

**DRAFT NATIONAL RECOVERY PLAN
FOR
THE BARN OWL AND ITS HABITAT**



(Tyto alba)
Ontario Population

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ON BEHALF OF THE
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FOR THE
Recovery of Nationally Endangered Wildlife (RENEW) Committee

December 2002

Disclaimer

This document is the National Recovery Plan for the Barn Owl (*Tyto alba*) - Ontario population. It has been prepared on behalf of the Ontario Barn Owl Recovery Team (OBORT) by Bernt Solymár of EarthTramper Consulting Inc. and Jon McCracken of Bird Studies Canada, with the advise and input from Recovery Team members, to define recovery actions necessary to protect and recover the species and its habitat. It does not necessarily represent official positions of agencies and/or the views of individuals involved in the development of the plan. The goals, objectives, and recovery actions identified in this recovery document are subject to the priorities and budgetary constraints of participating jurisdictions and organizations, as well as modifications to accommodate new objectives or findings.

Acknowledgements

We thank Heide Isaacs, Habitat Haldimand; Debbie Badzinski, Bird Studies Canada; Dave Reid, Norfolk Stewardship Council; Mary Gartshore, Norfolk Field Naturalists; and Dave Richards, Ron Gould and Hal Shraeder of the Ontario Ministry of Natural Resources for critical review of the draft recovery plan. Also thanks to Bruce Colvin, Colvin Consulting Services in Massachusetts, Dave Scott of the Ohio Division of Wildlife and Lorraine Andrusiak, Keystone Wildlife Research, British Columbia for their external review of the initial recovery plan submission.

We gratefully acknowledge funding from the following sources: Ontario Ministry of Natural Resources, the Community Fisheries and Wildlife Improvement Program (OMNR), Ontario Trillium Foundation, TD Friends of the Environment, Shell Environmental Fund, Ontario Federation of Hunters and Anglers, Simcoe District Fish and Game Club, Ontario Power Generation (formerly Ontario Hydro), Simcoe Rotary Club, Tallgrass Ontario, and private individuals.

Thanks also to James Cowan of the Canadian Raptor Conservancy, for supplying and displaying a captive-bred Barn Owl at various presentations across the province, and to our past project coordinators - Tanya McGregor, Christine Havill and Kate MacIntyre. A special thanks to Robert Bateman and Ross Bateman for donating prints to raise funds for our project. Thanks also to Kay McKeever of the Owl Foundation in Vineland for advice and expertise on Barn Owl biology.

Finally, a thousand thanks to our numerous volunteers who have built and installed nest boxes, the many organizations that have helped locate and recruit sites to install nest boxes, the various businesses who have donated materials and services, and the private landowners who have allowed us to install nest boxes in/on their barns and provide our eyes in monitoring the 300 plus boxes across the north shore of Lake Erie.

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EXECUTIVE SUMMARY

In Canada, the Barn Owl's breeding range is restricted to southwestern Ontario and extreme southern British Columbia. In 1999 the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the species as "Endangered". Habitat loss is considered the major reason for the Barn Owls decline in Canada, but harsh winters, predation, road fatalities and agricultural rodenticide use may also have impacted populations. In Ontario, the population is particularly vulnerable due to historic and on-going losses of hunting habitat due to agricultural intensification and urban sprawl along the north shore of Lake Erie (the northern most range of the Barn Owl in eastern Canada).

Due to their secretive and nocturnal habit Barn Owls seldom appear in various survey results (e.g. Christmas Bird Counts, Ontario Breeding Bird Atlas, nocturnal owl surveys). Although farmers and rural landowners have vivid memories of Barn Owls nesting in their barns prior to the 1980's, reports have been sparse since that time. Since 1997 the Ontario Barn Owl Recovery Team (OBORT) has recorded several dozen sightings of which at least 6 are confirmed (including 2 birds recovered from vehicular collisions). In response, OBORT has initiated a volunteer nest box installation and monitoring program is in place with more than 300 nest boxes installed in/on barns across southern Ontario (west of Toronto). Education and outreach to landowners and the general public has been addressed through the development of a series of public information sheets, a newsletter, grassland species posters, and a PowerPoint presentation, which has been delivered to over 1000 people to date.

The goal of this Recovery Plan is to increase the population of the Barn Owl in Ontario to self-sustaining levels, and to conserve and restore grassland habitat for Barn Owls and other grasslands-dependent flora and fauna. Through a cooperative effort of community groups, another objective is to create at least 1000 ha of rough grassland habitat during the same time period.

The following strategies are key elements of achieving the goal of the recovery plan over the next 5 years (2002-2007):

1. Monitor breeding populations, locate nest sites, and maintain a database of information.
2. Maintain and expand the Barn Owl nest box monitoring program.
3. Identify, protect and conserve grassland habitat and biodiversity.
4. Develop public support through education and awareness.

SECTION I

Introduction/Species Background and Status Evaluation

1.1 Introduction

The Barn Owl is among the most widely distributed species of birds in the world, occurring on every continent except Antarctica. It is predominantly a warm-climate species; in North America, its principal breeding range is the U.S.A (Figure 1). In the U.S.A, the Barn Owl is most common in the southern and coastal states, becoming much less common and more localized in the northern interior states, and generally avoiding mountainous and heavily forested regions (Stewart 1980; Marti 1992). In Canada, the Barn Owl is restricted to extreme southern Ontario and southern British Columbia.

The Barn Owl has been in decline throughout much of interior North America since at least the 1950s (e.g. Stewart 1980; Colvin *et al.* 1984; Colvin 1985). Loss of nesting sites (e.g. mature cavity nesting trees, old wooden barns), loss of quality hunting habitat (large expanses of grassland that support healthy populations of rodents), and decreased survival rates due to increased predation by Great Horned Owls, road mortality, severe winters, and perhaps rodenticides are possible contributing factors (e.g. Stewart 1952; Henny 1969; Marti *et al.* 1979; Stewart 1980; Colvin 1985, Marti 1997). Of these, availability of foraging habitat is regarded as being the most critical limiting factor (e.g. Colvin 1984, 1985; Ehresman *et al.* 1988).

It is very likely that range retractions in Ontario have been exacerbated by declines in the neighbouring Great Lakes states. Ongoing declines of the species in the northeastern U.S., due to habitat loss, will undoubtedly have serious implications for the continued survival of the species in Ontario, particularly since the sustenance of our "fringe" northern population will rely to a large extent on birds that originate from farther south (immigrants).

1.2 Current Status

1.2.1 Current Status of the Barn Owl (Eastern Population)

1.2.1.1 Biological Considerations

1.2.1.1.1 Status of the Species

U.S.A. -

While the Barn Owl population in the southern U.S.A is considered common and stable, the species has experienced ongoing declines in the northern U.S., especially in the northeastern and mid-western states (e.g. Colvin 1984). In the U.S., the Barn Owl is listed as "Endangered" in seven mid-western states (Illinois, Indiana, Iowa, Michigan, Missouri, Ohio and Wisconsin), and at least nine others consider it as a species of special concern (Marti 1992), including Pennsylvania and New York (Austen and Cadman 1994).

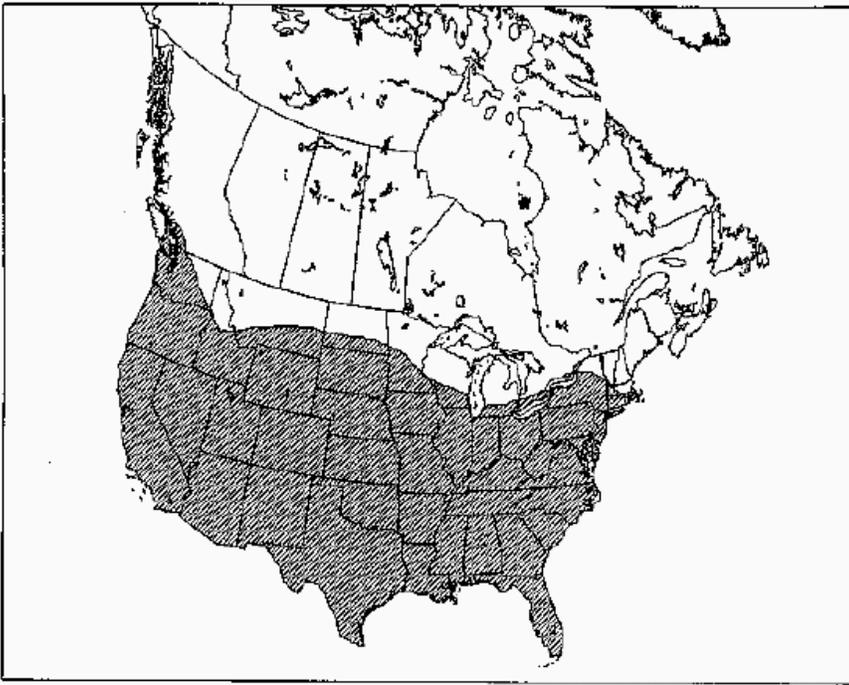


Figure 1. Breeding distribution of the Barn Owl in North America.

Canada -

In Canada, the breeding range of the Barn Owl is restricted to extreme southern-western British Columbia and southwestern Ontario (mainly within 50 km. of the north shore of Lake Erie) (Figure 1). The species was upgraded from nationally "vulnerable" to "endangered" in 1999 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

In British Columbia, the Barn Owl is an uncommon species, with a population size of approximately 1000 birds (Campbell and Campbell 1984; Andrusiak and Cheng 1997). Although not large, the B.C. Barn Owl population is substantially greater than that of the entire Great Lakes basin population, which is likely partly due to the fact that the lower mainland B.C. has the mildest climate in Canada (Andrusiak, pers. comm.).

The Barn Owl is classified as "threatened" in Ontario by the Ontario Ministry of Natural Resource's Committee on the Status of Species at Risk in Ontario (COSSARO).

1.2.1.1.2 Past and Current Distribution

The Barn Owl is notoriously difficult to census since it does not respond to tape-recorded calls and its nocturnal habits and is, therefore, apt to be widely overlooked by existing bird surveys, including the Breeding Bird Survey, Christmas Bird Count, and nocturnal owl surveys. Moreover, like many owl populations, Barn Owl numbers are apt to fluctuate annually in response to environmental conditions (vole populations and winter weather), which makes monitoring efforts more difficult. Perhaps for these reasons a thorough census of the southwestern Ontario Barn Owl population has never been conducted.

The Barn Owl historical status is unknown but it was probably always present in Ontario in small numbers, foraging mainly in tallgrass prairie and oak savannah habitat prior to European settlement. It likely became more

common in the province (and bordering states) following the clearing of forests and replacement with pastures and hay fields, and the erection of barns and other structures that augmented the availability of nest and roost sites.

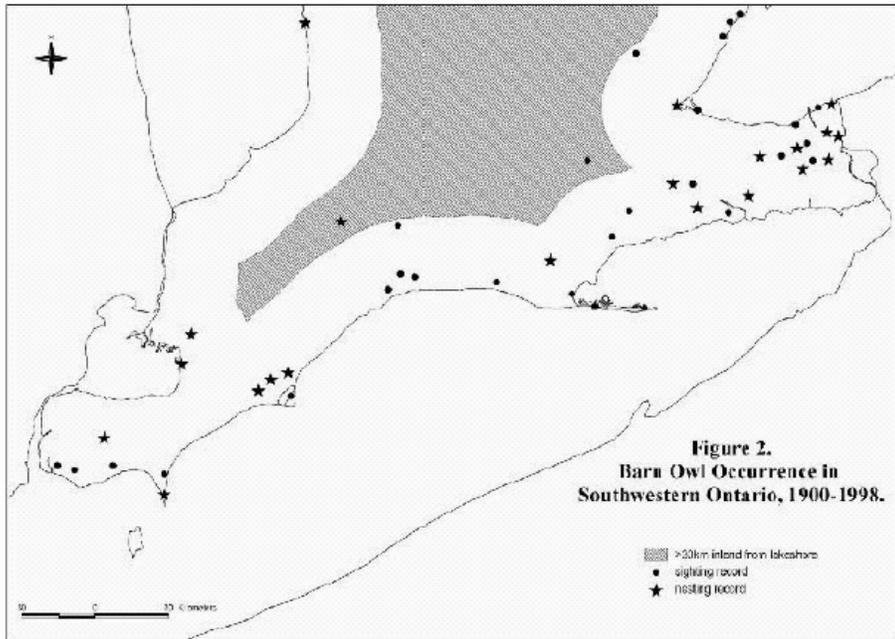
Records of Barn Owls prior to the mid-1850's are sketchy, probably due to the bird's nocturnal habits and secretive behaviour. The first official Ontario record of a Barn Owl in the province was a specimen collected in Hamilton in 1882 (Austen *et al.* 1994). In the mid 1930s, Barn Owls were known to nest in four localities: two in Kent County, one in Essex County and one in Middlesex County. Conversations with dozens of landowners seems to indicate much more frequent sightings and nesting in barns prior to 1970. McKeever (pers. comm.) of the Owl Foundation in Vineland indicates that injured Barn Owls brought to her rehabilitation facility up until the early 1980's were not uncommon, but numbers have dwindled over the last 15 years. No injured Barn Owls collected in Ontario have been delivered to the facility for at least 10 years.

