5 EFFECTS OF LAND USE ON WILDLIFE HABITAT

Throughout most of Strathcona County, more or less natural habitats have been fragmented by agricultural use, urbanization and residential development, industrial resource extraction projects, and traffic and infrastructures associated with all of these anthropogenic land uses. These activities have caused changes in habitat quantity, habitat quality, and habitat availability. The effects that these activities have on faunal species within Strathcona County is dependent both on inherent characteristics of specific wildlife species and on the nature and extent of the land use itself. Residential and country residential developments are the primary land use within Strathcona County, while agricultural activity continues to be fairly prominent as well. Below is a brief overview of concepts related to the effects and potential effects of human activities on faunal habitat as they pertain to Strathcona County landscapes.

5.1 Agricultural Development

Agricultural activities on cropland, rangeland, pasture, and mixedwood forested land have been altering wildlife habitats, in both positive and negative ways, for centuries. Both agricultural and forestry production has increased to meet the growing demands of an expanding and more affluent population. During early periods of settlement on the Canadian prairie, the clearing of land for small, scattered farms created habitat diversity that provided a fertile environment for the expansion of species like American robin (*Turdus migratorius*) and woodchuck (*Marmota monax*). However, favorable habitat was also concurrently decreased for species such as black bear and moose. Early habitat changes were gradual in relation to the modern rate of change brought about by the advent of mechanized agriculture. In the early periods, wildlife had time to *"adapt to changing conditions or to retreat to nearby undisturbed areas ... but modern agriculture has rapidly affected vast areas giving most wildlife species no time to adapt and no place to retreat"* (Brokaw 1978). Modern agricultural technologies, together with economic incentives, has favored large contiguous fields devoted to single crops. The increasingly efficient drainage of lowlands, improved varieties of crops capable of growing on marginal soils, increased and more efficient use of fertilizer and pesticides, and development of irrigation systems have all expanded croplands at the expense of natural landscapes and wildlife habitats.

In the agricultural landscape, the intention is to maintain pure stands of crop or pasture species and reduce consumption by pest species. By contrast, natural landscapes do not

aim to have single-species stands without herbivores or predators. Rather, the aim in a natural system is to have a suite of plants and/or animals with life histories and biologies which complement each other. In an ecological sense, agricultural landscapes establish and maintain systems of low species richness by ensuring that, through cultivation, there is an appropriate disturbance regime which ensures that the favored species approximates to a monoculture.

Historically, agricultural growth has been one of the major forces behind wetland declines in Canada, accounting for widespread and significant encroachment on the wetlands resource base. Agricultural expansion onto marginal lands such as wetlands has been encouraged by rising production costs and an increased demand for agricultural commodities. As a result, losses of wetland habitat to agriculture over the past century has been progressive and severe and wildlife populations in Alberta have been strongly influenced by this agricultural activity. Brusnyk et al. (1990) reported that, in Alberta's aspen parkland region, methods of intensifying agricultural production have included the removal of shelterbelts and fence line cover, increased grazing levels, clearing marginal agricultural lands, and draining wetlands.

Wetland drainage is a common example of habitat destruction on agricultural lands. Schick (1972) found a 61% loss in wetland area in the Aspen Parkland area between 1900 and 1972. Turner et al. (1987) found that during the period 1980 to 1985, an average of 66.0% of wetland basins and 93.0% of wetland margins showed evidence of agricultural impacts (Table 4).

The growth of field crops to uniform stands during growing seasons is not conducive to the provision of quality wildlife habitat because, for the remainder of the year, the soil is either bare or covered with stubble remains of the crop. Forage crops in general provide better habitat for wildlife than field crops do. These crops are usually perennial, so there are no bare fields remaining during the dormant season.

Table 4: GENERAL TYPES OF WETLAND LOSSES COMMON TO MID-CONTINENTAL NORTH AMERICA

Nature of Wetland Loss	Associated Causes of Wetland Loss
Total Loss	A. drainage followed by farming, construction, or other use of the site; B. tilling of adjacent areas with encroaching agricultural or other land use resulting in loss of wetland margins; C. filling from the perimeter creating abrupt shorelines as well as decreased size; D. siltation by poor upslope soil management in agricultural or urbanized areas.
Modified Productivity Due to Pollutants	A. fertilizer run-off; B. livestock wastes; C. sewage disposal; D. pesticides.
Water-level Modification	A. flooding; B. water stabilization; C. use for irrigation, industry, or human water supply.
Introduction of Exotic Plants and Animals	A. fish stocking for sport fishery or aquacultures; B. planting of aquatic vegetation C. infiltration by introduced species such as house sparrows and starlings.
Cluster Modification With Loss of Wetland Diversity By Complete or Partial Drainage	A. drainage of small units into streams, reducing size of both large and small units; B. drainage of smaller units into larger wetlands, flooding larger wetlands
Flooding of Wetland Clusters	A. flood-control impoundments; B. irrigation impoundments; C. hydroelectric power production.

