NATURAL PROCESSES AND LANDSCAPE FORM.

Wilson Creek Alluvial Fan: A Case Study.

A Practicum

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Master of Landscape Architecture

by

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ABSTRACT

The practicum is a study of Wilson Creek alluvial fan. The 15 square mile study area is located at the eastern boundary of Riding Mountain National Park, outside the park.

The study explores the problems of conflict between man and nature, i.e. the fit and misfit between forms of human processes and the forms of natural processes. The objective is to illustrate the consequences of achieving a good fit between man and nature. These consequences are the preservations of natural systems, avoiding the economic costs often involved with a bad fit between man and nature and ensuring the development of a landscape form visually expressive of place.

The method used to accomplish this is a case study area where it is easy to explore these ideas. Wilson Creek alluvial fan is selected for this because of an existing dramatic example of conflict between the natural processes of Wilson Creek and the agricultural land use and its pattern.

Within the study area the natural features are documented and interpreted to define the unique form of the land. The existing land use pattern is recorded and interpreted to define the conflicts or bad fit between use of the land and its natural form and to define where there is a good match between them.

To resolve the conflicts an alternative land use plan is developed, proposing agriculture and recreation use of the area rather than the existing single use, agriculture.

The consequences of the alternative plan are that the economic costs of conflict between man and nature are avoided and the natural form of the land is preserved and articulated, creating a landscape more expressive of place.

INTRODUCTION

NOTE: This practicum includes a written text and a set of maps prepared to be used together. Each section of the text usually refers exclusively to a specific map. The map numbers are listed with the section titles.

PRACTICUM CONCEPTS

Since this practicum concerns landscape it is essential to define landscape.

> " 'Nature knows nothing of what we call landscape,' for natures scenery is the natural habitat, while our landscape is the habitat manipulated by man for his own uses. Landscape therefore is not a static background which we inhabit, but the interaction of a society and the habitat it lives in, and if either man or the habitat changes then so inevitably must the resulting landscape."(5)

Landscape = habitat + man

Expressed another way, landscape is "the appearance of the country, town or village in which man lives -- is a very important aspect of the environment. Landscape is an expression of the underlying relationship of land and life." (2)

Where does this concept of landscape fit into the total environment? This can be resolved if we divide the environment into three categories. First are the areas which are in a natural condition e.g. forest and desert. In their pure form these exist only where man is absent. The second category is the landscape produced by man's alteration of natural habitats for his own uses generally without concern for the visual quality. The obvious example here is farming. On a smaller scale and more recently, industry and urban areas are producing landscapes even more radically changed from the natural habitats. The third category are landscapes which have been deliberately designed, generally for pleasure such as parks and gardens. (5)

In the past the third category--the consciously designed--has been of very minor extent; but increasingly conscious concern is spreading to landscape in general. It is our only hope for the future; that we should realize what we are doing to the whole of our surroundings and take deliberate action to extend conscious planning to our urban, industrial and farming landscapes.

Why should we do this? Existing and future demands on land, in a world which even now seems small, make it essential that we understand the land, its limitations and potential. Such an understanding will allow us to make the maximum and most efficient use of the land. What this probably will mean is a more complex pattern of use or multi-use of land than presently occurs. As well, a better fit between man and nature, in a sense an equilibrium, would ensure that costly conflicts would be avoided and destruction of natural system would end.

Ultimately what is needed is a balanced and self-renewing environment, containing all the ingredients necessary for man's biological prosperity. The landscape is the major part of our environment.

We should also be concerned about the character of the landscape, i.e. the development of its true form. Everyone needs identity, individuality and variety. In a general way man's increasingly organized societies and mobility which is a part of it, removes isolation and with it the expression of regions, places and people. Unique landscapes should exist. They are now being lost through an unharmonious response to natural systems and processes. We must take conscious steps to respond to what is special about places and in this way create unique landscapes.

The result would be regional landscapes which correspond to the regional pattern of natural processes and man's activities.

Every natural environment has a potential true landscape form. This is derived in the first instance from the land--its geology, geomorphology, vegetation and natural processes. It is also necessary to consider the historic development of the landscape. The creations of man, if of value, also become determinants of the "true" form of the landscape. These natural processes and cultural features constitute the genius loci (spirit of the place) of the land.

Ian McHarg, in discussing what values the planner should use as the determinants of form, further clarifies the relationship of genius loci, natural processes and form.

> "It seems to hold that memorable cities have distinctive characteristics. These may derive from the site, from the creations of man or from a combination of these. Rio de Janeiro, Naples and San Francisco are immediately associated with dramatic sites. Venice, Amsterdam and Paris are initially identified with the major artifacts that constitute them. Yet, when cities are built upon beautiful, dramatic or rich sites, their excellence often results from the preservation, exploitation and enhancement, rather than obliteration of this genius of the site. Where this lacks intrinsic drama, excellence can be created by buildings and spaces, as is so amply demonstrated in Amsterdam, Venice and Paris. When a city contains such excellent creations, then these enter the inventory of values, the genius loci. The total city can then be seen as an exploitation of the intrinsic site--the creations of man seen as conscious adaptations to it--that preserve, heighten and enhance its basic qualities." (10)

The concept of "true" form and conversely "false" form should be elaborated further. A true landscape form is a form which "fits" the natural processes, while afalse form does not. The basis of nature's form is fitness and this fitness lies in the fact that it can discern between arctic and tropic, as a gross example, but it can also discern subtle variations. The expression of this is seen in the individual forms which respond to the natural processes.

