lower Wisconsin, Lower Chippewa, and Mississippi rivers. In general, trees occurred in low density, usually as scattered individuals or in small groves, punctuating an open grassy landscape that was often dotted with deciduous brush. Where outwash was pitted, the topography was more pronounced and varied, and lakes and wetlands were sometimes frequent. In such areas, the pattern of vegetation was likely to be a mosaic of open prairie-like areas, brush, savanna, and occasional stands of deciduous, coniferous, or mixed forest. The interplay of topographic and edaphic factors strongly influenced the behavior and effects of the primary disturbance factor affecting the barrens—fire—and is responsible for much of the structural and compositional variability demonstrated by this community.

Surveyors' descriptions of the vegetation and general aspect of the barrens reflected this variability. In southern and western Wisconsin, the trees most often noted were oaks, especially black (*Quercus velutina*), bur (*Q. macrocarpa*), Hill's (*Q. ellipsoidalis*), and occasionally white (*Q. alba*). Where barrens adjoined extensive prairies, the aspect was that of a savanna, with widely spaced large trees over an open understory of prairie grasses and forbs. Fires were probably frequent and of relatively low intensity. Where the landforms and vegetational mosaic were more complex, the barrens aspect was more varied, sometimes characterized by dense brush, scattered stands of stunted, gnarly oaks, and smaller patches of open prairie. Fires may have been less frequent, but of greater intensity due to the buildup of woody fuels. The effects were sometimes catastrophic, with raging crown fires reducing the oaks to the status of low, multistemmed grubs. The barrens oaks are well adapted to cope with fire, possessing the ability to regenerate following each episode of destruction.

Characteristic shrub species of southern Wisconsin oak barrens include hazelnut (*Corylus americana*), gray dogwood (*Cornus racemosa*), rose (*Rosa* spp.), willow (*Salix humilis*), and smooth sumac (*Rhus glabra*). The ground layer typically includes prairie species such as lupine (*Lupinus perennis*), goat's rue (*Tephrosia virginiana*), flowering spurge (*Euphorbia corollata*), lead plant (*Amorpha canescens*), june grass (*Koeleria cristata*), little bluestem (*Schizachyrium scoparium*), needlegrass (*Stipa spartea*), western sunflower (*Helianthus occidentalis*), rough blazing star (*Liatris aspera*), goldenrods (*Solidago* spp.), and asters (*Aster* spp.).

In northern, eastern, and central Wisconsin, pines were frequently prominent in the barrens landscape. Jack pine was the most common species, occurring sometimes as single trees, but more often in scattered groves. The cones of jack pine are "serotinal," remaining closed for long periods until scorched and opened by fire. The fire that kills the parent tree thus liberates the seeds, which drop onto a well-prepared bed free of com-



"Open" aspect at Dunbar Barrens, Marinette County. (*Photo by Bill Tans*)

peting vegetation, and initiate the next generation. Red pine (*Pinus resinosa*) and, rarely, white pine (*P. strobus*) also occurred in the northern barrens, but typically as very widely scattered large "standards" or in groves protected from most catastrophic fire by lakes, moist depressions, or other topographic features. True pine savannas with large, sparsely distributed pines (usually red pine), like the oak savannas, were probably maintained by relatively frequent fires of low intensity. Today, large open-grown pines are almost totally absent from barrens, due to logging and altered fire regimes. Hardwood trees most characteristic of the northern barrens included Hill's oak, usually as grubs or thickets of small trees, and aspen (*Populus grandidentata, P. tremuloides*), typically in scattered small stands or clones.

The understory of northern pine barrens frequently supported areas of low shrubby heath with blueberries, sweet fern, bearberry (*Arctostaphylos uva-ursi*), bracken fern (*Pteridium aquilinum*), and dewberry (*Rubus pubescens*) being especially common. Thickets of hardwood shrubs, particularly hazelnut (*Corylus americana*), pin cherry (*Prunus pensylvanica*), and juneberry (*Amelanchier* spp.) were also characteristic. In north-central and northeastern Wisconsin, barrens landscapes often included "bracken grasslands" (Curtis 1959, Vogl 1964b), where bracken fern was especially abundant.

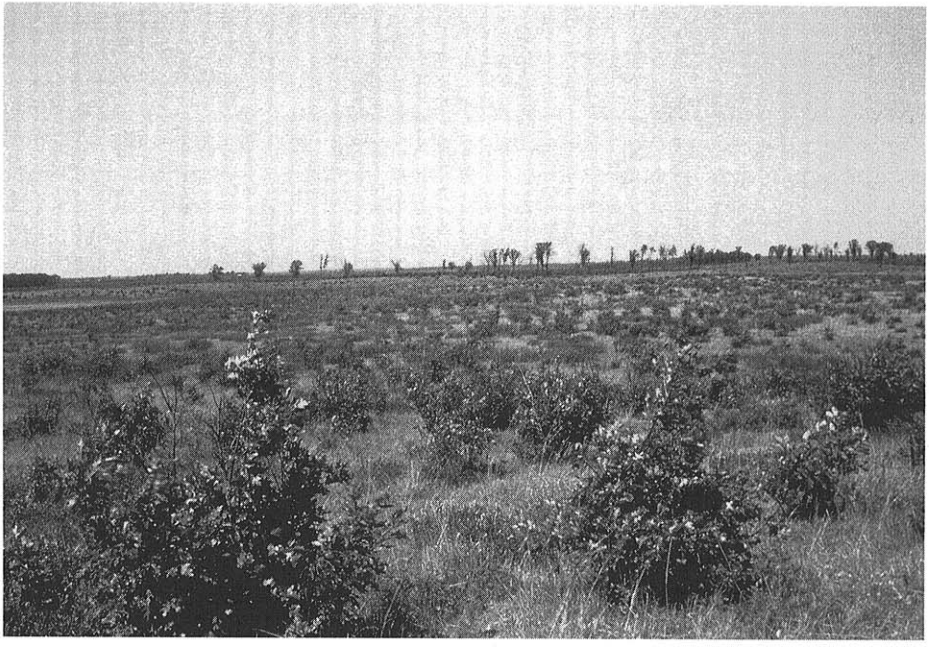
Throughout the present range of Wisconsin barrens, elements of the southern oak-dominated barrens and northern pine-dominated barrens intermix. Even in the most "northern,"

cool and moist stands, which occur in the northeastern counties, one can find at least a few plant species of prairie affinity such as little bluestem, big bluestem (*Andropogon gerardi*), and bush clover (*Lespedeza capitata*). In some stands of relatively hot and dry southwestern Wisconsin (for example near Gotham, on the lower Wisconsin River terraces), plants usually associated with more northern areas such as jack pine and blueberry occur. In northwestern and central Wisconsin, complex mixtures of northern and southern plant species can occur together, either heterogeneously or in relatively discrete patches that express the differences in soil moisture, slope aspect, edaphic factors, or site history.

An illustration of the complexity of local vegetational mosaics is found in the original land survey notes for what is now the southern part of Fort McCoy Military Reservation in Monroe County. These notes described the uplands variously as "oak openings," "level prairie," "oak brush," "jack oak and pine openings," "thinly-timbered with pine-oak," "pine-oak brush," "pine brush," and "oak forest."

More detailed information on Wisconsin oak and pine barrens is available in Curtis (1959), Murphy (1931), and Vogl (1964a, 1964b, 1967, 1970).

Curtis (1959), using information compiled and analyzed by the geographer R.W. Finley, estimated that at the time of the original land survey, over 4.1 million acres (11.8%) of Wisconsin land surface could be characterized as barrens. He classified 1.8 million acres (5.1%) south and west of the tension zone as oak barrens, and 2.34 million acres (6.7%) north and



Brush prairie at Crex Meadows, Burnett County. (*Photo by Signe Holtz*)

east of the tension zone as pine barrens. The Wisconsin Natural Heritage Inventory, which tracks high quality occurrences of biotic communities that have retained their presettlement character, has file information on barrens totalling ca 10,000 acres at 65 sites. Some of these are very small and hopelessly isolated from other barrens, with little prospect of expansion, but a few sites, especially in northwestern (e.g., Crex Meadows, Namekagon, and Moquah barrens) and central Wisconsin (Necedah National Wildlife Refuge) have been restored and expanded considerably, and there is potential to do more. At best, however, there are currently only about 50,000 acres remaining, including reclaimed forest and abandoned, semi-restored fields. This represents but 1.2% of the presettlement acreage. The loss has been due in part to grazing and cultivation. Irrigation is practiced extensively on river terraces and in the central Wisconsin sand counties. Other causes are tree planting (particularly red pine in recent years), and perhaps most importantly, the suppression of fire as a dynamic force on Wisconsin's landscape. In the absence of fire, barrens can succed to dense young forest of oak or pine in just a few decades. This can be devastating to plant and game species that need open habitat, especially large openings, and to species with low dispersal capability.

