SOME ECOLOGICAL FEATURES OF THE ROCANVILLE - ST. LAZARE AREA

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Field trips during the 1966 Annual Summer Meeting of the Saskatchewan Natural History Society revealed a remarkable diversity of habitats in the area from St. Lazare, Manitoba, westward to Rat Lake and Scissors Creek, near Rocanville, Saskatchewan (Figure 1). The purpose of this article is to record some of the conspicuous ecological relationships between geological parent materials, vegetation, animals, and humans in this area.

An ecological description may stress one or all of three general kinds of processes: (1) inter-relationships between living things and their environment; (2) inter-relationships between the living things themselves (for example, competition between two species of birds for territorial rights during the nesting season); or (3) inter-relationships between particular environmental factors. To bring this complex web of inter-relationships to a level that can be comprehended by the human mind, ecologists try to visualize each natural community as the result of five factors: *parent material* (the original rocks or weathered material of an area); *topography* (relief or physiography); *climate* (in either the broad sense, such as 'the climate of southern Saskatchewan', or a narrow sense such as the climate of a north slope and a south slope, or even on a minor scale such as the upper versus the lower sides of a decaying log on the forest floor); *organisms* (all living things); and *time* (the effects of historical events, such as burning or clearing for agriculture). These factors do not act individually in their control of an ecological community. They exert a combined or integrated influence over a period of time. Yet it is sometimes possible to pinpoint one of these factors as the dominant influence on the community. Examples from the Rocanville - St. Lazare area are presented below to show how these five factors may act to produce a particular landscape with a distinct community. All examples are from the block of land that lies north of Welwyn and between the St. Lazare and Rat Lake 1966 field trip sites (Figure 1).

Let us begin by imagining that this block of ten townships is a flat, featureless plain supporting no plants, humans or other animals. We can then examine the present landscapes and plant and animal communities in terms of how the five major factors have influenced this featureless plain. The reason for starting with an imaginary ecological void is that most pre-glacial features were obliterated by the forces of glaciation, and analysis of today's landscapes in this area can ignore, or assume to be featureless, that which existed in preglacial times. We know that there were living things present in Saskatchewan long before the last major glaciation and there is also evidence that the topography in the Rocanville area was not a featureless plain before glaciation. For instance, an ancestral river flowed towards the southeast, with its channel near the present geographic position of Rocanville but in a different course than the present Qu'Appelle and Assiniboine Rivers (McCrossan and Glaister, 1966). But with the exception of some small outcrops of Upper Cretaceous shale (about 75 million years old) along Scissors Creek, there was general burying of the pre-glacial landscape in the Rocanville area. Thus, our imaginary plain dates back to about 10,200 years ago when the last minor re-advance of ice is thought to have covered the Rocanville area (Christiansen 1965).

Parent Materials

Glaciation in the Rocanville - St. Lazare area left behind several different kinds of parent materials, four

