

SOME EFFECTS OF CAMPGROUND USE ON THE NATURAL
ENVIRONMENT IN MANITOBA AND THEIR
IMPLICATIONS FOR PARK PLANNING

by

Wendy A. Celentino

A Thesis

submitted to the Faculty of Graduate Studies
in partial fulfillment
of the requirements
for the degree
of
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ABSTRACT

The adverse effects of recreational use on the natural environment are examined with respect to the influence of campers in the peripheral areas of campsites in the Whiteshell Provincial Park.

An analysis of vegetation data collected using the relevé method indicates that there are several types of disturbance occurring around campsites. These include; the trampling of vegetation, the creation of paths from centres of activities, soil erosion resulting from the removal of vegetation, and 'vagrant impacts' such as tree scarring and littering. The data also indicates that six species are particularly useful as 'indicators' of disturbance within the peripheral area of the four campgrounds used in this study.

The causes of the spread of these impacts include; human disturbance, environmental, and planning and design factors, and the importance of the latter two are illustrated by applying the findings of the field study to the example of the new Black Lake Campground in Nopiming Provincial Park.

It is concluded that ways to alleviate extensive deterioration in campgrounds should include a consideration of the following :
periodic monitoring of the indicator species, planning campgrounds with more attention to the physical characteristics of the site, and designing the campground in such a way as to best protect the natural environment.

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CHAPTER ONE

INTRODUCTION TO THE PROBLEM

1.1 Introduction

The interrelationships between man and his environment are often stated as a primary concern within the discipline of Geography (Thomas, 1970; Krueger, 1976). A good example lies in a study of man-environment interactions taking place in recreational areas.

National and provincial parks in Canada occupy land where interference by man has been controlled. As a result, large tracts of vegetation are protected by park boundaries and appear to be in a 'natural' state. Most parks were originally selected for their natural beauty, but their ecological importance has also been recognized in that they are "respiring, energy trapping, oxygen producing, nutrient cycling, gigantic living organisms, enmeshed...with life in thousands of forms..." (Theberge, 1976;194). Preservation of these natural systems is frequently stated as one of the dominant aims of policies protecting these lands, but the use of parks for recreational purposes is also recognized in most mandates. For example, the policy governing provincial parklands in Manitoba states that:

- Provincial parklands shall be developed and maintained
- a) for the conservation and management of flora and fauna therein;
 - b) for the preservation of specified areas and objects therein that are of geological, cultural, ecological and other scientific interest; and
 - c) to facilitate the use and enjoyment of outdoor recreation therein.

(Manitoba, 1972B;373)

When the demand for recreational opportunities in a park is great, the preservation and conservation aims of park policy appear less important. When recreational use exceeds the ability of the environment to cope with this interference, physical deterioration results. This tolerance level, in the recreational context, is known as the carrying capacity and refers to the type of use that can be supported over a specified time by an area developed at a certain level, without causing excessive damage to either the physical environment or the experience of the visitor (Lime and Stankey, 1971).

The increasing popularity of many campgrounds in North America has caused the carrying capacity to be exceeded in several parks, and has resulted in many adverse effects or 'impacts' on the natural environment. Some of these include the loss of ground level vegetation, the creation of numerous paths from centres of activities, and vandalism (Wagar, 1964; Bohart, 1968). The degree of damage to the natural environment has many dimensions and depends on such factors as: the physical-biological components of the natural system, the type of visitor using the campground, and the duration and intensity of visitor usage.

Another element that can influence the extent of deterioration is the design of the campground. Camping areas are usually constructed with sections of relatively undisturbed vegetation between and around campsites. When these areas contain dense vegetation, a natural barrier is formed to deter movement. However, in many campgrounds, either this barrier is not present or it has

been destroyed as a result of various camping activities. If this impact pattern continues into the surrounding natural environment, as it does in campgrounds experiencing growth in their utility beyond their carrying capacity, then one can predict that the resultant deterioration could affect an ever increasing part of the park. The spread of such impacts is not desirable because it contradicts two of the three aims of the provincial park policy, namely conservation and preservation. If these areas are to remain in their natural state, the camping activities must be confined within the campground.