In Ontario, most Barn Owl sighting and nesting records have been within 50 km of the north shore of Lake Erie and the adjacent Lake Ontario shoreline (Figure 2). During the first Ontario Breeding Bird Atlas period (1981-85) 4 pairs of nesting Barn Owls were recorded in the province, with 3 of those records in the Municipality of Niagara and 1 in Haldimand County (Weir 1987a). Between 1974 and 1982, 182 Barn Owls were released by The Owl Foundation in that region (McKeever, pers. comm.), so it is likely that some of the Barn Owls recorded in Niagara and Haldimand at this time were descendents of those releases. Despite an extensive search in the core historic breeding areas in Essex, Kent and Lambton counties during the Atlas, which included newspaper advertisements asking for the rural public to report sightings, no Barn Owl nesting records were documented in the extreme southern part of the province (Weir 1987a).

In 1984, the Ontario population was estimated to consist of a maximum of 25-30 pairs (Campbell 1984), but was likely much lower. Information on 13 sightings were reported to the Ontario Rare Breeding Bird Program from 1986-1991, including three sites in the eastern portion of the Municipality of Haldimand-Norfolk (1986, 1991), one in Niagara County (1977), and one site in Huron County (1988) (Austen *et al.* 1994; see Figure 2). Only 29 Barn Owl nests had been reported to the Ontario Nest Records Scheme prior to 1980 (Peck and James 1983); several additional records (most of which are historic) brought the total to 41 cards (Peck 1998).

From 1997-2001, the Ontario Barn Owl Recovery Team received several sightings reports including: two road killed birds in 1999 (one near Chatham and one on Highway 401 near Kitchener), confirmed sighting near Fisherville (1999) and Ruthven (2002), Haldimand County, and near Windsor (2002) in Essex County. Additionally there were two highly probable sightings in 2001 – one at Long Point Provincial Park (Norfolk County) and one near Arkona (Lambton County), as well as numerous other unconfirmed reports spanning the last 2 decades. In Quebec, a Barn Owl was observed and photographed by dozens of birders, in April 2001 near Nun's Island wood near Montréal. Since 1997, there have been no reports of active nests or paired birds in eastern Canada.

It is hoped that the Ontario Breeding Bird Atlas now being conducted (2001-2006) will provide additional current and accurate information on Barn Owl activity in the province.



1.2.1.1.3 Incidence of Disease or Pests

In his review of the species, Marti (1992) indicates evidence in the literature of several protozoan blood parasites (*Haemoproteus*, *Leucocytozoon* and *Trypanosoma*), an intestinal protozoan parasite (*Sarcocystis*), several species of lice (*Kirodaia subpachygaster* and *Strigiphilus aitkeir*) and a parasitic fly (*Carnus hemapterus*) known to infest Barn Owl chicks and adults. It is not known if these diseases have the ability to impact a population on their own or only in combination with other stresses.

1.2.1.1.4. Commercial, Consumptive or Subsistence Use

Wild Barn Owls are not used commercially or for subsistence purposes in Canada or in the United States. Captive-reared birds are sometimes used for educational purposes at raptor conservatories and rehabilitation centres, zoos, conservation areas, fairs and other public venues.

1.2.1.2 Habitat Considerations

1.2.1.2.1 Overview of Habitat Requirements

Foraging Habitat

In North America, the Barn Owl is predominantly a bird of the open country, favouring native grasslands, pastures, hayfields, shallow marshes, wetland edges and other open grassy habitats that support adequate populations of mice and voles. Barn Owls will also occupy residential and even industrial areas, as well as nesting around farms, wherever vole populations are plentiful (e.g. Hegdal and Blaskiewicz 1984).

Very little information has been published concerning the habitat requirements to support a pair of Barn Owls in northeastern North America. Barn Owls in Great Britain are capable of breeding successfully in areas that contain

as little as 0.3-19 ha of continuous, rough grassland within a 1 km radius of the nest site, and the mean breeding territory was 12 ha (Rebane and Andrews 1995). This is markedly less than the 50 ha previously thought to be acceptable. Rebane and Andrews (*ibid*) concluded that about 20 ha of suitable habitat were quite adequate. It is quite likely that the acreage of habitat required is variable and more dependent on prey density. Native habitats, such as tallgrass prairie, oak savannah, salt marshes and wetland fringes, support larger populations of meadow voles, the Barn Owl's major prey in northeastern North America (Birney *et al.* 1976, Colvin 1985).

Nesting/Roosting Sites

"Natural" nests are commonly situated in naturally formed cavities in large hollow trees and in hollows in the faces of cliffs and riverbanks. Tree cavity nest sites are large and fairly deep (entrance must be at least 15 cm in diameter), situated at heights averaging 4.6 m above the ground (Bunn *et al.* 1982). Nest boxes and a great variety of man-made structures (especially barns, silos, bridges, belfries, warehouses, unused chimneys, hay stacks) are also favoured in many areas (e.g. Hegdal and Blaskiewicz 1984). No nesting material is gathered, but most females arrange a cup of shredded pellets as a nest (Marti 1992).

Campbell and Campbell (1984) reported that Barn Owls have a preference for abandoned or unused buildings, and that nest sites were usually located in very dark conditions. In British Columbia, 96% of all nest sites were situated in a man made structure, with barns accounting for 72% of the total (Andrusiak and Cheng 1997). Traditional wooden barns are used as nesting sites much more frequently than are modern structures (Campbell and Campbell 1984; Ramsden 1998). In New Jersey, man-made structures accounted for only 49% of 209 nest sites and only 29% of day roosts were in man-made structures - the majority were in wooded areas (Colvin 1984).

Of 29 Barn Owl nests in Ontario, most (17) were in farm buildings; other sites included water towers (2); an old flour mill (1); an airport hangar (1), a store (1); a bridge (1), and a natural nest in a tree hollow (about 1 m deep) in a woodland (Peck and James 1983). Most nests were situated in barn lofts (positioned on hay or straw, on boards and beams, and in nest boxes placed inside the lofts, and in recesses between hay bales), and in silos (positioned on boards of the attic, on top of silage, and in burrows in the silage up to 1 m long). Nest heights in Ontario ranged from 3 to 33 metres, with an average of 7.5 metres. It should be noted that that man made nest sites are much more likely to be reported and/or located.

Food and Diet

The Barn Owl's diet primarily consists of small mammals, with a distinct preference for voles (*Microtus* spp.) across most of its North American range (Wallace 1948; Phillips 1951; Colvin and McLean 1986; Campbell *et al.* 1987; Marti 1988b) and Europe (Yom-Tov and Wool 1997). The meadow vole (*Microtus pennsylvanicus*) is the preferred prey species in eastern North America, while the Townsend's vole (*Microtus townsendii*) comprises the major part of the barn owls diet in British Columbia. When *Microtus* populations are low Barn Owls will also prey on shrews, moles, young rats, various species of mice (*Peromyscus* and *Mus*), and occasionally birds (e.g. Rudolph 1978, Giger 1965; Colvin and McLean 1986, Cowan 1942).

Estimates of food intake of adults range from about 50 g/day to 150 g/day (see Marti 1992), which is equivalent to 1-3 voles per day. It is estimated that a typical family of two adult and four young Barn Owls consumes about 1000 rodents during the 10-week portion of the year when young are in the nest (see Colvin 1985). Pellets are cast at least daily, and are distinctively ovoid, glossy black, and about 25 x 50 mm in size (Burton 1973).

Barn Owls hunt most often within a couple of hours after sunset and again within a couple of hours prior to sunrise (Matteson and Petersen 1988; Marti 1992). Unlike Great Horned Owls, which primarily hunt from tall perches (e.g. trees, telephone poles), the Barn Owl hunts primarily on the wing in moth-like cruising flights close to the ground and from low perches (Bunn *et al.* 1982). In times of high prey densities, the Barn Owl is known to cache surplus food in the nest during the early nesting stages (Wallace 1948; Marti 1992), but there is no evidence of this behaviour outside the nesting season.

1.2.1.2.2. Status of Critical Habitat

The Ontario Barn Owl Recovery Team, in partnership with the Ontario Ministry of Natural Resources, is currently (2001–2002) conducting a grasslands inventory project for southwestern Ontario (Windsor to Niagara-on-the-Lake and north to Highway 401). Preliminary findings indicate that native grasslands and meadows are extremely limited in the largely agricultural landscape. Some detectable acreage remains on the heavier clay soils in Haldimand County, around Ft. Erie in the Niagara peninsula, around the Alvinston area in Lambton County, west of Pt. Ryerse in Norfolk County, and scattered other pockets along the north shore of Lake Erie. Most of these identified lands are fragmented and surrounded by intensively utilized agricultural lands and/or woodlots. Pastures and hayfields are concentrated in several counties, but pastures are heavily cropped by livestock (dairy and beef cattle) leaving scant nesting and foraging opportunities for voles and mice. Some efforts are underway in southern Ontario to conserve and restore tallgrass prairie habitat, but these are relatively small and scattered acreages.

Although relatively large numbers of wooden barns and other wooden structures (e.g. tobacco kilns in the sand plains of Norfolk and Elgin counties) still exist in southern Ontario, they are gradually being replaced by less accessible steel barns. Evidence of raccoons (an opportunistic predator of Barn Owl eggs and young), and farm cats is found in most barns that the Recovery team has worked in. Prior to the 1950's most farmers owned a few head of dairy and beef cows and several pigs for individual use. McKeever (pers. comm.) speculates that roosting Barn Owls benefited from heat created by farm animals in barns during winter months. Very few farms (other than commercial livestock operations and hobby horse farms) now house livestock.

Prior to the large-scale mechanization of farm equipment and grain storages, corn and grain were kept in silos on individual farms. This created an ideal habitat for mice in winter months and probably a supplementary food source for Barn Owls during times of heavy snow cover. Most corn and grains are now stored in well-sealed structures at central depots. Because farm machinery is more efficient today little wastage remains on agricultural fields, resulting in few foraging sites for rodents in winter. No-till may offer additional food and shelter for rodent populations in winter, but no studies have been conducted to date.

1.2.1.2.3 Existing and Future Land Use Conflicts

In Ohio, there has been a significant correlation in the decline in sheep and dairy farming and the decline in Barn Owls since the 1930's (Colvin 1985). Prior to the 1930's, sheep and dairy cows were pastured on minimally managed meadows (ideal *Microtus* habitat), which comprised at least 25% of each Ohio farmstead. An inverse relationship between Barn Owl decline and increased acreage planted to soybeans (a poor crop in terms of supporting *Microtus* populations) was also found. Land use pattern changes over time in Ontario have been very similar to that of Ohio.

Continuing changes in agricultural practices (e.g. row cropping, intensive corn and soybean production, overgrazing on pasture land, storage of corn and beans at central depots rather than on-farm) and development (e.g. urban encroachment, draining of wetlands) are expected in southern Ontario. Even in counties with higher acreages of pasture and hayfields (e.g. Haldimand and Niagara) there continues to be conversion to intensive row cropping and, in some cases, development. For example, in Haldimand-Norfolk pastureland has decreased from 28,861 acres in 1971 to 12,459 acres in 1991 (a reduction of 57% in 20 years)(OMAF 1996). Natural events (e.g. succession of grasslands and abandoned agricultural fields to shrubs and thickets) also result in loss of habitat.

1.2.1.2.4 Effects of Human Activities

Intensive agriculture and development in rural areas continue to reduce the quantity and quality of Barn Owl habitat. The effect of pollution on Barn Owls has not been studied. Agricultural pesticide use probably has minimal impact since use of insecticides, in particular, is minimal on field crops, such as corn and soybeans, and on hay and pastureland. Rodenticide use around farmsteads and road fatalities may also have an impact on Barn Owls in Ontario.

1.2.2 The Role of Barn Owls in Ecosystems and Their Interaction with Humans

1.2.2.1 Ecological Considerations

1.2.2.1.1 Ecological Role

Barn Owls are birds of open countryside. They typically forage by flying low over grassland habitat with frequent “hovering intervals” or by perching on fenceposts and trees along field edges (Rosenburg 1986). Superb hearing and excellent night vision allows Barn Owls to hunt in almost total darkness. Voles and other rodents, scurrying through grassed runways or under thin blankets of snow, can be detected by hearing alone.

The primary prey for Barn Owls in eastern North America is the meadow vole (*Microtus pennsylvanicus*), comprising up to 60% to 90% of its diet in most years (Colvin 1984, Rosenberg 1986). The short-tailed shrew (*Blarina brevicauda*) is an important secondary prey, followed by white-footed mouse (*Peromyscus leucopus*) and deer mouse (*Peromyscus maniculatus*) (Rosenberg 1986).

Barn owls historically have been considered an ally of farmers due to their voracious appetite for voles and mice, which are considered pests of many agricultural crops, including nursery and fruit trees (which they may girdle by chewing off the bark around the tree near soil level), strawberries, vegetable seedlings, cabbage, corn and grains. These species, along with the house mouse (*Mus musculus*), are also pests around farmsteads, populating grain and corn silos, damaging stored feedbags and birdseed, chewing on plastic coated electrical wires and building nests in farm equipment.

1.2.2.1.2 Taxonomic Position

Up to 35 subspecies of Barn Owl are recognized worldwide. There is only one recognized subspecies in North America (*Tyto alba pratincola*) and there is no evidence to suggest that the Canadian population is genetically distinct from populations in the U.S. However, Barn Owls on the Pacific coast are distinctly smaller and darker than those in the east (Pyle 1997) and more genetically distinct (McLarty 1995).

1.2.2.2 Socio-political Considerations

1.2.2.2.1 Public Appeal and Interest in Barn Owls

Barn Owls can be considered a flagship species for grasslands conservation and restoration efforts due to their visual appeal to humans. Many people have a fascination for owls, often portrayed as mystical or wise animals. The response that the Recovery Team gets at public venues (e.g. schools, naturalists and conservation clubs), especially when a captive Barn Owl is flown in the room, is one of awe and enthusiasm.