In the same way the "true" form of the landscape is derived in the largest part from an understanding and response to natural processes. Land suitable for agriculture can be found and certain areas are especially good for this purpose. Each area of land performs some work and has intrinsic value. It can be examined to reveal intrinsic suitabilities and land uses should respond to these. The converse is also true: certain areas contain such values, limitations and constraints that their use by man is entirely unsuitable. (10) From this examination of processes of the land we can develop the true landscape form which is a good fit between man and nature. The final result is a visual pattern expressive of place.

The previous emphasis on visual form and its psychological benefits should not detract from the other benefits to be derived from land use which fits the natural processes of the land. This fit would preserve natural processes and avoid the economic costs involved when there is not a good match.

The genesis of this practicum evolved in part from a book "New Lives New Landscapes" by Nan Fairbrother. The book was written within the context of England, however, the concepts havea broader application.

One of the ideas proposed in the book is the development of regional landscapes. Landscape variety like landscape itself is produced by the interaction of natural environments and man, and as man's technology becomes more dominant, so the natural environments will create less local variety. In England, pre-industrial man to a considerable extent was the product of his natural environment and local conditions, therefore producing local landscapes. The balance between modern man and nature is very different. Not only is man now dominant in the combination, but industrial man is not a product of a local environment. As a result regional character is destroyed in many ways. Modern farming produces everywhere similar tractor-worked fields.

Our future landscapes will only have local character if we deliberately plan to achieve it. This would mean dividing the land into areas delineated by their natural processes to establish landscape regions, where land use would be planned to have a good fit with the natural processes.

PRACTICUM OBJECTIVES

Initially it was conceived that the practicum would define the landscape regions of Southern Manitoba. One of these regions would be chosen to illustrate the unique landscape which would evolve through a harmonious response to the natural processes which themselves form the basis of the definition of the region. This course was not possible due to the time necessary to complete such a project.

The alternative which was chosen was to take a small case study area. A carefully chosen study area could still explore all the issues that would be covered in a landscape region. By limiting the study to a small size it would be easier to find an area where there was a dramatic and clear conflict between a natural system and man. A clear and dramatic conflict would make it easier to explore the ideas of landscape character; true form, false form, the fit between man and nature and multi-use of land.

Specifically the elements critical to the character of the study area and the false landscape form now developing due to the present unharmonious land use would be identified. The intrinsic suitabilities of the land would be ascertained, followed by a proposal for an alternative harmonious land use pattern. This would resolve the conflict between the special characteristics of the area and the present land use and generate the development of a unique landscape character.

The study area chosen was an alluvial fan. The fan was formed by a stream and its natural processes of erosion, deposition and overbank flooding. A number of such fans exist, and consequently work on the case study area would be directly applicable to a larger context.

WILSON CREEK ALLUVIAL FAN

CASE STUDY AREA

The study area was chosen for three reasons:

1. A known and documented (8) example of a conflict between the natural processes of Wilson Creek and the land use type and pattern exists within the study area. (See "Background of Conflict" on page 8 for a more detailed explanation.)

2. The study area is located adjacent to Riding Mountain National Park and work on the case study might have implications for the recreation development of land adjacent to the park.

3. Wilson Creek Alluvial Fan is typical of many similar land units along the Manitoba Escarpment which extends from the Pembina Hills near the United States border, to the Pasquia Hills some three hundred miles to the northwest. All have a number of streams and rivers which flow off them to form alluvial fans at the base of the escarpments. (See "Alluvial Fans" on page 9 for a more detailed explanation.)

BACKGROUND OF CONFLICT

The Manitoba Escarpment which includes the eastern slopes of the Riding Mountain is of pre-glacial origin. During periodic floods the streams which drain the escarpment carry large quantities of silt, shale and debris from the steep mountain valleys. The natural processes of erosion, deposition and overbank flooding have continued for thousands of years and have resulted in the formation along the base of the escarpment of a band of alluvial fans and rich arable land. The land is characterized by poorly developed drainage patterns.

As settlement and development of this fertile land progressed, increasingly severe problems of flooding and erosion control were encountered. The downstream channel of Wilson Creek, for example, was formed into a ditch to improve drainage and remedy these problems. The silt, shale and debris which was formerly deposited by the Wilson Creek and other streams over the alluvial fans now became deposited in the channels and man-made drains leading away from the toe of the escarpment. Over the years it became evident that conventional programs of downstream channel improvement, diking and diversions were becoming too costly for the limited benefits produced.

Recapitulating then, the bad fit between the processes of Wilson Creek and agricultural land use resulted in the creation of the false form of Wilson Creek Ditch. The ditch must be constantly maintained or adjusted to permit continuing agriculture use in the area.

A project called Wilson Creek Experimental Watershed was instituted in 1957 to investigate and remedy headwater causes of flooding and erosion on agricultural land which lay below the Manitoba Escarpment.

Following is a brief description of an alluvial fan and the processes which create it.

ALLUVIAL FANS

Alluvial Fans are similar to deltas but are formed on land. They form when a stream suddenly debauches from a steep mountain front onto a flat plain. The steep gradient of the mountain stream decreases abruptly where it discharges onto a plain. The alluvium and mudflow debris dropped by the stream, at the point of slope reduction, builds a conical mound with its apex at the base of the steep slope (as in the case of Wilson Creek). The fans spread radially outward over the land and gradually merge with the plain. The surfaces of alluvial fans are ideal forms for the dispersal of peak discharges and sediment loads from mountain streams during flash floods. The surface of an alluvial fan may be covered with braided channels, or it may have only a few radial channels which shift successively across the fan. (1)

WILSON CREEK ALLUVIAL FAN AND WATERSHED

The Wilson Creek Alluvial Fan is located at the eastern base of the Riding Mountain. Most of the fan occurs outside the Riding Mountain National Park in an area now used for mixed agriculture.

