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**SOIL CLASSIFICATION
and CHARACTERIZATION
for
SELECTED SITES in CYPRESS HILLS
PROVINCIAL PARK**

**by
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PREFACE

Five sites which have been subject to intensive recreational use for many years were selected in Cypress Hills Provincial Park. Soil profiles in the heavy-use areas and in adjacent non-use areas were described, and samples collected for analysis. The intent was to document any observable differences evident between soils in the heavy use and the non-use areas. The five sites selected were Ferguson Hill campground, Lodgepole campground, Spruce Coulee campground, Reesor Lake campground and a Reesor Lake day use area. This report presents the soil data compiled for the five sites.

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Mrs. Pal Foster typed and assisted in compiling and proof reading the report, while the soil chemical and physical analyses were determined by Messrs. A. Schwarzer and W. McKean.

Able field assistance was given by Mr. D. Skinner.

CHEMICAL AND PHYSICAL ANALYSES

Analytical data pertinent to soil classification and characterization is presented in Table 1. The following analyses were conducted, and a brief explanation of the significance of each is included.

1. Soil Reaction (pH)

This test measures soil acidity or alkalinity. Acid soils have pH values of 5.5 or less; decreasing pH values indicate increasing soil acidity. Neutral soils have pH values between 5.5 and 7.4; alkaline soils have pH values of 7.4 or more. Increasing pH values indicate increasing soil alkalinity. The best pH range for most crops in Alberta is 5.5 to 7.5.¹

¹ Alberta Soil and Feed Testing Laboratory, O.S. Longman Bldg. Edmonton

A Beckman model Zeromatic pH meter equipped with a glass and calomel electrode was used to determine pH. The pH in CaCl_2 was determined using a 1:1 0.01 M CaCl_2 solution to soil ratio (Peech 1965), and the pH in water was determined on a saturated soil paste (Doughty 1941).

2. Exchangeable Cations and Cation Exchange Capacity

The cation exchange capacity of a soil is a measure of the total amount of exchangeable cations that the soil can adsorb, and is an important factor influencing the fertility of a soil. The higher the exchange capacity, the greater is the ability of the soil to retain certain plant nutrients against the action of leaching. The capacity increases with increased clay and organic matter content, and is less in sandy soils.

The cation exchange capacity was determined by displacement of ammonium with sodium chloride (Chapman 1965). Exchangeable cations were extracted by the A.O.A.C. (1955) method and Na, K, Ca and Mg were determined by atomic absorption spectrophotometry.

3. Organic Carbon

The determination of organic carbon in soil is considered the best method of estimating the amount of organic matter. Generally it is assumed that soil organic matter contains 58 percent carbon, and that an estimate of organic matter is made by multiplying the amount of organic carbon by the factor 1.7.

Organic matter influences physical and chemical properties of soils far out of proportion to the small quantities contained therein (Brady 1974). It commonly accounts for at least half the cation exchange capacity of soils and is responsible, perhaps more than any other single factor, for the stability of soil aggregates.

Organic carbon was determined by dry combustion using an induction furnace (Allison *et al.* 1965) with a gasometric detection of evolved CO_2 (Leco Carbon Analyzer Model 577-100).

4. Calcium Carbonate Equivalent

This is a measure of the amount of free lime contained in the soil. Free lime may restrict nutrient availability to plants in the following ways:

- a) Deficiencies of available iron, manganese, copper or zinc may occur.
- b) Phosphate availability may be low due to the formation of complex and insoluble calcium phosphates.
- c) The uptake and utilization of boron may be hindered.
- d) The high pH in itself may be detrimental.

Free lime cannot be readily removed from the soil. The only practical way to counteract its effect is to increase soil organic matter content.

The calcium carbonate equivalent was determined by the inorganic carbon manometric method of Bascomb (1961).

5. Mechanical Analysis

The determination of sand, silt and clay sized particles (particle size distribution) in a soil sample allows the grouping of soils into textural classes as shown in Table 1. Where soil texture is known, approximations and estimates can be made of soil properties, such as permeability and moisture-holding capacity. In general, clay soils (those with 40 percent or more of clay sized particles) have high moisture-holding capacity and high cation exchange capacity, but often low permeability. Sandy soils on the other hand usually have low moisture-holding and cation exchange capacities, but high permeability.

Mechanical analysis was carried out by the pipette method of Kilmer and Alexander, as modified by Toogood and Peters (1953).

Table 1. Chemical and Physical Analyses of Soil Samples from Cypress Hills.

