Minnesota Department of Natural Resources

Long Range Duck Recovery Plan

Approved April 21, 2006

Minnesota Duck Plan

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Preface

Minnesota's diversity of landscapes and wildlife are important reasons why we call this state home. The state's 87,000 square miles are stretched over a frame roughly 400 miles long and 350 miles wide. From the "bald" prairies to majestic pines, the one constant is the surface water that covers nearly a fifth of the state.

Minnesota's waterfowl resource is diverse as well. From the diminutive blue-winged teal to the majestic trumpeter swan, more than a dozen species nest in the state. Nearly 30 species of waterfowl are regular migrants during spring or fall. This diversity challenges our ability to maintain waterfowl and our waterfowling heritage into the 21st century.

Waterfowl are an important part of Minnesota's natural and cultural heritage. Despite substantial losses in the quantity and quality of waterfowl habitat, Minnesota remains one of the most important production and harvest states in the Mississippi Flyway. Waterfowling traditions reach back to the 19th century and continue to be an important feature of Minnesota's outdoor heritage. Trip and equipment expenditures by Minnesota waterfowl hunters and watchers in 2001 totaled more than $224 million and generated more than $20 million in state tax receipts.

No other Mississippi Flyway state has the waterfowl production potential of Minnesota. Based on wetland resources, it is very likely that under presettlement conditions our state overshadowed both North and South Dakota in waterfowl production. The abundant habitat that supported breeding populations also provided an attractive and beneficial source of food and rest for migrating birds.

This plan identifies challenges and suggests strategies that the Department of Natural Resources (DNR) and its conservation partners feel will move us in the right direction. It is not a panacea nor does it suggest a quick fix. However, it reflects and builds on the knowledge and experience of seasoned professionals and ardent conservationists from many agencies and organizations. As the biennial targets illustrate, this plan is also connected in many ways to other conservation efforts.

Those familiar with our 2001 plan, *Restoring Minnesota's Wetland and Waterfowl Hunting Heritage* will note many familiar themes as well as some differences. This plan focuses specifically on ducks and related issues. The strategies identified are more explicit in identifying population goals and the habitat required to succeed. Like the previous plan, however, this effort will be subject to revisions and adjustment every few years to reflect our improved knowledge and changing world.

On the horizon are potentially dramatic shifts in energy production affecting agriculture and land use. Our planning strategies will need to adapt to new realities by clearly identifying both challenges and opportunities as the need arises.

Executive Summary

Minnesota Department of Natural Resources
Duck Recovery Plan

Strategic Vision

By 2056, Minnesota's landscape will support a productive spring breeding population of ducks averaging 1 million birds. The landscape necessary to support this population will also provide spring and fall migration habitat attracting abundant migrant waterfowl, 140,000 waterfowl hunters and 600,000 waterfowl watchers.

Goal

Recover historical breeding and migrating populations of ducks in Minnesota for their ecological, recreational, and economic importance to the citizens of the state. Progress towards this goal will be measured by the following long-term objectives: 1) A breeding population of 1 million ducks producing a fall population of 1.4 million ducks. 2) A fall duck harvest that is 16% or more of the Mississippi Flyway harvest. 3) An average of 140,000 waterfowl hunters and 600,000 waterfowl watchers.

Breeding Population Objective

Target: By 2056, restore a productive breeding population of ducks averaging 1 million birds that will produce a fall population of 1.4 million ducks from Minnesota (Figure 1). Achieving this fall population will require an annual mallard recruitment rate of 0.6, or an average of 0.6 new hens added to the fall population for each existing adult hen.

Current Conditions: The average breeding population of ducks in Minnesota since the May surveys started (1968-2005) is 630,000 birds. The average mallard recruitment rate since it was first available (1987-2005) is 0.43. The average recruitment rate needed to maintain a stable mallard population is 0.49. Minnesota has met or exceeded that level 8 out of the last 19 years (Figure 2).

Primary Strategy: The primary strategy is the restoration and protection of 2 million additional acres (30% wetland, 70% grassland) of habitat in wetland/grassland habitat complexes. Assuming no net loss of our existing habitat base, we will need to protect and restore an average of approximately 40,000 additional

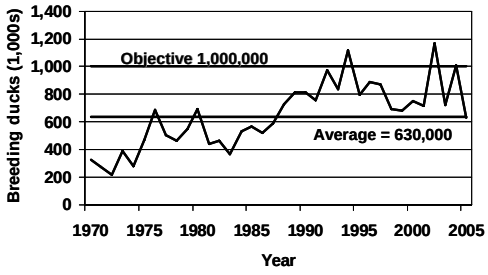

Figure 1. Minnesota Duck Breeding Populations, 1970-2005 based on May aerial surveys.

habitat acres a year to achieve the breeding population objective.

The strategy will initially focus on current acquisition and easement programs employed by state and federal agencies, including the federal farm program, as well as conservation organizations. Nearly 60% of the protected habitat will remain in private ownership under long-term or perpetual agreements. Although 40% of the protected habitat will be under federal or state ownership, the projected increase in current statewide public land ownership will be less than 2%.

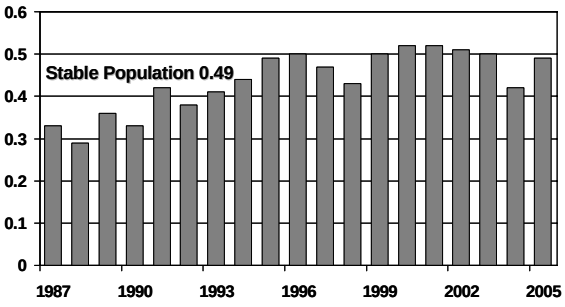

Figure 2. Mallard recruitment rate 1987 – 2005 for the prairie pothole region of Minnesota. Planned target is 0.6 which should produce an overall fall population of 1.4 million ducks. Data from U.S. Fish and Wildlife Service Habitat and Population Evaluation Team.

Breeding duck numbers are driven primarily by wetland abundance. Productivity of breeding ducks is driven primarily by grassland abundance. The best waterfowl production habitat occurs within prairie habitat complexes 4–9 square miles in size where at least 20% of the area is wetland and 40% is grassland. At least one-half of the wetland acreage should be temporary or seasonal basins and ideally each complex will include one shallow lake over 50 acres. One-half of the grasslands should be under long-term protection.

Measurement: The breeding population will continue to be tracked through our traditional May waterfowl breeding surveys. Productivity will be measured using established scientific models for the mallard to estimate recruitment based on waterfowl and habitat surveys. The target recruitment rate is 0.6, or an average of 0.6 new hens added to the fall population for each existing adult hen. That recruitment should produce a fall population of 1.4 million ducks from Minnesota.