The southern Wisconsin oak barrens have declined even more, with good examples of the "savanna" form being particularly rare. These persist at only a few small sites, on terraces of the lower Wisconsin and Chippewa rivers, at Fort McCoy, and 1–2 other locations. Restoration efforts at some sites have been relatively successful, but opportunities to reestablish extensive areas of oak barrens are limited.

Most of the northern barrens sites are under public agency management, and efforts to reintroduce fire into the barrens ecosystem have succeeded in restoring "brush prairie" conditions to thousands of acres, for example at Crex Meadows and Namekagon Barrens. True pine savannas are extremely rare, and are likely to become more so unless management prescriptions are developed which are more effective at restoring and maintaining savanna conditions. Currently, most barrens management in the north is focused on benefitting Sharp-tailed Grouse, a species that finds optimal habitat in Wisconsin in brush prairie. For the following discussion of barrens avifaunas we have distinguished several general categories of barrens structure that exist today. In this discussion we use the term "heath" to describe hardwood growth of less than 1 m in height, regardless of whether it is a true ericaceous heath species such as blueberry, or whether it represents other hardwood shrub species or even oak grubs or aspen seedlings. Similarly, "shrubs" refers to the woody layer 1–3m in height, "saplings" 3–6m, and trees >6m.

We surveyed 58 barrens sites statewide, as well as several cutovers and young conifer plantations that occurred on sandy soils and presented a barrens-like aspect. This total of 79 sites was divided among the 4 barrens regions roughly in proportion to the available habitat in each (Table 1). The northwest had a high proportion of open and brush prairie tracts, and the central region had most of the conifer

Table 1. Distribution in Wisconsin of barrens stands surveyed for Table 2.

	Number of stands in indicated region:				
Habitat category	Northwest	North Central	Northeast	Central	Total
Open Aspect	4	0	0	1	5
Oak Savanna	0	0	0	2	2
Pine-dominated	1	0	0	5	6
Brush Prairie	8	0	0	1	9
Nearly Forest	3	1	1	4	9
Diverse	9	1	7	2	19
River Terrace	0	0	0	8	8
Cutover	5	0	0	1	6
Conifer Plantation	2	2	0	11	15
Total	32	4	8	35	79

plantations and conifer-dominated barrens.

"Open barrens" were characterized by predominant herbaceous cover and sometimes up to 35% heath cover. Some had a few pine or hardwood trees or saplings, or patches of shrubs (<5% cover). These sites, unless maintained in an open condition by frost, had generally been burned within 5 (usually 3) years prior to the survey.

"Oak savanna" was of the barrens type described above, as distinguished from oak savanna on more mesic soils, which is not treated in this paper. Our only examples of this type of barrens were at Fort McCoy, where there were scattered groves and individuals of both scrubby and open-grown Hill's oaks, relatively little shrub cover, and a predominance of open, herbaceous cover, which included some prairie grasses and forbs, but mostly penn sedge (*Carex pensylvanica*). In "conifer-dominated barrens," jack pine cover was 10–31%, and was not less than total hardwood cover. Structures were fairly diverse, with pines, and sometimes hardwoods, usually well represented in at least 3 of the 4 height classes. Common hardwood trees and shrubs were dewberry, Hill's oak, pin cherry, black cherry (*Prunus serotina*), and hazel. Sites were in Sauk, Adams, Jackson, and Burnett counties.

"Brush prairie" was common in Sharp-tailed Grouse management areas such as Crex Meadows, where most of the survey sites were located. Total woody cover was 30–60%, in some cases all within the shrub layer, and in others more equally divided between shrub and heath. At least one site had been recently burned, but only the heath layer died. Common plant species were sweet fern, hazel, oak grubs, cherries, redroot, and, on dampish sites, willow.

"Diverse barrens" are mainly those that are over 200 acres in size, and which incorporate large patches of 2 or more of the structural types described above. Some tracts were smaller, but still included patches and varied vegetational heights.

Central and southern Wisconsin "river terrace barrens" were extremely variable admixtures of jack pines, red cedar (*Juniperus virginiana*), oaks, and/or hardwood shrubs. Wisconsin River barrens included those at Blue River, Gotham, Sauk City, and Mazomanie,

Diverse barrens structure at Moquah Barrens, Bayfield County. (*Photo by Bob Read*)

and those along the Chippewa were at Nine-mile Island and the former Meridean Prairie. Total woody cover varied from 10% to 65%.

We sampled 15 young "conifer plantations" on sandy soils, where maximum tree height ranged from 0.3 to 4m, mostly 1–2m. Planted conifers included red, white, and scotch pines, blue, white, and Norway spruces, and balsam fir. For those 12 stands in which plant cover was estimated, conifer cover was 1–70% (mean = 29%), and hardwood heath and shrub cover was 0–40% (mean = 9%).

"Cutover" tracts had been logged within 1–3 years previous to our surveys. Structures were variable. In some tracts, scattered hardwood trees were left standing, and in others a few pines were left, while others had been totally clearcut. On the 6 stands for which cover was estimated, total woody cover was 30–60%, most of it in the shrub and heath layers.

As described above, the barrens is a tenuous community pulled in opposing directions by fire/frost and succession. The barrens avifauna responds to the variety and pattern of structures and dominant plant forms in this dynamic community, and can be seen as a variable combination of elements from related communities such as dry prairie (Sample and Hoffman 1989), xeric pine and hardwood forests (Hoffman and Mossman 1990), and even boreal forest (Mossman et al. 1990). Yet barrens also represent a real natural community with unique characteristics, and has undoubtedly been a major component of the upper Midwest landscape for centuries; thus it is not surprising that several bird

Diverse barrens structure at New Barrens, Florence County. (*Photo by Eric Epstein*)

species appear to be especially adapted to it. Following is a discussion of this avifauna according to the 7 general structural categories and 2 related, artificial habitat types described previously. Bird survey data from the 79 sites are summarized in Table 2. A total of 110 species were recorded.

Altogether, the most common and regular species of Wisconsin pine and oak barrens are Blue Jay, Common Yellowthroat, Rufous-sided Towhee, Brown-headed Cowbird, and the Chipping Sparrow, Clay-colored Sparrow, Field Sparrow, and Vesper Sparrow. Other characteristic species that are found here equally or more commonly than perhaps in any other native Wisconsin community include Sharp-tailed Grouse, Upland Sandpiper, Northern Flicker, Eastern Kingbird, Eastern Bluebird, Brown Thrasher, Tennessee Warbler, Lark Sparrow, Brewer's Blackbird, and American Goldfinch.

Open barrens are characterized by dry sand prairie birds, most of which tolerate or prefer some low (<1m tall) woody vegetation: Chipping Sparrow, Clay-colored Sparrow, Field Sparrow, Vesper Sparrow, Grasshopper Sparrow, Song Sparrow, Upland Sandpiper, Brown Thrasher, Bobolink, Western Meadowlark, Brewer's Blackbird, Brown-headed Cowbird, American Goldfinch. Although not represented in Table 2 because of detectability problems, the Common Nighthawk is another species common to open barrens and dry sand prairie. The relatively high abundance of Brewer's Blackbirds in open barrens is partly a consequence of its common association with recently burned sites

Table 2. Comparison of abundance of breeding birds on various types of barrens and related communities in Wisconsin.

