

**Analysis of Five Years
of Soil Data from the
AESAs Soil Quality
Benchmark Sites**

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ABSTRACT

The Alberta Environmentally Sustainable Agriculture (AESAs) Soil Quality Monitoring program established a series of Benchmark Monitoring Sites in 1998 in order to provide a cross validation dataset to test and validate simulation modeling, provide baseline soil information, determine landscape and soil quality variability and to monitor changes in soil quality over time. This report examines the first five years of data from this Benchmark Monitoring program, with the objective of examining the database for integrity, conducting statistical analyses to examine variation and trends soil properties with respect to ecoregion, sites, landforms and management practices. Relatively few significant differences were found in soil properties among ecoregions. Among the ecoregions, differences in organic matter (OM), light fraction (LF_{mass}), Hot KCl NH₄-N, K, clay and cation exchange capacity (CEC) were observed. Relatively small differences among slope positions were often found to be significant. Significant differences were found between slope positions for pH_w, pH_c, NO₃-N, P, K, S, OM, Hot KCl NH₄-N, bulk density (BD) and clay content. No significant effects of cropping system or tillage on soil properties were identified. Mean coefficient of variation in soil properties at each of the sites within ecoregion and slope position was highest for NH₄-N, NO₃-N, S and LF_{mass}. Year to year variation in relatively stable soil properties (pH_w, EC, P, K and LF_{mass}) was highest in the PL and BT ecoregions and lowest in the FG and MB ecoregions. The variability of each sampling location (126) and benchmark site (42) was assessed. Overall, 18 % of the 126 sampling locations were classified as highly variable and 29 % were classified as moderately variable. The lowest percentage of variability occurred in the PL and BT ecoregions, while the highest occurred in the AP and MM Ecoregions. Nineteen percent of the sites were considered highly variable and 26 % were classified as moderately variable. Based on the results of the first five years of data, recommendations for future sampling and analyses were given.

1.0 INTRODUCTION

Recognition of the importance of soils to environmental management has generated numerous studies of the effects of ‘improved’ management practices on soil quality. In 1997, the AESA Soil Quality Monitoring Program was initiated to determine the state of soil quality across Alberta and to evaluate the change in soil quality under different environments and management practices. The objectives of establishing the AESA Soil Quality benchmark sites were to provide a cross validation dataset to test and validate simulation modeling, provide baseline soil information, determine landscape and soil quality variability and monitor changes in soil quality over time (Cannon and Leskiw, 1999).

Many factors influence soil quality, but a fixed set of parameters have not been established for its quantification. Changes in soil organic carbon (SOC) are often used as one of the indicators of changes in soil quality. Janzen et al. (1998) indicated that two main approaches have been used to evaluate C sequestration in response to changes in management:

1. Measurement of changes in SOC by repeated analysis over time;
2. Quantifying differences in SOC between a ‘new’ practice and a control (e.g., no-till vs. conventional tillage).

These types of studies have generally been conducted using randomized, replicated experiments that allow an estimate of measurement and sampling error. However, methodologies for monitoring soil quality on a field scale are not well established. Kucharik et al. (2003) stated that, “There is an urgent need to develop a more comprehensive field-level methodology to ensure that C pool changes can be detected with acceptable levels of precision”. Garten and Wullschleger (1999) state that, “measurement of variation or confidence limits are rarely reported in the literature”.

The approach used in this benchmark study was to monitor a wide range of soil properties over a large geographic area. The sites were selected to represent typical soil/landscapes and management practices for ecoregions, in the main agricultural areas throughout the province (Cannon, 2002 and Leskiw et al., 2000). Ecoregions and site locations are shown in Figure 1. Two unique features of this study are:

1. The province-wide sampling of the major agricultural ecoregions;
2. The landscape stratification of the sampling sites.

Changes are currently monitored by repeated measurements (annually) over time. Replicate samples are not taken (samples taken at the same time) because of the extensive nature of the study and thus the high cost. This will result in a longer period of time to identify significant trends because sampling and measurement error cannot be separated from changes occurring over time. Since the greatest source of error in soil testing is often that associated with sampling, minimizing sampling error needs to be an important aspect of this study.

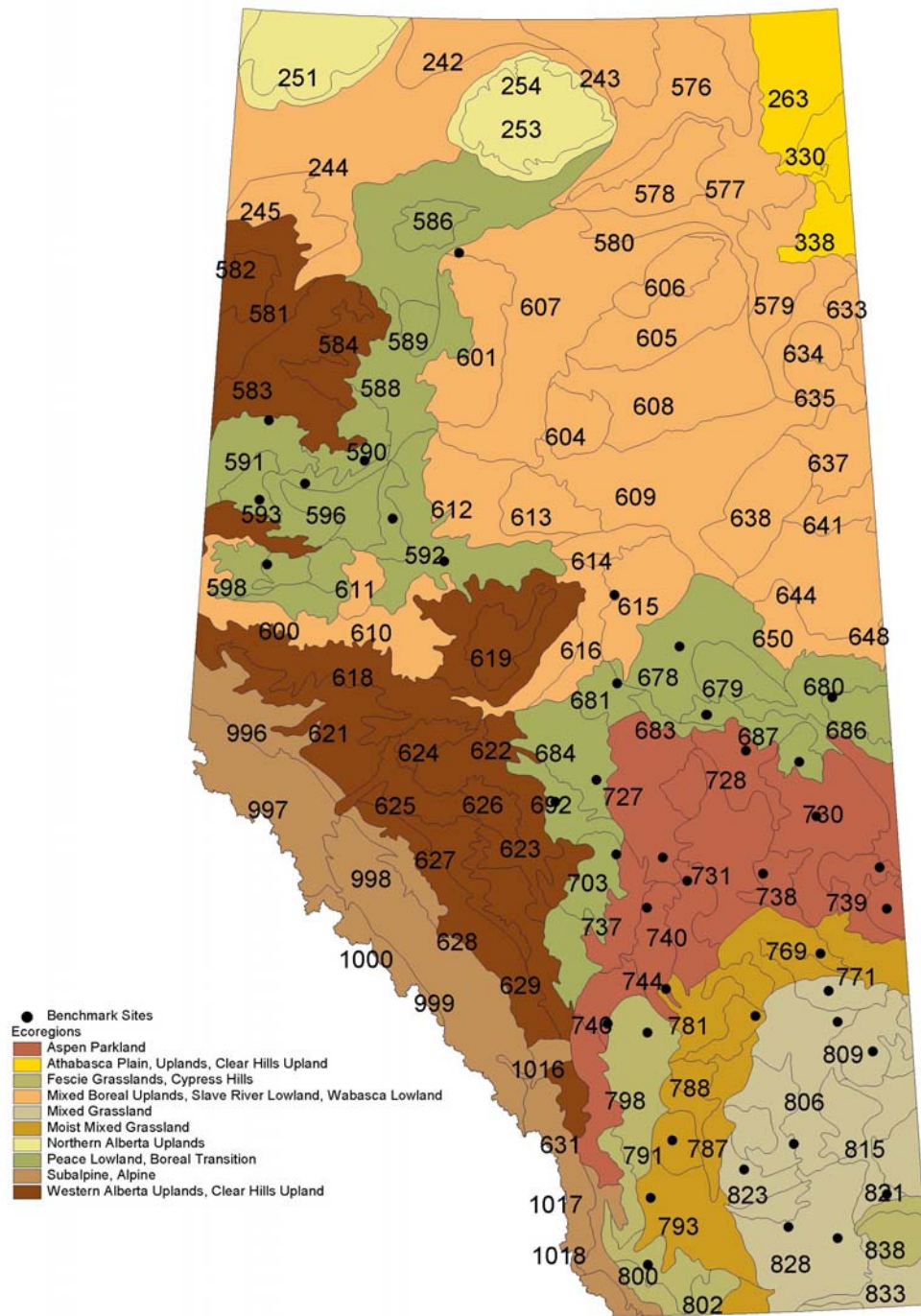


Figure 1. Location of 42 benchmark sites across Alberta.

This report examines the following aspects of the first five years of data from the Soil Quality Benchmark Program:

1. Variation in soil properties from year to year within sites to estimate when significant change could be determined.
2. Differences among ecoregions [Peace Lowland (PL), Mixed Boreal Uplands (MB), Boreal Transition (BT), Aspen Parkland (AP), Moist Mixed Grassland (MM), Fescue Grasslands (FG), and Mixed Grassland (MG)].
3. Differences among slope positions (upper, mid and lower slopes were sampled at each of the 42 benchmark sites).
4. Effects of management (cropping systems or tillage).

2.0 OBJECTIVES

The objectives of the soil-quality monitoring program as stated by Leskiw et al. (2000), were as follows:

“The soil quality monitoring program is designed to determine the state of soil quality across Alberta and to evaluate the change in soil quality under the influence of various management practices. The objectives of using benchmark sites are to: assess wind and water erosion; determine landscape and soil quality variables; and to monitor changes in soil quality over time”.

This report examines the data from the first five years of the study. The objectives were to:

1. Review the database (1998 to 2002) for data integrity;
2. Conduct various statistical analyses to examine variation and trends;
3. Examine yearly variation and trends of various soil properties with respect to ecoregion, site characteristics, landform and management practices.

3.0 METHODS

Data were examined from soil samples (0-15 cm and 15-30 cm) taken for fertility analysis. Soil samples were taken in the fall, after harvest, but before freeze-up and prior to fall fertilization. Composite samples of five to ten cores were collected within a radius of two meters from the central marker at each of the landscape positions (upper, mid and lower slope positions). The soil analyses included pH in water (pH_w), pH in CaCl₂ (pH_c), EC, free lime (CaCO₃), NO₃-N, NH₄-N, P, K, S, organic matter (OM), hot KCl extractable NH₄-N, bulk density (BD), light fraction mass (LF_{mass}), light fraction carbon (LFC) and light fraction nitrogen (LFN).

Descriptive statistical procedures [mean, max, min, standard deviation (SD) and coefficient of variation (CV)] were used for initial examination of the data and to evaluate yearly variation in soil properties at each sampling location (upper, mid and lower slope positions at the 42 benchmark sites). It was noted that the CVs of soil properties measured over the five-year period were much higher at some sites than at others. Therefore, the variability of sites and sampling locations was classified based on the CVs of relatively stable soil properties (pH, EC, P, K, and LF_{mass}).

Analysis of variance (General Linear Model procedure in SAS) was used to examine differences among ecoregions and slope positions. Years were treated as replicates and Student-Newman-Keuls was used for mean comparisons when the F test was significant ($p \leq 0.05$).

4.0 MAIN FINDINGS

4.1 Descriptive Statistics

Appendices 1 and 2 provide all of the data for the fourteen soil properties analyzed. Mean, max, min, SD and CV (%) values are shown for each ecoregion and the CV for each sampling location (site x 3 slope positions) over the five-year period.

4.2 Effect of Ecoregions, Slope Positions and Management Practices

4.2.1 Differences Among Ecoregions

There were relatively few significant differences in soil properties among the ecoregions, indicating that differences within ecoregions were often as large as between ecoregions (Table 1). Soil properties were averaged across all three landscape positions and corresponding sites for each ecoregion. There were no significant differences in pH_w, pH_c, EC, NH₄-N, NO₃-N, P, S, BD, and CaCO₃ between any of the ecoregions. OM, LF_{mass}, Hot KCl NH₄-N and CEC were lower in the MG Ecoregion than in the other ecoregions, but there were no differences among the other ecoregions. The low values for LF_{mass}, OM and CEC, and the high CaCO₃ value are characteristic of the MG Ecoregion (Brown Soil Zone). The relatively high BD in the MG Ecoregion would also be expected because of the low soil OM.

Other differences among ecoregions include:

1. Extractable K was lowest in the BT Ecoregion. It was significantly lower than in the MM, FG, and MG Ecoregions. This trend is consistent with summaries of routine soil test data for fertility evaluation.
2. OM was lower in the MG Ecoregion than in all other ecoregions, except MM.
3. LF_{mass} was highest in the FG Ecoregion and lowest in the MM Ecoregion.
4. Hot KCl NH₄-N is significantly lower in the MG than in the AP Ecoregion.
5. Clay (%) was highest in the PL Ecoregion, but only significantly different from the MM Ecoregion.
6. The PL Ecoregion had the highest CEC (significantly higher than MG). This is consistent with the high clay content of the sites in the PL Ecoregion.

The low BD, and high LF_{mass} and OM, in the MB Ecoregion, are uncharacteristic. The MB Ecoregion is represented by only one site. The upper slope position at this site has many values that are very atypical (the upper slope position is likely on an area where large amounts of straw or brush piles were burned). The MB site was removed from the dataset (because of high variability and having only one site in its respective ecoregion) before statistical analyses on ecoregions was determined. However, the descriptive analyses for the MB Ecoregion were still documented.

4.2.2 Differences Among Slope Positions

Analysis Of Variance (ANOVA) was used to identify differences in the five-year mean values for upper, mid and lower slope sampling positions. Significant differences among slope positions were observed for pHw, pHc, NO₃-N, P, K, S, OM, Hot KCl NH₄-N, BD and clay (Table 2). In this case, soil properties were averaged across all 42 sites. Generally, the lower slope position had significantly higher values of NO₃-N, P, K, S, OM, and Hot KCl NH₄-N when compared to the mid or upper slope positions. In contrast, BD values for the lower slope position were lower than those of the upper or mid slope position. Upper slope positions had significantly higher values of pHw and pHc than both the mid and lower slope positions. There were no significant differences among the three slope positions for EC, NH₄-N, LF_{mass}, CEC or CaCO₃.

In contrast to ecoregions where relatively large differences were not significant, relatively small differences among slope positions were often significant. For example, the mean pH of sites in the MG Ecoregion (7.3) was not significantly different from the MM Ecoregion (6.3), but the mean pH of upper slopes (6.7) was significantly higher than for the mid and lower slopes (6.5) [Tables 1 and 2]. The lack of significant differences in soil properties between ecoregions is in part a result of large variations in properties within ecoregions but it should also be noted that the statistical power for testing differences between slope positions is greater than between ecoregions. The magnitude of the difference required for statistical significance between ecoregions compared to slope positions is illustrated in Figures 2 to 5.

4.2.3 Effect Of Management

There were no significant effects of cropping system or tillage on the soil properties measured except that LF_{mass} was sometimes higher on tilled or annual cropping sites than on minimum or no-till sites or sites that included forages. This is opposite to what would be expected. The nature of this study does not provide for the comparison of management practices that are adjacent under the same soil and environmental conditions. Factors other than tillage, such as cropping systems and climate, can affect LF_{mass} (see comments under recommendations).

4.3 Variation In Soil Properties

Variability for soil properties at each of the sites within ecoregions and within slope positions was determined across all five years. As well, variability for each site within separate sampling years was determined across all ecoregions and slope positions. The mean coefficients of variation (CV) for NH₄-N, NO₃-N, S and LF_{mass} were higher than for pH, EC, P, K, OM, LFC, LFN, and BD (Table 3). The high variability of NH₄, NO₃, and SO₄ would be expected, since they can change rapidly due to mineralization, nitrification and crop removal. However, the high CV for LF_{mass} (45.6%) would not be expected. LF_{mass} consists of rapidly cycling organic matter derived from recent additions of crop residue, which may not be evenly distributed. Therefore, this could lead to large sampling errors. LF_{mass} is also affected by cropping systems, tillage and climate conditions but this should not result in large variations from year to year within a sampling location.

Table 1. Effect of ecoregions on some soil properties¹ (0-15 cm) averaged across all landscape positions for the past five years.

Eco-region	No. of sites	pH _w	pH _c	EC (dS/m)	NH ₄ -N (mg/kg)	NO ₃ -N (mg/kg)	P (mg/kg)	K (mg/kg)	S (mg/kg)	OM (%)	LF _{mass} (mgLFC/g)	Hot KCl NH ₄ -N (mg/kg)	BD (g/cm ³)	Clay (%)	CEC (meq/100g)	CaCO ₃ (%)
PL	9	6.6	5.8	0.58	1.48	15.4	23	256bc*	16.5	6.9a	7.0ab	34.9ab	1.29	36a	28.9a	0.74
MB	1	6.7	6.2	0.68	1.88	24.0	39	254	11.1	11.1	18.6	47.1	1.06	16	20.6	1.53
BT	8	6.4	5.7	0.45	1.84	7.7	17	188c	11.0	5.7a	7.2ab	32.4ab	1.33	26ab	24.1ab	0.77
AP	9	6.4	5.7	0.52	3.89	13.5	22	280bc	17.8	6.7a	7.4ab	39.6a	1.31	21ab	24.6ab	0.72
MM	5	6.3	5.6	0.49	1.68	13.2	26	348b	12.7	4.4ab	7.2ab	22.1bc	1.33	18b	18.0ab	0.70
FG	2	6.3	5.6	0.34	1.86	10.1	23	497a	6.0	6.5a	8.8a	32.9ab	1.29	29ab	26.1ab	0.70
MG	8	7.3	6.7	0.58	1.50	8.8	17	326b	12.3	2.4b	3.7b	15.6bc	1.47	24ab	15.7b	1.85

¹ pH_w, pH_c, EC, NH₄-N, NO₃-N, P, K, S, OM, LF_{mass}, Hot KCl NH₄-N, and BD sampled every year; clay, CEC, CaCO₃ sampled only in the establishment year.

*ecoregion means followed by the same letter are not significantly difference at $p \leq 0.05$.

Table 2. Effect of slope position on some soil properties¹ (0-15 cm) averaged across all sites for the past five years.

Slope Position	pH _w	pH _c	EC (dS/m)	NH ₄ -N (mg/kg)	NO ₃ -N (mg/kg)	P (mg/kg)	K (mg/kg)	S (mg/kg)	OM (%)	LF _{mass} (mgLFC/g)	Hot KCl NH ₄ -N (mg/kg)	BD (g/cm ³)	Clay (%)	CEC (meq/100g)	CaCO ₃ (%)
Upper	6.7a*	6.0a	0.55	2.28	10.5b	20b	264b	12.0b	4.6c	6.5	26.0c	1.38a	27a	23	1.10
Mid	6.5b	5.8b	0.48	2.29	11.6ab	18b	259b	10.1b	5.2b	6.6	30.4b	1.36a	25b	23	0.83
Lower	6.5b	5.8b	0.53	1.77	13.7a	26a	328a	19.3a	6.9a	7.6	34.9a	1.26b	26ab	25	0.88

¹ pH_w, pH_c, EC, NH₄-N, NO₃-N, P, K, S, OM, LF_{mass}, Hot KCl NH₄-N, and BD sampled every year; clay, CEC, CaCO₃ sampled only in the establishment year.

* slope position means followed by the same letter are not significantly different at $p \leq 0.05$

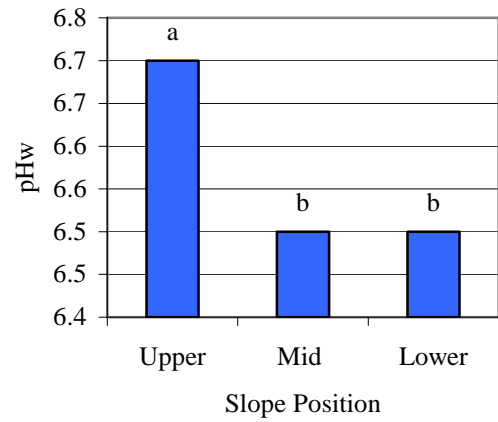


Figure 2. Effect of slope on pHw



Figure 3. Effect of slope on available P.

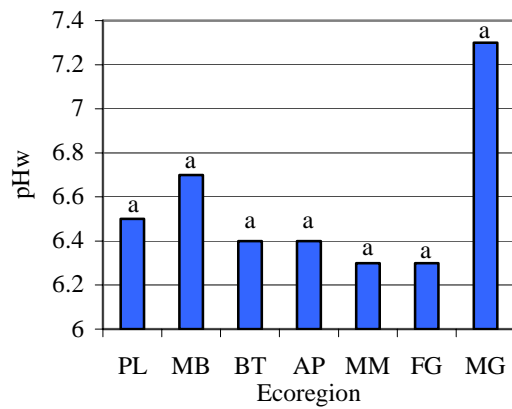


Figure 4. Effect of ecoregion on pHw.

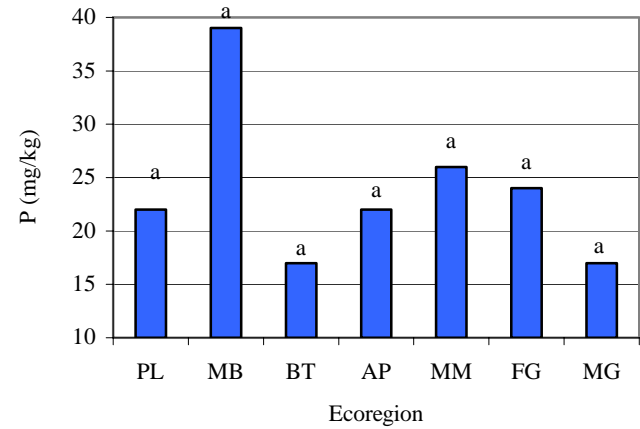


Figure 5. Effect of ecoregion on available P.

Some of the variation in LF_{mass} may also be a result of measurement error. The determination of LF_{mass} tends to be subject to greater laboratory error than is the case with other soil properties (Solberg, E., personal communication).