The delineation of the fan's boundaries, used for this study, were those developed by G. H. Mackay in his M.Sc. thesis A Quantitative Study of the Geomorphology of the Wilson Creek Watershed. The study area boundaries extend beyond the fan conforming with the section and quarter section survey lines--to form an area of 15 square miles.

The watershed of Wilson Creek is located within Riding Mountain National Park and has a drainage area of 5,440 acres (8) (approximately 8½ square miles). Downstream from the park boundary the stream is confined by an artificial drainage ditch.

METHOD OF APPROACH

Part One involves the mapping of those elements of the study area which form its character. This meant the analysis of the bedrock geology, topography, geomorphology, drainage and vegetation, and the historic and archaeologic features which constitute the sense of place. These elements were synthesized to pinpoint the concentrations or overlapping of important features which determine the character of the site--its genius loci.

The next step was to map the patterns of existing land uses, and identify the disharmonies and harmonies. Combined with this, trends in land use were described, since these have implications for the character of the landscape. These maps document the disharmonies and describe the false form of the landscape which has evolved (maps 9, 10, 11 and 12) and map 13 shows the harmonies existing between the present land use and natural pattern.

To resolve these conflicts and ensure the preservation and enhancement of the areas' unique character, an alternative land use concept in harmony with the natural processes and pattern of the study area was proposed.

Part two of the practicum focusses on the development of the alternative land use concept into a land use plan.

A. GENIUS LOCI NATURAL PROCESSES

map2 BEDROCK GEOLOGY

The description of bedrock geology was derived from MacKay (9). The bedrock surface throughout most of the Wilson Creek Watershed is covered by a surface mantle of unconsolidated glacial drift of rock materials. Immediately underlying the glacial drift are shale rock formations. Where the tributaries of Wilson Creek cross the escarpment, stream gradients are steep and V-shaped valleys have been cut 400 to 600 feet deep, through the glacial till into the shale bedrock. The raw and unstable banks of these valleys are the source of much of the water-borne
map4 material that formed the alluvial fan and this material is now deposited in the man-made channels. Two phases of the Riding Mountain formation, the Odanah (dark grey and greenish grey, hard siliceous shale) and the Millwood (greenish-grey, soft bentonitic shale) occupy most of the surface contact area.

The Vermilion River formation and Favel formation underlie the Riding Mountain shales and contact the surface deposits in the lower portion of the watershed. The Vermilion River formation has three members (chocolate brown carbonaceous shale and bentonite, Pembina Member);(grey calcareous, speckled shale, Boyne Member); (dark grey to black carbonaceous shale, Morden Member). The Favel formation consists of dark grey and black, greasy firm, calcareous shale and hard speckled, grey calcareous shale; minor limestone and bentonite.

CASE STUDY: WILSON CREEK ALLUVIAL FAN

PART ONE: ANALYSIS

map2 TOPOGRAPHY

The upper catchment area of the Wilson Creek Watershed is located on a relatively flat plateau at an elevation of about 2,400 feet and from here the land falls rapidly, dropping about 1,300 feet in four miles. From elevation 1,000 which roughly marks the present limit of the alluvial deposits from the escarpment, the land slopes gently toward the northeast to elevation 850 at Lake Dauphin.

map3 GEOMORPHOLOGY, GLACIAL AND LACUSTRINE

It is generally accepted that the last of the thick continental ice sheets that covered the northern part of North America prior to 15,000 years ago melted away from the Riding Mountain Area prior to 13,000 years ago. The ice as it moved over the Manitoba Escarpment altered the existing landscape by eroding the high areas and filling pre-glacial valleys with glacial debris. Immediately following deglaciation the escarpment and the plain at its base were plastered with a mantle of glacial drift.

Contemporary with the retreat of the continental ice sheet was the formation of Glacial Lake Agassiz from melting ice. As various outlets to Lake Agassiz were formed the lake receded and by 11,000 B.P. the lake had receded in the region of the Riding Mountain to what may be considered to be the base of the Manitoba Escarpment. (9)

Immediately following deglaciation, erosion of the slopes of the escarpment commenced. The eroded material was carried down the slopes and deposited in the glacial lake (9) in the configurations illustrated on map 3.

The most prominent remnant land forms are the glacial lake strandlines of two types: beaches and low escarpments, both of which occur in the study area. The beach ridges are of sand and gravel deposited by waves at the shore.(5) The escarpments of five to fifteen feet high were formed where waves attacked silt or clay on gently sloping coasts. Escarpments of 25 to more than 100 feet high are only common along the Campbell Strandline. The escarpment of the Campbell water plain stands highest in the silts of the Assiniboine Delta, while lower escarpments of 25 to 40 feet occur in till. (5)

map4 GEOMORPHOLOGY, ALLUVIAL

After the lake receded to below approximately elevation 1,100 (11,000 B.P.), the eroded material was deposited in the lagoons and swamps which were left behind various beach ridges of the glacial lake. These ridges inhibited drainage and the alluvial material was deposited in a series of coalescing deltas along the bases of the escarpment.(9)

Two distinct sections of the Wilson Creek delta may be identified. The base of the delta is the bedrock shale surface, or the surface of the glacial deposits remaining after the passage of the glacier. On top of the bedrock or till surface is the first section, a layer of lacustrine deposits overlain by the second section, a layer of alluvial deposits.(9)

The most easily discernible records of the alluvial deposits are the coarse shale ridges which were created by former braided stream channels, or a few radial channels which shifted successively across the fan.

map5 DRAINAGE PATTERN

This map shows a reconstruction of stream channels in the study area prior to European settlement. Reconstruction was based on identifiable remaining streams and streams recorded in the 1873 Dominion Land Survey Log Books.