	Abundance in indicated type of barrens									
Species	Overall	Open aspect	Oak savanna	Pine dominated	Brush prairie	Nearly forest	Diverse	River terrace	Cutover	Conifer plantation
Turkey Vulture	R	—	U	—	—	—	—	—	—	—
Northern Harrier	R	—	—	—	U	—	FC	—	—	R
Sharp-shinned Hawk	(R)	—	—	—	—	—	(R)	—	—	—
Cooper's Hawk	R	—	—	—	—	—	R	—	R	—
Broad-winged Hawk	(R)	—	—	—	—	—	(R)	—	—	—
Red-tailed Hawk	U	U	—	U	—	U	FC	—	—	R
American Kestrel	U	—	U	—	—	—	U	U	R	R
Ring-necked Pheasant	R	—	—	—	R	—	—	—	—	—
Ruffed Grouse	R	—	—	—	—	U	U	—	—	—
Greater Prairie-Chicken	(R)	(R)	—	—	(R)	—	—	—	—	—
Sharp-tailed Grouse	U	U	—	—	U	—	U	—	—	—
Northern Bobwhite	R	—	U	R	—	—	—	U	—	—
Sandhill Crane	R	U	—	—	—	—	—	—	—	—
Killdeer	R	U	—	—	R	—	U	—	—	—
Upland Sandpiper	U	C	FC	—	—	—	C	—	—	—
American Woodcock	R	—	—	—	—	R	—	—	—	—
Mourning Dove	FC	U	FC	U	U	U	FC	C	—	FC
Black-billed Cuckoo	FC	—	—	FC	FC	U	FC	U	U	R
Yellow-billed Cuckoo	R	—	—	—	—	U	R	—	—	—
Great Horned Owl	U	—	—	—	—	U	—	—	—	—
Common Nighthawk	U	—	—	U	—	—	—	—	U	—
Whip-poor-will	R	—	—	—	—	—	—	—	—	R
Chimney Swift	R	—	U	—	—	—	—	—	—	—
Ruby-throated Hummingbird	R	—	—	—	—	—	—	—	—	R
Red-headed Woodpecker	R	—	U	—	—	U	—	U	—	—
Red-bellied Woodpecker	R	—	—	—	—	—	—	U	—	—
Yellow-bellied Sapsucker	R	—	—	—	—	—	R	—	—	—
Downy Woodpecker	U	—	—	—	—	FC	U	U	—	—
Hairy Woodpecker	U	—	—	—	—	U	—	U	FC	—
Northern Flicker	FC	—	U	—	U	FC	C	C	U	—
Eastern Wood-Pewee	R	—	U	—	—	FC	U	—	—	—
Alder Flycatcher	R	—	—	—	U	—	R	—	FC	—
Least Flycatcher	R	—	—	—	—	U	U	—	—	—
Eastern Phoebe	(R)	—	—	—	—	—	(R)	—	—	—
Great Crested Flycatcher	U	—	U	U	—	FC	FC	FC	U	—
Eastern Kingbird	FC	FC	C	U	FC	U	C	U	C	U
Horned Lark	R	—	—	—	—	—	—	—	—	U
Purple Martin	R	—	—	—	U	—	R	—	—	U
Tree Swallow	U	FC	FC	—	—	U	C	U	—	U
Bank Swallow	R	—	—	U	—	—	—	U	—	R
Cliff Swallow	R	—	—	—	—	—	R	—	—	R
Barn Swallow	R	—	U	—	—	U	U	U	—	R
Blue Jay	C	—	C	C	U	A	C	A	U	U
American Crow	FC	FC	U	U	—	FC	C	—	U	—
Common Raven	R	—	—	—	—	U	U	—	U	—
Black-capped Chickadee	FC	—	U	C	U	A	FC	FC	U	U
Red-breasted Nuthatch	R	—	—	—	—	U	R	—	—	R
White-breasted Nuthatch	R	—	—	—	—	FC	R	U	U	—
Northern House Wren	FC	U	—	FC	U	FC	FC	FC	C	R
Sedge Wren	R	—	—	—	U	—	(R)	—	—	—
Blue-gray Gnatcatcher	R	—	—	—	—	—	—	U	—	—
Eastern Bluebird	U	U	C	U	U	U	C	FC	FC	U
Veery	R	—	—	—	—	—	U	—	U	—
Hermit Thrush	R	—	—	—	—	FC	U	—	—	—
Wood Thrush	R	—	—	—	—	—	R	—	—	—
American Robin	FC	—	FC	C	—	C	FC	C	FC	U
Gray Catbird	FC	—	—	FC	C	FC	FC	A	FC	R
Brown Thrasher	FC	FC	C	U	FC	U	C	C	FC	U

(*continued*)

Table 2. (*Continued*)

Species	Abundance in indicated type of barrens									
	Overall	Open aspect	Oak savanna	Pine dominated	Brush prairie	Nearly forest	Diverse	River terrace	Cutover	Conifer plantation
Cedar Waxwing	FC	—	U	U	U	C	C	C	U	FC
European Starling	R	U	—	—	—	—	U	—	—	—
Solitary Vireo	(R)	—	—	—	—	—	(R)	—	—	—
Yellow-throated Vireo	R	—	—	—	—	FC	—	—	—	—
Warbling Vireo	R	—	—	—	—	—	U	—	—	—
Red-eyed Vireo	U	—	—	—	R	C	FC	—	—	—
Blue-winged Warbler	R	—	U	—	—	U	—	U	—	—
Golden-winged Warbler	R	—	—	—	—	U	U	—	—	—
Tennessee Warbler	R	—	—	—	—	—	U	—	—	—
Nashville Warbler	FC	—	—	FC	—	C	FC	U	—	U
Yellow Warbler	FC	—	—	FC	C	U	U	U	FC	—
Chestnut-sided Warbler	U	—	—	U	—	C	C	—	C	R
Yellow-rumped Warbler	R	—	—	—	—	U	U	—	—	—
Pine Warbler	R	—	—	—	—	—	R	—	U	—
Palm Warbler	—	—	—	—	—	—	—	—	—	R
Black-and-White Warbler	U	—	—	U	—	U	U	—	U	—
American Redstart	R	—	—	—	—	U	R	—	FC	—
Ovenbird	R	—	—	—	—	C	U	—	—	—
Connecticut Warbler	R	—	—	—	—	U	R	—	—	R
Mourning Warbler	R	—	—	—	—	—	R	—	—	R
Common Yellowthroat	C	FC	—	U	A	FC	C	U	C	FC
Scarlet Tanager	R	—	—	—	—	FC	U	—	R	—
Northern Cardinal	R	—	—	U	—	—	R	U	—	—
Rose-breasted Grosbeak	U	—	U	—	—	C	C	U	U	R
Indigo Bunting	FC	—	FC	FC	FC	C	C	FC	FC	R
Dickcissel	R	—	—	—	—	—	R	—	—	—
Rufous-sided Towhee	C	—	U	C	C	C	A	C	A	FC
Chipping Sparrow	C	U	U	A	U	A	FC	C	U	A
Clay-colored Sparrow	A	C	—	—	A	FC	A	U	C	A
Field Sparrow	A	FC	A	A	C	C	A	A	C	A
Vesper Sparrow	C	A	A	A	C	R	C	C	C	C
Lark Sparrow	R	—	—	R	—	—	—	C	—	—
Savannah Sparrow	R	—	—	—	—	—	R	—	—	—
Grasshopper Sparrow	R	FC	C	—	—	—	R	U	—	—
Song Sparrow	FC	FC	—	FC	C	U	C	U	C	FC
Swamp Sparrow	R	—	—	—	R	—	—	—	U	—
White-throated Sparrow	R	—	—	—	—	U	R	—	—	—
Dark-eyed Junco	R	—	—	—	—	—	R	—	—	—
Bobolink	R	U	—	—	U	—	—	—	—	—
Red-winged Blackbird	U	U	U	—	U	R	R	U	—	U
Eastern Meadowlark	U	—	C	—	U	—	—	FC	—	—
Western Meadowlark	U	U	—	—	—	—	U	U	—	R
Brewer's Blackbird	FC	C	—	—	FC	—	FC	—	U	U
Common Grackle	U	—	U	—	U	R	—	U	—	U
Brown-headed Cowbird	C	FC	C	C	FC	C	C	A	A	C
Orchard Oriole	R	—	U	—	—	—	—	U	—	—
Northern Oriole	U	—	FC	—	—	U	U	FC	—	—
Purple Finch	R	—	—	—	—	—	U	—	—	—
Red Crossbill	(R)	—	—	—	—	—	(R)	—	—	—
Pine Siskin	R	—	—	—	—	—	R	—	—	—
American Goldfinch	A	C	FC	A	C	C	C	C	C	C
Evening Grosbeak	(R)	—	—	—	—	—	(R)	—	—	—

Abundance determinations are partly subjective, but based on the following guidelines: A = Abundant (occurred in 75% of sites, and sometimes in high numbers). C = Common (occurred in 50% of sites). FC = Fairly Common (occured in 25–50% of sites). U = Uncommon (occurred in 5–25% of sites). R = Rare (occurred in 1–5% of sites). Codes in parentheses refer to birds present on one or more stands, but not recorded on the particular counts used in compiling this table. Data are from walk-5-minutes/stand-5-minutes surveys conducted by Mossman, Epstein, Richard Verch (Moquah Barrens) and Hoffman (Ninemile Is.).

and dead, fallen wood. In some cases, Song Sparrows also seem attracted to recently burned areas where remain charred stems of shrubs and oak grubs. Nearly all of the species of Wisconsin's dry prairies are well represented in open or other types of barrens. Because these barrens are generally larger, and in many cases more manageable than southern Wisconsin's isolated, dry prairie relics, they serve an important role in maintaining this natural association of breeding-bird species, especially for those such as Upland Sandpiper that require large tracts.