Cost: The total cost for land protection in today's dollars will be approximately $3 billion. The cost of habitat restoration on that land will exceed $550 million and $2 million will be required annually to maintain habitat quality. Achieving the protection and restoration of proposed acres will cost an average of $64 million per year.

Migration Objective

Target: By 2056, restore and maintain a fall duck harvest that is 16% or more of the Mississippi Flyway harvest to reflect the recovery Minnesota's importance to spring and fall duck migration.

Current Conditions: The most recent 10 year average (1995-2004) for duck harvest in Minnesota has been approximately12.3% of the flyway harvest (Figure 3). The federal Harvest Information Program was established during this period so the average reflects a

combination of federal and state estimates. Future measurements will use only the federal estimates.

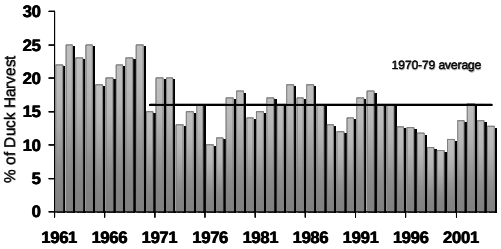

Figure 3. Minnesota's portion of the Mississippi Flyway duck harvest 1961-04. The 1970-79 average of 16% is the planned target.

Primary Strategy: The primary strategy is the protection, enhancement, and ongoing management of 1800 shallow lakes across Minnesota, although the wetland portion of the breeding population strategy will benefit migration use as well, particularly in spring. Methods of lake protection will include local ordinances, acquisition, and formal designation for wildlife management. Management will include lake outlet management, fish removal, surface use restrictions, and watershed restoration. An average of 29 additional lakes a year will need improved protection and/or management in order to achieve the target of managed lakes.

A separate statewide shallow lake planning effort is underway that will specify opportunities to increase habitat evaluation, reduce the impact of invasive plant and fish species, work with local units of government to increase shoreline protection, and resolve competing interests such as fish rearing.

The quality of migration habitat has been severely impacted by degraded watersheds, nonpoint sources of pollution, altered lake outlets, and undesirable species of fish. Data from the Minnesota Pollution Control Agency suggests that nearly two-thirds of the prairie region shallow lakes have poor water clarity and consequently poor conditions for submerged aquatic plants and invertebrates, the primary sources of food for migrating and breeding ducks. Approximately 350 shallow lakes (50 acres and larger) are currently managed for wildlife benefits. Only 39 of these lakes have been formally designated for wildlife management.

Measurement: The migration objective will be measured initially using the proportion of Mississippi Flyway duck harvest by hunters in Minnesota as an index to spring and fall migration use. Maintaining or exceeding an average of 16% of the total flyway harvest occurring in Minnesota based on federal Harvest Information Program (HIP) will be considered meeting the objective. The 16% reflects the 1970s average during the base years used to establishment of waterfowl population objectives in the North American Waterfowl Management Plan.

Costs: Expanding this effort to 1800 lakes will require approximately $150 million in development costs and $1.5 million in additional annual habitat management. This equates to an average expenditure of $3 million per year.

Recreation Objective

Target: An average of 140,000 waterfowl hunters and 600,000 waterfowl watchers will enjoy high quality duck hunting and viewing opportunities in Minnesota by 2056.

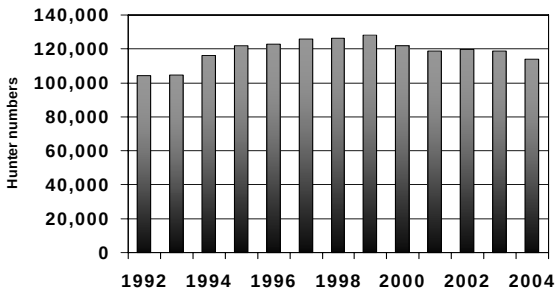

Figure 4. Recent waterfowl hunter numbers. Minnesota consistently ranks among the highest states in the nation.

Current Conditions: Minnesota waterfowl hunter numbers have remained relatively stable over the last decade. However, the number declined in 2004 and again in 2005 when approximately 100,000 state waterfowl stamps were sold (Figure 4). There are ongoing special efforts by conservation organizations and agencies to introduce young people to waterfowling. Like most types of hunting, participation in waterfowling begins to decline after 40 years of age. An U. S. Fish and Wildlife Service survey in 2001 found over 400,000 wildlife watchers listed waterfowl as their primary focus.

While the overall Minnesota hunting satisfaction rate (all types combined) has been 80 – 90% over the last decade, nearly 25% of the duck hunters have indicated dissatisfaction with their general hunting experience. A 2005 national survey found 32% of the duck hunters were dissatisfied with their most recent hunting season.

Primary Strategy: The habitat strategies for breeding population and migration objectives are also the most important strategies to improve the quantity and quality of duck hunting and viewing opportunities in Minnesota. In addition, current programs to introduce youth to waterfowling will continue to be encouraged and supported. A better understanding of hunting desertion rates by older hunters will be important for all types of hunting in the state.

Measurement: Numbers of waterfowl watchers will be measured by the National Survey of Fishing, Hunting, and Wildlife Associated Recreation survey conducted by the U. S. Fish and Wildlife Service every 10 years. Hunter numbers will be measured by federal HIP and state small game hunter surveys. Hunter satisfaction will be measured through periodic mail questionnaire surveys of waterfowl hunters.

Costs: Costs beyond those previously identified for the population and migration objectives are projected to remain relatively stable over time.

Minnesota Department of Natural Resources
Duck Recovery Plan

A Strategic Vision for Minnesota

By 2056, Minnesota's landscape will support a productive spring breeding population of ducks averaging 1 million birds. The landscape necessary to support this population will also provide spring and fall migration habitat attracting abundant migrant waterfowl, 140,000 waterfowl hunters and 600,000 waterfowl watchers.

The Importance of Waterfowl in Minnesota

Waterfowl are an integral part of Minnesota's natural and cultural heritage. Waterfowling traditions reach back to the 19th century and continue to be an important feature of Minnesota's outdoor heritage. Despite substantial losses in the quantity and quality of waterfowl habitat, Minnesota remains one of the most important production and harvest states in the Mississippi Flyway. Minnesota typically fields well over 100,000 waterfowl hunters and 400,000 waterfowl watchers a year, one of the highest in the nation. Annual trip and equipment expenditures by these enthusiasts in 2001 totaled more than $224 million and generated more than $20 million in state tax receipts.

Waterfowl in general, and ducks in particular, are also important indicators of environmental quality. The decline in quantity and quality of wetlands and shallow lakes in Minnesota correspond to an overall decline in water quality. These changes are reflected in turn by the health of our duck populations and the quality of related recreational activities, particularly hunting. Concern over duck hunting opportunities has fueled public interest in the quantity and quality of Minnesota's waters.

