

University of Nebraska - Lincoln

## DigitalCommons@University of Nebraska - Lincoln

---

Mammalogy Papers: University of Nebraska  
State Museum

Museum, University of Nebraska State

---

May 1996

### Mammals of the Mixedwood Plains Ecozone

Andrew Smith  
[asmith@unl.edu](mailto:asmith@unl.edu)

Donald A. Smith  
*Carleton University*

Follow this and additional works at: <https://digitalcommons.unl.edu/museummammalogy>

 Part of the [Zoology Commons](#)

---

Smith, Andrew and Smith, Donald A., "Mammals of the Mixedwood Plains Ecozone" (1996). *Mammalogy Papers: University of Nebraska State Museum*. 1.  
<https://digitalcommons.unl.edu/museummammalogy/1>

This Article is brought to you for free and open access by the Museum, University of Nebraska State at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Mammalogy Papers: University of Nebraska State Museum by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

This paper is online at: <http://www.naturewatch.ca/MixedWood/mammal/intro.htm>

From: *Assessment of Species Diversity in the Mixedwood Plains Ecozone*, edited by I. M. Smith. Ecological Monitoring Coordination Office, Environment Canada, 1996. Online at <http://www.naturewatch.ca/MixedWood/>

---

## MAMMALS

**Andrew B. T. Smith**

Department of Zoology and  
University of Toronto

**Donald A. Smith**

Department of Biology  
Carleton University

---

Ontario and Quebec were totally covered with ice during the last glaciation. Deglaciation was followed by gradual post-glacial repopulation of these two provinces (and others) by mammals from source areas in the United States. Thus most range expansions were from south to north east of the Great Lakes.

The mammalian fauna of the Mixedwood Plains Ecozone has been steadily changing since deglaciation about 10 000 years ago. During this period a succession of species assemblages has moved through this ecozone as the climate warmed. Several of the larger mammal species known from this area became extinct during this period of change. These included giant beavers, woolly mammoths, mastodons and species of deer and bison (Harrington, 1989). Throughout this period there have been steady, gradual changes in the biodiversity of the Mixedwood Plains Ecozone, but the most rapid changes have occurred over the last 300 years.

The best sources of information on the ranges of the mammals of the Ontario and Quebec parts of this ecozone are Peterson (1966) for both parts; Dobbyn (1994) and Peterson (1957) for Ontario; and Prescott and Richard (1982) for Quebec. Currently in the Mixedwood Plains Ecozone there are about 59 species of mammals in 44 genera and 16 families. This does not include four species recorded in this ecozone, but not established as part of its mammal fauna. An Evening Bat (*Nycticeius humeralis*) accidentally occurred in the Lake Erie Lowland Ecoregion once. Black Rats (*Rattus rattus*), Coypus (*Myocaster coypus*), and Domestic Ferrets (*Mustela putorius*) have all been introduced but have not persisted. Although the species richness of mammals has increased since European settlement, biodiversity has decreased in the Mixedwood Plains Ecozone through the reduction in population size of many ecologically important species and the complete disappearance of others. Wolverines, Cougars and Wapiti have all been extirpated from this ecozone. Many species of mammals have been extirpated from much of their former ranges in this ecozone because of destruction of forest habitat, over-harvesting of pelts by fur trappers, over-hunting, and persecution of predators. Southwestern Ontario is an area of special concern because of the permanent conversion of most forests to agricultural land; this has resulted in a dramatic decrease in mammalian biodiversity. The loss of some native species has

been coupled with increases in several new species through range expansion or direct introduction from other ecozones. The new species are typically generalists that have adapted to living in disturbed habitats.

Our knowledge of the status of mammal populations in the Mixedwood Plains Ecozone is nowhere near complete. The status and complete distribution are known for only a few species monitored today because of their economic importance. The status of a few other species has been examined by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC); its status designations will be mentioned later in the species accounts. Monitoring programs should be established to determine the status of ecologically important species for proper biodiversity assessments of this ecozone. Many small mammals such as shrews, moles, bats, squirrels, mice, and voles could easily be monitored with existing techniques. Larger mammals would be more difficult to monitor but there are effective methods available. Large mammalian predator populations should be monitored as indicators of ecosystem health. Historically in the Mixedwood Plains Ecozone predator populations have declined most dramatically because of human disturbances.

The mammals of the Mixedwood Plains Ecozone can be divided into five groups based on their overall ranges. One group of 14 species has a 'northern distribution' (Fig.MM-1.1); these species are found mainly in the boreal ecozones and adjacent montane ecozones of North America. The Mixedwood Plains Ecozone represents the most southern part of their ranges in eastern Canada.



Figure MM-1.1: Distribution of the Ermine; an example of northern distribution

Photo from Peterson, 1966.

The second group consists of 10 species with a 'southern distribution' (Fig.MM-1.2); these species reach or near the most northern parts of their ranges in this ecozone. This group is found mainly in the eastern United States in broad-leaved forest habitats.



Figure MM-1.2: Distribution of the Eastern Gray Squirrel; an example of southern distribution

Photo from Peterson, 1966.

The third group consists of 31 species with a 'widespread distribution' whose ranges extend over much of North America (Fig.MM-1.3).



Figure MM-1.3: Distribution of the Little Brown Bat; an example of widespread distribution

Photo from Peterson, 1966.

