Atlas of the Mammals of Ontario

Jon (Sandy) Dobbyn

Federation of Ontario Naturalists

The Atlas of the Mammals of Ontario

was generously supported by the following organizations:

Ontario Ministry of Natural Resources

Employment and Immigration Canada

Environmental Youth Corps

Ontario Heritage Foundation

Federation of Ontario Naturalists

Environment Canada

Ontario Federation of Anglers and Hunters

Canadian Wildlife Foundation

University of Waterloo

Royal Ontario Museum

Carleton University

Funding for the printing of the *Atlas of the Mammals of Ontario*

was provided by the Ontario Heritage Foundation.

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by Jon (Sandy) Dobbyn

with contributions from Judith Eger and Nancy Wilson

Canadian Cataloguing in Publication Data

Dobbyn, Jon Sandy, 1966-
Atlas of the mammals of Ontario
Includes bibliographical references and index.
ISBN 1-896059-02-3

1. Mammals - Ontario - Geographical distribution
- Maps. 2. Mammals - Ontario - Geographical distribution.
I. Federation of Ontario
Naturalists. II. Title.

QL721.5.05D63 1994 599.09713'022'3 C94-900351-4

Published by:

Federation of Ontario Naturalists
355 Lesmill Road, Don Mills, Ontario, Canada
M3B 2W8
(416)444-8419 Fax: (416)444-9866

Proceeds from the sale of this book go to support further volunteer conservation efforts.

Printed in Canada by D.W. Friesen
Altona, Manitoba Canada.

cover photo: Red Fox: Michael W.P. Runtz

Foreword

Eastern Chipmunk: Ivan Foster

The presence of a balanced, functioning mammal fauna in an area is an indicator of the general health of that environment. Monitoring mammal populations, particularly in habitats sensitive to human activities, is an important part of taking the environmental pulse. The *Atlas of the Mammals of Ontario* serves as a baseline in this regard, as did the maps published by R.L. Peterson earlier (1966, *The Mammals of Eastern Canada).* These documents summarize our knowledge of the distribution of mammals at specific periods in time.

The geographic distribution of a species is a major aspect of its natural history, and the knowledge of the geographic distribution of all species within a region provides the basis for faunal analyses or studies of biological diversity. The *Atlas of the Mammals of Ontario is* a compilation of distributional data, both historical and recent, for all wild mammals found in the province.

The distributional ranges of different species vary greatly, from those that are restricted to a relatively small area, such as the Eastern Mole, to those that encompass the entire province, such as the Red Fox. The reasons for this are not always clear. In some cases ranges may be limited by geographic barriers, but more importantly, the distribution and abundance of an individual species are governed by environmental factors that influence its chance to survive and reproduce. These factors may be grouped into four major categories: weather/climate, food, other animals and disease-causing organisms, and places in which to live. These major environmental components may act on their own, or, and this is probably more often the case, they may interact.

An example of a single environmental component being involved is provided by the evidence that the occurrence of prolonged periods of cold weather in winter is the factor that limits the northern distribution of the Virginia Opossum. The opossum's spread into the north temperate regions of North America is a relatively recent phenomenon and it is, therefore, not surprising that the species has not fully adapted to harsh winters.

To illustrate the more complex situation of a number of components interacting, one could consider the history of the distributions of the White-tailed Deer and the Caribou. Habitat changes produced by humans favoured the northward extension of the White-tailed Deer's range. With the deer came a parasitic meningeal nematode which, harmless enough in its normal host, proved to be deadly for the Caribou. The parasite, combined with extensive logging of old growth Boreal Forest on which the Caribou depends, played a major role in eliminating the Caribou from most of its southern range. Logging of the old growth forest favoured the expansion of Moose populations. Wolf numbers increased along with the Moose, resulting in higher predation rates on the more vulnerable Caribou.

These few examples serve to illustrate that a thorough knowledge of a species' requirements and an understanding of how the major environmental components interact are needed to explain the distribution and abundance of a species. Unfortunately, only a few species have been adequately studied and there remains much to be learned about the distribution and abundance of Ontario's mammals. One thing is certain, in the category "other animals", humans loom large as a factor in the distribution and abundance of all other

species. Humans are the most abundant large mammals in the province and their impact on the global environment is, as we all know, significant and pervasive. The effects of the general environmental degradation of air, water, and soil and the significant loss or fragmentation of habitats are most noticeable in southern Ontario where human population densities are greatest. Although many wild mammals were affected negatively, several have benefited from the human-made changes or have adapted to them in time. Some, such as Gray Squirrels and Raccoons, have even become urbanites.

In northern Ontario with nearly 90% of the land and only 10% of the human population, the situation may seem less acute, but major problems exist here as well. Most of these problems are caused by extractive industries and logging. Of particular concern at present, is the massive destruction of old growth boreal forests by clearcutting, which will have serious consequences for the distribution and abundance of species such as Caribou and Marten. It is clear that improving the environment and restoring healthy ecosystems requires intensive management of our own species.

Biodiversity has now become a household word, like ecology before it. Most people think of biodiversity simply as the number of species living in a particular area. However, there are other aspects of biological diversity that one has to take into consideration when comparing different areas, such as the relative abundances of species in a community, or seasonal changes in the number of species present. Another aspect of biological diversity is the adaptive radiation in a group. In this respect, mammals display greater diversity than other vertebrates, having adapted to all climates, and to life in the water, on the land, in the soil, in the trees, and in the air. For those interested in assessing the biodiversity of an area, the Mammal Atlas provides the basic information on the number of species present.

Not only are mammals an important part of the overall biological diversity of the province, but many are also keystone species in their ecological communities. For example, herbivorous mammals, such as voles, Snowshoe Hares, deer, and Moose, are important links in the food chains of terrestrial communities, whereas the larger carnivorous mammals function as top predators. There are also more subtle, but equally essential, interactions between mammals and plants that sustain communities, such as that between the Gray Squirrel and its food plants. Not only is this species an agent of seed dispersal for nut-bearing trees, but it also spreads the trees' mycorrhizal symbionts, by eating the fruiting bodies of the fungi and passing the spores, unharmed, in its droppings.

The Mammal Atlas will be a welcome and useful reference for all those interested in Ontario mammals and is a basis for further work on their distribution.