Map Unit	Site #	Horizon	Depth (cm)	pH CaCl ₂	pH H ₂ O	Exchangeable Cations meq/100g ¹				C.E.C. ² meq/100g	O.C. ³ %	CaCO ₃ equiv. %	Mechanical Analysis (% from fract. <2mm diam)			C.F. ⁴ %	Texture	
						Na	K	Ca	Mg				Sand	Silt	Clay		Lab det.	Field est.
16	12 UWK 510999 (beside Ferguson Hill camp-ground)	L-H	4-0	5.1	5.5	nd ⁵	nd	nd	nd	nd	30.1	nd	nd	nd	nd	0	nd	nd
		Ae	0-5	5.0	5.5	0.11	0.86	9.4	3.1	18.4	1.9	nd	48	34	18	0	L	L
		AB	5-25	4.8	5.2	0.05	1.0	11.6	4.8	22.5	0.88	nd	39	34	27	10	L-CL	SCL
		Bt	25-92	5.6	5.6	0.08	0.78	16.8	6.7	26.6	0.30	0.5	14	50	36	80	SiCL	vgv CL ⁶
16	12 UWK 510999 (Ferguson Hill camp-ground Heavy use area)	Aeh	0-5	5.5	6.1	0.07	0.75	6.9	1.8	12.8	1.8	nd	70	20	10	40	SL	gv LS
		AB	5-10	5.7	6.1	0.09	0.78	11.0	3.7	19.0	0.82	nd	50	25	25	80	SCL	vgv L
		Bt	10-72	4.8	5.2	0.06	0.88	16.0	4.8	30.2	0.51	0.3	12	50	38	80	SiCL	vgv CL
16	12 UWK 508997 (beside Lodgepole camp-ground)	L-H	7-0	5.4	5.7	nd	nd	nd	nd	nd	16.1	nd	nd	nd	nd	0	nd	nd
		Ae	0-10	5.1	5.7	0.04	0.65	4.6	1.4	9.9	1.4	nd	49	40	11	0	L	FSL
		Bt1	10-22	4.8	5.2	0.06	0.95	12.1	4.0	24.3	nd	nd	34	36	30	10	CL	CL
		Bt2	22-100	4.9	5.3	0.06	0.80	14.1	4.6	27.5	nd	0.2	30	37	33	30	CL	gv CL
16	12 UWK 508997 (Lodgepole camp-ground Heavy use area)	L-H	1-0	4.6	5.2	nd	nd	nd	nd	nd	11.8	nd	nd	nd	nd	0	nd	nd
		Ae	0-8	5.1	5.7	0.05	0.79	4.4	1.4	13.1	1.6	nd	47	40	13	0	L	L
		Bt1	8-38	4.7	5.2	0.07	0.93	12.0	5.0	26.4	0.5	nd	32	37	31	20	CL	gv CL
		Bt2	38-60	4.7	5.2	0.06	1.0	15.5	7.2	34.3	nd	nd	7	56	37	50	SiCL	vgv SiC
		BC	60-100	4.9	5.2	0.07	0.79	6.5	7.2	34.3	nd	0.1	nd	nd	nd	90	nd	vgv C
16	12 UWL 587030 (beside Spruce Coulee campground)	L-H	8-0	5.9	6.3	nd	nd	nd	nd	nd	24.1	nd	nd	nd	nd	0	nd	nd
		Ah	0-3	5.9	6.3	0.02	1.6	37.7	4.5	63.0	10.7	nd	11	64	25	70	SiL	vgv SiL
		Ahe	3-8	5.1	5.7	0.02	1.1	15.7	2.7	30.2	3.5	nd	14	64	22	70	SiL	vgv SiL
		Bt	8-44	5.1	5.5	0.03	1.3	14.7	3.9	31.9	1.0	nd	11	54	35	70	SiCL	vgv SiCL
		IIBC	44-100	5.2	5.4	0.10	0.84	28.0	9.0	50.7	nd	0.2	4	41	55	10	SiC	SiC

¹ meq/100g = milliequivalents/100 gm soil

² C.E.C. = cation exchange capacity

³ O.C. = organic carbon

⁴ C.F. = coarse fragments (>2 mm diam) (field estimate)

⁵ nd = not determined

⁶ gv = gravelly, vgv = very gravelly

Table 1. (continued)