A significant feature of the drainage was that, in 1908, the Wilson Creek had no formed channel through section 31-20-15 (No. 31 on drawing). Water that came into the section emptied into peat bogs and marshy areas, any outflow continued in a general northeasterly direction.(9)

map6 VEGETATION PRIOR TO EUROPEAN SETTLEMENT

The native vegetation map was reconstructed from the description of vegetation recorded in the Dominion Land Surveys of 1873, and from discussion with pioneers of the area. The D.L.S. description related, however, only to a narrow strip along each section right of way. This information was used in conjunction
maps 3,4 with on-site inspection of land forms to deduce a more specific delineation of vegetation units.

Much of the study area was poorly drained due to the impeding of water movement from the escarpment by beach ridges, and the ridge and swale micro-relief running at right angles to the general direction of landfall to the east. The result was the development of muskeg, tamarac swamp, willows, swamp and sedge in these areas, contrasting with drier sites on beach and shale ridges which developed entirely different plant communities. The important feature of the vegetation is its complex pattern which reflects the pattern of the natural land forms and drainage. The descriptive terms used, e.g. tamarac swamp, are those recorded in the Dominion Land Survey field books.

GENIUS LOCI: CULTURAL FEATURES

map7 TRAILS AND SETTLEMENT FEATURES

This map records the culturally significant landscape elements which reflect the history of human settlement in the area.

"The glaciation of Manitoba, the subsequent inundation of the province by Lakes Souris and Agassiz, resulted in a variety of landforms which were utilized extensively by Early Man.

map3 Archaeologic reconnaissance has revealed that relict beach ridges, outwash sands and gravels, elevated deposits of till, and sandy deltaic sediments were consistently sought out and frequented by Early Man. One reason for such selection would seem to lie with the excellent drainage of such features. The inactive extended beach ridges also invariably functioned as routes of travel through otherwise difficult country. Early descriptions of western Manitoba (Tyrell 1892 for example) refer to these ridges as "Indian Trails". Raised morainic features may have served as game watches and kill sites. Since the technology of Early Man was largely lithic, the outwash deposits, beach ridges, and stoney morainic hillocks also provided raw material for his stone industry." (8)

There is ample evidence to suggest, as well, that the Campbell Escarpment was used as a travel route by Pre-European man in Manitoba, particularly Neo-Indians. This is documented in the writings of early explorers (pers. comm. from Leo Pettipas).

Two major European travel routes existed near the study area. These were the Dauphin Trail and the Burroughs Trail. The Dauphin Trail ran along beach ridges and alluvial fans at the base of the Riding Mountain Escarpment. The Burroughs Trail followed a beach ridge just east of the Campbell Escarpment and joined with the Dauphin Trail just to the south of the study area.(2)

Within the study area itself, the Dominion Land Survey, records a number of "Indian Trails" and "Cart Trails" most of which occur on the beach ridges.

Discussion with pioneers, living in the study area, confirmed the use of these beach ridges as drysite travel routes in an area otherwise characterized by poor drainage.

The beach ridges were also used as dry sites for the first homes in the area. Today several farmyards still exist on these beach ridges, although artificial drainage of the surrounding land has eliminated the reason for their selection as homesites.

The apex of the alluvial fan (coarse shale), was logged before it was settled. A sawmill was located there (pers. comm. from farmers). The apex remained treed even after logging. It was settled in the late 1920's and early 1930's. The clearing of trees for agriculture and tree remnants left created an enclosed landscape. The landscape ranges from fields completely enclosed, partially enclosed, to entirely open areas. Enclosure is a direct response to the complex natural character of the land. Within the 15 square miles of the study area the land may be flat, gently sloping or steep (the Campbell Escarpment), and there is the micro-relief of shale and beach ridges. Streams include Wilson Creek, which drains the Manitoba Escarpment and smaller streams which drain the study area itself. There are wet and dry areas created by the pattern of drainage and landforms. Trees were left on beach and shale ridges adjacent to farmsites, along steams, the Campbell Escarpment, and in areas to wet to cultivate.

CONCLUSIONS

map8 SYNTHESIS OF GENIUS LOCI ELEMENTS

This map is a composite of the features identified in maps 2 to 7, as being part of the character of the study area, and which should be responded to in the pattern of land use.

B. DISHARMONIES AND FALSE FORM

map9 LAND OWNERSHIP PATTERN AND ROADS

Various surveys were made on or adjacent to the study area, the first of which occurred in 1873. These were the Dominion Lands Survey mentioned earlier.

The basic unit adopted was the six mile square township. Each township was divided into thirty-six sections of 640 acres and each section was divided into quarter sections of 160 acres. Road allowances were reserved along each section line to facilitate ingress and egress for the settlers. These allowances were 99 feet wide. (15)

This system of survey was adopted to have measured land available to settlers in Western Canada based on an orderly, workable system of allotment.

This map indicates the sections, the 99 foot road allowances; the pattern of existing land ownership and roads in use. The grid survey system and the boundaries of land ownership do not respond to the natural and historic pattern of the area the glacial lake strandlines, the alluvial fan with its shale ridges, the process of sedimentation and overbank flooding of Wilson Creek and historic archaeologic trails.

map10 ALTERED DRAINAGE PATTERN

Agricultural development of the Wilson Creek alluvial fan began in 1908. At this time Wilson Creek had no formed channel map5 through section 31-20-15 (9) and the water that came into this section emptied into peat bogs and marshy areas. Any outflow continued in a general north easterly direction probably joining with a similar type of flow from another creek to the north proceeding then to the Turtle River. Very shortly after the initial homesteading took place in the area, there was a concentrated effort to provide land drainage in order to lower the water table and to reclaim some land that was in swamp or in low marshy meadows.