The variability of NO₃-N and LF_{mass} within each sampling year (Table 5) was lower than in the five-year data (Table 3). For example, the mean CV for NO₃-N was 66.6% for ecoregions, but only 41% within separate sampling years. This suggests that variability from year to year may reflect management and climate conditions as well as sampling error.

In a study in Wisconsin, Kucharik et al. (2003), using 14 paired sites (composite samples of 15 core from paired transects on cropped land and adjacent land in the Conservation Reserve Program for >8 years), found that C and N storage rates were highly variable among sites (CVs > 20%). Using a minimum detectable difference method (MDD), 40 to 65 paired sites and sampling in 5 cm increments near the surface were needed to achieve an 80% confidence level ($\alpha = 0.05$; $B = 0.20$) in C and N sequestration rates. Given these results and the relatively high CVs for OM and LF_{mass} in this study, the sampling intensity and methodology should be reviewed. The current methodology and analyses detected relatively small differences among slope positions but not among Ecoregions or management systems.

Table 3. Mean coefficient of variation (CV %) within ecoregions for 14 soil properties over a five-year period.

Eco-region	pHw	pHc	EC	NH ₄ -N	NO ₃ -N	P	K	S	OM	LFC	LF _{mass}	LFN	Hot KCl NH ₄ -N	BD
PL	3.1	3.2	31.4	79.7	59.2	16.6	20.0	49.6	6.1	16.1	54.9	16.0	23.1	9.7
MB	5.6	7.7	39.9	54.8	108.0	43.1	41.7	37.0	24.6	11.3	66.2	11.2	31.9	21.0
BT	3.1	4.5	33.3	65.9	70.0	21.0	21.6	55.4	15.1	15.7	36.7	16.6	28.5	10.0
AP	4.2	4.1	41.3	93.9	66.5	28.1	29.2	59.2	8.8	16.3	38.5	12.5	33.7	9.1
MM	4.5	4.3	33.1	79.7	67.8	29.5	20.2	56.9	10.9	18.3	48.7	17.8	24.6	12.2
FG	4.9	6.5	39.5	86.2	75.0	33.0	25.3	54.1	7.7	29.5	79.9	25.3	21.2	11.4
MG	3.5	5.8	28.8	94.9	64.0	30.5	25.8	49.2	11.1	28.1	38.9	26.5	28.2	9.7
Mean	3.7	4.0	34.2	82.7	66.6	25.5	24.4	53.5	10.4	19.1	45.6	17.9	27.6	10.3

4.3.1 Effect of Ecoregion on Year-to-Year Variation of Relatively Stable Soil Properties

Variation from year to year in the more stable soil properties (pHw, EC, P, K and LF_{mass}) was greater in some ecoregions than in others (Table 4). Variability was lowest in the PL and BT Ecoregions and highest in the FG, and MB Ecoregions (note: there were only two sites in the FG Ecoregion and one site in the MB Ecoregion). While the variation among years for the more stable properties was lower than for variable properties such as NO₃ and NH₄, it was still relatively high at many sites, indicating that large changes in these properties would have to occur before significant trends could be detected.

4.3.2 Effect of Slope Position and Year on Variation of Relatively Stable Soil Properties

The effect of slope position and year on variability of seven soil properties is summarized in Tables 4 and 5. The CVs of the three slope positions and years were similar for the seven parameters shown in Table 4. Also, the CVs were similar for each of the five years (Table 5), indicating that the inherent variability of these parameters was not influenced by year.

Table 4. Mean coefficient of variation (CV %) of slope positions for several soil properties (0-15 cm) over a five year period.

Slope Position	No. of Sites	pHw	EC	P	K	LF_mass	NO ₃ -N	BD
Upper	42	3.8	36	28	25	45	63	9.2
Mid	42	3.4	35	25	23	45	66	9.6
Lower	42	4.0	32	24	25	46	71	12.1

Table 5. Mean coefficient of variation (CV %) for years (0-15 cm).

Year	No. of Sites	pHw	EC	P	K	LF_mass	NO ₃ -N	BD
1998	37	6.2	29	43	33	37	41	8.3
1999	41	5.3	35	42	30	32	45	8.5
2000	42	5.5	30	37	26	31	40	9.3
2001	42	4.7	29	35	23	28	40	8.6
2002	42	5.6	28	36	27	39	39	9.6

4.4 Variation From Year-to-Year Within Sampling Location (slope positions within sites)

Variability of each sampling location (42 sites x 3 slope positions = 126 locations) was assessed using the CVs for pHw, EC, P, K and LF_mass. These properties were considered to be inherently less variable from year to year than properties such as NO₃-N, NH₄-N and S. [Note: Soil organic matter (OM) is also a relatively stable soil parameter as indicated by the low CV (Table 3). However, it was not included as a parameter in classifying the variability of the sites because the five-year data was not available when this analysis was conducted]. BD was not used because it was not analysed each year at all sites. A sampling location was classified as moderately variable when 3 of the 5 properties (pHw, EC, P, K, and LF_mass) were above a threshold CV value and highly variable when 4 or 5 of the properties were above a threshold value. The threshold CV values used were: pHw \geq 4; EC \geq 40; P \geq 25; K \geq 25; LF_mass \geq 25.

The number and percentage of locations classified as moderately or highly variable are shown in Table 6. The lowest percentage of variable sampling locations occurred in the PL and BT Ecoregions. The highest percentage occurred in the AP and MM Ecoregions. The MB and FG Ecoregions also had high percentages of variable locations, but they were represented by only one and two sites, respectively. Overall, 23 of 126 locations (18%) were classified as highly variable and 38 of 126 (29%) were classified as moderately variable.

Table 6. Number and percentage of variable sampling locations within each ecoregion

Ecoregion	No. of Locations	Moderately Variable (%)	Highly Variable (%)	Mod. & Highly Variable (%)
PL	27*	3/27 (11.1)	1/27 (3.7)	(14.8)
MB	3	0/3 (0)	2/3 (67)	(67)
BT	24	8/24 (33)	1/24 (4.2)	(37)
AP	27	13/27 (48)	6/27 (22)	(70)
MM	15	5/15 (33)	6/15 (40)	(73)
FG	6	2/6 (33)	2/6 (33)	(66)
MG	24	5/24 (21)	5/24 (21)	(48)

* no. of sites within ecoregion x 3 slope positions.

4.3.4 Variation Within Benchmark Sites

The variability of each site was also assessed using the variability of the 3 sampling locations upper (U), mid (M) and lower (L) slopes. Sites with 2 of the slope positions with a score of 3 or more were classified as moderately variable (3 or more of the 5 variable above the threshold value 3). Sites were classified as highly variable when all 3 slope positions had a score of 3 or more.

- PL - only one site was moderately variable (599 - M = 3, L = 4).
- MB- site 615 was moderately variable (U = 4, L = 4).
 - Note: there is only one site in the MB Ecoregion and some of the properties in the U and L slope positions are extremely variable
- BT - Site 678 was moderately variable (U = 3, L = 3)
 - Site 680 was highly variable (U = 3, M = 3, L = 3)
 - Note: 692 (U= 4)
- AP - 727 moderately variable (U = 3, M = 3)
 - 743 moderately variable (M = 3, L = 5)
 - 744 moderately variable (U = 4, M = 3)
 - 730 highly variable (U = 3, M = 4, L = 3)
 - 739 highly variable (U = 3, M = 3, L = 3)
 - 740 highly variable (U = 3, M = 4, L = 4)
 - 746 highly variable (U = 3, M = 3, L = 3)
 - Note: 692 U = 4, 728 L = 4, 738 L = 4
- MM - 769 moderately variable (U = 4, M = 3)
 - 786 moderately variable (U = 4, L = 3)
 - 781 highly variable (U = 4, M = 5, L = 3)
 - Note: 791 (U = 4)

- FG - 800 moderately variable (U = 3, M = 4)
-798 Highly variable (U = 4, M = 5, L = 3)
- MG - 806 moderately variable (M = 4, L = 4)
- 2828 moderately variable (U = 3, L = 3)
- 804 highly variable (U = 3, M = 4, L = 4)

From the above, 8 sites (19%) were highly variable and 11 (26%) moderately variable. The site in the MB Ecoregion should also be considered to be highly variable because some properties at the upper and lower slope positions have been extremely variable from year to year. Four of the highly variable sites were in the AP Ecoregion (4 of 9); one in BT (1 of 8); one in MM (1 of 5); one in FG (1 of 2); and one in MG (1 of 8).

4.4 Notes On Variability Of Specific Sampling Locations

The following sampling locations were noted because a high CV resulted mainly from one 'outlier' value or in the case of pH, inconsistencies between pHw and pHc values. Some of these may be analysis or recording errors and should be reanalysed.

Site No.	Slope Position	Comments
586	L	1999 - pHw is high (rerun)
591	U	2002 – pHw, pHc and EC are high
595	U	2000 – P high (rerun)
599	U U,M,L	1999 – EC is very high; likely a recording error 2002 – K is high
680	L	2001 – pHw (7.2) and pHc (5.6) (rerun)
687	U	1998 – pHw (6.4) and pHc (5.2) (rerun); 2001 and 2002 – high P
728	L	2001 – pHw and pHc both high
738	U,M,L	1998 – pHw is high and pHc is low
740	L	2002 – P and K very high but not on U and M (rerun)
746	U,M,L	2002 – high P
781	L U, M	1998 – pHw is high and pHc low (rerun) 1999 – P is low (rerun)
804	M,L	2000 – pH is high (rerun)
809	L	1999 – pHc (7.1) is higher than pHw (6.9) (rerun)
2828	U,M,L	Note – only 3 years of data (2000, 2001 and 2002)

5.0 SUMMARY

The inherent spatial variability of soil properties (both within defined soil/landforms as seen in variation among individual cores or composites of a small number of cores; or larger scale variability across soil/landforms) creates difficulties in identifying change. If variation among

samples taken from the same sampling location is high, then large changes in soil properties must occur to identify a significant trend. Morton et al. (2000) found that much of the total field variation in pH, K, P, S and C occurred within the first meter. This indicates that even with site-specific sampling (in this study, the sampling sites have a 1 m radius), 20 or more cores may be required to reduce sampling error to an acceptable level.

In field experiments where differences in management practices are imposed in a randomized and replicated pattern, a minimum of five to 10 years is often required to identify significant changes in soil properties. Field plots are designed to eliminate or minimize soil variability in order to isolate treatment effects. Conversely, the extensive nature and design of the Soil Quality Benchmark Study provides data over a wide range of soil properties, climate and management, but the lack of replicate sampling (replicates within the same year) will result in a longer time frame to detect significant changes in soil properties. On the other hand, the diversity encompassed in the design provides a database useful for model validation and for scaling up agronomic and soil quality information to a provincial scale.

The data from the 42 AESA Benchmark Sites have revealed differences in several parameters within different ecoregions and within slope positions. Within ecoregions, differences in OM, LF_mass, Hot KCl NH₄-N, K, Clay and CEC were observed. Within landscape positions, differences in pH_w, pH_c, NO₃-N, P, K, S, OM, LF_mass, Hot KCl NH₄-N, BD and clay content were observed. The importance of landscape sampling can't be emphasized enough since average values from composite samples taken across slope positions would not have demonstrated significant differences for several soil parameters.

6.0 RECOMMENDATIONS

1. Review sampling methodology/protocol and intensity:
 - Compare current and more intensive sampling on sites that have been identified as variable (high CVs) and uniform (low CVs).
 - Consider sampling depth intervals of 5 cm for LF_mass, OM and BD (LF_mass and OM values should be expressed on an equivalent mass basis).
2. Conduct repeat analysis for LF_mass on some samples to determine confidence limits of this method.
3. The author and Karen Cannon consulted with biostatisticians regarding the sampling protocol and the variability of the data from some of the sites. The main questions were:
 - Is sampling every year required?
 - Are replicate samples within years required?
 - Would trend analysis be useful at this point in the study?

The biostatisticians generally indicated that for trend analysis, sampling every year would be better than at intervals of 2 or 3 years with replicate samples within years. (Sampling every year, with replicates within years, would be ideal, but it is considered too costly). Initial attempts at trend analysis could be useful with 6 to 7 years of data.

4. This initial analysis of the data made limited use of the management information being collected. The management information could be utilized more effectively in the future if site information was classified on the basis of both the type (tillage system, crop rotation) and level of management [input level and effectiveness of the overall management (productivity index)].

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8.0 APPENDIX

Appendix 1. Five year summary of selected soil properties of the Ap horizon (0-15 cm) for 42 benchmark sites from 1998-2002.