This thesis uses a popular camping area in eastern Manitoba, the Whiteshell Provincial Park, to explore one aspect of the man-environment interaction described above. In order to examine the nature of the effect of recreational activity on the natural environment surrounding campsites, several questions were posed. For example, what effects of campground use are found in the periphery of campsites? Are there any components of the natural environment that can be used as 'indicators' of the degree of disturbance? What factors explain the spread of disturbance into these areas, and how could this information be applied usefully in the future planning and design of campgrounds in order to limit deterioration of the surrounding natural environment?

To answer the above questions, the following objectives were formulated:

1. To examine the effects of campers' use on the vegetation in the area peripheral to specific campsites in four campgrounds

in the Whiteshell Provincial Park.

2. To select several plant species as indicators of the degree of disturbance occurring in these areas.
3. To examine the degree to which environmental, human disturbance, planning and design factors were responsible for the amount of disturbance observed.
4. To apply this information to the development of Black Lake Campground in Nopiming Provincial Park, located north of the Whiteshell Provincial Park.

1.2 Literature Review

Many of the previous studies on park disturbance have examined the effects of visitor use on either the soil or vegetation components of the environment. Because of their intricate causal relationship, impacts to one of these parameters are reflected in the other element. For example, soil compaction may be caused by people walking along a trail and this can affect the future growth and reproduction of vegetation species (LaPage, 1967; Ward and Berg, 1973).

Hiking trails have been the focus of many park disturbance studies. The process of trail degradation involves the disturbance of vegetation cover by trampling and the disappearance of sensitive species. Once the vegetation disappears, the exposed soil becomes vulnerable to removal by water, or when dry, by wind erosion (Bryan, 1977). The process of trail erosion itself has been found to be two-dimensional, involving a vertical dropping of the trail surface

by soil compaction and erosion, as well as a horizontal movement at approximately the same rate (Ketchledge and Leonard, 1970).

Trampling has also been found to have both direct and indirect effects on plant growth. Indirectly it influences growth by reducing soil aeration and soil moisture, and directly it affects root penetration, reduces the infiltration of rainfall and lowers the moisture status (Landals and Scotter, 1973).

Changes in soil conditions are important to consider in the explanation of the effects of disturbance on the natural environment, but some authors feel that vegetational changes are more sensitive indicators of the intensity of recreational use, and can be more easily measured (Burden and Randerson, 1972). As a result, several studies on the effects of vegetation disturbance have taken place, many of them in campgrounds.

A study of intensive recreational use in California revealed that over half of 137 camping and picnic areas lacked tree seedlings or shrubs, and that 95% of the individual camping sites lacked a ground cover of grasses and forbs (Magill and Nord, 1963). Other studies of the "on-site" effects of camping concurred with Magill and Nord's reporting of a lack of ground cover, for example Lesko and Robson (1975) in Banff National Park, and Frisell and Duncan (1965) in the Quetico-Superior canoe country.

One solution to the problem of a lack of ground cover was found to be a combined treatment of fertilizing, grass seeding, and watering (Herrington and Beardsley, 1970; Beardsley and Wagar, 1971). While this treatment may help in some areas, it is not always feasible to undertake a management programme such as this, especially in an area

which is supposed to be natural. In several campgrounds in Manitoba, the problem of decreasing ground cover is avoided by the provision of a gravel pad for camping. Many of these sites contain a picnic table and fire pit and are designed to confine use to the more durable gravel surface (Fig.1).

In a study of the effect of recreational use on soil and vegetation in Rushing River Provincial Park in Ontario, it was suggested that gravel use for campsites be halted, because the gravel kills vegetation immediately nearby, particularly birch trees (James et al., 1976). However, where soil depth is shallow or where drainage is poor, the use of a gravel pad protects the ground from further degradation.