1.2.2.2.2 Utilitarian Use

No studies have been undertaken in North America to determine the utilitarian use of the Barn Owl, but individual birds or families probably do impact on rodent numbers in localized areas.

Barn Owls may be an indicator of healthy, extensive grassland habitats, along with other species like Northern Harriers and Short-eared Owls, two other raptor species that depend on grasslands and are also in decline across most of their ranges.

1.2.2.2.3 Legal Considerations

Although designated as federally “endangered” by COSEWIC, like all other raptors, the Barn Owl is not protected under the Migratory Birds Convention Act, but rather falls under provincial jurisdiction. In Ontario, it is designated as “threatened” by COSSARO/OMNR and therefore does not fall under the provincial Endangered Species Act. Although “significant portions” of its habitat are technically afforded protection under the Provincial Policy Statement of the Provincial Planning Act, it is the municipalities that implement that Act and therefore they have to be the jurisdiction that decides on zoning changes and land use permits. The Act is also weakened by the fact that the species often breeds on private lands and because its occurrence at any one location is apt to be quite ephemeral. Because of this enhanced legislative protection of the Barn Owl would likely be very difficult to enforce and would not provide a substantive solution to the plight of the species in Ontario. Public education and awareness, however, will play an increasingly important role for protection of species on private land.

1.2.2.2.4 Proportion of Breeding Population in Canada

Ontario accounts for less than 0.1% of the Barn Owl's North American breeding range, but roughly one-half of its Canadian breeding range (inland valleys in south-western B.C. being the other). Hence, Ontario shares a high jurisdictional responsibility for the conservation of this species in Canada.

1.2.3 Recovery Potential for the Barn Owl

1.2.3.1 Review of Major Causes of Threat and Likelihood of Continued Threat

1.2.3.1.1 Loss of Habitat and Prey Availability

Wherever the Barn Owl is in decline in Europe and North America, the chief cause has been identified as habitat loss resulting from changing agricultural practices (e.g. Bunn *et al.* 1982; Colvin 1984; Colvin 1985; Matteson and Petersen 1988; Marti 1992). These changes include the conversion of hayfields, grasslands, wetlands and pastures to intensive, large scale, row crop operations that reduce rodent populations (Colvin 1984). In Ohio,

there was a correlation between Barn Owl declines and reduction in livestock production (especially sheep farming) and pastureland acreage (Colvin 1984, 1985). Concomitant with these decreases was an increase in row crop production acreage, like corn and soybeans. The trend was indicative of a general pattern of replacement of grasslands-dominated types of agriculture to large-scale monoculture farming practices. A similar trend has occurred in Ontario. For example, in 1981 the acreage of pastureland in Ontario decreased to 69% of that in 1971, while acreages of row crops like corn and soybeans increased almost two-fold from their 1971 levels (Ontario Ministry of Agriculture and Food 1986).

The major prey item for Barn Owls in eastern North America is the meadow vole (*Microtus pennsylvanicus*), a species predominately found in moist, dense grasslands with diverse mixes of grasses, sedges and forbs and substantial levels of plant litter. Preferred habitat includes wet meadows, wetland edges, tallgrass prairie, abandoned farmland, pastureland and grassy hayfields (Birney *et al.* 1976). There is, however, a direct negative correlation between increased acreage of intensive agriculture and vole populations (Colvin 1985). It is logical then that as favourable meadow vole habitat is lost, meadow vole populations decline, and Barn Owl populations can consequently decline as well.

Barn Owl productivity is closely linked to prey availability (Colvin 1985, Rosenburg 1992). Meadow voles follow highly cyclical population explosions and declines, usually over 3 to 5 year periods. In peak years, *Microtus* densities may reach 150 individuals per acre as compared to 15 to 45 individuals per acre in normal years. Under adverse conditions (droughty summers or prolonged cool, rainy springs) populations can drop well below average numbers (Johnson and Johnson 1982). In years of low vole numbers Barn Owl productivity can drop dramatically (Colvin 1985). However, the Barn Owl is an r-strategist (high fecundity, early precocity and sexual maturity, and often more than one brood per year) allowing it to rapidly recover in subsequent years as vole populations recover again (Colvin 1985, Rosenburg 1992)

1.2.3.1.2 Climatic Factors

The Barn Owl is poorly adapted to cold climates. The Barn Owl's feathers are less insulating than are other owls, their legs are only sparsely feathered, they have less insulating adipose tissue, and they have a higher metabolic rate than that of other owl species. All of these characteristics make the species more vulnerable to starvation during extreme cold winters and when extended periods of deep snow cover (which reduces hunting success) (Keith 1964; Johnson 1974; Marti 1992, 1997; Massemin and Handrich 1997). In Britain, starvation accounts for about 26% of documented Barn Owl deaths, second only to road mortality (Newton *et al.* 1997). Persistent snow cover and cold temperatures can also significantly delay onset of the breeding season and reduce the number and success of breeding attempts (Marti and Wagner 1985; Marti 1997). A successive series of hard winters could have long-lasting impacts on Barn Owl populations across very large regions, making population rebound more difficult (Andrusiak and Cheng 1997).

In southern British Columbia, which generally has the mildest winter climate in Canada, Barn Owl productivity declined and mortality increased during a single year noted for its snowfall and cold winter (Andrusiak and Cheng 1997). Persistent snow cover impaired hunting success, especially for the younger (less-experienced) birds.

It is worth noting that winter temperature in the Lake Erie region is colder than in Utah or British Columbia. The following is a summary of mean January weather conditions for Simcoe, ON: daily mean temperature is -6.2°C; mean snowfall is 40 cm; mean month-end January snow cover is 13 cm; and measurable snowfall occurs on an

average of 15 days in January (Environment Canada web-site information). These values can be compared with Vancouver, BC, where mean daily temperature is +3.0°C; mean snowfall is 21 cm; mean month-end January snow cover is 1 cm; and measurable snowfall occurs on an average of 5 days in January. It is obvious that southern Ontario is a climatologically marginal environment for Barn Owls.

It has been suggested that the use of man-made structures, because of their insulating effects, are particularly important to Barn Owls in northern latitudes (Johnson 1974, Campbell and Campbell 1984; Andrusiak and Cheng 1997). McKeever (pers. comm.) hypothesizes that the presence of several heads of horses and livestock (for milk, meat and eggs) that most farm families maintained up until several decades ago provided extra heat in barns, which allowed Barn Owls to survive during frigid winter months.

1.2.3.1.3 Nesting Site Availability and Nest Predation

Although there has been some debate on the importance of nesting site availability to Barn Owl populations (see Matteson and Petersen 1988), in regions where intensive agriculture has gradually replaced more pastoral farming, where old wooden sided barns have been replaced by steel barn structures, and where farm woodlots containing snags have all but disappeared, the availability of nest sites is probably a limiting factor for the Barn Owl (Bunn *et al.* 1982), as it is for all secondary-cavity nesting species. In fact, all Barn Owl recovery programs (including those in B.C. and Ontario) have adopted a nest box strategy as part of their strategy to better monitor local populations and offer predator havens. However, there is still some question about whether the provision of nest boxes actually boosts levels of the target population.

Installation of artificial nest boxes (and the preservation of existing nest structures) will aid in monitoring populations and provide safety from nest predators such as raccoons, opossums, and cats. The Barn Owl Recovery Team found that in southern Ontario, more than 90% of barns we work in have raccoon scats present and a majority of farms have at least one or two farm cats. This is an obvious danger and potential deterrent to Barn Owl breeding in barns.

1.2.3.1.4 Population density

Population density is obviously a factor in mate location and subsequent breeding success. Barn Owls have considerable dispersal skills and strong colonization ability. Where common, breeding densities may reach 2-5 pairs/10 km sq. (Sharrock 1976; Taylor *et al.* 1988), and up to 10-30 pairs/10 km sq (Rebane and Andrews 1995). In Ontario, the northern fringe of the species' range, peak densities could probably never realistically be expected to reach much more than 1 pair/10 km sq, even in optimal habitat and, if the Ontario population is as rare as believed, adults that now occur here have a lower probability of locating a potential mate. However, with the creation/return of favourable habitat the barrier to population increase and expansion in the southern part of the province may be possible.

1.2.3.1.5 Predation

Because Barn Owls often nest in tree cavities, some protection from avian nest predators is undoubtedly conferred (e.g. Nice 1957). Incidences of Barn Owl nest depredation as reported in the literature are scant, but loss of nestlings and eggs are mostly believed to be due to predation by snakes, raccoons, farm cats and opossums (Campbell and Campbell 1984; Ehresman 1984; Matteson and Petersen 1988; Marti 1992). In general, birds using nest boxes experience reduced rates of nest predation compared to those nesting in natural cavities (Nilsson

1986; Moller 1989). This is likely also the case for Barn Owls, especially for boxes that are mounted in locations inaccessible to predators (Laycock 1985).

The Great Horned Owl is the most serious predator of free-flying young and adult Barn Owls (Rudolph 1978; Campbell and Campbell 1984; Marti 1992), but the extent of this predation is highly variable. In a radio-telemetry study of 34 Barn Owls in New Jersey (where both Barn Owls and Great Horned Owls are common and appear to maintain stable populations), there was only one (3%) instance of predation (probably from Great Horned Owls), although many of the marked birds were unaccounted for (Hegdal and Blaskiewicz 1984). Based upon his work in New Jersey, Dr. Bruce Colvin (cited in Matteson and Petersen 1988) agrees that there is no evidence to support the contention that Barn Owl populations are limited by Great Horned Owls in that state.

1.2.3.1.6 Other Factors

Disturbance and Harassment

Although Barn Owls, because of their close association with humans, are quite tolerant of human activities near their nest sites, disturbance should be kept to a minimum during the nesting season in order to prevent nest abandonment (Hegdal and Blaskiewicz 1984). Disturbance was cited as the primary cause of nest abandonment in some studies (Klaas *et al.* 1978). Barn Owls will frequently desert nests if disturbed during the egg-laying or incubation phase (Andrusiak and Cheng 1997).

Road mortality

In areas of high road density, road mortality is a major contributor to poor survivorship of Barn Owls (Smith and Marti 1976; Keran 1981; Baudvin 1997; Newton *et al.* 1997). In France, 700 of nearly 1600 dead birds picked up on roadways were Barn Owls (Baudvin 1997). In a 23-year study of the mortality of over 1100 Barn Owls in Britain, about 45% were attributed to road-kills, more than any other cause of death (Newton *et al.* 1997).

This species is much more prone to road-kill than any other species of owl in France, due to differences in habitat selection and foraging height (Massemin *et al.* 1998). In Iowa, telemetry revealed that many owls spent time along grassy roadside ditches where adjacent fence posts provided low perches from which to hunt. In that study of 24 radio-tagged Barn Owls, 17% (4 birds) died due to vehicular collisions (Ehresman *et al.* 1988).

Christie (2002) reports that, according to the Transportation Association of Canada, “a recent historic study of southern Ontario shows a fivefold increase in the amount of significant road between 1935 and 1995. In that period, major roads in the province’s most populous region grew from 7,133 kilometres to 35,637 kilometres”.

Pesticides

Pesticides have probably not been a major factor in Barn Owl population declines in North America (Colvin 1984, 1985; Hegdal and Blaskiewicz 1984), in large part because the potential for poisoning is low given the owl's propensity to forage in habitats away from farmsteads where pesticides may be used. Unlike species such as Peregrine Falcons and Bald Eagles, Barn Owls do not feed on prey that has been exposed to chronic doses of pesticides (organochlorine and organophosphate insecticides), such as songbirds and fish, over lengthy periods of time. Given the short life span of Barn Owls in northern latitudes, this species probably does not incorporate levels of chlorinated hydrocarbons that are high enough to impact breeding success. Moreover, the use of organochlorine insecticides (e.g., DDT, aldrin) in agriculture has virtually disappeared and organophosphates, used mostly in small-acreage horticultural crops, are gradually being replaced with low-toxicity alternatives.

Poisoning from rodenticides has not been documented to any great extent in Barn Owls on this continent. In Europe, poisonings were implicated in about 6% of Barn Owl deaths over a 23-year period in Britain (Newton *et al.* 1997). The higher toxicity and greater persistence of newer rodenticides on the market, many of which are powerful anticoagulants that have largely replaced warfarin to control rodents, provide greater risks of secondary poisoning in Barn Owls. However, most telemetry studies of Barn Owls in North America indicate that Barn Owls tend to forage away from farmsteads and farm structures where rodenticides are normally used (ICI Americas).

Shooting

As was formerly the case for all raptors, deliberate shooting of Barn Owls was once a fairly common occurrence (see Campbell and Campbell 1984; Speirs 1985). In Ohio, about 200 Barn Owls were shot in 1917 alone (Earl 1934). In Britain, shooting accounted for 1% of documented Barn Owl deaths during the period 1963-96 (Newton *et al.* 1997). Although shooting raptors has undoubtedly declined in recent decades, owing to public education and legal restrictions, the occasional incident may still occur (but is unlikely to be reported).

1.2.3.2 Current Recovery, Protection and Habitat Management Efforts

The Ontario Barn Owl Recovery Project was formed in October 1997 to address conservation/recovery needs for the Barn Owl in southern Ontario. The committee consists of representatives from government, naturalist groups, land stewardship groups, fish and game clubs, a raptor conservatory, a conservation authority, and Bird Studies Canada. In July 2001 a coordinator was contracted, based on two years of funding, to coordinate recovery efforts.