Map Unit	Site #	Horizon	Depth (cm)	pH CaCl ₂	pH H ₂ O	Exchangeable Cations ¹				C.E.C. ² meq/100g	O.C. ³ %	CaCO ₃ equiv. %	Mechanical Analysis (% from fract <2mm diam)			% ⁴ C.F.	Texture	
						Na	K	Ca	Mg				Sand	Silt	Clay		Lab Det.	Field est.
16	12 UWL 587030 (Spruce Coulee campground: heavy use area)	Ahe	0-9	5.6	6.0	0.03	1.4	24.3	3.8	43.7	5.9	nd ⁶	13	58	29	40	SiCL	gv SiL
		Bt	9-58	5.3	5.7	0.05	0.76	22.9	5.7	40.2	0.51	nd	17	39	44	60	C	vgv SiCL
		IIBC	58-70	5.7	6.6	0.07	0.67	26.8	7.2	43.7	nd	0.2	12	38	50	10	C	SiC
		IICca	70-100	7.2	7.7	nd	nd	nd	nd	nd	nd	9.8	6	42	52	10	SiC	SiC
15	12 UWL 649007 (beside Reesor Lake campground)	Ah	0-18	6.9	7.4	0.01	0.97	45.3	8.3	6.3	7.3	nd	25	45	30	0	CL	L
		AB	18-25	7.0	7.4	0.12	0.95	39.4	8.8	57.8	4.2	nd	13	44	43	0	SiC	SiCL
		Bmg	25-50	7.3	7.8	nd	nd	nd	nd	nd	0.44	2.8	59	24	17	0	SL	SL
15	12 UWL 649007 (Reesor Lake campground: heavy use area)	Ah	0-13	6.6	7.1	0.13	1.2	24.9	9.4	41.9	4.0	nd	23	49	28	0	CL	L
		Bm	13-43	7.3	7.7	nd	nd	nd	nd	nd	0.76	2.8	42	35	23	0	L	L
		Ckg1	43-55	7.5	7.9	nd	nd	nd	nd	nd	nd	3.8	47	32	21	0	L	SL
1	12 UWL 642019 (Reesor Lake day use area: moderately grazed)	Ah	0-10	7.2	7.6	nd	nd	nd	nd	nd	8.0	nd	9	48	43	5	SiC	SiL
		Bmk	10-30	7.5	7.9	nd	nd	nd	nd	nd	1.8	16.6	5	49	46	5	SiC	SiCL
		Cca	30-100	7.6	8.2	nd	nd	nd	nd	nd	nd	24.9	3	57	40	5	SiCL-SiC	CL
1	12 UWL 642019 (Reesor Lake day use area: heavy use area-parking)	Ah	0-10	7.3	7.7	nd	nd	nd	nd	nd	5.2	nd	10	47	43	5	SiC	SiL
		Bmk	10-30	7.5	7.9	nd	nd	nd	nd	nd	3.0	8.8	9	48	43	5	SiC	SiCL
		Cca	30-100	7.7	8.1	nd	nd	nd	nd	nd	nd	11.9	23	43	34	5	CL	SiCL

1 meq/100g = milliequivalents/100 gm soil

2 C.E.C. = cation exchange capacity

3 O.C. = organic carbon

4 C.F. = coarse fragments (>2 mm diam) (field estimate)

5 nd = not determined

6 gv = gravelly, vgv = very gravelly

SOIL PROFILE DESCRIPTIONS

Beside Ferguson Hill Campground

Map Unit: 16 (Greenlee 1978)
Classification: Orthic Gray Luvisol
Date sampled: 21 September, 1978
Location: NW13-8-3-4, 12 UWK 510999. The sampling site was located 35 feet south of the southern edge of the paved road at the southern end of the campground, and 70 feet east of the eastern side of the main north-south paved road which passes the western side of the campground.

Parent material: moderately fine textured very gravelly and cobbly fluvial sediments

Landform: inclined fluvial (Fi)

Relief: about 4 m over a frequency of about 100 m

Slope and topography class: about 4% (C)

Slope range: 2 to 5%

Elevation: about 1310 m

Aspect: north

Erosion: nil

Surface stoniness: non-stony (0)

Estimated drainage: well drained

Vegetation: about 70% tree cover with lodgepole pine (*Pinus contorta* var. *latifolia*) (65%) and white spruce (*Picea glauca*) (5%); about 30% shrub cover with Canadian buffalo-berry (*Shepherdia canadensis*), wild rose (*Rosa* sp.), saskatoon-berry (*Amelanchier alnifolia*) and others; about 60% herb cover with twinflower (*Linnaea borealis* var. *americana*), pea vine (*Lathyrus*

ochroleucus), *Aster* sp., wild strawberry (*Fragaria* sp.) and others; and about 60% grass cover (various species).

Profile description:

<u>Horizon</u>	<u>Depth (cm)</u>	<u>Description</u>
L-H	4-0	Very fragile, consists dominantly of pine needles; few, fine to coarse, horizontal roots; highly porous; abrupt, smooth boundary; acid.
Ae	0-5	Dark brown (10YR 4/3 m) loam; amorphous; very friable, moist; few, fine to coarse, horizontal roots: moderately porous; clear, smooth boundary; acid.
AB	5-25	Yellowish brown (10YR 5/6 m) loam to clay loam; weak, fine subangular blocky; friable, moist; few, very fine to medium, oblique roots; moderately porous; estimated gravelly coarse fragments about 10%; gradual, wavy boundary; acid.
Bt	25-92	Yellowish brown (10YR 5/6 m) very gravelly silty clay loam; moderate, medium subangular blocky; firm, moist; very few, micro to medium, oblique roots; slightly porous; estimated gravelly and cobbly coarse fragments about 80%; neutral.