As expressed earlier, this study is concerned with the effects and extent of disturbance in the area peripheral to the campsite. Movements beyond the campsite are usually planned to direct users along roadways or well-maintained paths. Natural vegetation can act as barriers to movement in undesired areas and if campgrounds are planned effectively, movements around campsites should be minimized.

Observations of the many trails in Rocky Mountain National Park, Colorado led to the conclusion that whenever the trail 1) goes where people want to go, 2) is well-routed and well-constructed, and 3) is well-maintained, the impact of visitor activities on adjacent ecosystems is very slight. In a number of cases, rare plants have even been found growing at the side of the trail surface, indicating how little deviation from the trail occurs.

(Scott-Williams, 1967;116)

Therefore, planning can play a major role in the protection of the natural environment and studies on the peripheral areas of campsites are important as an indication of the effectiveness of a

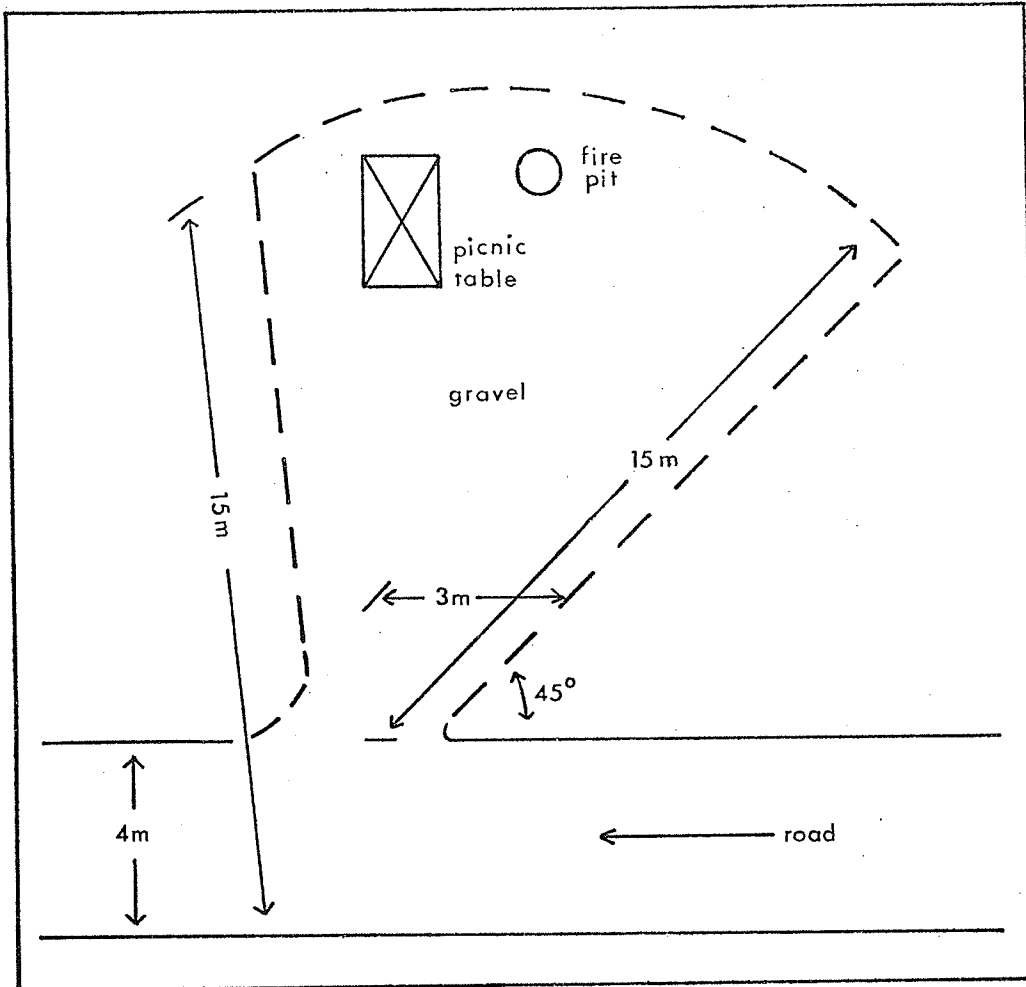


Fig. 1 Dimensions and components of a typical campsite.
(after : Manitoba, 1977A)