The Recovery team has been active in a number of areas:

- Establishment of a Barn Owl nest box program along the north shore of Lake Erie. Almost 300 nest boxes have been built and installed, with the aid of several volunteer groups (including boy scouts, correctional centre inmates, high school students, institutes for the mentally challenged, and naturalist and conservation clubs), in and on barns and silos in rural areas adjacent to grasslands/pastures/hayfields. Farmers and rural landowners volunteer to monitor and report back activity on nest boxes on their property. A database of nest box locations, including GPS coordinates, is being maintained.
- A “Wanted!” Information on Barn Owls” poster was developed providing a contact number for anyone with information on Barn Owl sightings or nesting locations. These were distributed to naturalist and conservation organizations across southern Ontario and posted in agricultural co-ops, hardware stores and other public locations.
- Several information sheets have been developed for landowners and other interested parties, including *The Barn Owl in Ontario*, nest box building plans and information on locating nest boxes, *Commonly Asked Questions for Landowners*, and *Rodent Management on Farms to Prevent Accidental Poisoning of Raptors and other Non-Target Wildlife*. A web site (<http://www.bsc-eoc.org/regional/barnowl.html>) has been created and an annual newsletter (*The Grasslands Flyer*) is being produced.
- Two posters, *Grasslands Fauna of Ontario* and *Grasslands Flora of Ontario*, were produced and have been distributed to over 750 schools in southern Ontario, to provincial parks and conservation areas, naturalist groups and to other educational institutions.

- In late 1999 two information workshops were held (one in Norfolk county and one in Haldimand County) for rural landowners and farmers with nest boxes and other interested members of the public. Over 100 people attended.
- Public presentations and seminars (over 25) on Barn Owls, their grassland habitats and recovery efforts, have been delivered to school children, naturalist and hunt clubs, conservation organizations (including Bird Studies Canada and World Wildlife Fund) and rotary and women's groups across southern Ontario.
- A Southern Ontario Grasslands Inventory Project has been initiated in partnership with the Ontario Ministry of Natural Resources. The purpose is to identify rough grasslands, abandoned farmland, pastureland, and hay field concentrations along the north shore of Lake Erie (historical range limitation of the Barn Owl in Ontario). This will allow the Recovery Team to focus their efforts in areas with highest habitat requirements for the owls. It is expected that a number of other recovery groups and government agencies will also find these maps extremely useful for their conservation efforts.
- Regular activity reports are prepared by the Project Coordinator and distributed to the OBORT.

1.2.3.3 Degree of Habitat Management Required

The Barn Owl requires dense grassy fields for foraging. This includes wetland edges, moist meadows, abandoned farmland, grassed ditchbanks and corridors, tallgrass prairie, and pastures and hayfields (Colvin 1984, Rosenberg 1986). The quantity and quality of these habitats influences vole populations, which in turn, impacts Barn Owl breeding and survival (Colvin and Hedgal 1988).

Habitat management that would benefit the Barn Owl over the long term will require a substantial and ongoing commitment on the part of landowners, private industry with rural land holdings and the provincial government to maintain a suitable amount of habitat within suitable successional stages. However, compared to other kinds of habitat (e.g. forests and marshes) areas of rough grassland are relatively easy and inexpensive to create and maintain. Moreover, areas of rough grassland can always be easily converted back to productive farmland, preferably under a suitable schedule of rotation.

The challenge in southern Ontario, a highly intensive agricultural area, will be to raise appreciation and awareness for grassland habitat and biodiversity, and to create partnerships with farmers and rural landowners, as well as government (re. public lands), to retire marginal farm lands and implement best management strategies, such as grassed field edges, grassy buffers along ponds and waterways, and minimal rodenticide use on farms.

The creation and maintenance of grassland habitat would doubtless have many other important benefits to wildlife, including a host of grassland-dependent birds, nesting waterfowl and upland game, erosion control, and, in some cases, as a precursor to reforestation efforts. Grasslands habitat creation and management need not be directly linked to tall-grass prairie and oak savannah conservation and restoration, but there is an obvious opportunity to explore linkages here as well.

The first draft of the Ontario Barn Owl Recovery Plan indicated a target of creating 400 hectares (1000 acres) of grassland habitat over 5 years. This initial effort must be considered only as a starting point, the reality being that large, contiguous grassland habitat areas with connecting corridors and good plant diversity, spread along the north shore of Lake Erie, will be necessary to create sufficient habitat to take into account Barn Owl foraging, territorial and dispersal needs.

1.2.3.4 Biological Considerations Affecting Recovery

1.2.3.4.1. Recruitment Rate

No information has been published on recruitment rates for Barn Owls in Canada. It is unlikely, based on the scarcity of Barn Owls in western New York, that this area serves as a recruitment source for Ontario. Lake Erie may offer a significant barrier, with the only other possible source of incoming wild birds being the Detroit-Windsor area. Roughly 80% of all Barn Owl sightings between 1999 and 2002 have been in Essex and Kent counties, and Lambton-Middlesex directly to the north.

1.2.3.4.2 Minimal Viable Population

No information has been published on the minimum number of Barn Owls required to sustain a viable population. Salwasser *et al.* (1984) suggest at least 500 pairs (1000 individuals) are required to genetically sustain a given species population in a given geographic area. This is, however, a number that is contested by other biologists and many examples exist of smaller populations that are viable where sufficient stable habitat occurs. It is, however, a safe assumption, based on information from Christmas bird counts, the Ontario Breeding Bird Atlas, historical nesting records and the database maintained by the Ontario Barn Owl Recovery Project since 1997, that the Barn Owl population in Ontario is well below a minimum viable population requirement at present.

Because the Barn Owl in this province is at the northernmost edge of its range in North America and is adjacent to populations in Ohio Michigan, Pennsylvania and New York, there is the potential for recruitment from those states. The species is considered a relatively rare breeder in New York and Michigan, but a fairly common breeder in Pennsylvania (Rosenburg 1992). The Ohio population, although considered endangered, has been steadily increasing since a statewide recovery program was initiated in 1988 (Scott, pers. comm.). If there is a genetic flow between Barn Owls in Ontario and adjacent states then Ontario birds can be considered part of a larger “northern” meta-population and the species probably relies strongly upon on-going recruitment from neighbouring areas in order to sustain the northern population (Laycock 1985).

In addition to the above it should be noted that the Barn Owl, unlike other raptor species, is an “r-selected” species because of its relatively large clutch sizes, ability to breed at an early age and potential for more than one brood per year (Colvin *et al.* 1984, Marti 1997, Taylor 1994). The species also has excellent re-colonization abilities, a high rate of juvenile dispersal and can rebound from an adverse event (i.e. harsh winter, vole population crash) relatively quickly (Colvin 1984).

In summary, although the Barn Owl population is currently much smaller than the suggested minimum of 500 pairs, recovery efforts are still warranted in southern Ontario. Based on a similar argument in the national recovery plan for the Henslow’s Sparrow (Austen *et al.* 1997), “it is essential to maintain population levels at the northern limit of the species’ range in order to prevent further range and population declines”. The Barn Owl is also a very appropriate flagship species for the recovery and conservation of grassland habitat, which will benefit many other grassland flora and fauna and promote greater biodiversity and conservation efforts.

1.2.3.5. Competing Species and Predators

Squirrels, opossums and raccoons are probably the most serious competitors for natural cavity nest sites. Starlings and Rock Doves have frequently used Barn Owl nest boxes in Ohio and Ontario but Barn Owls will evict these species (Scott, pers. comm.). The Ontario recovery program has also documented American Kestrels (*Falco sparverius*) nesting in Barn Owl nest boxes, and found evidence of Screech Owls (*Otus asio*) using the boxes for roosting.

The Barn Owl's chief avian competitors for voles and mice in southern Ontario are the Great Horned Owl (*Bubo virginianus*), Red-tailed Hawk (*Buteo jamaicensis*), Northern Harrier (*Circus cyaneus*) and American Kestrel, as well as wintering Short-eared Owls (*Asio flammeus*) in some regions. Foxes, coyotes, cats and snakes also feed on voles. Although not documented, competition for food is apt to be strong only in those winters when rodent populations are low or protected by snow cover and under prolonged drought conditions. Under most conditions, however, competition for food should not be viewed as a serious limiting factor.

1.2.3.6 Captive Propagation and Release

The Barn Owl is a bird, whose life history and biology, seems to lend itself well to a captive-release program. The Barn Owl has an r-selected breeding strategy, which favours a high reproductive output. It breeds at an early age, has a large clutch size, and is capable of producing two broods in a year (although probably not in Ontario and northern states). Although populations are very cyclical, closely following that of their prey, they have a well-documented ability to “bounce back”, providing suitable habitat and healthy prey populations are present. Coupled with its ability to breed prolifically in captive situations, these traits might make it a very good candidate for a captive-breeding and release program.

However, many life history traits of Barn Owls have been shown to be counter-productive to captive propagation/release programs:

1. Fledged young have a high propensity to disperse, sometimes several hundred kilometres;
2. Barn Owls are a short-lived species (2 years on average in the wild);
3. Populations are cyclical – a harsh winter or summer long drought could decimate a whole population, negating all the hard work of a release program;
4. If sufficient “sustainable” habitat with large populations of meadow voles are absent owls may starve to death;
5. Additionally, in southern Ontario, Great Horned Owls, a major predator of young (fledged) and adult Barn Owls, and a potentially limiting factor to Barn Owl survivorship, are common and widely distributed. Important nest predators like raccoons; opossums and farm cats are common in today's rural Ontario landscape.

Based on very few sightings and no records of Barn Owls breeding in Ontario for at least the last 5 years, there is probably minimal on-going natural recruitment to augment any release and add to genetic variability. Grassland inventories, conducted by the Recovery Team, show little suitable habitat exists along the north shore of Lake Erie and there continues to be conversion to intensive row cropping and, in some cases, development. Even in counties with higher acreages of pasture and hayfields (e.g. Haldimand and Niagara) the quality of those lands are questionable as pastures are intensively grazed and hay is cut 2 –3 times, leaving little suitable habitat for voles and mice.

To put the concept of a captive propagation/release program into perspective one must, however, also look at the experiences of others. The British and Americans have the most experience in these types of programs. Summaries of their successes/failures are outlined below, as well as the limited Ontario experience. Appendix I summarizes comments from the two external reviewers and RENEW of the earlier draft of the Ontario Recovery Plan (November 1998) and includes a discussion paper by Dr. Bruce Colvin, widely regarded as the foremost expert on Barn Owls in eastern North America on Barn Owl release potential.

UNITED STATES

Between 1979 and 1986 captive propagation and release programs operated in Indiana, Iowa, Michigan, Missouri, Nebraska and Wisconsin. “Programs in Indiana and Michigan were conducted by private conservation groups or zoos; programs in Iowa, Missouri, Nebraska and Wisconsin were either cooperative efforts, or were conducted solely by state conservation agencies. The number of captive breeding pairs, young produced and young released was highly variable between each program” (Dinan and Lock 1989), Iowa and Missouri being the most productive (producing between 80 and 96 offspring per year). Release methods included both recommended techniques (developed in Great Britain), the long-term release method (utilizing paired adult birds confined in a barn until brood produced) and the young clutch release (where 4 to 6 week old owlets are placed in a box and supplementally fed until fledged). A total of over 50 adult birds and 1324 young were released over the 7 year period. The majority of the owls were banded and the Iowa, Missouri and Nebraska programs reported using radio telemetry to some degree to track birds. Appendix 1 details the Iowa study and a second study in Wisconsin. All programs were supported by artificial nest box installation projects.

Returns of released owls or their offspring to natal/nesting sites were reported in Missouri and Nebraska. Henke and Crawford (1987) reported 3 cases of captive-propagated barn owl breeding successfully in the wild. In some states, several other reports were received of barn owls nesting in the vicinity of releases but they were not confirmed as being released or offspring of released owls. Recoveries of banded birds were reported from all projects that had banded and released captive-raised birds: 6 in Wisconsin, 20 in Iowa, 22 in Missouri, and 10 in Nebraska. “Of the 56 total recoveries with distance-moved data available, 39 (70%) were recovered within 80 km. of the release site. Forty-one (73%) of the 56 recoveries were six months of age or younger”. “Only 3 (5%) of recoveries were more than 12 months of age, representing a 95% overall mortality rate in released young”. Mortality causes in recovered birds were reported to be vehicular collisions, predation by Great Horned Owls, starvation and electrocution.

In 1988 a survey was conducted by Dinan and Lock (1989) on the perceived value of barn owl restoration efforts in mid-western states involved in captive-release programs. Respondents from Kansas, Missouri and North Dakota felt there was value in a barn owl release programs (public outreach and knowledge gained from working directly with the birds). Respondents from Illinois, Indiana, Iowa, Michigan, Minnesota, Nebraska, Ohio and Wisconsin “believed that releasing captive-raised birds was not an effective strategy to restore barn owl populations”. The propensity of young barn owls to disperse long distances from their release site, high mortality and lack of foraging habitat were identified as reasons for the negative responses. These states indicated that habitat restoration and providing/protecting secure nesting sites was the best conservation tactic for the species. Appendix II outlines two recovery attempts in the Midwestern U.S.

The following excerpt is quoted from P. Matteson and L. Peterson. 1988. *Wisconsin Common Barn Owl Management Plan*, Wisconsin Endangered Resources Report # 37. Bureau of Endangered Resources, Wisconsin

Department of Natural Resources: “The Bureau of Endangered Resources decided in 1987 to discontinue the captive-propagation and release program since there was no evidence that the program had enhanced the state’s barn owl population”.