C.G. van Zyll de Jong

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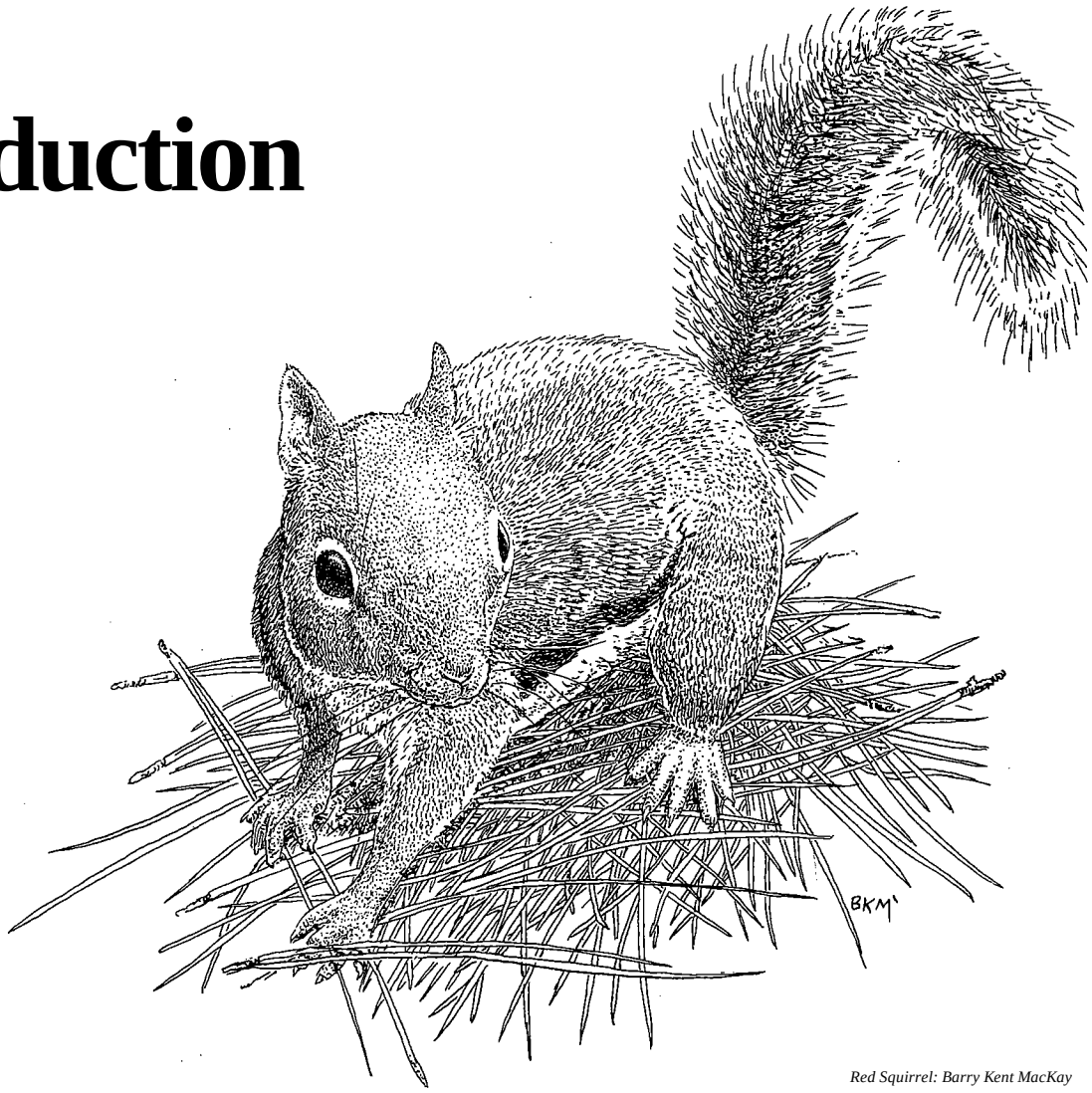
Introduction



Red Squirrel: Barry Kent MacKay

Naturalists, biologists, environmental consultants and planners are but a few of the many people who will find this book useful. By mapping the presence of Ontario's 86 wild mammal species, the *Atlas of the Mammals of Ontario* (Mammal Atlas) will provide: a benchmark for future studies, an aid in determining conservation priorities, an information source for status reports on rare or vulnerable species, and a resource for environmental impact assessments.

The Mammal Atlas makes use of information collected from institutions and volunteers to document a provincial range for each wild mammal in Ontario. As such, the Mammal Atlas is a much more accurate record of Ontario's mammals than can be found in a field guide. Maps in field guides tend to be large-scale, sometimes including entire countries or even continents in an attempt to map the entire range of a species. The Mammal Atlas focuses on Ontario, mapping actual mammal specimen records, sightings, and telltale evidence. Mammal Atlas species accounts also outline factors known to affect local distribution, including habitat preferences, land-use practices and climate.

The maps in the Mammal Atlas illustrate what is currently known about the distribution of Ontario mammals. However, the maps are not comprehensive. Volunteers sometimes had difficulties finding and identifying smaller species. In some remote areas, no surveying was done at all. Consequently, some of the maps show sufficient data to indicate specific mammal distribution while others indicate further study is needed to provide a more accurate distribution assessment. For most species, the Mammal Atlas maps are the best available representation of their Ontario range. It is hoped this book will stimulate new studies that might further improve our knowledge of mammal distribution in Ontario.

Guide to the Mammal Atlas

The *Atlas of the Mammals of Ontario* includes two range maps and a species account for every wild mammal found in the province. The larger range map (that of either southern or northern Ontario) subdivides the province into 10X10-km squares while the smaller all-Ontario map subdivides the province into 100X100-km blocks. Symbols are plotted in the centre of squares and blocks when mammals are found to exist within their borders. Symbols include: circles (representing pre-1900 records), triangles (representing records from 1900 to 1969), and squares (representing records from 1970 to 1993). If mammals have been observed over two or three time periods, the symbol for the most recent time period is used.

The range of a species can be determined by looking at the configuration of the symbol-containing squares. The furthest group of symbols in any direction is a good indication of the extent of a particular species' range. Unfortunately, for a few species, insufficient Mammal Atlas data can create a false impression of distribution. However, when inadequate data misrepresent a mammal's range, the commonly accepted range is noted in the species account.

Occasionally, open symbols (for instance, perimeters of squares) are placed on the maps. Open symbols indicate that a mammal record can't be pinpointed to a single square. Usually, imprecise record locations stem from having to adjust Ontario Ministry of Natural Resources fur harvest trapline data to the 10X10-km square system. In such instances, records are assigned to the square that is most likely the origin of the record. If data aren't sufficient to ascertain one likely square of origin, the record is plotted as an open symbol in two, three, or a maximum of four squares.

Mammal Atlas species accounts make use of standard geographic regions to facilitate range discussion (Figure 1).

For research or planning purposes, more specific Mammal Atlas information can be obtained by contacting the Federation of Ontario Naturalists.

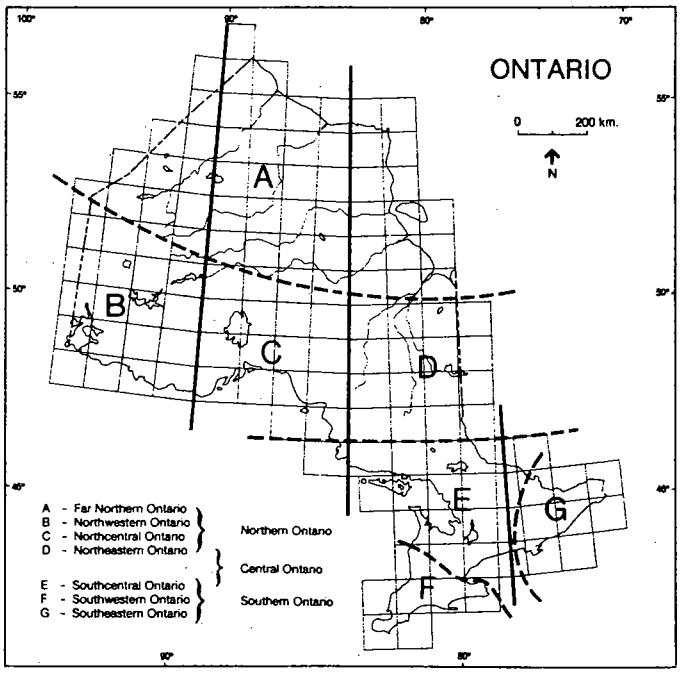


Figure 1: ***Standard geographic regions in Ontario***

Atlas History

Long-tailed Weasel: Linda Shaw

Atlassing of flora and fauna originated in Britain with the *Atlas of the British Flora,* published in 1962. The British atlas was the first comprehensive document to use the 10X10-km square as the basis for surveying and mapping species. It laid the foundation for other atlas projects including the 1976 *Atlas of the Breeding Birds in Britain and Ireland*. The British breeding bird atlas project was an overwhelming success, generating over 285 000 records from over 10 000 contributors (Sharrock 1976). Similar atlases have since been produced in most European countries, in Africa, Australia and several states and provinces in North America.