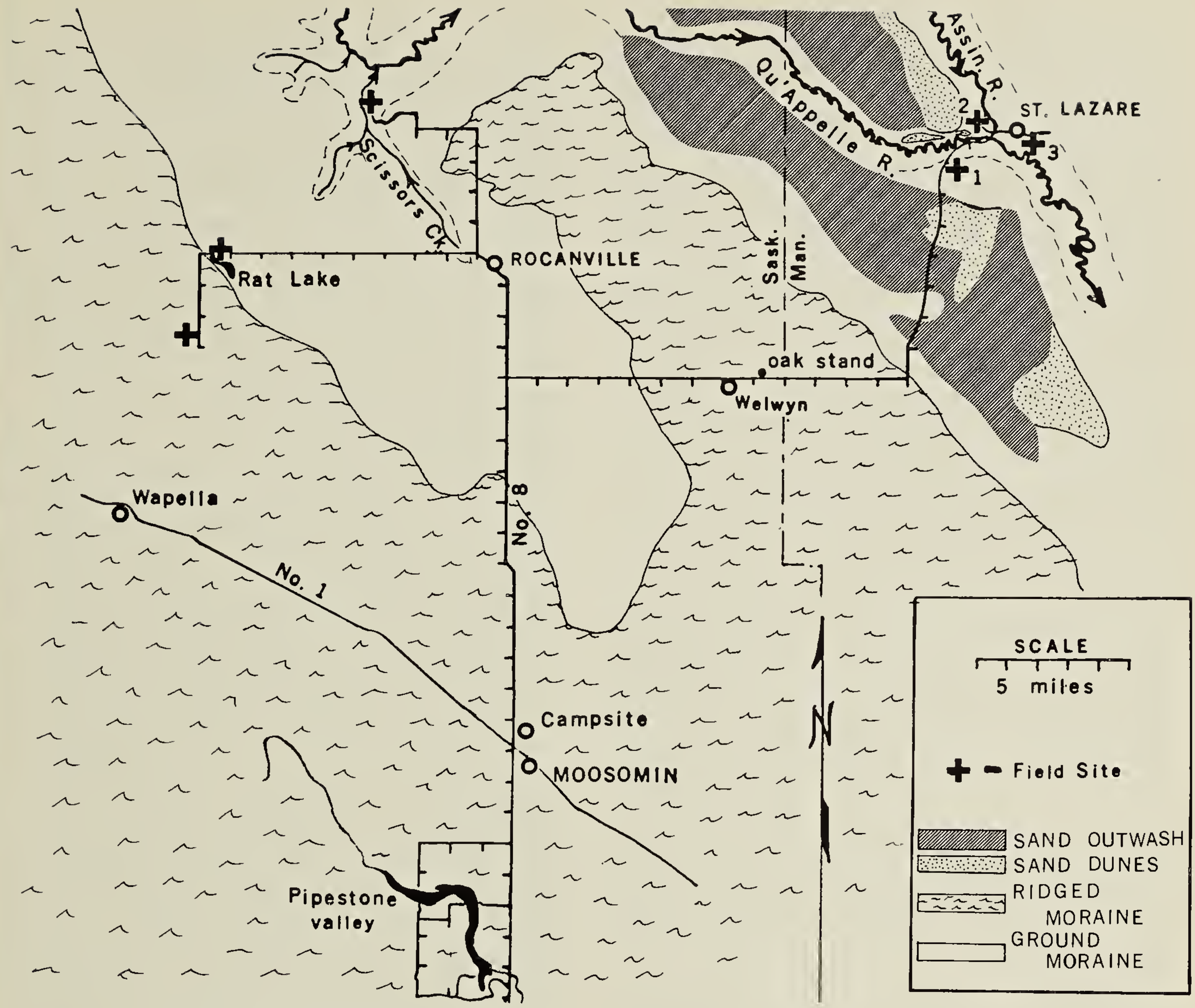

FIGURE 1—Rocanville-St. Lazare area, showing locations of 1966 Annual Summer Meeting field trip sites. Major subdivisions of parent material are from the map of surficial geology by Klassen (1965).

of which are shown on the map in Figue 1. Rocanville is located on an area of relatively flat morainal material that was deposited beneath the last ice-sheet (ground moraine). To the southwest, south and east of Rocanville is a large area of ridged moraine which is partly composed of material that was pushed up in front of the ice rather than being overridden by ice as in the case of ground moraine.

The sandy outwash plain near St. Lazare forms a striking contrast with the ice-deposited parent materials to the west. This large area of sand is partly a result of deposition by the major meltwater channel that drained a glacial lake in the Saltcoats-Yorkton area. Along the eastern edge of this water-deposited sand there has been movement of the sand by wind and formation of dunes (Figure 1).

The distinction between ground moraine and ridged moraine is not so much a difference of parent material as it is of topography. Some effects of these differences in topography are discussed in the next section. Parent materials of both kinds of moraine bear hardwood forests of aspen and oak, in the absence of agricultural clearing. In contrast, the sand outwash and sand dune areas support only shrub, grass and herb communities. The large area of sand prairie, west of the confluence of the Qu'Appelle and Assiniboine Rivers, supports the following distinctive plant species: Creeping Juniper, Sand Cherry, Bearberry and several lichens *(Cetraria islandica, Cladonia uncialis* and *Cladonia alpestris)*. Local concentrations of wolf-willow and river birch occur where the outwash sand has been reworked by wind. All of these species are absent or rare on the morainal areas. Aspen communities with their distinctive plant and animal components (Bird, 1961) flank the open sandy areas, but have not yet succeeded in invading much of this particular parent material. The addition of these two very distinct parent materials (moraine versus outwash deposits) to our assumed featureless plain has had another human ecological effect. A map of population density in this area (Atlas of Canada, 1957, Plate 48) reveals a density of one to four persons per square mile on an area that coincides with the outwash sands. Surrounding parent materials support four to ten persons per square mile, with up to twenty persons per square mile around Wapella and from twenty to forty per square mile just southeast of Moosomin. These figures reveal the magnitude of economic and ecologic differences brought about by varied parent materials.