The much smaller fourth group contains three species with a 'Mixedwood Plains Ecozone distribution'. These species have a relatively large proportion of their ranges within the Mixedwood Plains Ecozone (Fig.MM-1.4). The fifth group consists of four 'introduced' species. The following species accounts also include three species that no longer occur in the Mixedwood Plains Ecozone. They are included because they were recently extirpated as a result of human disturbance.



Figure MM-1.4: Distribution of the Hairy-Tailed Mole; an example of Mixedwood Plains distribution

Photo from Peterson, 1966.

### **Order Marsupialia: Family Didelphidae - opossums**

#### ***Didelphis virginiana* southern distribution**

The Virginia Opossum is a southern species with a range that has recently expanded into the Mixedwood Plains Ecozone of Canada. The clearing of forests and maintenance of agricultural land in southwestern Ontario has benefitted this species. Before the widespread destruction of the forests of this ecozone the Virginia Opossum did not occur in eastern Canada.

## **Order Insectivora**

All species of shrews and moles are important ecologically as consumers of invertebrates. Stable shrew and mole populations are vital to the regulation of populations of ground-dwelling invertebrates, some of which are considered forest pests. Some of these mammals are difficult for an untrained individual to identify. Shrews and moles are also secretive and spend much of their time underground so monitoring these populations requires trained individuals using special trapping techniques.

## **Family Soricidae - shrews**

### *Sorex cinereus* **widespread distribution**

The Cinereous Shrew is a northern species with a range throughout most of Canada and the northern United States. This is probably one of the most abundant mammals of the Mixedwood Plains Ecozone. Cinereous Shrews are found in many different habitats from fields to forests. Their populations within the ecozone are probably stable but because of a lack of monitoring data it is impossible to be certain.

### *Sorex fumeus* **Mixedwood Plains distribution**

The Smoky Shrew has a much smaller range than the Cinereous Shrew. The Mixedwood Plains Ecozone represents a large part of the Smoky Shrew's total range. For that reason particular importance should be placed on monitoring this species within the Mixedwood Plains Ecozone. Because the Smoky Shrew is usually found in damp forests, it is noticeably absent from extreme southwestern Ontario, most of which has been converted to agricultural land. Very little is known about the ecology and population status of this shrew.

### *Sorex hoyi* **northern distribution**

The Pygmy Shrew is a northern species found through much of Canada. Very little is known of its biology or population status. In the Mixedwood Plains Ecozone the Pygmy Shrew is found in a variety of habitats and has a sporadic distribution with naturally low population levels. The absence of this shrew from southwestern Ontario may be attributed to both the destruction of its natural habitats in that area and the absence of source populations for recolonization from the south.

### *Sorex palustris* **northern distribution**

The American Water Shrew is another northern species that reaches part of its southern limit in the Mixedwood Plains Ecozone. This shrew is always found near water and forest cover. Because of the semi-aquatic nature of this shrew it is very hard to catch; therefore little is known about its population status. It is likely decreasing because of the removal of forest especially in southwestern Ontario.

### *Blarina brevicauda* **widespread distribution**

The Northern Short-tailed Shrew is common in a wide range of habitats in the Mixed Wood Plains Ecosystem. This shrew occurs across much of eastern North America with the Mixedwood Plains Ecozone being central to its range. Populations of this species can reach high

densities in some areas and can devastate insect and small-mammal communities (Peterson, 1966). It is likely that this species maintains a stable population within the Mixedwood Plains Ecozone.

*Cryptotis parva* **southern distribution**

In the Mixedwood Plains Ecozone the Least Shrew is known only from Long Point, Ontario. It has been suggested that this population of Least Shrews originated from individuals that rafted across Lake Erie. An investigation of the grassy dune habitats near Lake Erie might augment our limited knowledge of the Least Shrew in our ecozone, or, on the other hand, might suggest that the small population there has been extirpated.

**Family Talpidae - moles**

*Parascalops breweri* **Mixedwood Plains distribution**

Because of the Hairy-tailed Mole's (Fig. MM-1.5) limited distribution, the Mixedwood Plains Ecozone represents a substantial portion of its range. Although the biology and distribution of this species are poorly known, sandy, dry soil with vegetation cover seem to be preferred (Peterson, 1966). The maintenance of a stable population of Hairy-tailed Moles within the Mixedwood Plains Ecozone is probably vital to the success of this species. Appropriate measures should be taken to monitor its populations within this ecozone.



Figure MM-1.5: Hairy-tailed Mole.

Photo courtesy of D. Smith.

### *Scalopus aquaticus* **southern distribution**

The Eastern Mole's Canadian distribution is limited to Essex County in the Lake Erie Lowland Ecoregion in extreme southwestern Ontario. It is also found across the entire eastern half of the United States. The preferred sandy soil habitat of this mole is restricted within the Mixedwood Plains Ecozone. Even though the restricted Canadian range of the Eastern Mole is spatially insignificant compared to the vast range south of the border, it's a species meriting special consideration for conserving Canadian biodiversity. COSEWIC listed Canadian populations of Eastern Moles as vulnerable.

### *Condylura cristata* **widespread distribution**

The Star-nosed Mole occurs across much of eastern North America including all of the Mixedwood Plains Ecozone. These moles live in moist bogs, swamps, forests, and meadows and often forage in water. The Star-nosed Mole is fairly common but the status of the population is not known because of a lack of monitoring data.