The first land drainage in the Wilson Creek delta was initiated in 1916. (9) There was no further drainage until about 1929 when reconstruction of the original drain was carried out. From 1935 to 1975 periodic cleaning of the drain was carried out to remove the sediment deposited. As this continued more of a problem became encountered in the disposal of material dredged out of the drain. As the spoil bank adjacent to the drain became larger it was necessary to purchase more land in order to dispose of the material. Also the bed of the ditch gradually rose above the elevation of the adjacent farmland, and water from the ditch seeped through the spoil bank. This made necessary the construction of a second ditch to protect the adjacent farmland from seepage. (pers. comm. from Dr. R.W. Newbury). The map shows the existing altered drainage pattern of Wilson Creek and other smaller streams.

The fixing of the location of Wilson Creek by the ditch has caused the Creek immediately above the ditch to downcut into the shale fan, and prevented it from overflowing and efficiently depositing its shale bedload as it did naturally before ditching. Instead the shale was transported and deposited in the ditch where it must be removed periodically.

An alternative to this situation would be to allow the Creek to revert to its natural shale deposition process by the development of sediment basins of several hundred acres, through which the Creek could meander in its natural state (pers. comm. from Dr. R.W.Newbury). After a number of years the Creek would be moved into another area and the first area put back into agriculture.

map11 DECLINING WOODLAND

The native woodland remnants form an important component of the landscape. These remnants have persisted for a number of reasons. Some of the land is of marginal value because of poorly drained soils, steep slopes and low fertility on coarse shale ridges. Other remnants persist because they are heavily treed (making clearing expensive) or as remnants adjacent to farmsites, streams and property lines. The map shows the dramatic decline of these remnants from 1948 to 1974. Improved drainage, increasing farm sizes (22), impact of cattle grazing on treed pasture and mechanized tree removal all contribute to the disappearance of woodland remnants. With the disappearance of these remnants the unique enclosed landscape of the apex of the alluvial fan is being lost.

map12 FIELD PATTERNS AND CROPS

Field patterns respond only to the land ownership pattern of the grid survey. There are exceptions, such as several fields which respond to the pattern of the relict shale ridges. These ridges are easily discernable when walking over the cultivated land, due to the large concentrations of shale particles in the soil. Their different soil characteristics require a sequence of crop rotation suited to their droughty condition. This involves a rotation of alfalfa, rye and summerfallow. Hay and pasture tend to occur on wetter soils which are not suitable for annual cultivation.

Under present conditions, there seems little opportunity to have the fields more closely reflect the natural pattern of the land.

LAND USE TRENDS

The most significant and thoroughly documented land use trend is the change in average farm size. Within the municipality of McCreary (where the study area is located) between 1951 and 1966 the average farm size increased from 290 acres to 582 acres (19) and the population of the municipality declined by greater than 20%. (20)

This increase in farm size and decrease in population has meant the disappearance of farmsites and their associated trees. It also indicates a necessity for greater economic efficiency for farm units. This is reflected in further drainage of wet areas, clearing of woodland and larger field sizes, with the resulting loss of details in the landscape.

CONCLUSIONS

DISHARMONIES

The present agricultural land use and its pattern of grid fields, do not respond to the natural processes, relict landforms and cultural features of the study area.

Specifically, conflicts exist between the natural shale deposition process of Wilson Creek and the grid ownership agricultural pattern. Minor streams are ditched and straightened. Wet areas and bogs are drained. Relict landforms such as beach ridges are ignored in the pattern of land use. The complex pattern of native vegetation has been removed. The few remnants which are left are gradually disappearing.

Historically and archaeologically significant elements of the landscape are ignored or destroyed. These are: beach ridge travel routes of Paleo, Meso and Neo-Indians, and European pioneers, log buildings, and the enclosed field pattern carved from the woodland on the shale ridges.

The end result of these disharmonies between the natural characteristics of the site and present land use is that the unique character of the landscape is being destroyed.

mapl3 EXISTING LAND USE EXPRESSIVE OF GENIUS LOCI

Some harmonies do exist. These are few, and relatively insignificant. The location of hay and pasture generally corresponds to former wet areas. Some streams remain intact and the Campbell Escarpment is still treed. Finally, several fields correspond to the pattern of shale ridges, due to the crops needed for the special soil conditions.

C. CONCLUSIONS: ALTERNATIVE HARMONIOUS LAND USE CONCEPT

To retain more of the natural character of the area, and to preserve and articulate its special features from the present processes of destruction and alteration requires a land use pattern in harmony with the land.

To achieve this end requires two steps. First: Wilson Creek should be allowed to revert to its natural shale deposition process. This may eventually require that some land presently being used for farmland be removed from agricultural production. It should be noted, however, that the land necessary for shale deposition may not be lost entirely to agricultural use. Existing relict shale ridges, deposited by past Wilson Creek streams, are presently farmed successfully through a land use approach adapted specifically to their unique characteristics. This suggests that the proposed Wilson Creek "floodplain" or "meander belt" may also be used for agriculture. If not during its active phase, at least after, when the streambed is shifted to a new location.