In 1981, the Federation of Ontario Naturalists and the Long Point Bird Observatory initiated the Ontario Breeding Bird Atlas. Five years of field work was conducted by 1 351 volunteers who contributed over 400 000 records (Cadman *et al.* 1987). The *Atlas of the Breeding Birds of Ontario,* published in 1987, quickly became the authority on the distribution of breeding birds in the province.

By 1989, with Ontario atlas projects already surveying reptiles and amphibians, butterflies, and rare vascular plants, the Ontario Ministry of Natural Resources and Ontario conservation organizations decided it was time to create a mammal atlas. The Atlas of the Mammals of Ontario was launched in January of 1990.

Originally, the Mammal Atlas was to be a five-year survey of Ontario's mammals similar to the *Atlas of the Breeding Birds of Ontario*. However, after one year of field surveys, it became apparent that a comprehensive volunteer-based Mammal Atlas would not be feasible because of low volunteer interest and difficulties in locating and distinguishing some mammals. Fortunately, a wealth of information on mammal distribution exists in Ontario from sources such as the Ontario Ministry of Natural Resources, the Royal Ontario Museum, the Canadian Museum of Nature, and various universities. It was therefore determined that the Mammal Atlas would rely primarily on existing institutional data supplemented by volunteer records.

The Mammal Atlas is similar to the *Provisional Atlas of the Mammals of the British Isles,* which is an ongoing project to map mammal distribution in Britain. The British atlas is a compilation of both volunteer and institutional data mapped using the 10X10-km square system (Arnold 1978).

Although the Mammal Atlas was administered by the Federation of Ontario Naturalists, most of the project's goals and policies were developed by the Atlas Management Committee. The committee included representatives from the Federation of Ontario Naturalists and sponsor organizations, as well as professional biologists.

A second committee, the Atlas of the Mammals of Ontario Technical Committee, included professional mammalogists from Ontario universities, the Royal Ontario Museum, Ontario Hydro, and the Ontario Ministry of Natural Resources. The technical committee provided methodological advice, reviewed mammal records, and assisted in the production of instructional materials.

Committee members were all volunteers. Their experience, knowledge and advice were crucial to the project's success. See the acknowledgements for a complete list of committee members.

Methods

Meadow Vole: Linda Shaw

Methods used to collect and process data for the Mammal Atlas were suggested by the Atlas of the Mammals of Ontario Technical Committee and developed by atlas staff. For more detailed information on Mammal Atlas methods, contact the Federation of Ontario Naturalists for copies of the Atlas of the Mammals of Ontario Participant's Manual numbers 1 and 2.

Mammal Atlas data were obtained from institutions and volunteers. Data-contributing organizations included the Ontario Ministry of Natural Resources, the Royal Ontario Museum, the Canadian Museum of Nature and several universities (see the Acknowledgements for a complete list). Volunteer data came from interested naturalists, hunters, and researchers.

General Data Collection

Species

Data were collected on all wild mammals including indigenous species, non-indigenous (released) species that have developed a sustainable population, and any escaped mammals thought to be reproducing in the wild. For a complete species list, consult the table of contents, or the species index at the back of the book. Common and scientific names used in the Mammal Atlas were decided upon by the nomenclature sub-committee of the Atlas of the Mammals of Ontario Technical Committee.

Location

To ensure geographic accuracy, mammal locations were recorded using the Universal Transverse Mercator Grid (UTM) coordinate system. The 10X10-km square, a unit of the UTM grid, was chosen as the basic unit for Mammal Atlas surveying.

Instructions for determining the UTM of a location are provided in the right margin of all topographic maps under the heading "ONE THOUSAND METRE UNIVERSAL TRANSVERSE MERCATOR GRID". Figure 2 shows the UTM zones and 100X100-km blocks of Ontario and indicates how the blocks are further subdivided into 10X10-km squares. Figures 3 and 4 illustrate, respectively, northern and southern Ontario, including larger cities, towns, and lakes. UTM grid lines plotted over Figures 3 and 4 will help readers determine the location of specific squares on the species maps.

Whenever possible, records from volunteers and institutions were assigned a UTM coordinate to within a 100X100-m site. However, when data were not sufficient to allow such precision, records were assigned to a 10X10-km square in southern Ontario or a 100X100-km block in northern Ontario.

Date

The dates of most mammal observations were recorded to the day. However, sometimes dates were accepted precise to the month, year, or "ten-year period" (for instance, 1980-1989).

For common mammals, only one record per square per ten-year period was required. But for less common species, called "Provincial Priority Species" (as denoted by a $^{+}$ in the species index), all available records were collected.

Evidence Codes

A voucher specimen or photograph provides the best evidence of a mammal observation. However, many species are rarely seen in the wild. Mammals do often leave telltale signs of their presence, though, including tracks, scat, and homes. The Mammal Atlas made use of such evidence to document mammal presence. A series of evidence codes was developed and grouped into three categories based on the nature of evidence.

l. Voucher specimen or photograph

VS Voucher Specimen - skin and skull, skeleton, or other distinctive part collected, or whole animal pickled or frozen and placed in a collection or museum