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	pHw					CV (%) across years	pHc					CV (%) across years	EC (dS/m)					CV (%) across years
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
586	PL	U	0-15	7.2	6.9	6.6	6.8	6.9	3.1	6.0	6.0	6.0	6.2	6.2	1.89	0.35	0.43	0.46	0.54	0.53	16.86
586	PL	M	0-15	7.2	7.4	6.6	6.9	6.7	4.8	6.2	6.1	6.0	6.1	6.0	1.44	0.38	0.56	0.52	0.36	0.47	19.29
586	PL	L	0-15	7.1	7.6	6.7	6.8	6.7	5.4	6.1	6.1	6.0	6.1	6.0	0.84	0.35	0.46	0.45	0.40	0.46	11.46
588	PL	U	0-15	8.3	7.8	8.1	7.9	7.8	2.7	7.6	7.2	7.5	7.2	7.4	2.61	0.49	1.04	0.51	0.51	0.99	39.86
588	PL	M	0-15	8.3	8.0	8.1	7.9	8.0	1.8	7.7	7.5	7.7	7.3	7.6	2.42	0.45	0.75	0.52	0.67	1.12	37.31
588	PL	L	0-15	6.5	6.8	6.5	6.9	6.6	2.8	5.9	6.4	5.8	6.2	6.1	3.89	0.60	0.55	0.42	0.33	0.53	22.56
590	PL	U	0-15	6.2	6.3	6.3	6.3	6.1	1.4	5.6	5.9	5.5	5.5	5.5	3.04	0.56	0.79	0.55	0.46	0.42	25.68
590	PL	M	0-15	6.6	6.4	6.5	6.4	6.2	2.3	5.8	5.9	5.6	5.6	5.5	2.83	0.40	0.64	0.31	0.33	0.29	36.41
590	PL	L	0-15	5.9	6.2	6.2	6.2	6.0	2.4	5.2	5.6	5.3	5.5	5.3	2.91	0.68	0.52	0.28	0.32	0.29	42.14
591	PL	U	0-15	6.0	6.7	6.4	6.5	7.0	5.7	5.4	5.9	5.5	5.7	6.5	7.56	0.42	0.23	0.26	0.46	0.97	63.48
591	PL	M	0-15	7.0	7.5	7.2	7.2	7.1	2.6	7.1	7.0	6.6	6.7	6.7	3.30	0.51	0.47	0.60	0.67	0.55	14.00
591	PL	L	0-15	6.8	6.9	6.7	6.4	6.5	3.1	6.0	6.4	5.9	6.0	5.8	3.79	0.80	0.40	0.36	1.12	0.68	46.45
592	PL	U	0-15	7.1	7.1	7.4	7.4	7.0	2.7	6.8	6.6	6.8	6.4	6.5	2.56	0.83	0.62	0.68	0.61	0.62	13.86
592	PL	M	0-15	7.1	7.2	7.2	7.2	7.0	1.4	6.6	6.8	6.7	6.5	6.6	1.81	0.61	0.74	0.62	0.48	0.57	15.80
592	PL	L	0-15	7.4	7.1	7.2	7.2	7.1	1.7	7.0	6.7	6.7	6.5	6.7	2.91	0.78	1.02	0.76	0.49	0.57	28.66
593	PL	U	0-15	6.3	6.7	6.4	6.6	6.4	2.5	5.5	5.9	5.4	5.6	5.6	3.34	0.25	0.36	0.25	0.25	0.28	17.01
593	PL	M	0-15	6.3	6.7	6.5	6.7	6.6	2.6	5.7	5.9	5.7	5.6	5.5	2.55	0.30	0.26	0.18	0.26	0.25	17.42
593	PL	L	0-15	6.5	6.7	6.5	6.7	6.3	2.6	5.6	6.0	5.6	5.6	5.6	3.08	0.35	0.36	0.20	0.25	0.23	26.34
594	PL	U	0-15	.	5.8	5.5	5.8	5.7	2.6	.	4.9	4.7	4.9	4.8	1.89	.	0.43	0.48	0.32	0.33	20.06
594	PL	M	0-15	.	5.6	5.5	5.8	5.6	2.2	.	4.8	4.8	4.9	4.8	1.04	.	0.56	0.57	0.34	0.33	29.69
594	PL	L	0-15	.	5.8	5.7	6.0	5.7	2.6	.	5.3	4.9	5.3	5.1	3.50	.	0.55	0.50	0.49	0.62	10.89
595	PL	U	0-15	6.0	6.5	5.9	6.2	5.7	5.0	4.9	5.3	5.2	5.0	4.9	3.56	0.67	0.66	0.48	0.41	0.57	20.05
595	PL	M	0-15	5.8	6.0	5.7	5.8	5.7	2.1	4.9	5.6	4.9	4.8	4.8	6.69	0.62	0.76	0.59	0.41	0.77	23.69
595	PL	L	0-15	5.6	5.8	5.9	5.9	5.6	2.5	4.8	5.1	4.9	4.8	4.9	2.38	0.82	0.71	0.34	0.43	0.58	33.99
599	PL	U	0-15	.	6.0	5.8	6.2	5.6	4.2	.	5.4	5.0	5.2	4.9	4.42	.	7.65	0.43	0.41	0.52	159.7
599	PL	M	0-15	.	6.1	5.7	6.1	5.5	5.0	.	5.4	5.0	5.3	4.9	4.62	.	0.79	0.66	0.51	0.81	19.74
599	PL	L	0-15	.	6.3	5.9	6.2	5.6	5.3	.	5.5	5.1	5.4	5.0	4.53	.	0.61	0.55	0.51	1.04	36.18
			Mean	6.7	6.7	6.5	6.6	6.4		6.0	6.0	5.7	5.8	5.7		0.53	0.85	0.46	0.46	0.57	
			Max	8.3	8.0	8.1	7.9	8.0		7.7	7.5	7.7	7.3	7.6		0.83	7.65	0.76	1.12	1.12	
			Min	5.6	5.6	5.5	5.8	5.5		4.8	4.8	4.7	4.8	4.8		0.25	0.23	0.18	0.25	0.23	
			SD	0.7	0.7	0.7	0.6	0.7		0.8	0.7	0.8	0.7	0.8		0.18	1.37	0.15	0.18	0.25	
			CV by year (%)	11.02	9.83	10.98	9.15	10.94		14.03	11.51	14.19	11.77	14.18		34.00	161.8	32.53	38.54	43.51	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	pHw					CV (%) across years	pHc					CV (%) across years	EC (dS/m)					CV (%) across years
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
615	MB	U	0-15	7.4	6.5	7.2	6.0	6.3	9.0	7.3	6.1	6.6	5.6	5.6	11.47	0.87	0.95	0.73	0.64	0.38	31.11
615	MB	M	0-15	6.3	6.1	6.1	6.3	6.3	1.9	5.9	5.8	5.2	5.6	5.5	4.89	0.28	0.28	0.29	0.60	0.33	38.75
615	MB	L	0-15	7.8	6.8	6.9	7.0	6.9	5.8	7.6	6.7	6.4	6.6	7.1	6.88	0.75	0.71	0.68	1.83	0.91	49.75
			Mean	7.2	6.5	6.7	6.4	6.5		6.9	6.2	6.1	5.9	6.1		0.63	0.65	0.57	1.02	0.54	
			Max	7.8	6.8	7.2	7.0	6.9		7.6	6.7	6.6	6.6	7.1		0.87	0.95	0.73	1.83	0.91	
			Min	6.3	6.1	6.1	6.0	6.3		5.9	5.8	5.2	5.6	5.5		0.28	0.28	0.29	0.60	0.33	
			SD	0.8	0.4	0.6	0.5	0.3		0.9	0.5	0.8	0.6	0.9		0.31	0.34	0.24	0.70	0.32	
			CV by year (%)	10.84	5.43	8.44	8.05	5.33		13.09	7.39	12.48	9.81	14.77		49.24	52.49	42.51	68.29	59.52	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U, M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-reg-ion ¹	Slope Position ²	Depth (cm)	pHw					CV across years (%)	pHc					CV across years (%)	EC (dS/m)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
678	BT	U	0-15	5.7	5.9	6.1	6.0	5.6	3.6	4.6	5.6	5.3	5.2	5.0	7.22	0.49	1.60	0.42	0.55	1.09	60.92
678	BT	M	0-15	5.8	5.7	5.7	5.7	5.5	1.9	5.0	5.1	4.9	5.0	4.8	2.27	0.44	0.69	0.58	0.90	0.84	27.33
678	BT	L	0-15	7.0	6.6	6.5	6.6	6.6	3.0	6.3	6.3	5.8	6.0	5.9	3.84	0.32	0.69	0.45	0.61	0.61	27.84
680	BT	U	0-15	6.5	7.0	6.5	6.8	6.6	3.2	5.7	6.3	5.8	5.8	5.9	3.94	0.39	0.25	0.27	0.48	0.71	44.54
680	BT	M	0-15	6.6	6.8	6.4	7.0	6.3	4.2	5.7	6.2	5.7	6.0	5.6	4.41	0.30	0.32	0.29	0.33	0.46	20.19
680	BT	L	0-15	6.6	6.8	6.5	7.2	6.4	4.5	5.7	6.2	5.7	5.6	5.7	4.10	0.32	0.31	0.34	0.75	0.71	46.02
681	BT	U	0-15	6.9	6.8	6.8	6.8	6.9	0.8	6.3	5.8	5.9	6.0	6.1	3.19	0.59	0.27	0.28	0.37	0.46	34.07
681	BT	M	0-15	6.5	6.8	6.8	6.8	6.6	2.2	5.8	6.2	5.8	6.1	5.8	3.22	0.82	0.29	0.23	0.50	0.47	49.97
681	BT	L	0-15	6.9	7.1	6.8	6.9	6.8	1.8	6.2	6.8	5.9	6.1	6.1	5.57	0.57	0.35	0.30	0.47	0.44	24.76
684	BT	U	0-15	5.9	6.5	6.8	6.3	6.8	5.9	5.0	5.6	6.0	5.5	6.3	8.77	0.31	0.33	0.27	0.45	0.53	28.50
684	BT	M	0-15	6.3	6.2	6.2	6.0	6.2	1.8	5.3	5.7	5.3	5.4	5.4	3.08	0.32	0.23	0.26	0.63	0.40	43.89
684	BT	L	0-15	6.2	5.9	6.3	6.3	6.2	2.7	5.4	5.5	5.5	5.5	5.4	1.00	0.52	0.50	0.33	0.40	0.52	18.88
687	BT	U	0-15	6.4	6.2	5.6	5.8	5.7	5.7	5.2	5.5	4.9	4.9	5.0	4.92	0.41	0.48	0.32	0.71	0.50	30.16
687	BT	M	0-15	6.0	6.3	5.8	5.8	5.7	4.0	5.2	5.5	5.1	5.0	5.1	3.62	0.43	0.48	0.44	0.79	0.66	28.37
687	BT	L	0-15	7.2	7.1	6.8	6.9	7.0	2.2	6.7	6.8	6.2	6.5	6.6	3.58	0.81	0.73	0.49	0.84	0.84	19.88
688	BT	U	0-15	6.2	6.1	6.0	6.3	6.2	1.8	5.9	5.3	5.4	5.3	5.6	4.53	0.19	0.22	0.18	0.27	0.47	44.94
688	BT	M	0-15	6.1	6.0	5.8	6.0	6.1	2.0	5.8	5.3	5.2	5.1	5.4	5.09	0.22	0.41	0.15	0.33	0.40	37.70
688	BT	L	0-15	6.1	6.2	5.8	6.0	5.9	2.6	5.9	5.5	5.1	5.1	5.2	6.49	0.17	0.34	0.15	0.24	0.39	40.79
692	BT	U	0-15	6.3	6.4	5.9	6.5	5.9	4.4	5.4	5.9	5.1	5.5	5.2	5.72	0.38	0.36	0.31	0.38	0.24	17.69
692	BT	M	0-15	5.8	6.1	5.8	6.1	6.0	2.4	5.1	5.4	5.0	5.2	5.0	3.27	0.32	0.18	0.31	0.28	0.24	21.57
692	BT	L	0-15	5.7	6.1	5.7	6.2	5.9	3.6	5.0	5.5	5.0	5.2	5.1	4.00	0.29	0.19	0.28	0.31	0.22	19.91
703	BT	U	0-15	6.8	7.0	6.6	6.7	6.7	2.2	5.6	6.5	5.8	5.8	6.0	5.76	0.16	0.29	0.30	0.42	0.44	35.16
703	BT	M	0-15	6.3	6.1	6.4	6.4	6.3	1.8	5.2	5.7	5.6	5.6	5.5	3.55	0.15	0.34	0.26	0.43	0.41	36.39
703	BT	L	0-15	8.1	7.5	7.4	6.9	7.7	6.1	7.4	7.1	7.0	6.3	7.4	6.52	0.58	1.21	1.27	0.60	1.40	38.84
Mean				6.4	6.5	6.3	6.4	6.3		5.6	5.9	5.5	5.6	5.6		0.40	0.46	0.35	0.50	0.56	
Max				8.1	7.5	7.4	7.2	7.7		7.4	7.1	7.0	6.5	7.4		0.82	1.60	1.27	0.90	1.40	
Min				5.7	5.7	5.6	5.7	5.5		4.6	5.1	4.9	4.9	4.8		0.15	0.18	0.15	0.24	0.22	
SD				0.6	0.5	0.5	0.4	0.5		0.6	0.5	0.5	0.4	0.6		0.18	0.33	0.22	0.19	0.27	
CV by year (%)				8.63	7.31	7.56	6.69	8.24		11.10	9.16	8.90	8.03	10.65		46.30	72.33	62.37	37.91	48.44	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	pHw					CV (%) across years	pHc					CV (%) across years	EC (dS/m)					CV (%) across years
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
727	AP	U	0-15	7.0	6.6	6.5	7.1	7.4	5.3	6.4	6.2	6.1	6.5	6.9	4.85	0.59	0.56	0.83	0.52	0.65	19.28
727	AP	M	0-15	5.9	6.1	5.6	6.2	6.0	3.7	5.1	5.4	5.1	5.4	5.4	3.08	0.36	0.79	1.21	0.30	0.41	62.81
727	AP	L	0-15	5.9	5.6	5.8	6.1	5.7	3.5	5.1	5.5	5.2	5.3	5.2	2.93	0.30	0.48	0.35	0.29	0.46	23.68
728	AP	U	0-15	6.0	5.8	5.9	6.2	6.1	2.4	5.3	5.3	5.2	5.4	5.5	2.06	0.31	0.45	0.20	0.39	0.94	62.32
728	AP	M	0-15	6.5	6.1	6.0	6.1	6.1	3.3	5.4	5.5	5.3	5.1	5.5	3.12	0.23	0.37	0.28	0.51	0.98	63.82
728	AP	L	0-15	6.3	6.3	6.0	7.1	6.1	6.8	5.6	5.6	5.5	6.4	5.6	6.70	0.27	0.71	0.48	0.84	1.03	44.77
730	AP	U	0-15	7.2	6.9	7.4	6.8	7.0	3.5	6.3	6.4	6.8	6.0	6.8	5.21	1.00	0.42	0.73	0.39	2.75	92.32
730	AP	M	0-15	6.8	6.7	6.1	6.5	5.9	6.0	5.8	5.8	5.3	5.8	5.3	4.99	0.39	0.25	0.24	0.43	0.90	60.95
730	AP	L	0-15	7.0	7.1	7.0	6.9	6.8	1.6	6.2	6.4	6.1	6.3	6.2	1.78	0.93	0.32	0.29	0.51	0.79	50.07
738	AP	U	0-15	6.8	6.1	5.7	5.8	5.7	7.7	4.8	5.5	4.9	5.0	5.1	5.37	0.37	0.42	0.41	0.52	0.47	13.25
738	AP	M	0-15	6.8	5.9	5.7	5.6	5.8	8.2	4.7	5.2	4.8	4.8	5.0	4.08	0.26	0.34	0.34	0.67	0.40	39.53
738	AP	L	0-15	6.8	6.1	5.8	6.1	6.0	6.2	4.9	5.8	5.0	5.3	5.3	6.67	0.32	0.38	0.42	0.54	0.38	20.36
739	AP	U	0-15	6.7	6.3	6.2	6.1	5.8	5.3	5.6	5.6	5.1	5.0	5.2	5.55	0.25	0.35	0.26	0.13	0.40	37.80
739	AP	M	0-15	6.7	6.5	6.3	6.3	6.0	4.1	5.6	5.7	5.3	5.4	5.2	3.85	0.15	0.20	0.19	0.19	0.40	43.56
739	AP	L	0-15	6.7	6.3	6.1	6.1	5.8	5.4	5.7	5.5	5.0	5.0	5.1	6.32	0.26	0.33	0.21	0.19	0.42	33.51
740	AP	U	0-15	.	6.4	5.9	6.1	6.3	3.5	.	5.6	5.2	5.1	5.6	4.76	.	0.18	0.44	0.25	0.36	37.92
740	AP	M	0-15	.	6.3	6.1	6.2	6.2	1.4	.	5.7	5.5	5.2	5.6	3.76	.	0.27	0.61	0.18	0.42	51.48
740	AP	L	0-15	.	7.5	7.7	7.8	7.7	1.6	.	7.2	7.5	7.6	7.3	2.42	.	1.60	4.20	4.46	1.78	50.82
743	AP	U	0-15	7.7	8.1	7.9	7.5	8.1	3.5	6.8	7.5	7.2	7.1	7.6	4.52	0.44	0.63	0.42	0.81	0.72	28.31
743	AP	M	0-15	7.3	6.4	6.3	6.5	6.3	6.5	5.9	5.7	5.3	5.6	5.7	3.88	0.25	0.54	0.28	0.46	0.41	31.34
743	AP	L	0-15	6.5	5.6	5.8	5.7	5.4	7.2	5.2	4.8	4.9	4.5	5.0	5.00	0.26	0.61	0.19	0.36	0.86	60.77
744	AP	U	0-15	.	6.0	6.0	6.0	5.8	1.6	.	5.4	5.3	5.4	5.3	0.90	.	0.29	0.62	0.25	0.42	41.99
744	AP	M	0-15	.	5.9	6.1	6.0	5.8	2.1	.	5.3	5.4	5.5	5.2	2.08	.	0.19	0.31	0.22	0.43	37.71
744	AP	L	0-15	.	5.9	6.0	6.0	5.8	1.5	.	5.4	5.2	5.3	5.2	1.86	.	0.23	0.34	0.15	0.34	35.12
746	AP	U	0-15	7.1	7.5	7.0	7.6	7.0	3.9	6.5	7.1	6.1	6.9	6.5	6.00	0.36	0.46	0.27	0.44	0.51	23.04
746	AP	M	0-15	6.6	6.7	6.5	6.8	6.3	3.1	5.8	6.0	5.5	6.0	5.6	4.11	0.18	0.14	0.18	0.18	0.31	32.88
746	AP	L	0-15	6.1	6.6	6.2	6.9	6.2	5.3	5.4	5.9	5.4	5.5	5.5	3.72	0.20	0.22	0.20	0.21	0.28	14.97
			Mean	6.7	6.4	6.3	6.4	6.3		5.6	5.8	5.5	5.6	5.7		0.37	0.43	0.54	0.53	0.67	
			Max	7.7	8.1	7.9	7.8	8.1		6.8	7.5	7.5	7.6	7.6		1.00	1.60	4.20	4.46	2.75	
			Min	5.9	5.6	5.6	5.6	5.4		4.7	4.8	4.8	4.5	5.0		0.15	0.14	0.18	0.13	0.28	