Even more so than dry prairies, the oak savannas of southern Wisconsin suffer from the effects of small tract size, disturbance, and succession. Here again, the size, manageability, and relatively intact flora of barrens landscapes give them a fairly high potential for maintaining oak savanna bird communities. The only barrens with a purely oak savanna aspect, for which we have bird count data, are on Fort McCoy. They include the characteristic open barrens birds, as well as other true savanna species that associate with scrubby or open-grown oaks, which may be either scattered or in small groves: American Kestrel, Red-headed Woodpecker, Eastern Wood-Pewee, Great Crested Flycatcher, Eastern Kingbird, Blue Jay, Black-capped Chickadee, Eastern Bluebird, Orchard Oriole, and Northern Oriole.

In moderately open barrens that have a substantial component of jack pines, the Chipping and Vesper Sparrows are abundant. Altogether, this community is a combination of very few species of prairie (e.g., Vesper Sparrow) and pines (e.g., Chipping Sparrow, Nashville Warbler), and a large number of generalized "edge" species that are fairly widespread in Wisconsin in various types of open, shrubby woods, woods edge, and other habitats dominated by shrubs and saplings. These include Black-billed Cuckoo, Blue Jay, Black-capped Chickadee, House Wren, American Robin, Gray Catbird, Yellow Warbler, Indigo Bunting, Rufous-sided Towhee, Field Sparrow, Song Sparrow, Brown-headed Cowbird, and American Goldfinch. In addition, Lark Sparrows sometimes occur near sand blows.

Repeatedly burned barrens that are in a brush prairie stage may have prairie birds, especially if near more open habitat, or if shrubby growth is not too tall or thick. But in general, shrub-loving species dominate. Table 3 summarizes the general effects of brush prairie succession on the barrens breeding-bird community in the northwestern region, especially Crex Meadows. Species such as Sandhill Crane, Upland Sandpiper, American Crow, Red-winged Blackbird, Brewer's Blackbird, Eastern Meadowlark and Western Meadowlark, and Grasshopper Sparrow are restricted, to varying degrees, to the more open tracts. Of the prairie birds, Eastern Meadowlark and Bobolink seem to be most abundant, respectively, in heath and heath-shrub stages rather than in open barrens. This is probably a response to the prostrate, residual, herbaceous nesting cover that accumulates in the absence of recent fire, as well as the presence of song perches. Here, as in southern and central Wisconsin's prairies, Western Meadowlarks appear less tolerant of woody encroachment than do Easterns. Sharp-tailed Grouse, although difficult to detect on our bird counts, occur mostly in the early to mid suc-

Table 3. Relative abundance of selected breeding-bird species in successional stages of northwestern Wisconsin brush prairie.

Species	Mean relative abundance in indicated successional stage (%)[1,2]			
	Open	Heath	Heath and Shrub	Shrub
Sharp-tailed Grouse	+	1	+	—
Sandhill Crane	1	—	—	—
Upland Sandpiper	6	5	—	—
Black-billed Cuckoo	—	—	+	2
Eastern Kingbird	1	1	1	2
American Crow	1	+	—	—
Gray Catbird	—	—	3	2
Brown Thrasher	+	1	+	2
Red-eyed Vireo	—	—	—	2
Yellow Warbler	—	1	11	10
Common Yellowthroat	2	13	16	6
Rufous-sided Towhee	—	1	4	10
Clay-colored Sparrow	16	24	25	32
Field Sparrow	1	1	1	12
Vesper Sparrow	8	5	2	2
Grasshopper Sparrow	9	—	—	—
Song Sparrow	1	8	4	—
Bobolink	1	2	3	—
Red-winged Blackbird	13	2	2	—
Eastern Meadowlark	—	1	—	—
Western Meadowlark	+	—	—	—
Brewer's Blackbird	26	11	2	—
American Goldfinch	2	2	4	2

[1]Mean relative abundance = mean percentage of individuals counted in each stand.
[2]Data for the 3 stands in "Open" stage and for 1 of 3 stands in "Heath" stage are from the "Open" category in Table 2. All others are represented in the "Brush Prairie" category of Table 2.

cessional stages of brush prairie. Black-billed Cuckoo, Rufous-sided Towhee, and Field Sparrow increase with an increase in tall shrub cover. Gray Catbirds are most abundant among dense shrub or shrub-heath cover, while thrashers remain at approximately equal levels throughout the succession, wherever both open and shrubby patches exist. Common Yellowthroats and Song Sparrows are most prominent in mixtures of shrub and heath. The Clay-colored Sparrow is clearly the most abundant species throughout all but the most open stages of brush prairie succession, wherever there is much woody cover at heights of 0.7–2m.

When brush prairie reaches an advanced stage, forest bird species may appear. For example, we found 3 territorial male Red-eyed Vireos within extensive brush prairie at Crex Meadows, at a particular site where oak grubs, pin cherries, and hazels attained 50% cover and many grubs were 2–3m tall. These birds sang and foraged within the grubs, at least as low as 1m.

When barrens are left unburned for many years, their structure and avifauna (Table 2) approach those of northern dry forest (Curtis 1959, Hoffman and Mossman 1990). Young oak, aspen, or jack pine trees become dominant. Although many typical barrens birds may remain, others more typical of hardwood forest appear or increase: Ruffed Grouse, Yellow-billed

Diverse structure at Aurora Barrens, Florence County. (*Photo by Eric Epstein*)

Cuckoo, several woodpeckers and flycatchers, White-breasted Nuthatch, Yellow-throated Vireo, Red-eyed Vireo, Blue-winged Warbler, Golden-winged Warbler, Chestnut -sided Warbler, Black-and-White Warbler, American Redstart, Scarlet Tanager, Rose-breasted Grosbeak, and Northern Oriole. Pine and mixed forest species also occur: Common Raven, Red-breasted Nuthatch, Hermit Thrush, Nashville Warbler, Yellow-rumped Warbler, Connecticut Warbler, Chipping Sparrow, and White-throated Sparrow. Blue Jay and Black-capped Chickadee, common in all types of northern dry to dry-mesic forest, become the most abundant species, and another forest generalist—Ovenbird—becomes common.

However, forest-like groves were apparently a part of the presettlement barrens landscape, and often are today as well, especially in tracts that are large enough to incorporate a variety of microsite features such as frost pockets, damp or slightly mesic substrates, and topographic relief. Several such tracts are represented in the "Diverse" category of Table 2, and in the descriptions of specific, high-quality sites at the end of this article. The breeding-bird fauna of this type of barrens is rich, and because of large tract and patch sizes, is not dominated solely by edge species, but instead incorporates nearly the full range of open to closed barrens species.

Several species were found on surveys of these diverse tracts but not on other types of barrens. For some of these, this is a consequence of the large number of sites and the large average area surveyed in each, as well as the

habitat's diverse structure. For example, the Veery and Wood Thrush could also have been found in other forest-like tracts, and Cliff Swallow on various other open barrens, especially those with ponds and near potential nesting sites. The Savannah Sparrow and Dickcissel were apparently present because of somewhat mesic microsites that allowed a relatively lush growth of grasses and forbs and perhaps the buildup of residual ground cover. Warbling Vireos were sometimes encountered in moderately mature trees typical of their usual breeding habitat in Wisconsin, but some were among small patches of scrubby, 2–3.5m tall oaks or 2.5–8m tall aspens, well out in barrens and isolated from any larger trees. Pine Warblers were present only where jack or red pines at least 12m tall had survived cutting or burning; this species was probably more common in presettlement barrens when true pine savanna was apparently more prevalent. Although the Sharp-shinned Hawk, Solitary Vireo, Dark-eyed Junco, Purple Finch, Red Crossbill, Pine Siskin, and Evening Grosbeak might also occur in other barrens that include conifers, we suspect they respond positively to the diverse natural landscape of these large barrens. The Tennessee Warbler is a boreal species that occurs rarely in Wisconsin's boreal coniferous-hardwood forest near Lake Superior (Mossman et al. 1990), but as frequently in 6–10m tall aspens, oaks, and pines of large barrens in Douglas and Bayfield Counties.