Comments: Samples were not collected below the 92 cm depth due to the difficulty in digging the gravel.

Within Ferguson Hill Campground

Map Unit: 16
Classification: Orthic Gray Luvisol
Date Sampled: 21 September, 1978

Location: NW 13-8-3-4, UWK 510999. The sampling site was located 140 feet northeast (30° east of north) of the previous sampling site.

Parent Material : moderately fine textured very gravelly and cobbly fluvial sediments

Landform: inclined fluvial (Fi)

Relief: about 4 m over a frequency of about 100 m

Slope and topography class: about 4% (C)

Slope range: 2 to 5%

Elevation: about 1310 m

Aspect: 20° west of north

Erosion: slight - the L-H horizon has been destroyed

Surface stoniness: exceedingly stony (4)

Estimated drainage: well drained

Vegetation: about 70% tree cover with lodgepole pine (*Pinus contorta* var. *latifolia*) (65%) and white spruce (*Picea glauca*) (5%).

Profile description:

<u>Horizon</u>	<u>Depth (cm)</u>	<u>Description</u>
Aeh	0-5	Dark grayish brown (10YR 4/2 m) gravelly sandy loam; amorphous; loose, moist; few, very fine to coarse, horizontal roots; highly porous; estimated gravelly coarse fragments about 40%; clear, smooth boundary; acid.
AB	5-10	Yellowish brown (10YR 5/4 m) very gravelly sandy clay loam; weak, fine subangular blocky; friable, moist; very few, very fine to coarse, horizontal roots; moderately porous; estimated gravelly and cobbly coarse fragments about 80%; gradual, wavy boundary; neutral.

Bt 10-72 Yellowish brown (10YR 5/4 m) very gravelly silty clay loam; moderate, medium subangular blocky; firm, moist; very few, micro to fine, oblique roots; slightly porous; estimated gravelly and cobbly coarse fragments about 80%; acid.

Comments: (1) Samples were not collected below the 72 cm depth due to the difficulty in digging the gravel.

(2) This site has been severely worn down by human foot traffic. The understory vegetation and L-H horizon have been completely destroyed and no longer exist.

Beside Lodgepole Campground

Map Unit: 16
Classification: Orthic Gray Luvisol
Date sampled: 27 September 1978.
Location: NW 13-8-3-4, 12 UWK 508997. The sampling site was located 60 feet southwest (40° west of south) of the southern edge of the paved entrance road leading into the campground, and 35 feet northwest (40° north of west) of the western edge of the main north-south paved road which passes the eastern side of the campground.
Parent material: moderately fine textured gravelly to cobbly till.
Landform: inclined morainal (Mi)
Relief: about 6 m over a frequency of about 100 m
Slope and topography class: about 6% (D)
Slope range: 5 to 9%
Elevation: about 1335 m
Aspect: 40° east of north

Erosion: nil

Surface stoniness: non-stony (0)

Estimated drainage: well drained

Vegetation: about 80% tree cover with lodgepole pine (*Pinus contorta* var. *latifolia*) (75%), white spruce (*Picea glauca*) (3%) and aspen (*Populus tremuloides*) (2%); about 20% shrub cover with Canadian buffalo-berry (*Shepherdia canadensis*) (15%) and wild rose (*Rosa* sp.) (5%); about 80% herb cover with twinflower (*Linnaea borealis* var. *americana*), wild lupine (*Lupinus* sp.) pea vine (*Lathyrus ochroleucus*), wild vetch (*Vicia* sp.) and others; and about 70% grass cover (various species).

Profile description:

<u>Horizon</u>	<u>Depth (cm)</u>	<u>Description</u>
L-H	7-0	Matted root and leaf litter; plentiful, very fine to coarse, horizontal roots; highly porous; abrupt, smooth boundary; acid.
Ae	0-10	Grayish brown (10YR 5/2 m) loam; weak, fine platy; very friable, moist; plentiful, micro to medium, oblique roots; moderately porous; clear, wavy boundary; acid.
Bt1	10-22	Yellowish brown (10YR 5/4 m) clay loam; moderate, medium and coarse subangular blocky; firm, moist; few, micro to medium, oblique roots; slightly porous; estimated gravelly coarse fragments about 10%; gradual, wavy boundary; acid.

Bt2 22-100 Yellowish brown (10YR 5/4 m) gravelly clay loam; strong, coarse subangular blocky; very firm, moist; very few, micro to medium, oblique roots; slightly porous; estimated gravelly to cobbly coarse fragments about 30%; acid.

