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Ecology of Manitoba Mammals

by J. Dewey Soper

Ecology deals with the mutual relations between organisms and their environment. Communities of living things are studied in all their physical and biological connections to determine the conditions which have brought them together and which keep them in a particular region. Many factors are involved such as climate, soil, moisture, chemical and physical conditions of the surroundings and the interrelations of the species inhabiting the region, whether hostile, mutually beneficial, or non-significant.

One authority in speaking of the mutual fitness of organisms and environment says:

"Looking as we are likely to do at only one side of the matter, we marvel at the adaptation of the organism to its environment, but it never seems to occur to us that the fitness of the environment to the organism is just as remarkable. The whole matter of life phenomena is as much a question of the extent to which the cosmic processes, matter, and energy favor the existence of such mechanisms, as living things, as it is a question of the manifestations of the living organisms themselves. Environment is thus in a sense permissive; all adjustments for whatever purpose not only are possible because of it, but are also strictly limited or restricted by it. In brief, for a living thing to exist there must be not only a mechanism capable of life, but also the external forces of nature, animate and inanimate, to which this mechanism responds. A living organism is, therefore, a state of matter placed in peculiar relationship to surrounding conditions of matter and energy. To see this, one need only try to conceive of a living creature, such as a dog, apart from its environment. If there were no light such elaborate structures as eyes for response to light would not exist, if no ground to walk on legs would be meaningless, if no food to eat there would be neither mouth nor digestive tract; and so by removing one factor of environment after another a dog would be analyzed away until

practically nothing remained, not even the bark, since that is only a means of using part of a dog's environment to inform other creatures (also a part of the environment) of its existence."

In any ecological work a study of the habitat is a fundamental requirement. The major habitats of the world are three in number--the ocean, fresh water and the land. All three of these are represented in Manitoba, since the northeastern part of the province is delimited by the tidal waters of Hudson Bay. In our case, the number of mammals which inhabit this ocean, or salt water environment, are comparatively few in number, represented by the following species:

Atlantic Harbour Seal	Atlantic Walrus
Ringed Seal	Bowhead Whale
Harp Seal	White Whale
Bearded Seal	

At the present time none of these animals are abundant and several are very scarce. It would appear that those most frequently observed are the Harbour Seal and White Whale.

As land habitats are of greatest interest to us in this province, discussion will centre chiefly about that type of environment. In contrast to a water habitat the land involves a number of special ecological factors, some of which are extremely variable.

It is evident that anything like a complete survey of ecology must include both plants and animals because of their complex and intimate interrelations. Groups of animal and plant species commonly living together in a definite kind of formation obviously do so because they thrive under existing conditions. Such a biotic organization is briefly termed a biome. The biome constitutes a composite unit of plants, animals, and their physical surroundings in any of the various climatic regions of the earth--an interrelationship of extreme intricacy. Such formations are commonly named from the dominant organisms, whether plant or animal, which exert a controlling influence, or from the physiographic conditions of the occupied area. Thus we may speak of a "deciduous forest biome" or a "grassland biome", etc. The great landscape types of vegetation are commonly

used for purposes of reference, since plants, lacking the mobility of most animals, form communities which are generally more permanent. Nevertheless, such a biome is characterized by its customary animals as well as its prevailing plants.

The major biotic formations, or biomes, of North America, based on climatic conditions may be roughly classified as follows from north to south: (1) The Artic Tundra; (2) The Northern Coniferous, or Evergreen Forest; (3) The Southern Coniferous Forest; (4) The Deciduous Forest; (5) The Grassland or Prairie; (6) The Sagebrush; and (7) The Desert Plain. These are obviously not sharply delimited, but show intergradations at their margins with adjacent territory, and occasional discontinuity in distribution. Also special local communities, such as swamp, woodland, desert scrub, etc., may exist within the boundaries of any of the major formations.