PH Photograph clearly showing distinguishing characteristics

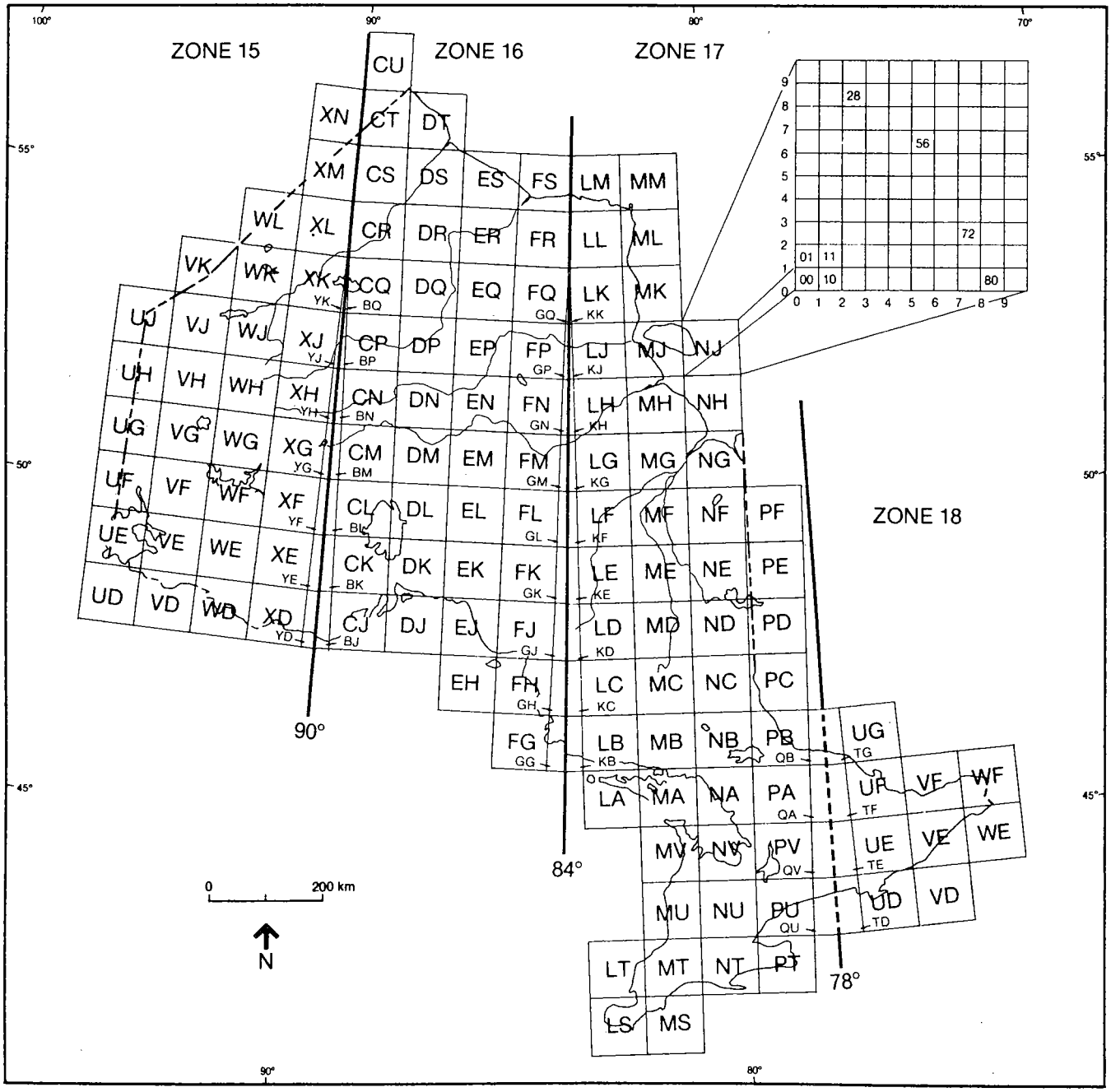


Figure 2: ***UTM zones, blocks, and squares in Ontario***

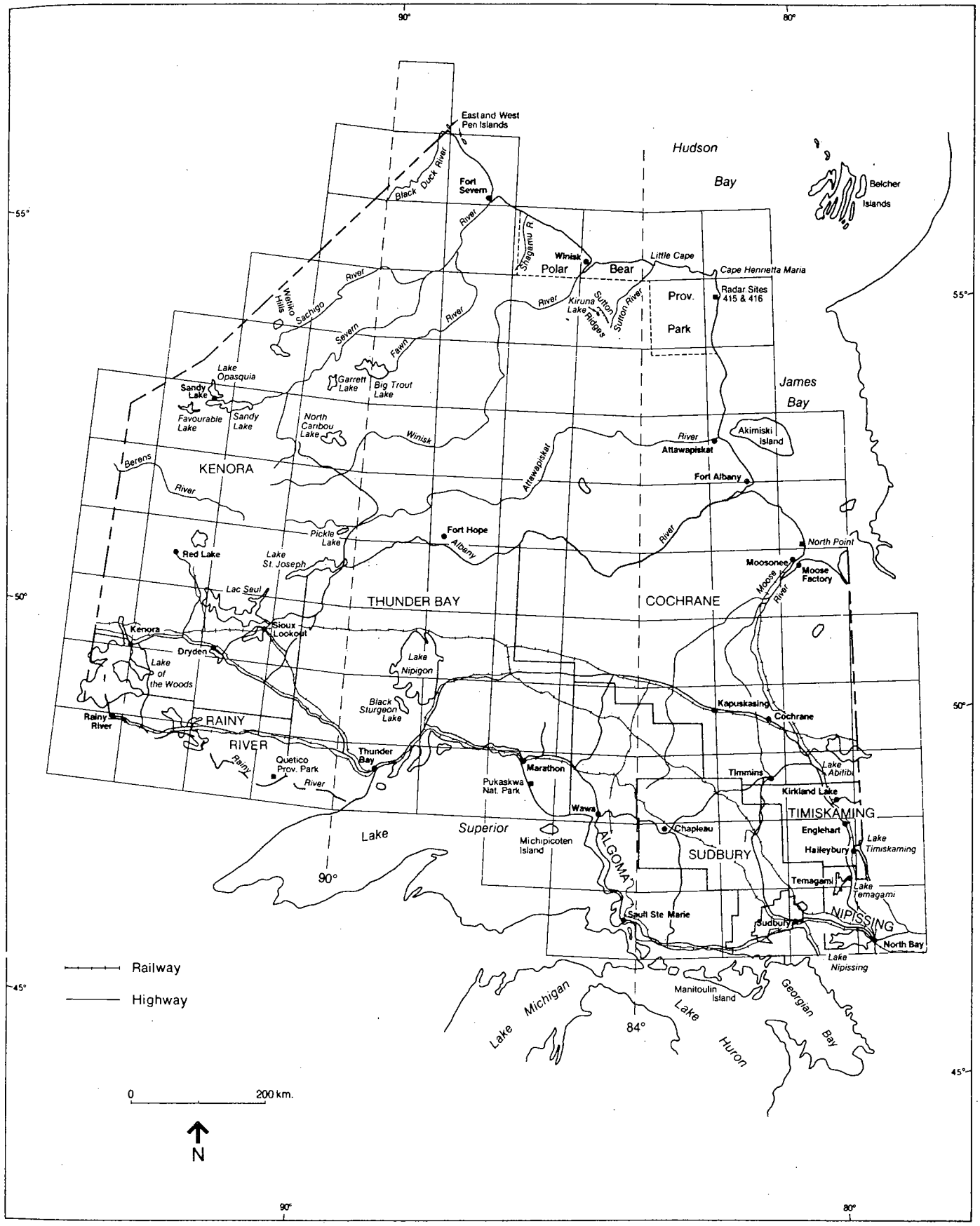


Figure 3: ***Districts, urban centres, and other localities in northern Ontario***

2. Actual observation in whole or part but not retained or photographed

OB Observed live mammal
TR Trapped, netted, or hand-captured mammal
CA Carcass of mammal seen and identified
BO Bones, especially skulls, antlers or teeth
RE Remains in scat or raptor pellet
HA Hair
QU Quills
DP Other distinctive part found

3. Distinctive signs observed

DA Dam (*e.g.*, Beaver)
DE Den (*e.g.*, Black Bear)
BU Burrow (*e.g.*, Woodchuck)
HO House (*e.g.*, Muskrat)
NE Nest (*e.g.*, Gray Squirrel)
FC Food cache (*e.g.*, Red Squirrel)
OD Odour (*e.g.*, Striped Skunk)
PD Plant damage (*e.g.*, Porcupine chewing)
RT Radio-tracking (for use by scientists)
SC Scat (*e.g.*, White-tailed Deer)
TK Tracks (*e.g.*, Virginia Opossum)
VO Vocalization (*e.g.*, Gray Wolf)