## **Order Chiroptera**

As all bats found in the Mixedwood Plains Ecozone prey entirely on nocturnal and crepuscular flying insects, they, like shrews and moles, are important ecologically. Of the eight species of bats found in the Mixedwood Plains Ecozone three are migratory and five hibernate underground during winter. The migratory species move south out of this ecozone during the fall so environmental factors in their wintering grounds may also affect their populations.

The specific techniques required to monitor bat populations would have to be performed by specially trained individuals. Special training and experience are also needed to identify bats to species. Because of the complexities of monitoring bat populations there are very few quantitative data on the status of bat populations within this ecozone.

## **Family Vespertilionidae - common or vesper bats**

### *Myotis leibii* **Mixedwood Plains distribution**

The Eastern Small-footed Bat has a relatively small distribution. A high proportion of this distribution falls within the Mixedwood Plains Ecozone. Little is known about its biology or population status. Its absence from extreme southwestern Ontario may be due to the removal of forests from this area as well as the absence of underground hibernation sites. As this ecozone represents a large part of the total range of Eastern Small-footed Bats, extra emphasis should be placed on the monitoring and conservation of this species within this ecozone.

### *Myotis lucifugus* **widespread distribution**

The Little Brown Bat (Fig. MM-2, Fig. MM-3, Fig. MM-4) is found in much of North America, including the entire Mixedwood Plains Ecozone. This is one of the most common and best studied bats of our area. But like all other bats, its overall population status is unknown.





Figure MM-2: Little Brown Bat.

Photo courtesy of D. Smith.



Figure MM-3: Little Brown Bat.

Photo courtesy of D. Smith.



Figure MM-4: Little Brown Bat.

Photo courtesy of D. Smith.

*Myotis septentrionalis* **widespread distribution**

The Northern Long-eared Bat is found through much of eastern North America including the Mixedwood Plains Ecozone. This bat is relatively uncommon and little is known of its biology although it seems to be found more frequently in heavily forested areas. The absence of this bat from extreme southwestern Ontario may be due to the removal of forests in this area and absence of hibernation sites.

*Lasiorycteris noctivagans* **widespread distribution**

The Silver-haired Bat is a migratory species found over most of North America including all of the Mixedwood Plains Ecozone. Although this bat is often described as solitary, maternity colonies of females and young have been found in hollow trees, including one in the Manitoulin-Lake Simcoe Ecoregion of this ecozone. This species lives in forested areas along streams and lakes. Like the other bats of this ecozone virtually nothing is known of its abundance or population status.

*Pipistrellus subflavus* **southern distribution**

The Eastern Pipistrelle almost reaches its northern limit of distribution in the Mixedwood Plains Ecozone. This bat occurs throughout most of the eastern United States and Mexico. It is usually found near water and forest edges but may avoid large tracts of unbroken forest (Kurta, 1995). In the Mixedwood Plains Ecozone this bat is most abundant on the north shores of Lake Erie and Lake Ontario (Dobbyn, 1994).

*Eptesicus fuscus* **widespread distribution**

The Big Brown Bat is found all over North and Central America except north of the boreal forest. This may be the most common bat in the Mixedwood Plains Ecozone because it occurs in open habitats including agricultural and urban areas (van Zyll de Jong, 1985). Because it is not common in heavily forested areas it is likely that the Big Brown Bat population has increased over levels present before the destruction of most of the forests in this ecozone.

*Lasiurus borealis* **widespread distribution**

The Red Bat is a migratory species found in the Mixedwood Plains Ecozone for only half of the year. It is also found in much of the United States and Central America. The Red Bat is a solitary species found in forested areas near water (Peterson, 1966).

*Lasiurus cinereus* **widespread distribution**

The Hoary Bat is another migratory species found in the Mixedwood Plains Ecozone for only half of the year. This species occurs throughout most of North America and down to South America. It too is a solitary species found in forested areas near water (Peterson, 1966).

**Order Lagomorpha: Family Leporidae - rabbits and hares**

These lagomorphs are more widely recognized than most small to medium-sized mammals because they are larger in size and often active during the day. They are very important ecologically as abundant consumers of ground vegetation. Lagomorphs are also key prey items for many carnivores especially foxes, Coyotes, large weasels, and native cats. Of the three species found in the Mixedwood Plains Ecozone only one was present before European settlement. That species is the Snowshoe Hare (*Lepus americanus*) which has probably declined because of habitat destruction while being replaced by two new species which prefer open, disturbed habitat. The loss of large mammalian predators due to over-harvesting and habitat destruction has undoubtedly benefitted all lagomorphs within this ecozone. Because these lagomorphs are such important links in the natural food chains of the Mixedwood Plains Ecozone, monitoring populations would be critical to estimating future trends in biodiversity of this ecozone.

*Sylvilagus floridanus* **southern distribution**

The Eastern Cottontail (Fig. MM-5, Fig. MM-6), the only rabbit in this ecozone, is found throughout most of the United States and into the Mixedwood Plains Ecozone where it just about reaches its northern limit. This rabbit is typically found in disturbed areas including open forest, forest edges, agricultural land, and urban areas. The Eastern Cottontail may have occurred in the Mixedwood Plains Ecozone sporadically long before European settlement, but they expanded

within this ecozone permanently about 1860 (Dobbyn, 1994). Since then range expansion and population increase of this species have been observed across the Mixedwood Plains Ecozone. Obviously this species has benefitted from the destruction of most of the forests and the decrease in many large predators in this ecozone.