Of the biomes named above, the last two do not occur in Manitoba, but during severe and prolonged periods of drought, the extreme southwestern portion of the province becomes semiarid in character and makes a close approach to conditions which normally exist in the sagebrush biome.

It is to be pointed out before going further, that the species of mammals which will be listed under the various biomes are those most characteristic of those areas, but they are not strictly confined to them. Overlapping in the ranges of different species occurs at the margins of the major biotic belts, while some mammals range throughout two or more of these, such as the Varying Hare, Bonaparte and Least Weasels, Red Fox, Hudson Bay Red Squirrel, Drummond Meadow Vole and Beaver.

(1) The Arctic Tundra Biome

(Exclusive of strictly marine mammals)

Polar Bear
Arctic Weasel
Arctic Fox
White Tundra Wolf
Black Lemming
Richardson Collared Lemming
Dawson Red-backed Vole
Barren Ground Meadow Vole
Hudson Bay Arctic Hare
Barren Ground Caribou
Barren Ground Muskox

Two highly characteristic mammals of the Arctic Tundra Biome--The Arctic Fox and Barren Ground Caribou--range in winter far south of their summer habitat. Thus they invade the Northern Coniferous Forest Biome for long distances and in the case of the caribou, it sometimes completely crosses the latter biome to penetrate the southern Coniferous Forest as far south as Nelson Lake and Burntwood and Grass Rivers. A few years ago a few even reached the Hudson Bay Railway south of Grass River. In late winter, or early spring, the animals retrace their way to the north and again reach the barren grounds of the Arctic in time to give birth to their young.

(2) The Northern Coniferous Forest Biome

Richardson Weasel
Common Wolverine
Northern Gray Wolf
Hudsonian Red-backed Vole
Yellow-cheeked Meadow Vole

Of the five Manitoba biomes under consideration, the present one has the lowest number of truly characteristic mammals. In nature it is more of a transition type of environment between the Arctic tundra and the heavily wooded country of the Southern Coniferous Forest Biome. To a large extent its mammal population is made up of individuals of various species which range north into it for varying distances from the latter biome. Noteworthy among these species are Saddle-back Shrew, Hudson Bay Mink, Red Fox, Canada Lynx, Hudson Bay Red Squirrel, Hudsonian White-footed Mouse, and Hudson Bay Muskrat.

(3) The Southern Coniferous Forest Biome

Masked Shrew
Saddle-back Shrew
Common Water Shrew
Keewatin Pigmy Shrew
Silver-haired Bat
Common Brown Bat
Black Bear
Hudson Bay Marten
Fisher
Bonaparte Weasel
Hudson Bay Mink
Otter
Red Fox
Canada Lynx
Little Northern Chipmunk
Lake Superior Chipmunk
Hudson Bay Red Squirrel
Hundson Bay Flying Squirrel
Canadian Beaver
Hudsonian White-footed Mouse
Boreal " " "
Richardson Lemming Mouse
Gapper Red-backed Vole
Drummon Meadow Vole
Hudson Bay Muskrat
Hudson Bay Jumping Mouse
Porcupine
Varying Hare
Mule Deer
Moose
Woodland Caribou
Wapiti

The largest number of truly characteristic species, in relation to their centre of abundance, is found in the Southern Coniferous Forest Biome. As already pointed out, many of these find their northern limits of distribution in the adjacent biotic zone to the north and some also inhabit the Deciduous Forest Biome to the south. Among these are Masked Shrew, Bonaparte Weasel, Beaver, Drummond Meadow Vole, Varying Hare and Mule Deer. Some representatives of this biome are also found in isolated areas, or communities of comparable character, as on Riding Mountain and in the Spruce Woods Forest Reserve. A new subspecies of small mammal discovered on Riding Mountain--the Prairie Phenacomys--was described by Dr. R. M. Anderson in April, 1942.