Within Lodgepole Campground

Map Unit: 16

Classification: Orthic Gray Luvisol

Date sampled: 27 September 1978

Location: NW 13-8-3-4, 12 UWK 508997. The sampling site was located 200 feet southwest (40° west of south) of the southern edge of the paved entrance road leading into the campground and 150 feet northwest (40° north of west) of the western edge of the main north-south paved road which passes the eastern side of the campground.

Parent material: moderately fine textured very gravelly and cobbly till

Landform: inclined morainal (Mi)

Relief: about 5 m over a frequency of about 100 m

Slope and topography class: about 5% (C)

Slope range: about 5 to 9%

Elevation: about 1335 m

Aspect: 60° east of north

Erosion: slight

Surface stoniness: non-stony (0)

Estimated drainage: well drained

Vegetation :

about 70% tree cover with lodgepole pine (*Pinus contorta* var. *latifolia*) (65%) and white spruce (*Picea glauca*) (5%); about 1% shrub cover with Canadian Buffalo-berry (*Shepherdia canadensis*); about 1% herb cover with twinflower (*Linnaea borealis* var. *americana*); and about 1% grass cover (various species).

Profile description:

<u>Horizon</u>	<u>Depth (cm)</u>	<u>Description</u>
L-H	1-0	Very fragile leaf litter, consists dominantly of pine needles; few, very fine to coarse, horizontal roots; highly porous; abrupt, smooth boundary; acid.
Ae	0-8	Pale brown (10YR 6/3 m) loam; weak, fine platy; very friable, moist; moderately porous; clear, wavy boundary; acid.
Bt1	8-38	Yellowish brown (10YR 5/4 m) gravelly clay loam; moderate, medium subangular blocky; firm, moist; very few, very fine to coarse, oblique roots; slightly porous; estimated gravelly and cobbly coarse fragments about 20%; gradual, wavy boundary; acid.
Bt2	38-60	Yellowish brown (10YR 5/4 m) very gravelly silty clay loam; strong, medium subangular blocky; very firm, moist; very few, very fine to medium, oblique roots; slightly porous; estimated gravelly and cobbly coarse fragments about 50%; clear, wavy boundary; acid.
BC	60-100	Yellowish brown (10YR 5/6 m) very gravelly clay (field texture); amorphous; very firm, moist; slightly porous; estimated gravelly and cobbly coarse fragments about 90%; acid.

Comments: This site has been extensively worn down by human foot traffic. Most of the understory vegetation and L-H horizon have been worn away.

Beside Spruce Coulee Campground

Map Unit: 16
Classification: Dark Gray Luvisol
Date sampled: 27 September 1978
Location: NE 27-8-2-4, 12 UWL 587030. The sampling site was located 5 feet outside of the western side of the campground, 20 feet southeast (20° east of south) of the northwestern corner of the campground.
Parent material: moderately fine textured very gravelly fluvial sediments overlying fine textured till containing a high proportion of weathered shale.
Landform: fluvial veneer overlying hummocky morainal (Fv/Mh)
Relief: about 11 m over a frequency of about 100 m
Slope and topography class: about 11% (e)
Slope range: 10 to 15%
Elevation: about 1320 m
Aspect: 10° south of east
Erosion: nil
Surface stoniness: excessively stony (5)
Estimated drainage: well drained
Vegetation: about 90% tree cover with aspen (*Populus tremuloides*), lodgepole pine (*Pinus contorta* var. *latifolia*) and white spruce (*Picea glauca*); about 60% shrub cover with wild rose (*Rosa* sp.), wild red raspberry (*Rubus* sp.) buckbrush (*Symphoricarpos occidentalis*), willow (*Salix* sp.) and others;

about 70% herb cover with bunchberry (*Cornus canadensis*), common pink wintergreen (*Pyrola asarifolia*), wild strawberry (*Fragaria* sp.), wild vetch (*Vicia* sp.), pea vine (*Lathyrus ochroleucus*), western meadow rue (*Thalictrum occidentale*) and others; and about 50% grass cover (various species).

Profile description:

<u>Horizon</u>	<u>Depth (cm)</u>	<u>Description</u>
L-H	8-0	Leaf litter; plentiful, very fine to coarse, horizontal roots; highly porous; clear, smooth boundary; neutral.
Ah	0-3	Black (10YR 2/1 m) very gravelly silt loam; strong, medium granular; very friable, moist; plentiful, very fine to coarse, horizontal roots; moderately porous; estimated cobbly and gravelly coarse fragments about 70%; clear, wavy boundary; neutral.
Ahe	3-8	Dark grayish brown (10YR 4/2 m) very gravelly silt loam; weak, medium platy; very friable, moist; plentiful, very fine to coarse, horizontal roots; moderately porous; estimated cobbly and gravelly coarse fragments about 70%; clear, wavy boundary; acid.
Bt	8-44	Dark grayish brown (10YR 4/2 m) very gravelly silty clay loam; strong, medium subangular blocky; firm, moist; few, micro to coarse, horizontal and oblique roots; slightly porous; estimated cobbly and gravelly coarse fragments about 70%; gradual, wavy boundary; acid.