campground design. If use is spreading into the natural area, then the reasons for the impact should be explored and the results of that information should be incorporated in the planning and design of future campgrounds.

Only a few studies have dealt with the influence of campers beyond the campsite itself. In alpine and sub-alpine meadow ecosystems in Yoho National Park, Landals and Scotter (1973) found that impact in the peripheral area of the campground was concentrated within thirty metres of the meadow edge. Damage to the forest margin was caused by campers collecting wood for fires and tent poles. This may seem trivial as a short-term impact, but as nearby sources of wood are depleted and campers are forced further and further from the meadow edges, open spaces are created in the forest margins which attract the establishment of campsites in this area, and lead to further degradation.

Another study located in Rushing River Provincial Park (Hoffman et al., 1975) evaluated the effects of recreational use in areas of high impact, i.e. the campsite, to areas of low impact, i.e. the periphery. They concluded that there was a gradient of decreasing impact from the campsite to the periphery and that there were more plant species present as the distance from the campsite increased.

One other campground impact study, that of Lesko and Robson (1975) took place along hiking trails and in primitive campgrounds in Banff National Park. They found that visitor impact outside of the campgrounds and off trails was very small and that most hikers did not seem to stray from the trails at all. Evidence of littering and of tents

pitched illegally near the lakeshore were the only signs of disturbance recorded in this particular ecosystem. However, degradation of campground areas has been shown by others to be a more severe problem in some parks than that expressed by Lesko and Robson's study (Wagar, 1964; Lavery, 1974). Generally the spread of disturbance beyond the campsite appears to be more prevalent in areas that experience intensive use, such as Rushing River Provincial Park, and Banff, Yoho and Rocky Mountain National Parks. When the carrying capacity of a campground is exceeded or when campgrounds are not designed effectively, the potential for deterioration of the surrounding natural environment is present.

In Manitoba, environmental deterioration can be expected in the Whiteshell Provincial Park, an area which contains 33% of the total number of campsites in the province (Nuxoll, 1978, personal communication). This research examines the condition of the natural environment around campsites in four of its campgrounds and analyzes factors responsible for the degree of disturbance found there. The results of this analysis are then applied to the future planning and management of campgrounds in similar environments.

CHAPTER TWO
THE STUDY AREA

2.1 The Selection of Suitable Campgrounds

The Whiteshell Provincial Park is an area of 1700 square kilometres in southeastern Manitoba and was selected for this study for a variety of reasons. Its location on the Pre-Cambrian Shield, where there are numerous lakes and rivers in a forested setting, make it attractive to many people for a variety of recreational uses. Some indication of its increasing popularity can be seen in the growth of summer vehicle attendance from 232,263 in 1968 to 308,743 in 1977, an overall increase of 32.9% in nine years (Lenton, 1977, personal communication). Much of the park's popularity is due to its proximity to a major urban centre (less than a two-hour drive from Winnipeg), and to its accessibility from the Trans-Canada Highway (Fig.2).

A total of 2,087 campsites are found in the park spread between fourteen transient and three seasonal campgrounds¹. These areas occupy a variety of different ecosystems within the park's eighty kilometre latitudinal extent. For example, the dominant vegetation varies from the pure trembling aspen cover (*Populus tremuloides*) of Falcon Lake's Overflow Campground, to the white birch (*Betula papyrifera*) at West Hawk Lake Campground, to the mixed species found

¹ Seasonal campgrounds issue camping permits for the whole summer season (last week in May to Labour Day in September), while transient campgrounds restrict camping to three weeks maximum (Manitoba, 1977B).

