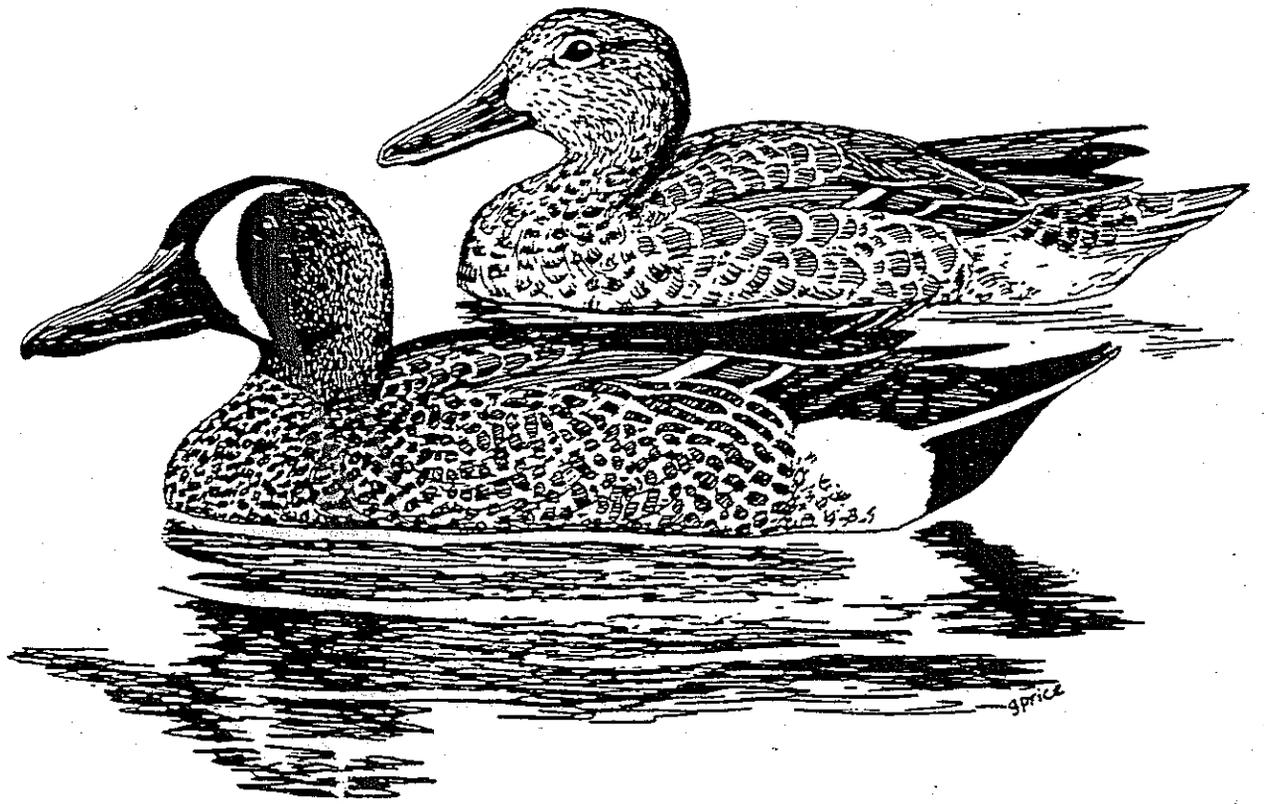


Upper Mississippi River
and Great Lakes Region
Joint Venture -
WISCONSIN PLAN

March 1992



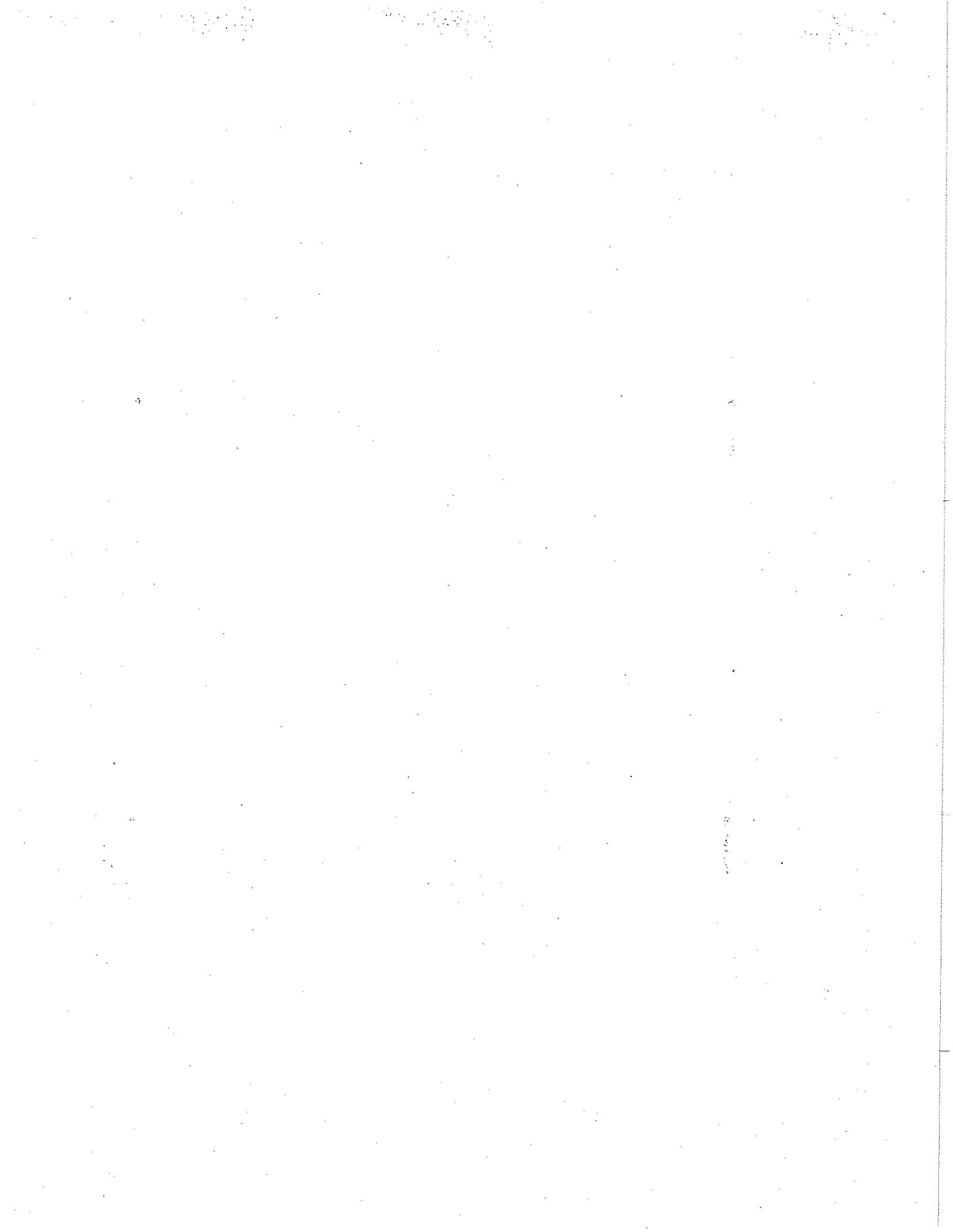


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EXECUTIVE SUMMARY

The North American Waterfowl Management Plan (NAWMP) establishes a continental breeding population goal of 62 million ducks, including 8.7 million mallards, and a fall flight of 100 million ducks during years of average environmental conditions. The Upper Mississippi River and Great Lakes Region (UMR&GLR) Joint Venture (JV) was approved in 1991 as a Joint Venture under the NAWMP. Wisconsin is a major partner in the UMR&GLR JV. Wisconsin portion of the UMR&GLR JV goal and objectives will address addressing breeding population and habitat objectives established by the NAWMP for the surveyed portion of the United States. Specifically, the Wisconsin's phase of the JV will target the objectives described in the Concept Plan for the UMR & GLR JV. The UMRGLR JV calls for improving or permanently protecting habitat on 2.84 million acres of public lands in the region over the next 15 years. An additional 1.87 million acres of habitat on private lands should be sustained using consecutive short-term agreements to provide improved habitat for waterfowl and other wildlife.

Implementation of the JV in Wisconsin will permanently protect and enhance an additional 55,000 acres of habitat with 3:1 upland to wetland ratio. On private lands, another 112,500 acres of habitat will be protected and improved under shorter-term agreements. Finally, 65,100 acres of habitat on newly-acquired or existing public lands will be enhanced for waterfowl and other wildlife.

Accomplishing Wisconsin's portion of the UMRGLR JV will contribute to the NAWMP population goal by adding 200,000 ducks, including 50,000 mallards and 125,000 blue-winged teal, to Wisconsin's average spring breeding population, thereby increasing the state's fall flight contribution by 325,000 ducks by the year 2005. In addition, diving duck use days will be increased by 1 million.

The goals and objectives of Wisconsin's portion of the UMRGLR JV will be achieved through action carried out by a partnership of federal, state, and private organizations, and individuals. Emphasis will include strategies to restore, protect, enhance and manage habitats for multiple wildlife and human benefits. Major thrusts of these efforts, in order of priority, will be:

1. restore or enhance wetland-upland complexes and protect existing complexes, using fee title and perpetual easements;
2. develop and sustain habitat on private land to increase waterfowl production and other wildlife and wetlands values, including soil and watershed protection;
3. enhance and manage existing or newly acquired public lands and waters to increase waterfowl production and other wildlife and wetland values, including soil and watershed protection;
4. protect existing wetlands on private lands via existing and new legislation both on the state and national level.

Total cost to achieve the habitat objectives of Wisconsin's portion of the UMRGLR JV is estimated at \$6.8 million per year during the next 15 years. The costs will be shared by state, federal, and private organizations, and individual partners dedicated to achieving the goals and objectives of this JV.

Nine habitat focus areas are established in Wisconsin and within these focus areas, townships with critical habitat are identified into which implementation of this plan will be directed. State, federal, and private agencies will be concentrating their wetland and waterfowl programs in these focus areas to achieve the goals and objectives outlined in this plan. Research priorities and evaluation strategies are identified in the plan.

I. INTRODUCTION

The North American Waterfowl Management Plan (NAWMP) identifies habitat loss and degradation as the major factors limiting waterfowl in North America. The NAWMP, signed by the United States and Canada, recognizes that the conservation of North American waterfowl should be pursued through cooperative planning and coordinated management (USFWS 1986b). To that end, the plan establishes a framework for the recovery of declining waterfowl populations through defined goals and objectives for both populations and habitats.

Joint Ventures (JV), cooperative efforts between governments and private organizations are encouraged by the NAWMP to fund high priority management and research projects of international concern that require a pooling of resources. Joint ventures serve as a means of cooperatively planning, funding and implementing projects to restore, preserve and enhance waterfowl habitat and achieve the goals of the NAWMP.

The NAWMP identified two major waterfowl habitat areas of concern from Wisconsin's perspective, the "Prairie Potholes and Parklands" (Area 32) and the "Upper Mississippi and Northern Lakes" (Area 22) regions. (USFWS 1986b). The prairie potholes and parklands of Canada and the United States are designated as top priority habitats for protection because of their significance as the continent's most important duck producing region. Deterioration of pothole and parkland habitat is the principal cause of the decline in the abundance of mallards and pintails which, together with black ducks, are species of great international concern.

The Ladd Report outlined the future objectives and priorities of the U. S. Fish and Wildlife Service's (USFWS) Migratory Waterfowl Habitat Acquisition Program (Ladd 1978). This report identified 15 broad geographic habitat categories of national importance to waterfowl. Category 11 was identified as breeding duck habitat in the Great Lakes region consisting primarily of prairie pothole-type wetlands in portions of Wisconsin, Minnesota, Illinois, Indiana and Michigan. A concept plan was developed to describe and identify waterfowl habitat protection needs for the area (USFWS 1979).

In 1985, the Service developed a new acquisition strategy, the Ten-Year Waterfowl Habitat Acquisition Plan, also known as the Morgan Report, to better address habitat needs of certain individual waterfowl species and populations determined to have serious habitat related problems (USFWS 1985). This document again identified habitat protection needs within 11 habitat acquisition priority categories. Category 2 of this document included the glaciated pothole habitat of Wisconsin.

In 1986, the NAWMP recognized 34 waterfowl habitat areas of major concern, including Category 22, identified as the "Upper Mississippi River and Northern Lakes" region, but the remnant prairie wetlands of Wisconsin were not specifically identified. Waterfowl production habitat in the Great Lakes region serves as an integral part of the waterfowl habitat in North America. "Breeding habitat in the Great Lakes region is contiguous to and interrelated with western and northern production areas and southern wintering areas. Preservation of

waterfowl producing habitat in the Great Lakes region is important because of its contribution to the waterfowl resource of the Mississippi and Atlantic Flyways and the Nation" (USFWS 1979).

Further, to assist in the implementation of the Emergency Wetlands Resources Act (Act) of 1986, the Services Region 3 developed a Regional Wetlands Concept Plan that identifies priority wetlands and outlines strategies to protect them. The Upper Great Lakes Basin and Mississippi Basin were identified as priority areas in the Regional Wetlands Concept Plan.

The NAWMP (USFWS 1986b) lists the following goals:

- Maintain the current diversity of duck species throughout North America and, by the year 2000, achieve a breeding population level of 62 million during years with average environmental conditions. This would provide a fall flight of over 100 million birds during average years.
- Reach or exceed population goals (1970-79 average population levels) for breeding populations of mallard, pintail, gadwall, wigeon, green-winged teal, blue-winged teal, shoveler, redhead, canvasback, and scaup.
- By the year 2000, achieve and maintain in the surveyed area a breeding population index level of 8.7 million mallards during years of average environmental conditions (Wisconsin population estimates are included in the surveyed area). Twenty-five percent (1.2 million mallards) of the breeding mallards would be from surveyed areas of the United States.
- By the year 2000, to achieve and maintain in the surveyed area a breeding population index level of 6.3 million pintails during years of average environmental conditions. Thirty-five percent (1.1 million pintails) of the breeding pintails would be from surveyed areas of the United States.
- To attain, by the year 2000, a wintering population index of 385,000 black ducks in the Atlantic and Mississippi Flyways.

To achieve the population goals, the NAWMP also identifies the following habitat goals that directly or indirectly affect duck populations associated with Wisconsin by:

- restoring 1.1 million acres of mallard and pintail breeding habitat (275,000 wetland acres and 825,000 upland acres) in the midcontinent region of the United States;
- maintaining the habitat value of NAWMP-designated areas of international significance to waterfowl;
- maintaining waterfowl habitats of acceptable quality and minimize exposure to contaminants;

Individual population and habitat objectives for Wisconsin proposed under the UMRGLR JV address NAWMP breeding population and fall flight goals for mallards and blue-winged teal and their critical habitats, as well as contribute to population goals for other species. Wisconsin's participation in the JV initiative will address a portion of those needs.

Wisconsin's portion of the JV also includes, (1) a combined breeding population objective for wood ducks, shovelers, green-winged teal, gadwall, redheads and ring-necked ducks, (2) restoration and enhancement of fall staging and migration habitat for mallards and other dabbling ducks and for canvasback, scaup, and other diving ducks, and (3) a broad spectrum of wildlife associated with wetlands, including several endangered or threatened species, that will benefit from JV initiatives.

II. BACKGROUND

Development of plan for Wisconsin's portion of the JV equates to stepping down the NAWMP to the state level, providing the necessary detail on goals, objectives, strategies and proposals needed to meet established population levels for mallards, pintails, black ducks and other waterfowl and their habitat.

Input from Wisconsin's JV Planning Committee, comprised of wildlife managers and researchers from the Wisconsin Department of Natural Resources (WDNR), USFWS staff from Region 3, Ducks Unlimited (DU), The Nature Conservancy (TNC), Great Lakes Indian Fish and Wildlife Commission (GLIFWC), Wisconsin Waterfowl Association (WWA), U.S. Forest Service (USFS), and the U.S. Soil Conservation Service (SCS) provided the basis for this plan and the recommended needs and direction for its implementation.

III. TERMINOLOGY

FOCUS AREA - Geographic areas within the recommended JV area that have been identified as high priority production or migration habitats for mallards, pintails, black ducks and other waterfowl.

PROJECT PLAN - Plan describes a specific habitat project site within a focus area that outlines strategies, budgets, cooperating entities and schedules for implementing, monitoring, and evaluating the project. A focus area may contain one or more projects, depending on the area.

MANAGEMENT STRATEGIES - Methods and techniques to accomplish JV objectives. Some strategies may apply to the entire recommended JV area, e.g. cooperative efforts with agricultural agency programs to work with private landowners. Other strategies may apply only to specific focus areas, e.g. restoration of wetlands on public and private lands.

IV. DESCRIPTION OF WATERFOWL USE

Species

Wood ducks, mallards, blue-winged teal, and giant Canada geese are the most abundant breeding waterfowl in Wisconsin. Less common nesting waterfowl include black ducks, pintail, shovelers, green-winged teal, American wigeon, redheads, ruddy ducks, and ring-necked ducks. Wisconsin's average spring breeding population estimate during 1973-79 represented about 4 percent of the total ducks counted on the annual surveys of the U.S. portion of the Prairie Pothole Joint Venture (PPJV) (Andryk et al. 1988, USFWS 1988b). During the 1980s, Wisconsin's spring population represented a slightly greater proportion (5 percent) of the ducks counted on the spring surveys in the U.S. portion of the PPJV since average breeding populations in that region outside of Wisconsin declined, while Wisconsin's duck numbers increased substantially on a statewide basis.

Habitats

Breeding habitats within Wisconsin's primary duck-producing regions (Figure 1) are predominantly pothole-type wetlands created by the Wisconsin glaciation. These shallow, glaciated lakes and marshes are similar to the productive marshes of the prairie pothole region of the north central U.S. and Canada (USFWS 1979). Other habitats in the primary breeding range include streams and ditches, inland lakes, beaver flowages, man-made ponds, and impoundments of various types, and state and federal waterfowl management areas. Figure 1 shows the proposed boundaries of Priority I and II habitats of Wisconsin's portion of the JV. Priority I habitat (approximately 30,675 square miles) includes primarily the SE/Central and western Northern High spring breeding survey strata which cover regions of highest overall duck densities, plus several adjacent counties where WDNR managers felt habitat potential and duck densities warranted JV attention. About 2,500 square miles of this area are not included in the spring breeding survey and another 3,100 square miles are in the Northern Low survey stratum (about 20 percent of the stratum).

The Mississippi River system and Green Bay are also given Priority I status to recognize their importance in the NAWMP. Counties given Priority I status include all of those already approved for Waterfowl Production Area (WPA) acquisition using Small Wetland Acquisition Program (SWAP) funding, plus any additional potentially productive areas recommended by WDNR personnel.

Most ducks common to the north central U.S. and Canada migrate through Wisconsin each spring and fall. Bellrose (1976) outlines two major duck migration corridors crossing regions of Wisconsin proposed for JV status. Wisconsin is also the major spring and fall migration stop for the 900,000+ Mississippi Valley Population (MVP) of Canada geese. Critical migration habitats within the JV include state and federal refuges, inland lakes, especially those of the Winnebago system in the southern Priority I habitats which historically were major canvasback concentration areas, the Mississippi River and its tributaries, the Wisconsin River flowages and bottomlands, the larger

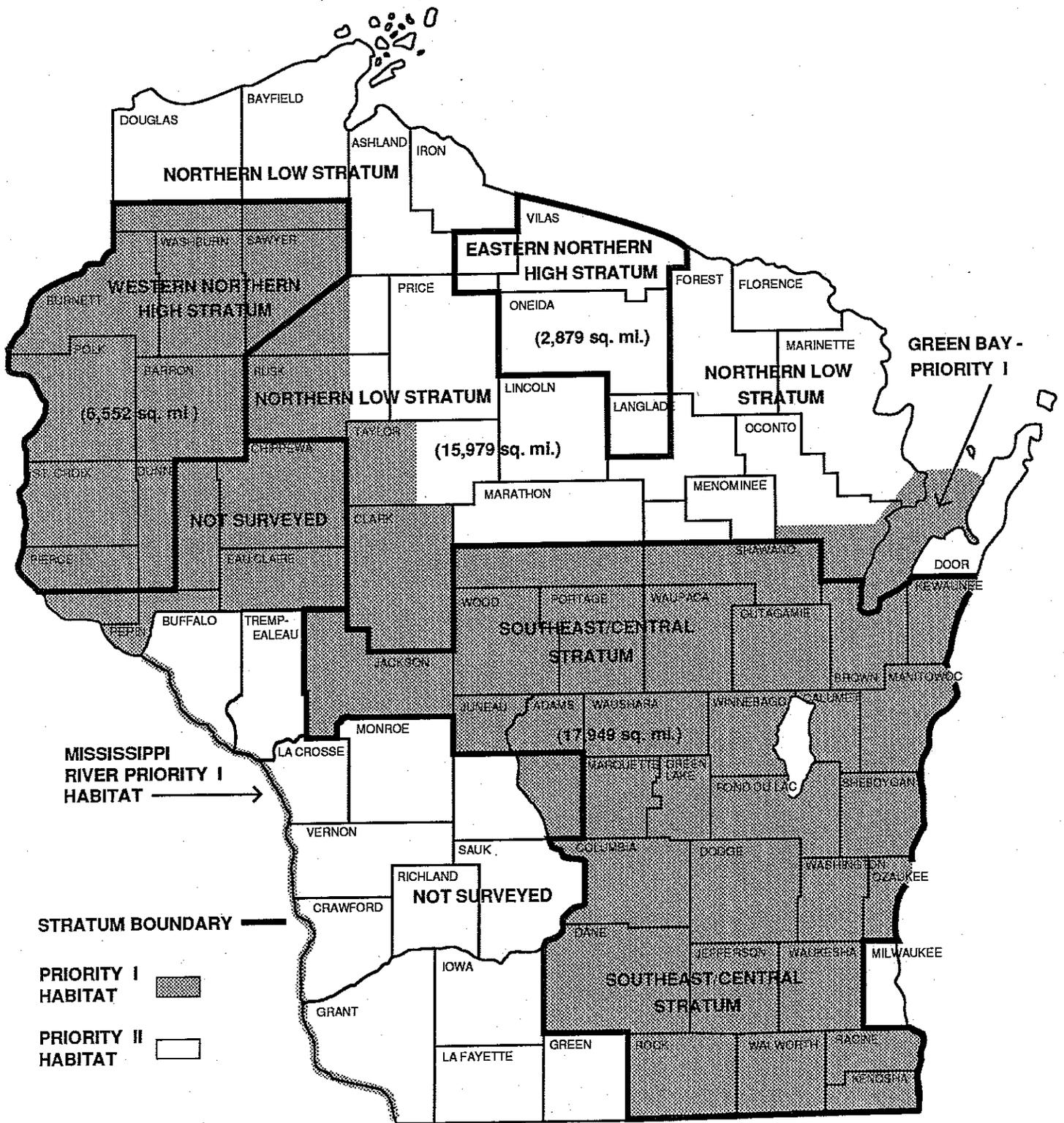


Figure 1. Spring breeding duck survey strata in relation to Joint Venture Priority I and Priority II habitats.

glaciated ponds and marshes, Green Bay and its coastal marshes, and Lake Michigan.

Breeding Populations by Region

Since 1973, Wisconsin has annually surveyed spring breeding waterfowl populations throughout glaciated portions of the state. Much of the JV area falls within one of the three spring breeding survey strata (Andryk et al. 1988).

During 1973-79, which encompasses most of the 1970-79 period selected as the "base population levels" for the NAWMP goals (USFWS 1986b, USFWS 1988a), an estimated 184,800 ducks (Table 1) bred in the SE/Central survey stratum which encompasses much of the southern Priority I habitats. Included were an average of 113,500 blue-winged teal and 46,900 mallards (Table 1). Breeding population estimates over the same area in 1980-88 averaged only 131,300 ducks. Ducks seen on individual transects in the eastern and southern portion of the stratum declined as much as 50-60 percent. The major decline came in the numbers of blue-winged teal and species other than mallards (Andryk et al. 1988). Gatti (1988) indicated spring population estimates for blue-winged teal were declining at an average rate of 10 percent per year in the SE/Central stratum during 1973-86, while mallards apparently remained stable. Stability in mallard numbers at least partially reflects the more stable wetland habitat and better recruitment of the species in Wisconsin when compared to the PPJV region. In much of the PPJV, mallards did not respond to the few years of good water conditions during 1977-86, and populations remained below goals established under the NAWMP (USFWS 1986b).

The southern Priority I habitat, covering about 18,550 square miles, is capable of supporting higher spring duck populations than presently exist. Blue-winged teal population estimates for the SE/Central stratum exceeded 100,000 breeders in 5 springs during 1973-88, with a peak population estimate of 200,000+ teal in 1975 (Andryk et al. 1988). Also, mallard population estimates for the SE/Central stratum exceeded 50,000 breeders in 5 springs during 1973-88. Based on averages of 1973-79 peak numbers (Table 1), the SE/Central stratum and adjacent portions of Adams and Oconto counties have a potential, with wetland restoration and enhancement and additional perennial upland nesting cover establishment, to support 77,000 mallards, 145,000 blue-winged teal and 44,000 other ducks for a total population of 266,000 birds in years with average habitat conditions. Wood ducks are underrepresented in the population objective for "other ducks" because of the difficulty in accurately censusing breeding wood ducks.

Over 12,100 square miles of Priority I habitat are in northwestern and westcentral Wisconsin and include all of the area of the western portion of the Northern High survey stratum, plus all or parts of 6 adjacent counties (Figure 1). Chippewa, Eau Claire, and Pepin counties are not included in the statewide spring breeding survey, but contain habitat of importance to breeding wood ducks and other species. Clark, Rusk and Taylor counties are in the Northern Low spring survey stratum, but have duck densities comparable to those in some parts of the two higher density strata. During 1973-79, spring population estimates for the northern Priority I area, excluding the

Table 1. Average spring breeding populations and population goals for Priority I habitat of the Wisconsin Joint Venture.

Wisconsin Breeding Pair Survey Stratum and Species Goals	<u>Estimated Numbers of Breeding Ducks*</u>				Year 2005 Priority I Pop.
	<u>1973-79</u>		<u>1980-88</u>		
	Ave.	Ave. 3 High Yrs.	Ave.	Ave. 3 High Yrs.	
SE/Central (17,949 mi ²)					
Mallard	46,900	59,700	47,100	64,500	77,000
B.W. Teal	113,500	120,100	64,600	110,200	145,000
Other Spp.	<u>24,400</u>	<u>37,400</u>	<u>19,600</u>	<u>36,400</u>	<u>44,000</u>
Total	184,800	---	131,300	---	266,000
Western Portion of Northern High (6,552 mi ²)					
Mallard	14,100	19,400	24,200	34,000	40,000
B.W. Teal	16,800	23,500	15,800	25,300	33,000
Other Spp.	<u>10,700</u>	<u>17,800</u>	<u>22,200</u>	<u>38,600</u>	<u>43,000</u>
Total	41,600	---	62,200	---	116,000
Priority I Portion of Northern Low (3,170 mi ²)					
Mallard	3,800	5,400	7,700	10,300	12,000
B.W. Teal	4,400	7,500	3,200	5,400	6,000
Other Spp.	<u>3,900</u>	<u>8,100</u>	<u>5,400</u>	<u>9,400</u>	<u>10,000</u>
Total	11,300	---	16,300	---	28,000

Table 1. Continued.

Wisconsin Breeding Pair Survey Stratum and Species Goals	<u>Estimated Numbers of Breeding Ducks*</u>				Year 2005 Priority I Pop.
	<u>1973-79</u>		<u>1980-88</u>		
	Ave.	Ave. 3 High Yrs.	Ave.	Ave. 3 High Yrs.	
Entire Area Surveyed (43,359 mi ²)					
Mallard	86,100	---	119,900	---	---
B.W. Teal	159,600	---	103,000	---	---
Other Spp.	<u>59,100</u>	---	<u>78,000</u>	---	---
Total	304,800		300,900		

*Data taken from Andryck et al. 1988

non-surveyed portions, averaged 17,900 mallards, 21,200 blue-winged teal, and 14,600 other ducks, for a total of 52,900 birds. In 1980-88, average populations increased to 31,900 mallards and 27,600 other ducks, excluding blue-wings. Blue-winged teal estimates were lower than in the 1970's, averaging only 19,000 birds. The total breeding population increased to 76,500 ducks. On the average, strong recruitment and stable brood water have positively benefited all species in the region except blue-wings, especially under Wisconsin's recent drought conditions.

Based on averages of peak populations recorded during the 1980's (Table 1), with additional wetland and upland habitat the northwestern and western Priority I areas could support 52,000 mallards, 39,000 blue-winged teal, and 53,000 other ducks (recognizing that wood duck populations cannot be accurately measured), for a total population of about 144,000 ducks in years of average habitat conditions. Gatti (1988) found mallard populations were already increasing throughout the Northern High stratum during 1973-86. Blue-winged teal population estimates were relatively stable and other species, especially wood ducks, were increasing.

Mallards and blue-winged teal are the most abundant breeding ducks in the Priority I habitats, based on the birds counted on spring surveys. However, wood ducks presently may be Wisconsin's most abundant breeding duck. Wood ducks utilize forested habitats, making accurate measurement of breeding populations impossible with known methods. Indirect population estimates of wood duck populations still appear to be the best indices to actual populations. Bowers (1977) estimated 138,000 breeding wood ducks in Wisconsin, using indirect methods. Although his estimate is somewhat outdated because it was made when populations were thought to have been below present numbers, it remains the best estimate of the relative abundance of wood ducks in the state. However, increased harvests of wood ducks, also supported by field wildlife managers' subjective opinions, suggest the species is still increasing statewide.

Bacon (in press), in reviewing ground counts used to correct aerial transects for visibility biases, concluded that wood duck densities were 5-6 times greater in the Northern High and Northern Low strata than in the SE/Central stratum. Survey routes were not selected to sample all prime wood duck habitats, especially along the Mississippi and other important river systems. Therefore, the species probably is not adequately represented in data from the ground correction segments. Wood ducks would, therefore, be underrepresented in the breeding population objectives generically suggested for "other ducks". Habitat restoration and management under the JV will provide some positive benefits for wood ducks, but would be primarily directed at ground-nesting species.