IIBC 44-100 Pockets of brown (10YR 5/3 m) light brownish gray (2.5Y 6/2 m) and weak red (10R 5/4 m) silty clay; strong, medium and coarse subangular blocky; very firm, moist; very few, micro to medium, oblique roots; slightly porous; estimated gravelly and cobbly coarse fragments about 10%; acid.

Within Spruce Coulee Campground

Map Unit: 16
Classification: Dark Gray Luvisol
Date sampled: 28 September 1978
Location: NE 27-8-2-4, 12 UWL 587030. The sampling site was located about 100 feet southeast (60° east of south) of the northwestern corner of the campground.
Parent material: fine textured cobbly gravelly till, overlying fine textured till containing a high proportion of weathered shale.
Landform: hummocky morainal (Mh)
Relief: about 15 m over a frequency of about 100 m
Slope and topography class: about 15% (e)
Slope range: 10 to 15%
Elevation: about 1320 m
Aspect: 40° west of north
Erosion: slight
Surface stoniness: exceedingly stony (4)
Estimated drainage: well drained
Vegetation: about 70% tree cover with aspen (*Populus tremuloides*), lodgepole pine (*Pinus contorta* var. *latifolia*) and white spruce (*Picea glauca*).

Profile description:

<u>Horizon</u>	<u>Depth (cm)</u>	<u>Description</u>
Ahe	0-9	Dark grayish brown (10YR 4/2 m) gravelly silty clay loam; weak, medium platy; firm, moist; very few, very fine and fine, horizontal; and plentiful, medium and coarse, horizontal roots; slightly porous; estimated gravelly and cobbly coarse fragments about 40%; clear, wavy boundary; neutral.
Bt	9-58	Yellowish brown (10YR 5/4 m) very gravelly clay; strong, medium subangular blocky; very firm, moist; very few, micro to medium, oblique roots; slightly porous; estimated cobbly and gravelly coarse fragments about 60%; clear, wavy boundary; acid.
IIBC	58-70	Grayish brown (2.5Y 5/2 m), with pockets of weak red (10R 4/4 m) and bands of dark gray (10YR 4/1 m) clay; strong, fine subangular blocky; very firm, moist; very few, micro; and very fine, oblique roots; slightly porous; estimated cobbly and gravelly coarse fragments about 10%; abrupt, wavy boundary; neutral.
IICca	70-100	Grayish brown (2.5Y 5/2 m), with pockets of weak red (10R 4/4 m) and bands of dark gray (10YR 4/1 m) silty clay; strong, fine subangular blocky; very firm, moist; very few, micro, oblique roots; slightly porous; strong effervescence; estimated cobbly and gravelly coarse fragments about 10%; neutral.

Comments: The understory vegetation and L-H horizon have been completely destroyed by foot traffic at this site, and numerous bare tree roots are exposed on the soil surface. The surface Ahe horizon appears very compacted and dense.

Beside Reesor Lake Campground

Map Unit: 15
Classification: Gleyed Dark Gray Chernozemic
Date sampled: 28 September, 1978
Location: SE 20-8-1-4, 12 UWL 649007. The sampling site was located east of the campground, 55 feet east of the fence along the eastern side of the campground, at a point situated 40 feet southeast (30° south of east) and 80 feet south of the southeastern edge of the Texas gate at the campground entrance.
Parent material: moderately coarse textured to fine textured fluvial sediments, overlying very coarse textured fluvial sediments (gravel).
Landform: level fluvial (FI)
Relief: about 2 m over a frequency of about 100 m
Slope and topography class: about 2% (b)
Slope range: 0.5 to 2%
Elevation: about 1235 m
Aspect: 10° north of west
Erosion: nil
Surface stoniness: nonstony (0)
Estimated drainage: moderately well (surface) to imperfectly (internal) drained

Vegetation:

about 60% tree cover with balsam poplar (*Populus balsamifera*), white spruce (*Picea glauca*) and aspen (*Populus tremuloides*); about 50% shrub cover with willow (*Salix* sp.), wild rose (*Rosa* sp.), wild red raspberry (*Rubus* sp.), wild gooseberry (*Ribes oxycanthoides*), dogwood (*Cornus stolonifera*), buckbrush (*Symphoricarpos occidentalis*) and others; about 30% herb cover with horsetail (*Equisetum* sp.), cow parsnip (*Heracleum lanatum*), western Canada violet (*Viola rugulosa*), western meadow rue (*Thalictrum occidentale*), alsike clover (*Trifolium hybridum*), common yarrow (*Achillea millefolium*) and others; and about 15% grass cover (various species).