Figure MM-5: Adult Eastern Cottontail.

Photo courtesy of D. Smith.

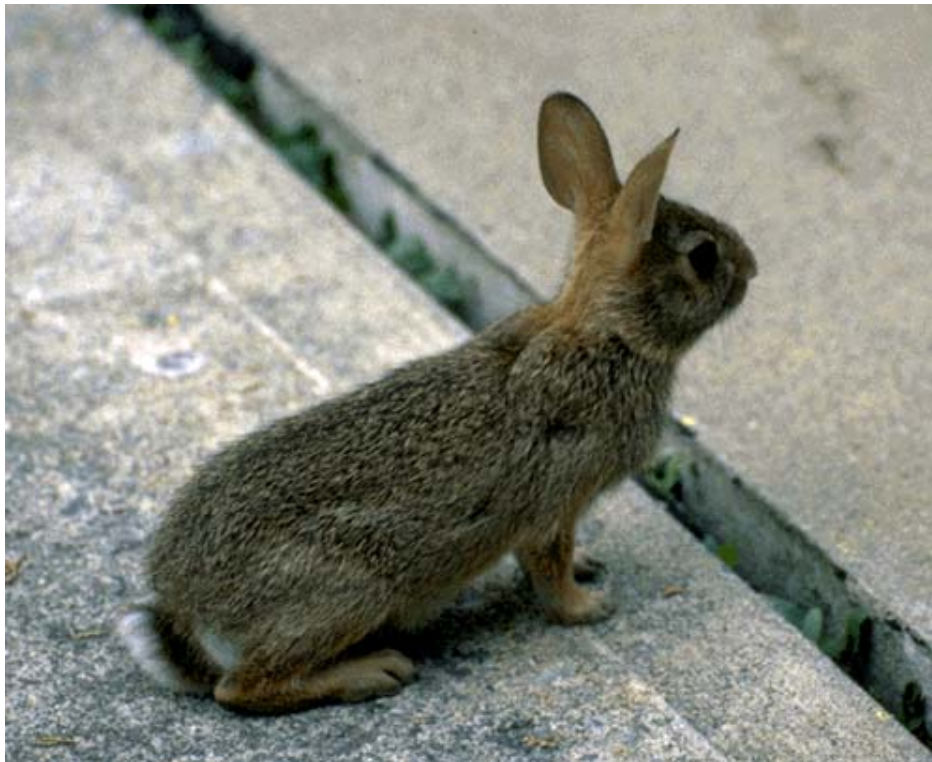


Figure MM-6: Young Eastern Cottontail.

Photo courtesy of D. Smith.

*Lepus americanus* **northern distribution**

The Snowshoe Hare (Fig. MM-7) is the only lagomorph that occurred in the Mixedwood Plains Ecozone before European settlement. It is also found across most of the boreal forests of Canada. Unlike the other two lagomorphs found in this ecozone the Snowshoe Hare prefers heavily forested habitats away from human disturbance. Coniferous forests, especially White Cedar swamps, are where they occur in our ecozone. The removal of most forests from the Mixedwood Plains Ecozone has resulted in declining populations and range of this species.



Figure MM-7: Snowshoe Hare.

Photo courtesy of D. Smith.

*Lepus europaeus* **introduced**

The European Hare was introduced to North America near Brantford, Ontario in 1912 (Dobbyn, 1994). The European Hare prefers cultivated fields and disturbed areas; this allowed it to expand its range and population through most unforested parts of the Mixedwood Plains Ecozone in Ontario. Owing to the lack of monitoring data the status of its population within the Mixedwood Plains Ecozone is unknown.

## **Order Rodentia**

Rodents are the most diverse group of mammals in the Mixedwood Plains Ecozone with 20 species in 17 genera and five families. Most rodents are small but abundant and therefore represent a large percentage of the mammal biomass in all terrestrial habitats within this ecozone. Rodents usually consume plant matter but many also prey on invertebrates. They are preyed upon by foxes, Coyotes, mustelids, hawks, and owls. Rodents are important links in food webs and have major impacts on the entire ecosystem. Because of their diversity, ecological importance, and abundance in all terrestrial habitats, rodents are an important group to monitor in an assessment of biodiversity for any ecozone.

### **Family Sciuridae - squirrels**

Squirrels represent a widely recognized group of small mammals owing to the diurnal habits and high visibility of most species.

#### *Tamias striatus* **widespread distribution**

The Eastern Chipmunk is found in most of eastern North America including the Mixedwood Plains Ecozone. This species is common in most dry forest and bushy habitats across the ecozone. Although the population of Eastern Chipmunks has probably decreased since European settlement with its preferred mature maple-beech habitat in this ecozone, it seems to have adapted to some human disturbance and to maintain a stable population.

#### *Marmota monax* **widespread distribution**

The Woodchuck occurs across much of the eastern United States and Canada including the Mixedwood Plains Ecozone. It prefers open habitat and has increased as the native forests were destroyed in this ecozone. The elimination of most large predators through over-harvesting and habitat destruction has also undoubtedly benefitted this species of ground-dwelling squirrel. The Woodchuck is abundant throughout the Mixedwood Plains Ecozone.