Another distinctive substrate in this area is the recently-deposited alluvial material on the floodplains of the Qu'Appelle and Assiniboine Rivers. This water-deposited parent material forms the special habitat for westward extension of eastern species such as American Elm, Green Ash and Manitoba Maple (Fowells, 1965). However, topography is also a factor in the control of this particular community of organisms.

Topography

The most conspicuous topographic features of the Rocanville-St. Lazare area are the broad valleys of the Qu'Appelle and Assiniboine Rivers (Figure 2). Erosion of the landscape by these deep valleys has greatly increased the number of habitats available for plants and animals over what would have been possible on the hypothetical flat plain. As long as topographic differences are a result of parent material differences, we are not reallv introducing a new ecological variable. In some parts of this particlar study area we do, in fact, find that the topography is a direct result of different kinds of parent

FIGURE 2—View westward from St. Lazare, Manitoba. The confluence of the Qu'Appelle and Assiniboine Rivers, although not visible, is located near the centre of the photograph and the valley of the Qu'Appelle extends upstream into the distance at the right of the picture. Note floodplain terraces accentuated by snow patterns in centre of photograph, and scattered oaks on the southwest-facing slope in the foreground.

material. For example, between Rat Lake and Wapella the ridges are from 10 to 25 feet high and there is strong alignment of depressions and ridges in a southeast-northwest direction. These topographic features of the ridged moraine contrast sharply with the subdued topography of the ground moraine around Rocanville. Further variations are shown by the ridged moraine that lies east of Rocanville. Here the ridges are very gently undulating and their general flattening is likely a result of erosion by glacial meltwater that flowed eastward from the Rocanville ice-lobe into the meltwater channel that appears in Figure 1 between the ridged moraine and the sandy outwash plain (Klassen, 1965). These examples show how two of the five major factors may act jointly to produce a particular effect on the landscape.

In contrast to the above examples of coincidence between topography and parent materials, there are also examples of topography that have developed independently of parent materials. The glacial spillway of the Qu'Appelle River, for instance, exposes a number of different parent materials on its side-slopes. Along the upper reaches of this river (e.g. north of Regina and upstream from there) the general topographic effect is for north-facing slopes to be forested with south-facing slopes supporting trees only in protected ravines or wetter depressions. Progressing eastward the amount of available moisture increases, probably as a result of a more favourable balance between rainfall and evaporation. Thus, near the Manitoba - Saskatchewan border the river valley is potentially forested on both north-facing and south-facing slopes. For example, at field site No. 3 (Figure 1) even the warmest and driest slope (southwest-facing) supports an attractive forest of aspen and oak. In contrast, on the west side of St. Lazare (field site No. 2 in Figure 1) where the south-facing slope of the valley cuts through sands and gravels of the outwash plain there are no forested habitats. Thus, the excessive drainage of the outwash parent material has counteracted the general tendency for south-facing slopes to be forested at the lower end of the Qu'Appelle Valley. These examples show how several different ecological controls may act jointly to produce a given effect. In this case of the Qu'Appelle Valley, we started with the assumption that topography and microclimatic differences associated with topography are basic reasons for the differences in the amount of forest habitat on north and south slopes of the upper Qu'Appelle Valley; then as we progress eastward, a climatic influence is observable with an increasing abundance of forest habitat on all slopes; thirdly, we find that these general topographic and climatic controls may be locally disrupted by strong parent material differences. The analysis of inter-relationships such as these is an important part of ecological study.

There are numerous habitat differences that are directly the result of variations in topography. Obvious examples are the steep, forested north-facing slopes which are the favoured habitats for birds such as Great Crested Flycatchers, Ovenbirds, Black and White Warblers, Redstarts and Rufous-sided Towhees, versus the flat, open areas of the outwash plain where species such as Sprague's Pipit, Chestnut-collared Longspur, Baird's Sparrow and Upland Plover occur (E. M. Callin, personal communication). Even the Bank Swallows that were seen along the Assiniboine River near St. Lazare depend upon a special kind of topography for their nesting and shelter. Plant species such as Paper Birch, Ground Dogwood and Twinflower were conspicuously controlled in their distribution by topography, being found only in deep, usually north - facing ravines. This list of examples could be expanded, but those readers who attended the 1966 field trips will likely recall on their own many similar relationships. Those readers who were not at the Rocanville outings, can have an interesting time searching for comparable topographic controls of plants and animals in their home localities.