As international migrants, Minnesota ducks have far reaching implications. Minnesota is a member of the Mississippi Flyway Council along with 13 other states and 3 Canadian provinces. Of the four flyways established in North America, the Mississippi Flyway is the most important in duck migration, harvest and number of hunters.

In recognition of the international importance of waterfowl, the North American Waterfowl Management Plan set continental population goals and identified priority strategies to reach them. The strength of the plan has been the international agreements between the Unites States, Canada and Mexico as well as the partnerships brought together through 18 habitat-based joint ventures that target the most important waterfowl areas on the North American continent.

The Mississippi Flyway includes 5 U. S. and 3 Canadian habitat joint ventures. Minnesota is a member of two of these important efforts (Figure 5): 1) the Prairie Pothole Joint Venture (PPJV) which also includes portions of North and South Dakota, Montana, and Iowa; and 2) the Upper Mississippi River and Great Lakes Region Joint Venture (UMR/GLJV) which also includes Wisconsin, Michigan, and portions of Ohio, Indiana, Illinois, Iowa, Missouri, Nebraska and Kansas. These joint ventures will often be referenced in the following text.

Figure 5. Minnesota is included in two North American waterfowl Plan Joint Ventures.

The Challenge

Duck Breeding Populations

Importance of Wetlands: The number of breeding ducks attracted to the PPJV portion of Minnesota in spring is driven primarily by the abundance of wetlands. A combination of temporary, seasonal, semipermanent and permanent wetland types located in complexes four to nine square miles in size provide the most productive breeding habitat. Ideally, temporary (surface water for a few days to a few weeks) and seasonal (surface water for a few weeks to a few months) wetlands should make up one half of the wetland acreage.

Temporary and seasonal wetlands are critically important during the breeding season because they provide abundant invertebrates (Figure 6). More permanent wetlands and shallow lakes become increasingly important in summer and fall, although high quality basins are also critical to migrating Lesser Scaup in spring.

Although habitat complexes in the UMR/GLJV portion of Minnesota are less well understood than their counterparts on the prairie, it is likely that shallow wetland habitat remains an important unifying theme. Wetlands in this region tend to be more permanent although seasonal wetlands still play an important role.

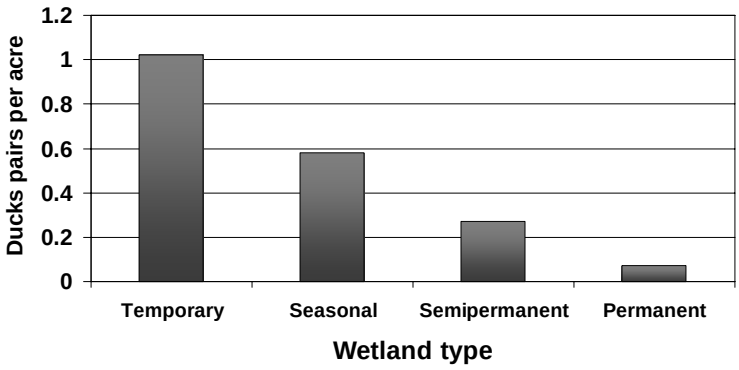

Figure 6. Predicted number of breeding duck pairs per acre based on wetland type.

Wild rice lakes, slow moving streams, shallow areas of deeper lakes, and vernal ponds (temporary and seasonal wetlands within forests) are important habitat components for waterfowl.

Wetland losses: Minnesota has lost more than 90% of its prairie wetlands. While Minnesota's prairie wetland acreage exceeded the combined total found in North and South Dakota in pre-settlement times, Minnesota had less than either state by 1980. Temporary and seasonal wetlands have suffered the greatest losses. This vast wetland base provided habitat for between 4 and 5 million breeding ducks.

Although overall wetland habitat losses have been much less severe in the UMR/GLJV, some southern counties have lost over 90% of their wetlands to agricultural and urban development. Even areas with most wetlands intact face many issues concerning wetland habitat quality and outright loss due to human development. Dams, roads, housing, channelization, shoreline alteration, aquatic vegetation removal and increased watercraft use have all taken a toll on the quantity and quality of wetland habitat.

Although Minnesota has one of the strongest wetland protection statutes in the nation, many temporary and seasonal wetlands remain unprotected. In addition, federal wetland protection laws have been weakened by recent case law and continue to be challenged in court. The limited legal protection, as well as ignorance on the part of some citizens, has resulted in the continuing loss of wetlands. Increased detection efforts through aerial reconnaissance by DNR conservation officers are helping improve compliance with existing regulations.

Some wetland losses are offset by mitigation and wetland restorations completed through various conservation programs. The determination of no net loss of wetland quantity and quality, however, continues to be debated and cannot be resolved without a concerted effort to collect additional information. The DNR, Pollution Control Agency, and Board of Water and Soil Resources, in cooperation with the U. S. Fish and Wildlife Service, has developed a pilot effort to make this assessment possible with funding from the U. S. Environmental Protection Agency and state appropriations.

Loss of Wetland Quality: Remaining seasonal wetlands have often been degraded by invasive species such as hybrid cattail, purple loosestrife, and reed canary grass. Excessive runoff and undesirable fish such as carp have degraded permanent wetland basins and shallow lakes. Research by the DNR's Wetland Wildlife Research Group has clearly documented poor habitat quality in basins with high densities of even some native fish such as black bullheads and fathead minnows.

Increases in nutrients, higher water levels, suspension of bottom sediments, algae blooms and shoreline disturbance have combined to eliminate aquatic plants and accompanying populations of invertebrates in many basins. Nearly two-thirds of the shallow prairie lakes surveyed by the Minnesota Pollution Control Agency have impaired water clarity (Figure 7).

Duck Production

Importance of Grasslands: Minnesota's most abundant breeding ducks, such as mallards and blue-winged teal, nest in upland grasses as far as a mile from water. The most important factors affecting mallard populations within the PPJV and the UMR/GLJV are nest success, hen survival during the nesting season, and brood survival (Figure 8). The nesting season is unquestionably the most dangerous time of the year for hens.