Turtle Mountain is another insular area closely related to the Southern Coniferous Forest Biome. While it lacks evergreens, its fauna is obviously more boreal in character than that of the surrounding plains. However, the American Varying Hare found farther north is here replaced by another subspecies, the Minnesota Varying Hare. Likewise, the common Hudson Bay Red Squirrel which is widely distributed in coniferous and deciduous woods to the north and east is here replaced by a newly described subspecies, the north Dakota Red Squirrel.

Three mammals with a very narrow range in Manitoba are the Lake Superior Chipmunk, Gapper Red-backed Vole and Jackson Jumping Mouse. All are known only from the coniferous forest belt in the southeastern part of the province. The first named is replaced to the northwest by the Little Northern Chipmunk and the second, to the west, by the Loring Red-backed Vole. The Jackson Jumping Mouse is in a special subgenus of its own, but the Hudson Bay Jumping Mouse which also occurs in southeastern Manitoba is replaced to the west by the Prairie Jumping Mouse.

(4) The Deciduous Forest Biome

Pigmy Shrew
Little Brown Bat
Northern Red Bat
Least Weasel
Northern Plains Skunk
Northern Coyote
Canada Woodchuck
Striped Ground Squirrel
Franklin " "
Gray Eastern Chipmunk
Minnesota Gray Squirrel
Pale Flying Squirrel
Saskatchewan Pocket Gopher
Baird White-footed Mouse
Loring Red-backed Vole
Great Plains Muskrat
Minnesota Varying Hare
Nebraska Cottontail Rabbit
White-tailed Deer

Next to the Southern Coniferous Forest Biome, the present one harbours the largest number of species, or subspecies, of mammals. Much of the country is a mixture of aspen poplar "Parklands" and prairie, with heavier woods of Manitoba Maple, Elm, Ash, etc., along streams and the margins of lakes. On the whole, the mammalian fauna is highly characteristic of this wooded or semi-wooded belt of deciduous trees, but as with other zones many forms spread at the margins into adjacent biomes. Thus the Saskatchewan Pocket Gopher, Baird White-footed Mouse, and Loring Red-backed Vole, which are typical of this environment, are also found in the coniferous forests of Riding Mountain. A few forms have a very restricted distribution in Manitoba. One of these is the Minnesota Gray Squirrel which is apparently confined to the Red River Valley and its general vicinity. Another is the Gray Eastern Chipmunk.

(5) The Grassland or Prairie Biome

Hayden Masked Shrew
Long-tailed Weasel
Mississippi Valley Mink
Common Badger
Richardson Ground Squirrel
Dakota Pocket Gopher
Maximilian Pocket Mouse
Maximilian Grasshopper Mouse
Osgood White-footed Mouse
Little Upland Vole
Great Plains Muskrat
Prairie Jumping Mouse
White-tailed Jack Rabbit

In former times, the American Bison, Kit Fox, Great Plains Wolf and Prong-horned Antelope also inhabited the prairies of southern Manitoba, but they became exterminated many years ago. While all the mammals listed above are markedly typical of the prairie country and the vast majority of individuals are strictly confined to it, a few wander into open grassland territory within the aspen grove belt. Among the species which do this to a greater or lesser degree are Long-tailed Weasel, Richardson Ground Squirrel, Dakota Pocket Gopher and Prairie Jumping Mouse.

Niches. It is evident from the foregoing that in different biotic communities there are, in such a sequence, corresponding occupational levels held by different kinds of mammals. While these are commonly determined by relations to food and foes, other factors such as size, or soil and

water requirements are also important. The space occupied by restricted biotic communities, or associations, are known as niches; a niche means literally a place or situation specially adapted to its occupant. Such reference permits of description in terms of occupation or function instead of mere appearance.