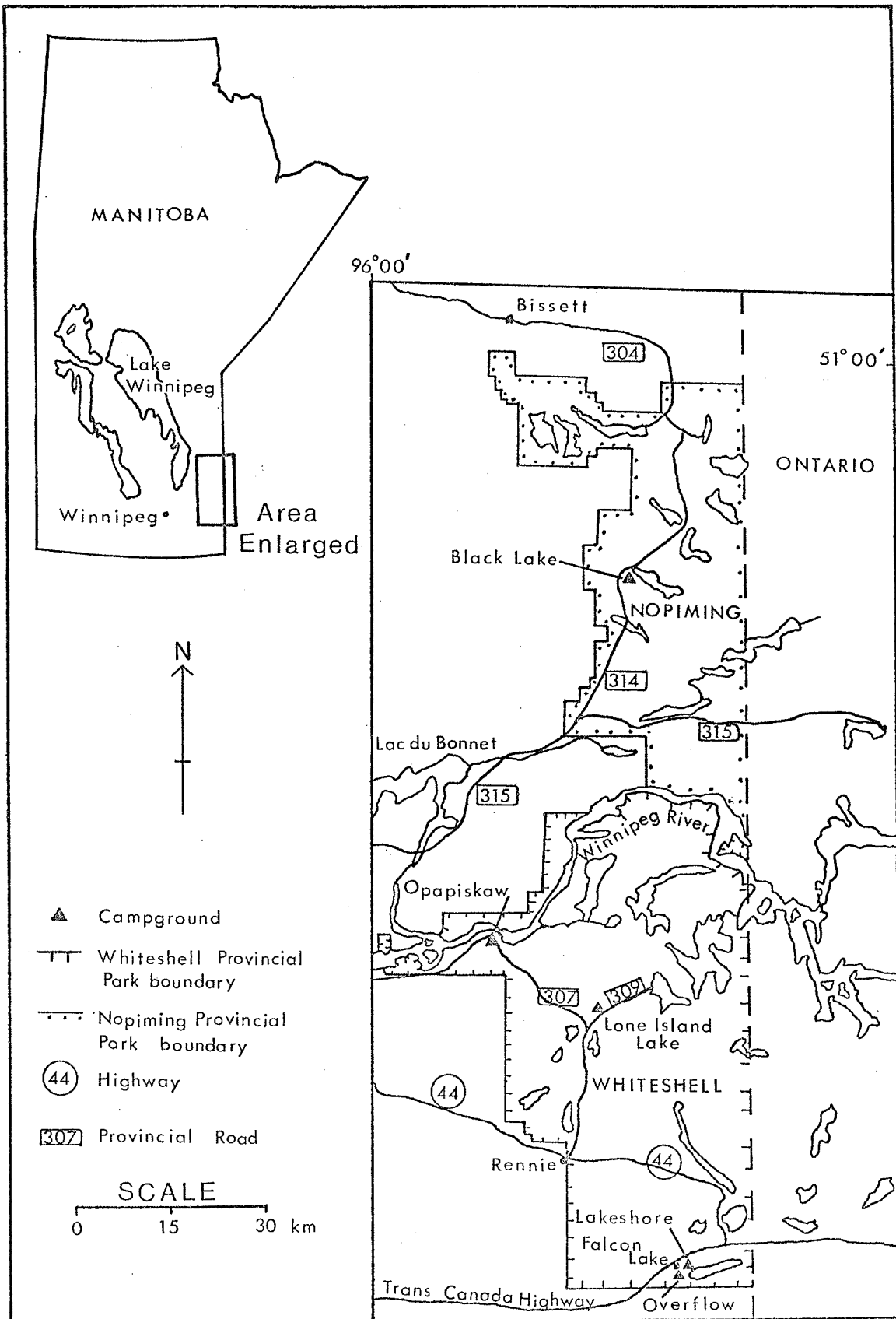


Fig.2 The study area, showing the location of the Lakeshore, Overflow, Lone Island Lake, and Opapiskaw Campgrounds in the Whiteshell Provincial Park, and Black Lake Campground in Nopiming Provincial Park.

in the northern part of the park. This variation reflects differing soil, topography and drainage characteristics throughout the area.