The last category of barrens we will discuss is the jack pine, red cedar, and oak-dominated stands of sandy Wisconsin and Chippewa River terraces. The most abundant species are Blue Jay, catbird, Field Sparrow, and cowbird, while Vesper Sparrow and several edge species are common, including Mourning Dove, flicker, robin, thrasher, waxwing, towhee, Chipping Sparrow, and goldfinch (Table 1). Nashville Warblers breed among jack pines in some sites as far south as Gotham and Muscoda on the lower Wisconsin River, but otherwise, northerly-distributed species are absent. Southern species such as Northern Bobwhite, Red-bellied Woodpecker, Blue-winged Warbler, Orchard Oriole, and Cardinal are more abundant than in other barrens types. Clay-colored Sparrows are conspicuously uncommon, while Lark Sparrows are especially common—probably even more so than in dry prairie, its only other native, non-barrens habitat in Wisconsin. Even in these prairie sites, it often breeds where there are scattered jack pines, cedars, or hardwood saplings (Sample and Hoffman 1989). In areas such as the former Meridean Prairie along the Chippewa River, it also breeds in sandy, abandoned cropland. This species was formerly fairly common in the state (Kumlien and Hollister 1903) but is now decidedly uncommon and restricted in distribution, and will probably continue to decline to the extent that habitat is robbed by succession, clean farming, and development. Fortunately, opportunities still exist to protect and manage the lower Wisconsin and lower Chippewa ecosystems, in which these terrace barrens play a significant role.

On sandy soils, clearcutting or intensive, selective logging of hardwood, conifer, or mixed forest can produce an early successional stage of forest regeneration that mimics some barrens structures. Towhees and cowbirds tend to be abundant, while other typical

barrens birds are common (Table 2). Species that are generally more common here than in true barrens include Eastern Kingbird (attracted to snags), Northern House Wren (abundant among slash), Song Sparrow (often near dead standing and fallen wood), and Alder Flycatcher, Chestnut-sided Warbler, American Redstart, and perhaps Black-and-White Warbler (which occur among the thick shrub and sapling growth of such sites). Although not recorded on counts reported in Table 2, other species typical of cutovers on more mesic sites (Hoffman 1989) may also occur (e.g., Golden-winged Warbler and Mourning Warbler).

Most prairie birds—except perhaps Vesper Sparrow—are precluded from cutovers by the rapid resprouting and seeding in of hardwoods and shrubs, along with the usual cover of slash. Unless substantial numbers of pines or aspens are left standing, Nashville Warblers are absent. Those northern species noted above that seem to associate with relatively intact landscapes tend to be missing. If mature pines are left as scattered "standards" or in small groves, some of these species may occur, along with Pine Warbler.

Logging can provide a valuable means of supplementing populations of barrens breeding-birds, and is often the first step in recreating barrens. Several specific practices may help. Leaving mature standards and scattered groves can mimic a natural structure that is rare in today's managed forests and barrens. Setting back post-logging succession by fire will prolong habitat suitability for many barrens birds. Perhaps most important is considering the landscape context of forestry in barrens regions—in this case to maximize the extent of continuous, open tracts, rather than distributing openings in a patchwork pattern among forest. The WDNR is doing this already in its management of Bayfield County Forest land. Here, large, 400m-wide firebreaks are maintained in an open barrens stage by controlled burning; and to further maximize the extent of contiguous habitat for area-sensitive barrens plant and animal species, short-rotation forestry is concentrated at the borders of these breaks, thus assuring a continual addition of temporary barrens-like clearcuts to the edges of the more permanent open habitat.

Conifer plantations, although sometimes nearly useless to breeding birds, can provide suitable habitat for many barrens birds until trees attain a height of about 2.5m or until their cover reaches about 75%, especially so in those areas of the state where barrens naturally dominated prior to this century, and where plantations are large or adjacent to other suitable habitat (Hoffman and Mossman 1990). Table 2 summarizes bird count data from 15 Christmas tree and forestry plantations. The most common species are Chipping, Clay-colored, and Field Sparrows, and to a lesser extent Vesper Sparrow, cowbird and goldfinch—all typical barrens birds. As might be expected, species such as towhee and yellowthroat that prefer hardwood shrubs are less common here than in most barrens, and their abundance in plantations varies according to the extent of volunteer shrub cover. Species such as woodpeckers, pewee, and nuthatches that require snags or conifers of tree size, are also uncommon or absent. Nashville Warblers may appear when planted conifers are about 4m

tall, especially when more suitable habitat is nearby. Clay-colored Sparrows, which are abundant in hardwood shrubs and oak grubs of barrens and brush prairies, are here abundant in planted conifers, regardless of the presence or absence of hardwoods.

One surprise in our plantation surveys was the Palm Warbler. We found a lone, singing male and an agitated pair that evidently had a nest or fledglings nearby, in a pine plantation situated between jack pine woods and a Bayfield County Forest firebreak barrens. This boreal species is otherwise restricted in Wisconsin to muskeg-like spruce swamps, but here it was apparently breeding among 2–4m tall red pines (55% cover), and a total hardwood cover of about 20%, most of which was less than 1m tall, but with some taller shrubs, saplings, and small trees of aspen and oak. This sort of habitat is apparently not unusual farther north, nearer the center of its range, where it breeds in "bogs or barrens or similar situations on either dry or wet ground where trees are scattered and where there is ground shrubbery" (Godfrey 1986).

The suitability of young conifer plantations to barrens breeding-birds is one consideration in evaluating the advisability of creating and maintaining these artificial communities. There are other factors as well: without structural variety resulting from open, treeless patches, hardwood heath and shrubs, and various-sized trees, the plantation bird community comprises typically very few species; the use of pesticides to control plant competition and insect pests may have deleterious effects on birds and other native biota; depending on site and landscape characteristics, the particular species planted, and management, maturing conifer plantations may develop a very depauperate avifauna, which may far outlast the "barrens" stage (Hoffman and Mossman 1990); alternative uses of cutover forest or abandoned agricultural land may have different or greater advantages to Wisconsin wildlife.

Many barrens bird species are faring well in Wisconsin, in part because they tend to inhabit a wide range of habitats. However, the U.S. Fish and Wildlife Service's Breeding Bird Survey (S. Droege, in litt.) shows that several species have suffered highly significant population declines statewide during 1966–1989: Rufous-sided Towhee, Field Sparrow, Vesper Sparrow, Grasshopper Sparrow, Bobolink, Eastern Meadowlark and Western Meadowlark, and Brown-headed Cowbird.

Three of the species that are especially characteristic of oak and pine barrens, and which do not occur as commonly in any other native Wisconsin community, are the Sharp-tailed Grouse, Clay-colored Sparrow, and Brewer's Blackbird. The ranges of all three extend primarily northwest from Wisconsin.

The Sharp-tailed Grouse is a bird of open, partly shrubby habitats with some trees. At the time of settlement, it was common throughout the prairie, savanna, and probably barrens areas of the state. With further settlement, it declined while Greater Prairie-Chickens temporarily increased, and Kumlien and Hollister (1903) predicted its "speedy extinction" in Wisconsin. However, populations were maintained, and in some areas certainly increased, in northern and central Wisconsin on barrens maintained by frost and fire, in cutovers (especially

where burned), bogs, and abandoned or low-intensity agricultural lands. These habitats shrunk further as abandoned farms succeeded to forest, active farms became freer of "waste" brushland and weeds, wildfires were better controlled, and commercial and public agency foresters planted openings to conifers. By 1950 it was clear that public agencies must commit to a program of controlled burning if the species was to survive in the state (Grange 1948, Hammerstrom et al. 1952). With the help of hunters dollars through federal Pittman-Robertson funds, such a commitment was made in several Wisconsin barrens areas, where habitat was most easily managed. Yet as unmanaged habitat continued to dwindle, the few remaining sharptail barrens became increasingly isolated, and today it is debateable whether these few remaining barrens are large enough to prevent the species' extirpation in the state, especially with the added pressure of hunting (Temple 1989). In response to this problem, WDNR is considering a major expansion of the Namekagon and possibly Solon Springs barrens, to a minimum of 10,000 acres. The large tract size necessary for sharptails is due in part to their communal nature—forming flocks in winter and mating at social display grounds, or "leks," in spring. Habitat is generally considered ideal when it includes a mixture of open grassy sites for displaying and summer feeding, brush prairie for year-round use, and some patches of open or young woods for winter cover and food. Most managed sharptail habitat is in brush prairie successional stages.