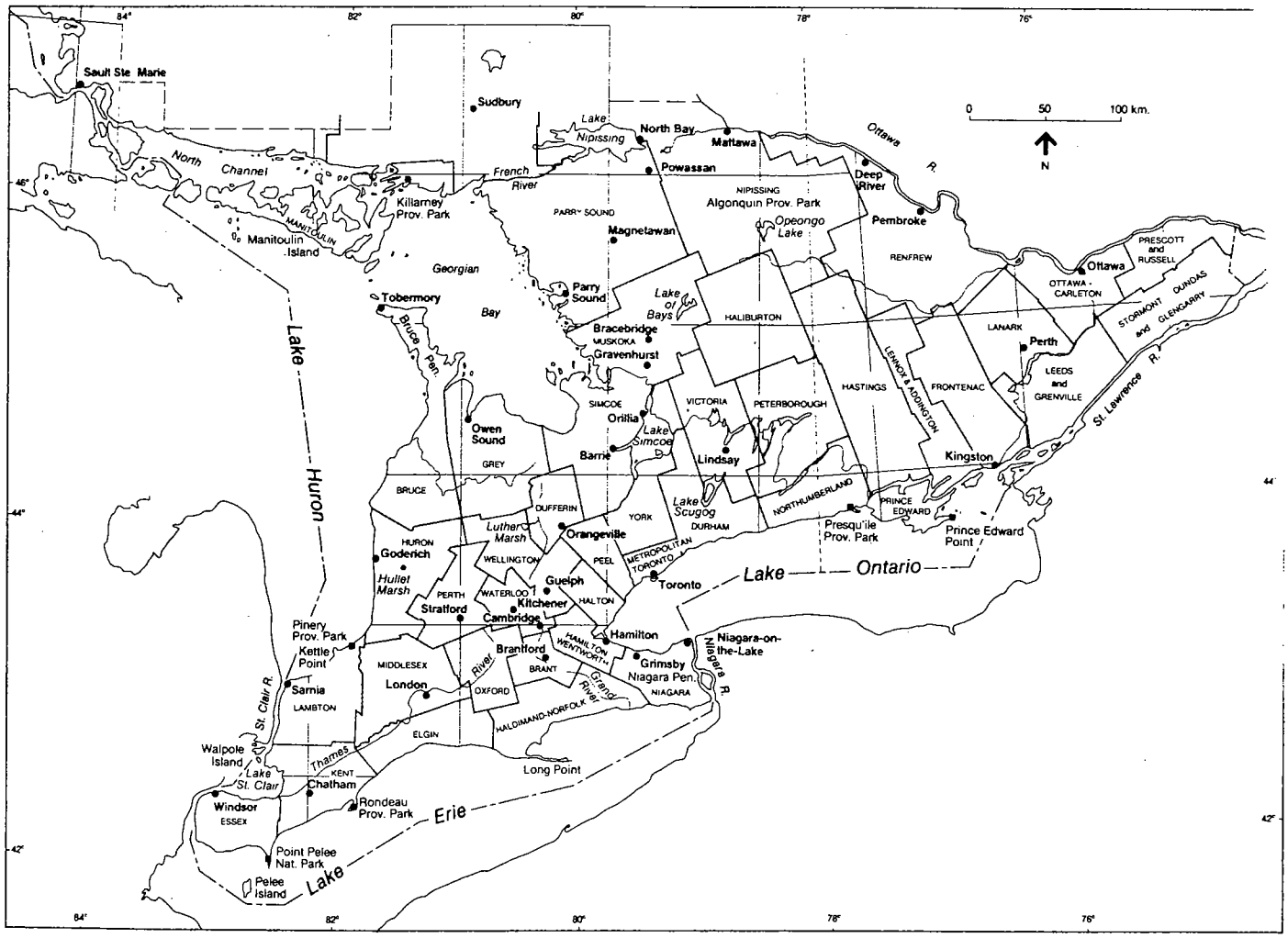


Figure 4: ***Counties, Regional Municipalities, Districts, urban centres, and other localities in southern Ontario***

Volunteer Data Collection

Two main data forms were used by volunteers: the Data Report Form for submitting personal historical data and casual observations, and the Square Survey Form for surveying a particular 10X10-km square. Volunteer surveys were conducted during 1992 and 1993.

Volunteers who submitted a record of a difficult-to-identify or Provincial Priority Species (as denoted by * and $^{+}$, respectively, in the species index) were also asked to forward detailed documentation on an Unusual Species Report Form. On these forms, the volunteers provided information stating: the time of the observation; the distance between mammal and observer; distinctive features of the mammal; and a detailed explanation of what characteristics led the volunteer to believe the record to be of a particular species and not any other similar species. The Unusual Species Report Forms were reviewed by the Atlas of the Mammals of Ontario Technical Committee. Acceptable records were incorporated into the data base.

Regions and Regional Coordinators

The coordination of hundreds of volunteers surveying an area the size of Ontario couldn't be handled from one central office. Volunteers required survey information, encouragement, and a steady supply of data forms. To best assist volunteers, Ontario was divided into a series of regions, each with a volunteer Regional Coordinator. Southern Ontario was broken into 40 regions and northern Ontario was divided into 10 regions. Regional Coordinators played an important role in directing the compilation of local historical records and in coordinating field data collection. See the Acknowledgements for a complete list of volunteers who acted as Regional Coordinators during the Mammal Atlas.

Special Volunteer Survey Techniques

Surveying by passive observation alone was not sufficient to obtain data on all species. Two special survey techniques were adopted by the Mammal Atlas: live-trapping and the use of bat detectors.

1. Live-trapping

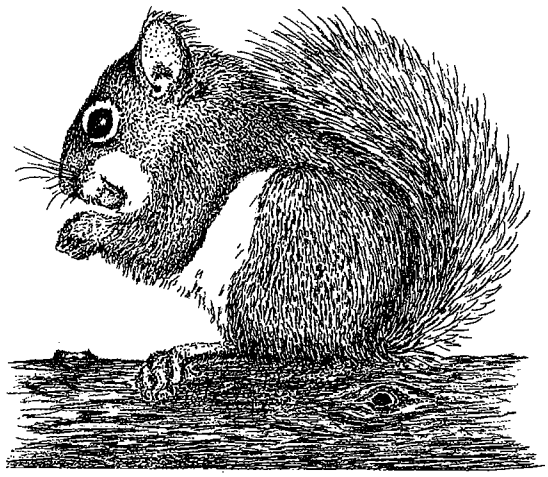
A pilot program of live small mammal trapping was conducted to assess trapping effectiveness in the determination of small mammal distribution. Trapping was conducted in eight regions throughout Ontario (Essex, Niagara, Bruce, Lanark/South Renfrew, Ottawa-Carleton, Manitoulin, Nipissing, and Chapleau). Sherman-type live traps captured mammals ranging in size from shrews to flying squirrels and weasels. The pilot project met with varying degrees of success. Some volunteers did not continue trapping long enough to obtain the skill and knowledge necessary to obtain high capture rates. In other cases, volunteers contributed useful information on some difficult-to-find mammals.

2. Bat Detectors

Bats were the most challenging group of mammals to survey. Fortunately, bat detectors can be used to identify certain bats based on characteristics of their echolocation calls. Bat detectors are small, transistor radio-sized electronic devices equipped with an ultrasonic microphone. The detector converts bat calls into a pulse which is heard through the bat detector speaker. Different species of bats are heard at different frequencies and some produce distinctive patterns in their calls which can be distinguished by a trained listener.

Volunteers borrowed bat detectors in exchange for any data collected. Some groups and individuals even purchased bat detectors. Volunteers who had been trained to use bat detectors could positively identify Eastern Red Bats and Hoary Bats. Identification of Big Brown Bats was also possible, although sometimes they can be hard to distinguish from Silver-haired Bats. Bats of the genus *Myotis* could be identified but distinguishing between the Eastern Small-footed, Northern Long-eared, and Little Brown bats was impossible with basic bat detectors. With increased experience, identifying the Eastern Pipistrelle was also possible.

Atlas Results



Red Squirrel: Ivan Foster

The Mammal Atlas sought to collect institutional information on mammal distribution in Ontario and supplement it with a volunteer survey program. As such, the Mammal Atlas was quite successful. For most species, Mammal Atlas range maps provide an excellent indication of overall range within the province and many also provide a decent indication of local distribution.

Twenty-one institutions and 444 volunteers contributed data to the Mammal Atlas. In all, 164 697 records were contributed, 137 106 from institutions and 27 591 from volunteers. Table 1 outlines the number of records obtained per species.

Mammal Atlas maps should be interpreted carefully. The number of mammal records does not always correlate with the actual abundance of a species.

Vastly different numbers of historical data were available for different species. The largest single source of data for the Mammal Atlas was the Ontario Ministry of Natural Resources. The OMNR contributed records on big game and furbearers and a few less common species such as Caribou. The OMNR does not keep significant quantities of data on other species. Consequently, big game and furbearers can misleadingly appear to be more common than other species.