Profile description:

<u>Horizon</u>	<u>Depth (cm)</u>	<u>Description</u>
L	0.5 -0	Undecomposed organic litter (leaves, small stems, and so on); highly porous; abrupt, smooth boundary; (not sampled).
Ah	0-18	Intermixed pockets of very dark gray (5YR 3/1 m) and brown (10YR 5/3 m) clay loam; strong, medium and coarse granular; very friable, moist; plentiful, very fine to coarse, horizontal and oblique roots; moderately porous; clear, wavy boundary; neutral.
AB	18-25	Intermixed pockets of very dark brown (10YR 2/2 m) and dark grayish brown (10YR 4/2-5/3 m) silty clay; strong, fine subangular blocky; friable, moist; few, very fine to coarse, oblique roots; slightly porous; abrupt, wavy boundary; neutral.

Bmg	25-50	Grayish brown (2.5Y 5/2 m) sandy loam; many, medium and coarse, prominent, reddish brown (5YR 4/4 m) mottles; moderate, fine platy; very friable, moist; very few, micro to coarse, oblique roots; moderately porous; abrupt, wavy boundary; neutral.
BCg	50-100	Gravel; highly porous; estimated gravelly and cobbly coarse fragments 100%; (not sampled).

Comments: A high incidence of earthworm activity appears evident in the Ah and AB horizons.

Within Reesor Lake Campground

Map Unit :	15
Classification:	Gleyed Dark Gray Chernozemic
Date sampled:	29 September 1978
Location:	SE 20-8-1-4, 12 UWL 649007. The sampling site was located 200 feet south of the southwestern edge of the Texas gate at the campground entrance.
Parent material:	medium to moderately fine textured fluvial sediments, overlying very coarse textured fluvial sediments (gravel).
Landform:	level fluvial (FI)
Relief:	about 2 m over a frequency of about 100 m
Slope and topography class:	about 2% (b)
Slope range:	0.5 to 2%
Elevation:	about 1235 m
Aspect:	40° east of north
Erosion:	slight
Surface stoniness:	nonstony (0)
Estimated drainage:	moderately well drained.

Vegetation:

about 70% tree cover with balsam poplar (*Populus balsamifera*) and aspen (*Populus tremuloides*); about 5% shrub cover with wild rose (*Rosa* sp.) and willow (*Salix* sp.); about 20% herb cover with common dandelion (*Taraxacum officinale*), aster (*Aster* sp.), common yarrow (*Achillea millefolium*) and others; and about 10% grass cover with fescue (*Festuca* sp.), bluegrass (*Poa* sp.) and others.

Profile description:

<u>Horizon</u>	<u>Depth (cm)</u>	<u>Description</u>
Ah	0-13	Intermixed pockets of dark grayish brown (10YR 4/2 m) and very dark brown (10YR 2/2 m) clay loam; moderate, medium and coarse granular; very friable, moist; very few, micro to fine, oblique; and few, medium and coarse, horizontal roots; moderately porous; gradual, wavy boundary; neutral.
Bm	13-43	Grayish brown (10YR 5/2 m) loam; amorphous breaking to weak, medium subangular blocky; very friable, moist; very few, micro to medium, oblique roots; moderately porous; clear, wavy boundary; neutral.
Ckg1	43-55	Brown (10YR 5/3 m) loam; common, medium, prominent, red (2.5 YR 4/8 m) mottles; amorphous; very friable, moist; very few, micro to fine, oblique roots; moderately porous; weak effervescence; abrupt, wavy boundary; alkaline.
Ckg2	55+	Gravel (field texture); weak effervescence; estimated gravelly and cobbly coarse fragments 100% (this horizon was not sampled).

Comments: (1) This site has been severely worn down by human foot traffic and the natural understory completely destroyed. The soil surface is hard and has a baked appearance.

(2) A high incidence of earthworm activity is evident in the Ah horizon.

Reesor Lake Day Use Area, Northeast Shore - moderately grazed

Map Unit:	1
Classification:	Calcareous Dark Brown Chernozemic.
Date sampled:	29 September 1978
Location:	NW 20-8-1-4, 12 UWL 642019. The sampling site was a road cut located one quarter of a mile southeast of the northwestern end of the lake, on the northeastern side of the paved road that parallels the northeastern shore. Also the sampling site was 200 feet northwest of the point where a trail, leading off to the northwest (30° west of north), intersects the road.
Parent material:	moderately fine to very fine textured till
Landform:	hummocky morainal (Mh)
Relief:	about 15 m over a frequency of about 100 m
Slope and topography class:	about 15% (e)
Slope range:	10 to 30%
Elevation:	about 1325 m
Aspect:	30° south of west
Erosion:	nil
Surface stoniness:	nonstony (0)
Estimated drainage:	well drained