Dr. Bruce Colvin of Bowling Green State University and Paul Hegdal of the United States Fish and Wildlife Service, both of whom are widely considered the leading experts on the life history and ecology of barn owls in the Midwest and the East, have often recommended the Wisconsin and other mid-western states re-evaluate the merit of captive propagation and release programs and instead focus on identification and preservation of grassland (foraging) habitats, the proper design and installation of nest boxes, and field surveys (Colvin 1986, B. Colvin *in litt.* To R. Nicotera, P. Hedgal *in litt.* to S. Matteson). Colvin (1986) stated: “We now know that there is no biological justification for barn owls releases as a recovery mechanism or as a way to achieve self-sustaining, long-term, population maintenance at the level of 20-30 years ago. It simply will not work given the current land use patterns in the midwestern states; the necessary habitat and specific prey no longer exist as they once did”. Further, Colvin (*in litt.* To S. Matteson) added that “...even established local populations may be largely extirpated in any given year under conditions of low vole numbers and weather extremes. These factors make propagation and release approaches highly questionable as a management tool”.

Based on internet searches and several follow-up phone calls, it was found that currently there are only several very small release programs in place in the U.S. (New York, Pennsylvania and Montana). All are run by not-for-profit rehabilitation centres and do not receive any state funding or other state support. Most use “hard releases”, letting birds go in daylight with media and supporters present to enhance P/R for their facilities and attract donations. None of these programs use radio telemetry or have any quantitative data to suggest releases are resulting in increased numbers of barn owls in their states, or even in the vicinity of where releases are conducted.

ONTARIO

Kay McKeever (1997) of The Owl Foundation indicated that approximately 200 young Barn Owls were produced, raised and released in southern Ontario between 1974 and 1994 (more than any other species handled by the Foundation). Most birds were released in September, following 1 month on live prey. McKeever (*fide* D. Richards) reports that about 18 birds were released per year from her facility, using a variety of “hard” release methods. Generally, individual or paired owls were released near barn structures in hopes that residence in these buildings would take place (McKeever, *fide* B. Solymar).

All released birds from the facility were banded. Only one was ever recovered, a dead two-year old individual bird, in New Jersey (McKeever, *fide* B. Solymar). Weir (1987a) and Austen *et al.* (1994) suggested that these releases might have explained the concentration of Barn Owls in the Niagara region during the 1980s (3 of 4 confirmed breeding pairs in the 1981-86 Ontario Breeding Bird Census were in the Regional Municipality of Niagara, the other in neighbouring Haldimand County).

Jon McCracken (1998) outlined a simple population model for a trial release of 100 Barn Owls in Haldimand-Norfolk County (see Appendix III). Based on the model, which takes in to account random dispersal, mate finding success and mortality factors, he concluded that “without further augmentation of the population through captive breeding (and release), by the end of the second year the original captive-released population will probably have died out”. A theoretical population viability analysis was also conducted to determine the

sustainability of a full-fledged release program. The model predicted that even at an annual release rate of 1000 birds for 5 years the population would decline and fairly quickly die out. McCracken concludes that, unless mortality rate and/or emigration rates are substantially lower than the model predicts, “despite maximizing the chances of birds finding mates, the model predicts that a self-sustaining population of Barn Owls in southern Ontario is not likely over the long-term, regardless of how many birds are released”.

GREAT BRITAIN

Great Britain has over 70 years of experience in Barn Owl conservation efforts and has traditionally been very involved with captive-release programs in an effort to re-populate the English countryside with this once common species.

The British population of Barn Owls in the 1930's was estimated at 12,000 to 14,000 birds. Steady and gradual decline in numbers over the last 70 years has resulted in an estimated 4000 wild birds by 1998. Numerous release programs have been conducted in Britain over the years (1000-2000 birds released annually during the 1980's and 1990's) to attempt to restore the species to earlier numbers.

There was so much enthusiasm to re-stock British Barn Owl populations by well-meaning birders, rehabilitators and others (estimated 15,000-20,000 captive birds in 1991) that the Department of Environment, Food and Rural Affairs (DEFRA) instituted a licensing system, called the 'Captive Barn Owl Release Scheme' in 1992 to prevent indiscriminate releases and ensure they were properly conducted (i.e. releases were concentrated where good habitat existed). This system meant that a permit had to be attained to release captive-bred Barn Owls. As a result of the legislation and increased accountability and paper work, the number of applicants for permits declined gradually in subsequent years (47 in 1993 to 12 in 2000).

Based on a countrywide consultation process and the recommendation of English Nature, on January 10, 2002 the Minister of State for the Environment banned all further captive-release programs. English Nature's study stated that “there are only very limited, if any, conservation benefits from release projects involving barn owls in England”. They indicated that suitable nesting and habitat were the main limiting factors in that country and that captive-release programs do not tackle these issues and often distract from real habitat conservation and protection programs. DEFRA, in their consultation paper, state that “conservation efforts are therefore likely to be much more effective than releases”. These comments support earlier work by Rebane and Andrews (1995), who noted that the evidence for captive-release program success is often circumstantial, and indicating they were unable to find even a single published study that proved that releases increased the British Barn Owl population.

The following statement is taken from the Department of Environment, Food and Rural Affairs' The Captive Barn Owl Release Scheme- Consultation Paper, June 2001,

(www.defra.gov.uk/wildlife-countryside/consult/barnowl/consultdoc.pdf):

“In conclusion, the Department believes that the current (captive propagation and release) scheme offers little conservation benefit to the wild barn owl population. The flagship approach to releasing barn owls, whilst highlighting the plight of the barn owl, has done little to reverse the degradation in habitat or to address the other factors, which affect the wild population. Whilst local populations may be bolstered it does not take into account the factors causing decline nor the fact that in the last 15 years the population has not altered significantly despite the scheme. The continuation of such a scheme will continue to mask the real factors behind the low numbers of barn owls, and in particular the erosion of suitable habitat”.

In summary, the overwhelming preponderance of evidence is that Barn Owl release programs have faced little or no success in recovery/re-population of the species in most U.S. states (especially more northern states) and in Great Britain, despite large numbers of birds being released annually, especially in Great Britain. All release programs in the mid-western states were abandoned in the late 1980's and in Great Britain the government outright banned captive-release this year since, after decades of releasing Barn Owls in the wild, there was no quantitative evidence that there was any positive impact on natural populations.

The Barn Owl is a neo-tropical and warm temperate region bird. The further south one goes the more commonly the species is found. Southern Ontario is at the northern fringe of the Barn Owl's North American range and represents a mere 0.1% (and probably less today) of the world population of this species. Although data is sparse it can be safely said that the Barn Owl was never common in Ontario and we don't even know if they were here prior to European settlement and the massive land clearing that followed. Current, and continuing, intensive agricultural land use practices and urban encroachment in southern Ontario have resulted in significant loss of wetlands (and associated wetland fringe habitat), native prairie/oak savanna, pastureland, and hay fields. Upland (cool season grass) grasslands and old fields are small and fragmented in most of southern Ontario. Drier, hotter summers, experienced over the last few years, generally result in significant cyclical population declines of meadow vole populations, the favoured prey item of Barn Owls in northeastern North America. Great Horned Owls, predators of adult Barn Owls, are common, and opportunistic nest predators, including raccoons, opossums and cats, are found on almost every farm.

To conduct a captive propagation-release trial in Ontario at this time, based on the scientific literature and extensive experience in Great Britain and the U.S., is, in all probability, a dead end and would detract from other objectives of the Recovery Plan. A trial like this, to be conducted in a valid, scientifically sound manner, would require a significant amount of preparation and a scientific approach (with quantitative results in mind), and would be very expensive to conduct. The result would, seemingly, be inevitable with the only benefits derived being some short-term public interest through media and some on-hands experience in working with the species.

If there is to be a continued serious effort to recover this species in Ontario then, as outlined in this Recovery Plan, the nest box monitoring program, grassland conservation and restoration (including development of grassland reserves), developing working partnerships with farmers and rural landowners to learn and practice more sustainable land stewardship, and public awareness and volunteerism should be the main focus of the Recovery Team over the next 5 years. This "Big Picture" approach can only benefit the long-term goals of restoring Barn Owls to the north shore of Lake Erie and create important positive spin-offs for other grassland species and biodiversity in general.

SECTION II

Barn Owl Recovery Plan

2.1 Recovery Goal and Objectives

The goal is to increase the population of the Barn Owl in Ontario to self-sustaining levels, and to conserve and restore grassland habitat for Barn Owls and other grasslands-dependent flora and fauna by:

1. Monitoring breeding populations, locating nest sites, and maintaining a database of information.
2. Maintaining, and potentially expanding, the Barn Owl nest box monitoring program.
3. Identifying, protecting, restoring and conserving grassland habitat and biodiversity.
4. Developing public support through education and awareness.

2.2 Strategies for Goal Achievement

1. Determine current population status, distribution and trends in Ontario and explore effects and solutions of other potentially serious limiting factors to recovery (e.g. predators, rodenticides use, road fatalities)
2. Identify grassland habitat and initiate efforts to conserve, restore and protect grasslands
3. Develop public awareness and support for Barn Owls and grassland habitat
4. Establish partnerships and cooperation with grassland and grassland species recovery teams, other NGOs, government, private sector, and rural landowners/farmers.

2.3 Tasks Required to Implement Strategies: A Step-down Outline

1. *Determine current population status, distribution and trends in Ontario and explore effects and solutions of other potentially serious limiting factors to recovery (e.g. predators, rodenticides use, road fatalities)*
 - a. Develop and maintain a volunteer nest box installation and monitoring program involving rural landowners and farmers
 - b. Develop volunteer-supported grasslands indicator species surveys and reporting systems to assess the health of southern Ontario grasslands.
 - c. Maintain a central data base of all survey results, sightings and nesting site locations
 - d. Examine potential impact/risk of predators, rodenticides and road fatalities on the Barn Owl population
 - e. Develop an action protocol for located active nesting pairs of Barn Owls
 - f. Consult researchers in adjacent U.S. states to determine regional population trends in their jurisdictions, share relevant information, and encourage cooperative programs
 - g. Produce annual reports summarizing survey findings and documenting trends relative to the population target established by the Recovery Plan.
 - h. Investigate the feasibility of a captive breeding and release program
 - i. Develop an action protocol for when an individual bird or breeding pair is located

2. *Identify grassland habitat and initiate efforts to conserve and restore grassland communities*
 - a. Conduct a grasslands inventory across the north shore of Lake Erie via groundtruthing and satellite imagery and mapping
 - b. Identify, demonstrate, and promote sustainable grassland management practices to rural landowners and farmers
 - c. Explore economic and environmental benefits of grassland habitat
 - d. Conduct rodent population surveys in different grassland types
 - e. Explore and promote concepts such as incentives/tax breaks, land trusts and conservation easements
 - f. Approach government and large corporate landowners, re. Setting aside lands for grasslands reserves

3. *Develop public awareness and support for Barn Owls and grassland habitat*
 - a. Develop, produce and distribute educational materials
 - b. Develop and maintain a website and annual newsletter
 - c. Publicize through the media the status and plight of the Barn Owl, other grassland species and grassland habitat in southern Ontario
 - d. Provide presentations, with slides and live Barn Owl, to naturalist clubs, fish and game clubs, school children, fairs and conferences, and other public venues

4. *Establish partnerships and cooperation with grassland and grassland species recovery teams, other NGOs, government, private sector, and rural landowners/farmers.*
 - a. Cooperate and enlist support from NGOs, naturalist clubs, fish and game clubs, conservation authorities, land stewardship councils, and others to work towards strong cooperation and partnerships in protecting grassland species and habitat
 - b. Provide information, awareness and contacts for habitat conservation efforts private rural landowners, farmers, and corporate landowners.

5. *Needs on the Recovery Team, and for a Project Coordinator and Regional Action Groups*
 - a. Hire a project coordinator to implement the actions outlined in the Recovery Plan
 - b. Formal review of Recovery Team membership and formation of associated Recovery Action Groups (RAGS)
 - c. Provide a project review and evaluation

2.4 Narrative Description and Justification of Tasks Listed in Step-down Outline

2.4.1 Determine current population status, distribution and trends in Ontario

- a. *Develop and maintain a volunteer nest box installation and monitoring program involving rural landowners and farmers*

Barn Owls are cavity nesters and readily breed in artificial nest boxes mounted on or in farm buildings (e.g. wooden barns, silos, tobacco kilns, etc.). The development of an artificial nest box monitoring program can facilitate monitoring Barn Owl populations and provide predator-safe nesting and roosting sites for the birds.

Various designs were explored and several chosen for the Ontario program. Volunteers (e.g. boy scouts, correctional centres, mentally handicapped, high school students) were recruited to build over 300 nest boxes of 3 basic designs: Ontario internal and external models, and the New Jersey Ohio nest box. Members of the Recovery Team committee drove back roads in Norfolk and Haldimand county and identified properties with suitable grassland/pasture habitat (see Appendix 1 for site selection criteria) in the vicinity of barns and other farm structures. Landowners of selected properties were visited, given background literature and asked permission to install a nest box on their property. All participant landowners received a sign to display their support of the project.

In other counties along the north shore of Lake Erie (historically populated by Barn Owls) partner organizations were sought to assist in locating appropriate locations for nest boxes, contacting landowners, and installing nest boxes. These include county land stewardship councils, fish and game clubs and naturalist clubs.

In 2000 a student was hired by the Recovery Team to monitor the installed nest boxes. However, as the program expanded this became economically non-feasible. A volunteer nest box monitoring program was initiated whereby landowners with nest boxes on their property are asked to visually monitor their boxes from June through August. All observations on nest box activity are then sent back to the Team in self-addressed, stamped envelopes and data entered into a database. Landowner contact and support are considered essential to the success of a Barn Owl recovery project.