			SD	0.5	0.6	0.6	0.6	0.7		0.6	0.6	0.7	0.7	0.7		0.22	0.29	0.77	0.81	0.53	
			CV by year (%)	6.99	9.30	9.67	9.14	10.48		10.27	10.83	12.42	13.13	12.63		60.62	66.09	143.11	151.97	78.21	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-reg-ion ¹	Slope Position ²	Depth (cm)	pHw					CV across years (%)	pHc					CV across years (%)	EC (dS/m)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
769	MM	U	0-15	5.0	5.8	5.6	5.6	5.4	5.5	4.4	5.1	4.7	5.1	4.7	6.30	0.87	0.45	0.43	0.92	0.55	36.21
769	MM	M	0-15	5.0	5.6	5.4	5.3	5.2	4.2	4.3	4.8	4.4	4.7	4.5	4.42	0.51	0.45	0.41	0.84	0.55	30.56
769	MM	L	0-15	4.9	5.5	5.3	5.3	5.2	4.2	4.3	4.8	4.5	4.7	4.6	4.09	0.81	0.37	0.41	0.69	0.44	35.65
781	MM	U	0-15	5.1	5.6	5.2	5.9	5.0	7.2	4.5	5.1	4.5	4.7	4.6	5.32	0.75	0.18	0.48	0.23	1.14	71.31
781	MM	M	0-15	5.3	5.3	5.2	5.7	5.0	4.9	4.7	5.1	4.4	4.5	4.5	5.94	0.62	0.29	0.52	0.27	1.16	62.89
781	MM	L	0-15	6.2	5.0	5.0	5.7	5.0	10.1	4.5	4.6	4.2	4.5	4.3	3.81	0.55	0.23	0.55	0.35	0.74	40.69
786	MM	U	0-15	7.2	7.5	7.2	8.1	7.4	4.9	7.0	7.0	6.5	6.8	7.1	3.45	0.74	0.52	0.61	0.71	0.95	22.90
786	MM	M	0-15	7.1	7.0	7.3	7.0	7.0	1.8	6.2	6.2	6.5	6.6	6.4	2.95	0.33	0.53	0.40	0.69	0.59	28.62
786	MM	L	0-15	6.5	6.4	6.0	6.4	6.4	3.1	5.5	5.5	5.1	5.5	5.5	3.37	0.26	0.18	0.36	0.35	0.37	26.99
791	MM	U	0-15	6.4	6.6	6.0	6.3	6.0	4.2	5.5	5.8	5.2	5.4	5.1	5.08	0.30	0.18	0.34	0.19	0.23	28.25
791	MM	M	0-15	7.8	7.5	7.2	7.3	7.4	3.0	7.1	7.1	6.7	6.8	7.0	2.59	0.48	0.47	0.89	0.60	0.60	27.87
791	MM	L	0-15	6.5	6.3	6.2	6.3	6.3	1.7	5.5	5.5	5.2	5.6	5.2	3.33	0.21	0.18	0.24	0.19	0.20	11.56
793	MM	U	0-15	7.8	7.7	7.2	7.2	7.5	3.7	7.1	7.2	6.6	6.7	7.1	4.00	0.44	0.40	0.66	0.76	0.50	27.46
793	MM	M	0-15	7.9	7.9	7.2	7.1	7.5	5.2	7.2	7.4	6.7	6.5	6.9	5.12	0.45	0.39	0.57	0.65	0.48	20.31
793	MM	L	0-15	7.1	7.0	6.5	6.9	6.7	3.5	6.2	6.3	5.7	6.3	5.9	4.35	0.25	0.20	0.36	0.37	0.26	25.52
			Mean	6.4	6.4	6.2	6.4	6.2		5.6	5.8	5.4	5.6	5.6		0.50	0.33	0.48	0.52	0.58	
			Max	7.9	7.9	7.3	8.1	7.5		7.2	7.4	6.7	6.8	7.1		0.87	0.53	0.89	0.92	1.16	
			Min	4.9	5.0	5.0	5.3	5.0		4.3	4.6	4.2	4.5	4.3		0.21	0.18	0.24	0.19	0.20	
			SD	1.1	1.0	0.9	0.8	1.0		1.1	1.0	1.0	0.9	1.1		0.22	0.13	0.16	0.25	0.30	
			CV by year (%)	17.21	14.78	14.12	13.09	16.24		20.15	16.60	17.90	16.21	19.34		42.68	40.15	33.11	47.98	51.45	
798	FG	U	0-15	6.8	6.2	6.3	6.3	5.6	6.9	6.3	5.3	5.5	5.1	4.8	10.45	0.47	0.23	0.32	0.44	0.56	32.11
798	FG	M	0-15	6.3	6.6	7.0	6.8	6.9	4.2	5.6	5.9	6.3	5.8	6.5	6.10	0.28	0.19	0.70	0.59	0.86	53.93
798	FG	L	0-15	5.9	6.3	6.3	6.3	5.9	3.7	5.1	5.6	5.5	5.2	5.4	3.83	0.36	0.32	0.28	0.40	0.50	22.67
800	FG	U	0-15	6.8	6.5	6.1	6.1	6.1	5.0	6.2	5.7	5.3	5.3	5.3	7.21	0.24	0.18	0.16	0.31	0.23	25.45
800	FG	M	0-15	6.6	6.3	5.9	5.9	6.1	5.0	5.7	5.7	5.2	5.2	5.2	5.04	0.18	0.20	0.18	0.73	0.19	81.92
800	FG	L	0-15	6.8	6.3	6.2	6.1	6.1	4.6	6.2	5.6	5.5	5.4	5.3	6.43	0.26	0.19	0.27	0.24	0.16	21.03
			Mean	6.5	6.4	6.3	6.3	6.1		5.9	5.6	5.6	5.3	5.4		0.30	0.22	0.32	0.45	0.42	
			Max	6.8	6.6	7.0	6.8	6.9		6.3	5.9	6.3	5.8	6.5		0.47	0.32	0.70	0.73	0.86	
			Min	5.9	6.2	5.9	5.9	5.6		5.1	5.3	5.2	5.1	4.8		0.18	0.18	0.16	0.24	0.16	
			SD	0.4	0.2	0.4	0.3	0.4		0.5	0.2	0.4	0.3	0.6		0.10	0.05	0.20	0.18	0.27	
			CV by year (%)	5.62	2.36	5.94	5.22	7.04		8.00	3.49	7.00	4.75	10.54		34.34	24.13	61.83	40.57	65.83	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	pHw					CV across years (%)	pHc					CV across years (%)	EC (dS/m)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
804	MG	U	0-15	6.5	6.0	6.5	6.2	6.2	3.4	5.8	5.5	5.5	5.6	5.4	2.70	0.42	0.64	0.19	0.38	0.31	42.79
804	MG	M	0-15	6.0	6.1	7.1	6.2	5.9	7.7	5.3	5.5	6.5	5.5	5.1	9.71	0.42	0.76	0.61	0.76	1.00	30.14
804	MG	L	0-15	5.7	5.7	7.1	6.1	5.7	10.0	4.9	5.1	6.8	5.4	5.1	14.07	0.47	0.58	1.01	0.45	0.98	39.34
806	MG	U	0-15	7.4	7.8	7.5	7.4	7.2	3.0	6.9	7.3	6.7	6.8	6.7	3.60	0.84	0.51	0.87	0.76	0.96	21.77
806	MG	M	0-15	6.7	6.9	6.4	7.4	7.5	6.6	5.7	6.7	5.3	6.9	6.8	11.71	0.22	0.88	0.44	0.93	0.84	47.44
806	MG	L	0-15	5.6	6.3	5.6	6.7	5.8	8.0	4.7	5.7	4.8	6.3	5.0	12.80	0.18	0.20	0.47	0.92	0.46	66.78
809	MG	U	0-15	8.1	7.8	7.7	7.5	7.8	3.0	7.4	7.4	7.0	7.0	7.1	2.82	0.38	0.44	0.53	0.56	0.56	16.19
809	MG	M	0-15	6.4	6.8	7.0	6.4	6.7	4.0	5.6	6.5	6.3	5.6	6.0	6.86	0.26	0.31	0.45	0.49	0.51	27.60
809	MG	L	0-15	6.3	6.9	6.6	6.6	6.3	3.9	5.5	7.1	5.7	5.8	5.5	11.33	0.19	0.13	0.28	0.35	0.36	38.19
812	MG	U	0-15	8.2	8.1	8.0	7.9	8.1	1.5	7.7	7.9	7.4	7.1	7.6	4.19	1.59	0.75	0.83	0.64	0.73	42.67
812	MG	M	0-15	8.2	8.4	8.2	8.0	8.3	1.7	7.8	8.3	7.6	7.3	7.7	4.83	0.87	0.56	0.75	0.66	0.62	17.47
812	MG	L	0-15	8.2	8.4	8.2	8.0	8.2	1.6	7.8	8.3	7.5	7.3	7.7	4.81	1.09	0.61	0.85	0.69	0.61	26.51
815	MG	U	0-15	8.4	8.1	8.0	8.0	7.9	2.4	7.8	7.5	7.4	7.3	7.3	2.86	0.45	0.35	0.65	0.56	0.58	22.83
815	MG	M	0-15	8.3	8.1	8.0	7.8	7.9	2.3	7.6	7.3	7.3	7.1	7.4	2.34	0.48	0.44	0.63	0.71	0.54	19.68
815	MG	L	0-15	6.7	6.8	6.2	6.8	6.4	4.0	5.9	5.9	5.4	5.8	5.6	3.75	0.34	0.22	0.67	0.39	0.27	46.59
823	MG	U	0-15	8.1	8.2	8.0	7.9	8.0	1.4	7.6	7.7	7.5	7.4	7.7	1.96	1.13	1.09	0.86	0.94	1.49	22.13
823	MG	M	0-15	7.7	7.3	7.4	7.6	7.5	2.0	7.2	6.8	6.7	7.0	7.0	2.78	0.71	0.62	0.81	0.64	0.73	10.69
823	MG	L	0-15	7.4	7.3	7.2	7.5	7.3	1.6	7.0	6.7	6.5	6.8	6.7	2.68	0.68	0.49	0.70	0.58	0.86	21.05
1828	MG	U	0-15	8.3	8.4	8.2	8.0	8.0	2.2	7.7	8.4	7.5	7.3	7.5	5.65	0.40	0.40	0.44	0.46	0.47	7.53
1828	MG	M	0-15	7.2	7.4	7.0	7.4	7.2	2.2	6.5	7.2	6.3	6.6	6.5	5.17	0.28	0.38	0.48	0.38	0.34	19.62
1828	MG	L	0-15	8.0	8.0	7.3	7.3	7.9	5.0	7.3	7.9	6.6	6.5	7.3	8.21	0.41	0.50	0.36	0.44	0.53	15.25
2828	MG	U	0-15	.	.	6.8	7.1	7.1	2.4	.	.	6.1	6.3	6.7	4.75	.	.	0.28	0.57	0.44	33.44
2828	MG	M	0-15	.	.	6.6	6.9	7.1	3.7	.	.	5.9	6.1	6.6	5.79	.	.	0.31	0.53	0.59	30.96
2828	MG	L	0-15	.	.	7.0	7.2	7.1	1.3	.	.	6.3	6.6	6.7	3.19	.	.	0.44	0.71	0.53	24.22
			Mean	7.3	7.4	7.2	7.2	7.2		6.7	7.0	6.5	6.6	6.6		0.56	0.52	0.58	0.60	0.64	
			Max	8.4	8.4	8.2	8.0	8.3		7.8	8.4	7.6	7.4	7.7		1.59	1.09	1.01	0.94	1.49	
			Min	5.6	5.7	5.6	6.1	5.7		4.7	5.1	4.8	5.4	5.0		0.18	0.13	0.19	0.35	0.27	
			SD	0.9	0.9	0.7	0.6	0.8		1.1	1.0	0.8	0.7	0.9		0.36	0.23	0.22	0.18	0.28	
			CV by year (%)	12.95	11.66	9.83	8.64	11.18		16.04	14.16	12.25	9.98	13.61		64.58	44.69	38.57	29.07	43.30	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	NH ₄ -N (mg/kg)					CV across years (%)	NO ₃ -N (mg/kg)					CV across years (%)	P (mg/kg)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
586	PL	U	0-15	2.4	1.0	1.1	0.3	2.5	64.30	7.9	1.8	5.5	5.2	5.4	42.19	45	38	39	45	52	13.15
586	PL	M	0-15	2.6	1.1	1.4	0.9	0.6	59.02	7.8	5.2	4.5	3.0	4.5	34.90	51	36	40	39	49	15.49
586	PL	L	0-15	1.9	0.5	2.0	0.5	0.4	78.22	6.4	1.6	3.2	4.0	3.5	46.53	34	27	28	36	38	14.80
588	PL	U	0-15	0.6	3.2	0.6	0.3	1.3	97.94	9.1	25.3	3.6	4.5	32.1	86.99	14	11	12	8	14	21.75
588	PL	M	0-15	0.1	6.7	0.7	0.3	2.0	139.12	7.8	9.2	6.1	5.9	55.2	127.61	24	21	24	18	24	12.01
588	PL	L	0-15	3.8	1.1	0.9	0.3	2.7	81.42	22.8	12.0	6.7	7.0	23.7	57.66	39	37	39	37	48	11.65
590	PL	U	0-15	3.1	0.7	1.2	1.3	0.4	79.11	36.5	24.6	17.8	12.3	10.7	51.68	40	30	23	26	38	23.73
590	PL	M	0-15	0.8	1.0	0.9	0.7	0.7	15.62	6.1	16.1	5.7	7.4	9.4	47.57	34	38	23	31	35	17.77
590	PL	L	0-15	4.9	1.1	1.6	1.4	0.5	90.86	51.8	12.4	7.6	8.0	7.9	109.87	27	24	25	23	27	7.27
591	PL	U	0-15	0.9	1.1	2.2	0.7	3.1	63.73	24.0	8.0	9.0	31.2	12.8	59.79	15	11	10	12	12	16.09
591	PL	M	0-15	0.4	0.9	0.7	0.6	2.6	86.13	6.3	8.3	11.6	34.8	17.3	73.30	10	16	13	12	13	17.43
591	PL	L	0-15	0.5	0.2	0.4	0.7	4.5	144.51	60.7	17.1	12.9	89.9	44.4	70.90	29	32	33	36	36	8.72
592	PL	U	0-15	0.3	0.4	0.5	1.1	1.6	70.39	12.2	10.2	14.1	11.9	9.7	15.07	27	27	32	23	29	12.23
592	PL	M	0-15	0.4	0.8	0.6	0.7	1.8	64.27	9.7	7.6	13.9	12.3	12.1	22.22	20	29	27	21	34	21.86
592	PL	L	0-15	0.4	0.6	1.3	0.6	1.6	56.76	27.7	37.5	27.0	15.4	14.0	39.94	31	35	41	33	30	12.78
593	PL	U	0-15	0.9	0.7	0.3	1.2	2.6	77.29	5.0	12.5	7.6	3.4	9.4	47.35	7	11	8	6	7	25.92
593	PL	M	0-15	1.5	1.0	0.3	1.0	3.0	73.26	6.2	7.4	5.1	4.0	6.1	22.12	19	15	16	17	18	9.32
593	PL	L	0-15	0.6	0.7	0.3	0.5	3.4	117.96	9.8	9.7	6.4	5.5	7.7	24.83	20	19	17	16	18	9.05
594	PL	U	0-15	.	1.0	0.7	0.6	1.5	41.58	.	8.9	4.3	1.6	1.0	91.10	.	8	12	14	11	21.33
594	PL	M	0-15	.	0.8	0.4	0.7	1.9	66.58	.	16.1	8.6	2.5	1.0	97.78	.	10	12	13	13	12.19
594	PL	L	0-15	.	1.2	0.3	0.7	1.9	66.80	.	7.6	8.6	1.5	1.0	84.95	.	14	14	15	15	3.63
595	PL	U	0-15	4.0	13.1	1.5	0.4	3.0	115.10	22.9	42.6	16.7	12.5	25.5	48.13	14	18	38	15	20	46.68
595	PL	M	0-15	4.2	0.8	1.3	0.3	1.0	101.59	24.7	49.1	21.1	13.3	36.9	48.53	13	15	24	19	19	23.59
595	PL	L	0-15	4.8	0.8	1.5	0.7	1.4	92.27	27.6	36.9	6.9	9.3	24.1	60.46	19	19	23	22	23	9.58
599	PL	U	0-15	.	4.8	1.4	0.3	2.7	83.70	34.5	37.4	19.7	6.5	12.5	61.00	.	15	11	12	15	14.80
599	PL	M	0-15	.	2.4	2.9	0.3	2.4	57.47	.	24.1	35.8	9.1	45.7	54.95	.	14	17	15	21	18.30
599	PL	L	0-15	.	1.8	1.8	0.8	4.1	66.49	.	24.7	18.5	5.9	46.0	70.45	.	8	14	11	16	28.17
			Mean	1.9	1.8	1.1	0.7	2.0		19.4	17.6	11.4	12.1	17.8		25	21	23	21	25	
			Max	4.9	13.1	2.9	1.4	4.5		60.7	49.1	35.8	89.9	55.2		51	38	41	45	52	
			Min	0.1	0.2	0.3	0.3	0.4		5.0	1.6	3.2	1.5	1.0		7	8	8	6	7	
			SD	1.6	2.7	0.7	0.3	1.1		15.6	13.1	7.9	17.4	15.8		12	10	11	10	13	
			CV by year (%)	88.36	145.09	62.27	47.17	53.74		80.43	74.73	68.99	143.52	88.73		47.32	46.75	46.17	49.18	50.29	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	NH ₄ -N (mg/kg)					CV across years (%)	NO ₃ -N (mg/kg)					CV across years (%)	P (mg/kg)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
615	MB	U	0-15	0.3	1.0	2.9	2.5	1.6	64.25	32.5	67.4	17.1	1.4	2.4	112.95	182	112	120	30	28	69.41
615	MB	M	0-15	0.4	1.9	1.5	2.4	1.9	46.72	20.3	28.0	4.6	1.0	2.1	108.94	16	10	10	7	6	38.87
615	MB	L	0-15	1.2	3.3	1.9	1.3	4.1	53.54	23.9	86.7	44.9	4.4	6.6	102.15	10	11	13	14	17	21.02
			Mean	0.6	2.1	2.1	2.1	2.5		25.6	60.7	22.2	2.3	3.7		69	44	48	17	17	
			Max	1.2	3.3	2.9	2.5	4.1		32.5	86.7	44.9	4.4	6.6		182	112	120	30	28	
			Min	0.3	1.0	1.5	1.3	1.6		20.3	28.0	4.6	1.0	2.1		10	10	10	7	6	
			SD	0.5	1.2	0.7	0.7	1.3		6.3	29.9	20.6	1.8	2.5		98	59	63	12	11	
			CV by year (%)	77.89	56.08	34.34	31.28	53.41		24.52	49.29	92.92	80.87	68.00		140.80	132.19	131.46	69.47	63.87	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002

(continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	NH ₄ -N (mg/kg)					CV across years (%)	NO ₃ -N (mg/kg)					CV across years (%)	P (mg/kg)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
678	BT	U	0-15	1.5	2.5	1.9	2.1	2.9	24.92	18.3	84.1	10.8	10.2	36.9	96.73	5	14	13	10	15	35.24
678	BT	M	0-15	1.7	1.9	1.8	5.0	2.8	52.09	11.3	42.3	26.4	26.3	29.3	40.66	13	14	16	14	19	15.61
678	BT	L	0-15	0.7	2.4	0.9	1.3	2.3	52.41	2.3	36.3	12.8	8.1	11.8	91.20	24	38	15	30	27	31.35
680	BT	U	0-15	1.1	3.1	0.3	0.8	3.3	78.52	0.8	2.5	1.9	1.0	1.2	47.63	7	6	7	5	9	22.22
680	BT	M	0-15	1.1	4.8	0.5	0.8	2.6	91.14	3.0	8.5	4.7	1.0	1.0	85.88	12	9	8	5	11	30.43
680	BT	L	0-15	1.2	2.9	1.0	7.7	3.4	83.52	0.7	8.3	2.8	5.9	1.9	79.46	15	11	13	10	17	22.47
681	BT	U	0-15	1.2	0.6	0.5	0.3	1.5	64.60	9.7	3.8	1.0	1.0	1.6	108.04	5	5	5	6	5	6.31
681	BT	M	0-15	1.1	0.7	0.5	0.3	4.9	128.06	9.7	7.1	1.0	1.0	10.1	78.08	5	6	5	5	5	8.60
681	BT	L	0-15	0.6	0.5	0.6	0.3	1.8	79.90	2.4	8.6	1.0	1.0	1.0	117.80	5	6	5	7	5	12.09
684	BT	U	0-15	1.5	0.5	0.6	1.1	1.8	50.45	2.1	3.3	3.0	1.0	1.5	44.64	23	24	25	32	24	14.21
684	BT	M	0-15	1.7	0.5	1.0	1.7	1.6	41.87	5.8	5.2	3.8	1.0	1.0	67.66	25	27	26	45	32	26.71
684	BT	L	0-15	1.1	2.0	1.0	1.1	1.9	34.28	6.0	33.4	16.5	3.9	1.7	106.55	84	71	100	79	100	14.84
687	BT	U	0-15	0.3	3.4	0.6	0.5	2.8	98.08	3.0	7.4	3.6	4.7	4.0	37.78	13	20	21	41	33	44.27
687	BT	M	0-15	0.2	2.9	0.6	1.1	2.4	82.02	3.8	4.9	5.5	5.7	5.7	15.66	26	28	30	55	44	34.08
687	BT	L	0-15	0.4	3.5	1.0	0.9	2.0	79.30	1.8	3.0	8.6	5.1	2.6	64.82	23	22	21	32	26	18.61
688	BT	U	0-15	2.5	3.0	0.3	0.9	2.8	64.76	4.8	8.7	6.9	3.3	5.2	35.65	7	7	8	7	8	8.68
688	BT	M	0-15	1.4	0.8	0.3	0.7	2.3	70.93	4.2	22.2	7.8	5.8	8.0	75.20	7	8	8	8	8	6.86
688	BT	L	0-15	0.3	2.0	0.6	0.9	2.2	70.48	0.8	15.9	9.1	7.4	13.2	62.59	18	19	21	20	25	13.17
692	BT	U	0-15	2.5	1.3	1.3	3.2	5.5	62.76	1.0	2.4	3.7	3.2	2.7	39.43	5	4	9	5	6	33.75
692	BT	M	0-15	2.9	1.0	1.9	3.5	4.6	50.52	6.6	3.5	5.4	1.4	3.2	50.21	3	4	7	5	5	27.89
692	BT	L	0-15	3.1	1.8	1.8	2.4	3.9	34.75	2.1	5.3	14.3	2.3	4.1	89.24	3	5	5	6	5	21.63
703	BT	U	0-15	1.6	2.4	0.5	0.4	1.3	66.16	0.2	1.8	1.0	1.0	1.2	55.07	4	4	5	5	5	13.19
703	BT	M	0-15	5.0	2.7	7.9	0.4	3.6	70.91	0.2	6.9	3.0	1.0	1.7	102.93	4	5	5	5	5	9.32
703	BT	L	0-15	1.8	2.3	3.3	0.9	1.3	48.66	0.4	20.0	16.3	2.3	10.4	86.48	17	16	25	11	13	32.70
			Mean	1.5	2.1	1.3	1.6	2.7		4.2	14.4	7.1	4.4	6.7		15	16	17	19	19	
			Max	5.0	4.8	7.9	7.7	5.5		18.3	84.1	26.4	26.3	36.9		84	71	100	79	100	
			Min	0.2	0.5	0.3	0.3	1.3		0.2	1.8	1.0	1.0	1.0		3	4	5	5	5	
			SD	1.1	1.1	1.6	1.7	1.1		4.4	18.7	6.3	5.4	9.0		17	15	19	20	21	
			CV by year (%)	71.24	55.66	124.13	109.63	41.51		103.71	130.03	89.02	123.62	134.21		113.78	96.90	115.36	105.76	108.88	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	NH ₄ -N (mg/kg)					CV across years (%)	NO ₃ -N (mg/kg)					CV across years (%)	P (mg/kg)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
727	AP	U	0-15	1.9	1.6	7.1	0.6	3.3	87.18	20.7	42.2	70.3	4.4	5.5	97.40	34	43	33	16	22	36.61
727	AP	M	0-15	1.9	2.8	86.7	0.4	2.8	200.20	20.1	28.1	97.0	7.2	16.4	107.02	7	13	15	6	9	39.07
727	AP	L	0-15	1.4	1.3	1.6	0.6	3.9	71.90	3.4	45.3	19.6	7.4	13.7	92.34	5	10	17	7	12	46.79
728	AP	U	0-15	3.0	1.0	0.4	1.3	2.4	66.94	5.5	7.8	8.4	9.3	32.8	88.40	19	20	20	23	21	7.10
728	AP	M	0-15	2.5	1.1	0.4	1.7	7.0	102.87	9.0	13.3	13.8	14.4	59.0	95.19	19	19	22	27	23	15.33
728	AP	L	0-15	5.4	1.6	0.6	1.5	6.0	82.52	20.4	34.8	25.2	26.1	67.6	54.71	43	58	57	78	110	37.60
730	AP	U	0-15	2.1	2.7	0.3	1.8	2.1	50.21	13.3	2.6	5.6	2.7	31.0	108.57	14	10	14	17	21	27.07
730	AP	M	0-15	2.2	2.7	0.3	1.9	7.5	93.12	12.8	2.4	7.9	6.7	34.1	97.63	13	11	12	17	20	26.05
730	AP	L	0-15	4.1	3.5	0.3	1.2	1.9	72.54	2.8	4.9	7.0	7.4	26.6	98.69	28	14	13	15	15	36.63
738	AP	U	0-15	0.7	3.5	9.2	79.8	1.9	179.53	9.8	12.2	12.3	4.9	9.1	31.47	30	30	31	29	33	5.05
738	AP	M	0-15	0.7	3.0	0.5	7.7	1.4	111.39	5.9	11.9	9.9	7.8	4.3	38.16	41	35	26	42	35	17.65
738	AP	L	0-15	0.6	2.8	1.4	1.0	1.6	56.42	2.4	12.2	15.8	5.9	2.8	76.02	17	10	18	17	22	25.70
739	AP	U	0-15	1.6	2.5	0.3	0.6	2.0	65.67	7.7	4.9	5.5	1.7	8.2	46.04	19	14	18	14	14	15.29
739	AP	M	0-15	1.1	2.3	0.3	1.3	2.7	61.91	3.7	2.9	4.0	3.5	7.0	38.09	13	13	11	13	12	7.58
739	AP	L	0-15	1.1	2.6	0.3	1.9	1.7	57.05	0.6	4.3	5.2	3.2	6.4	56.25	13	9	8	8	11	23.75
740	AP	U	0-15	.	3.3	24.2	0.3	2.3	148.60	.	3.1	10.0	2.9	5.2	62.52	.	8	9	7	13	29.03
740	AP	M	0-15	.	3.8	34.8	0.4	2.6	156.99	.	10.3	28.2	6.3	9.5	72.97	.	11	9	6	14	32.74
740	AP	L	0-15	.	4.0	39.3	0.3	3.6	155.68	.	28.1	50.1	19.2	40.9	39.48	.	87	78	102	170	38.12
743	AP	U	0-15	1.7	0.4	0.3	0.5	1.3	72.81	1.9	17.0	2.8	5.2	13.3	83.57	19	15	11	21	15	23.89
743	AP	M	0-15	2.6	0.5	0.3	1.2	1.9	73.78	2.7	20.4	5.9	5.7	15.0	74.87	23	25	23	20	23	7.83
743	AP	L	0-15	1.5	0.9	0.3	3.5	1.8	74.82	10.0	27.3	6.0	13.6	46.2	79.51	25	42	19	18	26	36.83
744	AP	U	0-15	.	5.8	0.3	0.7	2.8	104.18	.	8.2	6.1	4.4	13.1	47.41	.	9	7	12	14	31.13
744	AP	M	0-15	.	1.7	0.3	0.6	2.7	81.84	.	6.1	9.1	9.1	18.1	49.04	.	17	9	13	22	37.12
744	AP	L	0-15	.	1.7	0.3	1.0	2.6	70.18	.	11.0	6.5	6.1	11.9	33.68	.	14	13	13	18	16.63
746	AP	U	0-15	0.2	-	0.3	0.5	1.6	98.28	5.9	5.8	5.3	4.0	9.5	33.64	16	14	10	5	16	38.62
746	AP	M	0-15	0.5	1.3	0.6	0.6	2.1	66.00	3.5	3.9	8.7	4.6	13.3	61.41	11	19	11	6	28	57.39
746	AP	L	0-15	0.6	1.2	0.7	0.6	2.4	72.02	4.9	9.4	12.3	7.2	10.2	32.29	16	32	14	13	26	41.26
			Mean	1.8	2.3	7.8	4.2	2.8		8.0	14.1	17.0	7.4	19.7		20	22	20	21	28	
			Max	5.4	5.8	86.7	79.8	7.5		20.7	45.3	97.0	26.1	67.6		43	87	78	102	170	
			Min	0.2	0.4	0.3	0.3	1.3		0.6	2.4	2.8	1.7	2.8		5	8	7	5	9	
			SD	1.3	1.3	19.0	15.2	1.6		6.3	12.3	21.9	5.4	17.1		10	18	16	22	34	
			CV by year (%)	70.93	54.88	242.39	360.45	56.65		78.73	87.56	128.92	72.10	87.09		50.22	80.73	80.27	104.51	119.58	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	NH ₄ -N (mg/kg)					CV across years (%)	NO ₃ -N (mg/kg)					CV across years (%)	P (mg/kg)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
769	MM	U	0-15	2.3	1.3	1.9	3.3	1.3	40.93	34.3	18.9	11.1	41.6	13.9	55.63	35	23	27	55	38	35.14
769	MM	M	0-15	0.7	0.4	0.3	4.2	1.2	119.71	21.3	14.6	11.6	39.1	16.7	52.77	37	20	28	39	39	25.56
769	MM	L	0-15	0.2	0.6	0.5	3.6	0.8	124.70	13.8	16.9	14.0	29.5	15.8	36.40	32	21	29	32	26	16.70
781	MM	U	0-15	11.7	0.5	0.4	0.5	3.2	150.61	30.7	3.1	15.4	3.4	54.3	101.04	54	19	55	43	60	35.50
781	MM	M	0-15	1.2	0.5	0.6	1.3	2.3	60.71	29.1	8.7	17.1	3.5	56.4	91.77	39	24	35	40	61	33.72
781	MM	L	0-15	5.6	0.2	0.4	1.1	2.4	114.08	14.6	6.4	15.5	4.2	29.9	71.54	32	36	51	39	54	22.62
786	MM	U	0-15	2.9	0.9	1.1	3.2	2.0	51.15	15.0	8.5	4.6	8.2	11.8	41.02	41	14	8	22	19	60.90
786	MM	M	0-15	1.5	1.1	0.8	2.5	1.4	42.54	5.7	20.2	3.3	11.2	6.3	71.92	8	8	12	10	8	19.72
786	MM	L	0-15	1.5	1.3	0.8	4.3	1.6	73.61	2.2	4.0	11.6	9.5	5.6	59.16	14	16	17	21	26	25.28
791	MM	U	0-15	1.5	1.1	5.9	1.8	1.1	89.58	7.3	2.0	11.4	3.9	6.2	58.24	21	10	37	25	20	43.26
791	MM	M	0-15	0.3	0.9	3.5	1.7	1.1	80.56	6.7	3.2	21.2	3.5	6.6	90.27	10	9	22	18	18	36.77
791	MM	L	0-15	0.2	0.7	0.6	1.7	1.3	66.89	4.8	3.0	14.0	2.7	2.3	91.98	17	22	27	23	19	17.87
793	MM	U	0-15	0.7	1.2	0.3	1.5	1.7	53.22	5.5	3.3	15.7	18.8	6.2	69.59	14	19	19	25	18	20.51
793	MM	M	0-15	1.7	0.8	0.9	1.3	2.1	40.35	5.5	2.3	8.6	13.1	5.6	57.89	11	11	18	21	14	29.18
793	MM	L	0-15	1.6	0.9	0.6	1.6	4.7	87.52	2.9	3.3	13.1	10.9	4.7	67.29	13	15	20	21	17	19.70
			Mean	2.2	0.8	1.2	2.2	1.9		13.3	7.9	12.5	13.5	16.2		25	18	27	29	29	
			Max	11.7	1.3	5.9	4.3	4.7		34.3	20.2	21.2	41.6	56.4		54	36	55	55	61	
			Min	0.2	0.2	0.3	0.5	0.8		2.2	2.0	3.3	2.7	2.3		8	8	8	10	8	
			SD	2.9	0.3	1.5	1.2	1.0		10.8	6.5	4.6	13.1	17.4		14	7	13	12	17	
			CV by year (%)	131.50	41.01	123.48	53.91	53.70		81.04	82.54	36.67	96.49	107.49		56.22	40.80	49.10	41.65	59.10	
798	FG	U	0-15	0.7	1.7	0.8	0.8	1.8	46.83	5.2	4.7	6.7	5.7	17.1	66.05	17	43	18	29	38	40.08
798	FG	M	0-15	0.3	0.8	0.5	5.3	1.1	131.01	7.1	2.4	6.7	4.0	17.3	77.61	19	27	17	25	34	27.72
798	FG	L	0-15	0.3	1.1	0.4	0.5	1.5	66.71	2.5	8.8	6.2	5.0	15.2	64.13	35	40	14	27	35	33.73
800	FG	U	0-15	3.9	1.0	0.8	2.5	0.3	87.25	5.9	2.2	21.1	13.1	5.6	78.95	13	10	15	20	19	27.45
800	FG	M	0-15	3.8	1.8	0.3	11.3	1.8	115.31	5.5	3.0	27.9	42.6	6.8	101.24	15	11	21	28	27	36.55
800	FG	L	0-15	4.2	0.7	0.8	3.1	2.0	70.16	6.6	3.1	18.0	8.4	8.6	61.76	14	13	24	28	23	32.62
			Mean	2.2	1.2	0.6	3.9	1.4		5.5	4.0	14.4	13.2	11.8		19	24	18	26	29	
			Max	4.2	1.8	0.8	11.3	2.0		7.1	8.8	27.9	42.6	17.3		35	43	24	29	38	
			Min	0.3	0.7	0.3	0.5	0.3		2.5	2.2	6.2	4.0	5.6		13	10	14	20	19	
			SD	1.9	0.5	0.2	4.0	0.6		1.6	2.5	9.2	14.8	5.4		8	15	4	3	8	
			CV by year (%)	88.42	39.06	35.39	102.79	44.51		29.51	61.87	63.95	112.63	45.54		43.58	62.14	20.72	12.51	25.57	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	NH ₄ -N (mg/kg)					CV across years (%)	NO ₃ -N (mg/kg)					CV across years (%)	P (mg/kg)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
804	MG	U	0-15	1.3	0.5	0.9	3.1	0.7	80.63	9.5	28.5	1.8	10.9	8.9	83.14	10	13	8	11	13	18.87
804	MG	M	0-15	1.0	0.1	0.3	6.7	0.7	158.92	12.4	33.1	2.8	27.9	41.2	66.56	14	18	8	17	20	30.39
804	MG	L	0-15	0.3	0.2	0.3	4.6	0.9	149.16	14.6	33.9	6.3	17.4	51.2	72.52	12	13	10	14	20	27.23
806	MG	U	0-15	1.4	0.2	0.3	1.9	0.8	79.45	3.5	2.6	11.6	4.9	5.6	62.53	15	8	14	13	18	27.15
806	MG	M	0-15	1.4	1.8	0.4	2.7	1.3	54.48	2.6	4.5	6.8	6.6	5.8	33.11	16	15	14	14	20	15.99
806	MG	L	0-15	1.7	0.4	0.3	2.9	0.9	86.54	1.8	1.8	14.7	23.1	10.8	86.63	22	7	20	19	30	42.40
809	MG	U	0-15	0.4	0.7	0.3	1.8	0.9	73.91	2.4	6.0	3.0	3.0	8.0	54.11	9	9	9	10	8	9.90
809	MG	M	0-15	0.8	0.8	0.4	1.8	0.8	54.49	5.2	10.0	7.4	15.2	14.9	42.29	13	10	7	14	12	25.87
809	MG	L	0-15	0.9	0.9	0.4	0.5	0.8	36.18	1.0	1.3	7.3	9.4	10.6	76.21	13	9	10	8	14	23.56
812	MG	U	0-15	4.5	0.4	0.7	0.8	1.3	110.58	5.5	0.9	4.5	2.3	4.9	53.73	20	10	12	9	10	37.54
812	MG	M	0-15	4.8	0.1	0.6	0.4	1.4	133.65	5.4	1.1	2.9	1.8	5.4	60.75	14	15	13	11	15	11.41
812	MG	L	0-15	3.3	0.2	0.7	0.5	1.3	105.02	4.5	1.4	4.4	4.3	7.1	46.55	14	43	28	27	33	36.21
815	MG	U	0-15	3.3	0.8	0.6	0.7	1.2	86.42	5.6	1.9	15.2	6.4	4.9	73.42	4	8	12	11	11	35.94
815	MG	M	0-15	2.8	2.5	0.3	0.7	0.9	79.60	4.6	7.1	12.3	12.8	5.0	47.12	3	10	14	16	9	48.81
815	MG	L	0-15	2.4	0.9	0.3	1.0	1.0	69.73	6.6	4.7	26.9	14.1	2.3	91.26	33	40	46	39	46	13.36
823	MG	U	0-15	31.1	0.5	0.7	0.4	1.1	200.97	19.4	5.3	16.2	1.4	13.2	68.08	13	12	31	19	12	46.72
823	MG	M	0-15	14.3	0.6	0.5	0.4	1.2	179.72	11.8	6.9	17.7	1.0	8.6	66.98	15	17	36	28	33	36.50
823	MG	L	0-15	9.8	0.6	1.8	0.6	1.1	142.65	8.6	13.3	12.9	1.7	19.4	58.75	24	18	28	24	42	33.18
1828	MG	U	0-15	0.4	0.1	0.3	0.5	0.7	56.62	3.5	7.8	2.6	3.8	4.0	46.36	6	5	8	9	7	22.83
1828	MG	M	0-15	0.4	0.1	0.3	0.4	0.5	43.11	6.1	10.9	4.5	8.9	4.9	38.94	14	10	24	19	16	31.79
1828	MG	L	0-15	1.8	0.1	0.3	0.5	0.5	106.17	1.1	11.4	3.7	11.0	4.5	72.83	7	8	13	10	11	24.36
2828	MG	U	0-15	.	.	0.3	0.5	1.6	86.07	.	.	1.4	3.2	7.0	73.94	.	.	15	16	35	51.28
2828	MG	M	0-15	.	.	0.3	0.7	1.1	56.98	.	.	2.5	4.5	11.9	78.81	.	.	21	15	38	48.09
2828	MG	L	0-15	.	.	0.5	1.2	1.5	45.52	0.8	.	3.6	3.5	8.9	80.94	.	.	26	21	39	31.85
			Mean	4.2	0.6	0.5	1.5	1.0		6.2	9.3	8.0	8.3	11.2		14	14	18	16	21	
			Max	31.1	2.5	1.8	6.7	1.6		19.4	33.9	26.9	27.9	51.2		33	43	46	39	46	
			Min	0.3	0.1	0.3	0.4	0.5		0.8	0.9	1.4	1.0	2.3		3	5	7	8	7	
			SD	7.0	0.6	0.3	1.6	0.3		4.8	10.2	6.5	7.1	11.6		7	10	10	7	12	
			CV by year (%)	167.84	100.45	67.03	107.51	30.80		77.29	109.84	80.78	86.15	103.17		49.70	69.00	57.54	44.51	57.32	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	K (mg/kg)					CV across years (%)	S (mg/kg)					CV across years (%)	OM (%)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
586	PL	U	0-15	391	361	322	366	543	21.57	11.1	18.3	21.0	20.0	46.0	57.04	6.24	5.91	5.59	5.63	6.90	8.89
586	PL	M	0-15	347	316	273	257	419	20.00	20.1	37.1	27.0	15.8	12.0	44.34	8.27	6.69	5.74	6.60	7.50	13.80
586	PL	L	0-15	333	345	261	301	392	15.04	19.8	27.0	21.0	26.0	29.0	16.17	6.03	5.67	6.10	6.32	6.00	3.85
588	PL	U	0-15	161	222	160	156	191	15.93	4.1	40.8	9.0	6.5	13.5	101.24	4.90	4.83	4.70	4.50	4.60	3.50
588	PL	M	0-15	272	297	208	221	294	16.08	7.5	41.8	11.2	9.3	8.8	93.13	6.87	6.47	6.99	6.67	7.00	3.32
588	PL	L	0-15	264	306	256	245	334	13.37	16.2	27.2	37.0	27.4	46.0	36.61	6.41	6.19	6.28	6.52	6.30	2.00
590	PL	U	0-15	171	162	111	119	171	19.94	13.9	15.5	8.8	22.2	8.1	41.76	4.51	4.24	4.13	4.20	4.60	4.74
590	PL	M	0-15	165	195	102	110	153	26.75	15.1	15.4	6.8	8.4	5.8	44.78	3.95	4.43	3.86	4.38	4.20	6.12
590	PL	L	0-15	155	177	132	118	158	15.68	6.1	10.0	6.4	10.2	6.2	27.39	5.05	5.18	5.50	5.52	5.10	4.25
591	PL	U	0-15	269	224	168	165	218	20.77	11.4	4.9	7.4	8.4	14.4	39.58	8.08	7.54	6.29	7.07	5.80	13.26
591	PL	M	0-15	155	181	183	116	215	21.68	19.4	6.0	13.1	10.1	91.0	127.44	8.35	11.15	10.96	11.25	9.20	12.96
591	PL	L	0-15	255	308	233	216	312	16.41	32.2	9.6	19.4	17.7	12.0	48.42	11.42	11.78	11.42	11.88	11.20	2.45
592	PL	U	0-15	322	339	243	211	332	20.12	21.2	13.0	5.3	7.8	7.3	58.80	8.37	8.59	8.50	8.63	8.00	3.00
592	PL	M	0-15	232	345	243	201	328	23.41	18.9	13.6	5.5	7.5	8.2	50.87	8.18	8.74	8.58	8.78	8.40	2.91
592	PL	L	0-15	299	393	305	260	373	16.95	17.0	11.9	4.5	7.6	7.1	50.96	11.16	10.17	10.47	9.57	9.10	7.91
593	PL	U	0-15	251	280	204	180	303	21.08	8.8	5.2	6.8	5.8	6.6	20.72	8.70	7.68	8.58	8.03	8.10	5.11
593	PL	M	0-15	430	365	282	257	407	21.89	12.8	8.1	7.0	4.8	5.3	42.06	6.94	6.60	6.56	5.81	6.00	7.27
593	PL	L	0-15	387	395	301	252	351	17.96	13.7	9.4	5.6	6.3	4.2	48.32	5.91	5.93	5.15	4.80	4.40	12.88
594	PL	U	0-15	.	204	188	173	211	8.83	.	11.2	18.9	12.3	12.1	26.06	.	3.51	3.78	4.08	3.10	11.53
594	PL	M	0-15	.	198	198	182	240	12.13	.	10.7	17.8	10.9	12.1	25.94	.	3.48	3.89	4.15	3.60	7.93
594	PL	L	0-15	.	357	281	332	438	18.60	.	22.4	27.5	32.7	25.0	16.33	.	4.53	4.21	4.74	4.80	5.79
595	PL	U	0-15	184	190	277	155	258	24.43	38.2	27.1	20.3	19.6	15.9	36.36	7.76	7.85	6.87	7.92	7.60	5.62
595	PL	M	0-15	184	173	207	160	246	17.46	26.1	27.8	28.8	24.2	12.0	28.65	7.72	7.76	7.28	7.98	7.70	3.28
595	PL	L	0-15	235	218	203	177	290	18.81	37.4	22.8	12.2	17.7	14.4	48.10	5.90	6.17	6.09	6.27	6.10	2.27
599	PL	U	0-15	.	343	230	239	428	30.29	.	10.3	4.0	18.8	27.0	66.73	.	8.93	8.52	8.51	9.10	3.38
599	PL	M	0-15	.	292	243	255	445	30.18	.	9.3	6.7	23.8	19.0	54.77	.	9.09	8.48	8.76	9.20	3.71