#### *Sciurus carolinensis* **southern distribution**

The Eastern Gray Squirrel occurs in the eastern United States and almost reaches its northern limit of distribution in the Mixedwood Plains Ecozone. The pelage colour is variable, with the two main morphs being gray (Fig. MM-8) and black (Fig. MM-9). The black morph is more common than the gray in the northern part of its range in Ontario and southwestern Quebec. This squirrel occurs anywhere where there are broad-leaved trees including in cities. A range expansion northward has been observed over the past century. The Eastern Gray Squirrel has apparently benefitted from human alterations to the Mixedwood Plains Ecozone.



Figure MM-8: Eastern Gray Squirrel.

Photo courtesy of D. Smith.



Figure MM-9: Eastern Gray Squirrel.

Photo courtesy of D. Lafontaine.

*Sciurus niger* **introduced**

The Fox Squirrel was introduced from the eastern United States to Pelee Island in Lake Erie. This isolated population is of little importance to the biodiversity of the Mixedwood Plains Ecozone. COSEWIC has declared it 'not at risk'.

*Tamiasciurus hudsonicus* **northern distribution**

The American Red Squirrel (Fig. MM-10) occurs over most of northern North America including the Mixedwood Plains Ecozone. This squirrel can be found anywhere there are coniferous trees, even including many urban areas. Although the American Red Squirrel is abundant and seems to have a stable population in this ecozone it is unknown what the population levels were in the past.



Figure MM-10: Red Squirrel.

Photo courtesy of D. Lafontaine.

*Glaucomys sabrinus* **northern distribution**

The Northern Flying Squirrel occurs in most boreal and adjacent montane regions of North America south of the treeline. The Mixedwood Plains Ecozone represents the most southern part of its eastern range other than in the Appalachian Mountains. Over most of its range it prefers coniferous forests. The population status of these nocturnal squirrels is unknown because of a lack of monitoring data. Its population levels may be affected by the population of the more southerly ranging *Glaucomys volans*. Long- term monitoring would provide information on the dynamics of these two species.



*Glaucomys volans* **southern distribution**

The Southern Flying Squirrel is found throughout the eastern United States and reaches almost the northern part of its distribution in the Mixedwood Plains Ecozone. The preferred habitat of this squirrel is deciduous forests. Because the two flying squirrel species are difficult to distinguish without training, observational data are scarce, but the Southern Flying Squirrel appears to have recently expanded its range northward in Ontario and southern Quebec. Population monitoring by trained individuals would reveal the population and distribution status of the flying squirrels. COSEWIC listed populations of Southern Flying Squirrels as vulnerable in Canada.

**Family Castoridae - beavers**

*Castor canadensis* **widespread distribution**

The North American Beaver is found virtually everywhere in North America including the Mixedwood Plains Ecozone. Beavers prefer forested areas with slow-moving water. After the destruction of this habitat they no longer occur in extreme southwestern Ontario (Dobbyn, 1994). Extensive habitat destruction and over-harvesting of beavers almost caused their extirpation from this ecozone about a century ago. Management of their populations including the prevention of further over-exploitation allowed them to recover to the relatively high levels they are at today.

**Family Muridae - rats, mice, and voles**

Although they are not as easily seen as some other mammals, these rodents are by far the most abundant of mammals in their habitats within the Mixedwood Plains Ecozone. Population levels are comparable only to those of some of the shrews. It is therefore important to study the population dynamics of these species to interpret some of the changes in biodiversity within an ecozone.

*Peromyscus leucopus* **southern distribution**

The White-footed Mouse is found across the eastern and central United States and reaches almost the northern edge of its eastern distribution in the Mixedwood Plains Ecozone. This mouse is most common in broad-leaved forests and is abundant across the entire ecozone. The White-footed Mouse is very closely related to *Peromyscus maniculatus*, the Deer Mouse, which can co-exist in the same forest. Distinguishing between these two species is difficult and must be done by trained individuals who must capture them and make measurements and critical observations. Although this species is abundant its population status is unknown because of the lack of data and difficulty in identification.

*Peromyscus maniculatus* **widespread distribution**

The Deer Mouse is found through much of North America including the Mixedwood Plains Ecozone. Two subspecies of Deer Mice live in this ecozone, *P. m. bairdii* in the grassland of the Lake Erie Lowland Ecoregion and *P. m. gracilis* in the forests of the rest of the ecozone. Although this species is abundant across the Mixedwood Plains Ecozone, its population status is unknown. It is possible that Deer Mouse populations in forests are affected by populations of closely related White-footed Mice but because of the difficulty in identification and a lack of data this is unknown.

*Clethrionomys gapperi* **northern distribution**

The Southern Red-backed Vole is found throughout boreal and adjacent montane areas of North America including part of the Mixedwood Plains Ecozone where it reaches its southern limit in Canada. This species occurs in moist coniferous and mixed forests. Although the Southern Red-backed Vole can be very abundant in this ecozone its population status is unknown.

*Microtus pennsylvanicus* **widespread distribution**

The Meadow Vole is found throughout most of North America except the extreme southern United States. This vole is abundant throughout the meadows and open areas of the Mixedwood Plains Ecozone. It has benefitted from the destruction of most of the forest habitats within this ecozone and has probably increased in population size over the past few centuries.