Climate

To return to our imaginary featureless plain, we can assume that in a small area such as this (10 townships) there would be no significant climatic differences from one end to the other. However, one needs only to stand on the exposed rim of Scissors Creek canyon on a windy day and then to walk down to the sheltered valley floor to realize that there are great climatic differences even in small segments of the 10-township block. Also, on a calm day, the streamlined form of the Common Juniper clumps on the overlook of Scissors Creek canyon will testify to the frequency and intensity of winds in this particular habitat. In addition, a visit to this area in early spring will reveal that certain habitats, because of their topographic position, are still 'in winter' whereas others are well into 'spring'. For example, Crocuses on the open south-facing slopes near St. Lazare are in flower when the Ground Dogwood of the opposite north-facing slope is still buried by several feet of snow. Many of these climatic differences, within a small area, are as great as one could expect over several hundred miles north to south on a flat plain. Thus, we see that topographic variations may result in great climatic differences; in fact, when we think of topographic controls in the distribution of plants and animals we should really be thinking in terms of microclimatic controls. Of course there are other important ways that climate may shape a landscape or a community. Think of the consequences of the high water levels in the Qu'Appelle Valley in 1954. Floods that year were a result of the unusual weather conditions over a large area and the effects of flooding will be visible in floodplain communities for many decades. Wherever a poplar tree died from the prolonged high water levels, a new habitat was made available for insects that inhabit dead, standing trees and for birds that eat such insects. Whole new communities of plants are now developing in places that were flooded or where new sand bars were deposited. The crescentic terraces that are visible in the centre of Figure 2 indicate the dynamic nature of the flood-plain communities and remind us of the importance of climatic fluctuations.

Habitat changes brought about by climatic fluctuations are also well shown by the presence of sand dunes along the eastern edge of the outwash plain and in the bottom of the Qu'Appelle Valley just west of the town of St. Lazare. These dunes all appear to be stable today because of the cover of vegetation upon them—an excellent example of the influence of organisms upon the environment. However, at some time in the past the climate was such that there was not sufficient plant cover on the sand to prevent its movement by wind. With this example we have now introduced an even more complex ecological sequence, involving inter-relationships between: *parent material* (the sand), *topography* (outwash plain versus sand dunes), *climate* (winds of sufficient intensity to move the sand), and *organisms* (the presence or absence of vegetation as a consolidating factor on the dunes).

Organisms

Various plants and birds have been named in the discussions above and all ecological settings must, by definition, include living things. The character of any plant or animal community will obviously be influenced by the species that are available to occupy the habitat. Thus, the subject matter of animal geography and plant geography (the study of distributional ranges) is extremely important to the ecologist. The Turkey Vulture that was observed in flight over the Assiniboine River and the oaks that occupy the south-facing slopes in this area (Figure 3) are both examples of organisms that increase the ecological diversity simply because their distributional ranges happen to extend to the Rocanville - St. Lazare area.

Influences of the environment upon living things have been discussed by various examples above and the list need not be expanded here. Influences of living things upon the environment are often less conspicuous, providing we temporarily exclude the influences of man. The example of vegetation changing an unstable dune environment into a stable one has already been mentioned. An expanding aspen clump is another case, because the shade created by the overstory creates an environment near ground level very different from that at the same level in the open. These shade-induced environmental changes allow invasion of various plants and animals that would not otherwise be present.

As in most of southern Saskatchewan, man has done more here to influence the environment and change the landscape than all other organisms combined. Bird - watchers are well aware of the special habitats that have been created for birds by man's barns, shade trees, ornamental plants, agricultural crops and domestic animals. The introduction of new plant species, including weeds, has had an obvious effect on the vegetation of the area. Since the first settlers arrived in the Rocanville area in 1882 (Mrs. Wilma Sutton, Rocanville, personal communication), many other changes have been brought about: roads have been built, wet areas have been drained, bodies of water have been created, exposed knolls of the ridged moraine have been eroded down to the grey sub-surface soil layer following cultivation, trees have been cut and land has been cleared (although in general the increased protection from fires appears to have allowed a greater development of forest on areas that were described as grassland by the early explorers and first settlers). The subject of man as an ecological factor is so large and important that it could only be introduced here to remind the reader that a total ecological assessment of an area must always take man and his influences into consideraton. Assessment of the ecological impact of man in the Rocanville-St. Lazare area is a fascinating field of study that is awaiting research, as it is in most settled areas of Saskatchewan.