The Clay-colored Sparrow is most abundant in Canada's prairie provinces, especially among aspen parklands (Robbins et al. 1986). It is fairly common in the northern two-thirds of Wisconsin, where it breeds in shrubby meadows, oldfields, and hedgerows, as well as in the habitats described above. Early in the breeding season, nests are usually built in residual grassy cover at the bases of shrubs or saplings, and in the summer they are placed more often in the lower branches of a shrub or small conifer. In the presettlement landscape this species probably occurred in many types of shrubby sites, including barrens, unburned meadows, prairies, savannas, and burned-over forest. It apparently disappeared from southern parts of its range as the Midwestern prairies were replaced by cropland (Root, *in* Bent 1968), and its range later expanded eastward as far as New York, possibly as a result of the opening of the Great Lakes forests (DeVos 1964). Its breeding populations have remained fairly stable in recent decades, both continentwide (Robbins et al. 1986) and in Wisconsin (S. Droege, in litt.).

In southern Wisconsin and elsewhere near the current southern and eastern limit of its breeding range, the Clay-colored Sparrow tends to breed in conifer plantations (e.g., Kelley 1978, Bull 1985, Bohlen 1989). In our state it is nowhere as abundant as on the brush prairies of northwestern and central Wisconsin, including those in the late successional stages of Greater Prairie-Chicken management lands on the former Buena Vista Marsh, Portage County. Overall, it seems to reach its highest densities in dry habitats with a simple structure consisting of either conifers or shrubby hardwoods that are of a rather uniform height, between 0.7 and 2m. They are typically

absent from pine-dominated barrens (Table 2), which tend to have a complex structure, with variously-sized conifers and hardwoods; yet they are invariably found in nearby plantations.

Brewer's Blackbird breeds most abundantly in the western states, where it is widespread in many natural and artificial habitats. Its presettlement status in Wisconsin is unknown. Because there is so little information available on northern Wisconsin birdlife in the succeeding decades of the late 1800s, we can only extrapolate from information in eastern Minnesota (Roberts 1932) and southern Wisconsin (Kumlien and Hollister 1903), and guess that it was probably uncommon and widely scattered. By 1919 it was apparently uncommon or rare in northwestern Wisconsin, for Jackson (1943) did not mention it. However the subsequent range expansion of this species from western Minnesota to eastern Michigan during the period 1914–1960 has been well documented (e.g., Walkinshaw and Zimmerman 1961) and has been called "one of the most remarkable range extensions known within recent history" (DeVos 1964). In Wisconsin, Brewer's Blackbirds began appearing in numbers in 1926; and they were common near Hayward in 1928 and were breeding in several places in southeastern, central, and northwestern Wisconsin during 1926–1931 (Schorger 1934). The species has since disappeared from most of the southeast, but it breeds sparingly in Columbia, Marquette, and Dodge counties, and more commonly to the north and northwest.

As elsewhere (Williams, *in* Bent 1958), it nests here in loose colonies and may fly far to collect food for its young. In central and northern Wisconsin it sometimes breeds in agricultural habitats such as pastures, grass hay, or abandoned fields, although individuals may feed in other nearby habitats such as cultivated fields. However, in more natural settings Brewer's Blackbirds are clearly most regular and abundant in sedge meadows, conifer swamps, and especially barrens, which have recently burned, and particularly where there are dead, standing or fallen trees or saplings. For example, in the successional series of brush prairies summarized in Table 3, Brewer's Blackbirds occurred in 5 of 6 tracts that had burned in the same or previous year that the count was made, and it was sometimes the most abundant species. It was recorded in only 2 of the 6 tracts not recently burned, in low numbers. This species seems most likely to return to a site for several years after a burn, when dead wood remains.

Interestingly, Schorger (1934) noted an even stronger association between this species and recently burned habitats, during the early years of the range expansion in Wisconsin. Yet, neither we nor Schorger knew of similar reports outside Wisconsin. In Michigan, for example, the species was reported as typically breeding in muck farms near ponds in the south, and in bogs and meadows in the north (Walkinshaw and Zimmerman 1961).

It is also noteworthy that whereas Brewer's Blackbirds nest mostly in shrubs and trees from central Minnesota westward, in the more recently invaded breeding areas of the Great Lakes they nest almost invariably on the ground (Roberts 1932, Walkinshaw and Zimmerman 1961). We have found 4 nests in Wisconsin, all of them on the ground. One was in an open

pasture. The others were in barrens, associated with dead wood: at the base of a weathered wooden post, beneath the limbs of a fallen hardwood tree, and near from a rotten, fallen, burned jack pine.

Wisconsin barrens also provide habitat for several notable bird species not included in Table 2. For example, we saw a Burrowing Owl at the Namekagon Barrens on 26 May 1990 (*Passenger Pigeon* 52:401, 1990), and a female Prairie Warbler at the Solon Springs Sharptail Barrens on 23 May 1989. Both were outside their normal breeding ranges, but occurred in suitable nesting habitat. Pat Savage (*Passenger Pigeon* 52:200, 1990) found a Black-shouldered Kite at the Namekagon Barrens in September 1989. Barrens are among the most likely places to encounter Golden Eagles in the winter. Kettle depressions in barrens often hold ponds or marshes. Although we omitted birds of these wetlands in Table 2, they can be an important part of the barrens breeding-bird fauna, especially in the northwest. At a pond on the Solon Springs Barrens, observers have recorded Pied-billed Grebe, a Ring-necked Duck pair, Soras, Killdeer, Spotted Sandpipers, and Sedge Wrens, along with common edge-loving species such as Red-winged Blackbirds and Song Sparrows at its border. At a pond rimmed with emergents on the north unit of the Namekagon Barrens, we found a Common Loon, Great Blue Heron, Mallard, Green-winged Teal, 2 Lesser Scaup, 2 Spotted Sandpipers, 4 Killdeer, and 2 Yellow-headed Blackbirds.

In summary, Wisconsin's oak and pine barrens evolved in a dynamic landscape governed largely by the forces of succession, fire, and frost. Variety on this landscape was imparted by the variable influences of climate, topography, soils, moisture regimes, and fire barriers. Despite the neglect and abuse that most barrens have undergone since settlement, this is one of our most resilient natural communities, and it will respond to careful management by controlled burns and cutting. Moreover, its economic land value is generally low, and comparatively little has been permanently converted to other uses. Perhaps for no other native community are the opportunities for large-scale restoration so great.

Yet restoration and the necessary, continual management demand not only longterm commitment and effort, but also appropriate goals. Wisconsin currently stands at a crossroads in setting goals that will guide the future of the barrens ecosystem. Proposed objectives range from wood pulp production, to species-oriented management for Sharp-tailed Grouse, grassland songbirds, white-tailed deer, upland-nesting waterfowl, reintroduced elk, and endangered plants and butterflies, to community restoration. Hopefully our future course of research and management will provide for all elements of the native barrens ecosystem: the full complement of plants and animals, physiognomic structures, and ecological interactions that to the best of our knowledge belong here.

To ensure the variety and patch sizes of various structural types adequate to support longterm, viable populations of the many constituent species of barrens ecosystems, restoration will undoubtedly have to occur on tracts several thousand acres in extent. Native northern dry and dry-mesic forest,

dominated by pine and oak, are also ultimately dependent on fire, and should be considered as part of this managed landscape (Hoffman and Mossman 1990). Appropriate commercial logging and planting could be incorporated as well—as at the Bayfield firebreaks—to enhance the viability of these ecosystems.

Several sites are especially appropriate for this type of large-scale management in the state. Large barrens complexes are already managed at most of these. Foremost are the Namekagon and Solon Springs barrens, which should be expanded and joined to create a single tract of at least 15,000 acres. WDNR, and Douglas and Burnett counties are currently pursuing this.