599	PL	L	0-15	.	247	204	257	420	33.64	.	10.1	7.5	23.5	50.0	85.43	.	8.07	7.51	7.66	7.90	3.20
			Mean	260	275	223	210	314		17.7	17.3	13.6	15.0	19.2		7.18	6.93	6.74	6.90	6.72	
			Max	430	395	322	366	543		38.2	41.8	37.0	32.7	91.0		11.42	11.78	11.42	11.88	11.20	
			Min	155	162	102	110	153		4.1	4.9	4.0	4.8	4.2		3.95	3.48	3.78	4.08	3.10	
			SD	84	76	58	66	102		9.4	10.7	9.0	7.9	19.3		1.95	2.20	2.16	2.12	2.02	
			CV by year (%)	32.46	27.52	25.84	31.27	32.52		53.19	62.19	66.55	52.93	100.19		27.19	31.70	31.98	30.78	30.07	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	K (mg/kg)					CV across years (%)	S (mg/kg)					CV across years (%)	OM (%)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
615	MB	U	0-15	1110	548	359	183	239	76.82	15.8	6.4	8.5	7.1	7.3	42.89	8.40	5.49	7.04	4.40	4.80	27.63
615	MB	M	0-15	191	149	126	118	133	20.27	9.6	4.3	5.1	5.7	6.6	32.75	3.77	4.12	4.13	3.90	4.60	7.68
615	MB	L	0-15	73	138	131	175	138	28.01	15.5	10.7	19.0	16.9	28.0	35.30	7.63	23.83	26.24	28.70	29.10	38.55
			Mean	458	278	205	159	170		13.6	7.1	10.9	9.9	14.0		6.60	11.15	12.47	12.33	12.83	
			Max	1110	548	359	183	239		15.8	10.7	19.0	16.9	28.0		8.40	23.83	26.24	28.70	29.10	
			Min	73	138	126	118	133		9.6	4.3	5.1	5.7	6.6		3.77	4.12	4.13	3.90	4.60	
			SD	568	234	133	36	60		3.5	3.3	7.2	6.1	12.2		2.48	11.00	12.02	14.18	14.09	
			CV by year (%)	123.96	83.93	64.82	22.57	35.18		25.64	45.73	66.68	61.77	87.05		37.54	98.70	96.35	114.94	109.77	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	K (mg/kg)					CV across years (%)	S (mg/kg)					CV across years (%)	OM (%)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
678	BT	U	0-15	205	155	114	125	150	23.49	4.7	13.4	13.7	28.3	23.0	55.32	4.29	3.79	4.07	4.30	4.60	7.15
678	BT	M	0-15	231	199	166	146	202	17.54	13.5	8.5	19.7	23.4	27.0	40.51	4.04	5.19	5.19	4.90	5.70	12.20
678	BT	L	0-15	306	385	215	278	448	27.98	6.8	20.9	21.0	16.8	26.0	39.39	9.34	10.40	7.59	9.90	9.50	11.39
680	BT	U	0-15	104	120	104	86	178	30.02	12.2	3.3	6.8	4.0	6.0	54.35	2.31	2.07	2.33	2.50	3.20	17.27
680	BT	M	0-15	157	123	112	111	147	16.01	4.2	3.6	7.6	5.1	6.4	30.31	4.50	3.02	4.58	2.34	5.40	31.55
680	BT	L	0-15	132	105	100	106	148	17.55	14.3	3.3	7.5	15.9	6.5	56.51	5.79	5.53	6.05	4.38	6.30	13.31
681	BT	U	0-15	76	83	81	109	103	16.29	12.0	3.3	4.1	4.6	5.2	60.02	2.76	3.20	3.00	4.40	3.20	19.11
681	BT	M	0-15	103	87	72	98	97	13.46	12.8	2.9	5.0	6.5	4.9	59.02	2.35	2.57	2.70	4.90	3.40	32.52
681	BT	L	0-15	94	94	99	112	128	13.85	8.3	3.5	5.7	5.6	5.6	29.68	4.16	6.08	4.96	3.90	5.20	17.91
684	BT	U	0-15	105	115	100	111	118	6.67	7.5	8.2	5.2	5.2	18.2	60.73	1.35	1.82	1.28	2.20	1.60	22.69
684	BT	M	0-15	94	153	124	195	181	27.68	6.1	6.4	8.3	13.7	10.1	34.90	2.56	3.15	2.66	4.00	3.40	18.61
684	BT	L	0-15	440	442	339	346	503	16.95	4.0	15.4	10.4	9.3	16.9	45.98	4.72	5.09	4.91	5.30	5.00	4.28
687	BT	U	0-15	94	130	93	137	127	18.05	10.1	3.2	6.4	16.9	11.3	54.20	1.54	2.06	1.93	2.34	2.20	15.33
687	BT	M	0-15	166	161	142	208	253	23.94	18.6	5.1	11.5	24.6	16.2	48.41	2.36	2.76	3.11	3.16	3.10	11.74
687	BT	L	0-15	112	129	105	146	130	12.96	37.2	20.0	13.3	48.2	2.9	75.12	4.98	5.12	4.79	5.58	4.20	10.19
688	BT	U	0-15	253	208	183	170	251	17.85	4.1	4.4	7.4	6.9	1.8	46.29	9.30	8.81	9.68	6.98	6.90	15.73
688	BT	M	0-15	242	234	154	180	255	20.52	5.4	4.8	5.9	15.2	12.8	54.75	9.13	9.55	9.43	9.89	8.30	6.51
688	BT	L	0-15	446	522	317	198	450	33.31	4.4	5.6	12.3	7.4	48.0	118.45	8.48	9.12	9.90	10.51	10.70	9.59
692	BT	U	0-15	461	285	323	285	461	25.00	9.9	4.9	18.0	6.0	55.0	111.41	6.61	4.95	6.01	7.80	5.30	18.45
692	BT	M	0-15	342	241	317	251	336	16.16	9.2	3.1	14.9	10.7	3.7	59.59	6.73	6.06	6.86	6.90	7.00	5.62
692	BT	L	0-15	307	282	254	207	339	18.23	5.1	4.9	10.1	5.3	3.9	41.43	7.39	7.16	9.58	7.30	8.20	12.74
703	BT	U	0-15	85	92	103	99	158	27.16	3.1	2.2	3.9	6.0	4.6	36.45	2.36	1.70	2.13	2.05	2.40	13.14
703	BT	M	0-15	53	155	84	112	194	46.80	2.6	7.8	4.2	5.6	5.6	37.33	2.21	2.40	2.00	2.16	2.50	8.83
703	BT	L	0-15	50	127	115	128	117	30.36	13.5	16.4	19.0	11.0	55.0	79.02	28.87	16.66	26.27	15.14	25.10	27.32
			Mean	194	193	159	164	228		9.6	7.3	10.1	12.6	15.7		5.75	5.34	5.88	5.53	5.93	
			Max	461	522	339	346	503		37.2	20.9	21.0	48.2	55.0		28.87	16.66	26.27	15.14	25.10	
			Min	50	83	72	86	97		2.6	2.2	3.9	4.0	1.8		1.35	1.70	1.28	2.05	1.60	
			SD	129	117	87	69	127		7.3	5.6	5.3	10.3	16.1		5.55	3.55	5.11	3.28	4.73	
			CV by year (%)	66.51	60.52	54.54	42.21	55.68		75.99	76.96	52.75	81.63	102.47		96.50	66.40	86.91	59.22	79.79	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	K (mg/kg)					CV across years (%)	S (mg/kg)					CV across years (%)	OM (%)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
727	AP	U	0-15	804	805	591	349	374	37.95	7.2	13.8	18.2	4.9	15.1	47.20	10.39	10.72	10.30	8.01	8.90	11.97
727	AP	M	0-15	407	335	322	253	345	16.58	5.8	11.3	16.8	14.1	8.1	39.50	12.32	11.12	12.73	12.43	12.50	5.19
727	AP	L	0-15	133	191	169	111	198	23.40	13.6	11.5	19.0	17.0	21.0	23.61	10.22	10.67	12.15	11.74	12.10	7.70
728	AP	U	0-15	166	178	148	139	184	11.79	8.4	2.2	9.0	7.0	5.0	43.81	4.54	4.92	4.77	5.65	4.70	8.78
728	AP	M	0-15	248	286	214	257	257	10.22	7.9	5.1	12.6	6.7	7.0	36.17	7.82	8.04	8.18	7.77	8.60	4.14
728	AP	L	0-15	645	974	660	495	660	25.45	8.8	5.9	19.5	24.0	8.5	59.38	10.06	10.90	10.70	12.52	12.00	8.91
730	AP	U	0-15	273	216	252	194	287	15.84	4.7	2.6	5.0	3.7	13.2	72.36	2.51	2.71	2.61	2.82	2.70	4.40
730	AP	M	0-15	168	170	142	244	185	20.98	6.5	3.6	8.0	10.1	4.4	40.44	3.87	3.06	4.62	3.57	4.00	15.04
730	AP	L	0-15	263	171	150	192	237	23.04	67.8	10.8	3.5	4.9	6.1	148.47	4.83	4.70	5.79	6.14	5.30	11.50
738	AP	U	0-15	384	251	217	231	399	29.62	32.7	3.1	12.9	25.6	26.0	59.23	4.40	4.88	5.01	4.67	5.20	6.37
738	AP	M	0-15	297	254	170	265	403	30.34	12.2	7.0	15.4	55.0	15.5	91.85	4.74	5.16	5.40	5.57	5.10	6.06
738	AP	L	0-15	261	183	173	225	317	25.51	17.6	7.1	12.3	31.6	12.1	58.28	5.49	4.97	5.42	5.94	5.80	6.81
739	AP	U	0-15	413	436	279	195	338	29.76	4.4	16.9	4.9	3.9	8.0	71.07	2.46	2.69	2.43	2.95	2.50	8.34
739	AP	M	0-15	219	232	147	166	194	18.51	3.6	6.9	2.6	3.7	12.2	67.79	2.06	2.30	2.19	2.25	2.30	4.48
739	AP	L	0-15	427	435	305	152	428	35.13	5.8	13.4	8.6	3.3	15.2	54.18	2.99	3.40	3.14	3.79	3.10	9.75
740	AP	U	0-15	.	229	201	131	258	26.66	.	3.5	14.6	9.5	7.2	53.43	.	4.35	4.00	3.79	4.00	5.71
740	AP	M	0-15	.	268	193	135	327	36.52	.	3.3	43.0	6.9	17.1	102.02	.	8.64	8.40	8.79	9.50	5.38
740	AP	L	0-15	.	486	399	311	1220	69.02	.	114.0	190.0	544.0	130.0	82.75	.	11.38	11.50	9.11	10.90	10.34
743	AP	U	0-15	285	250	165	319	442	34.72	3.7	2.6	10.2	25.3	11.5	85.03	3.16	3.18	2.93	4.10	3.50	13.42
743	AP	M	0-15	306	328	206	249	403	25.36	5.2	3.2	13.4	16.3	5.3	66.57	4.47	4.45	4.27	5.13	4.60	7.18
743	AP	L	0-15	406	304	219	197	348	29.67	15.1	6.0	11.5	13.6	14.2	30.19	5.87	5.75	5.40	6.26	5.90	5.31
744	AP	U	0-15	.	142	106	120	220	34.65	.	4.0	7.1	7.7	17.3	63.61	.	9.17	5.73	6.29	6.90	21.46
744	AP	M	0-15	.	217	145	186	333	36.67	.	4.0	4.8	6.1	1.5	47.36	.	8.80	8.41	8.68	8.60	1.90
744	AP	L	0-15	.	154	171	108	272	39.30	.	4.0	10.2	6.5	16.8	59.52	.	5.14	8.55	9.46	9.80	25.87
746	AP	U	0-15	150	155	138	100	226	29.64	4.5	2.4	4.2	5.2	6.5	32.88	6.88	7.64	7.08	7.08	7.20	3.96
746	AP	M	0-15	151	182	130	104	229	30.32	3.5	3.2	5.7	3.0	7.4	42.02	8.99	11.40	9.28	9.96	11.60	11.73
746	AP	L	0-15	205	455	185	193	289	42.93	6.2	5.1	5.7	4.8	7.8	20.06	10.20	11.29	9.95	10.16	10.80	5.27
			Mean	315	307	230	208	347		11.7	10.2	18.1	32.0	15.6		6.11	6.72	6.70	6.84	6.97	
			Max	804	974	660	495	1220		67.8	114.0	190.0	544.0	130.0		12.32	11.40	12.73	12.52	12.50	
			Min	133	142	106	100	184		3.5	2.2	2.6	3.0	1.5		2.06	2.30	2.19	2.25	2.30	
			SD	167	195	132	90	203		14.5	21.1	35.3	103.0	23.6		3.13	3.22	3.16	2.98	3.31	
			CV by year (%)	53.02	63.66	57.52	43.05	58.46		124.30	206.30	194.88	321.71	151.46		51.26	47.85	47.18	43.63	47.49	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	K (mg/kg)					CV across years (%)	S (mg/kg)					CV across years (%)	OM (%)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
769	MM	U	0-15	443	331	214	424	448	26.94	14.8	4.0	17.7	23.7	17.9	46.44	3.81	3.64	3.36	4.59	3.90	11.81
769	MM	M	0-15	566	414	278	462	464	23.96	10.5	2.9	10.4	12.0	14.7	43.40	4.62	4.82	4.57	5.25	4.80	5.61
769	MM	L	0-15	624	587	372	465	555	19.57	11.8	3.1	13.1	14.2	8.4	44.30	4.68	5.39	5.36	5.27	5.00	5.85
781	MM	U	0-15	364	301	273	259	383	17.46	111.0	3.3	12.9	9.3	17.7	146.32	5.87	5.52	6.27	5.83	6.10	4.80
781	MM	M	0-15	484	281	285	251	383	28.52	3.0	5.0	16.4	13.5	15.0	57.98	5.76	4.63	6.54	5.44	6.50	13.81
781	MM	L	0-15	306	196	179	266	221	22.28	326.0	5.3	16.3	17.3	15.4	183.81	6.55	6.26	6.11	6.50	6.40	2.84
786	MM	U	0-15	559	354	194	319	373	36.53	7.7	4.3	5.7	8.5	15.1	50.44	6.15	3.41	3.24	5.08	3.90	28.33
786	MM	M	0-15	380	276	218	236	305	22.65	6.7	2.3	3.8	7.0	5.1	39.60	3.79	3.52	2.69	3.54	2.90	14.28
786	MM	L	0-15	276	197	174	212	371	32.30	3.2	1.7	4.6	3.9	6.0	41.24	2.89	1.58	2.12	2.84	3.10	25.41
791	MM	U	0-15	365	269	283	308	343	12.82	10.5	1.9	3.7	2.0	4.2	79.11	3.65	3.51	3.93	4.00	3.50	6.35
791	MM	M	0-15	286	294	310	291	359	9.69	2.5	2.2	2.9	1.5	3.5	29.24	3.35	3.64	4.25	4.50	3.90	11.72
791	MM	L	0-15	690	768	600	493	720	16.68	3.3	2.5	3.6	3.0	4.8	25.17	4.51	5.09	5.54	5.00	4.60	8.31
793	MM	U	0-15	273	240	251	290	312	10.65	3.3	2.5	2.7	2.2	4.4	28.88	3.56	3.75	4.04	4.20	3.80	6.47
793	MM	M	0-15	262	262	253	313	294	9.29	3.1	2.9	2.7	2.7	3.6	12.86	2.93	3.18	3.56	3.80	3.40	9.96
793	MM	L	0-15	311	269	252	278	356	14.02	4.6	2.9	2.7	3.3	4.4	24.42	3.25	3.40	3.82	4.00	3.60	8.44
			Mean	413	336	276	324	392		34.8	3.1	7.9	8.3	9.3		4.36	4.09	4.36	4.66	4.36	
			Max	690	768	600	493	720		326.0	5.3	17.7	23.7	17.9		6.55	6.26	6.54	6.50	6.50	
			Min	262	196	174	212	221		2.5	1.7	2.7	1.5	3.5		2.89	1.58	2.12	2.84	2.90	
			SD	141	153	104	91	120		85.0	1.1	5.8	6.7	5.8		1.22	1.18	1.34	0.96	1.18	
			CV by year (%)	34.08	45.58	37.66	27.97	30.53		244.30	34.72	73.06	80.82	61.78		27.89	28.87	30.79	20.53	26.95	
798	FG	U	0-15	206	720	225	341	547	54.21	2.9	4.0	12.3	12.8	21.0	69.75	6.00	7.46	6.54	7.02	7.00	8.13
798	FG	M	0-15	275	317	167	250	344	25.28	3.5	3.6	4.9	19.4	6.9	87.39	6.32	6.47	6.94	6.64	6.40	3.74
798	FG	L	0-15	614	731	257	357	539	38.44	4.9	3.6	4.9	12.7	14.5	62.40	6.88	7.56	6.38	6.78	7.20	6.41
800	FG	U	0-15	610	658	513	537	580	9.94	1.9	2.7	4.7	3.7	3.3	32.33	5.88	5.89	6.22	6.90	6.10	6.74
800	FG	M	0-15	672	632	524	534	700	13.05	2.5	2.3	2.7	4.9	3.8	33.50	5.83	5.51	6.25	7.20	6.10	10.30
800	FG	L	0-15	597	637	510	627	690	10.82	2.8	1.5	3.4	5.0	3.6	39.42	5.51	5.56	6.60	7.10	6.20	10.97
			Mean	496	616	366	441	567		3.1	3.0	5.5	9.7	8.9		6.07	6.41	6.49	6.94	6.50	
			Max	672	731	524	627	700		4.9	4.0	12.3	19.4	21.0		6.88	7.56	6.94	7.20	7.20	
			Min	206	317	167	250	344		1.9	1.5	2.7	3.7	3.3		5.51	5.51	6.22	6.64	6.10	
			SD	201	152	167	146	130		1.0	1.0	3.5	6.2	7.3		0.48	0.92	0.27	0.21	0.48	
			CV by year (%)	40.45	24.72	45.50	33.05	22.86		33.48	32.28	63.10	63.64	82.60		7.83	14.32	4.13	3.00	7.41	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	K (mg/kg)					CV across years (%)	S (mg/kg)					CV across years (%)	OM (%)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
804	MG	U	0-15	311	325	171	188	284	27.90	7.9	3.0	6.9	6.4	4.3	35.11	2.70	2.66	2.84	2.56	2.50	4.99
804	MG	M	0-15	297	358	144	247	372	32.67	10.3	3.9	5.8	15.3	18.5	57.38	2.94	2.88	2.27	3.28	3.10	13.20
804	MG	L	0-15	430	442	203	401	540	30.64	15.4	5.3	18.9	10.4	11.9	41.56	4.79	4.44	3.78	4.71	4.80	9.55
806	MG	U	0-15	349	281	234	237	388	23.00	7.4	3.7	11.8	6.3	12.1	43.87	2.16	2.11	2.34	2.13	2.10	4.57
806	MG	M	0-15	315	319	202	202	343	24.82	4.8	3.3	15.7	19.1	5.2	75.31	2.07	2.43	2.28	2.23	1.90	9.30
806	MG	L	0-15	458	310	326	289	437	21.33	6.1	2.7	10.1	16.3	15.3	57.78	3.60	2.11	3.50	3.30	3.50	19.31
809	MG	U	0-15	312	359	210	295	433	25.56	2.7	2.0	2.7	1.5	3.0	25.12	2.20	1.95	2.36	2.66	2.40	11.25
809	MG	M	0-15	495	366	219	323	479	30.40	5.2	1.7	2.6	4.3	3.0	41.43	2.37	2.19	2.28	2.59	2.60	7.66
809	MG	L	0-15	471	303	254	230	540	38.40	4.0	3.2	5.1	3.3	3.7	19.55	3.59	3.39	2.35	2.38	3.70	21.45
812	MG	U	0-15	238	236	211	167	281	18.39	109.0	46.3	13.5	10.9	4.9	117.57	1.87	1.63	1.85	2.17	1.80	10.44
812	MG	M	0-15	265	213	188	168	244	18.44	20.9	18.7	14.2	15.4	6.4	36.72	2.27	1.33	1.54	1.73	1.60	20.83
812	MG	L	0-15	277	333	269	231	334	15.38	69.0	16.8	15.7	17.5	3.5	104.16	2.43	1.90	2.09	2.42	2.00	11.19
815	MG	U	0-15	196	247	229	211	330	21.62	1.8	1.8	1.4	1.6	3.2	36.16	1.39	1.69	2.02	2.06	1.60	16.24
815	MG	M	0-15	193	314	242	280	318	19.51	1.9	2.7	1.5	2.4	3.8	35.74	1.44	1.63	1.83	2.30	1.40	21.31
815	MG	L	0-15	697	750	510	475	760	21.29	3.2	5.5	7.2	6.8	12.5	48.66	2.83	2.80	3.24	2.74	3.10	7.37
823	MG	U	0-15	254	276	290	278	244	7.02	69.8	56.0	19.0	45.8	114.0	57.49	2.31	2.55	2.67	2.88	2.60	7.86
823	MG	M	0-15	352	408	366	295	397	12.30	7.8	5.2	18.9	19.9	13.1	50.30	2.40	2.22	2.61	2.61	2.50	6.67
823	MG	L	0-15	541	504	401	418	640	19.40	9.2	5.5	21.0	46.4	30.0	73.82	2.95	2.52	2.72	3.06	3.10	8.53
1828	MG	U	0-15	174	119	140	152	232	26.41	1.4	0.9	1.9	1.0	1.0	33.54	1.36	1.33	1.20	1.44	1.00	13.61
1828	MG	M	0-15	450	454	379	359	472	11.91	2.4	1.6	5.5	3.7	3.1	45.31	2.05	1.54	2.29	2.19	1.90	14.58
1828	MG	L	0-15	315	358	341	329	420	11.60	2.2	1.5	4.2	1.0	4.4	58.58	1.88	2.14	2.20	2.27	1.90	8.67
2828	MG	U	0-15	.	.	202	202	469	52.95	.	.	9.6	16.6	7.5	42.27	.	.	2.47	2.53	2.50	1.13
2828	MG	M	0-15	.	.	175	158	436	60.85	.	.	10.1	14.4	8.9	25.89	.	.	2.34	2.43	2.80	9.59
2828	MG	L	0-15	.	.	270	239	535	46.74	.	.	12.5	17.8	16.1	17.55	.	.	2.68	2.93	3.10	7.26
			Mean	352	346	257	266	414		17.3	9.1	9.8	12.7	12.9		2.46	2.26	2.41	2.57	2.48	
			Max	697	750	510	475	760		109.0	56.0	21.0	46.4	114.0		4.79	4.44	3.78	4.71	4.80	
			Min	174	119	140	152	232		1.4	0.9	1.4	1.0	1.0		1.36	1.33	1.20	1.44	1.00	
			SD	131	126	90	86	129		28.7	14.8	6.2	12.2	22.6		0.82	0.73	0.57	0.63	0.84	
			CV by year (%)	37.18	36.48	34.98	32.28	31.28		166.15	162.34	63.57	96.01	174.98		33.18	32.30	23.67	24.65	34.00	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	Light Fraction Carbon (%)					CV across years (%)	Light Fraction Carbon_mass (mg/g)					CV across years (%)	Light Fraction Nitrogen (%)					CV across years (%)	