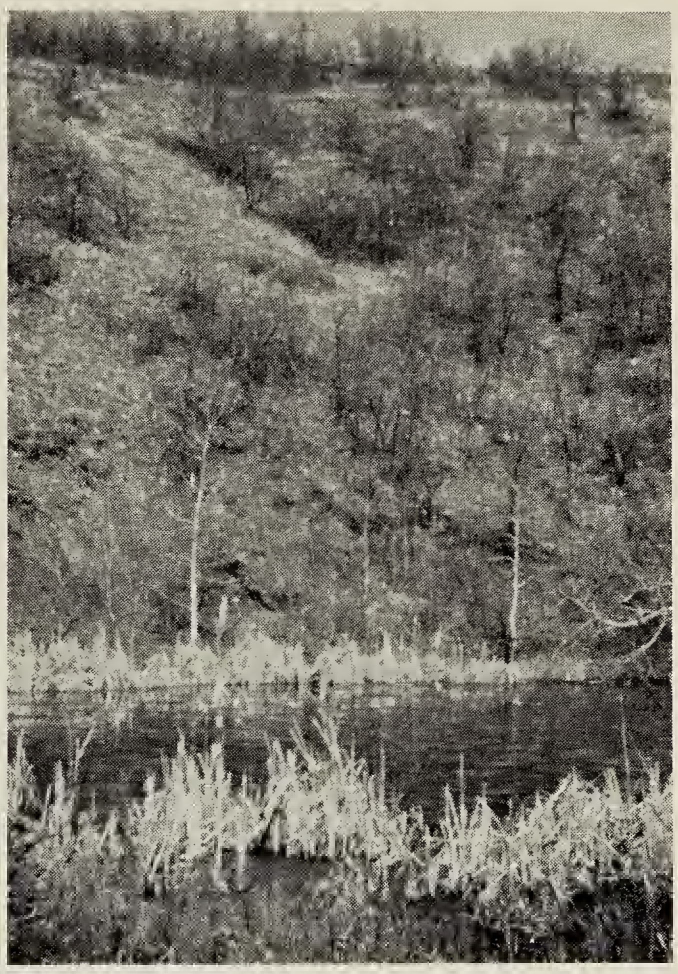

FIGURE 3—Distinctive distribution of oaks as scattered individuals on southerly-facing slopes along Scissors Creek. This habitat indicates why Bur Oak is classed as one of the most drought resistant species of the eastern hardwoods. The small marsh in the foreground has formed behind a slump terrace on the mid-slope of Scissors Creek canyon.

Time

The ecological influences of parent materials, topography, climate and organisms all require time for their operation. In fact, we may think of time as the integrating force for these other factors. For example, the depth and length of Scissors Creek canyon are functions not only of parent materials (resistance of the rock to downcutting) and climate (amount of water available for erosion) but also of time (how long the area has been exposed to erosive forces). Similarly, the presence of oak on the south-facing slopes of the large river valleys and on the morainal uplands is likely controlled to some extent by the time that the species has had for

FIGURE 4—Green ash stump cut by beaver along Assiniboine River near St. Lazare, Manitoba. Note regeneration of new stems on the ash.

northwestward migration since glaciation. Thus it is important to realize that the time that we happen to observe a particular ecological sequence or situation may greatly influence what we see. The beaver-chewed stump of green ash from along the Assiniboine River near St. Lazare (Figure 4) may be used to illustrate two important ecological principles: (1) there are frequently two-way, rather than one-way relationships between organisms in a community (in this case the ash serves as one of the dam-building materials for beaver but, in turn, cutting by beaver stimulates production of new stem shoots on the ash—thus, the number of stems of ash per acre and the number of beaver per acre could both be inter-related and influential upon one another); (2) assessment and description of an ecological situation will depend on when it is observed (note, for example, how an ecologist's assessment of number of ash stems per acre could vary if he visited the site before harvesting of ash by beaver, immediately after harvesting by beaver, or after regeneration of numerous secondary stems).

Summary

The examples above have suggested several possible ways that we may approach a study of inter-relationships between organisms and their environment. Although the Rocanville area lent itself exceptionally well to the search for such inter-relationships, we may find similar phenomena wherever we live or travel in Saskatchewan. Unlocking the ecological story of any area serves both as a fascinating outdoor exercise and as a stimulus to our appreciation of natural and managed landscapes.

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Ed. Note: Details and programme of the SNHS Summer Meeting at Rocanville, June 1966, including complete list of birds seen and people registering may be obtained by writing to the editor.