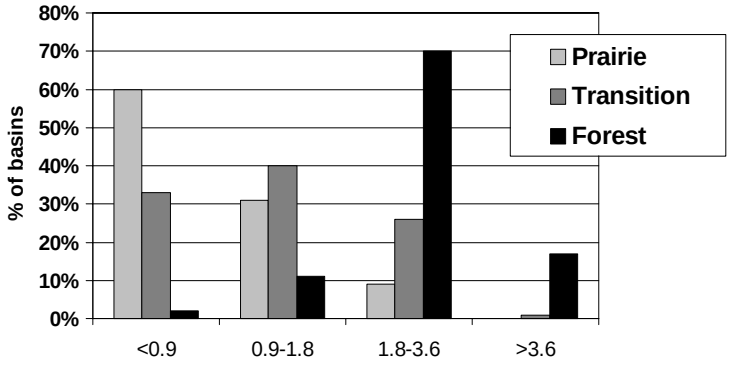

Figure 7. Water clarity is an important indicator of wetland and shallow lake quality. Shallow lakes in the prairie region of Minnesota have had the greatest loss of clarity. Adapted from PCA data.

The most important factor affecting nest success and hen survival in the PPJV is predation related to insufficient acreages of upland grass and an altered predator community. Striped skunks, raccoons, and fox are the most important ground nest predators. Some ducks, especially mallards, have strong renesting instincts when their nest is destroyed before hatching. Unfortunately, nest predators such as the red fox are effective in taking the hen as well as the nest.

Native prairie grasslands once totaled more than 18 million acres in Minnesota. Less than 1% (150,000 acres) remains today. In recent years, the Conservation Reserve Program (CRP) has provided temporary protection for about 1.7 million acres of grass within Minnesota. Over 90% of that acreage occurs within the PPJV. However, maintaining the wildlife benefits of CRP faces continuing challenges over future funding and payment rates. In 2007, nearly 400,000 acres of CRP contracts will expire in Minnesota.

Waterfowl production is often defined by recruitment rate, that is, how many hens are added to the fall population for each hen in the spring population. Mallards require a recruitment rate of 0.49 to maintain a stable population. According to the U. S. Fish and Wildlife Service, Minnesota has met or exceeded that recruitment rate in the PPJV only 8 of the last 19 years.

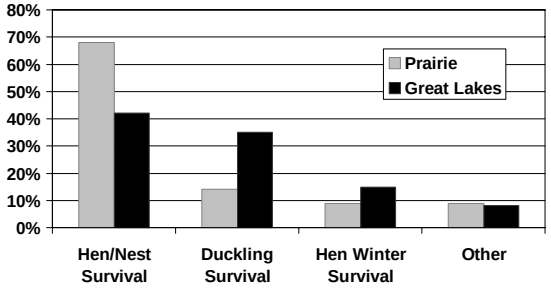

Figure 8. Importance of factors limiting prairie region and Great Lakes region mallard populations. Adapted from Yerkes, Ducks Unlimited, May/June 2005.

Duck nest success can surpass the critical threshold necessary to increase populations by increasing the amount of grass in the landscape. Quality wetland/grassland complexes in Minnesota

should have at least 20% of their area in protected permanent grassland and a total of 40% grassy cover of all types. Invading trees that provide perches for crows, hawks, and owls can compromise the nesting quality of the grassy areas.

Other Nesting Habitat: Nest success and hen survival in the UMR/GLJV area of the state depends on safe nesting habitat as well. Within forested areas, shoreline development, invasion of shoreline sedge meadows by willow and hybrid cattail, obstructed outlets of wild rice lakes, and loss of suitable trees for cavity nesting ducks all reduce secure nesting opportunities for ring-necked ducks, wood ducks, hooded mergansers and goldeneyes. Over the last 20 years development has increased by over 500% in Minnesota's lake country, the heart of the UMR/GLJV. More than 10% of the "lake homes" are on shallow, non-fishing lakes. Studies have found an average of a 66% reduction in aquatic vegetation along developed shorelines. Counties within the UMR/GLJV are also expected to receive the brunt of a 27% increase in Minnesota's population over the next 25 years.

Although portions of the PPJV support cavity nesting wood ducks and hooded mergansers, this habitat is especially important in the UMR/GLJV. While trees as small as 12 inches in diameter can provide cavities, trees over 24 inches in diameter are preferred by cavity nesting ducks. For example, aspen over 20 inches in diameter produces cavities at 5 times the rate of trees 11-20 inches in diameter.

Aspen, maple, and basswood are the most important tree species for cavity nesting ducks in Minnesota. Larger trees within a half-mile of brood water should be encouraged with old growth and extended rotation forest management. When feasible, extended rotation management should be considered within a mile of important wild rice lakes.

Nest Predators: Predator management has received considerable attention from waterfowl managers over the years. At the heart of this issue is the altered landscape across the prairie pothole region. Conversion of grassland to cropland, lack of fire to invigorate existing prairie, encroachment of trees, an altered predator community, and the increase of denning sites in manmade structures have all contributed to an expanded distribution of nest predators and reduced security for nesting hens.

At the same time, the DNR recognizes that the most prominent ground nest predators are also valuable furbearers that are an important part of the wildlife community. The DNR has a mandate to properly manage these furbearers along with other wildlife for their use and appreciation by our citizens. Any predator management program must be biologically effective and supported by the public.

Predator management falls into two general categories. The first is best described as predator abatement techniques. As previously discussed, duck nest success can surpass the critical threshold necessary to increase populations by increasing the amount of grass in the landscape. Quality wetland complexes in Minnesota should have at least 20% of their area in protected permanent grassland and a total of 40% grassy cover of all types.

Another abatement technique is the use of artificial nesting structures designed to prevent predator access to nests. Wood duck houses and overwater nesting structures for mallards are examples of this effort. Numerous studies have shown that these structures are effective in improving nest success when they are properly designed and placed. Although not a panacea for overall duck production, they can make a fairly dramatic difference in enhancing local populations. Their continued effectiveness depends on annual maintenance.

The second general category of predator management involves the direct removal of one or more predator species. Research has shown that the effectiveness of removal is directly correlated with the timing and the intensity of the removal effort. Work conducted by the Mid-Continent Waterfowl Research Project in Minnesota during the 1980s combined the use of fenced exclosures with predator removal. While successful, the effort was expensive and labor intensive. Some of this work has continued by the U. S. Fish and Wildlife Service.

Research was also conducted by the Mid-Continent research group on predator removal across broader areas that proved much less effective. However, recent predator removal efforts have been effective at doubling duck nest success on 36 square mile blocks in North Dakota. This work was conducted by Delta Waterfowl in cooperation with the U.S. Fish and Wildlife Service. Large block trapping in Minnesota may be considered as a future management action pending research to test its effectiveness in Minnesota landscapes.

In 2002, the DNR, U. S. Fish and Wildlife Service, and the Minnesota Waterfowl Association convened a two-day workshop on predator management that reviewed the pros and cons of different management approaches. Following the workshop, DNR expressed a willingness to consider support of limited efforts to remove predators where landscape features, such as islands, provide potential predator exclusions. Proposals must demonstrate that the removal will have a high probability of enhancing nest success while minimizing negative effects on furbearer populations. Other selection criteria include cost benefit and environmental impact.