Wisconsin's spring population estimates for mallards and blue-winged teal, especially if prorated to smaller geographic units, are subject to a high degree of variability and are best treated as annual indices to abundance (Gatti 1988). Similar individual estimates for other species are based on even less data, have high variability, and are best used to compare relative abundance in the spring population. JV objectives will therefore combine values for all species, except mallards and blue-winged teal. Pintails and black ducks, priority species in the NAWMP, breed in Wisconsin. The 1965-70 spring

population estimates were 7,100 black ducks and 1,300 pintails (March et al. 1973). All pintail and about a one-third of the black ducks were in the Priority I JV counties. In 1973-79, there were only an estimated 3,500 black ducks breeding statewide, but the pintail estimate had increased to 2,100 ducks (WDNR files), suggesting the latter species was becoming more abundant. Recent studies in northern habitats confirm the overall scarcity of black ducks in Wisconsin's historically occupied habitat (Gregg 1988).

Statewide breeding duck population estimates for other species in 1965-70 were, shoveler-5,000, green-winged teal-3,000, gadwall-less than 500, redhead-1,300, ruddy-500, American wigeon-less than 500, ring-necked ducks-6,500, hooded mergansers-1,400, and common and red-breasted mergansers-800 (March et al. 1973). Similar estimates for 1973-79 (WDNR files), indicated greater numbers of gadwall (2,300 birds), American wigeon (700), redheads (5,500), and ruddy ducks(1,600). Green-winged teal (1,300), shoveler (4,100), and ring-necked duck (5,400) estimates suggested declining populations.

Breeding Pair Densities and Reproductive Success

Breeding pair densities within the Priority I areas during 1973-88 ranged from 4 to 9 pairs per square mile (Wheeler and March 1979, Wheeler et al. 1984, Evrard and Lillie 1987, Andryk et al. 1988, and Vander Zouwen unpubl. data). By comparison, breeding densities in Priority II habitat in northern Wisconsin ranged from 2 to 5 pairs per square mile (Andryk et al. 1982, Gregg 1988).

In southern Wisconsin, 1977-79 duck densities in areas surrounding WPA's averaged 18 pairs per square mile or 55 pairs per 100 wetland acres. WPA's averaged 35 pairs per square mile or 77 pairs per 100 wetland acres (Petersen et al. 1982). More recently, Gatti (in prep) found 42 pairs per 100 wetland acres on several of the same WPA's--the major decline was for blue-winged teal. The densities reported in both studies were comparable to those reported for North Dakota by Stewart and Kantrud (1973) and other areas of the PPJV (USFWS 1979, 1988b).

In Barron, Polk, and St. Croix counties in the Northwestern Focus Area, Petersen et al. (1982) found 15 pairs per square mile in the vicinity of WPA's (35 pairs per 100 wetland acres) and 37 pairs per square mile (40 pairs per 100 wetland acres) on WPA's. Evrard and Lillie (1987) estimated 59 pairs per square mile on these same WPA's during 1982-86.

Gatti (1987) reviewed past nesting studies from Wisconsin and elsewhere and concluded that nest success within the state's proposed JV regions for both mallards and blue-winged teal was equal to or better than that reported recently from elsewhere in the north central U.S. and Canada. Gatti (1987) recently found 32 percent nest success (51 percent hen success) on agency-owned and managed areas. Mallard nest success averaged 35 percent which is high enough to generate a 16 percent per year population increase. Evrard and Lillie (1987) and Evrard (unpubl. data) also found sufficiently high nest success (23 percent Mayfield) to support the population increases

identified by spring aerial counts in their area. Six of 7 studies from Iowa, Minnesota, and the Dakotas (1968-85) indicated Mayfield nest success rates below 15 percent (Gatti 1987), and Greenwood et al. (1987) found only a 12 percent Mayfield nest success rate in prairie Canada. For at least the present, hens attracted to Wisconsin habitats have better nest success than hens nesting in the more traditional prairie pothole regions.

Data on brood and duckling survival are scarce, making comparisons of the Wisconsin's JV areas with other regions difficult. Most past estimates do not consider total losses of broods. Data from the prairie pothole regions (Talent et al. 1983, Cowardin et al. 1985) suggest greater total brood loss, but lower duckling mortality prior to fledging than found in Wisconsin (Wheeler et al. 1984 and Gatti and Wheeler, unpubl. data). Both areas appear to have less than desirable brood and duckling survival. A number of management strategies in the Wisconsin's portion of the JV address improving duckling survival. Research proposed under the JV also will improve survival estimates by using radio telemetry.

The most current range of duckling production estimates from the Wisconsin's JV areas are 28 (Wheeler et al. 1984), 50 (Wheeler and March 1979), 78 (Petersen et al. 1982), and 142 (Evrard and Lillie 1987) young produced per 100 wetland acres. This is generally lower productivity than historically was reported elsewhere, including the PPJV region. However, the current lower nest success rates found in the PPJV area may make these earlier, higher production estimates obsolete.

Recent comparable production estimates for Priority II habitats are unavailable. Jahn and Hunt (1964) reported an average of 23 ducklings per 100 acres of occupied wetland in the Northern Highland physiographic region which approximates the current JV's Priority II northern lakes region, plus part of the Priority I area. Production from the entire region was considered low except for isolated marshes and beaver flowages. Knudsen (1962), however, found at least 66 ducklings per 100 acres of beaver flowage. Jahn and Hunt (1964) reported that duckling production in the 1950's in the Southeast/Central and western Northern High survey strata (i.e., Priority I habitat) was up to 6 times greater than in the northern forest or Driftless areas (both Priority II habitat). Using breeding pairs as an index to production potential, a similar situation exists today in Priority II habitats, although duck broods, especially mallards, are abundant on some northern lakes (Gregg 1988).

Throughout the 1980's, drought conditions and poor duck recruitment rates have plagued much of the prairie-parklands regions of the U.S. and Canada (USFWS 1986b). Conversely, waterfowl habitat in Wisconsin, including the proposed Priority I regions, because of greater average precipitation, has remained generally wetter and more drought resistant. Also, recruitment in Wisconsin, as judged by nest success rates, seemed capable of maintaining or increasing breeding duck populations, especially mallards and wood ducks.

Blue-winged teal have been less successful, particularly in southern Wisconsin. The continuing downward trend of teal in Wisconsin is probably related to declines outside

the state, but also results from the species tendency to nest in hayfields (Gates 1965) where it suffers high losses from mowing. The provision of additional secure upland cover under the JV will attempt to alleviate the biological drain of active hayfields. Mallards are more opportunistic in their choice of nest sites, and are earlier nesters than teal, reducing their exposure to hayfield losses.

Although prairie pothole regions outside Wisconsin produce more ducks per unit area overall, Wisconsin mallard hens produce more ducklings per hen because of higher recruitment rates. Management strategies targeted at Wisconsin's JV goal and objectives could show more immediate and greater net returns than in prairie-parkland habitat. Wisconsin's habitat base currently limits total duck production and the fall flight derived from the state. Restoration and enhancement of additional wetlands with adjacent secure upland nest cover will increase Wisconsin's habitat base. Breeding pairs attracted to these wetlands and adjacent cover should produce a net gain in offspring and contribute positively toward PPJV and NAWMP population objectives.

Fall Flight Estimates

Based on a summer production ratio of 1.16 young fledged per adult breeder in the spring population, Wisconsin generated an average fall flight of about 875,000 ducks during 1973-79. Included were 186,000 mallards, 345,000 blue-winged teal, 128,000 other ducks, and 216,000 wood ducks (this latter estimate for wood ducks accounts for the majority of the state's wood duck population which is not counted in the spring survey or included under "other ducks"). The average spring population was 405,000 breeding adults, including 159,600 blue-winged teal, 86,100 mallards, and a minimum of 138,000 breeding wood ducks (Bowers 1977). The spring breeding population and fall flight estimates are minimum values because almost one-fourth of the state is not covered by the spring survey and the breeding population estimate used for wood ducks is probably too conservative. Over 70 percent of the total fall flight originated from the Priority I areas proposed under the JV.

The 1980-88 average fall flight estimate, including wood ducks, was 866,000 ducks or only 1 percent lower than the average of the previous 7 years. Other than blue-winged teal, ducks breeding in Wisconsin did not suffer the severe declines noted in regions further to the west and north.

Proposed JV breeding population objectives should produce, on the average, a 30 percent statewide increase in the fall flight originating from Wisconsin by the Year 2005. Under this scenario, Wisconsin would eventually contribute more than 1.1 million ducks to the 13.6 million bird continental fall flight objective set for the U.S. surveyed areas (USFWS 1988b).

Fall Migration

The proposed JV Priority I area in Wisconsin includes important fall migration stops and staging areas for 22 species of ducks. Another 5 or 6 species of sea ducks periodically use the JV areas, but primarily are found on Lake Michigan. In addition,

several southern Priority I counties are the key migration stopovers for the MVP Canada goose population. Lesser snow geese also stop regularly in Wisconsin, but in much smaller numbers.

Jahn and Hunt (1964) rated the relative importance of the volumes of the fall flight of ducks crossing Wisconsin. Species with major flight volumes were American wigeon, blue-winged teal, canvasbacks, ring-necked ducks, scaup, and ruddy ducks. The wood duck fall flight crossing Wisconsin was considered "minor" because a majority of these birds were produced in the state. Mallards, although one of the two or three most important fall migrants in Wisconsin from the standpoint of abundance and harvest, were considered minor in volume because the species major migration route travels west of the state. Reservoirs on the Missouri River have also reduced the volume of mallards following the Mississippi River, including the Wisconsin portion, in recent years (Green 1984). Even under those constraints, March and Hunt (1978) estimated Wisconsin's 1961-72 pre-season mallard populations at 0.4 to 1.7 million birds, averaging 1.0 million.

Dramatic changes in habitat quality and quantity have altered the fall distribution of ducks in Wisconsin, including in the JV counties. For example, habitat loss and degradation on historic canvasback staging areas such as the Lake Winnebago pool, Green Bay, and Lakes Mendota, Koshkonong and Puckaway, have shifted the major Wisconsin migration corridor of that species to the Upper Mississippi River National Fish and Wildlife Refuge (Green 1984). Canvasback numbers started to build rapidly on the Mississippi River about 1968 (Green 1984). Peak populations of diving ducks on the major southern Priority I lakes exceeded 150,000 birds during the 1950's (WDNR files), with over 75,000 canvasback counted in 1955. Counts on the same lakes in the 1980's found only 5,000 to 10,000 divers and less than 1,000 canvasback (WDNR files).

Conversely, development of major state waterfowl management projects during the 1950's and 1960's have partially redistributed fall mallard populations and harvest in Wisconsin (March and Hunt 1978). These projects, most of which have waterfowl refuges, together with national wildlife refuges, the Mississippi, the Wisconsin and other major rivers, larger inland lakes and impoundments, Lake Michigan and urban areas, represent the state's primary fall waterfowl concentration areas.

Wisconsin ranked sixth in the proportion of the continental duck harvest during 1970-79, accounting for 3.4 percent of the total U.S.-Canadian harvest (USFWS 1988c). From 480,000 to 600,000 ducks were harvested in the state during those years (Gambel 1987). Comparing fall flight estimates for 1973-79 with harvest in the same years, Wisconsin "exported" about 280,000 birds to other areas (875,000 fall flight minus 595,000 ducks harvested).

Duck stamp sales in Wisconsin have historically averaged over 100,000, ranking the state either second or third in sales in the Mississippi Flyway (Gambel 1987). Sales have dropped below 90,000 during the 1980's, however. Wisconsin currently ranks third in sales in the Flyway and fifth in the nation.

Several major initiatives to improve migration and staging habitat are planned or underway in Wisconsin. The Upper Mississippi River System Environmental Management Program (EMP) has projects directed at waterfowl habitat improvement. A comprehensive management plan for the Lake Winnebago system is nearing implementation and will restore and improve waterfowl habitat historically used by thousands of diving ducks (Bruch 1988). Ongoing management of federal and state waterfowl projects has also increased fall duck use. Drawdowns of inland lakes and flowages for rough fish control and other efforts to improve fisheries and restore aquatic vegetation have greatly benefited breeding habitat and fall waterfowl use (Wheeler et al. 1984). The proposed JV recognizes these ongoing efforts and identifies management strategies for improving other key wetland areas. Joint venture emphasis, however, will be on increasing the breeding and production habitat base.

Winter Period

While Wisconsin does winter some waterfowl (less than 25,000 ducks), mostly mallards and Canada geese, numbers are insignificant from a continental viewpoint, representing less than 1 percent of 1970-79 winter inventories for the U.S. (USFWS 1988c). Historically, wintering populations of black ducks were present at two or three sites within the JV areas. In recent years, however, their numbers have dwindled to only a few thousand birds. Localized efforts will be made under the JV to protect wintering areas of these remnant flocks from further degradation.

Rock and Walworth counties winter several thousand giant Canada geese, known as the Rock Prairie flock. Giant Canadas also winter in the Green Bay area and in Marquette, Dodge, and Milwaukee counties and probably several other locations. The total number of Canada geese wintering in the Priority I area of Wisconsin reached 38,400 in January 1989 (W.E. Wheeler, pers. com.).

Diving ducks also winter within the JV area along the western shore of Lake Michigan. Offshore wintering populations of oldsquaw, for example, may reach 12,000 birds (Ishmael 1987). Other divers, mostly goldeneyes and mergansers, winter on JV rivers. Other than continuing to support ongoing efforts to reduce environmental contaminants and enforcing environmental protection laws to minimize the chances of an oil spill or exposure to hazardous substances, no special initiatives will be proposed along Lake Michigan.

V. SPECIES OTHER THAN WATERFOWL

Avian Species

Joint venture wetlands and secure uplands will provide critical breeding, migration, and wintering habitat for a variety of avian species besides ducks and geese. Ring-necked pheasants, gray partridge, bobwhite quail, common snipe, woodcock, and ruffed grouse were found on WPA's by Petersen et al. (1982). Marshland birds present included American coots, common gallinules, and Virginia and sora rails.

Fourteen other species of summer marshland birds, including sandhill cranes, were found on southern WPA's. At least 12 species were thought to have nested on the WPA's (Petersen et al. 1982). Northern WPA's had 36 summer marshland bird species. The most common residents were pied-billed grebes, great egrets, great blue herons, green-backed herons, killdeer, black terns, and yellow-headed blackbirds (Petersen et al. 1982). At least 18 of the species nested on the WPA's.

The endangered trumpeter swan, currently being reintroduced into breeding habitats in Wisconsin, will greatly benefit from the habitat objectives of this JV. Thousands of tundra swans currently stop in Wisconsin to feed and rest during both spring and fall migration between wintering to breeding areas. This Joint Venter will also enhance habitats for this avian species.

Sixteen nesting grassland songbird species were found in northern WPA uplands. The most common species were bobolinks, red-winged blackbirds, and grasshopper sparrows (Petersen et al. 1982). Twelve of the 16 species have shown downward population trends statewide in recent years (Mossman and Sample 1988).

Raptors common to the JV include red-tailed and rough-legged hawks, great-horned and short-eared owls, kestrels, and northern harriers. These raptors use wetland habitats and adjacent uplands for hunting and, depending on the species, nesting. Common crows are also abundant and represent potential nest predators.

Mammals

Most mammals common to the north central U.S. were found on or in the vicinity of WPA's in the JV counties (Petersen et al. 1982). Common species include muskrats, beaver, white-tailed deer, cottontail rabbits, and gray and fox squirrels. Although they are not common, white-tailed jackrabbits inhabit the northern Priority I area and occur on its WPA's.

Small mammals are abundant in upland grassland areas throughout the JV counties. Mammalian predators using these same habitats include red fox, coyote, mink, weasels, striped skunks, opossums, raccoons, Franklin's ground squirrels, and domestic cats and dogs. Raccoons and skunks account for the majority of duck nest losses in the JV counties (Petersen et al. 1982, Wheeler et al. 1984).

Other Species

Numerous reptiles, amphibians, and insects depend on JV wetlands and uplands for survival.

Wetlands adjacent to lakes and rivers provide significant feeding, spawning, and nursery habitat for fish. Species such as northern pike, walleye, bass, and panfish are important sport species. Numerous forage fish use these areas as well. Unfortunately, many of the wetlands also serve as key spawning areas for rough fish, especially carp,

which contribute significantly to waterfowl habitat degradation.

Endangered and/or Threatened Species

During migration, bald eagles, ospreys, and peregrine falcons periodically use wetlands throughout the JV counties. Peregrine chicks have been released in at least two Priority I counties and nesting falcons have been recorded along the Mississippi River. In addition, ospreys and Forster's and common terns, all listed as endangered species in Wisconsin, either nest in or adjacent to wetlands in the JV counties or historically used them. Listed threatened avian species nesting in JV habitats include red-necked grebes, bald eagles, and great egrets. In 1987, a 10-year project to restore extirpated trumpeter swans to the state was also started at several sites within the JV.

A number of Wisconsin's grassland birds are known to be declining (Mossman and Sample 1988). While none of the species are yet listed as threatened or endangered, upland habitat losses are suspected of contributing to their decline. Perennial upland nesting cover established under the JV will directly benefit grassland birds. Existing WPA's already provide excellent habitat and most of the species of concern nest on the areas (Petersen et al. 1982).

Wetlands of the JV counties historically served as habitats for a number of Wisconsin's endangered or threatened reptiles, amphibians, and plants. Additional wetland protection and restoration under the JV could benefit these organisms as well.

VI. DESCRIPTION OF HABITAT

Overview of Present Distribution of Waterfowl Habitat Within Wisconsin's Joint Venture Area.

Southeastern Wisconsin makes up about 3/4 of the southern Priority I habitat. It is generally an area of low relief, with uneven glacial deposits accounting for most of the surface irregularity. Soils are developed from a discontinuous loess covering, glacial till and outwash, lacustrine deposits, and peat and muck of bogs (Beatty et al. 1964). Hole (1976) noted the large extent of the wetlands, the variability of soil depth, and the high level of natural soil productivity. Approximately 15 percent of the landscape is occupied by wet mineral soil in numerous lowlands and nearly 10 percent of the region is in peat and muck soils. Near Lake Michigan, soils are mostly reddish clay loams. Presettlement vegetation consisted of oak-hickory forests and oak savannahs, interspersed with extensive tracts of prairie (Beatty et al. 1964). Native vegetation has been drastically altered. Petersen (1985) described this region as the "Woodlot-Fencerow" ecological province for planning and future management purposes (Figure 2) and further divided it into three subprovinces based on soil, cover type, land use, and featured wildlife species. Mallard, blue-winged teal, and Canada geese were the featured waterfowl. Today, land use is predominantly dairy or cash-crop farming with a typical alfalfa-corn-oats cropping rotation (Petersen et al. 1982). Soybeans and winter wheat are becoming more common. Some drained lowland sites are devoted to

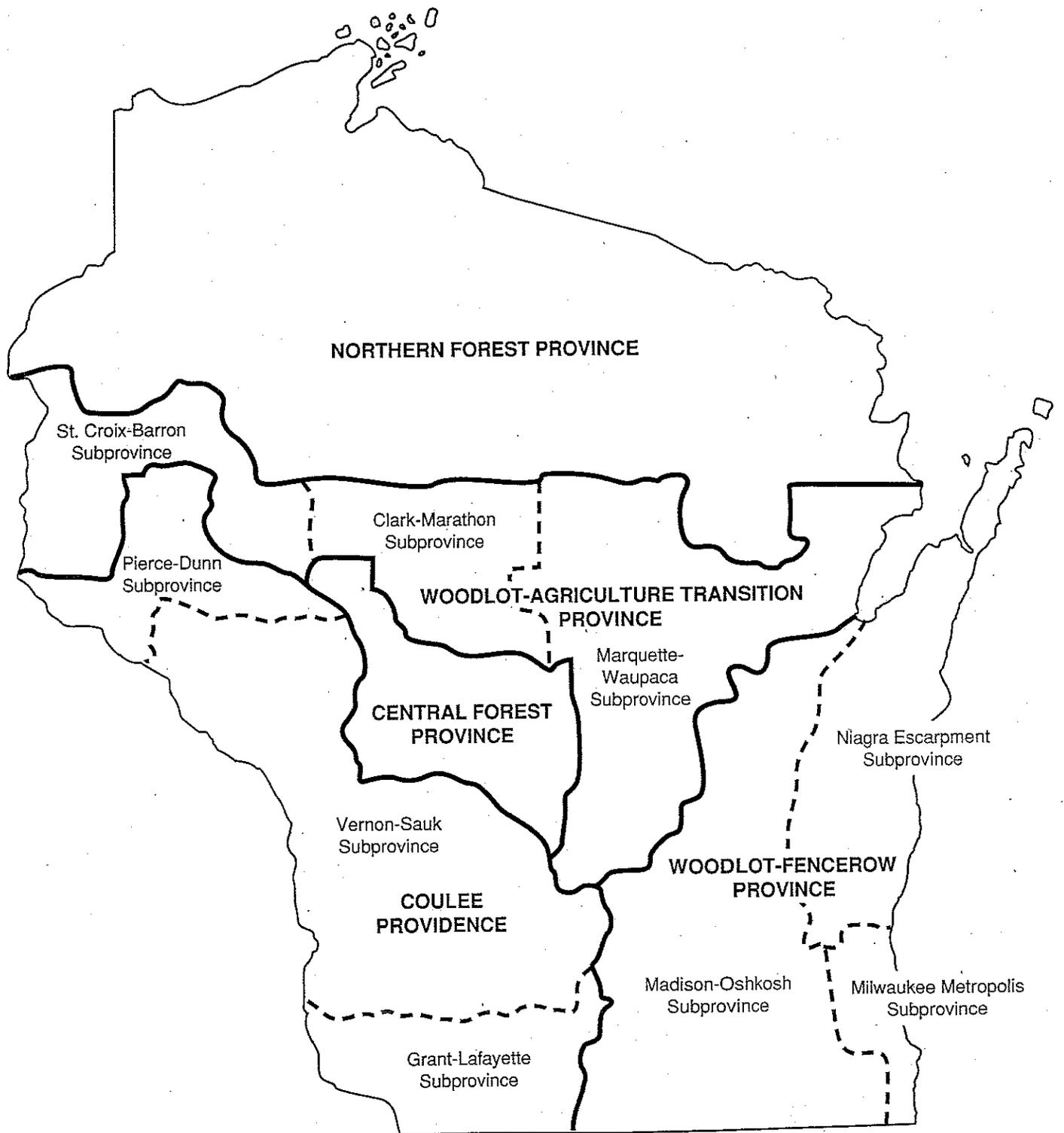


Figure 2. Ecological planning provinces and subprovinces as described for Wisconsin by Peterson (1985)

mint and sod farming. Urban and industrial developments encroach on wetlands near the more urbanized areas, especially in the extreme southeast counties and in the Fox River valley. Western portions of the SE/Central stratum are underlain by Cambrian sandstone (Martin 1965). Although variable, relief is generally low. Little of the present surface is due to direct erosion of the sandstone but instead is due to river deposits, lake-bottom accumulation, especially former Glacial Lake Wisconsin, swamp vegetation or glacial drift (Martin 1965). Portions of Wood, Portage, Adams, Juneau, and Jackson counties were not overridden by recent glaciation.

Several major river systems drain the region, with the Upper Fox and Wolf rivers and their vast marshes and the Wisconsin River flowages and bottomlands of greatest value to waterfowl. The state's largest swamp, formerly covering almost 750,000 acres (Martin 1965), lies in the center of the region and includes portions of at least seven Priority I counties. Large segments of these lowlands are under cultivation, including the growing of cranberries. Growing trees for pulpwood is also a major land use. Petersen (1985) divides this area into two ecological planning provinces, the "Woodlot-Agriculture Transition" and "Central Forest" provinces (Figure 2). Much of the JV area lies in Petersen's (1985) "Marquette-Waupaca" subprovince of the Woodlot-Agriculture Transition province which is characterized by dairy farming, farm woodlots, irrigated cash crops on the sands, and recreational land uses.

Mallards and greater prairie chickens are featured species. The Buena Vista and Leola marshes in Portage, Adams, and Waushara counties are managed for Wisconsin's relic greater prairie chicken population. Sandhill cranes also nest throughout the area. Grazing of woodlots and wetlands is a common practice. Some areas, especially along the major riverways are urbanized, but contain much less urban sprawl than areas further east and southeast. While this area still has the largest acreages of wetlands, potential duck production is limited in the unglaciated, sandy central part because of poorer water fertility and inadequate food (Balasarre 1978, Nelson 1978).

A large part of the central sands area is already owned and managed by either WDNR or the FWS. The large existing investments in waterfowl management in this part of the SE/Central stratum warrant its Priority I status, especially as migration habitat. However, compared to southeastern and northwestern portions of the Priority I habitat, the central sands area is closer to Priority II habitat in terms of its duck production potential. Proposals for JV funding will take that shortcoming into consideration when setting priorities.

Petersen (1985) divided the western Northern High stratum into three distinct ecological provinces, with the majority being in either the Woodlot-Agriculture Transition or the "Northern Forest" provinces (Figure 2). The southernmost part of the stratum lies in the "Pierce-Dunn" subprovince of the "Coulee Province" (Petersen 1985). The best waterfowl habitat, which closely resembles that of the PPJV region, lies in the "St. Croix-Barron" subprovince in the "Star Prairie" portion of St. Croix and Polk counties (Petersen 1985). Featured species are mallard and blue-winged teal plus other prairie-nesting waterfowl and wood ducks.

In the western portion of this stratum and adjoining counties, the landscape is gently undulating, with slope gradients rarely exceeding 20 percent. The southern part of the stratum occupies the flat-topped highland regions between the St. Croix and Chippewa rivers. All of the area has been glaciated and the relief has been decreased by glacial deposition (Martin 1965). The major soil region is one of grayish and sandy loams, derived mostly from local bedrock formed by glaciation (Beatty et al. 1964). Presettlement vegetation consisted of southern hardwood forests, oak savannah, and prairie (Curtis 1959), none of which occupy significant areas today. Current land use also includes agriculture, with corn and alfalfa the most common crops. Rural homesite development is also common, especially in areas closest to the Minnesota border.

Petersen (1985) divides the northern part of the stratum and adjoining counties on the east into the Northern Forest province and the "Clark-Marathon" subprovince of the Woodlot-Agriculture Transition ecological province. Except for isolated hills of solid rock, the area is level to gently rolling (Martin 1965). Soils are largely the result of glacial action and local areas are quite stony. Second growth forest covers large portions of the region and lakes are abundant (Gregg 1988). Northern hardwoods and aspen predominate, with oak and jackpine abundant in some areas. Shoreland development for recreational and residential use is common on most lakes. The St. Croix, Chippewa and Wisconsin rivers and their tributaries flow through the Priority I areas. While ducks, especially mallards are abundant throughout the region, the more productive habitats are within the western Northern High stratum or in the townships immediately adjoining it on the north and east. WDNR owns several major waterfowl projects in this area, most notably the Glacial Lake-Grantsburg complex. A portion of the region lies within the Chequamegon National Forest. Another portion lies within the Lac Court Oreilles Indian Reservation in Sawyer County. Although the region has the highest wetland densities and acreages in the state overall, much of this habitat is in dense shrub swamps and is not of much value to ducks (Mann 1955).

Wetland Base

Out of almost 10 million acres of soils originally classified as somewhat to very poorly drained, Wisconsin has an estimated 5.3 million or more acres of wetlands remaining (Wisconsin Wetland Inventory 1978-80). About 3.3 million acres of wetlands remain in the Wisconsin counties proposed for Priority I JV status.

The shallow, glaciated lakes, marshes and potholes, plus marshes associated with lakes, impoundments, and river systems, of the JV counties, represent both Wisconsin's most productive and also most threatened, waterfowl production habitat. Counties proposed for the JV in Wisconsin have 2-26 percent of their total surface areas in wetlands. The most recent wetland inventory, however, did not specifically identify high value waterfowl habitat. Mann (1955) and Shaw and Fredine (1956) reported 380,000 to 390,000 acres of high value waterfowl habitat in Wisconsin. In addition, Panzner (1957) indicated the state had over 604,000 acres of permanent water significant to waterfowl, primarily for migration. Because these earlier estimates of total wetlands were less than half the total remaining acreages estimated in the 1978-80 inventory,

high value waterfowl habitat acreages probably were also underestimated. Presently, within the counties approved for WPA purchase, the FWS has identified a minimum of 30,000 acres of high quality production habitat needing protection by acquisition (USFWS 1979, McLaury 1988).

Within the approved WPA counties, complexes of Types I-VI wetlands (Shaw and Fredine 1956) resemble the marshes of the more traditional prairie-parkland regions and provide abundant plant and invertebrate life to meet nutritional requirements for egg production, duckling growth, and replacement of feathers during molt (USFWS 1979). Temporary wetlands provide isolation for territorial breeding pairs and the semi-permanent and permanent marshes, lakes, and streams provide brood habitat. Emergent vegetation in these wetlands is cattail, bulrush, burreed, smartweed, grasses, and sedges. Submergent vegetation includes pondweeds, coontail, water milfoil and *Ranunculus* spp. Wheeler and March (1979) and Evrard and Lillie (1987) reported invertebrate and seed resources in their wetlands comparable to those reported from the PPJV region. Water chemistries of Wisconsin wetlands, however, can be distinctly different (i.e., less alkaline) from those of the prairie-parklands (Evrard and Lillie 1987).

In addition to their benefits to waterfowl, JV wetlands are natural nutrient-holding systems, acting as pollution filters. They also act as groundwater discharge areas, retain flood waters and act as buffer zones to protect shorelines and stream banks. Wetlands enhanced or restored under the JV will provide these additional functions and values beyond those emphasized for waterfowl.

In the southern Wisconsin Priority I area, Wheeler and March (1979) found 4-6 wetlands per square mile, representing about 68 to 75 acres of wetland per square mile or roughly 11 percent of the landscape. Sixty percent of the wetland acreage was in either lakes or Type II (Shaw and Fredine 1956) wetlands. Type III and IV wetlands, the backbone of the region's waterfowl production habitat, comprised only 2 percent of the total land area. Spring aerial surveys in the SE/Central stratum reported 16-year averages of 3-4 Type I, II and VI wetlands per square mile, one Type III per square mile and 2-3 Types IV-V (Andryk et al. 1988).

In northwestern Priority I areas, Evrard and Lillie (1987) reported 3-8 Types I, II, and VI wetlands per square mile, 1-2 Type III's, 3-4 Types IV-V, and 2-3 streams and ditches. Aerial surveys in the western Northern High Stratum found 2-4 Types I, II, and VI per square mile, one Type III, 3-4 Types IV-V, and 2+ streams and ditches (Andryk et al. 1988).