Secondly other features need to be preserved and articulated. However it does not seem possible to modify agricultural use to achieve this. The types of agriculture, (crops, pasture, hay) and pattern of agriculture, (large fields) are not complex enough to respond to the pattern of the natural features. Agriculture in some situations completely destroys the natural feature such as vegetation. Therefore, other viable land uses need to be introduced. Multi-use of the area by activities which maximize the potential of individual features would preserve and articulate these features.

A mix of agriculture and recreation would be suitable for several reasons:

-the proximity of Riding Mountain National Park and Agassiz Ski Hill has created a demand for second home locations.

-present National Parks policy is oriented toward minimizing development within park boundaries, thereby creating a demand for the development of certain facilities outside the park.

-recreation would have some economic benefit to local residents in terms of sale of marginal land, and through management of facilities providing services to visitors.

-the agricultural landscape is scenic making it suitable for certain recreation activities.

To corroborate the potential of the area for recreation an independent study of recreation capability was referred to. This was the Canada Land Inventory (C.L.I.) Land Capability for recreation. The main determining factor in the selection of a C.L.I. capability class for a land unit depends on the quantity or intensity of use a site can support. The more intense use a site can offer, the higher the capability ranking. Capability classes in the upper half of the classification scale are usually representative of intensive forms of outdoor recreation such as bathing. Classes in the lower half of the scale are usually representative of extensive forms of recreation such as hiking. The capability classes range from one to seven.

map15 The Canada Land Inventory rates the study areas as classes $5^{L}_{O}E$ and $6^{V}_{P}0$ (14), therefore having recreation potential due to interesting landform features (L), land with vegetation possessing recreational values (E), and land affording opportunity for viewing upland wildlife (O). It also contains an area which offers a superior view relative to the class of units which contain it (V), and exhibiting cultural landscape patterns of agricultural industrial or social interest (P).

The class 5 and 6 designation of C.L.I. capability scale means that these sites have "moderately low" and "low capability" for outdoor recreation. However, this assessment is based on intensity or quantity of use and does not reflect the area's true capability for extensive recreation (for which it is probably best suited) but rather its capacity for intensive activities.

A more accurate assessment of the study area's extensive recreation potential can be derived from the "Outdoor Recreation Existing Places and Capability" section of the "Whitemud River Watershed Resource Study Phase I". This study developed a new capability classification scale which provides separate capability rankings for intensive and extensive outdoor recreational uses. Extensive outdoor recreation uses (e.g. the hunting and viewing of wildlife, angling and hiking) were redefined such that a C.L.I. class 5 land unit would be considered as having "moderately high" to "moderate" outdoor recreation capability, as opposed to "moderately low" capability. (14)

map8 The features of the area are generally linear, have historic and archaeologic significance, are visually scenic and in several cases have diverse vegetation communities associated with them. These factors and the ones previously mentioned suggest that extensive recreation, particularly a trail system for hiking, cross-country skiing and horseback riding would be an appropriate additional land use and could tie into the existing trails in Riding Mountain National Park. Such a recreation system would require a minimal amount of land, but would still be extensive enough to use and preserve the net of natural features: streams, beach ridges and escarpments.

The three movement types, hiking, horseback riding and corss-country skiing were selected because trails for them already exist within the National Park. They represent summer-winter use and varied time-distance capabilities. This does not mean that other recreation movement types would not be suitable for the area. Other types could be developed as the demand for trail recreation facilities increases, and after the popularity of the first three types is proven.

The creek is presently used as a recreation area by the local residents, therefore the development of a park on the creek would be another suitable use.

A last component of the concept is that recreation use would be loosely structured. This would be realized in the plan through the development of a main designated trail system, augmented by additional free choice routes.

CASE STUDY: WILSON CREEK ALLUVIAL FAN

PART TWO: RECREATION PLAN

A. REGIONAL CONTEXT - PHASE ONE

To make decisions concerning the development of a recreation plan for the study area it is necessary to develop a recreation concept at a broader scale. The development of the broader recreation concepts takes place on two levels: "Regional" and "Manitoba Escarpment". The Manitoba Escarpment level is a step between the regional context and the study area.

map14 TRAIL LOCATION DETERMINANTS AND CONCEPT

The regional recreation concept is an outgrowth of the conclusions reached for the study area. This was essentially to develop a trail system which would utilize the features critical to the landscape character. These features were Wilson Creak, its shale alluvial fan, former streambeds, Lake Agassiz relict strand-lines (beach ridges and the Campbell Escarpment), other minor water features such as small streams and bogs, and archaeologic and historic features generally associated with these natural elements.

It should be noted that not only were some of these elements significant for their geomorphic forms, as in the case of beach ridges, the Campbell Escarpment, shale fans, the location of historic features and historic travel routes; but were also significant in their influence on the pattern of woodland remnants in an agricultural landscape. The most important manifestation of this is the creation of an enclosed landscape, unusual in the Prairies.

The logical broader application of this would be to develop an extended trail system following the pattern of these features, particularly the Campbell Escarpment. The main direction of the trails could then be North and South, following the Manitoba Escarpment, the Campbell Escarpment, beach ridges, streams coming off the Manitoba Escarpment, and the associated series of alluvial fans.

The trail system could link Riding Mountain National Park with other existing recreation features creating an extended trail system suitable for week-long trips. The main elements to be linked would be Riding Mountain National Park and Spruce Woods Provincial Park, the two most important recreation areas in the region.

The Regional Study Area is a wide corridor between the Riding Mountain and Spruce Woods Parks, bounded on the east by the Campbell Escarpment and extending as far west as the town of Minnedosa. The western limits are loosely defined as there is no boundary comparable with the Campbell Escarpment. The distance from Minnedosa to the Campbell Escarpment is 30 miles and from the study area to Spruce Woods Provincial Park is 105 miles.