Duckling Survival: Brood survival is dependent on quality habitat as well. Emergent aquatic plants such as rushes, wild rice and rooted common cattail provide protective cover from weather and predators. Abundant aquatic invertebrates are critical for growth. An abundance of invertebrates reduces the time ducklings spend foraging, which increases their survival rates.. As stated earlier, the quality of wetlands and shallow lakes providing brood habitat has dramatically declined due to a combination of factors including high water and channelization that favor winter survival of undesirable fish. These fish reduce the invertebrates and aquatic plants necessary for brood survival.

Preliminary research indicates that brood survival may be more important in the UMR/GLJV than in the PPJV. This may be related to the abundant duckling predators found in this region. Herons, loons, gulls, large predator fish, snapping turtles and furbearers all prey on vulnerable ducklings.

Fall Migration

Habitat Quality: Ducks are driven by their need for food and rest during fall migration. Temporary and seasonal wetlands sometimes fill these needs for dabbling ducks during extremely wet falls, particularly within the PPJV. Typically though, it is the larger, more permanent wetlands and shallow lakes that provide the most important fall habitat. Unfortunately, in Minnesota, the quality of this wetland habitat has declined markedly due to shoreline development, drainage, excessive runoff, sedimentation, and invasive plant and fish species.

The worst damage is within the PPJV and southern portions of the UMR/GLJV. Restoration of wetland and grassland complexes within the watersheds of these lakes will help reduce excessive runoff and improve water quality, but will not resolve in-lake degradation problems caused by undesirable fish.

Invasive Fish: Invasive fish, particularly carp, pose a serious challenge to maintaining water quality, desirable aquatic plants and invertebrates. Problems with common carp date back to the 1940s and are generally limited to the southern half of the state. Potential problems with four new species of Asian carp are at our doorstep via the Mississippi River. These fish species were introduced in southern states to aid aquaculture and escaped into the wild. Their combined impact on invertebrates and aquatic vegetation could be devastating to Minnesota's aquatic habitat.

Water quality issues in wetlands and shallow lakes have also been linked to high densities of fathead minnows and black bullheads. Continuing research has led to a better understanding of the intricacies of these important habitats, although much remains to be learned.

Watershed alterations have created aquatic pathways for fish into previously isolated basins in agricultural and urban environments. Drainage into and out of wetlands has been acerbated by the high water levels of the 1990s. Increased fish passage and reduced winterkill due to high water and warm winters has created a nearly perfect storm of degradation related to dense populations of undesirable fish.

Fish Rearing: Loss of wetland quantity and quality has created a scarcity of basins, resulting in competition for remaining wetlands and shallow lakes. Two of these uses are fish rearing for the bait industry and game fish stocking in lakes. The bait industry is an important economic activity in Minnesota and the state legislature has required the DNR to support the industry. The legislature has also been pressed by anglers to strongly encourage increased levels of walleye stocking. The fingerlings to support these stockings are raised in natural wetlands and shallow lake basins. More than 2,000 wetlands and shallow lakes are currently approved for fish rearing activities.

Recent concerns over the impact of fish rearing has led to additional research by the DNR and increased interest by the legislature. As a result, the DNR has proposed a moratorium

on the use of additional basins for fish rearing until ecological criteria can be established to measure the impact of rearing activities on individual wetlands and shallow lakes.

Wild Rice: Minnesota has more natural wild rice than any other state in the nation. Wild rice stands provide important brood and migration habitat for ducks in the UMR/GLJV and eastern portions of the PPJV. Too often these stands have deteriorated due to high water caused by lake outlet blockages by beaver dams and other obstructions. Managing wild rice remains an ongoing challenge for the DNR. In recent years, Ducks Unlimited and tribal governments have been important partners in these efforts. Over 170 lakes are actively managed for wild rice.

Wild rice lakes are also susceptible to damage by shoreline development. Over the last 20 years, development has increased by over 500% in Minnesota's lake country, the heart of the wild rice habitat. More than 10% of the "lake homes" are on shallow, non-fishing lakes that often have significant stands of wild rice. Studies have found an average of 66% loss of aquatic vegetation along developed shorelines. Counties within the UMR/GLJV are also expected to receive the brunt of a 27% increase in Minnesota's population over the next 25 years.

Disturbance: Increased disturbance on traditional migration areas has reduced the number of lakes providing rest opportunities for migrant ducks. Without opportunities to rest undisturbed, these birds move through the state quickly. Disturbance from watercraft often accompanies increasing human populations and shoreline development. The DNR recently completed a statewide survey of refuges and rest areas and found significant gaps in the statewide quantity and quality of sites available to migrating flocks. Although the process for establishing refuges and rest areas differs by ownership and type, it is usually dependent on citizen initiation and support.

Three levels of protection from disturbance are possible through Minnesota statutes. Restrictions on motorized watercraft are possible through the designation of Feeding and Resting Areas or in some cases through designation of lakes for wildlife management. Restrictions on hunting are generally accomplished through State game refuges. Restrictions on all activities are possible through the designation of Wildlife Sanctuaries. This last option is usually only available on publicly owned land.

Waterfowl Hunting

Harvest: Minnesota is traditionally one of the highest waterfowl harvest states in the nation. Minnesota hunters averaged over 16% of the Mississippi Flyway harvest of ducks during the 1970s. However, while duck harvest in the Flyway and United States climbed towards near record highs during the 1990s, Minnesota's harvest was stable or declined. The greatest decline occurred in the forested area of the UMR/GLJV.

Over two-thirds of Minnesota's duck harvest comes from migrating birds. Mallards, wood ducks, ring-necked ducks, blue-winged and green-winged teal are our most harvested species (Figure 9). Mallards typically account for about a third of our harvested ducks. Nearly one-half of Minnesota's duck harvest occurs during the first 10 days of the season (Figure 10).

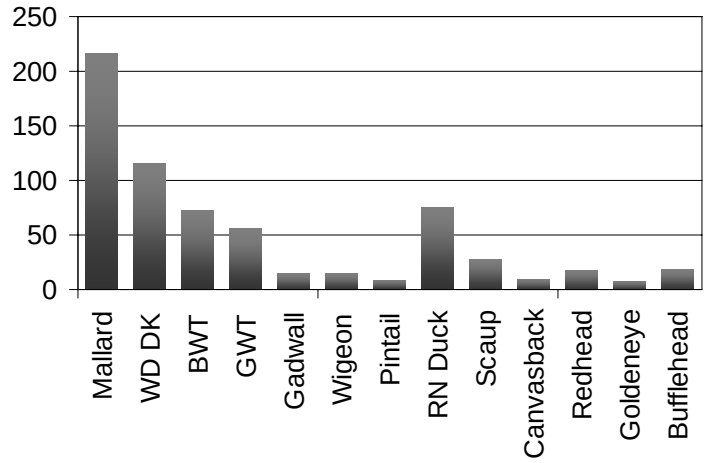

Figure 9. Minnesota's average duck harvest by species 1996-2000. Mallard, wood duck, ring-necked duck, blue-wing teal, and green-winged teal dominate the harvest.