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		
586	PL	U	0-15	30.6	29.3	30.5	29.3	13.9	26.84	3.63	1.17	2.84	1.85	4.69	49.18	1.37	1.18	1.26	1.19	0.67	23.98	
586	PL	M	0-15	32.2	28.4	31.7	29.8	28.9	5.56	3.10	0.76	1.16	2.38	2.57	49.66	1.23	1.06	0.76	1.00	0.97	16.75	
586	PL	L	0-15	28.3	30.5	31.4	22.1	22.1	16.69	1.74	0.81	1.46	3.02	1.91	45.00	1.17	1.03	1.07	0.86	0.75	17.24	
588	PL	U	0-15	30.0	21.2	28.3	19.4	8.2	40.49	1.37	0.57	0.85	0.84	2.18	55.17	1.62	1.19	1.35	0.91	0.49	38.84	
588	PL	M	0-15	28.7	21.7	24.9	21.2	17.8	18.10	1.34	0.36	1.16	1.06	1.58	41.59	1.62	1.27	1.32	0.98	1.03	20.66	
588	PL	L	0-15	27.9	27.3	21.0	21.4	23.3	13.36	1.12	0.91	0.49	0.50	0.99	36.24	1.51	1.50	0.93	0.99	1.19	22.33	
590	PL	U	0-15	26.5	23.4	23.2	20.1	19.6	12.48	2.96	1.72	2.55	1.94	4.35	38.57	1.63	1.39	1.41	1.20	1.23	12.57	
590	PL	M	0-15	26.7	26.0	23.4	22.4	18.5	13.84	2.13	1.82	1.25	1.50	2.85	32.68	1.53	1.53	1.29	1.30	1.11	13.20	
590	PL	L	0-15	26.2	26.1	26.2	22.6	29.4	9.33	2.63	1.48	1.22	1.43	3.10	42.54	1.55	1.48	1.41	1.24	1.51	8.47	
591	PL	U	0-15	24.9	26.3	21.1	22.9	23.0	8.44	2.14	1.67	1.20	2.52	1.14	34.54	1.40	1.23	0.93	1.22	1.12	14.51	
591	PL	M	0-15	26.7	28.1	25.9	23.4	28.1	7.36	2.02	2.06	1.55	2.96	1.97	24.45	1.46	1.27	1.11	1.30	1.24	9.84	
591	PL	L	0-15	27.0	26.5	25.9	20.1	30.2	14.07	2.77	1.68	0.95	3.82	0.98	60.88	1.56	1.37	1.07	1.20	1.35	14.13	
592	PL	U	0-15	27.4	16.9	16.1	22.5	24.6	22.81	1.54	0.79	0.81	2.99	2.07	56.73	1.98	1.20	1.16	1.55	1.77	23.23	
592	PL	M	0-15	29.0	18.6	21.7	20.4	22.7	17.66	1.38	1.11	1.01	3.13	2.41	51.03	2.13	1.34	1.46	1.46	1.58	19.45	
592	PL	L	0-15	28.6	25.5	16.5	19.7	24.6	21.08	1.99	1.02	0.44	2.56	1.81	53.43	2.07	1.61	1.04	1.43	1.65	23.87	
593	PL	U	0-15	26.5	21.6	24.2	15.7	23.8	18.26	1.08	0.58	1.13	0.68	0.90	27.73	1.34	1.10	1.27	0.90	1.17	14.69	
593	PL	M	0-15	26.6	23.6	25.8	19.2	23.8	12.09	2.22	0.31	0.77	0.45	0.88	81.80	1.26	0.99	1.18	1.01	0.94	12.58	
593	PL	L	0-15	24.8	18.9	24.3	21.0	23.7	11.13	1.21	0.44	0.73	0.70	0.84	35.48	1.21	0.92	1.13	1.08	1.08	9.74	
594	PL	U	0-15	.	23.6	25.2	18.4	21.8	13.14	.	0.86	1.85	1.41	0.47	52.95	.	0.97	1.16	0.87	0.90	13.31	
594	PL	M	0-15	.	24.6	25.0	23.0	22.2	5.56	.	1.31	1.92	1.68	0.27	56.34	.	0.91	1.15	1.02	0.95	10.54	
594	PL	L	0-15	.	23.5	25.1	19.4	26.8	13.37	.	1.25	1.42	1.81	3.34	48.69	.	0.97	1.18	0.95	1.06	10.07	
595	PL	U	0-15	24.0	23.0	7.3	18.5	26.9	38.61	1.08	0.69	0.29	1.85	1.31	56.98	1.21	1.06	0.54	0.98	1.02	26.18	
595	PL	M	0-15	21.7	24.6	15.6	19.7	20.7	16.11	1.10	1.07	0.42	1.78	1.55	44.30	1.18	1.14	0.87	1.05	0.99	11.76	
595	PL	L	0-15	23.7	21.5	16.8	17.4	30.5	25.34	1.20	0.86	0.50	2.20	1.95	53.47	1.17	1.00	0.87	0.91	1.29	17.06	
599	PL	U	0-15	.	21.7	19.1	21.0	22.7	7.22	.	1.16	0.83	3.07	1.85	57.48	.	1.04	1.01	1.21	1.12	8.18	
599	PL	M	0-15	.	19.8	22.5	20.5	25.4	11.26	.	0.73	0.83	4.03	1.74	83.85	.	1.09	1.03	1.23	1.21	8.34	
599	PL	L	0-15	.	20.3	21.6	17.1	24.2	14.23	.	0.81	0.79	2.39	1.53	54.81	.	1.08	1.04	0.92	1.22	11.76	
			Mean	27.0	23.8	23.0	21.0	23.2			1.89	1.04	1.13	2.02	1.90		1.48	1.18	1.11	1.11	1.13	
			Max	32.2	30.5	31.7	29.8	30.5			3.63	2.06	2.84	4.03	4.69		2.13	1.61	1.46	1.55	1.77	
			Min	21.7	16.9	7.3	15.7	8.2			1.08	0.31	0.29	0.45	0.27		1.17	0.91	0.54	0.86	0.49	
			SD	2.4	3.4	5.3	3.1	4.9			0.76	0.46	0.61	0.99	1.07		0.29	0.20	0.21	0.19	0.29	
			CV by year (%)	9.06	14.48	23.28	14.75	21.04			40.32	44.72	54.52	48.76	56.54		19.48	16.74	19.00	17.28	25.16	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	Light Fraction Carbon (%)					CV across years (%)	Light Fraction Carbon_mass (mg/g)					CV across years (%)	Light Fraction Nitrogen (%)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
615	MB	U	0-15	30.2	33.1	31.4	28.9	29.9	5.26	4.70	4.31	10.98	4.53	11.19	50.46	1.94	2.01	2.03	1.65	1.79	8.57
615	MB	M	0-15	29.2	34.1	27.6	22.7	29.8	14.32	2.52	1.93	2.94	1.44	5.03	49.96	1.73	1.66	1.69	1.21	1.61	13.40
615	MB	L	0-15	33.0	42.5	32.6	33.0	29.7	14.30	2.41	3.83	13.89	0.88	15.80	94.29	2.22	1.71	1.95	1.91	1.68	11.51
			Mean	30.8	36.6	30.5	28.2	29.8		3.21	3.36	9.27	2.28	10.67		1.96	1.79	1.89	1.59	1.69	
			Max	33.0	42.5	32.6	33.0	29.9		4.70	4.31	13.89	4.53	15.80		2.22	2.01	2.03	1.91	1.79	
			Min	29.2	33.1	27.6	22.7	29.7		2.41	1.93	2.94	0.88	5.03		1.73	1.66	1.69	1.21	1.61	
			SD	2.0	5.2	2.6	5.2	0.1		1.29	1.26	5.67	1.97	5.40		0.24	0.19	0.18	0.35	0.09	
			CV by year (%)	6.36	14.14	8.57	18.36	0.37		40.09	37.41	61.19	86.07	50.60		12.44	10.56	9.41	22.25	5.43	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	Light Fraction Carbon (%)					CV across years (%)	Light Fraction Carbon_mass (mg/g)					CV across years (%)	Light Fraction Nitrogen (%)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
678	BT	U	0-15	29.6	25.0	23.4	20.3	26.2	13.83	1.37	1.50	2.11	1.55	3.09	37.04	1.43	1.25	1.16	0.96	1.25	14.17
678	BT	M	0-15	25.1	26.0	23.4	22.9	23.6	5.29	1.49	1.73	2.81	2.29	4.11	41.86	1.43	1.20	1.20	1.09	1.23	10.04
678	BT	L	0-15	31.6	24.3	28.2	31.0	26.7	10.67	1.10	0.89	1.60	2.58	2.60	45.85	1.50	1.23	1.18	1.14	1.40	11.97
680	BT	U	0-15	27.4	16.6	20.6	20.5	27.4	21.11	0.78	0.44	0.69	1.50	1.88	57.24	1.48	0.87	1.04	1.05	1.18	20.13
680	BT	M	0-15	24.6	17.4	20.5	20.2	25.0	14.94	1.84	0.58	1.23	1.61	2.73	49.68	1.42	0.94	1.13	1.12	1.33	16.02
680	BT	L	0-15	24.3	20.4	18.7	22.8	24.8	11.81	1.90	1.29	1.74	2.89	3.05	35.02	1.47	1.20	1.06	1.22	1.43	13.45
681	BT	U	0-15	31.7	21.4	18.5	20.5	25.3	22.22	1.23	1.28	0.99	1.23	1.94	26.90	1.51	1.19	0.87	1.11	1.15	19.61
681	BT	M	0-15	26.9	22.8	18.4	21.9	25.5	14.37	0.80	1.14	1.04	1.53	1.95	34.90	1.48	0.94	0.83	1.13	1.19	22.47
681	BT	L	0-15	30.0	27.8	25.1	18.6	25.9	16.78	1.32	1.76	1.42	0.99	2.13	28.46	1.40	1.15	1.03	0.91	1.11	16.31
684	BT	U	0-15	24.2	22.9	16.7	18.4	22.8	15.45	0.73	0.84	0.50	1.78	1.28	49.47	1.28	0.95	0.82	0.89	1.04	17.97
684	BT	M	0-15	27.1	27.7	21.9	24.8	23.9	9.48	0.69	1.29	1.17	3.64	2.06	65.37	1.35	1.34	0.99	1.13	1.12	13.12
684	BT	L	0-15	25.0	25.0	26.6	19.3	24.5	11.59	1.73	2.09	2.21	1.41	2.34	19.37	1.33	1.12	1.17	1.11	1.19	7.35
687	BT	U	0-15	23.5	23.5	22.3	19.7	24.9	8.65	0.98	2.11	1.56	1.18	2.09	32.57	1.38	1.27	1.24	1.18	1.32	6.08
687	BT	M	0-15	24.1	22.3	21.1	23.8	30.5	14.95	1.32	2.23	1.90	1.75	2.84	28.35	1.42	1.31	1.12	1.44	1.66	14.23
687	BT	L	0-15	25.3	24.2	17.5	20.2	23.5	14.60	1.42	1.53	0.81	1.01	1.59	26.87	1.46	1.28	1.00	1.07	1.29	15.15
688	BT	U	0-15	21.2	21.8	18.2	18.4	23.0	10.37	1.91	1.67	1.70	0.92	1.34	25.69	1.40	1.35	1.23	1.10	1.30	9.16
688	BT	M	0-15	23.1	22.0	18.8	20.8	22.7	8.01	2.00	1.17	1.63	2.08	1.41	23.21	1.46	1.40	1.25	1.35	1.39	5.76
688	BT	L	0-15	23.8	21.8	19.9	20.9	21.6	6.65	1.60	1.96	2.12	1.53	2.82	25.66	1.52	1.38	1.32	1.35	1.37	5.62
692	BT	U	0-15	31.2	15.5	35.3	29.5	28.1	26.70	3.06	0.10	0.94	2.16	1.21	76.40	1.49	0.74	1.08	1.26	1.18	23.82
692	BT	M	0-15	28.6	26.7	31.1	25.7	28.2	7.30	2.19	1.07	1.55	2.91	2.57	36.35	1.20	0.92	1.28	1.35	1.29	14.02
692	BT	L	0-15	29.8	27.9	29.2	21.8	13.1	28.98	2.90	0.84	2.14	2.33	0.75	53.21	1.21	0.97	1.20	1.37	0.64	26.38
703	BT	U	0-15	26.6	12.2	17.3	13.0	16.4	33.58	0.64	0.33	0.52	0.48	0.51	22.52	1.26	0.64	0.84	0.61	0.63	34.34
703	BT	M	0-15	28.0	27.9	15.2	17.4	22.5	26.45	0.98	0.56	0.51	0.75	0.86	27.13	1.49	1.50	0.70	0.81	0.76	38.51
703	BT	L	0-15	39.1	39.7	31.5	20.3	32.9	23.96	7.91	1.32	6.30	1.35	13.74	84.46	1.83	1.29	1.64	1.00	1.54	22.11
			Mean	27.2	23.4	22.5	21.4	24.5		1.74	1.24	1.63	1.73	2.54		1.43	1.14	1.10	1.11	1.21	
			Max	39.1	39.7	35.3	31.0	32.9		7.91	2.23	6.30	3.64	13.74		1.83	1.50	1.64	1.44	1.66	
			Min	21.2	12.2	15.2	13.0	13.1		0.64	0.10	0.50	0.48	0.51		1.20	0.64	0.70	0.61	0.63	
			SD	3.9	5.4	5.3	3.8	4.0		1.46	0.59	1.17	0.76	2.53		0.13	0.22	0.20	0.19	0.25	
			CV by year (%)	14.28	22.85	23.75	17.64	16.39		83.80	47.60	71.43	44.07	99.84		8.88	19.42	18.31	17.34	20.56	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	Light Fraction Carbon (%)					CV across years (%)	Light Fraction Carbon_mass (mg/g)					CV across years (%)	Light Fraction Nitrogen (%)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
727	AP	U	0-15	29.1	24.5	25.2	18.3	27.7	16.69	1.25	1.06	1.26	0.73	1.30	21.12	1.61	1.15	1.23	0.97	1.34	18.97
727	AP	M	0-15	27.3	15.8	22.3	18.5	17.0	23.18	1.12	0.69	1.27	0.99	0.72	26.30	1.50	1.02	1.23	1.09	0.97	18.36
727	AP	L	0-15	24.7	16.6	21.5	16.2	16.6	20.07	0.62	0.44	1.36	1.29	0.79	45.34	1.45	1.06	1.27	1.02	0.99	17.13
728	AP	U	0-15	23.2	25.4	21.7	23.7	23.4	5.64	1.66	2.20	2.03	3.08	1.60	28.23	1.47	1.58	1.46	1.52	1.20	10.10
728	AP	M	0-15	24.2	22.1	21.9	21.2	21.6	5.35	2.87	2.58	2.33	4.45	2.45	29.65	1.59	1.43	1.37	1.42	1.19	10.39
728	AP	L	0-15	28.4	23.3	27.5	26.4	31.1	10.47	6.22	5.27	4.86	13.91	5.87	52.22	1.64	1.49	1.59	1.72	1.54	5.59
730	AP	U	0-15	18.1	13.0	15.2	17.2	21.1	18.09	0.67	0.22	0.81	0.75	0.52	39.99	1.16	0.78	0.99	1.11	1.10	14.69
730	AP	M	0-15	16.2	20.2	17.0	17.2	21.5	12.38	0.93	1.21	1.02	1.55	0.56	34.64	1.02	1.28	1.08	1.11	1.19	8.90
730	AP	L	0-15	21.3	19.3	14.6	20.6	21.3	14.49	0.65	1.16	0.73	1.17	1.01	25.43	1.47	1.32	0.97	1.27	1.28	14.31
738	AP	U	0-15	21.0	18.9	19.4	25.6	20.9	12.49	1.74	1.26	1.61	2.39	2.03	23.66	1.10	1.08	1.14	1.11	0.99	5.39
738	AP	M	0-15	21.8	18.1	19.7	19.7	22.6	8.90	1.85	1.45	1.31	1.97	2.22	21.32	1.12	1.04	1.15	1.04	1.03	5.15
738	AP	L	0-15	21.0	16.4	22.8	20.0	29.4	21.91	1.87	0.55	1.14	1.53	3.08	57.90	1.13	0.88	1.27	1.30	0.68	25.36
739	AP	U	0-15	16.0	17.1	18.9	14.5	18.5	10.70	1.12	1.37	0.95	0.68	0.73	29.23	1.09	1.13	1.25	1.00	1.24	9.15
739	AP	M	0-15	16.4	14.2	17.2	14.9	22.4	19.03	0.83	0.90	0.74	1.04	0.49	25.56	1.06	0.95	1.11	0.98	1.32	13.51
739	AP	L	0-15	20.7	21.1	18.6	17.9	22.0	8.70	1.67	2.18	0.87	1.01	1.45	36.69	1.37	1.34	1.19	1.12	1.22	8.41
740	AP	U	0-15	.	16.4	21.0	20.1	23.8	15.04	.	1.15	1.54	1.34	1.23	12.93	.	1.03	1.16	1.28	1.20	8.94
740	AP	M	0-15	.	20.0	22.2	21.3	22.0	4.50	.	2.34	2.14	4.33	2.64	34.91	.	1.30	1.42	1.36	1.27	5.05
740	AP	L	0-15	.	19.4	19.0	20.0	27.3	18.32	.	1.16	1.14	2.00	1.34	28.45	.	1.40	1.36	1.46	1.56	6.02
743	AP	U	0-15	21.5	8.2	17.3	24.5	28.4	38.68	0.56	0.11	0.29	0.82	0.17	75.56	1.11	0.55	1.02	1.22	1.06	26.05
743	AP	M	0-15	22.3	11.4	20.6	19.0	20.8	23.05	1.31	0.23	0.55	1.26	0.27	72.95	1.12	0.63	1.09	0.94	0.90	20.82
743	AP	L	0-15	20.9	19.3	20.0	18.9	23.4	8.69	1.50	0.58	1.00	1.20	0.46	45.50	1.17	1.10	1.19	1.14	1.07	4.53
744	AP	U	0-15	.	21.4	16.8	18.9	27.2	21.32	.	1.28	0.84	2.39	1.96	42.70	.	1.19	0.93	1.19	1.27	12.86
744	AP	M	0-15	.	17.9	20.0	17.6	24.7	16.36	.	0.78	1.13	3.23	3.21	63.10	.	1.10	0.99	1.11	1.22	8.37
744	AP	L	0-15	.	16.3	19.4	16.9	28.4	27.62	.	0.76	1.36	2.14	2.31	43.75	.	1.07	1.07	1.11	1.30	9.67
746	AP	U	0-15	25.0	19.1	14.7	14.3	18.9	23.43	0.58	0.70	0.59	0.81	0.47	20.80	1.50	1.18	0.92	0.92	0.97	22.60
746	AP	M	0-15	27.8	27.8	16.2	19.3	24.0	22.43	0.72	1.85	0.70	1.55	1.24	41.86	1.52	1.48	0.95	1.13	1.13	19.82
746	AP	L	0-15	27.9	24.7	23.6	20.3	25.0	11.43	7.38	1.73	0.47	1.42	1.25	114.10	1.48	1.42	1.34	1.22	1.26	8.04
			Mean	22.6	18.8	19.8	19.4	23.4		1.77	1.30	1.26	2.19	1.53		1.32	1.15	1.18	1.18	1.16	
			Max	29.1	27.8	27.5	26.4	31.1		7.38	5.27	4.86	13.91	5.87		1.64	1.58	1.59	1.72	1.56	
			Min	16.0	8.2	14.6	14.3	16.6		0.56	0.11	0.29	0.68	0.17		1.02	0.55	0.92	0.92	0.68	
			SD	4.0	4.4	3.1	3.1	3.7		1.78	1.03	0.87	2.56	1.22		0.21	0.25	0.17	0.19	0.19	
			CV by year (%)	17.83	23.26	15.89	15.92	16.05		100.70	79.28	69.39	116.95	79.77		16.28	22.14	14.80	16.10	16.15	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	Light Fraction Carbon (%)					CV across years (%)	Light Fraction Carbon_mass (mg/g)					CV across years (%)	Light Fraction Nitrogen (%)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
769	MM	U	0-15	19.6	12.7	17.3	16.8	16.8	15.13	1.44	0.46	0.81	2.18	0.31	74.16	1.30	0.88	1.17	1.18	0.85	18.38
769	MM	M	0-15	20.8	19.6	17.9	18.3	20.8	7.05	2.59	0.92	1.07	2.75	1.10	53.54	1.38	1.21	1.21	1.27	1.15	6.96
769	MM	L	0-15	21.8	17.2	20.0	17.2	30.3	25.39	1.83	0.97	1.33	1.55	1.52	22.03	1.40	1.16	1.35	1.20	1.48	10.29
781	MM	U	0-15	22.6	15.1	19.1	17.8	25.9	20.98	1.56	0.55	1.59	1.37	0.55	47.00	1.33	0.95	1.23	1.08	1.36	14.64
781	MM	M	0-15	22.2	16.7	18.5	16.3	14.8	16.05	1.86	0.33	1.42	1.63	0.41	62.75	1.38	0.95	1.16	1.07	0.86	18.58
781	MM	L	0-15	21.8	17.3	17.7	17.9	19.7	9.90	1.49	0.81	1.30	2.63	0.83	52.55	1.37	1.09	1.17	1.18	1.01	11.47
786	MM	U	0-15	26.5	23.0	18.6	21.8	24.9	13.11	10.41	2.53	2.11	3.34	1.99	87.84	2.07	1.63	1.34	1.65	1.69	15.62
786	MM	M	0-15	22.1	29.2	15.1	19.6	27.6	25.38	3.31	4.96	1.01	2.42	2.04	54.09	1.62	1.91	1.06	1.39	1.56	20.75
786	MM	L	0-15	29.1	20.8	18.8	24.8	29.5	19.64	3.12	1.11	0.75	2.56	3.87	58.02	2.07	1.36	1.25	1.69	1.91	21.08
791	MM	U	0-15	22.0	15.4	16.5	18.2	13.3	19.04	1.47	0.62	1.54	1.82	0.32	55.97	1.35	0.92	1.01	1.11	0.85	18.59
791	MM	M	0-15	23.6	14.2	17.9	18.5	14.4	21.52	0.57	0.43	1.08	1.29	0.33	57.35	1.42	0.87	1.04	1.09	0.67	27.50
791	MM	L	0-15	25.1	17.8	18.0	21.3	20.9	14.52	1.11	0.83	1.62	2.06	1.18	35.52	1.50	1.12	1.06	1.09	0.90	19.54
793	MM	U	0-15	21.6	15.3	13.6	14.6	12.8	22.46	0.70	0.56	0.50	0.78	0.31	32.00	1.24	0.95	0.79	0.83	0.77	21.33
793	MM	M	0-15	19.4	12.4	14.9	21.5	15.2	22.15	0.50	0.54	0.69	1.43	0.19	69.13	1.19	0.76	0.78	1.00	0.85	19.49
793	MM	L	0-15	22.6	16.1	12.4	17.0	15.2	22.33	0.86	0.54	0.66	0.97	0.29	40.26	1.26	0.91	0.70	0.88	0.80	23.21
			Mean	22.7	17.5	17.1	18.8	20.1		2.19	1.08	1.17	1.92	1.02		1.46	1.11	1.09	1.18	1.11	
			Max	29.1	29.2	20.0	24.8	30.3		10.41	4.96	2.11	3.34	3.87		2.07	1.91	1.35	1.69	1.91	
			Min	19.4	12.4	12.4	14.6	12.8		0.50	0.33	0.50	0.78	0.19		1.19	0.76	0.70	0.83	0.67	
			SD	2.5	4.3	2.2	2.6	6.1		2.43	1.20	0.45	0.72	1.01		0.27	0.31	0.20	0.24	0.39	
			CV by year (%)	11.18	24.64	12.60	13.86	30.51		111.12	111.13	38.28	37.76	99.10		18.51	28.17	18.32	20.52	34.73	
798	FG	U	0-15	22.4	23.5	15.0	18.4	21.3	17.19	1.27	8.79	0.90	3.07	1.57	104.99	1.42	1.32	0.94	1.13	1.22	15.22
798	FG	M	0-15	21.5	21.9	14.9	20.2	16.4	16.52	1.66	2.99	1.09	3.83	0.59	66.13	1.36	1.30	0.96	1.22	0.99	15.59
798	FG	L	0-15	21.8	24.1	14.0	18.4	21.9	19.71	2.24	5.87	0.65	3.06	1.90	71.09	1.41	1.40	0.89	1.14	1.29	17.74
800	FG	U	0-15	18.2	8.5	14.1	20.3	10.4	34.93	0.86	0.17	0.57	1.89	0.16	97.62	0.90	0.53	0.79	1.11	0.54	31.98