*Pitymys pinetorum* **southern distribution**

The Woodland Vole ranges across most of the eastern United States and reaches the northern tip of its distribution in the Mixedwood Plains Ecozone. Within this ecozone the Woodland Vole is found only in part of the Lake Erie Lowland Ecoregion in Ontario and in the St-Laurent Lowlands Ecoregion of southern Quebec just north of the border with Vermont. This vole seems to prefer mature broad-leaved forest habitat, which has been almost entirely destroyed in the Mixedwood Plains Ecozone. It is very likely that Woodland Vole distribution and population size have decreased in this ecozone in historic times along with their native habitat. Monitoring the small populations isolated in small forest remnants would be highly recommended for a biodiversity assessment of this ecozone.

*Ondatra zibethicus* **widespread distribution**

The Muskrat is found throughout most of North America including the Mixedwood Plains Ecozone. They are found in ponds, streams, lakes, and marshes with aquatic vegetation. The population of Muskrats in this ecozone seems to be stable even though it continues to be trapped heavily for pelts.

*Synaptomys cooperi* **widespread distribution**

Although the Southern Bog Lemming is found throughout the central part of eastern North America, the Mixedwood Plains Ecozone is in the centre of its distribution. The habitat of this lemming is in bogs, meadows, and forests with deep litter - either damp or dry. This species is uncommon in this ecozone especially relative to the abundance of other species in this family. Owing to the lack of monitoring data on this species very little is known of its population status and habitat requirements in the Mixedwood Plains Ecozone. Populations have likely declined due to habitat destruction and possibly competition with Meadow Voles (Kurta, 1995).

***Rattus norvegicus* introduced**

The Norway Rat was introduced to North America about 1775 and since has spread across the continent to most places with human settlements, including the Mixedwood Plains Ecozone (Kurta, 1995). This species is only found associated with human settlement, not in 'natural' habitats. Were Norway Rats ever to invade the latter and to compete with native species, they could potentially have a negative impact on the biodiversity of this ecozone.

***Mus musculus* introduced**

The House Mouse was introduced to North America by early European settlers and has spread across the continent to most places with human settlements, including the Mixedwood Plains Ecozone. This species, like the Norway Rat, is found mainly in areas of human settlement now but potentially could have a negative impact on the biodiversity of this ecozone.

**Family Dipodidae - jumping mice**

The jumping mice are not as diverse or abundant as the murids in the Mixedwood Plains Ecozone but they are an important part of the natural ecosystems of this area. These rodents are hibernators and relatively good burrowers and use these abilities to exploit different niches than other small rodents in this area.

***Zapus hudsonius* widespread distribution**

The Meadow Jumping Mouse is found through the boreal regions of Canada and much of eastern North America, including the Mixedwood Plains Ecozone. This species is most common in moist meadows but is also found in a variety of other habitats. The Meadow Jumping Mouse seems to have a stable population in this ecozone but this is uncertain because of a lack of monitoring data.

***Napaeozapus insignis* northern distribution**

The Woodland Jumping Mouse inhabits the Boreal Shield and Atlantic Maritime Ecozones and adjacent montane areas of eastern North America. The Mixedwood Plains Ecozone is the southern tip of the part of this range in Ontario. This species is found in mature forests near water and has probably decreased in historic times owing to habitat destruction. The current status of the population seems to be stable but this is uncertain because of a lack of monitoring data.

**Family Erethizontidae - New World porcupines**

***Erethizon dorsatum* widespread distribution**

The Porcupine (Fig. MM-11) is found through much of North America including the Mixedwood Plains Ecozone. This species lives in forests, particularly coniferous forests. Porcupines have been extirpated from most of southwestern Ontario because of habitat destruction. Although Porcupines are still common in many areas, they seem to be sensitive to deforestation and cannot live in small, isolated woodlots. Monitoring of this species would be recommended in a biodiversity assessment of the Mixedwood Plains Ecozone.



Figure MM-11: Porcupine.

Photo courtesy of D. Lafontaine.

### **Order Carnivora**

Carnivores represent the second most diverse order of mammals in the Mixedwood Plains Ecozone with 16 species in 11 genera and five families present today. Many of these carnivores are relatively large and prey upon other living animals so they typically need large home ranges and have low population densities. A few species of carnivores have adapted to live in disturbed areas and have benefitted from the destruction of most of the habitats native to this ecozone, but most species have decreased dramatically. Most of the native carnivores in the Mixedwood Plains Ecozone have been extirpated from some or all of their former ranges. Many carnivores in this ecozone are economically valuable to the fur trade. Moreover, carnivores are ecologically important because they can influence the abundance of other vertebrates. A healthy carnivore population can help to prevent herbivore population explosions where levels increase until all the available vegetation has been consumed and the habitats are badly damaged. This type of system was present before the destruction of most native habitats and human persecution and over-harvesting of carnivore pelts began. Today several species of carnivores are missing; this negatively affects the ecosystems and therefore biodiversity in the Mixedwood Plains Ecozone. Some carnivores are important reservoirs of rabies in this Ecozone.

## Family Canidae - foxes, wolves, and allies

### *Canis latrans* **widespread distribution**

The Coyote (Fig. MM-12) is found throughout most of North America including the Mixedwood Plains Ecozone. This species was historically found in the prairies but has greatly extended its range eastward and southward, reaching this ecozone in the early 1900s (Peterson, 1966). The Coyote is found in disturbed habitats such as agricultural land and clearcuts. It is closely related to *Canis lupus* and domestic dogs and is known to hybridize with both. The recent population and distribution increase of the Coyote is still in a state of flux so monitoring programs of this and related species should begin as soon as possible to document this change.