Some species were particularly difficult to survey because of their small size, behaviour, secretive nature, or more obscure distinguishing characteristics. Fewer records were obtained for such species, even though they could actually be quite common. Examples of difficult-to-survey mammals include: shrews and voles (very small and live within the leaf litter or grass layer); Gray Wolves (very secretive); flying squirrels and bats (nocturnal).

Some specific regions exist where Mammal Atlas data require careful interpretation. On Mammal Atlas maps, for example, Algonquin Provincial Park mistakenly appears to be devoid of some mammals. Because there exists only a localized harvest of furbearers or big game mammals from the park, data were generated almost exclusively from volunteers. Unfortunately, Algonquin has a large area and very few resident atlassers. A shortage of volunteers affected data accumulation in sparsely-populated areas of northern Ontario as well. Infrequent northern records of Woodchuck and Porcupine (species for which no harvest records are kept), for example, reflect a lack of volunteers in the north, not necessarily fewer mammals.

Figure 5 illustrates the number of species obtained for each 100X100-km block in Ontario (5A) and each l0X10-km square in southern Ontario (5B). The average number of species obtained per square in southern Ontario was 14.7 (maximum 46), whereas the average number of species per block for the province was 26.6 (maximum 61).

Although 444 volunteers contributed data to the Mammal Atlas, the number falls short of the 1 351 who contributed to the *Atlas of the Breeding Birds of Ontario*. The difference in volunteer support for the two atlases can likely be attributed to the higher number of birders in the province, and difficulties in locating and identifying mammals.

A comprehensive all-biota inventory in Hamilton suggested that more survey time results in a higher

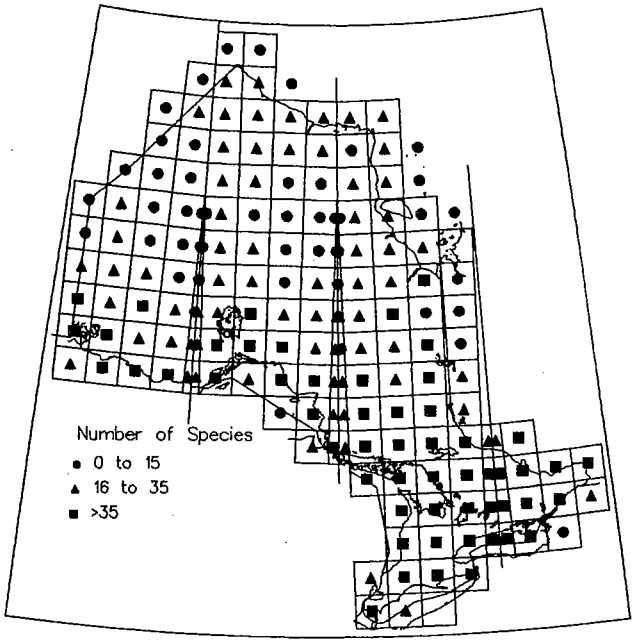
number of species being found per 10X10-km square. So, to increase the number of species found, future studies might consider longer, more localized surveys and/or surveys of fewer species. A more focused study would also ease coordination problems and help maintain volunteer involvement.

Table 1: ***The number of records per species***

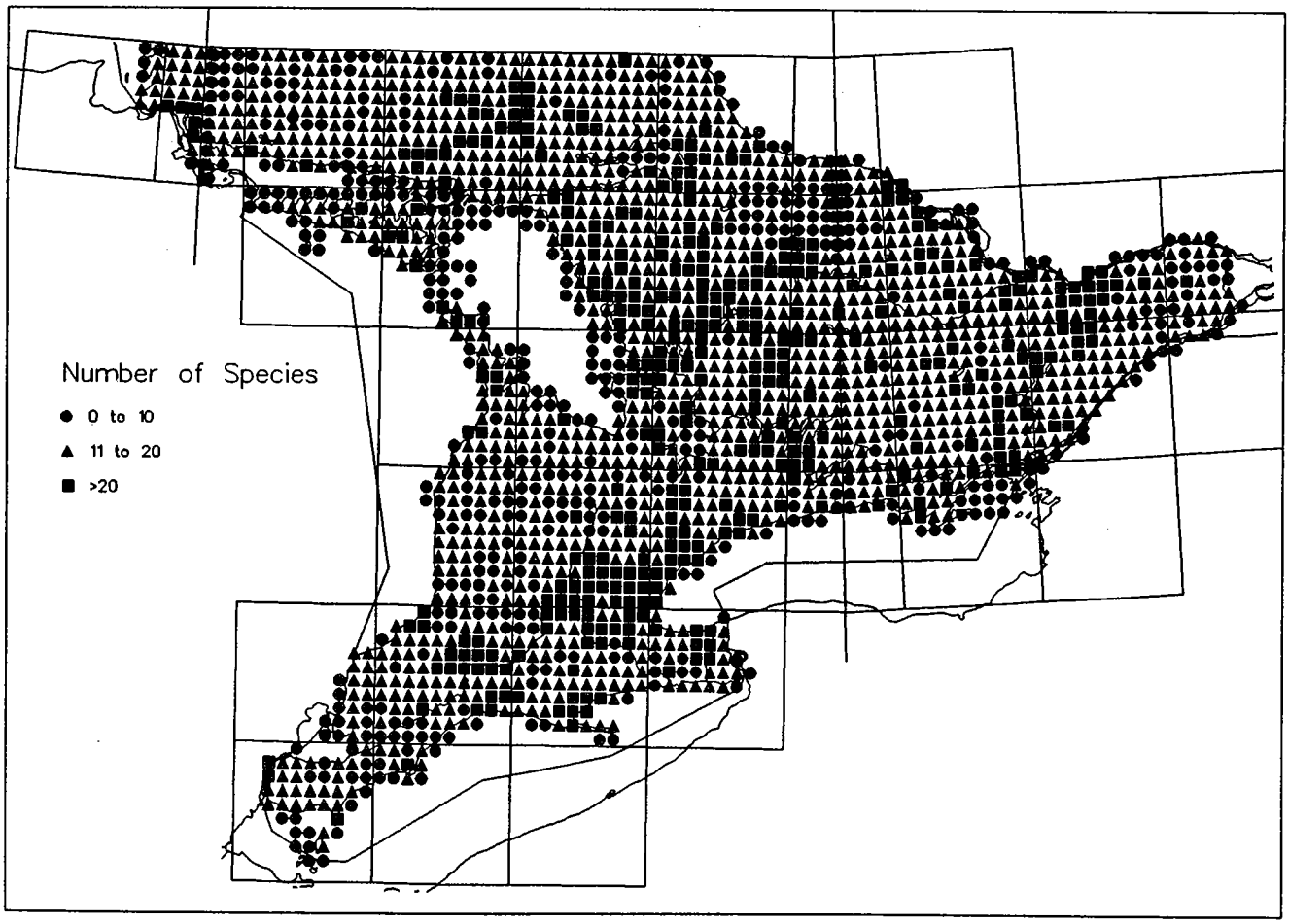
Virginia Opossum	940	Muskrat	3803
Black-backed Shrew	192	Northern Bog Lemming	23
Common Shrew	1901	Southern Bog Lemming	288
Smoky Shrew	525	Norway Rat	370
Pygmy Shrew	254	Black Rat	4
Water Shrew	317	House Mouse	361
Northern Short-tailed Shrew	1890	Meadow Jumping Mouse	985
Least Shrew	2	Woodland Jumping Mouse	697
Hairy-tailed Mole	269	Porcupine	1202
Eastern Mole	52	Coypu	8
Star-nosed Mole	556	Beluga	73
Eastern Small-footed Bat	141	Narwhal	1
Little Brown Bat	1793	Minke Whale	1
Northern Long-eared Bat	248	Coyote	1941
Silver-haired Bat	135	Gray Wolf	3564
Eastern Pipistrelle	91	Arctic Fox	65
Big Brown Bat	1878	Red Fox	7058
Eastern Red Bat .	264	Gray Fox	23
Hoary Bat	167	Black Bear	4129
Evening Bat	1	Polar Bear	4575
Eastern Cottontail	1133	Raccoon	6661
Snowshoe Hare	1464	Marten	1868
Arctic Hare	1	Fisher	1635
European Hare	356	Ermine	492
White-tailed Jackrabbit	3	Long-tailed Weasel	325
Least Chipmunk	558	Domestic Ferret	145
Eastern Chipmunk	2696	Least Weasel	9
Woodchuck	2053	Mink	7342
Franklin’s Ground Squirrel	16	Wolverine	52
Gray Squirrel	1653	Badger	18
Gray Squirrel Black Phase	866	Striped Skunk	3889
Gray Squirrel Gray Phase	430	River Otter	2369
Fox Squirrel	56	Cougar	678
Red Squirrel	4056	Canada Lynx	1149
Northern Flying Squirrel	373	Bobcat	177
Southern Flying Squirrel	163	Walrus	51
Beaver	3885	Ringed Seal	18
White-footed Mouse	2489	Bearded Seal	17
Deer Mouse	3170	Harbor Seal	1
Southern Red-backed Vole	1772	Wapiti	83
Heath Vole	107	White-tailed Deer	28373
Rock Vole	273	Moose	43846
Meadow Vole	2669	Caribou	2522
Woodland Vole	43	Bison	1