After 2 years this method yielded very few returned surveys (less than 5%) and was deemed as not an effective way to monitor installed nest boxes. Beginning in the Fall of 2002 local conservation-oriented groups were contacted and asked to assist in physically checking nest boxes. The advantage of this method will be an opportunity to clean and repair boxes as required, involve local volunteers and minimize risk of disturbing a nesting pair. Although it will not be feasible to check all boxes in Norfolk or Haldimand every year (about 100 nest boxes installed in each county) it is hoped that all boxes can be checked in 2 to 3 year rotations.

- b. *Develop volunteer-supported grassland indicator species surveys and reporting systems to assess the health of southern Ontario grasslands*

The Barn Owl is considered an indicator species for healthy, productive grassland habitat. However, given the rarity of the Barn Owl in Ontario, coupled with the fact that it is a notoriously difficult species to census, in part because it is less vocal than most other owl species (Rebane and Andrews 1995), it will be difficult to initiate an effective standardized, volunteer-based population and density monitoring program. By linking our efforts to recover the Barn Owl in Ontario with population surveys of other grassland indicator species we hope to develop a better picture of the current extent and diversity, and sustainability of grassland habitat in southern Ontario. In turn, this will allow more knowledgeable targeting and strategic planning for protecting and conserving existing grassland tracts and restoring others.

Candidate indicator species are the Northern Harrier and Short-eared Owl, both of which are declining across their North American ranges and both of which occasionally breed and/or

overwinter in southern Ontario. This makes them excellent candidates for indicator species surveys (wintering populations). A variety of grassland birds and insects have also been used in other states and provinces to assess grassland diversity, including Henslow's Sparrow, Savannah Sparrow, Vesper Sparrow, Grasshopper Sparrow, Bobolink, Eastern Meadowlark, Upland Sandpiper, Regal Fritillary, Karner Blue and a number of Orthopteran insects (grasshoppers, katydids, and crickets).

The surveying of these grassland indicator species in southern Ontario will further increase the potential popularity of the project, provide valuable information to partner organizations, and enhance its scientific, conservation and educational values.

c. *Maintain a central data base of all survey results, sightings and nesting site locations*

Maintenance of a central data base is essential in collecting information on potential sightings, grassland indicator species surveys, the nest box monitoring program, and from partner sources such as the Ontario Ministry of Natural Resources Natural Heritage Information Centre (NHIC), Bird Studies Canada Ontario-Birds-at-Risk Coordinator, and the Royal Ontario Museum/Canadian Wildlife Service Ontario Nest Records Scheme. Because these agencies are entrusted to supply and archive such critical information themselves, it is essential to also keep them informed and part of the reporting system.

“Wanted!” posters, explaining the project and asking for any sighting reports were distributed to farm supply, feed and pet stores, sent to farming organizations and individual farmers, and were posted at agricultural exhibitions and shows. We also want to regularly publicize the recovery program on birder internet “chat groups”, in ornithological journals, naturalist club newsletters, and newspapers with a call for information on Barn Owl sightings and any band recoveries throughout the Great Lakes basin.

d. *Examine potential impacts/risks of predators, rodenticides and road fatalities on Barn Owl the population*

Little is known about the potential impact of predation (raccoons, cats and opossums as nest predators and Great Horned Owls as predators of fledged juvenile and adult birds), agricultural chemical use (especially rodenticides) and rural traffic on Barn Owl mortality in Ontario. A historical study of whether these factors have been or have become a significant hindrance to Barn Owl population increase will help direct future recovery efforts in this province.

e. *Develop an action protocol for located nesting pairs of Barn Owls*

Because the Barn Owl is an endangered species a procedural protocol should be in place in the event an active nest is located. This protocol would include procedural outlines for legal aspects of reporting to government agencies, working with private landowners and/or local birders to keep information confidential, monitoring of the nest site, possible banding of adult birds and any young, and information recording schemes.

- f. *Consult researchers in adjacent U.S. states to determine regional population trends in their jurisdictions, share relevant information, and encourage cooperative programs*

It is important to initiate and maintain communications with our U.S. counterparts, especially in neighbouring states. Some of their recovery efforts have been operating longer than our program and we can learn much from both their successes and failures. Among several other things of interest, we need to be aware of any change (especially an increase) in their local Barn Owl populations that might be attributed to recovery efforts in Ontario. At the same time, we also want them to inform us of any recovery activities that they may adopt which could affect the Ontario recovery efforts. In time, we may also want to develop fully collaborative projects. Ultimately, the recovery of the Barn Owl in the northeastern part of its range will benefit enormously from multi-agency, multi-jurisdictional cooperation.

- g. *Produce annual reports summarizing survey findings and documenting trends relative to the population target established by the Recovery Plan.*

Annual reporting to volunteers, funders, landowners, and all interested parties is key to the continued interest and success of any recovery program.

- h. *Investigate the feasibility of a captive breeding and release program*

When assessing the value of any species re-introduction effort the underlying reasons for the decline of that species in a geographic area must first be established. When and where those factors resulting in the species decline from historic levels can be improved, subsequent re-introduction efforts become more justified. Barn Owl re-introduction efforts, also extensively tested in Great Britain and the U.S. Midwest, have met with little success. All biologically designed release efforts in the U.S. have been discontinued and the British Department of Environment, Food and Rural Affairs has banned the practice in Great Britain as no quantitative benefits (increase in Barn Owl populations) have ever been documented. Bruce Colvin and Paul Hedgal, both considered leading authorities on Barn Owls in the U.S.A., are highly critical of captive-release programs for the species and consider them “highly questionable” approaches to conservation and recovery of the species (Colvin, pers. comm., Henke and Crawford 1987).

In southern Ontario, if a captive breeding and release program is ever attempted, a massive effort to substantially increase grassland foraging habitat in a predominately agricultural landscape is first required. At that time the only justification would be that Ontario may have a natural barrier to the south – Lake Erie – which may be hindering re-colonization ability.

- i. *Develop an action protocol for when an individual bird or breeding pair is located*

Any sighting of individual birds, particularly one seen several times in a vicinity by several people or known to be roosting in a specific location, or breeding pairs of birds must be carefully collaborated, monitored and recorded. An action protocol in the event of such sightings must be developed and must encompass the following: contact chain, communication with landowner or sighter, and verification of sighting as one of the following ratings: either “not a Barn Owl”, “possible sighting”, “probable a sighting” or “confirmed sighting”. A strict follow-up protocol, re.

observations and any banding, etc. and to limit curious birders and members of the public flocking to the site must be developed.

2.4.2 Identify grassland habitat and initiate efforts to conserve and restore grassland communities

a. Conduct a grasslands inventory across the north shore of Lake Erie via groundtruthing and satellite imagery and mapping

To maintain a stable breeding population Barn Owls require large swaths of grassland habitat that supports sufficient prey densities. Grassland quality will vary depending on several factors: soil type and conditions, agricultural use, plant diversity, percent shrub and tree cover, prey densities, area covered by grasslands and has appropriate nesting sites in the vicinity of the grasslands.

To determine grassland type and occurrence across southwestern Ontario a grasslands inventory will be conducted. The inventory will require initial recent satellite imagery and infrared photography. These will be used to ground-truth areas of land along rural roads across the north shore of Lake Erie. Various “grassland types” will be identified including agricultural (pastureland, hayfields), early successional (abandoned farm land), native (tallgrass prairie), wetland fringe, and upland grasslands.

The above information will be mapped to differentiate (using a colour scheme) these different grassland types and determine where larger, contiguous areas exist and where grassland habitat is largely lacking. This knowledge will allow the Recovery Team to better focus its Nest Box Program, landowner awareness/conservation promotion efforts, and future grassland restoration/conservation efforts.

The maps are expected to provide valuable information to other grassland species recovery teams operating in southwestern Ontario, as well as some conservation organizations (e.g. local Conservation Authorities, Ducks Unlimited).

b. Identify, demonstrate, and promote sustainable grassland management practices to rural landowners and farmers

Grasslands and farmland pasture/hayfields can be managed to provide habitat, protect species, and increase biodiversity. They may also act as carbon sinks, prevent erosion and leaching, offer recreational opportunities (e.g. birding, horseback riding, hiking, hunting) and provide aesthetic value to rural landowners (e.g. flowering meadow).

A booklet will be produced for farmers and landowners in southwestern Ontario outlining best management practices for grasslands, and agricultural pastures and hayfields. It will outline practices such as planting and seed selection, mowing, burning, rotational hay harvesting, grassed buffer strips and corridors, and developing habitat for Barn Owls and other grassland species.

A presentation will be developed and funding pursued for initiating demonstration sites with the help of various partners (e.g. private landowners, stewardship councils, Ontario Soil and Crop Improvement Association, conservation and naturalist clubs).

c. Explore economic and environmental benefits of grassland habitat

A literature search will be conducted to identify uses of grasslands that can provide alternate sources of income for landowners and farmers (e.g. honey production, late season pasturing, bio-

fuel production) and the environmental benefits of grasslands (e.g. providing species habitat, promoting biodiversity)

d. Conduct rodent population surveys in different grassland types

Surprisingly little literature exists on what constitutes an ideal habitat for voles and other grassland rodents. Barn Owls need good hunting habitat with sustainable populations of meadow voles, their main prey. A grassland rodent survey (species, diversity and populations) in several grassland habitats (e.g. tallgrass prairie, wet meadow, retired farmland) will provide valuable information on which grassland types should be promoted to the rural community. It will also help us to better understand rodent population dynamics and species diversity and their potential impact on Barn Owl recovery efforts. Additionally, information on correlation of climatic factors (e.g. wet springs, droughts, harsh winters) on rodent population dynamics and lead to further studies on species-habitat type associations.

e. Explore and promote concepts such as incentives/tax breaks, land trusts and conservation easements

Rural landowners often lease their lands to farmers in order to qualify for tax breaks. Several alternative options exist in other areas, such as the U.S., including conservation easements, farmland trusts, and government grants and incentives to retire marginal farmland. These need to be explored for feasibility and implementation in Ontario.

f. Approach government and large corporate landowners, re. Setting aside lands for grasslands reserves

Some significant rural properties in southwestern Ontario are owned by the Crown or by private industry. These landowners need to be approached to raise awareness of the benefits of creating grassland reserves (environmental and public relations). The Ontario Barn Owl Recovery Team can provide sources of information on creating and maintaining grassland habitat in the rural landscape.

2.4.3 Develop public awareness and support for Barn Owls and grassland habitat

a. Develop, produce and distribute educational materials

Since 1997 the OBORT has developed various information sheets for rural landowners and other parties interested in recovery efforts for Barn Owls in southwestern Ontario. These include information on selecting nest box locations, nest box construction plans, nest box monitoring guidelines, a brochure on the Team's goals and activities, a fact sheet on the Barn Owl and its biology, and a paper on rodent management around farms and rural properties to minimize impact on non-target wildlife.

The OBORP team developed a set of posters, *Grassland Fauna of Ontario* and *Grasslands Flora of Ontario*, with financial support from the Shell Environmental Fund, the MNR's Community Fisheries and Wildlife Incentive Program (CFWIP), and Tallgrass Ontario. The poster set was

distributed to all schools across the north shore of Lake Erie, and to conservation authorities, provincial parks, naturalist clubs, government offices, and others.

b. Develop and maintain a website and annual newsletter

The OBORP Team has a website (www.bsc-eoc/regional/barnowl.html), maintained by Bird Studies Canada, and an annual newsletter called *The Grasslands Flyer*. The latter is sent to all nest box program participants, partners and other interested organizations and individuals.

c. Publicize through the media the status and plight of the Barn Owl, other grassland species and grassland habitat in southern Ontario

Numerous newspaper articles have covered the recovery efforts of the OBORP Team. These have included the *Hamilton Spectator*, *Ontario Farmer* and *Brantford Expositor*. TVO and CBC Radio have also featured the project. The Team will continue to promote their project through the media.

d. Provide presentations, with slides and live Barn Owl, to naturalist clubs, fish and game clubs, school children, fairs and conferences, and other public venues

To date over 25 presentations on the Barn Owl Recovery Teams efforts have been delivered to various groups, including naturalist and conservation clubs, high school environment classes, and conservation organizations. A live Barn Owl often accompanies these presentations. A new presentation will be developed which will focus on the importance of grassland habitat to the Barn Owl and other grassland species.

2.4.4 Establish partnerships and cooperation with grassland and grassland species recovery teams, other NGOs, government, private sector, and rural landowners/farmers.

a. Cooperate and enlist support from NGOs, naturalist clubs, fish and game clubs, conservation authorities, land stewardship councils, and others to work towards strong cooperation and partnerships in protecting grassland species and habitat

The benefits of various groups working together towards the same goals are important to any conservation effort. The OBORP team has developed numerous contacts with other organizations and groups interested in grassland and grassland species conservation efforts. The Team will organize a one-day “Grassroots for Grasslands” stakeholders meeting to explore and initiate partnership opportunities, joint funding proposals, and joint lobbying efforts for grassland reserves in southwestern Ontario

b. Provide information, awareness and contacts for habitat conservation efforts to private rural landowners, farmers, and corporate landowners.

On an on-going basis, provide farmers and rural landowners (private and corporate) with contact information for funding agencies, information sources on grasslands, and other organizations with expertise in grassland species conservation.