Regulations: Waterfowl hunting regulations are established each year through a cooperative process involving the U.S. Fish and Wildlife Service, states, flyway councils and the general public. The role of the U.S. Fish and Wildlife Service is to establish waterfowl hunting season frameworks (overall season length, bag limit, earliest and latest hunting dates) in each of the 4 flyways. Because of differences in migration patterns, waterfowl abundance, and hunter activity, frameworks are specific to each flyway. States in turn are required to follow these frameworks when establishing their waterfowl seasons.

Wildlife managers in Minnesota must consider additional factors such as the status of Minnesota's local breeding population. Typically, resident ducks can account for up to one-third of the ducks harvested in the state in any given year. Other important factors to consider are the number of duck hunters in the state and the overall duck harvest that might be expected.

Minnesota has employed special regulations such as early season restrictions on motorized decoys and hunting later than 4 pm.

Coupled with season length and bag limit restrictions, this package of regulation options has protected local duck breeding populations but also provided reasonable duck harvests and opportunities for Minnesota duck hunters through wet and dry cycles

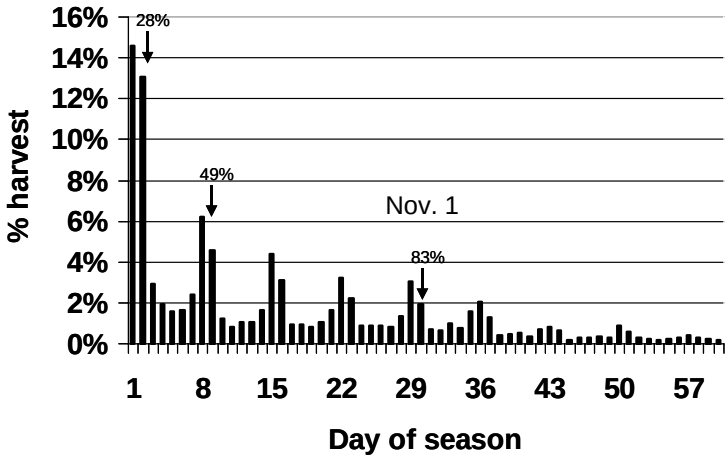

Figure 10. Tabulating the average daily total duck harvest from 1997-2003 (60 day seasons) illustrates the magnitude of the duck harvest during the first 10 days of the hunting season.

for the past few decades. Regulations alone, however, should not be thought of as the primary mechanism or tool used to try and stabilize or increase breeding populations of ducks.

For example, reductions in daily bag limits from 6 ducks/day to 4 ducks/day would likely only decrease total annual harvest in Minnesota by about 5%. Reductions in season length have more impact on reducing harvest. However, because much (about 50%) of the annual duck harvest occurs during the first 2 weekends of the season, reductions in overall season length have to be substantial in order to record large changes in total annual harvest. However, changes in bag limits or season lengths often reduce hunter numbers, which results in reduced harvest. Thus, both season length and bag limit remain important tools for waterfowl managers.

Hunter Numbers and Satisfaction: While Minnesota waterfowl hunter numbers have remained relatively stable over the last decade, the number declined in 2004 and again in 2005 when approximately 100,000 state waterfowl stamps were sold. There are ongoing special efforts by conservation organizations and agencies to introduce young people to waterfowling. These efforts include one-day events, summer camps, and special hunting opportunities within refuges or on "Youth Day". Like most types of hunting, participation in waterfowling begins to decline after 40 years of age.

Hunting satisfaction includes many variables. In the 2000 DNR survey of Minnesota waterfowl hunters, those surveyed cited enjoying nature and the outdoors, good behavior of other hunters, no crowding, seeing lots of waterfowl, and camaraderie as the most important elements leading to satisfaction. Skill development, equipment use, hunting dogs, access to public areas, long hunting seasons, and access to hunting information were also important.

While the overall Minnesota hunting satisfaction rate (all types combined) has been 80 – 90% over the last decade, nearly 25% of the duck hunters have indicated dissatisfaction with their general hunting experience. Nearly half, about 44%, were dissatisfied with the number of ducks harvested and about half of the duck hunters (51%) indicated that their satisfaction had decreased over the last three years. A 2005 national survey found 32% of the duck hunters were dissatisfied with their most recent hunting season.

Declines in waterfowl habitat quantity and quality directly affect waterfowl hunting opportunities. Places to hunt and waterfowl to see are critical elements leading to satisfaction. Restoring and protecting the habitat needed by breeding and migrating ducks are obviously beneficial for hunters as well. Access to some hunting areas can be physically challenging for any hunter and impossible for those challenged by age or physical ability. Balancing the issue of increased disturbance with appropriate access will be a challenge for the DNR, particularly as the population ages.

Minnesota Duck Recovery Plan

Goal

Recover historical breeding and migrating populations of ducks in Minnesota for their ecological, recreational, and economic importance to the citizens of the state. Progress towards this goal will be measured by the following long-term objectives: 1) A breeding population of 1 million ducks producing a fall population of 1.4 million ducks. 2) A fall duck harvest that is 16% or more of the Mississippi Flyway harvest. 3) An average of 140,000 waterfowl hunters and 600,000 waterfowl watchers.

Breeding Population Objective

Target: By 2056, restore a productive breeding population of ducks averaging 1 million birds that will produce a fall population of 1.4 million ducks from Minnesota. Achieving this fall population will require an annual mallard recruitment rate of 0.6, or an average of 0.6 new hens added to the fall population for each existing adult hen.

Current Conditions: The average breeding population of ducks in Minnesota since the May surveys started (1968-2005) is 630,000 birds. The average mallard recruitment rate since it was first available (1987-2005) is 0.43. The average recruitment rate needed to maintain a stable mallard population is 0.49. Minnesota has met or exceeded that level only 8 out of the last 19 years.

Primary Strategy: The primary strategy is to target the restoration and protection of 2 million additional acres (30% wetland, 70% grassland) of habitat in wetland/grassland complexes (Figure 11). Most of this additional habitat (85%) will be restored and protected within the PPJV region of Minnesota.