Another reason for the selection of the Whiteshell is that the park has been operating since 1931 and contains many campgrounds of different ages. The amount of deterioration the natural environment experiences is a function of both the number of years that a campground has been open, and the intensity of use experienced within it and thus, the older campgrounds were expected to show more signs of the effects of human disturbance than the newer ones. Confined use over a long period of time will have adverse effects on the environment and areas such as Falcon Lake's Beach and Brereton Lake Campgrounds show exposed soil throughout the campsites and a lack of young trees as two results of intensive recreational use, a finding similar to that of Magill and Nord (1963) in California.

The 'peak' of the tourist season occurs in July and August when children are out of school and the climate is most favourable for camping. Statistics on the average occupancy of campgrounds in the Whiteshell Provincial Park between 1970 and 1976 indicate the intensity of use experienced there, and these are illustrated in Table 1. An average occupancy of 100% indicates that all available campsites are occupied, and the campground has reached its planned carrying capacity. It is important to note that due to the system of calculating average occupancy¹, several campgrounds have average values greater than 100% during different years, (for example, Brereton Lake, White Lake

¹The formulae for calculating the average occupancy are included at the bottom of Table 1.

TABLE 1 : PERCENTAGE AVERAGE OCCUPANCY¹ FOR JULY AND AUGUST 1970-1976, WHITESHELL PROVINCIAL PARK CAMPGROUNDS

Campground	1970	1971	1972	1973	1974*	1975*	1976*
Betula Lake	92	80	108	85	104	100	100
Brereton Lake	93	140	148	64	60	78	85
Caddy Lake	29	44	62	77	81	80	82
Falcon Lake Beach	94	93	88	94	78	75	89 ²
Falcon Lake Lakeshore					82	76	77
Falcon Lake Overflow					figures n.a.		
Nutimik Lake	30	54	59	59	76	70	100
Opapiskaw	39	45	61	61	42	44	50
Otter Falls	35	42	53	65	30 ³	46 ⁴	65
Toniata Beach	57	88	82	76	70	66	67
West Hawk Lake	39	80	68	67	64	61	58
White Lake	71	108	113	63	104	75	69
Big Whiteshell Lake Old					130	100	100
Big Whiteshell Lake New	n.a.	122	89	99	170	93	91
Lone Island Lake	overflow campground - figures n.a.						
Falcon Trailer Village			100	98	92	80	90
West Hawk Trailer Village			99	100	80	76	75
Dorothy Lake Campground	100	100	100	99	100	97	100

¹Percentage occupancy = $100 \times \frac{\text{total number of permits sold}}{\text{number of days in month} \times \text{number of campsites (excluding overflow)}}$

Average occupancy = $\frac{\% \text{ occupancy July} + \% \text{ occupancy August}}{2}$

²figures only available for July 1976

³1974, Otter Falls closed May 27 to July 25 due to wet conditions

⁴based on Administration Branch data due to field error

*1974-1976 data as reported by field staff

n.a. - not available

SOURCES : (Manitoba, 1970, 1971A, 1972A, 1973, 1974, 1975A, 1976).