Figure MM-12: Coyote.

Photo courtesy of D. Lafontaine.

### *Canis lupus* **northern distribution**

The Gray Wolf is found throughout most of Canada and reaches the southern part of its distribution in the Mixedwood Plains Ecozone. This species was probably once common in the Mixedwood Plains Ecozone and found throughout North America but it has been extirpated from most of its former range including most of this ecozone. Destruction of habitat and persecution by humans have resulted in the almost complete disappearance of the Gray Wolf. Now the Gray Wolf can be found in the Mixedwood Plains Ecozone only along the northern edge. Population monitoring and conservation programs are strongly recommended for this ecologically and aesthetically important but disappearing native species.

***Vulpes vulpes* widespread distribution**

The Red Fox is found across most of North America including the Mixedwood Plains Ecozone. This species can be found in many different types of habitats except large tracts of mature forest. The Red Fox is very common throughout this ecozone and has benefitted from the destruction of most of the native habitat here. The population is stable and possibly increasing.

***Urocyon cinereoargenteus* southern distribution**

The Gray Fox is found throughout much of the United States and reaches the northern tip of its distribution in the Mixedwood Plains Ecozone. This fox prefers forested areas and was extirpated from this ecozone from the time of European settlement until the 1930s (Peterson, 1966).

Although the range is slowly expanding into southern Ontario and extreme southern Quebec from the south, the Gray Fox is very uncommon and has been designated as rare on the Ontario status list (Dobbyn, 1994), and as vulnerable in Ontario and Quebec by COSEWIC.

**Family Ursidae - bears**

***Ursus americanus* widespread distribution**

The American Black Bear ([Fig. MM-13](#)) occurs throughout much of non-arctic Canada and the United States including the Mixedwood Plains Ecozone. This species prefers forested areas and was once common throughout most of North America. Destruction of its habitat and the continued over-hunting by humans are the main causes of its decline. This species has been extirpated from much of this ecozone especially where forests have been permanently removed. Population monitoring and conservation programs are strongly recommended for the Black Bear.



Figure MM-13: Black Bear.

Photo courtesy of D. Lafontaine.

## Family Procyonidae - raccoons

### *Procyon lotor* widespread distribution

The Northern Raccoon (Fig. MM-14) is found throughout much of North America including the Mixedwood Plains Ecozone. This species is omnivorous and lives in many different habitats including urban areas. The Raccoon population is increasing in this ecozone as it adapts to human disturbance. This abundant carnivore should be monitored as the population seems to be rapidly changing.



Figure MM-14: Raccoon.

Photo courtesy of D. Lafontaine.

## Family Mustelidae - weasels and allies

### *Martes americana* northern distribution

The American Marten is found throughout the boreal forest and some adjacent montane areas in the west; it occurs in the northern edge of the Mixedwood Plains Ecozone where it reaches part of its southern limit. This weasel prefers large tracts of coniferous forests but also inhabits mixed forests. The American Marten once ranged across the entire Mixedwood Plains Ecozone but has been extirpated from almost all of it because of deforestation and over-harvesting of pelts. The American Marten has disappeared from many areas where the rodents it eats are still abundant. Population monitoring and conservation programs for the American Marten are highly recommended for this economically and ecologically important carnivore.

***Martes pennanti* northern distribution**

The Fisher has a distribution and habitat requirements similar to those of the American Marten. The Fisher has been extirpated from much of the Mixedwood Plains Ecozone for the same reasons as the American Marten and similar population monitoring and conservation programs are recommended.

***Mustela erminea* northern distribution**

The Ermine (Fig. MM-15) is found across most of Canada including the Mixedwood Plains Ecozone . It is found mainly in forested habitat and tundra. Ermine populations have probably declined because of habitat destruction but they are still regularly found in most of the ecozone. Distinguishing this species from the Long-tailed Weasel (*Mustela frenata*) can be difficult for an untrained individual.



Figure MM-15: Ermine.

Photo courtesy of D. Smith.

***Mustela frenata* widespread distribution**

The Long-tailed Weasel is distributed throughout the United States and some southern parts of Canada including the Mixedwood Plains Ecozone. This species, although more tolerant of disturbed habitats, is less abundant than the Ermine in this ecozone. The dynamics between Long-tailed Weasel and Ermine populations are not clear but warrant future research.

***Mustela vison* widespread distribution**

The American Mink occurs through much of North America including the Mixedwood Plains Ecozone. Minks are always found near lakes, rivers, streams, marshes, or the seashore, even in disturbed areas. This species seems to have a stable population in the Mixedwood Plains Ecozone.



*Gulo gulo* **northern distribution**

The Wolverine was once found throughout Canada and in some of the northern United States but today it occurs only in northern and western Canada and the northwestern United States. Wolverines were extirpated from the Mixedwood Plains Ecozone shortly after European settlement because of habitat destruction and human persecution. The Wolverine can be found in many types of undisturbed habitats but little else is known about the biology of this disappearing species.

*Taxidea taxus* **widespread distribution**

The American Badger occurs through much of western North America and reaches its eastern limit in the Lake Erie Lowland Ecoregion of the Mixedwood Plains Ecozone. Badgers are found in open grasslands and agricultural land, but it is unknown whether they inhabited the remnant prairie in extreme southwestern Ontario before European settlement. Even if they did, their small range in this ecozone likely increased eastward after the forests were destroyed for agriculture. COSEWIC has declared their small population in Ontario as 'not at risk.'