2.4.5 Needs on the Recovery Team, and for a Project Coordinator and Regional Action Groups

a. Hire a project coordinator to implement the actions outlined in the Recovery Plan

To ensure the goals and objectives of the Recovery Team are implemented the OBORT hired seasonal project coordinators in 1998, 1999 and 2000. In 2001 funding was secured to contract the services of EarthTramper Consulting to carry out activities listed in the Recovery Plan (July 2001 – June 2003).

b. Formal review of Recovery Team membership and formation of associated Recovery Action Groups (R.A.G.'s)

The Ontario Barn Owl Recovery Team was formed in October 1997. The volunteer-based committee is currently comprised of volunteers from a number of locally-based organizations from Norfolk and Haldimand counties (Haldimand Area Stewardship Council, Haldimand Bird Observatory, Habitat Haldimand, Norfolk Field Naturalists, Norfolk Land Stewardship Council, Simcoe Fish and Game Club), the Long Point Region Conservation Authority, the Ontario Federation of Anglers and Hunters, Bird Studies Canada and the Canadian Raptor Conservancy, as well as an Ontario Ministry of Natural Resources species-at-risk biologist. This “grass roots” committee has been instrumental in initiating the Barn Owl nest box monitoring program, in fund-raising activities and in providing public awareness and education on Barn Owls and grassland habitat.

It is recommended that the membership of the Recovery Team be reviewed with a focus on more complete representation of the parts of the province identified as having potential for Barn Owl recovery in the province. It is suggested that at least one representative be added from each of the following areas – Essex-Kent, Lambton, and Niagara. As well, it is recommended that a Canadian Wildlife Service biologist, a university researcher specializing in grasslands/farmlands habitat conservation, and a farmer associated with the Ontario Soil and Crop Association be recruited. The Recovery Team should also have official representation from Carolinian Canada and Tallgrass Ontario.

Additionally, in an effort to take greater advantage of the volunteer base available via local conservation-minded individuals, groups and organizations, the Recovery Team should actively encourage and support the formation of Recovery Action Groups (R.A.G.'s) by approaching local conservation-minded groups. Activities conducted by these partner groups could include nest box monitoring, education/awareness, landowner contact, fund raising and managing grassland habitat conservation/restoration projects. The partner groups, acting as local R.A.G.'s, would also be in a unique position to assist in objectives and activities associated with a number of Recovery Teams in southern Ontario (e.g. Northern Bob White, American Badger, Karner Blue Butterfly, tallgrass/oak savanna communities, etc.), as well as partner with other local conservation, farm and naturalist groups.

From a Barn Owl recovery perspective formal partnering with existing regional conservation groups, would be beneficial in the following geographic areas: Kent-Essex, Middlesex-Lambton, Haldimand-Norfolk, and Niagara. Representation on each partner group could consist of naturalist

club and fish and game club members, farmers, birders, stewardship coordinators, and other conservation-minded individuals.

c. Provide a project review and evaluation

A complete project review and evaluation to be prepared after the first 5-year phase of the project.

SECTION III

Implementation Schedule for the National Recovery Plan for the Barn Owl – Ontario Population

The implementation schedule outlines recovery tasks for the Barn Owl (Ontario population) for a 5-year period (2001-2005). Tasks are rated according to their priority and assigned to agencies/organizations taking lead and/or cooperating roles. Priority ranks are defined as:

- Priority 1: An action required to re-establish a population or to prevent its extirpation or irreversible decline in the near future.
- Priority 2: An action that must be taken to prevent a significant decline in species population and habitat quality, or other significant trends short of extirpation, negative impact short of extinction.
- Priority 3: Other actions necessary to achieve recovery and reclassification of the Ontario population

Key to acronyms used in Table 1.:

OBORT – Ontario Barn Owl Recovery Team
OMNR – Ontario Ministry of Natural Resources
OMAF – Ontario Ministry of Agriculture & Food
US BIOL – U.S. biologists
NFN – Norfolk Field Naturalists

NGO – Non-Governmental Organizations
CWS – Canadian Wildlife Service
UNIV – University researchers
CRC – Canadian Raptor Conservancy
BSC – Bird Studies Canada

Table 1. Implementation tasks (2000-2005) for the Barn Owl (Ontario population) Recovery Plan

Action	Recovery Plan #	Priority	Responsibility	Cooperators	Target Date	Estimated Costs (\$000s)				
						2000-01	2002	2003	2004	2005
2.4.1 Determine Current Population Status, Distribution and Trends in Ontario										
Develop a volunteer nest box installation and monitoring program involving rural land-owners and farmers	2.4.1.a.	1	OBORT	NGO	Ongoing	10	5	5	5	5
Develop volunteer-supported grassland indicator species surveys and reporting systems to assess the health of southern Ontario grasslands	2.4.1.b.	2	OBORT, BSC	NGO, OMNR, CWS	Ongoing	-	5	10	10	10
Maintain a central data base of all survey results, sightings and nesting site locations	2.4.1.c.	1	OBORT	OMNR, CWS	Ongoing	4	2	2	2	2
Examine potential impact/risk of predators, rodenticides and road fatalities on Barn Owl populations	2.4.1.d.	2	OBORT	OMNR	2005	-	-	2	-	-
Develop an action protocol for located active nesting pairs of Barn Owls	2.4.1.e.	1	OBORT, OMNR	CRC, BSC	2002	-	-	1	-	-
Consult researchers in adjacent U.S. states to determine regional population trends in their jurisdictions, share relevant information, and encourage cooperative programs	2.4.1.f.	3	OBORT, OMNR	U.S. BIOL	Ongoing	4	2	2	2	2
Produce annual reports summarizing survey findings and documenting trends relative to the population target established by the Recovery Plan	2.4.1.g.	2	OBORT		Ongoing	4	2	2	2	2
Investigate the feasibility of a captive breeding and release program	2.4.1.h.	3	OBORT, OMNR	CRC	2005	-	-	-	-	5
Develop an action protocol for when an individual bird or breeding pair is located	2.4.1.i.	1	BSC, OMNR, OBORT	CRC	2002	1	-	-	-	-
2.4.2 Identify Grassland Habitat and Initiate Efforts to Conserve and Restore Grasslands										
Conduct a grasslands inventory across the north shore of Lake Erie via groundtruthing and satellite imagery and mapping	2.4.2.a.	1	OMNR, OBORT	NGO	2002	30	10	-	-	-
Identify, demonstrate, and promote sustainable grassland management practices to rural landowners and farmers	2.4.2.b.	1	OBORT	NGO, OMNR, OMAF	Ongoing	-	10	20	20	20
Explore economic and environmental benefits of grassland habitat	2.4.2.c.	2	OBORT	NGO, UNIV, OMNR	2003	-	-	10	10	10
Conduct rodent population surveys in different grassland types	2.4.2.d.	3	OMNR, OBORT	NGO	2003-2005	-	-	12	12	12
Explore and promote concepts such as incentives/tax breaks, land trusts and conservation easements	2.4.2.e.	1	OBORT	NGO	Ongoing	-	-	5	5	5
Approach government and large corporate landowners, re. Setting aside lands for grasslands reserves	2.4.2.f.	1	NGO	OBORT	2003-2005	-	-	5	5	5
2.4.3 Develop Public Awareness and Support for Barn Owls and Grassland Habitat										
Develop, produce and distribute educational materials	2.4.3.a.	2	OBORT	OMNR, NGO	Ongoing	25	3	7	3	3
Develop and maintain a website and annual newsletter	2.4.3.b.	3	OBORT	NGO	Ongoing	2	1	1	1	1
Publicize through the media the status and plight of the Barn Owl, other grassland species and grassland habitat in s. Ontario	2.4.3.c.	3	OBORT	NGO, OMNR, CWS	Ongoing	1	1	1	1	1
Provide presentations, with slides and live Barn Owl, to naturalist clubs, fish and game clubs, school children, fairs and conferences, and other public venues	2.4.3.e.	2	OBORT	NGO, OMNR	Ongoing	4	2	2	2	2

<i>Action</i>	Recovery Plan #	Priority	Responsibility	Cooperators	Target Date	Estimated Costs (\$000s)					
						2000	2002	2003	2004	2005	
						-01					
2.4.4 Establish Partnerships and Cooperation with Grassland and Grassland Species Recovery Teams, Other NGOs, Government, Private Sector, and Rural Landowners/Farmers											
Cooperate and enlist support from NGOs, naturalist clubs, hunting organizations, conservation authorities, land stewardship councils, and others to work towards strong cooperation and partnerships in protecting grassland species and habitat	2.4.4.a.	1	OBORT	NGO, OMNR, OMAF, UNIV, CWS	Ongoing	1	5	5	5	5	
Provide information, awareness and contacts for habitat conservation efforts to private rural landowners, farmers, and corporate landowners	2.4.4.b.	2	NGO, OMNR, OMAF	OBORT	Ongoing	1	1	1	1	1	
2.4.5 Fund a Project Coordinator											
Hire project coordinator to implement Recovery Plan	2.4.5.a.	1	OBORT, NFN		Ongoing	75	45	45	45	45	
Project review and evaluation	2.4.5.b.	3	OBORT		2004	-	-	-	-	5	
Total Annual Estimated Project Costs						162	94	138	131	141	

SECTION IV

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APPENDIX I. Reviewers Comments on Ontario Barn Owl Recovery Plan (November 1998 draft)

REVIEWER ONE

“Throughout the document, there is a strong emphasis on releasing barn owls as a means of reintroducing the species or bolstering populations. This line of reasoning is put forth despite the preponderance of evidence against it, especially in North America. Much of this evidence is reviewed and the opinions of some experts reported; yet it is dismissed as not relevant to Canada. Barn owls are scarce in southwestern Ontario for a number of reasons (limited and degraded habitat, barriers to dispersal and colonization exacerbated by urbanization and intensive agriculture, poor adaptation to cold weather, high dispersal and mortality rates, etc.) for which “throwing critters out in front of the media” will never compensate. The public awareness and education that results may bring into question the logic that lead to huge expenditures of scarce conservation dollars.....”

“Of the 13 criteria to be satisfied before proceeding with a reintroduction program (page 26), I believe that items #1 (There must be a need to augment the wild population, especially from a global perspective), #4 (Causes of decline need to have been identified and reversed), #5 (Sufficient protected habitat needs to be in existence to

support and sustain a reintroduced population, and #11 (The re-introduction technology needs to be known or in development) remain in serious question. The recovery plan should address these items before suggesting that releases are the way to go. After reviewing the document, referenced information and other release attempts, and considering what I know about land-use and habitat in southwestern Ontario, I feel implementation of a release program is completely without merit. Even the rough attempt at developing a population viability analysis suggests that success is unlikely and a waste of valuable conservation dollars on a species that, at best, is on the extreme fringe of its large geographic range”.

REVIEWER 3

The document “implies that the plan is destined to include captive breeding. Overall, such an approach will ultimately fail to achieve a sustainable result and is unwarranted based on the biology of the species, history of other attempts, and cost implications versus reliable approaches to species management. Consider the following: habitat loss issues, potentially widespread and unpredictable mortality annually from weather, short-lived species (breeding possibly just one year on average), short adult life (2-3 years for adults), high chick/fledgling mortality rates (60% or more), excellent colonizing abilities, fringe of species range, dependency on immigration from more southern populations to sustain an Ontario population, and general population declines in the main portion of the species’ North American range”.

“The biological data presented in the Plan do not justify a release program or associated research for that purpose. Some experimentation with captive-reared owls may be of interest and help in gaining some insight on local mortality factors, dispersal, and habitat use – and provide opportunity for personnel to gain experience in working with barn owls. However, such actions should not be suggested as a means to justify or facilitate a large-scale release program. It appears that the direction is to fast-track into propagation without the proper field assessment of the current situation – and it is difficult to do that without properly designed and installed nest boxes and biologists trained in habitat recognition and survey methods”.

RENEW COMMENTS

“The independent review has strongly questioned the feasibility and justification of a reintroduction program. Two of the three reviewers have serious concerns with the proposed release program. The plan discusses concerns about a reintroduction program in Part 3, Section 5. The team acknowledges that previous attempts at reintroduction in other areas have not been successful. The team also points out that “winter weather in Ontario is the primary underlying factor limiting barn owl populations here, even more so than habitat loss” (i.e., it may just be too cold in Ontario for the species). Thirdly, declines in this species are mainly due to a shift in agricultural use, not to a loss of native wetlands and grasslands. Fourthly, at least two of the most important criteria for a successful reintroduction program (Part 3, Section 5: 4 & 5) are not satisfied. Yet, the team has decided to attempt a two-year reintroduction trial program, when both past experience and current scientific knowledge indicate that it will not likely succeed”.

“An alternative approach would be to focus resources on a nest box program, landowner contact and the preservation of existing nest structures, which would probably maintain the population at its current levels. The latter approach would not likely recover the species to previous levels, but the success of any recovery program must first start with the decision, based on available information, of whether the species should be actively recovered. At this point in time, we believe this is a case where the species should not be. We recommend that the team should proceed with a management approach to conserve this species, provided that the team and

agencies re-evaluate this decision should new information arise. As the eastern population of the species is listed as endangered, and not actively recovering the species could lead to its disappearance, we strongly recommend that the team take this question to their respective agencies and to the public for input. We as a society must make difficult decisions on where limited conservation dollars should be directed and this is an excellent example of such a decision”.

Comments on Barn Owl Management and Captive Propagation
From Bruce A. Colvin, Ph.D., Barn Owl Research Foundation (1998)

Although methods for barn owl conservation and management have been well defined in recent decades, there remains today a cyclic pattern of confusion about viable management options. This probably is a result of turnover in wildlife professionals over the past 20 years and because public interest in this species is easily raised and rekindled. The following text has been prepared as a result of frequent inquiries and misdirected efforts on barn owl conservation and management. It is intended to provide biologists, wildlife enthusiasts, and policy makers -- who have recent interest in barn owls -- with an overview of very expensive “lessons learned.”