Regional Wetland Trends

Waterfowl habitat throughout the U.S. and Canada has been destroyed or degraded by agriculture, urbanization, and industrial development. More than 50 percent of the original wetlands have been lost (USFWS 1986b). Wisconsin is no exception, with over 50 percent of the state's wetlands also lost. Wetland losses have not been proportional across the state. The greatest losses have occurred in southeastern/central

portions of the state. Many remaining wetlands are reduced in size or degraded by agriculture or development. Agriculture currently uses about 4.5 million acres of Wisconsin's 10.0 million acres of wet soils (Wisconsin Wetland Inventory 1978-80). Southeastern Wisconsin represents a major portion of this agricultural cropping of wetlands. Although the rate of drainage in the south slowed somewhat during the 1950's, activity increased again in the 1960's and remains unacceptably high. Petersen et al. (1982) found that the rate of wetland loss in several southern counties doubled from 0.8 percent per year to 1.6 percent per year between 1958-73 and 1973-77. Three-fourths of the losses were from drainage and included a 0.2 percent annual loss of brood habitat wetlands.

Estimates of wetland loss under the recent drought conditions are not readily available. However, Wheeler and March (1979) documented the conversion of southern Wisconsin wetlands to cropland under similar dry conditions in 1974-75, following several wet years. Areas recognized as problem wet areas were targeted for draining, tiling, and plowing in subsequent dry years. About 3 percent of the wetlands (1,000 acres per year) on Wheeler and March's (1979) study area were lost annually. Three consecutive wet years (1983-85) probably encouraged some renewed drainage efforts in 1986-88, as near drought conditions allowed easier ditching and tiling, followed by cropping. The "Swampbuster" provision of the 1985 Farm Bill and other wetland protection laws should reduce the amount of drainage when compared to the 1970's. Also, the depressed agricultural economy and the previous drainage of most of the easily drainable wetlands may also be slowing losses during this dry period. Temporary and semi-permanent wetlands have continued to be the main recipients of this most recent drainage activity.

While net wetland losses in several northern Priority I counties were proportionately less than in the south - about 3 percent between 1958 and 1977 (Petersen et al. 1982) - the most severe losses were the wetlands of greatest value to waterfowl. Overall, 14 percent of the wetlands were lost over the 20 years, or about 1 percent annually. Areas of an acre or less were the most vulnerable.

The Wisconsin picture is not entirely bleak, however. Compared to wetlands in the PPJV region, Wisconsin's habitat is relatively stable and drought-resistant. Precipitation in the WPA counties was above the long-term average in 16 of the last 25 years. During 1973-88, which included some of the driest years on the western prairies, Wisconsin's precipitation was above the long-term average in 11 years. Only 1974, 1976, the latter part of 1987, and 1988 were extremely dry statewide. Regions were dry in several other years, but precipitation elsewhere in the state remained either average or above average.

During the 5 driest years of 1973-88, May wetland densities were 28 percent below average in SE/Central Wisconsin, while they were 42 percent below average in the prairie-parkland regions (USFWS and CWS 1988) and 43 percent below average in the Northern High stratum in Wisconsin (Andryk et al. 1988). Also, apparently because of the differences in moisture regimes, Wisconsin's pattern of wet and dry cycles does not exactly correspond to that of the PPJV. During the 5 years of lowest May pond

numbers in the PPJV during 1973-88 (USFWS and CWS 1988), wetland densities were only 5 percent below average in the SE/Central stratum and were 14 percent above average in the Northern High stratum (Andryk et al. 1988).

Existing Habitat Protection Programs and Accomplishments

Since WPA acquisition began in Wisconsin in 1974, SWAP funds have been used to acquire over 9,700 acres in 65 WPA's, located in 11 counties proposed for JV status (Table 2). Included on WPA's are 1,600+ acres of wetland. The upland:wetland habitat goal is 3.4:1. The current program goal is to acquire 30,000 acres in the 24 counties approved for WPA's. WDNR manages WPA's under a series of Memorandums of Understanding with the FWS. The most recent MOU was signed in 1980 (McLaury 1989).

In addition to WPA's, the FWS owns about 153,250 acres, including over 100,000 acres of wetland, under the National Wildlife Refuge system in the Priority I area of Wisconsin (Table 2).

The WDNR's Bureau of Wildlife Management owns or leases over 353,000 acres in wildlife areas or public hunting grounds in the Priority I areas (Table 2). Over 100,000 additional acres remain to be purchased. The majority of the larger areas are primarily managed for waterfowl. Approximately 65 percent of the fee title acres and 85 percent of the easements are estimated to be some type of wetland. These wetlands range from some of the very best waterfowl habitat available to large areas of shrub swamp or monotypic cattail, or other habitat type with limited waterfowl value. Overall, state management areas probably make their greatest contributions as migration habitat or staging areas. However, managing uplands for perennial nesting cover has been a long-term effort on the wildlife areas, and duck and pheasant production is emphasized wherever appropriate. Gatti (1987), however, found an inverse relationship between nest success and property size, probably because the larger properties tended to have higher densities of ducks and also predators.

The WDNR's Natural Areas, Forestry, Fisheries, and Parks programs own or control additional wetland habitat, some of which is important to breeding and migrating waterfowl. Although not managed specifically for ducks, thousands of acres of spawning marshes permanently protected by Fisheries are also productive areas for broods.

Several federal agricultural assistance programs also are making significant, although short-term, contributions to waterfowl habitat protection and enhancement in Wisconsin. Over 6,741 acres of wetland and about 11,242 acres of upland are currently enrolled under 334 Water Bank contracts in 15 Priority I counties in Wisconsin (Table 2). Also, recent efforts to restore wetlands on farms in the Priority I counties, under either Conservation Reserve Program (CRP) agreements or Farmers Home Administration (FmHA) leases, have shown promise, with 1,505 wetland basins (3,318 acres) restored by the FWS and WDNR between 1988 and 1991 and the effort in this activity will increase.

Table 2. Accomplishments of waterfowl habitat programs in Wisconsin's Priority I areas.

Land Ownership	# of Acres				Total
	Wetlands		Uplands		
	Title	Lease	Title	Lease	
FWS					
WPA's	1,320+	0	8,072	0	9,713
NWR's					
Horicon	16,908	83	3,966	19	20,976 ¹
Necedah	11,200	0	28,600	0	39,800 ²
Upper Miss. R.	Majority				86,870 ³
Trempeleau	<u>Majority</u>	—	—	—	<u>5,617³</u>
Subtotal	29,749+	83	40,638+	19	161,037
WDNR					
Wildlife Areas	(212,670)	(2,222)	(114,575)	(392)	329,799
EWHP's	(7,426)	(1,799)	(3,998)	(317)	13,540
Scattered Wetlands	<u>(8,566)</u>	<u>1,147</u>	<u>0</u>	<u>0</u>	<u>9,713</u>
Subtotal	(228,662)	(5,168)	(118,513)	(709)	353,052
Other Federal					
Water Bank	0	6,741	0	11,242	17,983 ⁴
CRP	0		0	Majority	367,000 ⁴

() = Prorated @ 65% wetland on Fee Title lands and 85% on leased lands.

¹USFWS 1988b

²Sandford 1987

³Robert Drieslein, USFWS, pers. comm.

⁴Wisconsin State Office, ASCS files. CRP figures are through the 10th signup.

An unknown amount of additional wetland habitat, including some important to waterfowl, is protected through other federal, state or local governmental bodies and on tribal lands. Also, private organizations such as TNC have acquired some key wetland and upland acreages and plan to acquire more.

Habitat for cavity-nesting ducks, predominantly wood ducks, as indexed by trends in abundance of lowland timber types (elm, ash, soft maple, cottonwood), is generally stable to increasing. Acreages of lowland hardwoods increased 21, 25, and 26 percent, respectively, in Wisconsin's Southeast, Southwest, and Central forest survey regions between 1968 and 1983 (Spencer 1985, Raile 1985a, and Hahn 1985). In the Northwest (Smith 1984) and Northeast (Hansen 1984) survey regions, lowland hardwoods declined 1 and 10 percent, respectively. The Northeast region only has portions of 2 counties designated as Priority I habitat. The statewide increase in the primary wood duck nesting habitat was 7 percent which supports the apparent long-term increase in the state's population of that species.

Beaver populations in Wisconsin are generally increasing statewide, and are perceived to be at nuisance levels in central and northeastern regions, including 10 counties designated as Priority I habitat. Waterfowl habitat created by beaver is readily used by both breeding pairs and broods (Knudsen 1962) and is occupied at rates at or above those observed for Type IV-V wetlands (March et al. 1973). Encouraging waterfowl production by managing for higher beaver populations compares favorably with annual costs for maintaining man-made habitats (Ermer 1984). Benefits to waterfowl derived from promoting beaver in a given area must be weighed against actual or perceived damage by the species to coldwater fisheries, timber, roads, water control structures, and agriculture. Where such conflicts can be minimized or adequate abatement programs can be funded, proactive beaver management should be a preferred waterfowl habitat creation or enhancement strategy. Most duck species of interest, especially wood ducks, ring-necked ducks, and black ducks, benefit from beaver flowages.

While there are no quantitative estimates of beaver numbers in Wisconsin, they are found statewide and are common residents in all Priority I counties, including all major river systems.

Regional Upland Habitat Trends

Ecological characteristics of uplands are the primary factors limiting recruitment of young ducks to the fall population of the PPJV region (USFWS 1988a). Although duck recruitment in at least parts of the Priority I area presently appears to be higher than in the PPJV region (Gatti 1987), the amount and quality of undisturbed upland cover in Wisconsin is limited, especially on private lands. Intensive agriculture and urban development have caused major long-term losses in secure nesting cover. Losses were particularly severe during the early to mid-1980's. Quality nesting cover declined 33 percent over 3 years on Wheeler and March's (1979) southern Wisconsin study area, while the proportion of alfalfa hay increased. In the vicinity of WPA's in that same region, Petersen et al. (1982) found that although 24 percent of

the landscape was in potential nesting cover, about one-half of this was alfalfa with a high risk of nest loss or hen mortality. Around WPA's in northern Wisconsin, although 29 percent of the land was potential nesting cover, 76 percent of this cover was hay. Other than WPA's, the only high quality, non-cropped nesting cover was on Water Bank lands. Over time, Wisconsin ducks, especially blue-winged teal, have been forced to nest with greater frequency in alfalfa fields and suffer higher nest losses and hen mortality due to haying (Gates 1965, Wheeler and March 1979, and Petersen et al. 1982). Earlier cutting of alfalfa has added to the problem (Petersen et al. 1982).

Thanks to the 1985 Farm Bill, the CRP has increased upland cover in the JV counties. While Wisconsin landowners have not, for a variety of reasons, enrolled acreages comparable to those in Minnesota and Iowa, substantial acreages are under contract. Through the 10th signup, over 367,000 upland acres, representing over 11,000 contracts, were enrolled in CRP in the Priority I counties (Table 2). Proportions of farmland enrolled in CRP vary by county, with extremes being almost no CRP acres in counties on the northern edges counties. In southeastern Wisconsin, an average of less than 3 percent of the farmland is enrolled in CRP (range of 1-6 percent). Fortunately, several Priority I counties with average or better CRP participation are also among the better waterfowl producing areas. Quality of cover on CRP, while generally less than desired for optimum nesting, is improving through state and federal agency technical and financial assistance to landowners.

The U. S. Department of Agriculture (USDA) annual ACR (Set-Aside) acreages in Wisconsin for 1991 totalled over 156,000 acres in the Priority I counties. There may be opportunities to enroll some of these lands in a 3-5 year retirement program by offering landowners an additional financial incentive (e.g., cost of seed). Multi-year set-aside acres would contribute additional upland cover to the JV.

While prime nesting cover is still limited, the trend into the 1990's seems to be improving. Combined upland management efforts on CRP, FmHA, and Water Bank lands, together with WPA's and other state or federally managed areas, are definitely increasing nesting habitat. The JV will take maximum advantage of these opportunities, even though they are of shorter duration than would be desirable, to establish secure nesting cover for ducks and other birds on private lands. Use of electric fencing and other predator management will further improve recruitment from these acreages.

VII. JOINT VENTURE GOALS AND OBJECTIVES

Proposed Joint Venture Boundary

Priority I Habitats:

Priority I habitat is delineated in Figures 1 and 3. Included are most of the Woodlot-Fencerow and Woodlot-Agriculture Transition ecological provinces of Petersen (1985), plus part of the Central Forest, Northern Forest, and Coulee provinces and the Mississippi River.

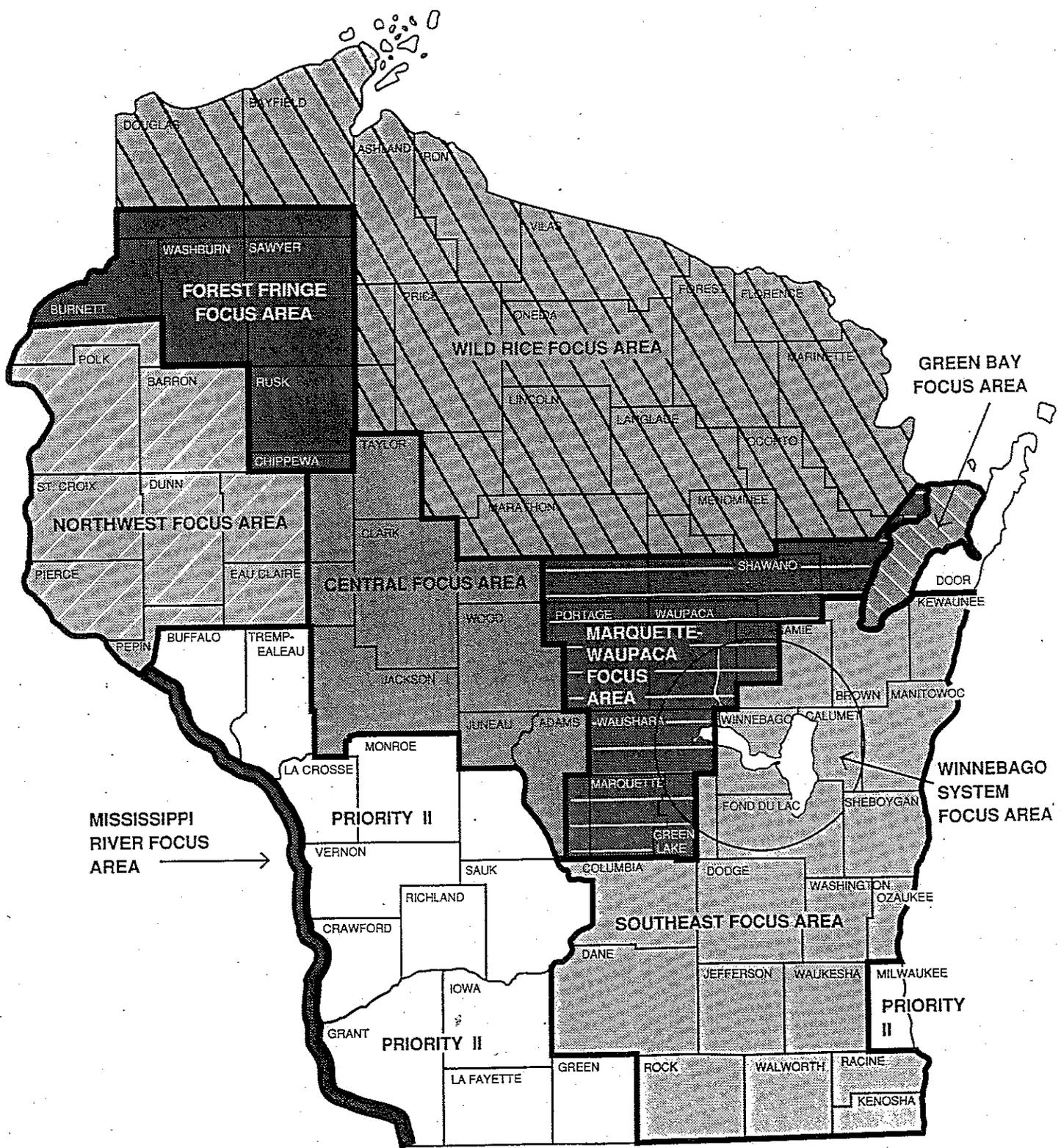


Figure 3. Priority 1 habitat focus areas of Wisconsin's portion of the Upper Mississippi River and Great Lakes Region Joint Venture

Priority I counties are generally those where, (1) spring breeding population densities average 2-3+ ducks per square mile uncorrected for visibility bias, (2) there are productive wetlands with physical and chemical parameters conducive to aquatic plants and invertebrates, or (3) habitat is limited and/or in jeopardy because of continuing threats from agriculture, urban sprawl or other forms of degradation, and (4) there is potential for increasing the numbers of breeding pairs through enhancement, restoration, or protection of wetland and upland habitats on either public or private lands.

Because wetlands and ducks are not uniformly distributed throughout the Priority I regions, wildlife managers and other WDNR and FWS personnel have delineated specific townships, watersheds, marsh complexes, etc., for actual habitat projects that might be initiated during the JV's implementation phase. These specific sites are scattered throughout the focus areas shown in Figure 3.

Priority II Habitats:

Priority II habitat lies predominantly in Petersen's (1985) Coulee ecological provinces but also includes small portions of the Central Forest and Woodlot-Agricultural Transition provinces (Figures 1 and 2).

Waterfowl populations and habitat in the southwestern Driftless Area counties (Figures 1 and 3) are primarily restricted to bottomlands along rivers and streams. Because of the region's low wetland and breeding duck densities, it is not included in the spring survey. March et al. (1973) estimated only about 5,000 ducks were in the 9,000 square miles area but because wood ducks are the primary species, this estimate was undoubtedly low. The Mississippi and Wisconsin rivers and their main tributaries provide the only fairly contiguous areas of habitat, primarily for wood ducks. The area is given Priority II status, except for the Mississippi River system (Figures 1 and 3). Habitat management opportunities are limited to protecting and managing bottomland timber, implementing waterfowl management objectives outlined in master plans for WDNR properties, especially along the proposed Lower Wisconsin Riverway, and encouraging good soil and water conservation practice on uplands adjacent to water courses. Because land in the region is highly erodible, CRP enrollment is substantial (over 117,500 acres), especially in the extreme southwest counties. A general lack of wetlands and absence of breeding ducks limit waterfowl nesting potential on these lands however. No habitat focus areas are specifically delineated in Priority II areas. While proposals for JV initiatives within Priority II habitats are not encouraged, individual proposals could be justified in terms of their projected net increases in ducks produced. Proposals for JV action in Priority II areas must be weighed against other ongoing and proposed projects within Priority I counties. Since there probably will not be sufficient funds to implement all high priority projects proposed for Priority I areas, opportunities to fund Priority II activities will be extremely limited. Priority II proposals will be funded under the JV only when the end products (anticipated increases in "new" ducks, etc.) contribute to JV objectives at the same magnitude as Priority I projects.

Joint Venture Goal

The goal of the Wisconsin Joint Venture is to involve state and federal agencies and private organizations in a broad-based, unified effort to increase populations of waterfowl and other wildlife species by preserving, restoring and enhancing wetland and upland wildlife habitat in suitable regions of the state. This entails not only the preservation of the wetland and upland habitats, and the life forms they support, but also initiating actions that integrate soil and water conservation into the system, i.e., a community approach to managing the landscape.

The goal and objectives of the UMRGLR JV will be reached only if proposed actions are carried out and costs shared by a coalition of state, federal and private organizations and individuals. Restoring, enhancing, protecting, and managing habitats for multiple wildlife and human benefits will be emphasized in the following order of priority:

1. Restore or enhance wetland-upland complexes and protect existing complexes, using fee title and perpetual easements.
2. Develop and sustain habitat on private lands to increase waterfowl production and other wildlife and wetland values.
3. Manage existing or newly acquired public lands and waters to increase waterfowl production and migration habitat and other wildlife and wetland values.
4. Protect and enhance wild rice habitats scattered throughout northern Wisconsin.

To attain the JV goal, two specific objectives, one for waterfowl populations, the other for habitat, have been developed for the Priority I counties. Strategies for meeting these objectives are outlined to provide general guidance for management actions that will address the objectives. These and other strategies would be applied to objectives developed for the Priority II counties if funding allows expansion beyond Priority I habitat. Individual managers and organizations will select the strategies more appropriate to their areas of focus and proposed projects.

OBJECTIVE A: Waterfowl Populations

By the Year 2005, the JV Steering Committee concludes that the population objective for Wisconsin's portion of the UMRGLR JV will be:

To provide habitats and management necessary to add 200,000 ducks, including 50,000 mallards and 125,000 blue-winged teal, to the average spring breeding population in the Priority I joint venture counties, thereby increasing

the regions' fall flight 325,000 ducks and increase diving duck use by 1,000,00 use days by the Year 2005.

The objective is designed to support the population objectives established for the U.S. portion of the NAWMP.

Wisconsin's portion of the JV population objective is based on regional objectives developed separately for groups of northern and southern JV counties. The southern JV population objective is based on the average of the 3 highest spring population estimates for the SE/Central stratum during 1973-79. Within these southern Priority I counties, by the Year 2005, the objective will be:

To add 135,000 ducks, including 30,000 mallards and 80,000 blue-winged teal, to the average spring breeding population, resulting in a 210,000 bird increase in the fall flight originating in that region.

The objective for the northern Priority I counties is based on the average of the 3 highest spring population estimates for the western Northern High stratum and adjoining Northern Low stratum counties during 1980-88. High population estimates for the latter period were used instead of 1973-79 because populations in the north were generally higher in the 1980's. Within the northern Priority I region, by the Year 2005, the objective will be:

To add 65,000 ducks, including 20,000 mallards and 20,000 blue-winged teal, to the average spring breeding population, resulting in a 115,000 bird increase in the fall flight originating in that region.

The objective for increasing diving duck use days is based on past level of use statewide. Diving duck use of the Mississippi River pools, Upper Fox River Lakes, and Lake Koshkonong have declined drastically in recent years.

OBJECTIVE B: Habitat

By the Year 2005, the Wisconsin Steering Committee concludes that the JV habitat objective for the state will be:

To protect and enhance a minimum of 55,500 additional acres of habitat (3,700 acres per year) in perpetuity with a 3:1 upland to wetland ratio and also restore or enhance 177,350 acres of habitat on public (4,340 acres per year) and private (7,500 acres per year) lands by the Year 2005.

Intensive management of these publicly owned or controlled lands will be necessary to maximize duck recruitment. Long-term protection is the only way to maintain habitats needed to keep populations at the objective level. Long-term benefits for threatened and endangered species and biological diversity are also met mainly through fee title acquisitions.

Habitat management on public lands, however, can only satisfy a portion of Wisconsin's JV's population objective. A majority of duck production occurs on private lands (Wheeler and March 1979, Petersen et al. 1982) and will continue to do so. The JV objective recognizes this and proposes to invest substantially to increase and enhance the habitat base on private lands. Strategies to increase the amount of secure upland cover and increase nest success will be emphasized. By taking advantage of land retirement programs such as CRP, Water Bank, and Set-Aside and providing adequate economic incentives to maintain this habitat for longer periods, waterfowl production and other wildlife benefits will be increased. Soil stability will also be maintained on these lands.

If strategies proposed for meeting population and habitat objectives are adequately funded and implemented, they should result in a 4 percent average annual increase in duck populations breeding in the Priority I areas.

VIII. MANAGEMENT STRATEGIES NEEDED TO ACHIEVE GOAL AND OBJECTIVES

Strategies for meeting breeding population and habitat objectives are outlined below to provide general guidance for management actions directed at meeting these objectives. Individual managers will select strategies most appropriate to their focus area and specific project.

Objective A. To provide habitats and management necessary to add 200,000 ducks, including 50,000 mallards, and 125,000 blue-winged teal to the average spring breeding population in Wisconsin's JV counties, thereby increasing the region's fall flight 325,000 ducks and increase diving duck use by 700,000 use days by the Year 2005.

Strategy A-1. Increase duck breeding populations and recruitment on existing and future public lands (3,700 acres per year) held in fee title by:

- a. increasing wetland acreage by restoring drained wetlands, enhancing wetlands, improving water level control, and opening monotypic stands of emergent vegetation;
- b. increasing permanent, dense nesting cover for upland nesting waterfowl and other grassland wildlife;
- c. optimizing upland and wetland cover quality by the selective use of mowing, grazing, burning, herbicide application, and other management practices;
- d. constructing electric predator fences and removing predators from enclosed areas;
- e. managing predator populations through direct, seasonal removal on properties with documented high nest predation rates;

- f. controlling rough fish, especially carp, in waterfowl impoundments through chemical control, mechanical, and electrical barriers, and commercial harvest;
- g. constructing nesting islands in wetlands wherever cost effective;
- h. removing predators from nesting islands;
- i. encouraging beaver populations to create new habitat wherever compatible with other property objectives and surrounding land use;
- j. cooperating with municipalities and other state and federal land management agencies to improve wetland and upland habitat to benefit wildlife (i.e., wetland restoration or enhancement, delayed or reduced mowing, reduced chemical use, reduced grazing, erosion control, etc.);
- k. controlling purple loosestrife using mechanical and approved chemical means and participating in testing and development of safe biological controls;
- l. upgrading existing waterfowl management areas by providing water control structures, dikes, etc., to maximize habitat stability and management capabilities;
- m. installing nesting structures where species and habitats maximize potential for substantial use by nesting waterfowl; and
- n. developing and implementing a shallow lakes classification and management initiative.

Strategy A-2. Manage and develop habitat on perpetual easements (acquired under Objective B) and other private lands (7,500 total acres per year) using short and longer-term management agreements that will maintain soil stability and optimize productivity. These agreements will accomplish the following:

- a. restore former wetlands;
- b. manipulate water levels and marsh vegetation to attract breeding pairs and promote better brood survival;
- c. establish perennial nesting cover on a 3:1 ratio with wetland acreage;
- d. delay hay cutting;
- e. manage grazing;

- f. promote no-till farming;
- g. plant cover crops on annual set-aside acres and promote voluntary 3-5 year set-aside on the same fields seeded to a suitable cover type;
- h. conduct selective controlled burns to enhance nesting cover; and
- i. construct electric predator fences where appropriate and remove predators from fenced areas.

Strategy A-3. Involve environmental and agricultural communities, the general public, and their agencies in a broad-scale unified effort to induce positive, long-term changes in land use on private and public lands to benefit wetland and grassland wildlife by:

- a. encouraging private conservation groups to initiate wildlife projects on private land;
- b. discouraging wetland drainage and destruction of upland cover;
- c. modifying the use and timing of tillage, mowing, pesticide application, and other farming techniques to make them less detrimental to nesting wildlife;
- d. using soil and water conservation programs (e.g., Priority Watershed program) in restoring wetlands, and reducing upland runoff, soil erosion, and nonpoint pollutants;
- e. requiring adequate land use planning and limit residential and other development occurring in and around existing wetland complexes; and
- f. reducing or eliminating exposure to contaminants by increasing the awareness of the public and the pesticide applicators as to the problems created by certain chemicals and by cleaning up major sources of contaminants that affect wetlands.

Strategy A-4. Protect existing waterfowl habitat and mitigate for losses through federal and state regulations by:

- a. identifying all wetlands and associated habitat critical to continued waterfowl production and other use within the JV counties;
- b. strengthening existing laws;
- c. seeking sponsorship of legislation that mandates "no net loss" of wetlands in Wisconsin;

- d. promoting legislation permitting tax credit for wetland and other wildlife habitat restoration and enhancement activities on private lands;
- e. aggressively enforcing existing federal portions of the 1985 and 1990 Farm Bill, including "Swampbuster" and "Sodbuster";
- f. strengthening coordination of regulatory agencies;
- g. increasing input to the state's congressional delegation during development of future national farm legislation and other activities to increase these programs' continuity related to wildlife habitat issues; and
- h. establishing additional refuge and sanctuary areas wherever necessary to protect breeding and migratory waterfowl from disturbance by boaters and other activities.

Strategy A-5. Minimize waste of adult ducks and broods by:

- a. emphasizing development and proper juxtaposition of wetland and upland complexes to minimize overland losses of broods to predation and other causes;
- b. developing incentives for landowners to delay haying in the vicinity of wetland complexes with above average densities of breeding waterfowl;
- c. reducing losses from physical hazards such as power lines crossing wetlands, etc.;
- d. controlling disease outbreaks and reducing opportunities for their occurrence;
- e. maintaining adequate water levels or discouraging waterfowl from using areas of known lead shot concentrations; and
- f. limiting the use of highly toxic pesticides through an educational program targeted at aerial applicators, retailers, and users.

Strategy A-6. Increase diving duck use by 1,000,000 use days by:

- a. implementing the breakwall projects of the Winnebago Comprehensive Management Plan;
- b. controlling rough fish, especially carp, in waterfowl impoundments through chemical control, mechanical and electrical barriers, and commercial harvest;

- c. developing and implementing a shallow lakes classification and management initiative;
- d. using programs (e.g., Priority Watershed program) in restoring wetlands, and reducing upland runoff, soil erosion, and nonpoint pollutants;
- e. reducing or eliminating exposure to contaminants by increasing the awareness of the public and the pesticide applicators as to the problems created by certain chemicals and the improper application of others, and by cleaning up major sources of contaminants that affect wetlands;
- f. establishing additional refuge and sanctuary areas wherever necessary to protect breeding and migratory waterfowl from disturbance by boaters and other activities; and
- g. restoring and enhancing 1,000 acres of wild rice in northern Wisconsin.

Objective B. To protect and enhance a minimum of 55,000 additional acres of habitat (3,700 acres per year) in perpetuity with a 3:1 upland to wetland ratio and also restore or enhance 177,350 acres of habitat on public (4,340 acres per year) and private (7,500 acres per year) lands by the Year 2005.

Strategy B-1. Acquire 30,250 acres in fee title to protect or enhance wetland and upland habitats for intensive waterfowl management by:

- a. protecting existing wetlands;
- b. restoring former wetlands;
- c. developing semi-permanent wetlands into more permanent brood habitat;
- d. establishing perennial upland nesting cover; and
- e. completing acquisition of key parcels, the lack of which are delaying implementation of waterfowl management opportunities on existing state and federal management areas.