Livestock grazing is a fairly common agricultural activity on much of the farmland in the County. Grazing by livestock is generally considered to be detrimental to wildlife habitats in most hardwood environments, riparian habitats, and in places where the livestock disturb the surface sufficiently to compact root systems or increase erosion. Available evidence (Ryder 1980, Fleischner 1994) indicate that livestock grazing has profound ecological costs which can be summarized as follows:

1. Alteration of species composition of communities, including decreases in density and biomass of individual species, reduction of species richness, and changing community organization.

2. Disruption of ecosystem functioning, including interference in nutrient cycling and ecological succession.

3. Alteration of ecosystem structure, including changing vegetation stratification, contributing to soil erosion, and decreasing availability of water to biotic communities.

Furthermore, Fleischner (1994) cites numerous examples of the deleterious effects of grazing observed in all vertebrate classes.

Livestock are adapted to mesic habitats and exhibit a preference and selection for riparian areas in order to meet requirements for shade, cooler temperatures, and water. Cattle spend a disproportionat amount of their time in riparian zones and this is a cause for ecological concern because these habitats are among the biologically richest in the study area. Livestock affect four general components of riparian systems: (a) streamside vegetation, (b) stream channel morphology, (c) shape and quality of the water column, and (d) structure of streambank soil.

5.2 Residential Development

Country and rural residential development is extensive in Strathcona County and is expected to continue to rise. Associated with this increasing development is a concomitant increase in infrastructures, recreational facilities, and other services which are required to meet the needs of growing numbers of residents. The most readily identifiable features associated with such development are the roads which gridlock the County, the water-based summer recreational facilities such as boat launches, and the actual lakeside residences.

The most significant impact of residential development on wildlife in any area, including Strathcona County, is anticipated to be caused by the removal of vegetation (trees, shrubs, and ground cover). Both cluster residential developments in upland habitats and ribbon residential developments on wetland margins cause changes to habitats that may profoundly influence their availability and/or use to local wildlife species. Direct habitat loss is the primary impact of such developments but habitat fragmentation and isolation is also of concern.

Like forest clearing and housing development, roads constitute an important habitat-fragmenting force. Many researchers have defined fragmentation of wildlife habitats through road development as causing loss of species through a number of mechanisms, including (Godron and Forman 1983, Harris 1984, Mader 1984, Noss 1987, Wilcove 1987):

- direct habitat loss;
- habitat alteration;
- reduction of habitat diversity; and
- isolation from the surrounding ecosystem.

Wilcox (1980) and Temple and Cary (1988) have identified that the degree of negative impact of roadways is dependent upon the spatial relationship between the disturbance (road) and the species being impacted. They have, thus, identified three zones of habitat disturbance extending outward from main roads, as described below.

Impact Zone 1 includes the immediate area of the road and the accompanying embankment where direct habitat loss occurs. Adjacent to this zone lies Impact Zone 2, which extends 200 meters from either side of the embankment margin and represents an area of extreme habitat alteration. From 200 to 600 meters on either side of the embankment margin lies Impact Zone 3, a zone which experiences moderate ecological disturbance. A full 600 meters from the point of disturbance (i.e., the road) begins the area of core forest which remains unaffected by the disturbance caused by the road.

Unlike simple, passive land uses, the traffic that accompanies roads can also serve as an additional active mortality source on local fauna. Roads that bisect otherwise contiguous habitats represent important sources of mortality on wildlife species for the following reasons (Harris and Scheck 1991):

- roads bisect natural migration routes and death results when animals attempt to cross the traffic stream;

- roads provide a deceptively easy movement opportunity and animals intermingle with traffic;

- roads bisect established home ranges or territories;

- new food resources are made available (e.g., spilled grain, nutritious forage, carrion), attracting animals to the road; and

- new habitat is attractive and serves as an "ecological trap" for both transient and resident wildlife.