For example, all over the world there are small rodent types like mice, ground squirrels and their kind which live primarily on fairly dry vegetation such as seeds and roots. The different species of such animals may be very great when considered geographically, but regarded from the viewpoint of environment they are occupying essentially the same physiological position in the scale of living things. Similarly, in another nutritional niche depending upon the rodents just mentioned, would come a group of forms such as foxes, coyotes and badgers which prey upon them. Or with an abundance of the right kind of vegetation, as on the prairie, there will be a more or less abrupt transition from woodland forms of mammals to such species as bison and antelope whose food is comprised of grass. However, which particular herbivore it shall be is decided by many factors of geographical distribution and the exact needs of the species concerned. The fact is that once a niche occurs, it sooner or later comes to be occupied by a fit form.

Climax. Where, for a number of years, conditions have remained fairly constant except for the usual seasonal cycles, the plant and animal population becomes settled into a characteristic climax community. For example our western prairies and plains were originally carpeted with an abundance of hardy, drought-resistent grasses and sedges and associated with this condition were various birds, bison, prong-horned antelope, plains wolf, ground squirrels and other rodent types; such a balanced aggregate of plants and animals before man's intervention was a climax community. At the other extreme in the Arctic regions was a climax community of an entirely different character composed of a peculiar avifauna and such mammals as Barren Ground Caribou, Muskox, White Fox and Wolf, Arctic Weasel and lemmings. Over most parts of the Arctic, because of the remoteness from civilization, this climax community has suffered comparatively little change. However, in some localities marked alteration in the balance of indigenous species has taken place through a great reduction in the number of caribou and muskox, or complete local extermination, particularly in respect to the latter

species. When used in its broadest significance the term climax becomes a synonym for biotic formation, or biome.

Succession. If a climax community, through some natural shift of environment or the intervention of man, is destroyed--as, for example, by a devastating fire--it tends to return through a series of biotic stages to its original formation. Or if a new physiographic formation appears, a similar sequence of types and eventually a climactic community characteristic of that region becomes established. Such orderly sequence of changes is termed succession. If in a land habitat, for example denudation were complete, a few pioneering plants would first come to bind sand or gravel into a non-shifting substratum on which to build soil. Soon secondary invaders appear in the region and as time goes on more and more colonization of the area occurs by both plant and animal life. Eventually the climax is attained with its characteristic dominants. So similar are the corresponding stages in such successions that an experienced ecologist, acquainted with the region, can tell in just what phase the succession is and what the eventual climax will be.

Among others, just such a succession has undoubtedly taken place in Manitoba in the area now known as the Spruce Woods Forest Reserve. Large quantities of sand was evidently blown by the wind from post-glacial Lake Souris and the deltaic deposits of Saskatchewan River which then flowed through what is now the Qu'Appelle River Valley. The sand was stabilized by some particular plants, followed by grasses to form a true prairie biome; this was doubtless succeeded by aspen poplar and finally in part by spruce. In the various stages of development the characteristic mammals would be successively those of the Prairie Biome (Bison, Kit Fox, Badger, Grasshopper and Pocket Mice, etc.), then the Deciduous Woods Biome (with such mammals as Bonaparte Weasel, Woodchuck, Franklin Ground Squirrel, Varying Hare and Baird White-footed Mouse) and finally a modified condition more or less representative of the Coniferous Forest Biome, which attracted Moose, Mule Deer, Wapiti, Black Bear, Marten and other characteristic species. Today, the mammalian fauna of that sector is composed of species normally identified with climax communities of both Deciduous Forest and Coniferous Forest Biomes. It is therefore of a somewhat complex character.

An interesting aspect of ecology is that known as the pyramid of numbers. In the universal sequence of slayer

and slain in the food chains of nature, increased size and strength of the successive organisms involved are usually evident. Plants, commonly of microscopic dimensions, are eaten by herbivorous insects, or other minute vegetarians which then become the food of carnivorous insects, spiders and the like. These in turn are captured by insectivorous birds, or small mammals, that may eventually be devoured by hawks and other predacious forms. Each stage in the chain generally but not invariably turns small food animals into larger ones, although in addition to size, rate of increase and numbers of individuals are also involved. There may be as few as two or three, or as many as seven or eight links in such food chains.