Vegetation:

about 10% shrub cover with buckbrush (*Symphoricarpos occidentalis*), wild rose (*Rosa* sp.) and shrubby cinquefoil (*Potentilla fruticosa*); also occurring in the vicinity are numerous clumps of hawthorn (*Crataegus douglasii*), saskatoon-berry (*Amelanchier alnifolia*), willow (*Salix* sp.), wild rose and buckbrush; about 60% herb cover with pasture sagewort (*Artemisia frigida*), cut-leaved anemone (*Anemone multifida*), wild lupine (*Lupinus* sp.), golden bean (*Thermopsis rhombifolia*), wild blue flax (*Linum lewisi*), northern bedstraw (*Galium boreale*), loco-weed (*Oxytropis* sp.), common yarrow (*Achillea millefolium*), bull thistle (*Cirsium vulgare*) and others; and about 70% grass cover (various species).

Profile description;

<u>Horizon</u>	<u>Depth (cm)</u>	<u>Description</u>
Ah	0-10	Very dark grayish brown (10YR 3/2 m) silty clay; strong, medium granular; friable, moist; plentiful, micro to fine, vertical; and few, medium, oblique roots; moderately porous; estimated angular gravelly coarse fragments about 5%; clear, wavy boundary; neutral.
Bmk	10-30	Very dark gray (10YR 3/1 m) silty clay; moderate, medium prismatic breaking to strong, fine subangular blocky; friable, moist; few, micro to medium, oblique roots; moderately porous; moderate effervescence; estimated angular gravelly coarse fragments about 5%; clear, wavy boundary; alkaline.

Cca 30-100 Yellowish brown (10YR 5/4 m) silty clay loam to silty clay; amorphous breaking to weak, medium subangular blocky; firm, moist; very few, micro to medium, oblique roots; slightly porous; strong effervescence; estimated angular gravelly coarse fragments about 5%; alkaline.

Reesor Lake Day Use Area, Northeast Shore - heavy use area (parking)

Map Unit: 1
Classification: Calcareous Dark Brown Chernozemic
Date sampled: 29 September, 1978.
Location: NW 20-8-1-4, 12 UWL 642019. The sampling site was located 175 feet southwest (30° west of south) of the previous sampling site, 50 feet from the lakeshore.

Parent material: moderately fine textured till
Landform: hummocky morainal (Mh)
Relief: about 13 m over a frequency of about 100 m

Slope and topography class: about 13% (e)
Slope range: 10 to 30%
Elevation: about 1235 m
Aspect: 10° south of west
Erosion: moderate (severe on some roadways - gullying)

Surface stoniness: nonstony (0)
Estimated drainage: well drained
Vegetation: occurring in the vicinity are numerous clumps of hawthorn (*Crataegus douglasii*),

saskatoon-berry (*Amelanchier alnifolia*), wolf willow (*Elaeagnus commutata*), wild rose (*Rosa* sp.) and buckbrush (*Symphoricarpos occidentalis*); about 10% herb cover with a few unidentified weedy species; and about 60% grass cover (various species).

Profile description:

<u>Horizon</u>	<u>Depth (cm)</u>	<u>Description</u>
Ah	0-10	Very dark grayish brown (10YR 3/2 m) silty clay; strong, medium granular; friable, moist; few, micro to fine, vertical and oblique roots; moderately porous; estimated angular gravelly coarse fragments about 5%; clear, wavy boundary; neutral.
Bmk	10-30	Dark brown (10YR 3/3 m) silty clay; moderate, medium prismatic breaking to strong, fine subangular blocky; friable, moist; very few, micro to very fine, oblique roots; moderately porous; moderate effervescence; estimated angular gravelly coarse fragments about 5%; clear, wavy boundary; alkaline.
Cca	30-100	Yellowish brown (10YR 5/4 m) clay loam; amorphous breaking to weak, medium, subangular blocky; firm, moist; very few, micro to very fine, oblique roots; slightly porous; strong effervescence; estimated angular gravelly coarse fragments about 5%; alkaline.

Comments: The soil surface at this site has been compacted from vehicular traffic and the vegetation severely damaged.

CONCLUDING REMARKS

The only significant difference evident from field profile descriptions between soils in non-use and heavy use areas was the severely compacted condition of the surface 5 cm in three heavy use areas. The three sites were Spruce Coulee campground, Reesor Lake campground and the Reesor Lake day use area. This condition causes reduced aeration for plant roots and a decrease in moisture infiltration rates; thus increasing surface runoff and the risk of soil erosion .

An obvious drastic decrease in understory vegetation was evident between the non-use and heavy use areas at all five sites. This condition was substantiated by much lower numbers of plant roots present in surface soil horizons of heavy use areas than in non-use areas at four of the five sites. The exception was Ferguson Hill campground.