It should be noted, however, that the negative impacts caused by direct mortality through vehicle collisions is a primary concern on major highways with high traffic volumes. Most of the roadways within Strathcona County are not of this nature, but rather are small, relatively low speed, and low volume conduits for movement of traffic. Nonetheless, other negative impacts of these roads, such as the imposition of movement barriers through habitat fragmentation, are more relevant to the immediate situation at hand in the County.

Also associated with the growth of residential populations in Strathcona County is the associated growth of recreation activity and developments required to facilitate such activities, primarily on and around lakes and wetlands. Activities such as game-bird hunting, fishing, bird-watching, hiking and nature photography have been termed "non-destructive" uses of natural habitats. However, other more "destructive" recreational uses have also accompanied the increased residential population of the County. In numerous areas, marshes have been fragmented and even eliminated in efforts to clean up the shoreline, dredged and deepened to provide bathing areas and boat access, and infilled for the extension of cottage development.

Numerous aquatic bird species, such as waterfowl, loons, and grebes, are over-water nesters and have been reported to be highly sensitive to disturbances caused by water-based recreation activities. For example, Riske (1976) documented a major decline of a red-necked grebe population at Pine Lake, Alberta between 1971 and 1976, which was attributed to increased lake recreational activity and cottage development. When not building nests in floating vegetation mats, loons nest as close to the water : land interface as possible. Thus, even shoreline nesting individuals can be extremely susceptible to the wash of motorboats, for example, which may destroy eggs and nests. Titus and Van Druff (1981) cite decreased breeding success of loons in response to powered boating on lakes while Vermeer (1973) also noted that diving birds such as loons and grebes are especially prone to injury or death by getting caught in commercial fishing nets.

5.3 Industrial Development

In Strathcona County, industrial development has had a limited effect on wildlife habitat relative to the county's predominant land-use, agriculture. Industrial impact consists predominantly of linear disturbance features (oil well access roads, oil refinery railway access, and seismic lines), and site-specific activities such as gravel extraction and oil refining. Oil field exploration and production development, in particular, within Strathcona County, has an extensive network of

infrastructure concentrated in a 42 square kilometre area of a sand dune complex. One characteristic of this industrial land-use is that the mixed-forest matrix in which the oil-field infrastructure is located, has been retained, not removed as would be the case for agricultural development on more fertile sites. The diverse mixedwood habitat is therefore available for wildlife, albeit in a fragmented state, alongside the oilfield installations.

The Wildlife Habitat Unit affected by gravel extraction is the Drainage Course WHU (balsam poplar - willow variant) located on the point-bars along the North Saskatchewan River Valley. The narrow band of riparian woodland has been removed along sections of the North Saskatchewan River, although the dominant species of this WHU (balsam poplar), is quickly regenerating on the spoil heaps left from former gravel extraction operations. This uneven terrain has resulted in many small ponds which will likely become valuable wildlife habitat with continued regeneration of forest cover around these features.

Extraction of sand is limited to small workings in eolian sand dunes supporting Upland Coniferous WHUs. Regeneration of these sites to native vegetation (jack pine - hairy wild rye-grass) has likely been slowed by off-road vehicle use.

6 WILDLIFE SPECIES HABITAT REQUIREMENTS IN STRATHCONA COUNTY

Wildlife resource assessment techniques have recently begun to rely upon habitat evaluations as opposed to, or in addition to, direct population measurement (Eccles and Stelfox 1985). Working definitions of the term "habitat" can be vague due to the range of scales at which it can be defined. For example, definitions can range from how species are associated with broad landscape-scaled vegetation types to detailed descriptions of immediate physical environments used by certain species. A common thread, however, amongst the differing definitions and terms is that habitat relates the presence of a species to attributes of the physical and biological environment (Morrison et al. 1992). The distribution and abundance of food also influences habitat use. If food is distributed in patches, a species may be restricted only to a portion of its potential habitat. Optimal foraging theory (Stephens and Krebs 1986) attempts to explain how the distribution, abundance, and quality of forage influence distributions, habitat use, and movements of avifauna. Therefore, it is crucial to understand that wildlife management and conservation is synonymous with habitat management and conservation. The following sections describe the general habitat requirements and relationships of the major wildlife guilds and species groups anticipated to use appropriate habitats within Strathcona County.