Strategy B-2. Acquire perpetual wetland, flowage, and upland easements on an additional 24,750 acres of private land to increase waterfowl production and recruitment by:

- a. protecting existing wetlands;
- b. restoring former wetlands;

- c. improving waterfowl use potential of existing wetlands through water level and vegetation manipulation; and
- d. protecting existing grassland and CRP and Water Bank lands adjacent to existing or newly developed wetland complexes.

IX. FUNDING

Financing for wetland habitat protection and enhancement programs in Wisconsin has come primarily from WDNR. Sources were the Segregated Fish and Game Account (fish and game license sales) dollars, state waterfowl stamp sales, or federal grant programs such as Pittman-Robertson or Dingell-Johnson. The FWS has also protected considerable acreages under the national wildlife refuge system. In 1974, federal SWAP dollars were also allocated to Wisconsin. Since that time, Wisconsin has received over \$5 million in SWAP funding (McLaury 1988). The bulk of this money came during the 1970's. Annually, SWAP commits about \$250,000 to Wisconsin.

Other federal programs, such as Water Bank, have also assisted wetland protection and habitat enhancement since the early 1970's. Programs initiated in the 1985 Farm Bill (CRP, Swampbuster, and Sodbuster) have given a major impetus to habitat creation and protection on private lands. Also, private organizations such as Ducks Unlimited, The Nature Conservancy, Wisconsin Waterfowl Association, and Audubon, have increasingly become involved in funding wetland preservation and enhancement in Wisconsin. Their contributions have taken on a more significant role as state and federal resources become less available or are stretched to cover new priorities. The need for public and private dollars is vital to the UMRGLR JV. A continuing public-private partnership will be the key to its success.

Responsibilities for achieving Wisconsin's portion of the JV objectives and strategies identified in this proposal must be shared by the WDNR, federal agencies, and non-governmental organizations who are the principal partners. Costs of achieving these objectives (Table 3) exceed the levels currently budgeted individually by the WDNR and the FWS. Although state budget increases via new programs such as the proposed Stewardship Fund, or new federal initiatives to fund the NAWMP are possibilities, these new dollars would not be sufficient to jointly fund all the necessary activities. Therefore, an equally important source of additional funding for this proposal must come from private sources including individuals who enjoy and benefit from the consumptive and nonconsumptive uses of wildlife.

Ducks Unlimited has unquestionably assumed a leadership role in implementing the NAWMP. DU's commitment to expend an additional \$300 million for NAWMP projects in the U.S. and Canada (the "Challenge Plus" program), combined with its plans to spend \$500 million for ongoing habitat programs, is the only significant source of new dollars currently directed at NAWMP funding needs.

WDNR and DU have worked as partners since the enactment of the state's waterfowl

Table 3. Proposed acquisition and development activities and annual cost estimates for the Wisconsin Joint Venture.

Strategy	Annual Activities and Costs			Total Annual Cost
	Acres Treated	Additional Ducks	Cost Per Acre Treated	
Public Lands				
Fee/Easement Acquisition				
New Uplands and Wetlands (3:1 ratio)	3,700	3,700	\$950*	\$3,515,000
Existing or Newly Acquired Public Lands				
Wetland Restoration, or Enhancement	1,250	1,250	\$800	\$1,000,000
Upland Cover Establishment	640	640	\$100	\$64,000
Predator Exclusion Fences in Upland Cover	50	1500	\$400**	\$20,000
Miscellaneous Techniques	<u>2,400</u>	<u>2,400</u>	\$100	<u>\$240,000</u>
	4,340	5,790		\$1,324,000
Subtotal				\$4,839,000
Private Lands				
Wetland Restoration or Enhancement	900	900	\$900 ^(\$100 Land) _(\$800 Development)	\$810,000

Table 3. Continued.

Strategy	Annual Activities and Costs			Total Annual Cost
	Acres Treated	Additional Ducks	Cost Per Acre Treated	
Private Lands (cont.)				
Upland Cover Establishment				
CRP Lands	2,400	2,400	\$90	\$216,000
Water Bank	800	800	\$90	\$72,000
3-5 Yr. Set-Aside	800	800	\$20	\$16,000
WDNR Leases	<u>2,400</u>	<u>2,400</u>	\$180***	<u>\$432,000</u>
Subtotal	6,400	6,400		\$736,000
Predator Exclusion Fences in Upland Cover	60	180	\$420****	\$25,200
Miscellaneous Techniques	<u>140</u>	<u>140</u>	\$105 ^(\$80 Land) (\$25 Practice)	<u>\$14,700</u>
Subtotal	<u>7,500</u>	<u>7,620</u>		<u>\$1,585,900</u>
Total	15,540	17,110		\$6,424,900 ¹

¹2,775 acres if upland @ \$1,000/acre + \$100/acre for nesting cover = \$1,100/Unit; 975 acres of wetland @ \$500/acre; Average cost of a complete "Unit" (3 acres wetland and 1 acre upland) = \$3,800 or \$950/acre.

**Assuming 40-acre blocks; cost is less if 80-acre blocks are fenced.

***\$80 for land rights and \$100 to establish nest cover.

****\$20/acre for permission to fence existing cover on CRP, etc.; \$400/acre to fence 40-acre block.

¹Does not include annual Research and Evaluation Costs of about \$80,000/year and does not include annual maintenance costs of about \$282,000 for public lands and \$5,000 for private lands.

stamp in 1978, with one-third of the revenue generated from the sale of state waterfowl stamps annually going to DU for habitat projects in Canada. Wisconsin is currently receiving Matching Aid to Restore States Habitat (MARSH) funds from DU for habitat projects in the state. The total MARSH allocation for Wisconsin for 1985-88 was \$946,877. DU sponsor program activities are just getting underway in the state and Wisconsin began its first Habitat USA project (funding level of \$100,000-\$150,000 per year), in 1990-91.

Another significant source of private dollars has been TNC. TNC has acquired and protected over 26,000 acres of unique and/or scarce habitats in Wisconsin and is currently acquiring wetlands of importance to waterfowl and other wildlife in several locations.

The recently created Natural Resources Foundation is another potential significant source of private funding for the JV.

Other private groups have also contributed to wetland protection and development and upland cover establishment, including the Wisconsin Waterfowl Association (WWA), who now provide about \$20,000 per year to WDNR and the FWS. Audubon, Pheasants Forever, and Wings Over Wisconsin also have habitat protection or management efforts underway. In addition, a number of key wetlands are protected by private ownership as waterfowl management and hunting areas.

Wisconsin's Nonpoint Source Pollution Abatement program is a cooperative effort of soil and water resource management between the WDNR and the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP). The backbone of the nonpoint program is its Priority Watershed planning and implementation activities. Areas designated as Priority I JV habitat also include a majority of the state's Priority Watersheds (Appendix A). Priority Watershed plans will include an integrated resource management strategy to enhance fish and wildlife habitat, protect endangered resources, protect and restore wetlands, and enhance esthetics. Several new "Best Management Practices," including wetland restoration, are authorized. All Best Management Practices contain provisions requiring establishment and restoration of wetland habitat, erosion control during construction, and protection of wetlands. Authority to obtain easements for nonpoint source pollution control is included. Governmental units and individual landowners are eligible for up to 50 percent cost-sharing grants for Best Management Practices and, if DATCP agrees, WDNR can cost-share a project up to 70 percent. If counties participate, up to 80 percent cost-sharing is possible.

Fund raising will be a responsibility at all levels within the NAWMP organization and the UMRGLR JV. WDNR will be implementing the Stewardship Fund which includes \$1.5 million annually for Habitat Restoration Areas (HRA). An objective of the HRA program is to restore wetlands and upland cover for waterfowl on a landscape scale.

Additional efforts to secure new monies must be made, in addition to accelerating

existing fund raising efforts to increase dollars available for continuing programs. A major initiative is required on all fronts to capture public support, not only for waterfowl, but also for soil, water, and all wildlife conservation measures, and to fund the projects necessary to successfully reach JV objectives by 2005.

Future estimated annual costs of Wisconsin's portion of the JV are summarized in Table 3. Estimates do not include existing base operating and management funds currently allocated to waterfowl and wetland habitat protection. Ongoing programs such as SWAP and acquisition and development on state wildlife areas and on national wildlife refuges are expected to continue under the JV and contribute toward meeting its costs and objectives. Also, cost estimates do not include land rental costs for CRP and Set-Aside, or other cost-sharing by the U.S. Department of Agriculture (USDA). The figures represent the future additional funding needed to accomplish the JV objectives and selected strategies described in the proposal.

In Table 3, items receiving highest priority for funding are the initiatives directed at restoring or enhancing wetlands wherever the opportunity exists, and the habitat work on private lands. Without the cooperation and involvement of private landowners, using the dollar incentives proposed, JV objectives cannot be met. A cooperative effort between state, federal, and private entities, directed at habitat restoration, enhancement, and protection on private lands can only be successful if financial incentives offered to the landowner are economically competitive with other income-generating land uses. Also, efforts on private lands solely for wildlife will produce few results. Wildlife must be just one of multiple benefits derived from JV actions. Table 4 lists the proposed habitat accomplishments for Wisconsin's portion of the JV by the Year 2005.

Proposed allocation of funding sources are identified in Table 5. Some of this effort would take advantage of land retirement programs already funded by USDA, such as CRP or annual Set-Aside. Combining USDA programs with long-term new or ongoing habitat programs of WDNR and the FWS is a key ingredient of these efforts. All involved groups, whether state, federal, or private, must work together, pooling their resources to complement one another's programs and funding, and collectively seek additional resources to carry out the Wisconsin's portion of the JV. Incorporation of wildlife interests with ongoing soil and water conservation programs, particularly the Priority Watershed initiatives, must also be a priority.

Legislative action that would, for example, result in no net loss of wetlands in Wisconsin or authorize tax credits or tax incentives for wildlife habitat and wetlands, would have a major positive effect on the total funding needed for Wisconsin's portion of the JV. If many of the remaining threats to existing habitat were removed through new legislation,

Table 4. Proposed habitat accomplishments of the Wisconsin Joint Venture by the Year 2005.

Wetlands:	
- Restored or enhanced wetlands on public lands	18,700 acres
- Additional wetlands permanently protected in either fee title or perpetual easement	29,050 acres
- Restored or enhanced wetlands on private lands that are protected for a specific period under some form of agreement	<u>13,550 acres</u>
Total	61,300 acres
Uplands:	
- Additional permanent nest cover established on existing publicly owned or controlled lands	9,600 acres
- Permanent nest cover established on newly acquired or perpetually eased land	26,450 acres
- Permanent nest cover established on private lands and protected for a specific period under some form of agreement	<u>95,850 acres</u>
Total	131,900 acres
Additional Habitat Management or Enhancement:	
- Permanent nest cover fenced with predator-proof fencing on public lands	700 acres
- Permanent nest cover fenced with predator-proof fencing on private lands under some form of agreement	<u>950 acres</u>
Total	1,650 acres
- Public lands treated with miscellaneous production enhancement techniques	35,900 acres*
- Private lands treated with miscellaneous production enhancement techniques under some form of agreement	<u>2,100 acres</u>
Total	38,000 acres

*Primarily carp treatment

Table 5. Costs of meeting the goals and objectives of Wisconsin's portion of the UMRGLR JV by the Year 2005 and proposed sources of funding.*

Activity or Strategy	Cost		Probable Funding Source
	Annual	15-Year Total	
Habitat on Public Lands			
- Initial Enhancement and Development on Newly Acquired Lands, 3,700 Acres/Year	\$272,500	\$4,162,500	(WDNR 50%) (Private 40%) (FWS 10%)
- Enhancement and Development on Existing Lands, 4,340 Acres/Year	\$1,324,000	\$19,860,000	(WDNR 50%) (Private 35%) (FWS 15%)
- Land Acquisition-Fee Title and Perpetual easement, 3,700 Acres/Year	\$3,237,500	\$48,562,500	(WDNR 70%) (FWS 20%) (Private 10%)
- Maintenance/Operations: \$20/Acre/Year on Developed Lands \$10/Acre/Year on Undeveloped Lands	<u>\$282,000</u>	<u>\$4,230,000</u>	(WDNR 75%) (FWS 25%)
Subtotal	\$5,121,000	\$76,815,000	
Habitat on Private Lands			
- Land Rental	\$286,700	\$4,300,500	(WDNR 100%)
- Enhancement and Development	\$1,299,200	\$19,488,000	(USDA 40%) ¹ (WDNR 30%) (Private 20%) (Other 10%)
-Maintenance/Enforcement	<u>\$5,000</u>	<u>\$75,000</u>	(WDNR 100%)
Subtotal	\$1,590,900	\$23,863,500	
Research and Evaluation	\$80,000	\$1,200,000	(WDNR 75%) (P-R 25%)
Total	\$6,791,900	\$101,878,500	

*Appendix B provides a detailed breakdown of annual costs.

¹In addition to land rental costs of CRP, Set-Aside, Water Bank, etc.

JV strategies could fully concentrate on increasing the total habitat base, focusing on restoration or enhancement of wetlands and upland cover. Efforts to enact these types of laws must be initiated in concert, and on an equal priority, with efforts to address funding shortfalls.

X. PROPOSED HABITAT FOCUS AREAS

The habitats deemed most important or critical to the breeding and migrational needs of ducks under the proposed JV are preliminarily delineated within each focus area. Some focus areas already have ongoing habitat restoration projects (e.g., WPA's, MARSH, or other management efforts) or significant planning efforts (e.g., the Winnebago Comprehensive Management Plan or the Rush Lake-Waukau Marsh Task Force) underway. Other focus area projects are proposed for the first time as part of the JV process. Initial JV funding could be directed at focus areas which are ongoing or ready for immediate implementation. Within focus areas or individual counties, specific projects will be proposed for JV action. Individual projects will be directed at overall population and habitat objectives established for the JV. Brief, site specific project implementation plans will be written, detailing the strategies, costs, funding source(s), cooperators, and time schedule necessary for completion. Habitat objectives are not stated in terms of specific acreages to be treated, but that information will be included in project write-ups. Individual projects will benefit a wide variety of wildlife besides waterfowl, and social, economic, and recreational benefits will also result from their implementation.

A. Southeast Focus Area

The Southeast Focus Area includes all or parts of 20 counties (Figure 4) and closely approximates Petersen's (1985) Woodlot-Fencerow ecological province (Figure 2). Included are most of the drainage basins of the Rock, Fox-Wolf, Milwaukee, Lower Fox (Illinois), Sheboygan, and Manitowoc rivers. Smaller portions of the Sugar-Pecatonica and Wisconsin river basins are also part of the focus area. More than 50 percent of the area is either cropland or pasture, and less than 20 percent is wooded. Four to 21 percent of the individual counties are currently mapped as wetland, averaging 13 percent. Mapped wetland acres total more than 875,000 acres. Panzner (1957) indicated the region had over 238,000 acres of permanent water of significance to ducks in the 1950's. The addition of flowages on state management areas since that time may have offset degradation of some of this habitat.

In seven southeast counties, 10-20 percent of the landscape is urbanized.

Horicon Marsh, Wisconsin's largest cattail marsh, lies near the center of the focus area and is located just south of the state's largest inland lake, Winnebago.

Blue-winged teal, mallards, wood ducks and Canada geese are the principal breeding waterfowl. Teal were once the most common nester but probably are currently second to wood ducks. Some of the highest breeding densities in

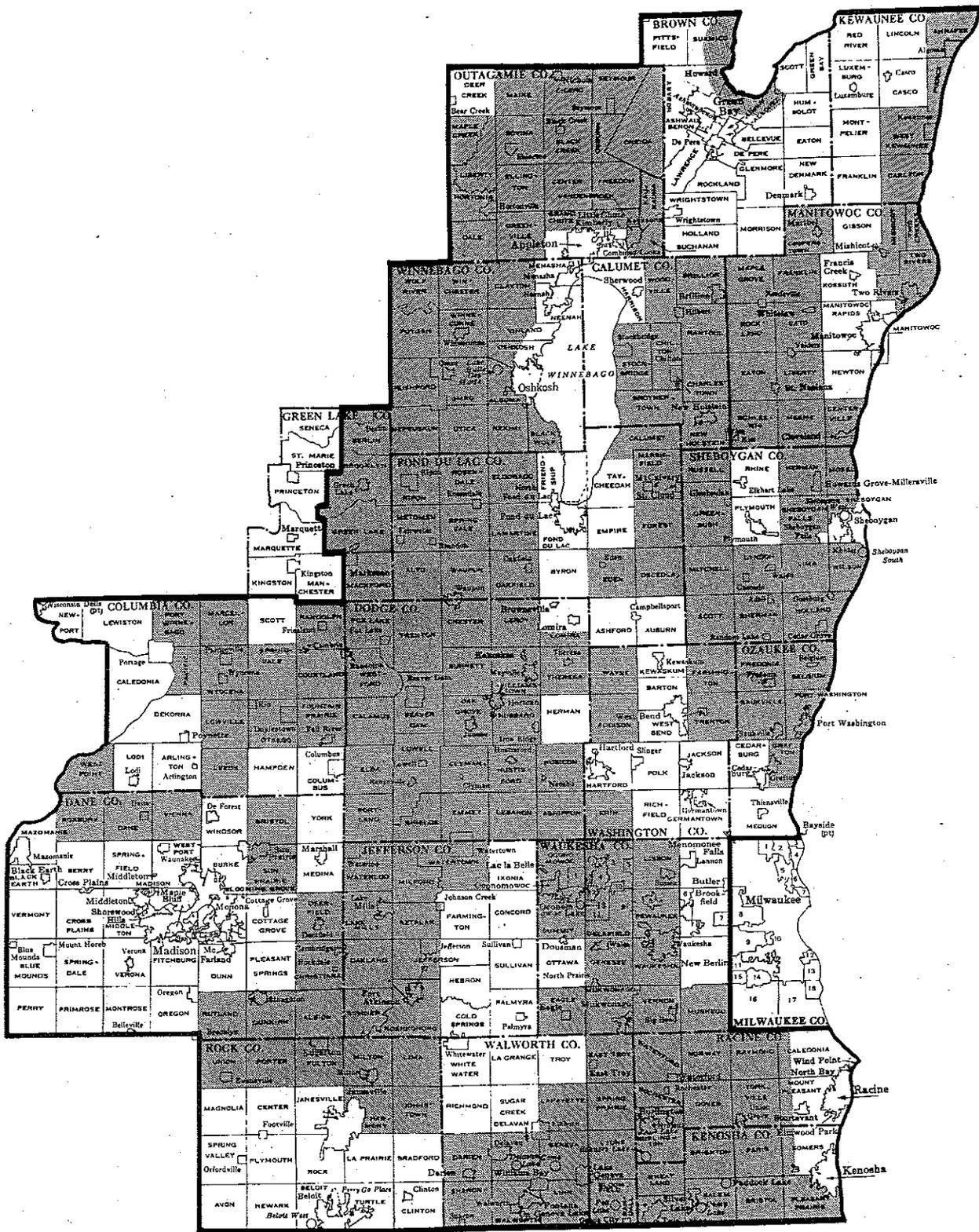


Figure 4. Southeast Focus Area of Wisconsin's portion of the Upper Mississippi River and Great Lakes Region Joint Venture. Shaded areas are townships designated as critical habitat for projects under the joint venture (as determined by WDNR wildlife managers and other knowledgeable persons).

Wisconsin come from this focus area. All waterfowl known to nest in the state are found here, including black ducks, pintail, redheads and ruddy ducks. The focus area includes most of the state's major migration habitats other than the Mississippi River. Historically, a majority of the continent's canvasback population passed through the region (Kahl 1985). Over 700,000 Canada geese use the area as both fall and spring migration stopovers and staging areas.

Other breeding and migrating birds found in the focus area are bald eagles, ospreys, peregrine falcons, great egrets, great blue herons, sandhill cranes, cormorants, Forster's common and black terns, coots, gallinules, several species of grebes including the threatened red-necked grebe, snipe, rails, various raptors and many songbirds, including grassland species and yellow-headed blackbirds.

- 1) Dodge County (Ashippun, Beaver Dam, Burnett, Calamus, Chester, Clyman, Elba, Emmet, Fox Lake, Hubbard, Hustisford, Lebanon, LeRoy, Lomira [South 1/2], Lowell, Oak Grove, Portland, Rubicon, Shields, Theresa, Trenton, Westford, and Williamstown townships).

Acres of County Mapped as Wetlands (percent of county acreage): 111,200(19.6%)

Acres of Habitat Currently Protected (Acreage Goal):

FWS

Horicon National Wildlife Refuge:	20,926 acres(21,000)
WPA's (3):	200+ acres(1,030+)

WDNR

Wildlife Areas:	19,000 acres(23,150)
EWHP's:	860 acres(860)
Scattered Wetlands:	890 acres(835)

Other

CRP:	12,167 acres (65,000)
Water Bank:	3,719 acres

Dodge County (Figure 4) is at the center of the best wetland-waterfowl habitat in the Southeast Focus Area and has the area's largest remaining wetland base. Together with adjoining counties of Columbia, Dane, Fond du Lac, Green Lake and Jefferson, and Rock and Winnebago counties, the region provides a majority of the critical duck production habitat of southern Wisconsin, plus much of the more important migration habitat.

Centered around the 32,000 acre Horicon Marsh and the Rock River system, Dodge County is approved for both WPA acquisition and for Water Bank. In addition, there are 5 state wildlife areas (Horicon Marsh, Mud Lake, Shaw Marsh, Westford, and Waterloo) and the Horicon National Wildlife Refuge. Several WDNR Bureau of Fisheries-managed spawning marshes also protect critical production and migration

habitat.

Breeding duck densities remain among the state's highest despite intensive agriculture and drier conditions in the 1980's. Blue-winged teal populations are especially impacted by these concerns. Although over 80 percent of Dodge County's surface area is in cropland or pasture, only about 7,500 acres are enrolled in CRP. Active agricultural operations in the county apparently are not interested in retiring lands or must crop them to remain financially sound. Calamus, Chester, Elba, Portland, Trenton, and Westford townships have been sites for the WDNR's experimental private lands wildlife management initiative which met with mixed success in meeting its habitat objectives. An evaluation of its results are ongoing (Vander Zouwen and Peterson 1985).

Habitat for waterfowl, especially mallards, blue-winged teal, redheads, and Canada geese, is such an important resource in Dodge County that 3 separate JV initiatives have been identified:

- a) Dodge Prairie Drumlins (Beaver Dam, Burnett, Calamus, Chester, Elba, Fox Lake, Lowell, Oak Grove, Trenton, and Westford townships)

The 10 townships located west of Horicon Marsh (Figure 4) encompass about 360 square miles and had more than 14,000 acres of shallow and deep marsh habitat remaining in the 1950's. Although a portion of that habitat is currently under public ownership, much remains to be protected or developed. Dabbling duck production and protection and enhancement of migration habitat will be emphasized. Protection of unique resources, e.g. heron and egret rookeries and sandhill crane nesting marshes, will also be a priority. Under the JV, priority will be to complete acquisition on delineated WPAs, plus wetland development and enhancement on public and private lands, leasing and planting permanent nest cover on private lands, increasing the amount of brood water, rough fish removal and control on the larger lakes, and protection of critical wetlands not currently delineated as WPAs. Included in this area are the Fox Lake-Beaver Dam Lake watershed, the Rock River-Lake Sinissippi-Dead Creek wetland complex, the Calamus Creek-Shaw Branch-Upper Beaver Dam River watershed, and extensive private wetlands and uplands surrounding federal and state lands.

Undisturbed nesting cover is limited because of intensive agriculture. Water Bank and CRP tracts provide some non-hayfield cover, but acreages are limited and are inadequate for realizing significant duck recruitment from private lands.

The marshes west and north of Lake Sinissippi (1,800+ acres) and on the east and west ends of Fox Lake (1,500+ acres) are a focal point for production habitat development on adjacent uplands. Similar opportunities exist on marshes adjoining other lakes and streams. Because topography of the area is gently rolling to flat, interspersed by glacial drumlins, wetland enhancement or restoration would be relatively easy using low-head dikes and water control structures to back up small streams and drainage ways. Acquiring the necessary

land rights to do so will require a major JV initiative however.

- b) Lower Beaver Dam and Crawfish Rivers (Lowell, Portland and Shields townships).

The Beaver Dam and Crawfish rivers, their tributaries and adjacent wetlands and uplands, make up the core of two state wildlife areas, Mud Lake and Waterloo. Part of Waterloo is also in Jefferson County. Over 8,000 acres are state-owned on the two projects. The emphasis of JV projects will be on leasing private uplands for nesting habitat and restoring small impoundments for pairs and broods on state lands.

- c) Horicon Marsh Unit (Horicon National Wildlife Refuge, 20,976 acres, and the Horicon Marsh Wildlife Area, 10,992 acres).

Strategies would complete acquisition on the wildlife area and development on both properties, including a large subimpoundment on state lands. Also, restoration and enhancement of wetlands and leasing of croplands for nesting cover would be initiated on private lands immediately adjacent to the marsh. The primary objective would be improved dabbling duck production and, on the marsh, increased redhead recruitment.

Horicon Marsh is the largest single block of waterfowl production habitat in southern Wisconsin and is second only to the Upper Mississippi River National Fish and Wildlife Refuge in terms of importance as migration habitat. The federal refuge provides habitat for a majority of Wisconsin's nesting redhead ducks and most ducks common to the state nest on the area. Although the state area attracts a significant number of nesting ducks, recruitment is poor because of nest predation. Fencing lands with predator-proof fences will also be a strategy here and elsewhere in the JV. Carp and their associated habitat degradation are problems on the marsh and throughout the Rock River system. Adequate water level control is also a major shortcoming on the state end of Horicon. Protection of the 4-Mile Island Natural Area heron and egret rookery, the state's largest, is also a priority.

Fall populations on Horicon have regularly exceeded 50,000-75,000 ducks and 200,000+ Canada geese. Horicon NWR is also a main molting and staging area for local nesting hen mallards and blue-winged teal.

- 2) Winnebago County (Algoma, Black Wolf, Clayton, Nekimi, Nepeuskun, Omro, Oshkosh, Poygan, Rushford, Utica, Vinland, Winchester, Winneconne, and Wolf River townships, excluding the lakes and major wetlands of the Winnebago system covered by the Comprehensive Management Plan, which is treated as a separate focus area).

Acres of County Mapped as Wetlands (percent of county acreage): 44,509 (15.5%)

Acres of Habitat Currently Protected (Acreage Goal):

WDNR

Wildlife Areas:	0 acres(0)
EWHP's:	600+ acres(600)
Scattered Wetlands:	296 acres(296)

Private

The Nature Conservancy	550 acres(10,000)
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Other

CRP	11,516+ acres(21,200)
Water Bank	1,719 acres

Winnebago County (Figure 4) is probably second only to Dodge County in importance to southern Wisconsin, especially for diving ducks. The Winnebago System, with its 4 large lakes, represents Wisconsin's major inland lake diving duck habitat. The Winnebago System Comprehensive Management Plan is such a significant and immense undertaking it is included as a separate focus area. The county's other major wetland complex, Rush Lake and Waukau Marsh, is discussed below as a separate JV initiative.

Land use in the county is quite contrasting from east to west with the highly urbanized Fox River Valley metropolitan area lying along the west shore of Lake Winnebago and the extensive Wolf and Fox River marshes and the Rush Lake-Waukau complex in the rural western half. In the 1950's, the designated townships totalled over 14,000 acres of shallow and deep marsh.

No WPA's have been acquired in Winnebago County, but the opportunity is there if an accelerated effort were made under the JV. The state's EWHP and Scattered Wetlands programs have protected some production habitat, but much more remains to be preserved. Acres enrolled in CRP are about average for the focus area and about 3,400 acres are in Water Bank. Four wetland basins were restored by the FWS in 1988 (8 acres) and other projects are planned. The greatest opportunities for habitat work on private lands lie in the western part of the county, away from high value lands in the urban areas.

Rush Lake-Waukau Marsh Complex (Nepeuskun, Rushford and Utica townships, plus Ripon township in Fond du Lac County).

In the Rush Lake-Waukau Marsh JV initiative, emphasis will be on shoreline and watershed protection, wetland restoration, restoration of aquatic and upland vegetation, improved water quality, rough fish control, and protection of unique, threatened, or endangered species.

Rush Lake has a 17.3 square mile watershed and is a unique, 3,070-acre, shallow lake. Its water chemistry and vegetation are similar to lakes found in the prairies

of the Dakotas or western Minnesota. Lake levels were historically lower than at present and are being kept higher by a township-owned, water control structure at its outlet. Resulting high water, together with carp activity, has severely decreased both submergent and emergent aquatics. The lake is one of the premier waterfowl and aquatic bird production areas and migration stops in southern Wisconsin. Before losses of bulrush stands depleted nesting habitat, redheads and ruddy ducks commonly used the area for breeding.

Rush Lake and its bulrush islands are also key nesting areas for the endangered Forster's tern and the threatened red-necked grebe. The prairie white-fringed orchid, a threatened plant species, is also found in the area.

The lake's shoreline is partially developed and fee title acquisition is necessary to protect the rest. Lowering water levels and controlling rough fish should restore the bulrush and other aquatics. Reducing soil erosion on uplands throughout its watershed would improve water quality in the lake and associated streams.

Waukau Marsh, originally about 4,600 acres, is located on Waukau (Rush Lake's outlet) and 8-Mile creeks. Their combined watershed is about 25 square miles. A majority of the marsh has been drained and is in muck farm. Acquisition and development of the area, a large part of which is in one ownership, would allow restoration of over 1,000 acres of wetland. In the 1950's, there still was over 2,800 acres of shallow and deep marsh in the townships around Rush Lake and the Waukau Marsh. Restoration of these wetlands will provide additional pair and brood habitat for dabbling ducks and a migration stop for both ducks and geese. The addition of permanent upland cover on the lands surrounding restored wetlands and Rush Lake will protect the watershed and also provide undisturbed nesting habitat that is currently scarce for both waterfowl and grassland birds.

The WDNR, FWS, TNC, DU, and University of Wisconsin-Oshkosh currently have a task force to develop a plan for the Rush Lake-Waukau complex. This partnership and planning effort is underway. The WDNR has acquired almost 200 acres, predominantly consisting of uplands in the Rush Lake area. TNC currently owns and manages 550 acres of land around Rush Lake. This preserve has been designated as the Owen and Anne Gromme Preserve. The property includes approximately 1/2 mile of shoreline, 80 acres of sedge meadow, and several oak openings. TNC intends to protect 10,000 acres in the Rush Lake area through a combination of acquisition, conservation easements, and voluntary agreements with private land owners. FWS presently owns 1,102 acres of Waukau Marsh, which is a drained wetland adjacent to Rush Lake. FWS intends to restore the drained wetlands and manage the property for duck production as a Waterfowl Production Area under the National Refuge System. The entire complex, including Waukau Marsh, is being considered for funding as one of the 12 initial major Habitat Restoration Areas proposed under the proposed Steward Fund legislative initiative.