The strategy will initially focus on current acquisition and easement programs employed by state and federal agencies, including the federal farm program, as well as conservation organizations. Nearly 60% of the protected habitat will remain in private ownership under long-term or perpetual agreements (Figure 12). Although 40% of the protected habitat will be under federal or state ownership, the projected increase in current statewide public land

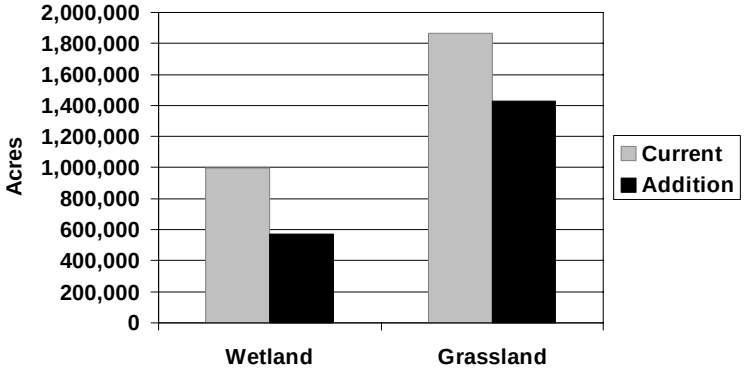

Figure 11. Current wetland and grassland habitat acres in the prairie region of Minnesota compared to needed additional acres to support a productive breeding population of 1 million ducks.

ownership will be less than 2%. Assuming no net loss of our existing habitat base, we will need to protect and restore an average of approximately 40,000 additional habitat acres a year to achieve the breeding population objective.

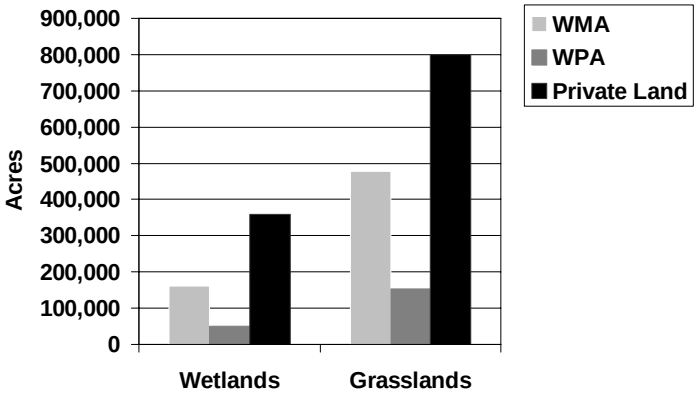

Figure 12. Projected ownership of additional habitat needed to support a productive breeding population of 1 million ducks. WMA signifies state owned wildlife management areas, WPA is federally owned waterfowl production areas, and Private Land is privately owned land under long-term habitat protection agreements.

Breeding duck numbers are driven primarily by wetland abundance. Productivity of breeding ducks is driven primarily by grassland abundance. The best waterfowl production habitat occurs within prairie habitat complexes 4–9 square miles in size where at least 20% of the area is wetland and 40% is grassland. At least one-half of the wetland acreage should be temporary or seasonal basins and ideally each complex will include one shallow lake over 50 acres. One-half of the grasslands should be under long-term protection.

Measurement: The breeding population will continue to be tracked through our traditional May waterfowl breeding surveys. Productivity will be measured using established scientific models for the mallard to estimate recruitment based on waterfowl and habitat surveys. The target recruitment rate is 0.6, or an average of 0.6 new hens added to the fall population for each existing adult hen. That recruitment should produce a fall population of 1.4 million ducks from Minnesota.

Cost: The total cost for land protection in today's dollars will be approximately $3 billion. The cost of habitat restoration on that land will exceed $550 million and $2 million will be required annually to maintain habitat quality. Achieving the protection and restoration of proposed acres will cost an average of $64 million per year.

Migration Objective

Target: By 2056, restore and maintain a fall duck harvest that is 16% or more of the Mississippi Flyway harvest to reflect the recovery Minnesota's importance to spring and fall duck migration.

Current Conditions: The most recent 10 year average (1995-2004) for duck harvest in Minnesota has been approximately 12.3% of the flyway harvest. The federal Harvest Information Program was established during this period so the average reflects a

combination of federal and state estimates. Future measurements will use only the federal estimates.

Primary Strategy: The primary strategy is the protection, enhancement and management of 1800 shallow lakes across Minnesota although the wetland portion of the breeding population strategy will benefit migration use as well, particularly in spring. Methods of lake protection will include local ordinances, acquisition, and formal designation for wildlife management. Management will include lake outlet management, fish removal, surface use restrictions, and watershed restoration. An average of 29 additional lakes a year need improved protection and/or management in order to achieve the target of managed lakes.

A separate statewide shallow lake planning effort is underway that will specify opportunities to increase habitat evaluation, reduce the impact of invasive plant and fish species, work with local units of government to increase shoreline protection, and resolve competing interests such as fish rearing.

The quality of migration habitat has been severely impacted by degraded watersheds, nonpoint sources of pollution, altered lake outlets, and undesirable species of fish. Data from the Minnesota Pollution Control Agency suggests that nearly two-thirds of the prairie region shallow lakes have poor water clarity and consequently poor conditions for submerged aquatic plants and invertebrates, the primary sources of food for migrating and breeding ducks. Approximately 350 shallow lakes (50 acres and larger) are currently managed for wildlife benefits. Only 39 of these lakes have been formally designated for wildlife management.

Measurement: The migration objective will be measured initially using the proportion of Mississippi Flyway duck harvest by hunters in Minnesota as an index to spring and fall migration use. Maintaining or exceeding an average of 16% of the total flyway harvest occurring in Minnesota based on federal Harvest Information Program (HIP) will be considered meeting the objective. The 16% reflects the 1970s average during the base years used to establishment of waterfowl population objectives in the North American Waterfowl Management Plan.

Costs: Expanding this effort to 1800 lakes will require approximately $150 million in development and enhancement costs and $1.5 million in additional annual habitat management. This equates to an average expenditure of $3 million per year.

Recreation Objective

Target: An average of 140,000 waterfowl hunters and 600,000 waterfowl watchers will enjoy high quality duck hunting and viewing opportunities in Minnesota by 2056.

Current Conditions: Minnesota waterfowl hunter numbers have remained relatively stable over the last decade. However, the number declined in 2004 and again in 2005 when approximately 100,000 state waterfowl stamps were sold. There are ongoing

special efforts by conservation organizations and agencies to introduce young people to waterfowling. Like most types of hunting, participation in waterfowling begins to decline after 40 years of age. An U. S. Fish and Wildlife Service survey in 2001 found over 400,000 wildlife watchers listed waterfowl as their primary focus.