Another important area is the Spread Eagle complex in Florence County, the 3 major units of which could be linked into 5,000 acres or more of barrens. This is perhaps the only opportunity to restore a large barrens of the bracken-grassland type, at least the flora of which is distinct from that of the more western and southern barrens. The Moquah Barrens (Bayfield County) has the potential of attaining several thousands acres of quality barrens, but integrated management of the surrounding landscape is sorely needed.

Barrens at Crex Meadows (Burnett County) and Necedah National Wildlife Refuge (Juneau County) are interrupted by managed impoundments, and would be enhanced by expansion into adjacent, mostly forested land. The Necedah refuge offers one of the very few chances for large-scale restoration in the central Wisconsin region.

A few smaller barrens are also worth restoring or maintaining, especially in the central and northcentral regions, where few if any opportunities exist to accomplish this on a larger scale; or where important species populations can be protected. Examples include those at Dunbar (Marinette County), Johnson Lake (Oneida County), Fort McCoy (Monroe County), and Van Zelst (Sauk County). All of these would benefit from expansion. Another central region site, which has received very little attention, is the jack pine barrens and forest located on sterile sands of the popular Mirror Lake State Park (Sauk County), near Wisconsin Dells. It would be a worthy educational site as well. Several of our surveys were done there. Juneau County's Buckhorn State Park has similar potential.

The barrens of the lower Wisconsin and Chippewa Rivers are not capable of being managed on a large scale: they are too fragmented naturally and by surrounding land uses. Yet tracts varying in size from approximately 40–400 acres are possible. They should be considered an integral component of these river ecosystems in management plans.

Description of Sites

The following 4 sites are among the best remaining examples of relatively large, intact pine barrens. All are represented in the "Diverse" category of Table 2. There are two sites each in northwestern and northeastern Wisconsin. A large proportion of the barrens avifauna can be expected at any site.

Solon Springs Sharptail Barrens State Natural Area

Size—240 acres of natural area lying within a 3000-acre barrens.

Location.—South-central Douglas County, within the Douglas County Wildlife Area.

Access.—From Solon Springs go south on Highway 53 for 3 miles, then west on Mead Church Road 0.5 mile to the southeast corner of the natural area.

Site Description.—This site presents a microcosm of the presettlement landscape of northwestern Wisconsin, where pine barrens were a mixture of very open areas, areas with scattered trees, and areas that had clumps of trees and shrubs. Part of an extinct glacial lake bed, it now has rolling topography with melanized sandy podzol soil and a pothole pond. The dominant trees are jack pine and aspen. Other species include Hill's oak, red pine, and choke cherry (*Prunus virginiana*). Common shrubs are hazel, blueberry, sweet fern, dewberry, dwarf willow, and redroot. The ground layer is represented by such species as little bluestem, wild rose, bearberry, asters, *Solidago* sp., puccoon (*Lithospermum* spp.), sage (*Artemisia* spp.) and Canada mayflower (*Maianthemum canadense*). The barrens community persisted here, in part due to its former use as a pointing-dog training and trial area by the Northern States Field Trial Association. It continues to be managed by fire to closely resemble the pre-settlement condition.

Birds.—The bird list here is influenced by the general aspect of large openings interspersed with scattered trees and clumps of jack pine or aspen, along with the presence of a pothole pond. The relatively open areas support birds such as Upland Sandpiper, Clay-colored Sparrow, Vesper Sparrow, and Brewer's Blackbird. Many other species are more closely associated with woodlands and edges: Black-billed Cuckoo, Eastern Wood-Pewee, Least Flycatcher, Veery, Hermit Thrush, Red-eyed Vireo, Chestnut-sided Warbler, Scarlet Tanager, Rose-breasted Grosbeak, Northern Oriole, and Pine Siskin. A comparison of those species found here and those found on the more open Namekagon Barrens is instructive.

Two very intriguing species have been found here in low numbers but with surprising regularity: the Connecticut Warbler, found in jack pine groves with dense understory, and the Tennessee Warbler, found in both aspens and pines. Data in Table 4 are an average from counts conducted by Jack Hailman (1973), Sam Robbins (1971–72, 1974–76), Mossman (1980), and Sumner Matteson (1988).

Namekagon Barrens

Size.—About 5500 acres, in three units.

Location.—Northern Burnett County.

Access.—From Wascott in southern Douglas County, proceed west on County Highway T for about 13 miles, then south on Town Road 2 miles to the northeast corner of the expansive barrens. Follow any of several gravel or dirt roads south and west to explore the barrens.

Site Description.—This is the main part of the Namekagon Wildlife Area. A primary objective of the barrens

Table 4. Average number of birds encountered on four barrens natural areas.

Species[1]	Average number[2] encountered at: Solon Springs	Namekagon	Aurora	Dunbar diverse[3]	Dunbar open[4]
Common Loon*		1			
Pied-Billed Grebe*	+				
Great Blue Heron*		1			
Green-winged Teal*		1			
Mallard*		3			
Ring-necked Duck*	+				
Lesser Scaup*		2			
Northern Harrier	+	2	1		
Red-tailed Hawk	+	2	1	+	
American Kestrel	+		1	+	
Ruffed Grouse		1			
Sharp-tailed Grouse	+	1			
Bobwhite	+				
Killdeer	1	6	4	+	
Spotted Sandpiper*		2			
Upland Sandpiper	1	16	3	2	5
Mourning Dove	3	3	1	+	+
Black-billed Cuckoo	2	1		+	
Common Nighthawk	+				2
Chimney Swift	+				
Downy Woodpecker		1		+	
Hairy Woodpecker				+	
Nothern Flicker	1	5	2	1	1
Eastern Wood-Pewee	1	2		4	
Alder Flycatcher	+	1			
Least Flycatcher	+	4		2	
Great Crested Flycatcher	+	1	1	2	
Eastern Kingbird	3	22	4	4	2
Tree Swallow	3	18	1	1	13
Barn Swallow	+	1			
Blue Jay	3	3	4	3	
Northern Raven	+	4	3	+	
American Crow	3	8	4	3	+
White-breasted Nuthatch					+
House Wren	1	15		1	+
Winter Wren				+	
Eastern Bluebird	2	21	3	2	7
Veery	+	3		2	
Hermit Thrush	+	1		1	+
Wood Thrush		4		1	
American Robin	1	12	3	4	+
Gray Catbird	+	18		1	
Brown Thrasher	4	22	4	4	1
Cedar Waxwing	1	6	2	8	1
Starling	+	1			
Yellow-throated Vireo				+	
Warbling Vireo	2	4			
Red-eyed Vireo	1	4		3	+
Golden-winged Warbler		1	1	+	
Tennessee Warbler	+				
Nashville Warbler		4	1	+	
Yellow Warbler	3	31			
Chestnut-sided Warbler		7	4	1	3

(*continued*)

Table 4. (*Continued*)

Species[1]	Average number[2] encountered at: Solon Springs	Namekagon	Aurora	Dunbar diverse[3]	Dunbar open[4]
Black-and-White Warbler					+
American Redstart				1	
Ovenbird				5	
Connecticut Warbler	+				
Mourning Warbler				+	
Common Yellowthroat	13	33		+	
Scarlet Tanager	+			2	
Rose-breasted Grosbeak		2	1	1	4
Indigo Bunting	1	5	1	3	2
Dickcissel		1			
Rufous-sided Towhee	7	55	4	6	+
Chipping Sparrow	1	2		3	3
Clay-colored Sparrow	23	243	21	4	21
Field Sparrow	5	26	4	7	10
Vesper Sparrow	4	44	2	1	10
Grasshopper Sparrow	+	1			
Henslow's Sparrow			+		
Savannah Sparrow		4			
Song Sparrow	10	15	10		2
White-throated Sparrow					+
Dark-eyed Junco			1	+	
Bobolink	+				
Red-winged Blackbird*		4	2		+
Western Meadowlark		2		+	
Yellow-headed Blackbird*	2	1			
Brewer's Blackbird	3	53	5		
Common Grackle	+			+	
Brown-headed Cowbird	2	18	1	4	2
Northern Oriole	2	1		1	
Purple Finch				1	
Red Crossbill	+				
Pine Siskin	1				
American Goldfinch	2	28	5	1	1
Evening Grosbeak	+			+	

[1]*Species recorded (at least primarily) on or adjacent to a pond.
[2]+ Species present, but $\bar{x} < 0.5$ individuals per survey.
[3]Surveys conducted prior to intensive management.
[4]Surveys conducted after intensive management and erection of nest boxes.

management has been to provide habitat for Sharp-tailed Grouse. Through the use of timber sales and prescribed burns, the former forest of jack pine and oak here was converted to a barrens dominated by brush prairie. The shrub layer consists of oak grubs, hazelnut, redroot, sweet fern, and blueberries. The ground layer is dominated by sand prairie species including little bluestem, panic grasses (*Panicum* spp.), thimbleweed (*Anemone cylindrica*), puccoon, goldenrods, asters, blazing star, and sunflowers. This area does not precisely resemble the presettlement landscape. Jack pine was an important component of the presettlement landscape of this region according to the land surveyors' notes, but it is rare on this barrens today.