- 3) Columbia County (Courtland, Fort Winnebago, Fountain Prairie, Leeds, Lowville, Marcellon, Otsego, Pacific, Randolph, Springvale, West Point and Wyocena

townships).

Acres of County Mapped as Wetlands (percent of county acreage): 76,189 (15.4%)

Acres of Habitat Currently Protected (Acreage Goal):

FWS

WPA's (9): 1,179 acres(2,421)

WDNR

Wildlife Areas: 12,115 acres(17,150)

Scattered Wetlands: 242 acres(242)

Private

Madison Audubon: 180 acres

Other

CRP: 8,150 acres(55,000)

Water Bank: 648 acres

Columbia County (Figure 4) has the second largest remaining wetland base in the Southeast Focus Area. Research has found that breeding duck densities per unit of wetland, especially blue-winged teal and mallards, in Columbia County are equivalent to the PPJV region and nest success is higher than on the prairies. The county is approved for WPA acquisition and there are 7 wildlife areas in the designated townships. Additional habitat is protected on several coldwater WDNR Bureau of Fisheries-managed properties. Migrant waterfowl using WDNR and FWS lands number in the tens of thousands. Schoeneberg's Marsh WPA is the third largest complex in the focus area and will be its biggest when all lands are purchased. Pine Island Wildlife Area, although outside the designated townships on the county's western edge, is a major Canada goose concentration area (20,000+ geese) in the Wisconsin River bottoms. Swan Lake (419 acres), Lake Wisconsin (5,328 acres), and the Wisconsin River bottoms are also outside the designated townships, but they provide additional important migration habitat for ducks, including divers.

The Madison Audubon Chapter owns 2 bird sanctuaries in the county, Goose Pond (100 acres) and Otsego Marsh (80 acres). Goose Pond annually attracts thousands of ducks, geese, and tundra swans, has nesting waterfowl, including ruddy ducks, and is widely known for its diverse bird life and prairie uplands. There are opportunities for wetland and upland habitat restoration/enhancement throughout the county, both on public and private lands. Target species would be dabbling ducks, pheasants, and grassland birds. In addition, JV funding would assist in completing waterfowl objectives in master plans for the 7 wildlife areas. The FWS has already identified at least 7 potential wetland restoration projects under 1985 Farm Bill directives. Habitat work in Columbia County will complement similar activities in adjoining Dane, Dodge, Green Lake and Marquette counties.

- 4) Dane-Jefferson-Rock Counties (Dane County--Albion, Bristol, Christiana, Dane, Deerfield, Dunkirk, Roxbury, Rutland, Sun Prairie, and Vienna townships; Jefferson County--Astalan, Jefferson, Koshkonong, Lake Mills, Oakland, Milford, Sumner, Waterloo, and Watertown townships; Rock County--Fulton, Harmony, Johnstown, Lima, Milton, Porter, and Union townships).

Acres of County Mapped as Wetlands (percent of county acreage):

Dane	52,956 (6.9%)
Jefferson	73,759 (20.5%)
Rock	<u>21,022</u> (4.5%)
	147,737

Acres of Habitat Currently (Acreage Goals):

FWS

WPA's:

Dane (7)	910 acres(1,348)
Jefferson (4):	250 acres(285)
Rock (3):	<u>287</u> acres(<u>416</u>)

1,447 acres(2,049)

WDNR

Wildlife Areas:

Dane	6,250 acres(7,470)
Jefferson	1,090 acres(1,120)
Rock	<u>2,440</u> acres(<u>3,475</u>)
	9,780 acres(12,065)

EWHP's:

Dane	80 acres(80)
Jefferson	300 acres(300)
Rock	<u>145</u> acres(<u>145</u>)
	525 acres(525)

Scattered Wetlands:

Dane	180 acres(180)
Jefferson	<u>1,145</u> acres(<u>1,145</u>)
	1,325 acres(1,325)

Other

CRP:

Dane	43,238 acres(100,000)
Jefferson	16,416 acres(35,000)
Rock	<u>19,936</u> acres(<u>90,000</u>)
	79,590 acres(225,900)

Water Bank:

Dane	191 acres
Jefferson	<u>1,154</u> acres
	1,345 acres

The 3 counties (Figure 4) still have significant wetland habitat remaining despite intensive agriculture and industrial/urban development. All are approved for WPA acquisition and have one or more state wildlife areas with waterfowl management objectives. Over 13,000 acres are already publicly controlled. Existing WPA's have breeding duck densities comparable to the PPJV and nest success is thought to be better than on the prairies.

Habitat work will be directed at increasing dabbling duck production. Upland nest cover and fencing to exclude predators, along with wetland restoration and enhancement will be the major strategies. Priority will be to develop management "complexes" around existing WPA's and state lands. The FWS restored 14 wetland basins in Dane and Jefferson counties in 1988 and others are planned for future years. Dane County has an especially large amount of CRP lands and together, the 3 counties total almost 62,000 acres enrolled in the program. Townships in Dane County are also parts of two Priority Watersheds (Appendix A).

Jefferson County also provides an opportunity to improve habitat for diving ducks. While the county has a good habitat base of smaller ponds and marshes, it also has several larger lakes, rivers and marshes, with the most important being the 10,480-acre Lake Koshkonong. Koshkonong, once famous for its fall canvasback flocks, has shown recent signs of again becoming a significant fall migration area (Kahl 1985). Rough fish control, plus more stable and lower water levels, have helped restore wild celery and other submergents. The ongoing fish control program, plus new JV initiatives to protect the watershed and remaining adjacent marshes, should continue to improve the lake's habitat for waterfowl. WDNR already owns 605 acres of wetlands on the southeast end of the lake at the mouth of the Rock River. Jefferson County has 4 other lakes and adjoining marshes of particular importance to waterfowl. Red Cedar Lake (370 acres) has almost 400 acres of marsh in its watershed and 2 WPA's adjoining the lake provide nest cover and ponds for pairs. Lake Ripley (433 acres), just north of Red Cedar, has 130+ acres of marsh. Rock Lake (1,371 acres) has about 1,700 acres of marsh, some of which is in the Lake Mills Wildlife Area. Included is the Bean Lake Natural Area (33 acres), a remnant tamarack swamp and Mud Lake (93 acres).

In Dane County, significant numbers of migrating waterfowl are found on only a few lakes (Bass, Crystal, and Fish, for example), although mallards, wood ducks, and Canada geese, primarily giants, are common throughout the area. Over 10,000 mallards, plus miscellaneous species, winter in the Madison area. Historically, the area also wintered several thousand black ducks, but numbers have drastically declined. The Madison lakes also had large numbers of diving ducks and coots in the 1950's, approaching 100,000 birds, including 60,000 canvasback. These lakes, especially Waubesa and Kegonsa, plus Upper and Lower Mud lakes, potentially provide 18,000+ acres of diving duck habitat, if suitable conditions and food resources are restored.

Management strategies in Rock County will be similar to those in Dane and

Jefferson, but will be more limited. The lower end of Lake Koshkonong, including the Indianford Dam, and the Rock River are in the county. Two state wildlife areas are in the designated townships. Both Lima Marsh and Storr's Lake have some of the county's best remaining marsh habitat. Waterfowl production habitat in Johnstown, Lima and Union townships is some of the best found anywhere in Wisconsin.

- 5) Kenosha-Racine-Walworth-Waukesha Counties (Kenosha County--Brighton, Bristol, Paris, Pleasant Prairie, Randall, Salem, West 1/4 of Somners, and Wheatland townships; Racine County--Burlington, West 1/4 of Caledonia, Dover, West 1/4 of Mount Pleasant, Norway, Raymond, Rochester, Waterford, and Yorkville townships; Walworth County--Bloomfield, Darien, Delavan, East Troy, Geneva, LaFayette, Linn, Lyons, Sharon, Spring Prairie, and Walworth townships; Waukesha County--Delafield, Eagle, Genessee, Lisbon, Merton, Mukwonago, Muskego, Oconomowoc, Pewaukee, Summit, Vernon, and Waukesha townships, plus the Milwaukee River Priority Watershed).

Acres of County Mapped as Wetlands (percent of county acreage):

Kenosha	16,194 (9.3%)
Racine	16,406 (7.7%)
Walworth	30,127 (8.5%)
Waukesha	<u>56,283</u> (15.9%)
	119,010

Acres of Habitat Currently Protected (Acreage Goals):

WDNR

Wildlife Areas:

Kenosha	1,330 acres (3,100)
Racine	2,250 acres (2,950)
Walworth	1,035 acres (1,610)
Waukesha	<u>3,640</u> acres (<u>12,225</u>)
	8,255 acres (19,885)

EWHP's:

Kenosha	310 acres (310)
Racine	0 acres (0)
Walworth	1,140 acres (1,140)
Waukesha	990 acres (<u>990</u>)
	2,440 acres (2,440)

Scattered Wetlands:

Racine	355 acres (355)
Walworth	1,430 acres (1,320)
Waukesha	<u>990</u> acres (<u>330</u>)

2,775 acres (2,005)

Recreation Areas:	
Kenosha	4,600 acres (4,635)
<u>Other:</u>	
CRP:	
Kenosha	3,473 acres (18,700)
Racine	4,893 acres (25,000)
Walworth	9,391 acres (90,000)
Waukesha	<u>8,467</u> acres (<u>28,500</u>)
	26,224 acres(163,100)
Water Bank:	
Kenosha	146 acres
Racine	446 acres
Walworth	579 acres
Waukesha	<u>1,163</u> acres
	2,334 acres

The 4 adjoining counties (Figure 4) are grouped because of similarities in habitat base, breeding populations, land use, management problems, and strategies that will be implemented as part of the JV. Despite being heavily agricultural (60-70 percent or more of the land) and urban (6-19 percent), these counties collectively have a significant remnant wetland base. Opportunities for restoration of wetlands exist if funds are available. In 1988, the FWS was able to restore 8 wetlands (18 acres) and others are planned. During the 1950's, the designated townships had almost 20,000 acres of deep and shallow marshes remaining. Habitat quality has declined in many areas, but important waterfowl habitat remains. Waterfowl production and migration habitat also remains adjacent to the region's many lakes, along its rivers, or as scattered ponds and marshes. A lack of secure nest cover adjacent to wetlands is a major drawback to improved duck production--this problem will be addressed by JV projects.

A large part of the remaining habitat is concentrated in two or three localities, either along the Fox (Illinois) and Des Plaines rivers and their tributaries or around lakes in Waukesha County. In western Walworth County, streams, including Turtle Creek, flow into the Rock River. The Turtle Creek Wildlife Area (including the part in Rock County) and neighboring Delavan Lake are critical wintering habitat for the Rock Prairie flock of giant Canada geese.

Lakes important primarily to waterfowl migration, but with some production include Camp (482 acres), Wind (821 acres), Tichigan (268 acres), Como (1,123 acres), Geneva (5,239 acres), Delavan (1,038 acres), and Big Muskego (2,260 acres).

All 4 counties are approved for WPA acquisition, but no lands have been purchased. Success with EWHP acquisition was excellent, suggesting that given SWAP funds and priority, WPA's could also be acquired. Six WDNR wildlife areas, plus a number of scattered wetlands, help protect a major portion of the remaining important marshes. Under the JV, waterfowl habitat acquisition and development

as outlined in property master plans could be completed and the projects brought to their full potential for waterfowl.

Other JV strategies will emphasize private land wetland restoration. Plugging or breaking tile lines has been an economical method of accomplishing previous wetland restoration in this region. There may also be interest in leasing private lands for secure nesting cover or fencing the cover against predators. Many of the better remaining wetlands are sites for rural residences and the owners are not dependant on farm incomes. Other activities will include shoreline and streambank protection, rough fish control on lakes, construction of water control devices, drawdowns to re-establish aquatic plants, establishing sanctuary areas on lakes to reduce disturbance, and cooperation with agricultural interests to delay haying and reduce the amounts of chemicals used on croplands.

Although CRP enrollment is about average acreage-wise, there are opportunities for additional habitat work and wetland restoration on CRP lands as well. These opportunities are currently limited by a lack of funds and manpower to initiate contacts and make follow-up visits.

- 6) Fond du Lac and Eastern Green Lake Counties (Fond du Lac County--Alto, Eden, Eldorado, Lamartine, Metomen, Oakfield, Osceola, Ripon, Rosendale, Springvale, and Waupun townships; Green Lake County--Berlin, Brooklyn, Green Lake, and Mackford townships).

Acres of County Mapped as Wetlands (percent of county acreage):

Fond du Lac	69,934 acres (15.0%)
Green Lake	<u>44,760</u> acres (19.6%)
	114,394 acres

Acres of Habitat Currently Protected (Acreage Goal):

FWS

A small portion of the Horicon NWR lies in Waupun and Oakfield townships of Fond du Lac County

WDNR

Wildlife Areas:

Fond du Lac	5,990 acres (6,260)
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EWHP's:

Fond du Lac	410 acres (850)
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Scattered Wetlands:

Fond du Lac	75 acres (75)
Green Lake	<u>40</u> acres (40)
	115 (115)

Other

CRP:

Fond du Lac	12,930 acres(20,000)
Green Lake	<u>8,792</u> acres(<u>12,000</u>)
	21,722 acres(32,000)

Water Bank:

Fond du Lac	1,311 acres
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As Dodge County's two northerly neighbors, western Fond du Lac and eastern Green Lake counties are part of the Dodge-Fond du Lac-Columbia-Green Lake-Winnebago complex of marshes and inland lakes that are the heart of southern Wisconsin's best remaining duck habitat. Although it is outside the designated townships, the southern one-third of Lake Winnebago borders Fond du Lac County on the east (Figure 4). The southern tip of Rush Lake, described previously, also is in Fond du Lac County.

The 6,000 acre Eldorado Marsh Wildlife Area lies just west of Lake Winnebago. Eldorado Marsh is in the watershed of the west branch of the Fond du Lac River which originates in the Town of Rosendale and eventually flows into Winnebago.

In the 1950's, the six westerly townships of Fond du Lac County and the three easterly Green Lake County townships had 1,500+ acres of shallow and deep marsh remaining. Lake Maria, in Green Lake County's Mackford Township (Figure 4), is 500 acres of important migration habitat that also furnishes brood habitat. Uplands adjoining the lake offer opportunities for nesting cover and extensive stands of emergent aquatics once provided overwater nesting habitat. Loss of emergents over time has reduced the value of the lake for overwater nesting and for broods. The lake does provide fall and spring habitat for 50,000+ MVP Canada geese, plus thousands of mallards, coots, and some diving ducks. Red-necked grebes formerly nested in the lake's emergents. Management problems include stable, above-normal water levels, loss of emergents, disturbance, and the potential for lead poisoning outbreaks. JV strategies would be to construct a water control device, lower the water levels, and protect shorelines from further development by either fee title or perpetual easement.

Other JV strategies in the two counties would include restoration/enhancement of wetlands and nest cover on private lands and acquisition of remaining semi-permanent and permanent wetlands as brood habitat. Development of a southern flowage on Eldorado Marsh will provide additional deep marsh for breeding birds and migrants. Erosion control and streambank protection in the Fond du Lac River watershed will benefit Eldorado as well as address nonpoint concerns. Eldorado Marsh was identified as an area of low nest success in the 1980's (Gatti 1987) and predator management would be proposed for the area.

Although both counties are approved for WPA acquisition, none have been purchased. CRP acreages are about average and offer potential for habitat work on private lands. In 1988, the FWS restored 27 wetland basins in Fond du Lac County

on these lands. Habitat work carried out in Fond du Lac and Green Lake counties will complement similar JV efforts in Dodge, Columbia, and Winnebago counties.

- 7) Ozaukee-Eastern Sheboygan-Washington Counties (Ozaukee County--Belgium, Fredonia, Grafton, Port Washington, and Saukville townships; Sheboygan County--Greenbush, Herman, Holland, Lima, Lyndon, Mitchell, Mosel, Scott, Sheboygan Falls, Sherman, and Wilson townships, and Priority Watersheds of the Milwaukee, Onion, and Sheboygan rivers; Washington County--Addison, Erin, Farmington, Trenton, and Wayne townships, the Milwaukee River Priority Watershed, and the east branch of the Rock River).

Acres of County Mapped as Wetlands (percent of county acreage):

Ozaukee	16,411 acres (10.9%)
Sheboygan	39,902 acres (12.1%)
Washington	<u>44,025</u> acres (16.0%)
	100,338 acres

Acres of Habitat Currently Protected (Acreage Goal):

FWS

WPA's:

Ozaukee (3)	126 acres(435)
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WDNR

Wildlife Areas:

Ozaukee	20 acres(20)
Sheboygan	610 acres(1,010)
Washington	<u>6,740</u> acres(<u>7,580</u>)
	7,370 acres(8,610)

EWHP's:

Ozaukee	40 acres(40)
Sheboygan	355 acres(355)
Washington	<u>560</u> acres(<u>560</u>)
	955 acres(955)

Scattered Wetlands:

Ozaukee	110 acres(80)
Sheboygan	20 acres(20)
Washington	<u>70</u> acres(<u>110</u>)
	200 acres(210)

Other

CRP:

Ozaukee	6,673 acres(5,000)
Sheboygan	3,919 acres(24,000)
Washington	<u>2,911</u> acres(15,000)
	13,503 acres(44,000)

Joint Venture initiatives in the three counties (Figure 4) will emphasize habitat improvement and development in the vicinity of the major river systems, most of which are already Priority Watersheds (Appendix A). The Milwaukee, Sheboygan, and Onion rivers have Priority Watershed projects either underway or in the planning stage. The east branch of the Rock River is important because it is a major water source for both the Theresa Marsh Wildlife Area and Horicon Marsh.

Seventy percent or more of these counties is in agriculture. The areas along Lake Michigan are heavily urban, however.

The general region is covered with small, glacially-formed kettle lakes, many of which are bog-like and of little value to ducks. Breeding waterfowl densities range from some of the better in southern Wisconsin to poorer than average for the region, as one goes north and east. Wood ducks and mallards are abundant in the more wooded areas, while blue-winged teal are common in the agricultural areas. Giant Canada geese are nesting in the "kettles" in greater abundance also.

The Lake Michigan shoreline and adjacent open waters of the lake off Ozaukee and Sheboygan counties are important feeding and resting habitat for migrating and wintering waterfowl. Rafts of over 3,000 scaup have been counted (Ishmael 1987). Other waterfowl, including Canada geese, follow the lake's shoreline on their southward migration, using the lake and its protected bays and harbors as rest areas. A wide variety of raptors also use the shoreline as a migration corridor. In rough weather, both waterfowl and other migrant birds seek shelter on wetlands and other habitat inland, providing an additional benefit to any restored or enhanced under the JV.

Although all 3 counties are approved for WPA acquisition, only three WPA's, all in Ozaukee County, have been purchased. Additional wetlands are protected on 4 state-owned wildlife areas. Jackson Marsh Wildlife Area, outside the designated townships, provides additional managed habitat in Washington County.

Theresa Marsh Wildlife Area, although mainly in Dodge County, has 5,684 acres in fee title and 1,155 acres leased. Located on the east branch of the Rock River, Theresa is managed for both ducks and geese. Almost 30,000 MVP Canada geese now stop at Theresa and the area also attracts several thousand ducks. JV projects in the other western townships of Washington County which also are in the Rock River watershed will complement management efforts on Theresa and in adjacent Dodge County.

Opportunities for wetland restoration and upland cover establishment are available on private lands. The Priority Watershed projects provide both habitat development opportunities and an additional source of funds. Under the 1985 Farm Bill, the FWS restored 23 Ozaukee County wetlands on private land in 1988. Similar projects are planned, mainly in Sheboygan County. While CRP enrollment is modest overall, these lands provide additional opportunities for upland cover.

Overall, JV priorities in these counties will be to protect existing production habitat and recreate new habitat on both public and private lands.

- 8) Calumet-Northeastern Fond du Lac-Manitowoc-Kewaunee-Northwestern Sheboygan Counties (Calumet County--Brillion, Brothertown, Charlestown, Chifton, New Holstein, Rantoul, Stockbridge and Woodville townships; Fond du Lac County--Calumet, Forest and Marshfield townships; Manitowoc County--Cato, Centerville, Cooperstown, Eaton, Franklin, Liberty, Maple Grove, Meeme, Mishicot, Rockland, Schleswig, Two Creeks and Two Rivers townships; Kewaunee--Abnapee, Carlton, Pierce and West Kewaunee townships; Sheboygan--North 1/2 of Greenbush and Russell townships).

Acres of County Mapped as Wetlands (percent of county acreage):

Calumet	22,969 acres (11.0%)
Manitowoc	55,394 acres (14.6%)
Kewaunee	<u>31,933</u> acres (14.5%)
	110,296 acres

Acres of Habitat Currently Protected (Acreage Goal):

WDNR

Wildlife Areas:

Calumet	5,570 acres(6,380)
Fond du Lac	2,005 acres(2,680)
Kewaunee	2,050 acres(4,820)
Manitowoc	9,680 acres(13,800)
Sheboygan	<u>630</u> acres(<u>860</u>)
	19,935 acres(28,540)

Scattered Wetlands:

Calumet	15 acres(80)
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Other

Sheboygan County:	7,500 acres
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CRP:

Calumet	1,257 acres(8,000)
Kewaunee	3,088 acres(11,000)
Manitowoc	<u>6,064</u> acres(<u>18,000</u>)
	10,409 acres(37,000)

Waterfowl habitat in the 4 counties (Figure 4) is diverse, but centers around 3 major state management projects - Collins, Brillion and Killsnake Marshes - plus several smaller state areas that include the WDNR-Sheboygan County Sheboygan Marsh project, and 4 rivers, the Kewaunee, Manitowoc, Sheboygan and Twin systems. Seventy to 80 percent of the landscape is devoted to agriculture. Another 10-16 percent is wooded. Although there are urban areas near Lake Michigan, the

designated townships are generally rural. Killsnake and Brillion wildlife areas have large tracts of upland nest cover, but a scarcity of wetlands appears to be limiting duck production. As the amount of area mapped as wetland indicates, the heavy, clay soils of this region provide extensive opportunities to restore former wetlands and enhance existing ones. Older aerial photos of the region show considerable evidence of former pothole-type habitat, now drained. Upland nest cover establishment and electric fences to exclude predators will also be priorities. Also, considerable development remains to be done on the state management projects to bring them to full potential. Dabbling ducks and Canada geese are the primary species, but Sheboygan Marsh and Sheboygan Lake also attract diving ducks, especially during rough weather on Lake Michigan. Both Killsnake and Brillion projects have high potential as goose concentration areas and Collins already attracts 20,000 or more Canada and snow geese and ducks.

The 2 townships in Kewaunee County and the 3 northeastern townships in Manitowoc County (Figure 4) are important local areas for black ducks and will be given special attention to ensure this use continues.

Other than on wildlife areas, permanent protection of waterfowl habitat has not occurred to any great extent. Although the counties, except Kewaunee, are approved for WPA purchase, no lands are in the program. Acreages protected as EWHP's or Scattered Wetlands are quite small. Considering the amount of wetlands remaining, there should be considerable opportunity to expand protection of scattered wetlands by acquisition. The Manitowoc and Sheboygan Priority Watersheds (Appendix A) should provide additional opportunities for habitat development in conjunction with watershed protection.

CRP enrollment is below average and will limit opportunities on private lands under the program. However, the FWS has been successful in restoring 24 wetland basins on CRP lands in Manitowoc County and additional ones are planned for future years. A few basins were also restored in Kewaunee County and 27 in Fond du Lac County, although not necessarily in priority townships. Based on successes in Manitowoc County, wetland restoration on CRP lands and elsewhere may be a successful JV strategy in these counties.

- 9) Brown and Outagamie Counties (Brown County--Suamico Township; Outagamie County--Black Creek, Bovina, Center, Cicero, Dale, Ellington, Freedom, Grand Chute, Greenville, Hortonia, Kaukauna, Liberty, Maine, Maple Creek, Oneida, Osborn, and Seymour townships).

Acres of County Mapped as Wetlands (percent of county acreage):

Brown	25,288 acres (7.5%)
Outagamie	<u>74,318</u> acres (18.1%)
	99,606 acres

Acres of Habitat Currently Protected (Acreage Goal):

WDNR

Wildlife Areas:

Brown	1,020 acres (1,000+)
Outagamie	<u>3,087</u> acres (<u>2,820</u>)
	4,107 acres (3,820+)

Other

Brown County: 700+ acres

CRP:

Brown	2,471 acres (5,000)
Outagamie	<u>6,883</u> acres (<u>3,000</u>)
	9,354 acres (8,000)

Key areas of habitat are Green Bay West Shore coastal marshes, which are treated as a separate focus area, and marshes and timbered bottomlands along the Wolf, Embarrass, and Shioc Rivers and their tributaries in Outagamie County (Figure 4). With low CRP acreages and almost no scattered wetlands protected under public ownership or lease, attempts to protect wetlands and establish upland cover on private lands would seem to be the priority JV strategies for the area. Waterfowl use away from Green Bay may be somewhat lower than elsewhere in the Southeast Focus Area. Waterfowl habitat and breeding populations in the 2 counties, particularly Outagamie, are more similar to those in the Marquette-Waupaca Focus Area which borders them to the north and west. Wood duck production is above average however. Breeding populations and production of other dabbling ducks along the river bottoms is better in years with abundant spring water and is not as consistent as in other parts of the Southeast Focus Area.

B. Northwest Focus Area

Included in this focus area is all of Barron, Dunn, Pepin, Pierce, Polk and St. Croix counties, plus portions of Burnett, Chippewa, and Eau Claire counties (Figure 5). It takes in both the St. Croix-Barron subprovince of the Woodlot-Agriculture Transition ecological province and the Pierce-Dunn subprovince of the Coulee ecological province described by Petersen (1985) (Figure 2). Included is the "Star Prairie" portion of St. Croix and Polk counties with its prairie pothole region (Petersen et al. 1982, Evrard and Lillie 1987). Featured species other than waterfowl are pheasants, gray partridge, and jackrabbits. While land use is variable, depending on the location within the focus area, over 50 percent of the landscape is usually cropland or pasture, with over 70 percent farmland in St. Croix County. About 30 percent of the land is wooded, again except for St. Croix County, which is only 16 percent wooded. Several counties are more urban (8-10 percent of the land), while others are quite rural (2-4 percent of the land). Two to 23 percent of individual counties were mapped as wetlands in the most recent inventory, with Burnett being the wettest and Pierce, the driest.

- 1) St. Croix County (Baldwin, Cylon, Emerald, Erin Prairie, Forest, Hammond, Hudson, Richmond, Somerset, Stanton, Star Prairie, St. Joseph, and Warren townships).

Acres of County Mapped as Wetlands: 14,382 (3.1%)

Acres of Habitat Currently Protected (Acreage Goal):

FWS

WPA's (25): 3,760 acres (5,340)

WDNR

Wildlife Areas: 3,770 acres (4,940)

EWHP's: 510 acres (510)

Scattered Wetlands: 140 acres (5,980)

Other

CRP: 42,012 acres (30,500)

Water Bank: 287 acres

St. Croix County's waterfowl habitat is the heart of the Northwest Focus Area (Figure 5). While the total amount of wetland acreage is considerably less than in most other Priority I counties, the quality of St. Croix County habitat and its importance to waterfowl production is outstanding. In vegetation type, invertebrate food resources, and breeding duck densities, these wetlands most closely resemble similar habitats in western Minnesota and the Dakotas. They rival the best production areas in southeast Wisconsin in ducks produced per wetland acre.

To date, WPA's have been established in nine townships, but with adequate funding, thousands of additional acres could be acquired. Existing WPA's will require purchasing land rights on almost 1,600 acres. More WPA acreage has already been acquired here than in any other county. Almost half the statewide WPA acreage is in St. Croix County. Acquisition of additional potholes and planting adequate acreages of uplands with secure nesting cover would significantly increase the already excellent waterfowl production in the county. While mallards and blue-winged teal are the primary species, green-winged teal, wood ducks, shovelers, American wigeon, gadwall, redheads, ring-necked ducks, lesser scaup, ruddy ducks, and hooded mergansers breed in the region (Evrard and Lillie 1987). Giant Canada geese are becoming more common nesters throughout the county.

More wetland restoration and development could be accomplished if adequate and regular funding and increased staff were available. Plugging drainage ditches and drain tiles, building lowhead dikes and water control devices, and digging out low areas are all feasible approaches. Ducks Unlimited and other private groups have expressed a strong interest in these activities in the area.