While the overall Minnesota hunting satisfaction rate (all types combined) has been 80 – 90% over the last decade, nearly 25% of the duck hunters have indicated dissatisfaction with their general hunting experience. A 2005 national survey found 32% of the duck hunters were dissatisfied with their most recent hunting season.

Primary Strategy: The habitat strategies for both the breeding population and migration objectives are also the most important strategies to improve the quantity and quality of duck hunting and viewing opportunities in Minnesota. In addition, current programs to introduce youth to waterfowling will continue to be encouraged and supported. A better understanding of hunting desertion rates by older hunters will be important for all types of hunting in the state.

Measurement: Numbers of waterfowl watchers will be measured by the National Survey of Fishing, Hunting, and Wildlife Associated Recreation survey conducted by the U. S. Fish and Wildlife Service every 10 years. Hunter numbers will be measured by federal HIP and state small game hunter surveys. Hunter satisfaction will be measured through periodic mail questionnaire surveys of waterfowl hunters identified through the HIP.

Costs: Costs beyond those previously identified for the population and migration objectives are projected to remain relatively stable over time.

Planned Biennial Targets FY06/07

DNR FY 06/07 targets for strategies affecting Minnesota's duck recovery.

Achieving the objectives in this plan cannot be accomplished by DNR efforts alone. Other state and federal agencies and conservation organizations play critical roles in meeting the challenges ahead. Listed below are FY06/07 biennial targets that the DNR has established for itself to measure progress. While many of these are linked to partnerships with other agencies and organizations, they represent the DNR's priorities for this biennium. Many of these targets are described in more detail in the DNR's Conservation Agenda. For more information on the Conservation Agenda visit our website http://www.dnr.state.mn.us/conservationagenda/index.html

Habitat Protection and Management

Prairie Wetland Complexes.

Focus acquisition and easement programs listed below to restore and protect 40,000 acres of wetland/grassland habitat complexes.

Wildlife Management Areas.

Accelerate acquisition to more than 5000 acres per year.

Wild Rice Lakes.

Work with partners such as Ducks Unlimited to actively manage at least 170 wild rice lakes each year.

Develop a formal list of important wild rice areas for distribution to the public and local units of government.

Rest Areas.

Conduct regional wildlife staff meetings to develop proposals to address gaps in coverage identified by the waterfowl refuge inventory.

Aquatic Invasive Species**.**

Limit the rate of spread of Eurasian watermilfoil to no more than 10 new lakes per year, and prevent further spread of zebra mussels to new waters not connected to previous infestations.

Work with the UMN to conduct field trials on the use of pheromones to help control common carp.

State Park Lands.

Purchase highest priority inholdings as funding is available.

Restore 5,400 acres of native vegetation and carry out prescribed burns on 3,000 acres each year.

Scientific and Natural Areas.

Dedicate three to seven new Scientific and Natural Areas.

Farmland Conservation.

Assist partners in enrolling more than 2 million acres in state and federal conservation land retirement programs by the end of the 2002 Farm Bill.

Help maintain enrollment of highest priority acres facing CRP contract expirations.

In the long-term develop new policies and programs to increase total enrollment to 2.5 million acres.

Working Lands Initiative.

Develop active local interagency habitat teams with local stakeholders within each of the five identified focus areas to target respective programs to restore and protect prairie wetland complexes.

Prairie Stewardship Assistance.

Work with private landowners to conduct at least 20 prairie stewardship plans and 50 management projects each year.

Shoreland habitat restoration**.**

Restore 10,000 to 15,000 linear feet of shoreline each year.

Reach 150 local government units with shoreline workshops each year.

Decrease the number of shoreline alteration permits issued for riprap and retaining walls.

Support the efforts of the North Central Lakes Pilot Project to develop alternative regulations that provide additional opportunities to protect sensitive habitat.

Forest Management.

Initiate the MN Forest Legacy Partnership to acquire up to 75,000 acres of permanent forest conservation easements by 2008.

Maintain a 44,000 acre network of designated DNR old-growth forest sites.

Establish target acreages of extended rotation forests at the landscape level.

Complete all Subsection Forest Management Plans.

Complete 65,000 acres of private land Forest Stewardship Plans with 18,000 acres completed by DNR staff and the remainder by the private sector.

State Trails.

Maintain existing natural vegetation restorations through appropriate management (e.g., prescribed burns).

Produce plant community inventories for three additional rail trails totaling 160 miles.

Habitat Monitoring

Wetland quantity, quality, and biological diversity.

Implement a comprehensive ongoing assessment program to monitor statewide no net loss of wetland quantity and quality.

Achieve no net loss of wetlands.

Shallow Lake Surveys.

Conduct habitat evaluations on 60 lakes per year.

Fish Rearing.

Continue research to better understand the impact of fish on wetland and shallow lake quality.

Propose a temporary moratorium on the issuance of licenses to rear fish in wetlands and shallow lakes until criteria can be developed to insure ecological sustainability.

Fall Use Survey.

Continue monitoring waterfowl use during the fall on 40 shallow lakes to develop case histories of migrational use.

Water Structure Inventory.

Inventory all of the water control structures on WMAs and DNR managed wildlife lakes by type and condition to develop a long-term replacement plan.

Lakeshed Mapping.

Develop a GIS layer with the mapped boundaries of all lakes 100 acres or greater in size.

Population Monitoring.

May Statewide Breeding Duck Survey.

Complete annual aerial surveys to estimate spring breeding population in key breeding areas.

Complete comprehensive evaluation of survey design, methods, and results

Ring-necked Duck Survey.

Complete special annual ring-necked duck survey within forested areas to estimate spring breeding populations.

Fall Use Survey.

Complete annual fall aerial surveys on 40 identified shallow lakes to develop case study information on habitat use.

Duck Banding.

Complete annual summer and preseason banding of ducks to continue gathering data on duck movements and survival.

Hunting Regulations.

Continue special hunting regulations such as the 4 o'clock closure and motorized decoy restrictions designed to protect resident ducks.

Enforcement

Wetland Conservation Act.

Increase the time spent on WCA cases by 15 percent.

Implement targeted aerial reconnaissance to detect violations.

Increase efforts in waterfowl hunting enforcement by 15 percent.

Recreation

Information/Education.

Continue to provide current information on waterfowl identification, habitat, hunting, and unretrieved loss in regulation booklets, articles, hunter education classes, and on the DNR website.

Hunter Survey.

Conduct a waterfowl hunter opinion and activity survey following the 2005 hunting season.

Hunter Recruitment.

Maintain youth hunter participation as measured by license sales and maintain special youth hunt opportunities.

Conduct a waterfowl hunter recruitment and retention survey following the 2005 hunting season.

Public Water Access.

Conduct a review of existing public access to shallow lakes.