The proposed regional trail links, recreation development other than the two parks and areas which have high capabilities for recreation as defined by C.L.I. Circle routes have been developed. The recreation development given priority, in determining the trail location, were those supporting water oriented recreation.

Although these determinants for the proposed system are valid they are augmented by a more detailed C.L.I. Recreation Capability Map and a Trail Suitability Map.

B. REGIONAL CONTEXT - PHASE TWO

map15 NATURAL ENVIRONMENT CAPABILITY FOR RECREATION

Map 15 illustrates in more detail the Canada Land Inventory survey of the region's natural environmental capability for recreation. This is of value in refining the regional trail system. It pinpoints areas of "High Capability" for intensive recreation activities. It should be noted that those areas of "High Capability" which occur outside the two large parks, are generally associated with lakes, reinforcing the earlier stated concept of linking water-oriented activities which are rare within the region.

map21 The trail system has been adjusted in response to this new level of data, so that it passes generally through areas of land having at the least "Moderately Low Capability" for outdoor recreation. These lands have a natural capability to engender and sustain moderately low total annual use based on dispersed activities. The trail system links all class 3 lands within the region which have a natural capability to engender and sustain moderately high total annual use based on intensive or moderately intensive activities. (17)

maps16, 17,18, 19,20 NATURAL ENVIRONMENT SUITABILITY FOR TRAILS

The Canada Land Inventory Capability classes, however, do not directly reflect the relative capabilities of the land for horseback riding, hiking and cross-country skiing. A map has been developed which describes the regions different levels of suitability for trails. The criteria selected for determining trail locations or ranking land on a scale of suitability for trails are: (6) (11)

1. variety of slopes
2. scenic aspect
3. a mixture of vegetation species for visual diversity - ecotone areas offer greatest diversity, and in general treed areas are most suitable.
4. adjoining or traversing areas where other recreation activities occur such as swimming.

The data for these criteria can be derived from the C.L.I. Recreation Capability classes. Each C.L.I. capability class records three subclasses of information describing the reasons for the areas capability. From these subclasses a data base of the regions characteristics can be developed. For example a map showing all the land having vegetation possessing recreation value can be derived. The subclasses do not precisely match the criteria selected to determine trail suitability.

The following C.L.I. subclasses were selected as being similar to the criteria listed before,

map17 1. Subclass L and Q for criteria 1 - Interesting landform features other than rock formation; areas exhibiting variety in topography or land and water relationships.

19 2. Subclass V for criteria 2 - A vantage point or area which offers a superior view relative to the class of the units which contain it, or a corridor or other area which provides frequent viewing opportunities.

18 3. Subclass E for criteria 3 - Land with vegetation possessing recreation value.

20 4. Subclasses B, K, N, S, A, C and H for criteria 4 which represent specific intensive and extensive recreation activities.

The four trail system suitability variables (criteria) were mapped and overlaid on each other to develop this composite map. Criteria 1, 2 and 3 were given a weight of 1 and intensive recreation activities were given a weight of 4. The extensive recreation activities were given a weight of 2.

One final observation to be made is that subclasses in the Canada Land Inventory which were applied to part of the Campbell Escarpment were extended to cover the entire escarpment. This decision was based on a knowledge of the escarpment's characteristics in the Wilson Creek study area.

Maps 17, 18, 19 and 20 show the individual trail system suitability variables.

map21 FINAL REGIONAL TRAIL SYSTEM

(TIME DISTANCE STANDARDS)
(EXISTING RECREATION TRAILS AND HISTORIC TRAILS)

This map records the finalized routes for the regional trail system. It links all the areas of level four suitability for trails, essentially those areas which have capability for recreation activities which would complement a regional trail system. It also links the existing system of trails within Riding Mountain National Park.

The two historic routes, the Dauphin Trail and the Burroughs Trail, are shown in relation to the proposed system. Other historic trails may be located within the region but time did not permit research of these. The two trails indicated were researched for the Wilson Creek Study Area.

The time-distance standards for the 3 types of trails show that a one way horseback trip from the Wilson Creek Study Area to Spruce Woods Provincial Park would take two to four days and a hiking trip from Wilson Creek to Neepawa would take seven to eight days.

C. MANITOBA ESCARPMENT CONTEXT

To develop a more precise context for the recreation plan for the Wilson Creek Study Area it was necessary to develop the trail system outside the study area in more detail than that in the Regional Trail Concept. This has been done in the "Manitoba Escarpment Context". This was chosen as it is large enough to allow the accurate application of the time-distance standards illustrated on Map 21, and to include the existing Riding Mountain National Park trails. It also is detailed enough to permit accurate location of trails.

naps 22, 23,24

TRAIL DETERMINANTS

The criteria for trail selection were: to use features constituting the area's sense of place (derived from the Wilson Creek Study Area) and existing recreation development, to have variety of trail locations and circle routes and to meet the time-distance standards. The features determining landscape character which were used are landforms, woodland and historic trails.

aps 25, 26,27 RECREATION PLANS

In general each trail type (hiking, cross-country skiing and horseback) is organized to traverse each of the different environments in the area, such as the Manitoba Escarpment, the plateau above the escarpment, streams coming off the escarpment, the two historic trails and the Campbell Escarpment. Only horseback trails were proposed for the beach ridges. These features and the adjacent land do not have enough variety and interest to warrant their use for hiking and cross-country skiing trails.