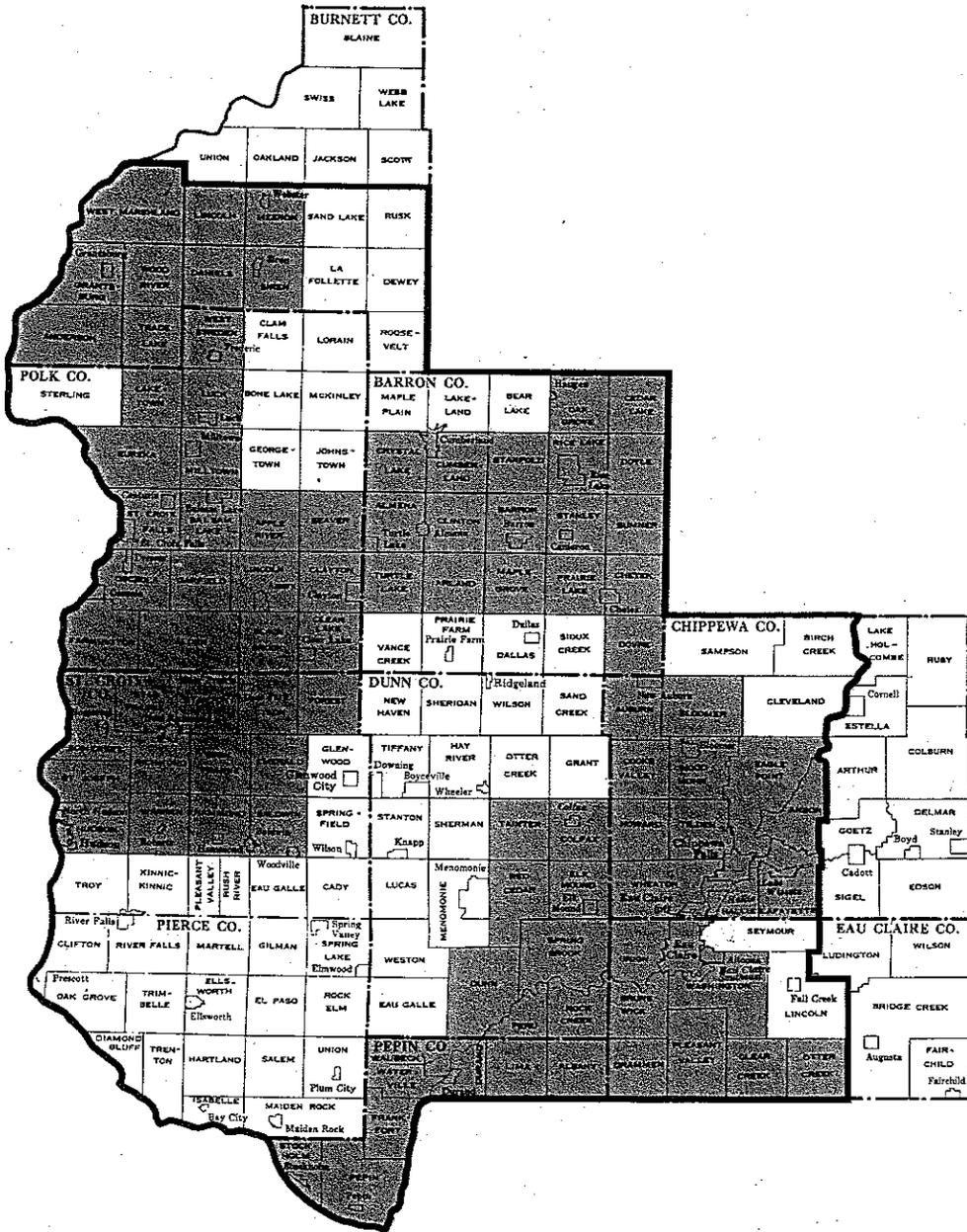


Figure 5. Northwest Focus Area of Wisconsin's portion of the Upper Mississippi River and Great Lakes Region Joint Venture. Shaded areas are townships designated as critical habitat for projects under the joint venture (as determined by WDNR wildlife managers and other knowledgeable persons).

The Upper Willow River is a Priority Watershed (Appendix A). This project should provide additional opportunities for upland cover establishment and, possibly, wetland restoration.

CRP acreage in St. Croix County is the second largest statewide, with seven percent of the surface acreage of the county and nine percent of the farmland enrolled. The CRP lands provide an excellent opportunity for upland nest cover and wetland restoration. On Evrard and Lillie's (1987) study area, CRP enrollment more than doubled the grassland acreage available to nesting birds. Federal funding for restoring wetlands on CRP lands also should increase the habitat base. A public-private partnership here is critically needed to establish a joint effort between wildlife agencies, private organizations, agricultural agencies, and landowners. Perhaps nowhere else in the Priority I habitat does such an extensive opportunity exist to progress toward meeting Wisconsin's portion of the JV objectives.

The small, scattered wetlands of St. Croix County also attract migrant waterfowl and other birds. The only larger bodies of water with significant waterfowl use are Oak Ridge (190 acres), Twin, and North Bass Lakes which are also WPA's, Cedar Lake (330 acres), St. Croix Lake (2,586 acres), and the rest of the St. Croix River, much of which is protected under the St. Croix National Scenic Riverway, the Lower St. Croix River State Park, or the St. Croix Islands Wildlife Area.

- 2) Barron-Polk-Southern Burnett Counties (Barron County--Almena, Arland, Barron, Cedar Lake, Chetek, Clinton, Crystal Lake, Cumberland, Dovre, Doyle, Maple Grove, Oak Grove, Prairie Lake, Rice Lake, Stanford, Stanley, Sumner, and Turtle Lake townships; Polk County--Alden, Apple River, Balsam Lake, Beaver, Black Brook, Clayton, Clear Lake, Eureka, Farmington, Garfield, Laketown, Lincoln, Luck, Milltown, Osceola, St. Croix Falls, and West Sweden townships; Burnett County--Anderson, Daniels, Grantsburg, Lincoln, Meenon, Siren, Trade Lake, West Marshland, and Wood River townships).

Area of County Mapped as Wetlands:

Barron	42,995 (7.8%)
Burnett	122,719 (23.4%)
Polk	<u>61,099</u> (10.4%)
	226,813

Acres of Habitat Currently Protected (Acreage Goal):

FWS

WPA's:

Polk

630 acres (1,671)

WDNR

Wildlife Areas:

Barron	3,820 acres	(4,760)
Burnett	46,440 acres	(46,440)
Polk	<u>4,330 acres</u>	(<u>4,980</u>)
	54,590 acres	(56,180)

EWHP's:

Barron	750 acres	(750)
Polk	95 acres	(<u>95</u>)
	845 acres	(845)

Scattered Wetlands:

Barron	890 acres	(890)
Polk	200 acres	(<u>240</u>)
	1,090 acres	(1,130)

Other

CRP:

Barron	3,959 acres	(15,000)
Burnett	1,042 acres	(3,000)
Polk	<u>16,959 acres</u>	(<u>20,000</u>)
	21,960 acres	(38,000)

Water Bank:

Barron	1,058 acres
Polk	<u>1,412 acres</u>
	2,470 acres

This group of 3 counties (Figure 5) is unique because of their large total acreages of important waterfowl habitat protected under public ownership. Combined state and federal ownership is almost 57,000 acres, with a goal of almost 62,000 acres. Much of this habitat is part of the 4 state wildlife areas, Crex Meadows, Danbury, Fish Lake and Amsterdam Slough, that make up Glacial Lake-Grantsburg Complex in southwestern Burnett County. Protected habitat is also well distributed throughout the counties on 2,565 acres of WPA's, EWHP's, or Scattered Wetlands. The combined goal for these programs is substantial. In these counties, 50 percent of the land area is used for agriculture, 30 percent is forested. Wetlands in the townships closest to St. Croix County (e.g. Farmington Township in Polk County) also closely resemble those of the parkland regions of the PPJV. In the more northerly townships, habitat is associated more with larger lakes, rivers and marshes. Strategies for JV implementation in the pothole or parkland areas will be similar to those proposed for St. Croix County. Because greater amounts of public land are involved in these 3 counties, JV resources committed to habitat already publicly-owned will be greater than in most other counties.

Besides significant public lands, there is opportunity to develop or protect additional habitat now in private ownership. Over 1,000 acres in 3 WPA units have been

delineated, but are left to be acquired. Lower priority habitat worthy of WPA acquisition has also been identified, for example, in Trade Lake Township in Burnett County. Barron County is approved for WPA's, but none have been purchased. Putting accelerated emphasis on acquiring habitat under either program would make major contributions toward JV objectives in the focus area.

On EWHP's, brood water averages 20 to 50 acres per unit. Sites for at least 7 small flowages (40 to 100 acres each) that could be built with short dikes are identified. Many more small basins could be restored through ditch plugs or tile breaking (David Evenson, pers. comm.). Since farming pressure is not as intense as further south, upland cover is somewhat more available. Much of this is in CRP, Water Bank (28 tracts), or other idled lands. Opportunities to improve nesting cover and add to the existing cover are good. The area would be ideal for a joint effort with DU, using MARSH funds for development and agency funds for acquiring land rights. A shift in acquisition funds to the WPAs using SWAP dollars is needed to initiate these actions.

The Glacial Lake-Grantsburg complex deserves special mention. Some acquisition and considerable development remains to be completed to bring the project, especially the Fish Lake and Amsterdam Slough units, up to full potential for waterfowl production and migration use. Management of the uplands on these projects relies heavily on prescribed burning to establish and maintain the native "brush prairie". On Crex Meadows, for example, over 6,000 acres of prairie have been restored (Hoefler 1987). Flowage development and management is the other main strategy. Sharp-tailed grouse and waterfowl are the major nesting species. Over 250 species of birds are reported from Crex Meadows. Sandhill cranes, great blue herons, upland sandpipers, and bald eagles also nest on the projects. Wisconsin's largest home-grown flock of giant Canada geese nest on the complex.

During the fall, the complex attracts tens of thousands of migrant waterfowl besides local breeders and some uplands are managed as cropland to feed them. Over 100,000 visitors a year stop at Crex Meadows to view birds and other wildlife (Hoefler 1987).

Since the 3 counties are dotted with lakes, rivers, and other wetlands, the most important migration areas are hard to identify. Waterfowl are scattered throughout the area in both spring and fall. Some of the more important lakes which might be targeted for JV actions are Bear, Montanis, Red Cedar, Stump and Tussock in Barron County; and Balsam, Big Butternut, Big Round, Bone, Half-Moon, Horseshoe, Wapogasset, Wild Goose, and White Ash Lakes, and the Apple River and the Apple River Flowage, in Polk County.

- 3) Chippewa-Dunn-Eau Claire-Pepin-Pierce Counties (Chippewa County--Anson, Auburn, Bloomer, Cooks Valley, Eagle Point, Hallie, Howard, Lafayette, Tilden, Wheaton, and Woodmohr townships; Dunn County--Colfax, Dunn, Elk Mound, Peru, Red Cedar, Rock Creek, Spring Brook, and Tainter townships; Eau Claire County--Brunswick, Clear Creek, Drammen, Otter Creek, Pleasant Valley, Union, and

Washington townships; Pepin County--Albany, Durand, Frankfort, Lima, Pepin, Stockholm, Waterville, and Waubeck townships; Pierce County--None specifically designated).

Acres of County Mapped as Wetlands (percent of county acreage):

Chippewa	81,637 (12.5%)
Dunn	44,485 (8.1%)
Eau Claire	43,715 (10.7%)
Pepin	4,498 (3.0%)
Pierce	<u>7,542</u> (2.0%)
	181,877

Acres of Habitat Currently Protected (Acreage Goal):

WDNR

Wildlife Areas:

Dunn	6,225 acres (9,445)
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EWHP's:

Dunn	220 acres (220)
Pepin	780 acres (<u>780</u>)
	1,000 acres (1,000)

Scattered Wetlands:

Chippewa	80 acres (80)
Dunn	<u>2,355</u> acres (<u>2,355</u>)
	2,435 acres (2,435)

Other

CRP:

Chippewa	8,483 acres (25,200)
Dunn	22,143 acres (50,000)
Eau Claire	13,734 acres (15,000)
Pepin	5,632 acres (8,100)
Pierce	<u>28,775</u> acres (<u>35,000</u>)
	78,767 acres (133,300)

Water Bank:

Dunn	3,455 acres
Eau Claire	<u>267</u> acres
	3,722 acres

This county group combines the remaining area of the Northwest Focus Area (Figure 5) and represents its more discontinuous and less productive portions. Greatest opportunities for JV projects probably are in Dunn and Pepin counties which are approved for WPA acquisition. Although no WPA's have been acquired in this area, 1,000 acres have been protected by WDNR under EWHP and another

2,435 acres as Scattered Wetlands.

Pierce County has the least potential for JV projects, except along the Mississippi River. However, the county's large acreages of CRP may already be positively affecting breeding ducks present.

Because the potential for significant returns from habitat improvement is not as great as in other parts of the focus area, JV proposals in this group of counties will need to be judged more on individual merit and priority rather than as part of a areawide effort. Substantial CRP acres are also enrolled in Dunn County, which should provide considerable potential for upland cover establishment and other strategies on private lands. Strategies and target species will be similar to other parts of the focus area. Chippewa and Eau Claire counties in particular have good remaining wetland bases on which to build habitat complexes. The FWS is already planning several wetland restoration projects in Chippewa and Eau Claire counties.

Since the area has only one large state or federal waterfowl area, migrant use is largely limited to lakes and rivers. The more important areas are the Chippewa River, and the New Auburn, O'Neill Creek and Jim Falls Wildlife Areas (all outside the designated townships) in Chippewa County; the Chippewa, Red Cedar, and Eau Galle Rivers, plus Blakely's, Elk, Menomin, Prochnow's, and Tainter Lakes, in Dunn County; the Chippewa and Mississippi rivers in Pepin County; and the Mississippi River in Pierce County. The Mississippi River and some of its important tributaries are discussed as a separate focus area.

C. Winnebago System Focus Area

Because of its overall significance to migrating waterfowl and advanced, well-prepared planning effort, the Winnebago System is designated a separate JV focus area (Figure 6). Goals and objectives of the Winnebago Comprehensive Management Plan (WCMP) (Bruch 1988) address management needs identified in Wisconsin's portion of the UMRGLR JV plan and will be incorporated as the main thrust of the focus area's objectives and strategies. JV funding of the WCMP will be limited to projects that demonstrate direct benefits to waterfowl. This is necessary because the overall cost of proposed WCMP actions is well beyond the scope of the JV if other priority projects are also to be funded. The WCMP reflects a multitude of values, interests, and potential benefits, not just those associated with waterfowl and the JV.

The watersheds of the Fox and Wolf Rivers encompass 6,400 square miles, primarily in Priority I habitat. The 4 major lakes of the Winnebago Pool total 167,000 acres. Individual acreages are: Winnebago-137,000 acres, Poygan-10,990 acres, Buttes des Morts-4,500 acres, and Winneconne-3,260 acres (Bruch 1988). The WCMP goal is:

"To restore, improve, and maintain the ecological diversity and quality, and beneficial uses of the fish, wildlife, and water resources of the Winnebago System," (Bruch 1988).

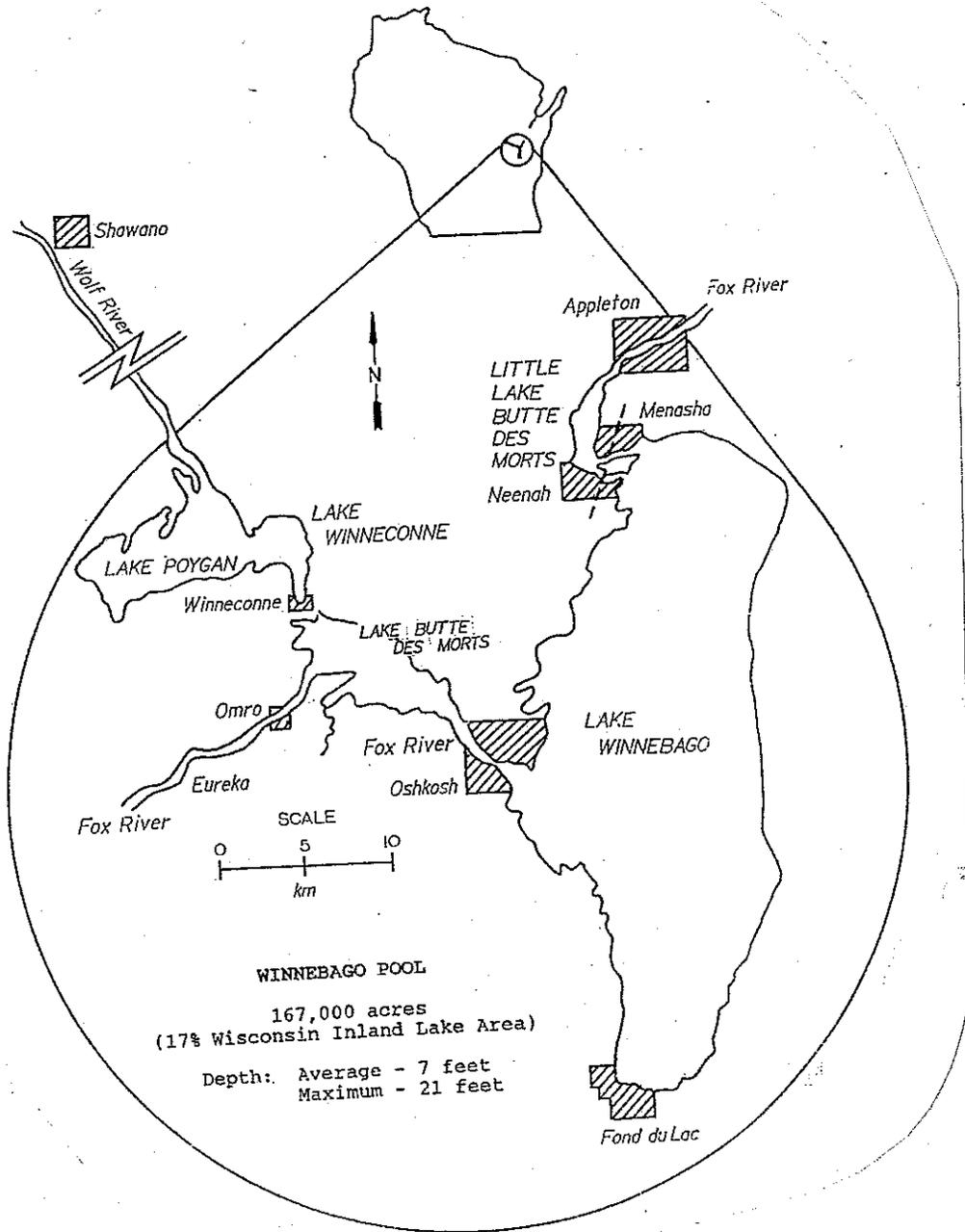


Figure 6. Winnebago System Focus Area of Wisconsin's portion of the Upper Mississippi River and Great Lakes Region Joint Venture (from Bruch 1988).

The 3 upriver lakes, Buttes des Morts, Winneconne and Poygan, historically were river marshes rather than lakes and Lake Winnebago was bordered by shallow bays and marshes. Wild rice and wild celery were common throughout the system. Increased water levels caused more severe wave action and erosion, which resulted in long-term losses of thousands of acres of marsh habitat. Diversity and abundance of fish, migrant duck use, and other marsh wildlife were negatively impacted. Duck use, especially by canvasbacks, during spring and fall was substantially reduced. The WCMP intends to reverse the process and restore diversity to the system.

WCMP objectives that also compliment the JV's goal and objectives are as follows (Bruch 1988):

HABITAT

"Increase quality fish and wildlife habitat on the pool lakes."

"Increase the relative abundance of desirable submergent and emergent aquatic macrophyte beds by 100 percent, including an increase in wild celery beds in the Upriver lakes from 280 to 800 hectares (700-2,000 acres)."

"Increase desirable macroinvertebrates (Pelecypoda, Gastropoda, Ephemeroptera, Chironomidae) densities in April and October to 8,000-10,000 per square meter."

WILDLIFE

"Increase diving duck use days, in both spring and fall on Lake Winnebago from 70,000-100,000 to 500,000 annually, and on the Upriver Lakes from 50,000-70,000 to 400,000 annually."

"Increase local production of dabbling ducks by 500 percent."

"Increase migrant dabbling duck use days on the Winnebago Pool by 500 percent."

ENDANGERED RESOURCES

"Maintain an annual breeding population on the Winnebago Pool Lakes, of at least 260 pairs of Forster's terns and 100 pairs of common terns, with an average annual production of 1 young per nesting pair."

TOXIC CONTAMINATION OF FISH AND WILDLIFE

"Determine the extent of toxic contamination and disease in the system's fish and wildlife populations by 1990."

LAND ACQUISITION

"Inventory and acquire critical fisheries and wildlife habitat areas within the system, and reevaluate acquisition priorities and activities by 1991."

A variety of management options are proposed to achieve these objectives. Many of them are similar to those proposed in the JV, while others are unique to problems identified in the WCMP. As JV projects are written, they will need to address specific WCMP actions and problems. Managers working on the JV will need to become an integral part of the WCMP effort.

The WCMP plan has undergone extensive public review and input and is nearing implementation. The JV Steering Committee envisions that the WCMP will already be underway when the JV is fully initiated and that JV projects may need to be integrated into ongoing efforts where appropriate. Other WCMP projects may receive their initial funding as part of this JV.

D. Upper Mississippi River and Tributaries Focus Area (Pierce, Pepin, Buffalo, Trempeleau, La Crosse, Vernon, Crawford, and Grant counties)

The NAWMP recognizes the Mississippi River as one of the 34 most important and critical areas of waterfowl habitat in North America (USFWS 1986b). The Upper Mississippi River drains either directly or indirectly via its major tributaries, the St. Croix, Chippewa, Wisconsin, and Rock Rivers, almost 75 percent of Wisconsin (Figure 7). Forming the western border of eight counties, the Mississippi River and its tributaries are Wisconsin's most important and productive wood duck habitat. Almost 94,000 acres of this riverine habitat and bottomlands are within Wisconsin's boundary, representing about 230 river miles and almost 2,000 miles of shoreline when all the meanders, backwaters, cuts, and sloughs are included. A series of 9 locks and dams of the U.S. Army Corps of Engineers (COE) maintain a 9-foot channel for navigational purposes.

The eastern shore of Lake Pepin, a 30-mile long lake created by a delta of the Chippewa River blocking the Mississippi, is part of Pierce and Pepin counties. This lake is very important to the ecology of the downstream part of the Mississippi since the lake acts as a settling basin for various pollutants, especially municipal sewage, dumped into the river (Green 1984).

The Upper Mississippi River is a diverse system. Over 1,250 species of plants, 291 species of birds, 23 species of reptiles, 57 species of mammals, 113 species of fish and 60 species of mussels have been identified along the river (Green 1984).

A significant amount of waterfowl habitat along the Upper Mississippi is publicly owned or controlled. The COE and the FWS are the primary agencies, with the FWS managing a majority of the COE lands through cooperative agreement. Over

88,500 acres are included in the Upper Mississippi River National Wildlife and Fish Refuge (UMRNWFR) and the Trempeleau National Wildlife Refuge within Wisconsin. The WDNR also owns and manages over 18,000 acres of habitat, with a goal of about 24,000 acres, mostly on tributaries to the main river. The largest state area is the Tiffany Bottoms Wildlife Area, a 12,365 acre tract of bottomlands and marsh at the mouth of the Chippewa River in Pepin and Buffalo counties.

Although the UMRNWFR is basically a migration refuge, it does produce a number of waterfowl each summer. About 10,000 wood ducks are raised on the refuge each year (Green 1984).

Mallards, black ducks, blue-winged and green-winged teal, hooded mergansers, and giant Canada geese are common nesters (W.E. Green, pers. comm.). All waterfowl common to the central U.S. use the river during spring and fall migration. Canvasbacks, however, are the species of greatest interest because of their tenuous status continentally and the large proportion of their total population concentrating on the Mississippi. Nearly 6.5 million canvasback use-days have been recorded annually in recent years and 160,000 cans were recorded on the UMRNWFR in 1975 (Green 1984). As many as 10,000 migrating tundra swans also use the refuge in spring and fall (Green 1984). The river and open areas below dams are important wintering areas for bald eagles and a few eagles and osprey nest on the refuge (Green 1984). In addition to its wildlife, the river receives high recreational use, with 3.5 million visitor days just on the UMRNWFR each year (Green 1984). State lands also receive heavy recreational use.

Wisconsin cooperatively manages the Upper Mississippi with its neighboring states of Minnesota and Iowa, the FWS, and the COE. Federal and state agencies, private interests, and the general public have cooperatively developed a "Comprehensive Master Plan for the Management of the Upper Mississippi River System". Prior to this master plan, the "Great River Environmental Action Team" (GREAT), made up of representatives from the various states, federal agencies, transportation groups, and the general public, was formed in the 1970's to study problems associated with deterioration of habitats and siltation. This study, together with the pressure to authorize construction of a second lock at Lock and Dam 26 (Alton, Illinois), eventually triggered the master planning process.

The U.S. Congress approved an upper Mississippi River master plan in 1986 as Public Law 99-662. It authorizes environmental programs to improve habitat for fish and wildlife, monitoring and analysis of the river's physical, chemical, and biological features, and expanded recreational opportunities (Upper Mississippi Basin Association, undated). It also authorized construction of the second lock at Lock and Dam 26. The P.L. 99-662 environmental activities and programs are called the "Upper Mississippi River System Environmental Management Program" or EMP and are funded by annual federal appropriations. State and local governments also cost-share some projects.

Wisconsin's portion of the UMRGLR JV will not initially propose any new projects

for the Mississippi River proper, but will rely on EMP projects already proposed or ongoing to address habitat problems on the main river. Instead, the JV will focus on habitat protection and enhancement on tributary streams. The WDNR's wildlife managers have identified the following streams as worthy of JV actions: the Black, Buffalo, Chippewa, Kickapoo, La Crosse, Platte, Trempeleau and Wisconsin Rivers, and Beaver, Coon, and Waumandee Creeks (Figure 7).

EMP and Wisconsin's JV projects should complement each other and there may be opportunities where pooling of funds or development efforts would increase the scope or complexity of a project enough to benefit objectives of both planning efforts.

Individual JV projects will propose specific activities to be implemented on the tributary streams and adjacent uplands. Since Beaver and Waumandee Creeks and the lower Black River are already Priority Watersheds, there should be opportunities for cost-sharing practices also beneficial to waterfowl. Strategies within the stream corridor will emphasize wood duck production and habitat protection. Beaver and other furbearer management will be encouraged where appropriate. Upland cover management for dabbling ducks and other grassland species will also be a priority and will support efforts to reduce soil erosion and stabilize streambanks. Other activities could include re-establishing aquatic macrophytes, water level control, nesting island construction, rough fish and purple loosestrife control, nest structure placement, and predator management. Some of these efforts would also benefit fisheries and would be cooperative projects with the WDNR Bureau of Fish Management.

E. Marquette-Waupaca Focus Area

The Marquette-Waupaca Focus Area includes all of Marquette, Portage, Waushara, and Waupaca counties, western Green Lake county, southeastern Adams and Marathon counties and southern Shawano and Oconto counties. (Figure 8). The focus area approximates the "Marquette-Waupaca" subprovince of the Woodlot-Agriculture Transition ecological province described by Petersen (1985). Land use of the subprovince is 30 to 50 percent agricultural and 30 to 50 percent wooded. Dairy farming is the major agricultural thrust, although alfalfa hay is a less common crop than in the Southeast or Northwest focus areas. Reduced hayfield losses may benefit reproductive success of hayfield nesting ducks in this focus area. Irrigated cash crops are grown on the sands and muck soils. All counties have at least 10 percent of their areas mapped as wetlands. Marquette County is 26 percent wetlands and Oconto County is 25 percent, based on the Wisconsin Wetland Inventory. Many of these wetlands are drained and farmed. Compared to Southeast and Northwest focus areas, the Marquette-Waupaca Focus Area is less agricultural and urbanized, more wooded, and has greater total wetland acreage. Breeding duck densities and overall waterfowl use, except for local areas, are less than in the Southeast and Northwest focus areas. Productivity is also generally poorer in the Marquette-Waupaca focus area.

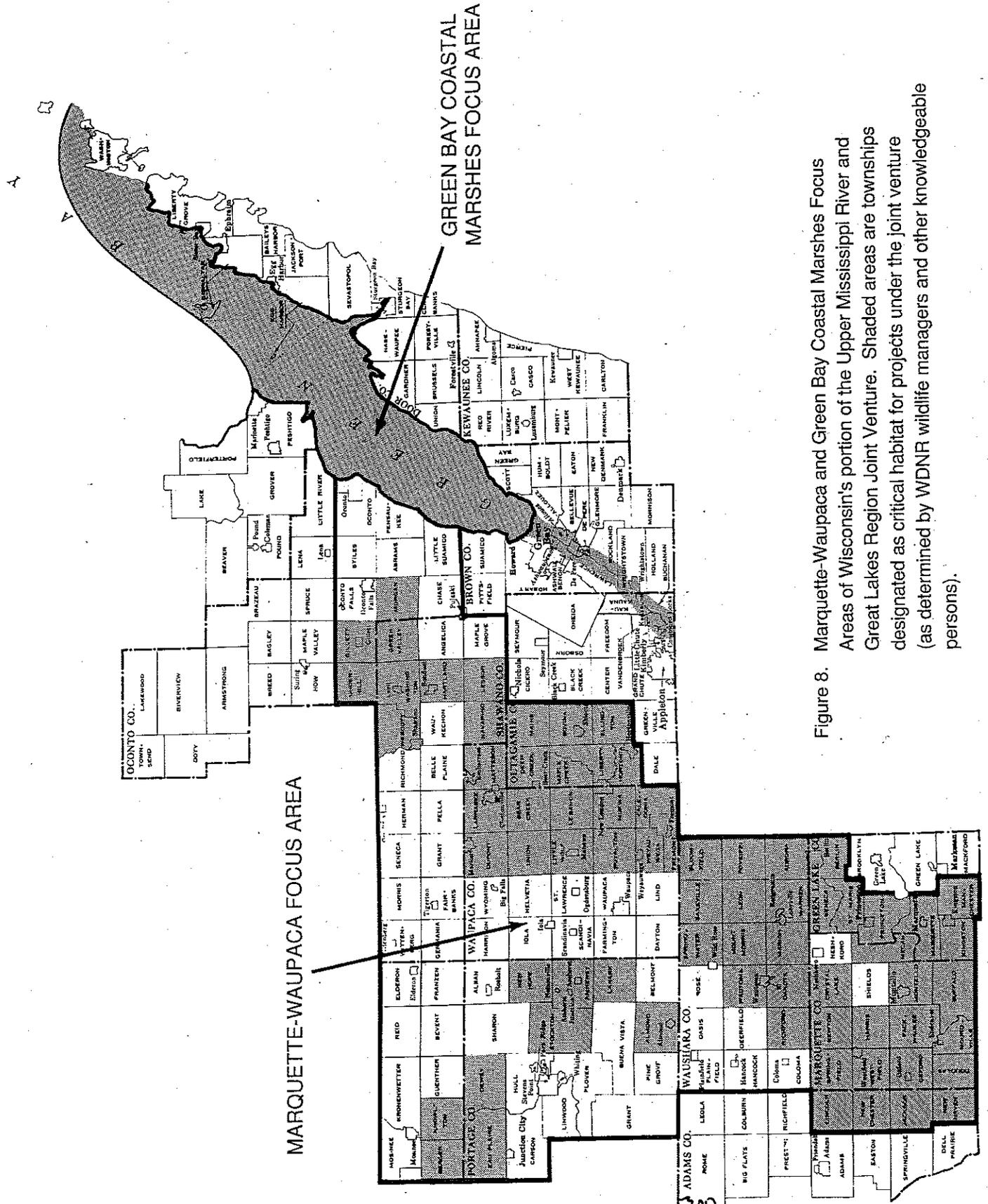


Figure 8. Marquette-Waupaca and Green Bay Coastal Marshes Focus Areas of Wisconsin's portion of the Upper Mississippi River and Great Lakes Region Joint Venture. Shaded areas are townships designated as critical habitat for projects under the joint venture (as determined by WDNR wildlife managers and other knowledgeable persons).