and Big Whiteshell Lake Campgrounds in 1971; Brereton Lake, White Lake and Betula Lake in 1972; and White Lake, Betula Lake and Big Whiteshell Lake in 1974). This is a strong indicator of potential overuse in these campgrounds. Also, many of the seasonal campgrounds such as Falcon Lake and West Hawk Trailer Villages, and Dorothy Lake Campground have experienced nearly 100% occupancy since their origin. In a sense these statistics hide an important fact. Since the values represent the average for July and August, peak fluctuations which occur on weekends are hidden by the overall figure. For example, in 1976 the Lakeshore Campground had a 77% occupancy average, whereas in actual fact, the Overflow Campground was used on twelve days during this time (Manitoba, 1976). Thus, the average occupancy indicates that the campground is operating at only 77% of its capacity, when on weekends it is operating at 100% capacity. This is true of many of the campgrounds in the Whiteshell, and this extensive human use of the natural area provided the opportunity to study whether campers were confined to the campsites, or were actually spreading their effects into the natural environment beyond the sites.

Many of these campgrounds were not suitable for this research and a selection process took place to reduce the number of study units from fourteen campgrounds to four. Those showing signs of extensive deterioration such as the Beach, Betula Lake, Otter Falls, Toniata Beach and Big Whiteshell Campgrounds were eliminated because damage was so extensive that a temporal study of the effects of camping activities on the vegetation cover over one growing season would yield little, if any, significant results. Other campgrounds have been developed to the extremes of their boundaries and now appear to be

sandwiched between a road and a lake. Brereton Lake and White Lake Campgrounds were eliminated for this reason. West Hawk and Caddy Lake Campgrounds were also eliminated because the area where people could wander was well-used, and site features such as large rock outcrops restricted any further spread of disturbance within these sites.

The campgrounds selected had to have a buffer zone of vegetation around the campsites so that the effects of campers near the sites could be studied. The design of each campground was also considered, as well as the physical characteristics of the site that could be comparable to the Black Lake Campground, further north. Falcon Lake's Lakeshore and Overflow Campgrounds, Lone Island Lake Campground in the central portion of the park, and Opapiskaw Campground in the northern part were selected as the four study units. These areas provide a variety of natural settings and have experienced differing intensities and duration of visitor usage in the past. They possess different campground designs and many aspects of impacts occurring in these areas were thought to be useful in the comparison with Black Lake Campground. The similarities and differences of the physical characteristics between these five recreational areas are listed in Table 2.

2.2 Description of Campgrounds and Relevé Locations

2.2.1 Falcon Lake - Lakeshore Campground

Falcon Lake is probably the most popular part of the Whiteshell Provincial Park. Located close to the Trans-Canada Highway (Fig.2), the area contains such modern facilities as a shopping centre, golf course, sports area and several campgrounds. The Beach and Lakeshore

TABLE 2 - SOME PHYSICAL CHARACTERISTICS OF THE FIVE CAMPGROUNDS USED IN THIS STUDY

Campground (Date Established)	Parent Material	Soil Name & Dominant Texture, Profile Type	Topography & Stoniness	Natural Drainage	Dominant Vegetation ¹
Falcon Lake - Lakeshore (1957)	granitic rock with stratified drift and peat deposits	Indian Bay Complex orthic and gleyed luvisols, orthic and gleyed podzols, organic soils	level to irregular, steeply sloping, slightly to extremely stony	good to poor	trembling aspen, white birch, balsam fir, white spruce
Falcon Lake - Overflow (1973)	15-76 centi- metres of fine sand over clay, loam to clay, till deposits	*Vassar Series (fine sand) Brunisolic Grey Luvisol (Bisequa Grey Wooded)	level to irregular, very gently sloping, stone-free to slightly stone-free	good (mod- erately well- drained)	trembling aspen
Lone Island Lake (1970)	*non-calcareous sandy glacial till and granitic bedrock, considerable bedrock outcrop	*Sandiland Series- degraded eutric brunisol on fine sands, Hunt Series- degraded eutric brunisol on sand and gravel, Telford Series- degraded eutric brunisol on stony sandy till, rock outcrop	*complex, gently sloping variable; non to very stony	*dominantly well- drained	jack pine, trembling aspen, white spruce, birch

...continued