Figure 5: ***Number of species recorded in (A) each block in all of Ontario, and (B) each square in southern Ontario***

(A)



(B)



Features Affecting Mammal Distribution

Mammal range is influenced by many factors, including: climate, land-use patterns, physiographic regions, and forest types. Two of these factors, physiographic regions and forest types, are particularly helpful in understanding mammal distribution.

Physiographic Regions

There are three physiographic regions within Ontario: the Hudson Bay Lowland, the Canadian Shield, and areas to the south and east of the Canadian Shield in southern Ontario (Figure 6). The following descriptions of the physiographic regions have been summarized from Cadman *et al.* (1987).

Hudson Bay Lowland

The Hudson Bay Lowland is found within 150 to 300 km of the shorelines of James and Hudson bays, immediately northeast of the Canadian Shield. The area is underlain with sedimentary bedrock and characterized by flat, poorly-drained lands with numerous small, shallow lakes and ponds. Most of the Hudson Bay Lowland is covered by the Hudson Bay Lowland Forest.

Canadian Shield

The Canadian Shield is the largest physiographic region in Ontario, extending from the Hudson Bay Lowland to southern Ontario. The southern extent of the shield is called the Frontenac Axis, which crosses the St. Lawrence River northeast of Kingston. The Canadian Shield is underlain with igneous and metamorphic bedrock and covered by a thin layer of relatively infertile soil and thousands of lakes. The primary forest regions of the shield are the Boreal Forest and the Great Lakes-St. Lawrence Forest. Significant Canadian Shield land features include the Little and Great Clay Belts which extend, respectively, from Haileybury to Englehart, and from Timmins to north of Cochrane and west of Kapuskasing. The clay belts are formed by the former bed of Lake Ojibway-Barlow, and are characterized by deep, fertile soils capable of supporting agriculture.

South and East of the Shield

The areas to the south and east of the Canadian Shield in southern Ontario are underlain with sedimentary rock and covered with deeper, more fertile soils. Relatively flat topography and rich soils make the areas south and east of the shield the province's most suitable region for agriculture. Significant land features in this region include the Niagara Escarpment and the Oak Ridges Moraine. The Niagara Escarpment extends from Niagara Falls to the tip of the Bruce Peninsula and across Manitoulin Island, and is characterized by large cliffs and heavily-wooded forests. The Oak Ridges Moraine extends westward from Presqu'ile Provincial Park to the Niagara Escarpment near Orangeville. The moraine features deep rolling hills with well-drained soil and large tracts of forest.

Forest Regions

Five main forest regions are found within Ontario: the Tundra, the Hudson Bay Lowland Forest, the Boreal Forest, the Great-Lakes-St. Lawrence Forest, and the Carolinian Forest (Figure 6).

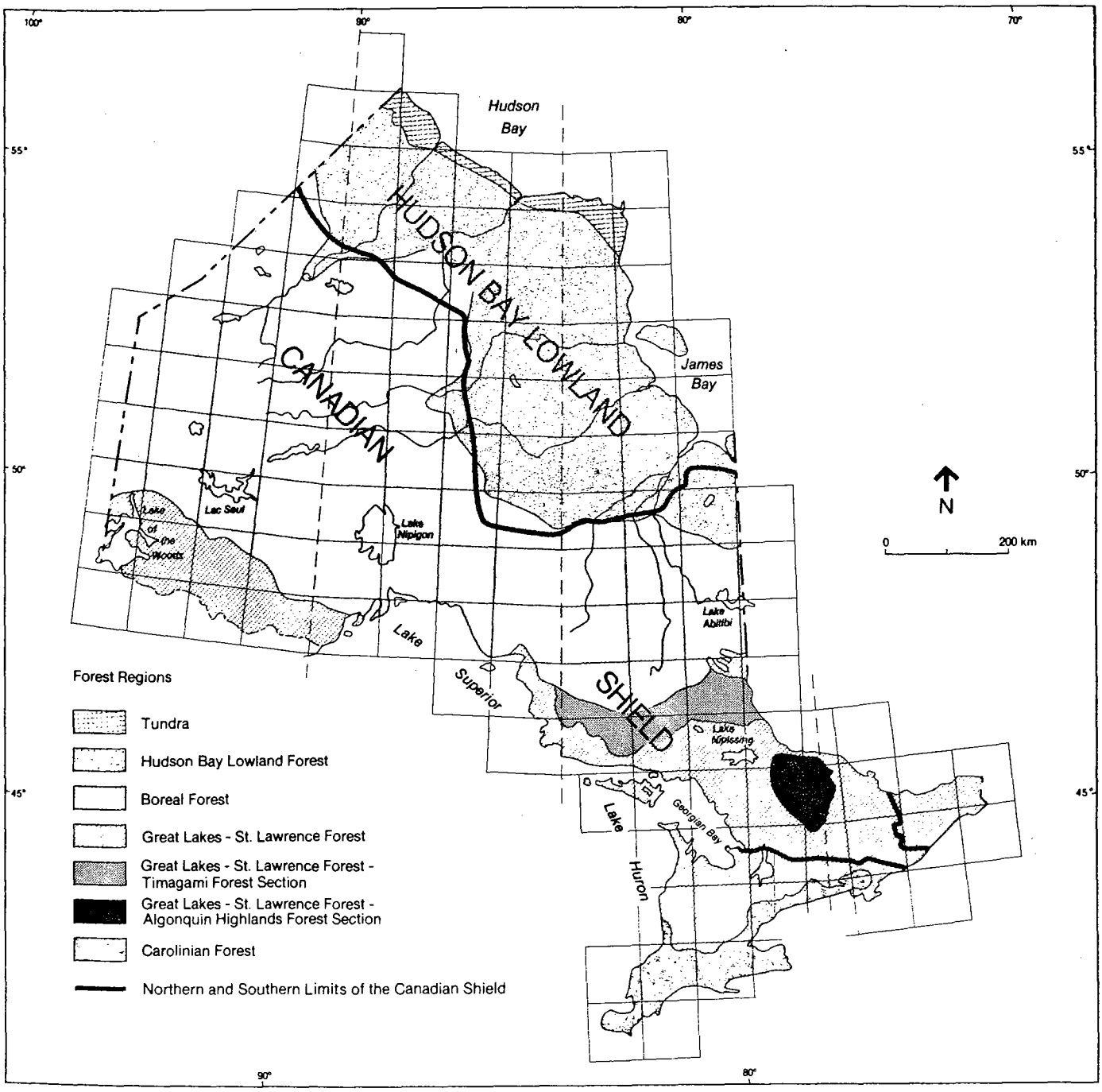


Figure 6: ***Physiographic and forest regions, and selected forest sections of Ontario***

The following descriptions of the forest regions have been summarized from Rowe (1972).