Priority I habitat in this focus area is really the transition between the fertile agricultural regions of southeastern and western Wisconsin and the less fertile northern lakes Priority II habitat. While wetland habitat is abundant in many parts of the Marquette-Waupaca Focus Area, the areas of greatest importance to waterfowl production are discontinuous and less abundant than in the state's better areas.

Considerable acreages of public land are found in this focus area. Most is state-owned or leased. Waterfowl use is mainly during migration. There are pockets of good production habitat, however. Some of this habitat is also on state lands. The WDNR's greater prairie chicken management area on Buena Vista and Leola Marshes covers a large area of Adams, Portage, and Waushara counties. Marshes along the Upper Fox River in Marquette and Green Lake counties are among the most valuable to waterfowl in the region.

Strategies selected to achieve UMRGLR JV objectives will be similar to those used elsewhere.

Although this is still Priority I habitat, its overall potential for increases in duck populations is less here than in the other focus areas previously described.

- 1) Adams-Western Green Lake-Marquette-Waushara Counties (Adams County--Jackson, Lincoln, New Chester, and New Haven townships; Green Lake County--Berlin, Kingston, Manchester, Marquette, Princeton, Seneca and St. Marie townships; Marquette County--Buffalo, Crystal Lake, Douglas, Harris, Mecan, Montello, Moundville, Newton, Oxford, Packwaukee, Springfield, and Westfield townships; Waushara County--Aurora, Bloomfield, Dakota, Leon, Marion, Mount Morris, Poy Sippi, Richford, Saxeville, Springwater, Warren, and Wautoma townships).

Acres of County Mapped as Wetland (percent of county acreage):

Adams	52,307 (12.6%)
Green Lake	44,760 (19.6%)
Marquette	76,016 (26.2%)
Waushara	<u>58,986</u> (14.7%)
	232,069

Acres of Habitat Currently Protected (Acreage Goal):

FWS

WPA's:

Adams 339 acres (339)

Fox River NWR: 665 acres

WDNR

Wildlife Areas:

Green Lake	17,675 acres	(23,880)
Marquette	2,390 acres	(2,385)
Waushara	<u>3,070</u> acres	<u>(4,190)</u>
	23,135 acres	(30,455)

Other

CRP:

Adams	5,144 acres	(3,000)
Green Lake	8,792 acres	(12,000)
Marquette	5,216 acres	(4,000)
Waushara	<u>2,202</u> acres	<u>(34,100)</u>
	21,354 acres	(53,100)

Adams, Marquette, and Green Lake counties (Figure 8) are approved for WPA acquisition, but only one WPA has been purchased.

Adams County offers opportunities to enhance and restore breeding habitat and establish nest cover on uplands for dabbling ducks. Mason Lake and Amey Pond in New Haven township (Figure 8) are used by both ducks and geese. Adams County is the least agricultural of the four and is over 50 percent wooded. Much of the habitat important to migrant waterfowl lies in western Adams County in the Central Focus Area.

The seven townships in Green Lake County, plus Crystal Lake, Mecan, Montello, Moundville, and Packwaukee townships in Marquette County, represent most of the better waterfowl habitat in the Focus Area (Figure 8). Included in these townships is the extensive marshland associated with the Upper Fox, Grand, Puchyan, and White rivers, Lake Puckaway, Buffalo Lake, Big Green Lake, the Puchyan Marsh and 3 state wildlife areas. Lake Puckaway (5,433 acres) has about 4,000 acres of adjoining marsh, Big Green (7,325 acres) has about 500-600 acres of marsh, and the Upper Fox River has about 10,000-12,000 acres of marsh. Altogether, this area has over 40,000 acres of habitat important to waterfowl. This complex of riverine and lacustrine habitats provides breeding and brood-rearing areas for most waterfowl common to Wisconsin, but is especially critical habitat for wood ducks, blue-winged teal, and mallards. Grand River Marsh Wildlife Area (6,865 acres) attracted over 400 breeding pairs of ducks annually (Wheeler et al. 1984). Cormorants and herons also nest there. Lakes and other management areas around Grand River supported 1,200 to 3,700 pairs of ducks, mostly blue-winged teal and mallards (Wheeler et al. 1984). Sandhill cranes also are common nesters throughout the 4 counties.

In fall, Lake Puckaway and Grand River provide space for thousands of ducks, including divers, and 80,000+ MVP Canada geese. Puckaway historically was also a major canvasback concentration site. Recent carp control projects and restoration of wild celery and other aquatic macrophytes have shown positive signs in terms of

greater diving duck use, including use by canvasbacks (Kahl 1985). Grand River Marsh had peak fall populations of 20,000+ ducks, mostly mallards, ringnecks, and wigeon, in years when carp had not severely depleted aquatic food resources.

Management strategies will emphasize carp control and water level manipulation on Grand River and carp control and aquatic plant restoration on Puckaway, which also is a major fisheries area. Protection of riverine marshes and soil erosion control on uplands will benefit all habitat in the 4 counties.

Another potentially major management area is the White River Marsh, also in Green Lake County. Considerable acquisition and extensive development are needed to bring this property up to full management potential. Water levels cannot be controlled as yet, but in wet years, waterfowl use is significant. Across the 4 counties, opportunities for acquisition and development of privately-owned, scattered wetlands is essentially limited only by lack of funds and personnel. A major JV strategy would be to move forward with acquisition of WPA's and other habitat, followed by development of these areas. CRP enrollment, acreage-wise, is about average, and there are CRP lands to work on in all counties. Big Green Lake and its tributaries are also a Priority Watershed which could allow additional private land management for waterfowl. The FWS has restored some wetlands on private lands in the area and has plans for others.

Buffalo Lake, just west of Lake Puckaway in Marquette County, also receives diving duck use. The 2,400 acre Germania Marsh Wildlife Area (2,400 acres), on the Mecan River, also provides habitat for both production and migrants. A unit of the 3,200 acre French Creek Wildlife Area extends into southwestern Marquette County.

The FWS owns 655 acres designated as the Fox River National Wildlife Refuge in Marquette County. This area of both wetland and upland adjacent to the Fox River was acquired as breeding and migration habitat for sandhill cranes. The area also produces ducks and benefits other wildlife.

Coldwater fisheries areas are scattered throughout these counties and protect considerable riparian habitat, some of which is marshy and used by waterfowl. Over 10,000 acres are owned by the WDNR Bureau of Fisheries Management in Marquette and Waushara counties.

Waushara County's Aurora, Bloomfield, and Poy Sippi townships (Figure 8) include most of the marsh on the west end of Lake Poygan, the second largest lake in the Winnebago System. While Winnebago is treated as a separate focus area, a discussion of Waushara County's waterfowl habitat must include mentioning the extensive marshes associated with Lake Poygan and its tributary streams, the Pine River and Willow Creek. Over 3,100 acres of this marsh is protected as the state's Poygan Marsh Wildlife Area, which also includes and protects a major section of the westernmost shoreline of Lake Poygan. Shoreline riptapping to protect both the wetland and the lake are a major ongoing activity that could be strengthened by JV funding.

- 2) Portage-Waupaca-Southeastern Marathon-Southern Shawano-Western Outagamie and Oconto Counties (Marathon County-Bergen and Knowlton townships; Portage County--Almond, Amherst, Dewey, Eau Pleine, Lanark, New Hope, and Stockton townships; Waupaca County--Bear Creek, Caledonia, DuPont, Larrabee, Lebanon, Little Wolf, Matteson, Mukwa, Royalton, Union, and Weyauwega townships; Shawano County--Green Valley, Hartland, Lessor, Navarino, Washington, and Wescott townships; Oconto County--Gillette, Morgan, and Underhill townships, plus the area east of state highways 41 and 141 along Green Bay which is in a separate focus area; Outagamie--Bovina, Deer Creek, Ellington, Hortonia, Liberty, Maine, and Maple Creek townships).

Acres of County Mapped as Wetland (percent of county acreage):

Marathon	117,576 (11.8%)
Oconto	160,263 (25.0%)
Portage	103,855 (20.0%)
Shawano	128,300 (22.3%)
Waupaca	<u>112,761</u> (23.4%)
	622,755

Acres of Habitat Currently Protected (Acreage Goal):

WDNR

Wildlife Areas:

Marathon	27,070 acres (30,960)
Portage	5,420 acres (7,860)
Shawano	14,540 acres (16,500)
Waupaca	1,290 acres (<u>1,320</u>)
	48,320 acres (56,640)

Other

CRP:

Marathon	971 acres (25,000)
Oconto	1,621 acres (2,500)
Portage	2,416 acres (10,000)
Shawano	2,602 acres (16,500)
Waupaca	<u>2,917</u> acres (<u>5,300</u>)
	10,527 acres (59,300)

Although wetlands abound in these counties, wetland quality is the key factor affecting waterfowl potential. Some of the more productive habitats are the marshes and bottomlands of the Wolf River and tributaries. Two state wildlife areas, Navarino and Mukwa in Shawano and Waupaca counties, plus several smaller areas in Outagamie County protect about 16,000 acres in this vicinity. In wet springs, flooded river bottomlands attract thousands of migrating Canada geese, tundra swans, and ducks. Higher breeding duck densities during wet springs also result in higher than normal production. In dry or average years, the habitat base shrinks and breeding populations are reduced. The area always is important wood

duck habitat. Fall use of the bottoms is also substantial in some local situations where there are managed, private marshes which attract large numbers of ducks.

Flowages created by hydroelectric dams on the Wisconsin and Big and Little Eau Pleine rivers provide considerable acreages of water, primarily of value to migrants and wood ducks. The state-owned 27,000+ acre Mead Wildlife Area, which extends west into the Central Focus Area, is both a major migration and a production area. Water quality and fertility and the associated lack of waterfowl foods are key factors limiting the project's duck use.

Other local pockets of waterfowl production habitat are scattered throughout the 5 counties, especially along the Embarrass, Oconto, Plover, and Pensaukee rivers. WDNR Bureau of Fisheries Management areas on several of these streams, mainly managed for trout, protect some waterfowl habitat, primarily used by wood ducks and mallards. If beaver did not directly conflict with fisheries objectives, managing for this furbearer would improve these streams for waterfowl.

Lakes scattered across these counties provide moderate to high value habitat for migrants and local breeders. Included are Shawano (6,178 acres), White (230 acres) and White Clay (360 acres) lakes in Shawano County, Partridge (940 acres), Partridge Crop (263 acres) and White (1,120 acres) lakes in Waupaca County, the Big Eau Pleine Flowage (5,000 acres) in Marathon County, and Lake DuBay (6,700 acres) in Marathon and Portage counties. Several other Wisconsin River flowages in Portage County also attract migrants.

Strategies used to develop or improve habitat will be similar to those for other focus areas and will be on a "target of opportunity" basis. Areas around existing state lands managed for waterfowl will be first priorities along with restoration of habitat on private lands either acquired in fee title or leased. Completion of waterfowl management aspects of state property master plans will also be emphasized.

WPA acquisition is not approved for any of these counties, primarily because of the generally lower productivity of the habitat. Also, CRP enrollment is poor by comparison to other areas, limiting opportunities on private lands through that program. Some private lands owned by FmHA have been offered to resource management agencies for their use and transferral of these properties is underway.

Because of the acreages involved and the major management investments already made at Mead and Navarino, the two projects deserve special discussion. Mead and its neighboring project to the west, McMillan Marsh (which is in the Central Focus Area), represent 31,200+ acres of public lands managed primarily for waterfowl, other aquatic birds, furbearers, ruffed grouse, woodcock, greater prairie chickens, and deer. Mead, which is the second largest wildlife property owned by WDNR, has an acquisition goal of about 31,000 acres. Mead and McMillan combined will be over 62,200 acres when complete. Wood ducks, mallards, blue-winged teal, and Canada geese, are the most common waterfowl. Migrant diving ducks use Mead's

larger flowages. The area has 400+ cormorant and 80 heron pairs (Meier 1987) and sandhill cranes are common nesters. Mead has a history of water level control problems, some of which have been addressed, and poor water quality and fertility, dike erosion, and brush invasion of upland grass cover are other management problems.

Navarino is 60 percent wetlands. The remainder is upland forests. The Wolf River flows on its northwest border and the Shioc River on the east. Key species are blue-winged teal, mallards, ring-necked ducks, and wood ducks. Sandhill cranes, black terns, great blue herons, and numerous songbirds also are common nesters (Wydeven 1987). Ruffed grouse, squirrels, and deer use the uplands. Canada geese stop during migration. Timber management, prescribed burning, and water level manipulation are the main management practices. Navarino is the only major state-owned waterfowl project in the northeast part of the focus area.

F. Green Bay Coastal Marshes Focus Area

Green Bay (Figure 8) is the second Wisconsin's focus areas recognized in the NAWMP (USFWS 1986b) as one of North America's 34 habitat areas of major concern. Because most of Green Bay's remnant coastal marshes lie along the west shore from the north edge of the City of Green Bay to the mouth of Peshtigo River (Figure 8), JV emphasis will be on that area of the Bay. However, what happens in other adjacent counties and in the Upper Fox River drainage impacts water quality of Green Bay. Therefore, the JV Steering Committee is also concerned about land use, pollution, and other problems in the watersheds contributing to the Bay.

Coastal marshes along the Great Lakes were historically high quality production and migration habitats (USFWS 1979). Green Bay continues to be an important migrational area for diving ducks and tundra swans. Lower Green Bay has attracted about 500 canvasbacks in recent falls, making it one of that species' main Wisconsin stopovers away from the Mississippi River (Kahl 1985). With about 75 acres of wild celery and fennelleaf pondweed, the Bay also has some of the more abundant supplies diving duck food. Dabbling ducks and other waterfowl also nest along Green Bay, with mallards and wood ducks the most common species. A resident flock of giant Canada geese nests around the Bay and winters at Brown County's Bay Beach Sanctuary. Migrant Canadas also frequent the area. Recently, the resident flock has exceeded several thousand geese. Bay Beach historically was also a black duck wintering area, but numbers have drastically declined. Buffleheads, common goldeneyes, common mergansers and scaup also winter at BayBeach and on the open waters of the Bay. Islands off the tip of Door County are nesting sites for mallards, black ducks, gadwall, mergansers, cormorants, and gulls.

Cormorants, common and Forster's terns, and great blue and green-backed herons all nest along the Bay (Bahti 1987). Artificial nesting structures have been used to improve cormorant and tern nesting success in the area.

Brown County alone has over 2,000 acres of coastal wetlands. This is especially critical habitat since it lies in the Green Bay metro area and is subject to the greatest threats of loss and degradation. Longtail Point is another critical piece of habitat off Brown County and is a nesting rookery for cormorants and herons (Bahti 1987).

Most of the publicly-protected coastal marshes are part of the state's Green Bay West Shores Wildlife Area which stretches for 42 miles along the west shore of the Bay. First efforts to preserve these shorelines, marshes, and deltas began in 1948 and is yet to be completed. To date, 6,700 acres are state-owned and managed in 11 separate units (Bahti 1987). The eventual acquisition goal is over 14,100 acres, suggesting an accelerated effort may be needed if that goal is to be met.

Several of the small, rocky islands off Door County are included under the FWS's national wildlife refuge system. The FWS also maintains a field office at Green Bay and its personnel work cooperatively with WDNR and University of Wisconsin-Green Bay to determine and resolve environmental problems in the Bay area.

Green Bay is the outlet for a number of major rivers, the largest being the Fox River. Other rivers include the Oconto, Pensaukee, Peshtigo and Menominee. Since the Upper Fox is a key river in two other focus areas, its habitat and health are important to a large segment of critical JV habitat. The Lower Fox, Peshtigo, and Oconto rivers were major sources of municipal and industrial pollutants flowing into the Bay (Moran 1985). Discharges into Green Bay have been drastically reduced since the 1970's, however, toxic substances stored in bottom sediments are still contaminating fish, birds, and other organisms through the food chain. The WDNR has issued health advisories regarding eating mallards taken on the Lower Fox River. The International Joint Commission for the Great Lakes' Water Quality Board has designated Green Bay as one of four Areas of Concern because of pollutants and toxic sediments.

A Green Bay Remedial Action Plan (RAP) has been prepared by a joint technical and citizen's advisory committee's efforts. Problems include toxic substances and large amounts of nutrients, causing heavy algal blooms and wetland degradation (Lewelyn and Christie 1987). Contaminants are thought to be responsible for reproductive failures in Forster's terns and bill deformities in waterbirds along lower Green Bay (Amundson 1985).

Joint Venture activities on Green Bay would support the RAP's goals, objectives, and strategies, and would aid in implementing the plan. In addition, JV projects would assist in implementing master plan objectives for the WDNR management units along the west shore.

G. Wild Rice Focus Area

A significant proportion of Wisconsin's waterfowl breed in the wild rice focus area.

The area lies predominantly in Petersen's (1985) Northern Forest. The 10 northernmost Priority II counties (Figure 1) have 6,500+ lakes, covering almost 272,000 acres, some 2,200 miles of stream (25,000+ acres), and 1.6 million acres of wetlands (Gregg 1988).

Certain wetlands in this area historically supported extensive stands of wild rice, which is an important waterfowl and other wetland associated wildlife food. Wild rice is an important duck food, especially during migration periods.

Despite their abundance, wetlands other than lakes and streams are probably a less important component of waterfowl habitat in the north than they are elsewhere in the state. Wetlands here are less valuable to ducks because they often lack surface water and preferred duck foods (Jahn and Hunt 1964). Inadequate food resources, due to low wetland fertility, limit duck populations (Moyle 1956, 1961), even on managed areas (Baldassarre 1978, Nelson 1978). Lakes, streams, and beaver ponds do, however, provide considerable duck habitat in the region (March et al. 1973, Gregg 1988). Except for the eastern part of the Northern High survey stratum and local pockets of better quality habitat, such as the Kakagon and Bad River sloughs in Ashland County and the Fish Creek area in Bayfield County, breeding duck densities in the northern lakes region are about 40 percent lower overall than those found in the western Northern High or SE/Central strata. Total numbers of ducks breeding in the region are, however, important and represent 20 percent of the population in the surveyed regions. The large acreages of relatively permanent, but less productive habitat are responsible for the total number of ducks being significant (March et al. 1973). Recent spring surveys also suggest an increasing population (Andryk et al. 1988), especially of mallards which make up 80+ percent of the breeding population (Gregg 1988). Unfortunately, habitat development and management opportunities that will produce significant results are not as readily available in this focus area as they are in other focus areas. The overriding factors of poor water fertility and greater difficulty in establishing quality nesting cover on soils better suited to growing trees and brush, severely limit management efforts in the region. Greater rate of important wetland loss, better overall fertility, and generally higher existing duck densities in the other focus areas, give them a higher priority for JV activities. The need to protect and increase habitat is more critical in the other focus areas and should result in a greater overall net increase in ducks. While the initial management costs are greater in Priority I areas, especially if land rights must first be secured, the number of additional ducks produced gives a greater return per unit treated.

Many of the historic wild rice stands have been lost or greatly reduced in size in recent years. Thus, management emphasis in this focus area will be directed at restoring and enhancing wild rice habitats.

The U.S. Forest Service (USFS) and the various Chippewa Indian bands are major landowners in northern Wisconsin, mostly in the Wild Rice Focus Area. The USFS, the Bureau of Indian Affairs (BIA), and the Great Lakes Indian Fisheries and Wildlife Commission (GLIFWC) may independently

initiate habitat projects that also address NAWMP goals and objectives. The BIA's "Circle of Flight" initiative is one example of this type of proposal. Wisconsin's Steering Committee supports any and all efforts to address the needs outlined by the NAWMP. However, requests by these agencies for funding from Wisconsin's portion of the JV to initiate projects or to supplement funding for ongoing projects will be subject to the same review and priority evaluation outlined above. **Habitat related work in other Priority I areas will receive the highest priority for funding under the JV.**

H. Central Focus Area

The Central Focus Area (Figure 9) includes all of Clark, Jackson, and Wood counties, most of Adams County, southeastern Marathon, northern Juneau, western Taylor, eastern Chippewa, and northeastern Eau Claire counties. Petersen (1985) designated much of this area as either the "Clark-Marathon" subprovince of the Woodlot-Agriculture Transition ecological province or the Central Forest ecological province (Figure 2). Overall, less than 50 percent of the landscape is cropland or pasture and 30 percent or more is wooded. Over 10 percent is mapped as wetland, with Juneau, Taylor, and Wood counties having over 20 percent wetlands. Only 3 counties have about 10 percent of their lands in urban areas. In the Clark-Marathon portion, dairy and cash crop farming, together with farm woodlots, are the principal land uses. Featured species that would benefit from the JV include (besides waterfowl) gray partridge, jackrabbits, and muskrats. Existing or potential cover types determine management priorities in the Central Forest ecological province, with mallards and wood ducks the featured species (Petersen 1985).

Habitat in the focus area is not uniformly distributed and is generally less productive, in terms of ducks, than the Marquette-Waupaca Focus Area with which it is most similar in terms of habitat and land use. Activities under the JV will have to be on a target of opportunity basis. There are several existing federal and state management areas that will serve as nuclei for additional habitat work in the surrounding areas. Because JV habitat work will have to be more localized during implementation, the following discussion is quite general and does not follow a county by county format. Instead, only areas with ongoing or known waterfowl management opportunities are highlighted. Other areas will be specifically delineated later. Strategies used to attain habitat objectives will be similar to those recommended for other "fringe" focus areas. Funding for projects within this focus area will be limited and only projects that demonstrate either significant production or migration benefits will be funded, at least initially.

The region's major waterfowl complex is the Necedah National Wildlife Refuge-Meadow Valley, Sandhill and Wood County Wildlife Areas. These projects total 126,000+ acres in Wood, Juneau, and northeast Jackson counties and are part of the Great Central Wisconsin Swamp Area. This is the largest publicly-controlled block of habitat in Wisconsin away from the Mississippi River. These public lands are owned by the FWS (Necedah), WDNR, and Wood County. Meadow Valley (57,450 acres) is owned mainly by the FWS and leased to WDNR. On the Wood

County area, 18,300+ acres of county land are also leased by WDNR. Sandhill's 9,455 acres are state-owned.

Canada geese, wood ducks, mallards, blue-winged teal, and ring-necked ducks are the common species using the complex, both as breeders and migrants. Other migrant waterfowl include American wigeon, green-winged teal, pintail, black ducks, and snow geese. Also, sandhill cranes nest on the areas and are common migrants in spring and fall, with flocks of 450 cranes counted (Sanford 1987). Other wildlife that benefit from these areas include muskrat and beaver, ruffed grouse, wild turkey, and white-tailed deer.

Management is achieved primarily through water level manipulation in the wetlands which are divided into numerous subimpoundments. On the uplands, prescribed burning benefits warm season grasses and forbs and provide nesting cover for waterfowl and other grassland birds. Green browse is planted as fall food crops for waterfowl and cranes.

Other larger blocks of protected waterfowl habitat are found on Jackson County's Dike 17 Wildlife Area in the Black River State Forest, the Pershing Wildlife Area in western Taylor County, the Augusta Wildlife Area in eastern Eau Claire County, McMillan Marsh Wildlife Area in western Marathon County, and the Colburn Wildlife Area in Adams County. No WPA's have been acquired in this focus area, although Adams County is approved for the program. Over 1,100 acres have been protected under the WDNR's scattered wetlands program, with the largest acreages in Clark and Jackson counties. CRP enrollment totals about 35,700 acres for the focus area, with most of the acreage in Eau Claire, Jackson, Juneau, Adams, and Chippewa counties. Clark, Marathon, Taylor, and Wood counties have only about 2,500 acres total in CRP. The FWS has done limited wetland restoration to date, but have plans for 19 restoration projects in four counties. There are also large acreages of county forest lands available for cooperative projects between agencies, counties, and private organizations.

The Dike 17 Wildlife Area in Jackson County attracts Canada geese, wood ducks, mallards, and blue-winged teal. Goose populations average about 2,500, with peaks of 7,000. Ducks populations average from 2,000 to 4,000 (Weitz 1987). Sandhill cranes, ospreys, cormorants, great egrets, great blue herons, and loons also are found on the area. Prescribed burning is the primary management tool used to improve uplands for sharp-tailed grouse, cranes, and waterfowl nesting.

The Pershing Wildlife Area lies in the forest-farm fringe of Taylor County. This large area of brush prairie is managed mainly for sharp-tailed and ruffed grouse and waterfowl. Pershing also has nesting giant Canada geese and sandhill cranes. Most other common waterfowl nest on the area and there is a heron rookery (Vanecek 1987). Water level management on the area's 13 flowages, together with prescribed burning on the uplands to maintain brush prairie, are the main and most effective management actions. Almost 1,000 acres of wetlands are available to breeding and migrating waterfowl.

Parts of the southern unit of the Chequamegon National Forest are within the Taylor County portion of this focus area. While waterfowl management is a lesser objective on the forest, the Chequamegon Waters Flowage does receive some use by waterfowl.

The two major flowages created by hydroelectric dams on the Wisconsin River where it forms the border between Adams and Juneau counties are also worthy of mention as migration habitat, especially for scaup and other diving ducks. Use by Canada geese is also increasing. Petenwell Flowage, the northernmost and the largest, is 23,000+ acres and Castle Rock, lying just south of Petenwell, is 16,600+ acres. The two flowages have held peak populations of divers that may have exceeded 10,000 birds in some years. Problems with water levels, rough fish, water quality, and toxics are the biggest concerns on the two areas. Mercury was the first major concern but levels were successfully reduced. Then dioxins and furans were found and remain a concern today. Levels of contaminants from waterfowl have not yet been a problem however.

I. Forest Fringe Focus Area

The remaining Priority I habitat in northwestern and north central Wisconsin is designated as the Forest Fringe focus area (Figure 10). Included are portions of Bayfield, Burnett, Chippewa, Douglas, Rusk, Sawyer, and Washburn counties. This focus area is basically northern lakes-forest farmland fringe habitat with better than average breeding duck densities. The area is designated as a separate unit from the Northwest Focus Area primarily because the area is more wooded and less agricultural. Waterfowl production habitat quality still warrants Priority I designation, however. Petersen (1985) designates much of this region as the Northern Forest ecological province (Figure 2) and suggests that management priority be determined by existing or potential forest cover type and featured species. Along with waterfowl, sharp-tailed grouse management is a priority in several localities. Fifty percent or more of the area is forested and generally less than 20 percent is in cropland or pasture. This is the least agricultural and most wooded of the Priority I habitats. CRP enrollment totals less than 2,000 acres and is mostly in Burnett, Chippewa, and Washburn counties. Areas mapped as wetlands make up 15-20 percent or more of the land. Urban areas only represent 3-5 percent of the landscape.

WDNR waterfowl projects in the Forest Fringe Focus Area total only about 2,400 acres, with an acquisition goal of about 3,250 acres. Counties in the focus area are not approved for the WPA program. WDNR Bureau of Fisheries Management projects throughout the region protect small amounts of habitat with value to waterfowl. The majority of waterfowl use in both the breeding season and during migration in the region occurs on the thousands of lakes of varying size. Total duck production from the region is difficult to measure with much precision because of the large amounts of habitat, its wide distribution, discontinuous use by breeding ducks, and the difficulty of surveying forested regions by air. Based on recent work by Gregg (1988), and the spring survey, a significant number of ducks

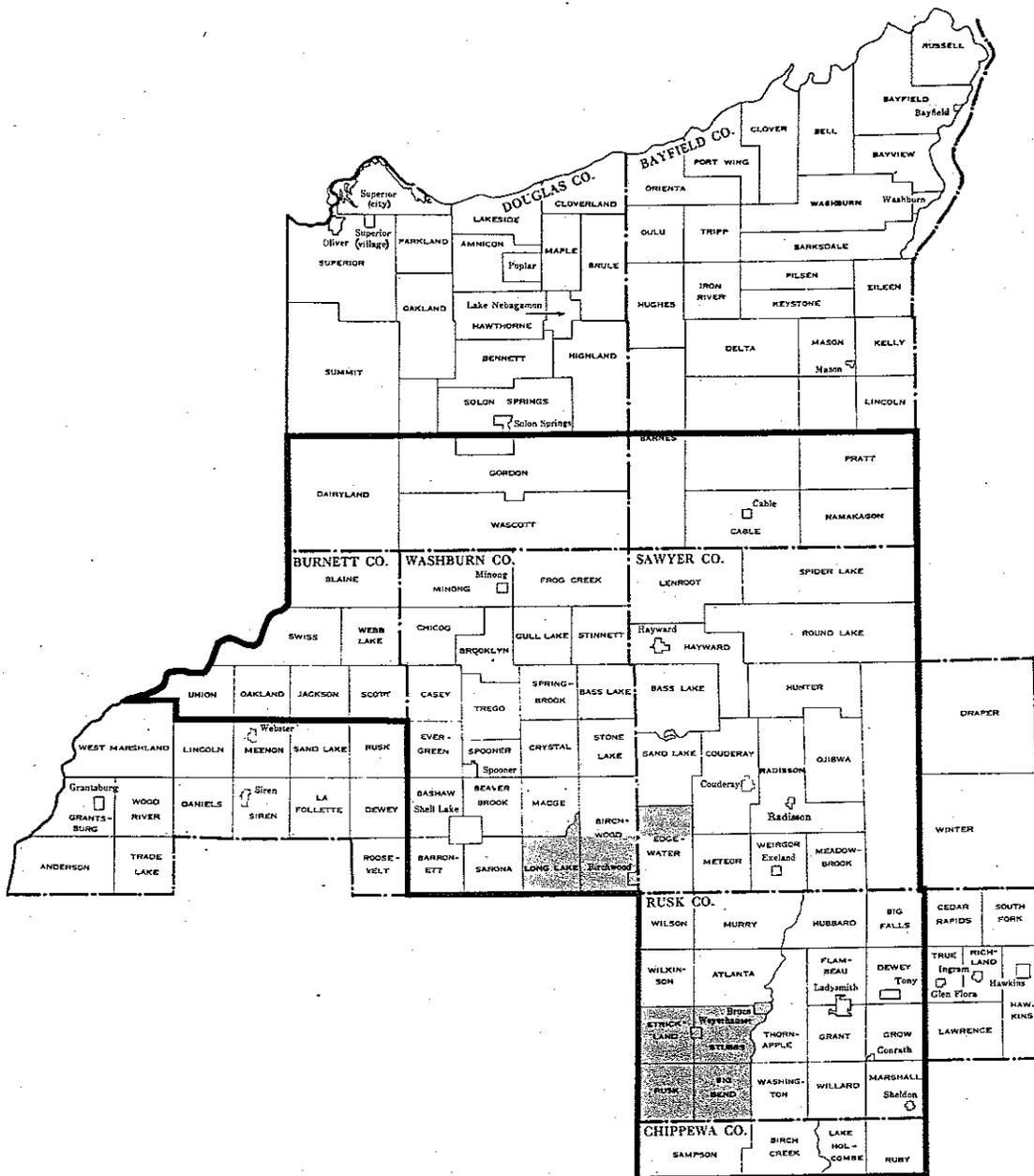


Figure 10. Forest Fringe Focus Area of Wisconsin's portion of the Upper Mississippi River and Great Lakes Region Joint Venture. Shaded areas are townships given preliminary designation as critical habitat for projects under the joint venture (as determined by WDNR wildlife managers and other knowledgeable persons).

nest in the region and production appears above average.