Birds.—The Namekagon Barrens is now proposed as a 10,000-acre managed area, to provide enough area to sustain a viable population of Sharp-tailed Grouse. This management will expand the openness of the area. Benefits should also be reaped by other species requiring large tracts and those that utilize the open end of the pine barrens continuum (Table 2). A comparison of Solon Springs and Namekagon Barrens birds indicate bird responses to different barrens structures. A total of 9 hours was spent on 3 counts, all on separate sections of the north and south units, by Epstein and Mossman in 1989. Table 4 gives a total of these counts. In an area of oak grubs burned just a few weeks prior to the surveys, Clay-colored Sparrows, Brewer's Blackbirds, and Rufous-sided Towhees were common. A small, unburned, wooded draw contained Black-billed Cuckoo, Least Flycatchers, Robins, Veery, Hermit Thrush, Red-eyed Vireo, Indigo Bunting, American Goldfinches, and a few other species.

Aurora Barrens

Size.—900 acres. One of 3 units of the Spread Eagle complex, which encompasses nearly 3500 acres of barrens.

Location.—Eastern Florence County.

Access.—From Florence, go south on County Highway N about 7 miles, then east on Roach Fire Lane (also known as the Plains Road) for 2 miles to the western edge of the barrens. This road bisects the barrens.

Description.—Aurora is the most open of the Spread Eagle barrens. It includes rolling glacial till with swales and low spots that are kept free of woody vegetation by growing-season frosts. The higher areas were originally covered with jack and red pines, but are now vegetated with shrubs. It is now surrounded by forest of aspen, oak, and jack pine. Occasional burns have occurred in the past; however, the barrens have been maintained in some parts without burning. This is a representative of bracken-grassland barrens, and bracken fern is the dominant species in several places.

Birds.—Aurora Barrens provides excellent habitat for barrens species requiring open areas. Observers should easily find Northern Harrier, Killdeer, Upland Sandpiper, Eastern Kingbird, Tree Swallow, Brown Thrasher, Eastern Bluebird, Rufous-sided Towhee, Clay-colored Sparrow, Song Sparrow, Brewer's Blackbird, and American Goldfinch.

Table 4 gives an average from 3 counts, conducted by Epstein and Mossman (1986) and Steve and Laura LaValley (1990).

Dunbar Barrens State Natural Area

Size.—A 240-acre natural area within a 1000-acre barrens.

Location.—Northern Marinette County.

Access.—From the intersection of Hwys 8 and U about 1 mile west of Dunbar, go west on Hwy 8 for 2.1 miles, to an unimproved but good ac-

cess road that leads north about 1 mile to the barrens.

Description.—The pine barrens is a portion of a large opening located on a pitted outwash plain. Aspen, oak, and jack pine form the forest on the surrounding, gently rolling topography. The dominant herbaceous vegetation on the barrens consists of strongly rhizomatous grasses and sedges. A well-developed shrub layer is present. The general aspect is that of a prairie with broad sweeping vistas and a distinctive panorama. The action of frost in low pockets contributes to the openness. Common plants include rice grass (*Oryzopsis* sp.), poverty oat grass (*Danthonia spicata*), bearberry, blueberries, sweet fern, barrens strawberry (*Waldsteinia fragarioides*), and hawkweeds (*Hieracium* spp.). There is a diverse and unusual lichen flora.

Birds.—The birdlife at Dunbar Barrens is today quite similar to other heavily managed barrens. Breeding-bird surveys conducted during 1976–85 recorded many forest and edge species. Subsequent management has opened the area more by eliminating or reducing the size of wooded patches or groves. Consequently, species such as forest flycatchers and thrushes, Ovenbird, Red-eyed Vireo, tanager, and Blue Jay have been replaced by more open-country birds such as Upland Sandpiper, Common Nighthawk, Vesper Sparrow, and Clay-colored Sparrow. By comparing surveys from 1976–85 with those of 1988–90, resultant changes in the avifauna are apparent (Table 4). The numbers of Tree Swallows and Eastern Bluebirds has been greatly enhanced by the erection of many nest boxes. Table 4 gives average values for counts conducted by Mr. and Mrs. Elmer Mathis (1975–76, 1978–80, 1982), Mossman (1985), Epstein (1988), and Nancy Meyer (1989–90).

Acknowledgements

Wisconsin would have almost no barrens remaining today, were it not for the foresight and efforts of various agencies and individuals. Foremost is the WDNR Bureau of Wildlife Management, especially staff in the Northwest District, where barrens management has long been a priority. The Natural Areas and Natural Heritage sections of the Bureau of Endangered Resources continue to identify, inventory, and assure the perpetuation of barrens statewide, and the Bureau of Research has provided answers to necessary questions, particularly with regard to Sharp-tailed Grouse. Much management and research for sharptails has been supported by Pittman-Robertson funding. Many barrens managed by WDNR are on state and county forest lands, and the cooperation of the WDNR Bureau of Forestry and Bayfield, Burnett, Douglas, and Dunn Counties has been essential. Florence and Marinette counties have also cooperated by leasing barrens lands to WDNR. Chequamegon National Forest has maintained barrens in Bayfield County, and Necedah National Wildlife Refuge is working to restore a complex of sand pairie, brush prairie, and oak savanna in Juneau County. The Van Zelst Barrens (Sauk County) is owned and managed by the University of Wisconsin. The Department of Defense is responsible for the oak savanna on Fort McCoy Military Reservation, Monroe County. We wish

to thank the cooperators who contributed survey data, as listed in the site descriptions. Our field work was supported in part by voluntary contributions to the Endangered Resources Fund.

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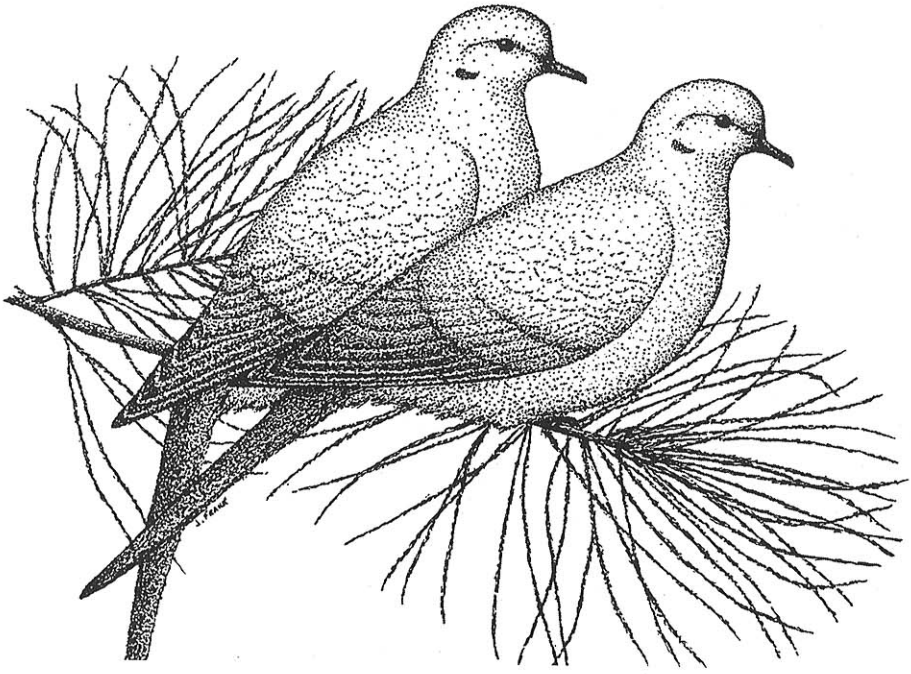

Mourning Doves *by James C. Frank.*