Waysides and campsites were located, whenever possible, to be jointly used for hiking, cross-country skiing and horseback riding. Some sections of trails were developed so as to be exclusive for each movement type. The routes proposed can be developed independently of the regional trail system. They provide a variety of trip lengths ranging from 1 to 2 days on horseback to 3 to 4 days skiing and hiking.

The horseback trail system (SHALE TRAIL OVERNIGHT HORSEBACK CAMPING) has been developed as a "typical" user's map, with illustrations of features of interest along the trails. The illustrations were selected to portray the natural processes, features and cultural background essential to understand what is unique in the landscape.

D. WILSON CREEK STUDY AREA

map28 RECREATION PLAN

The recreation plan includes, in addition to the trail system (developed in the Manitoba Escarpment context), horse rental facilities and stables, short 1 to 2 hour horseback trails, designation of interpretive features, a park for McCreary and recreation home sites.

The major trail system is more specific because of more precise information. It follows streams, beach ridges and the Campbell Escarpment. A primitive campsite and the McCreary Park have been located in the potential Wilson Creek "floodplain" or meander belt. A stable, horse rental facilities and parking lot have been placed close to the campsite and park. Secondary horseback trails have been developed to provide 1 to 2 hour horseback trips using rented horses.

Log buildings would be preserved, repaired and utilized, for example a cross-country ski shelter has been developed from a log house. Small interpretive markers would explain remnant native plant communities and historic farmsites (pioneer histories).

Vacation home sites are located on the Campbell Escarpment to take advantage of the views of the Manitoba Escarpment to the west and the plain to the east. Horseback trails adjoin the vacation homes allowing direct access to Riding Mountain National Park. Vacation houseowner's horses could be boarded at the rental stable.

E. IMPLEMENTATION

Land acquisition would be a critical aspect to the implementation of the proposed trail system. This is due to the pattern and distribution of land units needed, i.e. generally long strips of land following streams, escarpments or beach ridges. While only a narrow right of way is needed for a trail the total feature on which the trail is located, for example the vegetation adjacent to streams, must also be preserved. This would require the acquisition of properties with unusual configurations which would not conform to a simple and easily surveyed geometric pattern. What might be developed to resolve this problem is an air-photo record of boundaries.

Land acquisition of a trail system would be developed publicly and the trails would be public rights of way, or would be a cooperative of all the landowners whose land, the proposed trails cross. Such a cooperative could develop, operate and maintain the trail system. It would not require the purchase of property, but would need a contract agreement for use, preservation and perhaps restoration of natural features. Restoration could involve reforesting, with native trees. A possibility for land acquisition could be an exchange between private land along streams, escarpments and beach ridges and the public 99 foot rights of way along each section boundary. This would only be possible where the 99 foot rights of way are not used for roads and would probably not provide enough land for the total proposed trail system.

Some of the interpretive features of the trail system could be developed by local community groups such as scouts, 4-H or local historical societies - these groups could research histories of the community and early pioneers, and preserve, improve and maintain log buildings and develop historical markers.

To initiate the development of the proposed system of trails, a single basic unit for joint use by hikers, cross-country skiers and horseback riders could be developed. It should be at least an overnight camping trail such as the proposed Shale Trail. This includes 25 miles of existing recreation trails in Riding Mountain National Park and 50 miles of new trails mainly outside the park. The initial development should also include shorter routes requiring from one hour to a day to complete. As the demand for use increased, the initial development could be expanded and longer routes could be added as proposed at the regional level.

CONCLUSIONS

The case study confirms the concepts discussed in the introduction. Natural processes are complex and varied systems. They create a physically and therefore visually varied environment. The ultimate manifestation is a form or pattern of forms unique to each situation or area.

The traditional simplistic response to these systems in terms of use, if not in harmony with them, creates a false landscape form. This may destroy a unique or potentially unique landscape.

In the Wilson Creek Study Area the most dramatic example of this is the conflict between the single land use (agriculture), its grid pattern of application and the natural shale deposition process of Wilson Creek. There is a conflict between agriculture and relict land forms, plant communities and cultural history. The result of the conflict is that the creek was altered to conform to the land use and its pattern, rather than the land use responding to the pattern of the creek. This produced a twofold loss, first in terms of the economic costs of maintaining the false form of the Wilson Creek ditch and secondly in a loss of the intangible qualities, of a potentially unique landscape.

The proposed solution to these problems is to develop a more complex pattern of land use in harmony with the site. This could not be achieved by manipulating agriculture land use. Through the process of the study it was concluded that the natural features of the area have potential for recreation. Recreation use is proposed for those elements of the study area which constitute its unique character (which agriculture is destroying), thereby preserving them.

It is proposed that Wilson Creek revert to its natural meander shale deposition process. The meander belt would be used for a park and primitive campsite which could co-exist with the process of shale deposition. A system of recreation trails would preserve and articulate other features while removing only a small portion of land from agricultural production.

Some more general conclusions can be derived from the study. Land has a greater potential for use than is now generally realized. This greater potential can be achieved through a more complex and varied pattern of use. More planning and research is required to identify the true potential of land. This should not be left until a "demand" makes this necessary as resources may be lost through ignorance of their existence. The use of land may change over time. What should not change, in a sense be lost, is the basic character, resources and potential of the land. For example, holdings of indigenous plant communities should be preserved. For although they do not have a use now, they may in the future, and once they are lost they are irretrivable. The study as well illustrates the fact that the juxtaposition or mixing of land uses not only preserves the richness of the land but contributes an additional richness to each land use. Agriculture contributes to a more varied recreation experience. Recreation contributes to the agricultural community in terms of economic gains, in terms of preservation of a unique environment, and in social terms through preservation and interpretation of local history.

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