Recommendations for JV strategies are more difficult to make in the northern lakes region, especially if significant gains in waterfowl production are to occur. Vast amounts of county, state, and national forest lands, plus the many lakes which are essentially under the public domain and protected from most degradations, need to work on private lands less critical. Shoreline development, aquatic macrophyte control, the potential harmful affects of acid rain, and predation, are the main concerns in this region. Also, establishing secure upland nesting cover is very difficult and requires considerable effort to control invasion by brush and trees. Funding for projects within this focus area will be limited and only projects that demonstrate either significant production or migration benefits will be funded, at least initially.

Although WDNR wildlife managers were able to designate several townships in individual counties, these designations were only preliminary and are not meant to restrict possible JV activities to those few areas. As Wisconsin goes into the JV implementation phases, these designations will be reviewed and expanded as necessary. This is also true for designated critical habitat in the Central Focus Area (Figure 9) and other areas discussed previously.

In these fringe areas and in much of the Priority II habitat, the cost per additional duck fledged is greater than in more favorable Priority I habitat. Under the UMRGLR JV, these natural limitations of the landscape must be recognized in setting funding and implementation priorities. Given a limited amount of funding, habitat projects in the Northern Fringe Focus Area will be a lower priority than elsewhere in the more productive focus areas.

XI. RESEARCH PRIORITIES AND EVALUATION STRATEGIES

Evaluation of success of Wisconsin's portion of the JV will involve 3 strategies:

- A. Quantifying the quantity and quality of habitat protection and improvements accomplished;
- B. Monitoring changes in the state's breeding duck populations through the WDNR's spring survey;
- C. Using the Mallard Management Model to assess the impact of habitat improvements.

The quantification of habitat improvements will yield only indirect evidence of JV success. The spring breeding survey will yield more direct evidence, but only if the gains are large. The Mallard Model will yield the best direct evidence of annual gains during the JV. Appendix C outlines this issue and describes proposed strategies in greater detail.

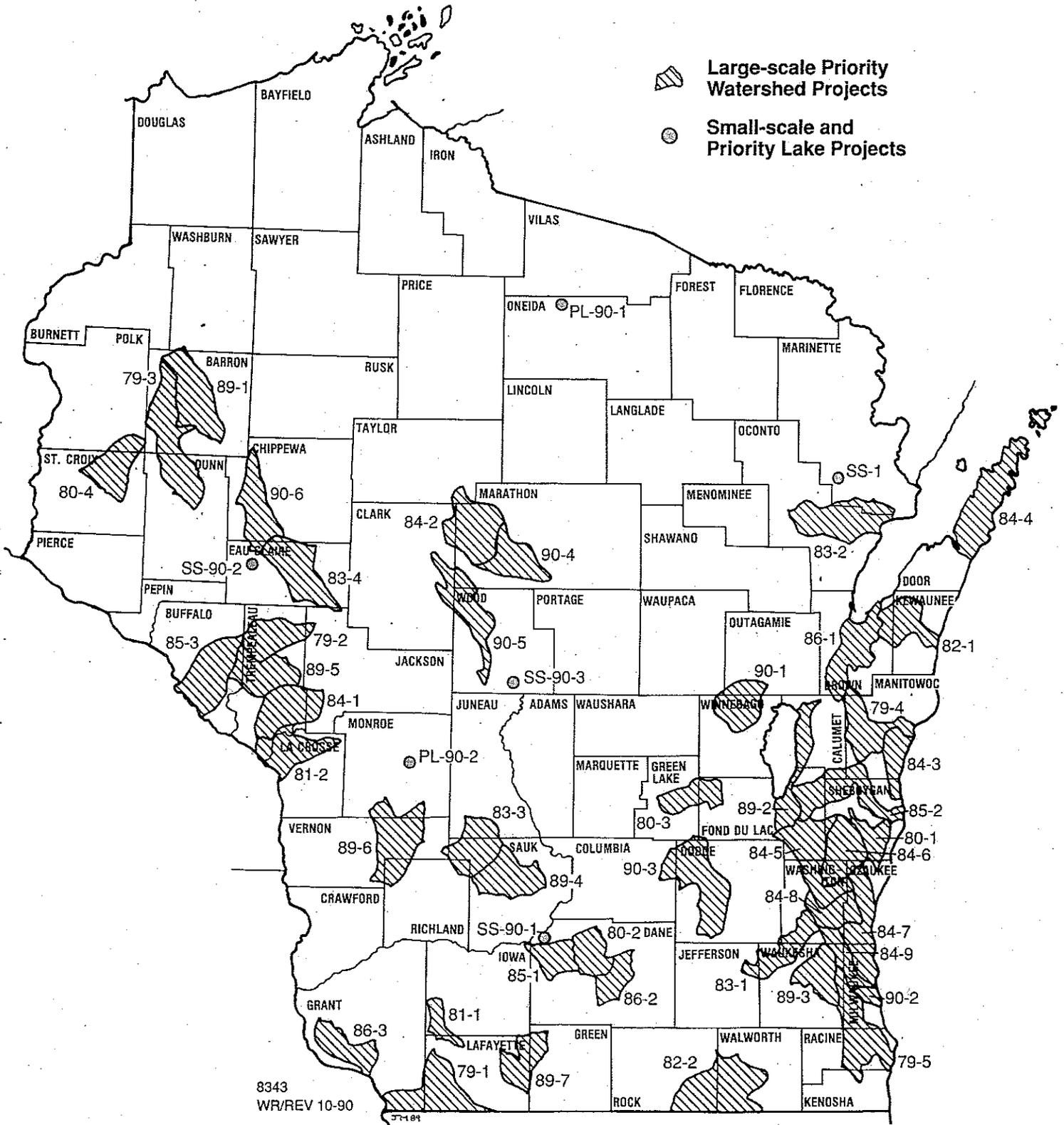
Baseline data on duck production from private lands is needed to adapt the FWS' Mallard Management Model for Wisconsin. Wisconsin does have considerable research to support the implementation of various management strategies on public waterfowl production lands. However, a void exists regarding duck production estimates from private lands. Because a main thrust of Wisconsin's portion of the UMRGLR JV will be to restore wetland and upland habitat on private lands, this becomes a crucial information gap. Wisconsin provides different land cover opportunities to nesting ducks than states in the PPJV regions. Wisconsin has larger proportions of its private landscape in woodlots, brush, actively mowed hayfields, and odd areas. Since many findings from public lands in North Dakota and Minnesota do not directly apply to the situation in Wisconsin, extrapolation of results from research in those states to Wisconsin's private lands also seems inappropriate. Research is needed to quantify 6 major components of the Mallard Management Model for application to private lands in Wisconsin:

1. breeding pair preferences among wetland types;
2. nesting preferences among land cover types;
3. nest success on land cover types;
4. brood preferences among wetland types;
5. brood and duckling survival by wetland types; and
6. breeding hen survival.

The research should span 3-5 years to include a range of environmental variability, which is so important to mallards. Research should focus on mallards and collect incidental data on blue-winged teal, concurrently covering the two most important breeding species besides wood ducks. Radio telemetry is the most cost-effective method of obtaining unbiased estimates of the model components. Research could utilize the methods developed by the FWS when they originally formulated the Mallard Management Model for the PPJV habitat.

The past and proposed research may also be used to develop better criteria and guidelines for setting priorities for wetland protection and habitat development done under the JV. These criteria could be similar to, or modelled after, the proposed WPA feasibility evaluation standards already developed by Petersen et al. (1982).

Priority Watershed Projects in Wisconsin 1990



Map Number	Large-scale Priority Watershed Project	County(ies)	Year Project Selected
79-1	Galena River	Grant, Lafayette	1979
79-2	Elk Creek*	Trempealeau	1979
79-3	Hay River*	Barron, Dunn	1979
79-4	Lower Manitowoc River*	Manitowoc, Brown	1979
79-5	Root River	Racine, Milwaukee, Waukesha	1979
80-1	Onion River*	Sheboygan, Ozaukee	1980
80-2	Sixmile-Pheasant Branch Creek*	Dane	1980
80-3	Big Green Lake	Green Lake, Fond du Lac	1980
80-4	Upper Willow River	Polk, St. Crox	1980
81-1	Upper West Branch Pecatonica River	Iowa, Lafayette	1981
81-2	Lower Black River	La Crosse, Trempealeau	1981
82-1	Kewaunee River	Kewaunee, Brown	1982
82-2	Turtle Creek	Walworth, Rock	1982
83-1	Oconomowoc River	Waukesha, Washington, Jefferson	1983
83-2	Little River	Oconto, Marinette	1983
83-3	Crossman Creek/Little Baraboo River	Sauk, Juneau, Richland	1983
83-4	Lower Eau Claire River	Eau Claire	1983
84-1	Beaver Creek	Trempealeau, Jackson	1984
84-2	Upper Big Eau Pleine River	Marathon, Taylor, Clark	1984
84-3	Sevenmile-Silver Creeks	Manitowoc, Sheboygan	1984
84-4	Upper Door Peninsula	Door	1984
84-5	East & West Branch Milwaukee River	Fond du Lac, Washington, Sheboygan, Dodge, Ozaukee	1984
84-6	North Branch Milwaukee River	Sheboygan, Washington, Ozaukee, Fond du Lac	1984
84-7	Milwaukee River South	Ozaukee, Milwaukee	1984
84-8	Cedar Creek	Washington, Ozaukee	1984
84-9	Menomonee River	Milwaukee, Waukesha, Ozaukee, Washington	1984
85-1	Black Earth Creek	Dane	1985
85-2	Sheboygan River	Sheboygan, Fond du Lac, Manitowoc, Calumet	1985
85-3	Waumandee Creek	Buffalo	1985
86-1	East River	Brown, Calumet	1986
86-2	Yahara River — Lake Monona	Dane	1986
86-3	Lower Grant River	Grant	1986
89-1	Yellow River	Barron	1989
89-2	Lake Winnebago East	Calumet, Fond du Lac	1989
89-3	Upper Fox River (Ill.)	Waukesha	1989
89-4	Narrows Creek — Baraboo River	Sauk	1989
89-5	Middle Trempealeau River	Trempealeau, Buffalo	1989
89-6	Middle Kickapoo River	Vernon, Monroe, Richland	1989
89-7	Lower East Branch Pecatonica River	Green, Lafayette	1989
90-1	Arrowhead River & Daggetts Creek	Winnebago, Outagamie, Waupaca	1990
90-2	Kinnickinnic River	Milwaukee	1990
90-3	Beaverdam River	Dodge, Columbia, Green Lake	1990
90-4	Lower Big Eau Pleine River	Marathon	1990
90-5	Upper Yellow River	Wood, Marathon, Clark	1990
90-6	Duncan Creek	Chippewa, Eau Claire	1990

Map Number	Small-scale Priority Watershed Project	County(ies)	Year Project Selected
SS-1	Bass Lake	Marinette	1985
SS-90-1	Dunlap Creek	Dane	1990
SS-90-2	Lowe's Creek	Eau Claire	1990
SS-90-3	Wood County Groundwater Prototype	Wood	1990

Map Number	Priority Lake Project	County(ies)	Year Project Selected
PL-90-1	Minocqua Lake	Oneida	1990
PL-90-2	Lake Tomah	Monroe	1990

* Project completed

Appendix B. Detailed breakdown of annual cost estimates for individual management activities or strategies under Wisconsin's portion of the Upper Mississippi River and Great Lakes Region Joint Venture.

Strategy or Activity	Annual Cost
Habitat on Public Lands	
- Initial Enhancement & Development on Newly Acquired Lands--3,700 acres/year	
+ Upland Cover Development: 2,775 acres @ \$100/acre	\$ 277,500
- Enhancement & Development on Existing Public Lands	
+ Wetland Restoration or Enhancement: 1,250 acres @ \$800/acre	1,000,000
+ Upland Cover Development: 640 acres @ \$100/acre	64,000
+ Predator Exclusion Fences: 50 acres @ \$400/acre for a 40-acre block of upland cover	20,000
+ Miscellaneous Management Techniques: 2,400 acres @ \$100/acre	<u>240,000</u>
Subtotal	\$1,324,000
- Land Acquisition--Fee Title or Perpetual Easements: 3,700 acres/year	
+ 2,775 acres/year in fee title @ \$1,000/acre	2,775,000
+ 925 acres/year in perpetual easement @ \$500/acre	<u>462,500</u>
Subtotal	\$3,237,500
- Operations & Maintenance on Developed Lands @ \$20/acre/ year; Undeveloped Lands @ \$10/acre/year	<u>282,000*</u>
Public Lands Costs Total	\$5,121,000
Habitat on Private Lands	
- Wetland Restoration or Enhancement--900 acres @ \$100/acre land rental + \$800/acre development	\$810,000

Appendix B. Continued.

Annual
Strategy or Activity
Cost

Habitat on Private Lands (cont.)

- Upland Cover Development

+ CRP Lands: 2,400 @ \$90/acre	\$ 216,000
+ Water Bank Lands: 800 acres @ \$90/acre	72,000
+ Multi-year Set-Aside: 800 acres @ \$20/acre	16,000
+ WDNR Leases: 2,400 acres @ \$80/acre land rental	192,000
2,400 acres @ \$100/acre land rental	<u>240,000</u>

Subtotal \$736,000

- Predator Exclusion Fences: 60 acres @ \$20/acre
for right to fence existing upland cover + \$400/acre
to fence a 40-acre block of upland cover 25,200

- Miscellaneous Management Techniques: 140 acres
@ \$25/acre for management rights + \$80/acre for
initial land rental 14,700

- Maintenance & Enforcement of Agreements:
7,500 additional acres/year @ \$0.67/acre/year; 15,000*

Public Lands Costs Total \$1,590,900

Research and Evaluation

- Annual Costs for the First 4 Years = \$95,121 (Year 1), \$89,301
(Year 2), \$89,301 (Year 3), and \$39,850 (Year 4). Average
annual cost over the 4 years is used as annual cost estimate.
Additional future costs will depend on results obtained in the
first 4 years. \$80,000

Grand Total \$6,791,900

*Average Cost/Year over the 15 Years

Appendix C. Duck production on Wisconsin Private Lands - an issue brief prepared by the WDNR Bureau of Research, March 3, 1989.

1. Issue Statement: Research study is needed to quantify 6 major components of the Mallard Management Model for application on private lands in Wisconsin: (1) breeding pair preferences among wetland types, (2) nesting preferences among land cover types, (3) nest success on land cover types, (4) brood preferences among wetland types, (5) brood and duckling survival on wetland types, and (6) breeding hen survival. The investigation should span 3 years to include a range of environmental variability. Emphasis should focus on mallards, with incidental information collected on blue-winged teal. An essential element of the research will be to evaluate the contribution to duck production of private lands retired under federal agriculture programs.

2. Issues Background: The majority of Wisconsin ducks breed on private lands, yet we know little regarding productivity. Duck production includes nest success, duckling survival, and adult hen survival during the breeding season. Past research on these topics in Wisconsin has been conducted on public lands. We have adequate knowledge of nest success but poor estimates of duckling survival over the range of public lands in the state; no estimates of nest success or duckling survival on private lands are available. Furthermore, we have no estimates of adult hen survival rates during the breeding season from any area in Wisconsin. Our surveys over the past 16 years indicate steadily declining blue-winged teal populations, but mallard populations that show no clear decline. Without production estimates on private lands in southern Wisconsin we cannot determine whether the stable mallard populations result from adequate production or continual pioneering from other states and areas.

U.S. Department of Agriculture land retirement programs (e.g., CRP, ACR) are likely major determinants of duck production on private lands, but their importance to nesting ducks in Wisconsin is unknown. Wisconsin is participating in a Joint Venture of the North American Waterfowl Management Plan (NAWMP), and the Department is a major cooperator. The NAWMP requires use of a Mallard Management Model for evaluation, and directs the development of model parameters for our ecological subregion.

3. Issue Analysis: This investigation requires the use of radio telemetry to determine preferences and survival. The annual cost of using telemetry would approximate \$90,000, but this could be reduced by sharing equipment with other wildlife research studies. An alternative to conducting this study is to use model components from other regions of the country. Past research on public lands indicated that Wisconsin presents unique conditions for nesting ducks, making extrapolations from results in other states inappropriate.

Issues and Needs for the Budget; the Research Bureau is listed as a cooperator in this endeavor. The Wisconsin Plan for the Upper Mississippi River and Great Lakes Region Joint Venture of the NAWMP details these exact research needs for the plan's success.

LITERATURE CITED

- Amundson, T.E. 1985. Toxics in wildlife. *Wis. Nat. Resour.* 9(2):15-16.
- Andryck, T., T. Meier, L. Waskow, R. Gatti, and J. Bergquist. 1988. Wisconsin breeding duck populations, 1973-1988. *Wis. Dep. Nat Resour., Bur. Wildl. Manage. Adm. Rep.*, 14pp.
- Bacon, B.R. In press. Ground count transects as an index to wood duck numbers in Wisconsin. *Proc. 1988 North Amer. Wood Duck Symp.*
- Bahti, T. 1987. Green Bay West Shores Wildlife Area. Pages 44-45 in D.L. Sperling, ed. *Watchable Wildlife*. *Wis. Nat. Resour. Spec. Edition*, Madison. 71pp.
- Baldassarre, G.A. 1978. Ecological factors affecting waterfowl production on three man-made flowages in central Wisconsin. M.S. Thesis. Univ. Wis., Stevens Point. 124pp.
- Beatty, M.T., I.O. Hembre, F.D. Hole, L.R. Massie, and A.E. Peterson. 1964. The soils of Wisconsin. Pages 149-170 in H.R. Theobald and P.V. Robbins, eds. *Wisconsin Blue Book*. *Wis. Legislative Reference Bur.*, Madison. 900pp.
- Bellrose, F.C. 1976. Ducks, geese and swans of North America. Stackpole Books. Harrisburg, PA. 543pp.
- Bowers, E.F. 1977. Population dynamics and distribution of the wood duck (*Aix sponsa*) in eastern North America. Ph.D. Thesis. Louisiana State Univ., Baton Rouge. 273pp.
- Bruch, R. 1988. Draft: Winnebago Comprehensive Management Plan *Wis. Dep. Nat. Resour., Bur. Fisheries Manage.*, Oshkosh. 80pp.
- Cowardin, L.M. and D.H. Johnson. 1979. Mathematics and mallard management. *J. Wildl. Manage.* 43(1):18-35.
- Curtis, J.T. 1959. The vegetation of Wisconsin, an ordination of plant communities. *Univ. Wis. Press*, Madison. 657pp.
- Ermer, E.M. 1984. Analysis of benefits and management costs associated with beaver in western New York. *N.Y. Fish and Game J.* 31(2):119-132.
- Evrard, J. O. and R.A. Lillie. 1987. Duck and pheasant management in the pothole region of Wisconsin. *Interim Rep. Study No. 316*. *Wis. Dep. Nat. Resour.*, Madison. 114pp.
- Gambel, K. 1987. Waterfowl harvest and population survey data. *U.S. Fish and Wildl. Serv.*, Columbia, MO. 66pp.
- Gates, J.M. 1965. Duck nesting and production on Wisconsin farmlands. *J. Wildl. Manage.* 29(3):515-523.

- Gatti, R.C. 1987. Duck production: the Wisconsin picture. Wis. Dep. Nat. Resour. Findings No. 1. 4pp.
- Gatti, R.C. 1988. Trends in Wisconsin's spring duck surveys. Wis. Dep. Nat. Resour. Findings No. 10. 4pp.
- Gatti, J.O. Evrard, and W.J. Vander Zouwen. (In prep). Electric fencing for duck and pheasant production in Wisconsin. Wis. Dep. Nat. Resour. Tech. Bull.
- Green, W.E. 1984. The Great River Refuge. Pages 431-439 in A.S. Hawkins, R.C. Hanson, H.K. Nelson, and H.M. Reeves, eds. Flyways, Pioneering Waterfowl Management in North America. U.S. Fish and Wildl. Serv., Washington, D.C. 517pp.
- Gregg, L.E. 1988. Duck ecology in northern Wisconsin. Wis. Dep. Nat. Resour. Perf. Rep., Pittman-Robertson Proj. W-141-R Study No. 319. 7pp.
- Greenwood, R.J., A.B. Sargeant, D.H. Johnson, L.M. Cowardin, and T.L. Shaffer. 1987. Mallard nest success and recruitment in prairie Canada. Trans. N. Amer. Wildl. Nat. Resour. Conf. 52:298-309.
- Hahn, J.T. 1985. Timber resource of Wisconsin's Central Survey Unit, 1983. U.S. For. Serv. Res. Bull. NC-84. 88pp.
- Hansen, M.H. 1984. Timber resource of Wisconsin's Northeast Survey Unit, 1983. U.S. For. Serv. Res. Bull. NC-78. 88pp.
- Hoefler, J. 1987. Crex Meadows and Fish Lake Wildlife areas. pp 50-52 in D.L. Sperling, ed. Watchable Wildlife. Wis. Nat. Resour. Spec. Edition, Madison. 71pp.
- Hole, F.D. 1976. Soils of Wisconsin. Univ. Wis. Press, Madison. 351pp.
- Ishmael, W.E. 1987. Lake Michigan is alive with ducks. Wis. Nat. Resour. 11(1):27.
- Jahn, L.R. and R.A. Hunt. 1964. Duck and coot ecology and management in Wisconsin. Wis. Conserv. Dep. Tech. Bull. No. 33. 212pp.
- Kahl, R.B. 1985. Canvasback status and habitat management. Prog. Rep. Study No. 021. Pages 43-50 in Wildl. Res. Proj. Annu. Rep. 1985. Wis. Dep. Nat. Resour., Madison Vol 3. 447pp.
- Knudsen, G.J. 1962. Relationship of beaver to forests, trout, and wildlife in Wisconsin. Wis. Conserv. Dep. Tech. Bull. No. 25. 52pp.
- Lewelyn, M.T. and J. Christie. 1987. No "limited use" for Wisconsin's lakeshore. Wis. Nat. Resour. 11(1):18-19.
- Mann, G.E. 1955. Wetlands inventory of Wisconsin. U.S. Fish and Wildl. Serv., Minneapolis,

- MN. 33pp. (Multilith)
- March, J.R. and R.A. Hunt. 1978. Mallard population and harvest dynamics in Wisconsin. Wis. Dep. Nat. Resour. Tech. Bull. No. 106. 74pp.
- March, J.R., G.F. Martz, and R.A. Hunt. 1973. Breeding duck populations and habitat in Wisconsin. Wis. Dep. Nat. Resour. Tech. Bull. No. 68. 36pp.
- Martin, L. 1965. The physical geography of Wisconsin. Univ. Wis. Press, Madison. 608pp.
- McLaury, E.L. 1988. Wisconsin WPA acquisition plan (Rev. February 1988), Wisconsin Wetland Management District. U.S. Fish and Wildl. Serv., Madison. 6pp.
- Meier, T.I. 1987. Mead Wildlife Area: Berkhahn Flowage rookery. Page 61 in D.L. Sperling, ed. Watchable Wildlife. Wis. Nat. Resour. Spec. Edition, Madison. 71pp.
- Moran, D.F., Jr. 1985. Clean lakes and streams. Wis. Nat. Resour. 9(2):25-26.
- Moyle, J.B. 1956. Relationships between chemistry of Minnesota surface waters and wildlife management. J. Wildl. Manage. 20(3):303-320.
- Moyle, J.B. 1961. Aquatic invertebrates as related to larger water plants and waterfowl. Minn. Dep. Conserv. Invest. Rep. 233. 24pp.
- Mossman, M.J. and D.W. Sample. 1988. Grassland bird status, distribution, habitat preference, and response to management practices. Wis. Dep. Nat. Resour. Prog. Rep. Pittman-Robertson Proj. W-141-R Study No. 132. 8pp.
- Nelson, E.C. 1978. Ecological factors influencing waterfowl production on three impoundments in central Wisconsin. M.S. Thesis. Univ. Wis., Stevens Point. 118 pp.
- Panzner, E.R. 1957. Inventory of permanent water habitat significant to waterfowl in Wisconsin. U.S. Fish and Wildl. Serv., Minneapolis, MN. 6pp. (Multilith)
- Petersen, L.R. 1985. Strategic planning for private land management. Final Rep. Study No. 125. Pages 121-130 in Wildl. Res. Proj. Annu. Rep. 1985. Wis. Dep. Nat. Resour., Madison. Vol. 3. 447pp.
- Petersen, L.R., M.A. Martin, J.M. Cole, J.R. March, and C.M. Pils. 1982. Evaluation of waterfowl production areas in Wisconsin. Wis. Dep. Nat. Resour. Tech. Bull. No. 135. 32pp.
- Raile, G.K. 1985a. Timber resource of Wisconsin's Southwest Survey Unit. U.S. For. Serv. Resour. Bull. NC-87. 88pp.
- Raile, G.K. 1985b. Wisconsin forest statistics, 1983. U.S. For. Serv. Resour. Bull. NC-94. 113pp.

- Sanford, T.S. 1987. Necedah National Wildlife Refuge. Page 70 in L. D. Sperling, ed. Watchable Wildlife. Wis. Nat. Resour. Spec. Edition, Madison. 71pp.
- Shaw, S.P. and C.G. Fredine. 1956. Wetlands of the United States: their extent and their value to waterfowl and other wildlife. U.S. Fish and Wildl. Serv. Circ. No. 39. 67pp.
- Smith, W.B. 1984. Timber resource of Wisconsin's Northwest Survey Unit, 1983. U.S. For. Serv. Resour. Bull. NC-73. 97pp.
- Spencer, T.S., Jr. 1985. Timber resource of Wisconsin's Southeast Survey Unit, 1983. U.S. For. Serv. Resour. Bull. NC-86. 94pp.
- Stewart, R.E. and H.A. 1974. Breeding waterfowl populations in the prairie pothole region of North Dakota. Condor 76(1):70-79.
- Talent, L.G., R.L. Jarvis, and G.L. Krapu. 1983. Survival of mallard broods in south-central North Dakota. Condor 85:74-78.
- Vander Zouwen, W.J. and T.L. Peterson. 1985. Private lands habitat development for pheasants, ducks, and cottontails. Final Rep. Job No. 129.1. Pages 157-182 in Wildl. Res. Proj. Annu. Rep. 1985. Wis. Dep. Nat. Resour., Madison. Vol 3. 447pp
- Vanecek, F. 1987. Pershing Wildlife Area. Page 63 in L.D. Sperling, ed. Watchable Wildlife. Wis. Nat. Resour. Spec. Edition, Madison. 71pp.
- U.S. Fish and Wildlife Service. 1979. Breeding duck habitat in the Great Lakes Region, Category 11. U.S. Fish and Wildl. Serv., Twin Cities, MN. 52pp.
- U.S. Fish and Wildlife Service. 1985. Report of the waterfowl habitat strategy team. U.S. Fish and Wildl. Serv., Washington, D.C.
- U.S. Fish and Wildlife Service. 1988a. Concept plan for waterfowl habitat protection, prairie potholes and parklands (U.S. portion). U.S. Fish and Wildl. Serv., Denver, CO and Minneapolis, MN. 30pp.
- U.S. Fish and Wildlife Service. 1988b. Waterfowl habitat acquisition plan; prairie potholes and parklands (U.S. portion). U.S. Fish and Wildl. Serv., Denver, CO and Minneapolis, MN. 57pp.
- U.S. Fish and Wildlife Service. 1988c. Draft guidance documents for joint venture plans. U.S. Fish and Wildl. Serv., Twin Cities, MN. 10pp.
- U.S. Fish and Wildlife Service and Canadian Wildlife Service. 1986a. 1986 status of waterfowl and fall flight forecasts. U.S. Fish and Wildl. Serv., Washington, D.C. 36pp.
- U.S. Fish and Wildlife Service and Canadian Wildlife Service. 1986b. North American

- waterfowl management plan: a strategy for cooperation. U.S. Fish and Wildl. Serv., Washington, D.C. 19pp.
- U.S. Fish and Wildlife Service and Canadian Wildlife Service. 1988. 1988 status of waterfowl and fall flight forecasts. U.S. Fish and Wildl. Serv., Washington, D.C. 37pp.
- Weitz, D. 1987. Coulee country wildlife. pp 24-27 in L.D. Sperling, ed. Watchable Wildlife. Wis. Nat. Resour. Spec. Edition, Madison. 71pp.
- Wheeler, W.E. and J.R. March. 1979. Characteristics of scattered wetlands in relation to duck production in southeastern Wisconsin. Wis. Dep. Nat. Resour. Tech. Bull No. 116. 61pp.
- Wheeler, W.E., R.C. Gatti and G.A. Bartelt. 1984. Duck breeding ecology and harvest characteristics on Grand River Marsh Wildlife Area. Wis. Dep. Nat. Resour. Tech. Bull. No. 145. 49pp.
- Wisconsin Wetlands Inventory. 1978-82. Wis. Dep. Nat. Resour., Madison.
- Wydeven, A.P. 1987. The Navarino Wildlife Area. pp 66-67 in L.D. Sperling, ed. Watchable Wildlife. Wis. Nat. Resour. Spec. Edition, Madison. 71pp.

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