Tundra

The Tundra, characterized by permafrost, is a narrow strip of land along the shore of Hudson and northern James bays. Features include dry uplands with lichens and heath plants, low-lying fens with grasses and sedges, and uplifted beach ridges with numerous ponds and lakes. Dwarf willows and birches occur in sheltered areas. Stunted spruces grow singly or in patches along riverbanks and occur with increasing frequency inland toward the transition with the Hudson Bay Lowland Forest at the tree line.

Hudson Bay Lowland Forest

The Hudson Bay Lowland Forest extends inland from the Tundra. It stretches south to the northern edge of the Canadian Shield. The Hudson Bay Lowland Forest is characterized by flat topography and poor drainage, numerous open fens and bogs, and treed fens and bogs of black spruce and tamarack. Ground cover consists of lichen in dry areas and sphagnum in wet areas. Forests of white spruce, balsam fir, trembling aspen, balsam poplar, and white birch are all common in well-drained areas. The southern parts of the Hudson Bay Lowland Forest are heavily forested, whereas the northwestern sections are dominated by lakes and wetlands.

Boreal Forest

The Boreal Forest is the largest forest region in Ontario. It is underlain by the Canadian Shield. The region is dominated by thousands of lakes and coniferous forests of black spruce, white spruce, balsam fir, jack pine, and tamarack with occasional white birch, trembling aspen and balsam poplar. Towards the southern extent of the Boreal Forest, the forest becomes transitional, exhibiting characteristics of both the Boreal and Great Lakes-St. Lawrence Forest regions.

Great Lakes-St. Lawrence Forest

The Great Lakes-St. Lawrence Forest is the primary forest region of southern Ontario. It is characterized by a mixture of coniferous and deciduous trees including sugar maple, yellow birch, eastern hemlock, white and red pine, red maple, basswood, white elm, white cedar, beech, red oak, and white ash.

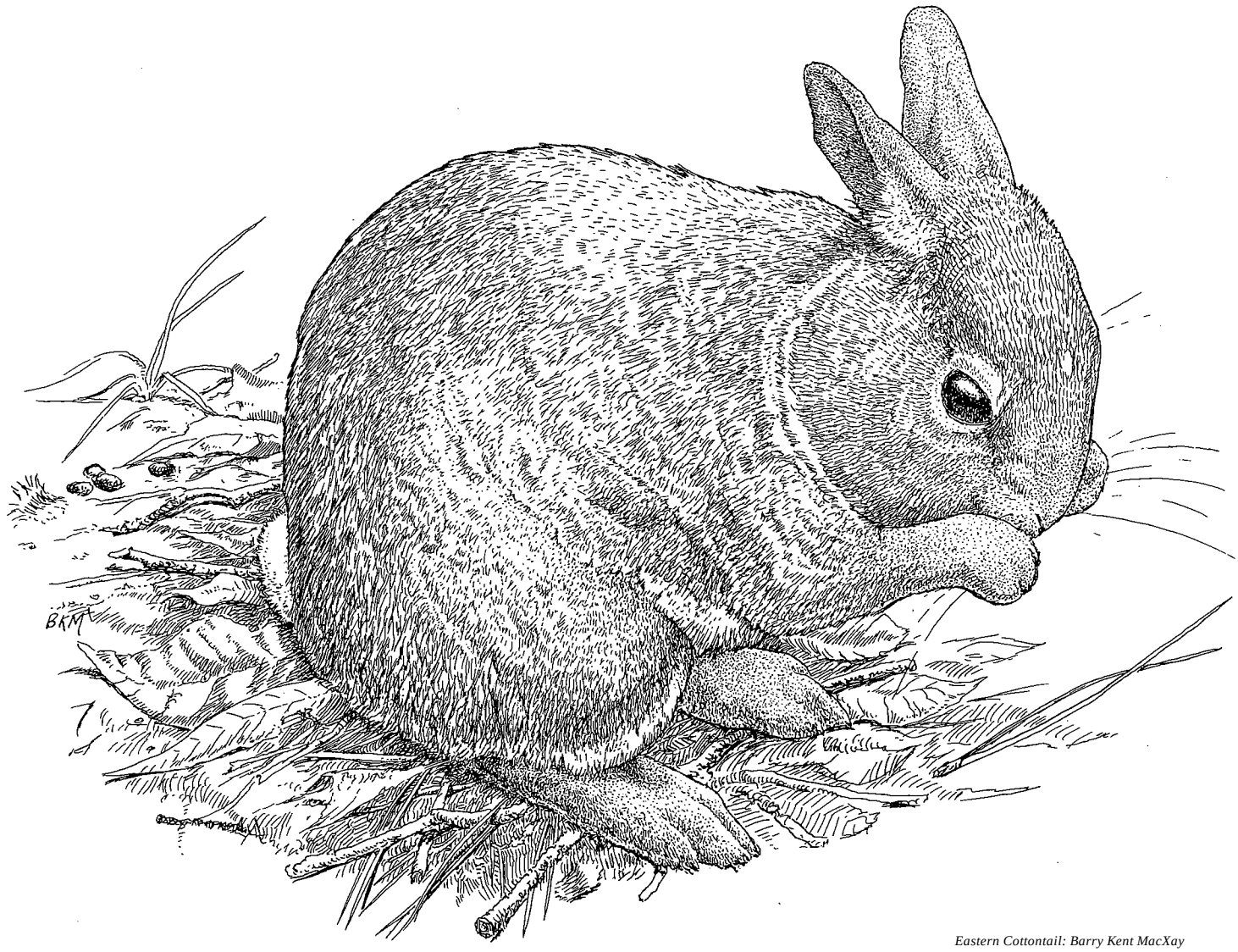
The northern portion of the Great Lakes-St. Lawrence Forest overlies the Canadian Shield while the southern and eastern portions are located over sedimentary rock. Most of the Great Lakes-St. Lawrence Forest region that is not located on the Canadian Shield has been cleared for agriculture, leaving only small pockets of forest cover.

The Great Lakes-St. Lawrence Forest region is divided into several forest sections, including the Timagami Forest and the Algonquin Highlands Forest sections. The Timagami Forest section is the transition area between the Boreal and Great Lakes-St. Lawrence Forest regions and features a high proportion of Boreal tree species. The Algonquin Highlands forest section, which is almost entirely contained within Algonquin Provincial Park, also contains a large proportion of Boreal tree species.

Carolinian Forest

The Carolinian or Eastern Deciduous Forest is restricted to the southern part of the province along lakes Erie and Ontario. Typical of eastern US forests, the Carolinian Forest is dominated by broad-leaved trees such as beech, sugar maple, basswood, red maple, black walnut, sycamore, swamp white oak, shagbark hickory, butternut, butternut hickory, rock elm, blue beech, and red, white, and bur oak. The Carolinian Forest also features a number of typically southern species such as tulip tree, black cherry; Kentucky coffee-tree, and sassafras. This forest region has been highly modified by settlement and agriculture. Consequently, few large woodlots remain, especially in southwestern Ontario.

Species Accounts



Eastern Cottontail: Barry Kent MacXay