A specific example among Manitoba mammals is the Drummond Vole which, living on vegetable matter and probably to a small extent, insects, is preyed upon by weasels and the weasels in turn may be killed by birds of prey. Other well-known predator-prey relationships are those existing between the Varying Hare and Canada Lynx; the Red Squirrel and Marten; and the barren ground lemmings and the Arctic Fox. A further relationship of a different kind often obtains between the Arctic Fox and the Polar Bear, when the former makes a meal from the offal left over from the kill when the bear captures a seal.

Within the field of ecology is another phase of mammalian and other animal life, known as population rhythms. Many animals have been found to fluctuate in numbers between maxima and minima, and since in numerous cases there is a certain degree of regularity about it, the phenomenon has been termed <u>rhythm</u>. One of the best known examples of such periodic fluctuations in numbers is that of the Norwegian lemming. Living normally in the mountains, every few years it spills over, as it were, in large numbers into the lowlands. Travelling mainly at night, the migrating hordes push forward, sometimes for more than a hundred miles until they reach the sea. There, undaunted, they plunge in and swim on and on until they die. This blind urge to migrate is caused primarily by population pressure in the natural home. Following the exodus of the migrants, a severe epidemic of disease sweeps away many of the remaining residents so that the population is reduced to relatively few individuals. It takes about four years for the maximal number to be restored, after which there is a repetition of the mass migration. Sometimes these occur as frequently as every third year.

Similar rhythmical fluctuations occur in the lemming population of The Canadian Arctic. Elton states that the curves for a plentiful supply of Arctic Fox skins, as shown in the records of the Hudson's Bay Company, coincide with the years of maximal numbers of lemmings, since these are the main food supply of the fox. He further points out that lemming years in Canada and in Norway synchronize almost exactly, and he concludes that the ultimate common factor which controls such parallel rhythms can be only climate. As is well known to most of us, violent fluctuations in number also take place in respect to our Varying Hare, or Snowshoe Rabbit, whose cycle is between nine and 10 years.

All rodents, small and large, ranging from mice and rats to rabbits, for which yearly records are available, are found to undergo somewhat similar periodic fluctuations. The cycle for the smaller rodents is usually three or four years; that for the larger, five to ten years. Epidemics are the most usual population reducers of the larger rodents. In America, huge migrations of rats and of squirrels, suggestive of those of the lemming, have been observed.

Another interesting feature in the study of mammals is the relationship exhibited between body size and temperature regulation. Since it is a physical law that in such a body as a sphere, mass increases as the cube of the diameter, and surface only as the square, it is evident that the larger such a body becomes the less relative amount of surface it has. In terms of temperature control this would mean that a large animal has relatively less area for loss of heat by radiation than a small one. This fact seems to be of adaptational significance in distribution of so-called warm-blooded animals from equator to pole. Thus, the White-tailed Deer becomes progressively larger toward the north. Our larger species of deer, in general, such as the wapiti and moose are found in the northern and not the southern regions of North America.

Exceptions to the principle which occur can usually be accounted for by the establishment of special procedures for escaping cold such as burrowing and migration, or by the development of distinctive heat—retaining devices such as extra air insulation in thick hair or fur, or great

layers of fat under the skin. Protection of this kind is common to Arctic mammals.

Mammals of the colder climates also retain their heat through reduction of such heat - losing surfaces as ears, tail and neck and the development of a generally more compact body. This tendency is well exemplified by the size of ears in foxes, for they become progressively smaller from warmer to colder climates. The Desert Fox of the south is smaller with relatively larger ears than the Red Fox to the north, and this in turn has much larger ears than those of the Arctic Fox. Another example may be cited. Thus the ears of the hares of both the Old World and the New become shorter to the north. For example, the Jack Rabbits of the southwestern states have ears approximately one-third the length of the body; in the species occurring from the central states to Canada the ears are somewhat shorter; in the varying hare of northern North America they are still shorter; and in the Arctic hares they are the shortest of all.

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