*Mephitis mephitis* **widespread distribution**

The Striped Skunk occurs throughout much of North America except the extreme north. This species inhabits semi-open and open areas both urban and rural and is abundant throughout the Mixedwood Plains Ecozone. Skunks have benefitted from the clearing of the forests in this ecozone and have undoubtedly increased as a result.

*Lontra canadensis* **widespread distribution**

The North American River Otter occurs in much of North America including the Mixedwood Plains Ecozone. This species is highly adapted for an aquatic life and is always found near lakes, ponds, rivers, streams and oceans. Otters fare poorly in areas of human disturbance and have become extirpated from southwestern Ontario because of habitat loss, over-harvesting, and pollution. Monitoring otter populations is recommended as a biological indicator of the health of aquatic ecosystems.

**Family Felidae - cats**

*Felis concolor* **widespread distribution**

Although the Cougar or Mountain Lion historically occurred throughout the United States and southern Canada including the Mixedwood Plains Ecozone, its natural distribution has been greatly reduced. Cougars were extirpated from the Mixedwood Plains Ecozone over 150 years ago because of habitat destruction and human persecution. The Wapiti (*Cervus elaphus*) was probably a major prey item for the Cougar in this ecozone so their extirpations could probably be linked together. COSEWIC listed eastern populations of Cougars as endangered.

*Lynx canadensis* **northern distribution**

The Canada Lynx is found throughout all of boreal Canada and adjacent montane areas of the western United States. This species has been extirpated from much of the southern part of its range including most of the Mixedwood Plains Ecozone. The Canada Lynx is found in large

areas of undisturbed coniferous forest usually where Snowshoe Hares also occur. The Canada Lynx has decreased along with the Snowshoe Hare in this ecozone because of habitat destruction and over-harvesting. Population monitoring and conservation programs are needed for this declining species. Nevertheless, COSEWIC declared the Canada Lynx as 'not at risk' throughout Canada.

***Lynx rufus* widespread distribution**

The Bobcat occurs throughout most of the United States and some of southern Canada including part of the Mixedwood Plains Ecozone. This species is found in forested habitats and is adaptable to some human disturbance. The Bobcat population has been extirpated from most of this ecozone because of habitat loss and over-harvesting of pelts. Population monitoring and conservation programs are needed for this possibly declining species.

**Order Artiodactyla: Family Cervidae - deer and allies**

***Cervus elaphus* widespread distribution**

The Wapiti (Fig. MM-16) was once found across much of central North America including the Mixedwood Plains Ecozone. Only small populations still exist today in western North America. Wapiti were extirpated from this ecozone by habitat destruction and over-hunting by 1850 (Peterson, 1966). The eastern race *C. e. canadensis* is now extinct.



Figure MM-16: Elk.

Photo courtesy of D. Lafontaine.

*Odocoileus virginianus* **widespread distribution**

The White-tailed Deer (Fig. MM-17) occurs throughout most of the United States and southern Canada including the Mixedwood Plains Ecozone. This species is found in agricultural land and other disturbed habitats as well as in forests, especially secondary ones. The clearing of most of the original forest in this ecozone along with the extirpation of all natural predators benefitted this species. Populations have been increasing and the range has been expanding northward since European settlement.



Figure MM-17: White-tailed Deer.

Photo courtesy of D. Lafontaine.

*Alces alces* **northern distribution**

The Moose (Fig. MM-18) occurs throughout boreal Canada and in adjacent montane areas in the northern United States. Moose entered the Mixedwood Plains Ecozone after deglaciation by moving north around the east end of Lake Ontario from the United States (Peterson, 1957). This species has been extirpated from most of its former range therein because of forest destruction and over-hunting. It is usually found in coniferous forests near lakes or streams. Because of the Moose's economic importance, its biology is well known. A brain parasite found in White-tailed Deer can be harmful to Moose. The spread of White-tailed Deer northward has therefore been detrimental to Moose populations.



Figure MM-18: Moose.

Photo courtesy of D. Lafontaine.

## REFERENCES

Dobbyn, J.S. 1994. Atlas of the Mammals of Ontario. Federation of Ontario Naturalists, Don Mills, Ontario.

Harrington, C.R. 1989. Ice-Age Fossils and Vanished Vertebrates. pp. 156-164 *in* Legacy: The Natural History of Ontario (ed. J.B. Theberge). McClelland & Stewart Inc., Toronto.

Kurta, A. 1995. Mammals of the Great Lakes Region. Fitzhenry & Whiteside Limited, Markham, Ontario.

Peterson, R.L. 1957. Changes in the Mammalian Fauna of Ontario. pp. 43-58 *in* Changes in the Fauna of Ontario (ed. F.A. Urquhart). University of Toronto Press for Division of Zoology and Palaeontology, Royal Ontario Museum.

Peterson, R.L. 1966. The Mammals of Eastern Canada. Oxford University Press, Toronto.

Prescott, J. et P. Richard. 1982. Mammifères du Québec et de l'est du Canada. Éditions France-Amérique, Montréal. 2 volumes.

van Zyll de Jong, C.G. 1985. Handbook of Canadian Mammals. Vol. 2. Bats. National Museums of Canada, Ottawa.