In the late 1970s, concern over declining barn owl populations in the U.S. precipitated research and many suggestions for species management. I was the primary researcher at that time investigating population declines and among the first to suggest the possible use of captive propagation. However, it was obvious that inadequate scientific information was available to make responsible decisions about barn owl management, or use of public/private funds for it. Reasons for population declines (and increases in some parts of the U.S.) needed to be better understood.

For more than 20 years now, Paul Hegdal (U.S. Fish and Wildlife Service, retired) and I have lead a team of researchers who have been evaluating barn owl populations and conservation methods. Through our collaborative research in the 1980s, the reasons for population changes and opportunities for species management became clear. Barn owl populations had most noticeably declined in the midwestern U.S., and this primarily was a result of habitat loss (grasslands, wetlands). In areas where foraging habitat remained or was being created, barn owl populations were sustaining or expanding.

In Ohio in the early 1980s, State biologists made a decision not to invest in propagation but rather to determine if propagation was warranted or a viable method based on sound biological information. Several other midwestern states jumped into propagation without scientific basis or true understanding of the species’ life-history strategy. Propagation appeared to be undertaken as a quick fix that had public/political support because of the attractiveness of the bird. The topic was “sexy” and brought desired funding and public attention to certain organizations. Concurrently, considerable misinformation was provided to the public about barn owls and their conservation.

Substantial amounts of money were spent during the early and mid 1980s to implement large-scale propagation programs in certain midwestern states. More than 1,300 owls were released. However, by the late 1980s, states began to shut down these efforts as biologists became more familiar with the biology of the bird and responsible conservation measures. There was no indication of a positive population effect, and mortality rates among released birds were high. In contrast, in Ohio where propagation was not part of the management plan, barn owl populations improved through an emphasis on habitat and training of biologists. Other states subsequently began to emphasize habitat and training.

Captive propagation today is not considered to be an appropriate management method in the U.S. for this species. Sadly, hundreds of thousands of dollars and unknown numbers of hours of work were wasted. These investments could have been avoided if sound biological information had been used originally in the decision-making process. Financial and time resources would have been more appropriately focused on habitat conservation and public education. The entire episode

will probably remain one of the worst examples of wildlife management in the U.S. (making decisions based largely on politics and public relations rather than science).

There is no biological justification for captive propagation as a management method for barn owls in North America, and the reasons why are many. Captive propagation of any species typically is considered when three factors collectively exist: 1) a catastrophic population decline has occurred, 2) the specific event/circumstance that caused the decline no longer impedes population maintenance, *and* 3) the species has a low reproductive and colonizing rate that limits its recovery, thus necessitating assistance through propagation. The situation with barn owls does not fit this composite of criteria.

Unlike other raptors for which propagation has been an accepted practice in some situations, barn owls are not limited by reproductive ability and their populations apparently did not suffer from the onset of the modern pesticide era. Barn owls have a short maturation time (can nest at seven months of age), are polygynous, nest multiple times a year, and have large brood sizes (up to 10 chicks per nest). This tremendous reproductive ability is balanced against short adult life (<3 years for an adult). Nesting success is highly variable and fluctuates with cyclic prey populations and weather conditions.

Mortality rates are naturally high, and barn owl populations are somewhat cyclic themselves. Population crashes commonly follow extreme winters and spring/summer drought. Barn owls are a southern latitude species, and thus populations on the fringe of their northern range are particularly susceptible to sudden disappearance (mortality) with snow and ice conditions. For these reasons, colonizing abilities are important in this species and propagation is not realistic for long-term population maintenance.

Barn owls readily populate areas on their own when habitat exists (this has occurred in both North America and Asia). For example, barn owl populations were not established in Ohio in the 1800s, yet within about 30 years they had extensively colonized the state as forests were cleared and grassland habitat was created through farming practices. Barn owl populations are regional and must be evaluated in that context. Fledglings widely disperse; only about 2% of the chicks raised within a local area actually enter the adult population there.

The primary problem for barn owls in the eastern and midwestern U.S. has been habitat loss, and no amount of propagation will overcome that. Grassland and wetland habitats have become more limited with urban sprawl and changes in farming practices. Barn owls have the ability to readily sustain their numbers when foraging habitat exists and nest sites are available, and as weather conditions allow. With habitat being limited, and given natural population fluctuations, a long-term and sustained improvement in barn owl numbers cannot be achieved through captive propagation.

Only a few people in the U.S. know how to recognize barn owl habitat, find nest sites, or identify their vocalizations (e.g., conversational calls). If habitat is present, barn owls may already be nesting locally but undetected. The first goal in any management strategy should be to become educated on this species, how to locate it, and standard management methods. Until those basic needs are addressed, responsible management decisions cannot be made.

A basic management plan for barn owls should include: 1) identification of suitable grassland and wetland habitat (short-eared owls and harriers use similar habitat), 2) then interview of local farmers/residents and surveys to help locate roosting/nesting owls, 3) installation of "sentinel" nest boxes within one mile of suitable foraging habitat to help evaluate local populations and provide an easy place to look for owls, 4) public education and training of wildlife professionals about barn owl habitat requirements, 5) monitoring of nest sites and adjustment of the nest box program based on observed results, and 6) protection and enhancement of grassland/wetland habitat. (Nest boxes must be properly designed, installed, and maintained or they will be useless.)

A focus on barn owl life-history strategy, selected prey resources, and habitat will provide the best avenue for cost-effective and successful management of this species. Captive propagation will not have long-term value, and it will misdirect public focus and funding from the essential issues of habitat conservation.

APPENDIX II. Two Case Studies of Barn Owl Release Programs in the American Mid-west

(excerpted from the Ontario Barn Owl Recovery Plan, November 1998)

Case Study #1: Iowa

In Iowa, 93 Barn Owls were acquired for captive breeding purposes from rehabilitation centres and zoos in Washington, Oregon, California, Arizona, Texas, South Carolina, Louisiana and Illinois beginning in 1982 (Ehresman 1984; Ehresman *et al.* 1988). Most of the captive breeders were permanent cripples or human imprints.

Public support and cooperation were enlisted throughout the program, and release sites (most of which were volunteered by the public) were carefully screened and selected (see Ehresman 1984 for details). A complementary nest box program was initiated at the same time. To discourage in breeding, birds of different parentage were placed at release sites that were in close proximity (about 60 km).

The release program was "gentle," such that the owls were placed in a sealed farmyard building (barn, silo, etc.). Olefin fibre netting was used to seal the building (to keep owls in and predators out). A nest box was placed inside, and several other boxes (up to 10 boxes) were placed in the vicinity of the release site in nearby structures. Paired adults were placed at release sites in January and February, where they were cared for by "attendants"

(usually landowners), until the birds nested and offspring had been successfully reared. In many cases, additional captive-bred owlets were added to these nests as part of a fostering program. Once the young were capable of sustained flight, the netting was removed, and all owls were allowed to come and go at will. Attendants continued to feed the owls after release for as long as the birds remained at the site (usually 2-4 days).

Besides placing paired adult owls at release sites and allowing them to nest "naturally" in Iowa, two other methods of placement were used. One involved transferring captive pairs that already had 3- or 4-week old young to the release site (i.e. releasing whole family groups). The other method involved placing groups of 5-7 young owls (usually fledglings) that were reared by captive pairs. Normally, owls placed by one of the above methods were held at release sites for only 4-6 weeks prior to release. Release techniques for all 3 methods were the same. A follow-up, largely volunteer-based monitoring program of release sites and nest boxes was considered an important part of the overall recovery program.

From 1983 through 1987, 427 Barn Owls (73 adults and 354 juveniles) were released at 44 suitable sites in 28 counties, mostly in the southern half of the state. Numbers released per county ranged from 4 to 42. Numbers released per year ranged from 53 to 129 birds; about 83% of the total number released involved young birds and no more than 10 pairs of adults were ever released in a single year.

During the same time period that the Iowa work was being undertaken, release programs were also going on in two adjacent states: Nebraska to the west (over 150 owls released) and Missouri to the south (over 200 owls released). Including the Iowa releases, over 1000 owls were released over a 6-year period in the mid west.

After 2 years, it was felt that the program was not yielding results, so a telemetry study was carried out to determine survivorship, movements and habitat use. The telemetry study, which was conducted by a full-time graduate student, was focussed on two release regions over a 2-yr period about 120 km apart. In total, 36 owls were radio-tracked (17 in 1985 and 19 in 1986).

Radio-tracking showed that most birds left the release site within one or two nights, while a few stayed at or near the release for as long as 30 days. Within 4 days, most of the remaining owls settled into home ranges that were occupied for up to 2.5 months. Mean distance from the nest site to the centre of the home range was about 5 km. More extensive wide-ranging movements were noted in the fall. Direction of dispersal appeared to be random, and involved distances of up to 120 km from the release site. Interestingly, all seven recoveries of banded owls in Iowa showed a distinct movement to the east, often towards the northeast, inconsistent with Stewart's (1952) findings which suggested a predominantly southward movement of Barn Owls breeding at the northern part of their North American range.

Telemetry revealed that at least 67% of the released owls died within several months of being released, apparently mostly due to Great Horned Owl predation and collisions with motor vehicles, painting "a grim picture for survival of captive reared barn-owls." Nevertheless, Ehresman *et al.* (1988) did feel that more sightings and more nestings took place during the release program than previous to it, though the rise in numbers was at least partly due to increased publicity and search effort. In Missouri, a release program involving over 200 owls in a localized area resulted in at least 2 nestings the following year, and similar results were found in Nebraska (Ehresman *et al.* 1988).

Ehresman *et al.* (1988) concluded that even though there had been over 1000 Barn Owls released in Iowa, Missouri and Nebraska in a 6-yr period (over 166 birds/yr), there was little evidence that the releases significantly boosted breeding populations, and the programs were all cancelled.

Case Study #2: Wisconsin

The following description of the Wisconsin release program is taken from Matteson and Petersen (1988). From a founder captive stock population consisting of 5 pairs of Barn Owls obtained from Texas (2 pairs), Missouri (2 pairs), and Arizona (1 pair), 98 birds were released in Wisconsin between 1982-87. Details of the release method are unavailable, but a "gentle" technique similar to that used in Iowa appears to have been used, including a complementary nest box program.

As in Iowa, a graduate student was hired to radio-track 5 owls in 1984, but contact with most of the birds was lost within the first 8 days, and the data were insufficient upon which to draw any meaningful conclusions. Based upon the telemetry and banding work, 9 of the 98 birds released (9%) were later reported dead. In 1987, the release program was discontinued owing to a lack of evidence that it enhanced the state's Barn Owl population.

APPENDIX III: A Simple Population Model Based on Release of 100 Birds in Haldimand County

(developed by Jon McCracken, Bird Studies Canada and excerpted from the Ontario Barn Owl Recovery Plan, November 1998)

At the northern edge of its range, the Barn Owl is not sedentary. It has been demonstrated that released owls disperse more or less randomly, extending up to several hundred kilometres. Stewart (1952) reported that about 64% disperse within 80 km of their hatching places; and 34% travel more than 80 km. Because I assume that Lake Erie acts somewhat as a physical barrier to dispersal (as it does to all raptors), this means that relatively few Barn Owls should disperse in southerly directions (where they might survive), thereby increasing dispersal in other directions, including northward. If birds are released near the north shore of Lake Erie (e.g. Haldimand-Norfolk), those that disperse in northerly directions will be prone to enter climatologically unsuitable regions (i.e. outside the 30 km climatologically suitable lakeshore zone) where they would likely perish. Using Stewart's (1952) figures as a guide, roughly a third of the dispersing birds will wind up in inhospitable northern regions, where first-year mortality would approach 100%.

Hence, given a random pattern of dispersal in all directions except south and across Lake Erie, of a total of 100 birds (both adults and juveniles) released in year #1, we would expect 33 birds to disperse to inhospitable areas

and suffer 100% mortality, while the balance would disperse more or less along the east-west axis of the Lake Erie shoreline. This yields an effective population of 67 birds that would be subjected to "normal" rates of mortality.

If overall average annual mortality of adults and immatures is about 65%, which is a reasonable estimate according to Stewart (1952) and Henny (1969; see Table 2), then we would expect that about 24 of the 67 birds remaining in southern Ontario would survive until the following breeding season. Assuming that none of these birds do in fact immigrate to the U.S., and assuming an equal sex ratio, this is equivalent to 12 potential pairs available in southern Ontario at the start of the next breeding season.

However, single birds need to find mates, the probability of which depends largely on population density. We do not know what this probability actually is, but given random dispersal distances of 100 km or more, it seems reasonable that with a density of about 1 bird per 1000 sq km^{*}, not much more than about 40% of the population would be likely to find mates. If we use that probability level, then we are left with an effective population consisting of about 5 breeding pairs going into year #2 of the program. Of these, we can assume that 50% will not nest successfully (and for all intents and purposes die without having reproduced), leaving us with perhaps 3 successful nestings. While these nestings may produce 12 young (average of 4 young per nest, which again is reasonable, if not fairly optimistic; see Table 1), most of these young birds will likewise disperse or die in their first year of life and none will be expected to breed in year #3.

Hence, without further augmentation of the population through captive breeding, by the end of year #2 the original captive-released population will probably have died out. Though the above is a very simplified model, its conclusion is strikingly similar to actual results from release programs in the U.S. mid west.