800	FG	M	0-15	20.1	4.5	14.8	19.3	13.0	43.50	0.99	0.09	0.69	2.25	0.18	103.55	0.82	0.36	0.83	1.04	0.71	33.14
800	FG	L	0-15	10.8	4.3	18.7	19.0	15.7	45.19	0.43	0.06	1.12	3.29	0.14	133.47	0.57	0.36	0.94	1.01	0.65	38.10
			Mean	19.1	14.5	15.2	19.2	16.4		1.24	3.00	0.84	2.90	0.76		1.08	0.88	0.89	1.11	0.90	
			Max	22.4	24.1	18.7	20.3	21.9		2.24	8.79	1.12	3.83	1.90		1.42	1.40	0.96	1.22	1.29	
			Min	10.8	4.3	14.0	18.4	10.4		0.43	0.06	0.57	1.89	0.14		0.57	0.36	0.79	1.01	0.54	
			SD	4.3	9.7	1.7	0.8	4.5		0.64	3.66	0.24	0.71	0.78		0.36	0.51	0.07	0.08	0.31	
			CV by year (%)	22.72	66.87	11.30	4.31	27.44		51.48	122.12	28.24	24.45	103.23		33.67	58.14	7.69	6.79	34.85	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	Light Fraction Carbon (%)					CV across years (%)	Light Fraction Carbon_mass (mg/g)					CV across years (%)	Light Fraction Nitrogen (%)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
804	MG	U	0-15	19.3	18.6	15.0	15.8	15.5	11.64	1.22	1.11	0.70	0.79	0.52	33.41	1.25	1.13	0.94	1.02	0.88	14.04
804	MG	M	0-15	19.7	19.3	14.0	16.0	22.8	18.76	2.21	1.48	0.51	1.49	0.99	47.32	1.22	1.18	0.89	1.02	1.27	14.03
804	MG	L	0-15	22.0	20.0	17.6	17.5	20.8	10.12	2.11	1.53	0.94	2.16	2.04	29.71	1.34	1.22	1.05	1.14	1.25	9.21
806	MG	U	0-15	20.7	4.0	9.7	10.6	11.4	53.16	0.15	0.05	0.23	0.35	0.13	62.18	1.08	0.26	0.58	0.62	0.51	48.90
806	MG	M	0-15	20.1	10.4	11.2	11.3	6.8	40.81	0.36	0.28	0.26	0.38	0.13	34.92	1.01	0.54	0.63	0.64	0.36	37.07
806	MG	L	0-15	19.3	26.1	15.1	14.4	15.0	27.66	0.97	0.09	0.75	1.01	0.38	62.24	1.19	1.31	0.96	0.93	0.71	22.90
809	MG	U	0-15	19.0	14.3	16.9	14.1	16.2	12.60	0.43	0.38	0.45	0.70	0.29	33.78	1.20	0.95	1.02	0.87	0.93	12.97
809	MG	M	0-15	16.4	15.1	11.4	14.5	16.1	13.50	0.74	0.40	0.30	0.82	0.46	41.06	1.09	0.93	0.76	0.95	0.92	12.64
809	MG	L	0-15	17.3	9.4	13.0	9.5	15.1	26.98	0.61	0.19	0.52	0.25	0.60	46.13	1.05	0.63	0.81	0.60	0.88	23.52
812	MG	U	0-15	13.6	7.8	20.8	11.4	21.4	39.86	0.48	0.10	0.49	0.34	0.29	46.36	0.75	0.51	1.33	0.74	1.32	40.10
812	MG	M	0-15	19.5	3.2	19.6	9.8	9.5	57.78	0.58	0.09	0.26	0.23	0.15	73.46	0.96	0.23	1.06	0.65	0.63	46.15
812	MG	L	0-15	17.6	3.1	18.0	7.2	18.3	56.00	0.80	0.06	0.54	0.26	0.16	82.48	0.72	0.25	1.10	0.50	1.15	51.82
815	MG	U	0-15	11.1	8.6	15.7	11.4	16.5	26.46	0.25	0.29	0.63	0.53	0.51	37.67	0.59	0.65	1.15	0.82	1.14	30.59
815	MG	M	0-15	10.4	14.2	16.5	15.6	15.5	16.78	0.25	0.38	0.50	1.14	0.42	65.38	0.70	1.08	1.23	1.13	0.98	19.97
815	MG	L	0-15	13.9	15.2	15.9	11.2	21.4	23.97	0.89	0.76	0.85	0.64	0.71	13.26	0.89	1.08	1.11	0.80	1.29	18.57
823	MG	U	0-15	13.7	15.8	14.8	15.7	4.3	37.72	0.34	0.16	0.59	0.57	0.07	68.67	0.69	0.94	0.90	0.93	0.24	40.03
823	MG	M	0-15	16.5	9.8	17.1	16.8	12.2	22.90	0.47	0.23	1.14	0.73	0.30	64.61	0.96	0.64	1.10	1.04	0.71	22.88
823	MG	L	0-15	11.7	4.2	12.4	14.8	14.9	37.80	0.63	0.11	0.58	0.79	0.22	61.74	0.74	0.31	0.84	0.90	0.87	33.28
1828	MG	U	0-15	5.8	3.5	13.5	11.0	11.9	46.61	0.10	0.09	0.36	0.37	0.17	62.29	0.33	0.24	0.80	0.70	0.50	46.07
1828	MG	M	0-15	10.7	11.3	15.9	12.6	17.4	21.54	0.60	0.19	1.27	0.76	0.37	65.38	0.65	0.70	0.93	0.76	0.80	13.98
1828	MG	L	0-15	6.9	10.3	16.3	13.5	17.6	33.72	0.25	0.14	0.65	0.45	0.27	57.62	0.42	0.69	0.91	0.79	0.74	25.89
2828	MG	U	0-15	.	.	15.7	15.7	18.5	9.91	.	.	0.31	0.58	0.49	29.12	.	.	0.72	0.85	0.88	10.58
2828	MG	M	0-15	.	.	13.1	12.4	18.4	22.37	.	.	0.39	0.46	0.66	27.59	.	.	0.61	0.71	0.99	25.77
2828	MG	L	0-15	.	.	17.1	17.0	15.7	4.91	.	.	0.34	0.57	0.37	28.91	.	.	0.67	0.89	0.73	14.82
			Mean	15.5	11.6	15.3	13.3	15.5		0.69	0.39	0.57	0.68	0.45		0.90	0.74	0.92	0.83	0.86	
			Max	22.0	26.1	20.8	17.5	22.8		2.21	1.53	1.27	2.16	2.04		1.34	1.31	1.33	1.14	1.32	
			Min	5.8	3.1	9.7	7.2	4.3		0.10	0.05	0.23	0.23	0.07		0.33	0.23	0.58	0.50	0.24	
			SD	4.7	6.3	2.6	2.7	4.5		0.56	0.45	0.27	0.44	0.40		0.28	0.36	0.20	0.17	0.29	
			CV by year (%)	30.07	54.54	17.33	20.56	28.91		82.14	116.62	48.06	63.82	90.78		31.42	48.42	21.78	20.46	33.66	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	Light Fraction _{mass} (mg/g)					CV across years (%)	Hot KCl NH ₄ -N (ppm)					CV across years (%)	Bulk Density (g/cm ³)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
586	PL	U	0-15	11.85	4.00	9.33	6.33	33.63	91.28	26.22	28.12	32.56	24.46	29.79	11.12	1.28	1.33	1.18	1.34	1.21	5.63
586	PL	M	0-15	9.63	2.67	3.67	8.00	8.88	48.39	28.44	29.67	27.69	25.88	32.20	8.19	1.37	1.38	1.07	1.29	1.21	10.13
586	PL	L	0-15	6.15	2.67	4.67	13.67	8.64	59.25	24.38	23.92	32.25	23.83	27.44	13.69	1.42	1.36	1.06	1.29	1.13	12.09
588	PL	U	0-15	4.56	2.67	3.00	4.33	26.70	125.38	9.28	12.81	18.98	12.49	13.44	26.20	1.40	1.62	1.43	1.51	1.33	7.60
588	PL	M	0-15	4.67	1.67	4.67	5.00	8.87	51.52	13.51	18.24	24.21	21.73	24.98	23.01	1.19	1.57	1.50	1.33	1.14	13.96
588	PL	L	0-15	4.02	3.33	2.33	2.33	4.26	27.86	32.50	32.00	46.82	31.33	34.20	18.34	1.27	1.56	1.33	1.39	1.46	8.08
590	PL	U	0-15	11.18	7.33	11.00	9.67	22.23	46.96	31.37	25.15	44.54	28.87	43.28	25.28	1.36	1.36	1.30	1.37	1.25	3.91
590	PL	M	0-15	7.98	7.00	5.33	6.67	15.37	46.89	23.77	25.98	30.40	26.65	39.33	20.98	1.30	1.50	1.43	1.34	1.14	10.19
590	PL	L	0-15	10.04	5.67	4.67	6.33	10.55	35.80	35.18	27.76	40.20	33.20	42.93	16.62	1.26	1.53	1.34	1.22	1.37	8.93
591	PL	U	0-15	8.62	6.33	5.67	11.00	4.95	33.87	39.41	46.63	43.43	35.44	38.27	10.86	.	1.08	1.33	.	1.06	13.01
591	PL	M	0-15	7.57	7.33	6.00	12.67	7.01	32.21	23.80	47.10	54.24	34.17	42.47	29.19	.	1.24	1.13	.	1.01	10.21
591	PL	L	0-15	10.26	6.33	3.67	19.00	3.23	76.53	45.95	67.87	34.44	47.84	57.69	24.90	.	1.21	1.23	.	0.96	13.27
592	PL	U	0-15	5.60	4.67	5.00	13.33	8.42	49.03	32.56	70.81	44.71	36.04	54.45	32.36	.	1.17	1.36	1.28	1.07	10.39
592	PL	M	0-15	4.74	6.00	4.67	15.33	10.64	56.06	35.07	61.08	50.21	39.71	57.24	22.86	.	1.14	1.31	1.17	0.99	11.39
592	PL	L	0-15	6.96	4.00	2.67	13.00	7.37	58.71	36.83	64.70	27.01	41.49	67.30	37.36	.	1.51	1.20	1.08	1.05	17.38
593	PL	U	0-15	4.10	2.67	4.67	4.33	3.79	19.60	26.79	47.55	29.56	29.31	41.78	26.06	.	1.54	1.26	1.41	1.20	11.32
593	PL	M	0-15	8.35	1.33	3.00	2.33	3.71	72.56	29.44	48.15	27.46	24.76	34.61	28.17	.	1.35	1.50	1.57	1.40	6.79
593	PL	L	0-15	4.87	2.33	3.00	3.33	3.54	27.27	33.78	44.55	22.21	24.08	30.50	28.68	.	1.34	1.48	1.49	1.41	4.88
594	PL	U	0-15	.	3.67	7.33	7.67	2.14	52.47	.	24.42	20.03	19.66	29.73	20.06	.	1.44	1.62	1.08	1.15	19.07
594	PL	M	0-15	.	5.33	7.67	7.33	1.20	55.22	.	28.03	18.85	22.33	31.54	22.55	.	1.49	1.50	1.13	1.16	15.34
594	PL	L	0-15	.	5.33	5.67	9.33	12.49	41.22	.	35.49	22.87	24.42	32.35	21.20	.	1.42	1.45	1.27	1.04	14.47
595	PL	U	0-15	4.52	3.00	4.00	10.00	4.88	51.77	22.66	35.57	34.08	29.53	51.02	30.31	.	.	.	1.01	1.06	3.42
595	PL	M	0-15	5.06	4.33	2.67	9.00	7.49	44.28	25.05	38.31	40.54	37.93	60.30	31.34	.	.	.	1.16	1.04	7.71
595	PL	L	0-15	5.09	4.00	3.00	12.67	6.40	61.22	26.53	36.47	36.59	30.25	53.76	28.44	.	.	.	1.11	1.17	3.72
599	PL	U	0-15	.	5.33	4.33	14.67	8.15	57.31	.	45.53	42.33	33.25	54.48	19.97	.	1.29	1.21	1.12	1.37	8.59
599	PL	M	0-15	.	3.67	3.67	19.67	6.87	89.96	.	44.75	41.72	34.38	52.76	17.53	.	1.39	1.38	1.22	1.38	6.09
599	PL	L	0-15	.	4.00	3.67	14.00	6.30	68.89	.	39.18	36.61	25.59	52.97	29.17	.	1.38	1.31	1.44	1.46	4.83
			Mean	6.94	4.32	4.77	9.66	9.17		28.69	38.88	34.24	29.58	41.88		1.32	1.38	1.33	1.28	1.19	
			Max	11.85	7.33	11.0	19.66	33.63		45.95	70.81	54.24	47.84	67.30		1.42	1.62	1.62	1.57	1.46	
			Min	4.02	1.33	2.33	2.33	1.201		9.28	12.81	18.85	12.49	13.44		1.19	1.08	1.06	1.01	0.96	
			SD	2.53	1.71	2.06	4.77	7.50		8.26	14.97	9.91	7.55	13.02		0.07	0.14	0.14	0.15	0.15	
			CV by year (%)	36.45	39.60	43.27	49.44	81.77		28.77	38.51	28.93	25.51	31.08		5.67	10.41	10.89	11.75	12.86	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	Light Fraction _{mass} (mg/g)					CV across years (%)	Hot KCl NH ₄ -N (ppm)					CV across years (%)	Bulk Density (g/cm ³)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
615	MB	U	0-15	15.57	13.00	35.00	15.67	37.40	50.72	35.01	39.48	55.55	30.33	39.97	23.69	0.84	1.08	1.37	1.19	1.23	17.28
615	MB	M	0-15	8.65	5.67	10.67	6.33	16.92	46.87	26.68	30.63	41.86	30.04	34.73	17.76	1.09	1.17	1.53	1.38	1.25	13.66
615	MB	L	0-15	7.32	9.00	42.67	2.67	53.20	101.03	27.82	56.35	71.52	128.19	58.03	54.15	1.17	0.70	0.75	0.58	0.59	32.03
			Mean	10.51	9.22	29.44	8.22	35.84		29.84	42.15	56.31	62.85	44.24		1.03	0.98	1.22	1.05	1.02	
			Max	15.56	13	42.66	15.66	53.2		35.01	56.35	71.52	128.19	58.03		1.17	1.17	1.53	1.38	1.25	
			Min	7.32	5.66	10.667	2.66	16.92		26.68	30.63	41.86	30.04	34.73		0.84	0.70	0.75	0.58	0.59	
			SD	4.42	3.67	16.70	6.70	18.19		4.52	13.07	14.84	56.58	12.22		0.17	0.25	0.41	0.42	0.38	
			CV by year (%)	42.13	39.81	56.74	81.52	50.75		15.14	31.00	26.36	90.02	27.63		16.64	25.37	33.86	39.81	36.69	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	Light Fraction _{mass} (mg/g)					CV across years (%)	Hot KCl NH ₄ -N (ppm)					CV across years (%)	Bulk Density (g/cm ³)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
678	BT	U	0-15	4.62	6.00	9.00	7.67	11.79	35.49	18.06	30.22	45.08	24.24	29.99	33.96	.	1.08	1.25	.	1.03	10.30
678	BT	M	0-15	5.93	6.67	12.00	10.00	17.43	44.58	42.09	29.38	46.45	32.12	39.50	18.62	.	1.11	1.10	.	0.99	6.24
678	BT	L	0-15	3.49	3.67	5.67	8.33	9.75	45.18	34.13	44.91	46.77	43.97	46.41	12.06	.	0.89	1.29	.	0.91	21.88
680	BT	U	0-15	2.84	2.67	3.33	7.33	6.87	49.79	15.60	21.92	20.87	17.06	16.08	15.80	1.80	1.57	1.69	1.75	1.62	5.49
680	BT	M	0-15	7.48	3.33	6.00	8.00	10.95	39.02	25.48	57.73	31.38	18.77	34.83	43.96	1.58	1.60	1.45	1.88	1.56	9.91
680	BT	L	0-15	7.80	6.33	9.33	12.67	12.29	28.55	27.58	33.70	38.55	28.77	30.89	13.75	1.80	1.50	1.24	1.46	1.26	15.53
681	BT	U	0-15	3.88	6.00	5.33	6.00	7.67	23.70	15.25	20.54	29.90	17.82	22.23	26.33	.	1.51	1.71	.	1.48	7.98
681	BT	M	0-15	2.98	5.00	5.67	7.00	7.64	32.31	24.44	22.54	29.63	19.51	19.99	17.66	.	1.42	1.83	.	1.60	12.71
681	BT	L	0-15	4.41	6.33	5.67	5.33	8.20	23.67	21.20	31.68	37.58	18.10	27.43	28.87	.	1.32	1.66	.	1.41	12.04
684	BT	U	0-15	3.01	3.67	3.00	9.67	5.60	56.62	8.58	17.20	20.83	18.44	15.23	28.94	1.22	1.37	1.38	1.22	1.40	6.81
684	BT	M	0-15	2.54	4.67	5.33	14.67	8.61	65.98	10.65	22.93	27.39	26.00	24.52	30.14	1.27	1.40	1.31	1.14	1.19	8.07
684	BT	L	0-15	6.92	8.33	8.33	7.33	9.54	12.61	28.23	39.94	39.02	38.56	40.49	13.69	1.22	1.34	1.29	1.19	1.14	6.42
687	BT	U	0-15	4.17	9.00	7.00	6.00	8.37	27.92	10.24	22.25	26.02	16.88	24.77	32.45	1.44	1.68	1.54	1.56	.	6.44
687	BT	M	0-15	5.45	10.00	9.00	7.33	9.29	22.26	16.06	42.31	29.04	15.11	32.28	42.59	1.53	1.62	1.64	1.45	.	5.60
687	BT	L	0-15	5.62	6.33	4.67	5.00	6.75	15.43	18.99	37.82	33.62	22.21	32.68	27.68	1.55	1.64	1.36	1.42	.	8.42
688	BT	U	0-15	9.04	7.67	9.33	5.00	5.85	25.94	30.30	38.83	123.77	21.36	36.46	83.18	1.09	1.19	0.92	1.22	1.21	11.25
688	BT	M	0-15	8.69	5.33	8.67	10.00	6.22	24.86	35.26	41.42	52.44	38.56	44.35	15.43	1.12	1.27	1.12	1.05	1.33	9.88
688	BT	L	0-15	6.75	9.00	10.67	7.33	13.04	27.38	35.83	44.98	61.57	40.21	56.04	22.62	1.04	1.16	1.03	1.08	1.16	5.68
692	BT	U	0-15	9.82	0.67	2.67	7.33	4.30	73.67	39.12	22.22	52.01	32.00	34.86	30.18	1.15	1.06	1.18	1.12	1.23	5.56
692	BT	M	0-15	7.66	4.00	5.00	11.33	9.10	40.30	35.61	32.83	51.69	35.25	45.08	19.94	1.13	1.11	1.22	1.14	1.20	4.13
692	BT	L	0-15	9.72	3.00	7.33	10.67	5.72	42.40	36.55	37.07	66.95	43.36	52.83	26.97	1.25	1.25	1.11	1.09	1.17	6.48
703	BT	U	0-15	2.39	2.67	3.00	3.67	3.13	16.37	17.07	13.58	25.35	12.21	23.52	32.00	1.70	1.59	1.97	1.71	1.58	9.20
703	BT	M	0-15	3.48	2.00	3.33	4.33	3.83	25.61	15.59	21.01	29.41	13.06	27.33	33.45	1.47	1.62	1.85	1.73	1.50	9.68
703	BT	L	0-15	20.25	3.33	20.00	6.67	41.80	82.30	57.39	38.64	86.37	44.30	54.74	32.80	0.61	0.86	0.57	1.27	0.73	34.80
			Mean	6.20	5.23	7.05	7.86	9.73		25.80	31.90	43.82	26.58	33.86		1.33	1.34	1.36	1.36	1.27	
			Max	20.25	10.0	20.0	14.66	41.8		57.39	57.73	123.77	44.30	56.04		1.80	1.68	1.97	1.88	1.62	
			Min	2.38	0.66	2.66	3.66	3.125		8.58	13.58	20.83	12.21	15.23		0.61	0.86	0.57	1.05	0.73	
			SD	3.81	2.44	3.78	2.68	7.55		12.03	10.82	23.24	10.62	11.69		0.30	0.24	0.33	0.27	0.24	
			CV by year (%)	61.52	46.61	53.68	34.10	77.54		46.63	33.92	53.04	39.96	34.54		22.73	18.17	24.09	19.71	18.95	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	Light Fraction _{mass} (mg/g)					CV across years (%)	Hot KCl NH ₄ -N (ppm)					CV across years (%)	Bulk Density (g/cm ³)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
727	AP	U	0-15	4.29	4.33	5.00	4.00	4.70	8.72	34.46	45.95	78.04	31.70	48.16	38.62	.	.	.	.	0.87	.
727	AP	M	0-15	4.11	4.33	5.67	5.33	4.25	14.97	41.17	45.14	189.75	46.99	63.54	82.04	.	.	.	.	0.86	.
727	AP	L	0-15	2.49	2.67	6.33	8.00	4.80	48.78	42.11	52.60	88.21	47.65	78.36	32.81	.	.	.	.	0.85	.
728	AP	U	0-15	7.16	8.67	9.33	13.00	6.84	27.39	24.93	26.17	38.17	29.33	30.01	17.42	1.39	1.56	1.35	.	1.47	6.44
728	AP	M	0-15	11.86	11.67	10.67	21.00	11.34	32.51	40.45	36.04	42.63	43.65	51.47	13.16	1.24	1.35	1.32	.	1.26	3.88
728	AP	L	0-15	21.88	22.67	17.67	52.67	18.86	54.72	51.65	53.86	59.81	53.46	55.23	5.62	1.11	1.25	1.20	.	0.95	11.68
730	AP	U	0-15	3.71	1.67	5.33	4.33	2.44	41.90	10.15	22.76	13.58	17.08	17.52	29.09	1.63	1.66	1.56	1.71	1.68	3.45
730	AP	M	0-15	5.72	6.00	6.00	9.00	2.60	38.65	14.57	35.59	29.05	25.03	34.37	30.61	1.59	1.55	1.32	1.66	1.53	8.33
730	AP	L	0-15	3.07	6.00	5.00	5.67	4.73	23.31	21.18	52.08	37.00	31.58	36.54	31.29	1.40	1.51	1.37	1.44	1.19	8.64
738	AP	U	0-15	8.27	6.67	8.33	9.33	9.72	14.01	19.17	76.97	55.59	54.98	36.65	44.82	1.29	1.27	1.22	.	1.47	8.28
738	AP	M	0-15	8.50	8.00	6.67	10.00	9.85	16.05	18.18	47.82	39.45	70.70	35.56	45.31	1.41	1.55	1.18	.	1.50	11.62
738	AP	L	0-15	8.90	3.33	5.00	7.67	10.46	40.89	24.21	45.03	37.90	31.49	36.23	22.12	1.38	1.35	1.25	.	1.44	5.87
739	AP	U	0-15	7.00	8.00	5.00	4.67	3.96	29.70	13.31	46.93	16.68	15.31	28.18	58.23	1.37	1.47	1.43	1.51	1.32	5.32
739	AP	M	0-15	5.03	6.33	4.33	7.00	2.20	37.71	10.53	31.06	14.60	11.24	31.96	54.00	1.43	1.39	1.38	1.44	1.43	1.90
739	AP	L	0-15	8.05	10.33	4.67	5.67	6.62	31.30	15.94	39.99	17.51	16.65	33.83	45.58	1.31	1.49	1.36	1.17	1.31	8.67
740	AP	U	0-15	.	7.00	7.33	6.67	5.16	14.67	.	34.42	62.50	14.49	34.11	54.29	.	1.24	1.53	1.31	1.40	9.14
740	AP	M	0-15	.	11.67	9.67	20.33	12.01	35.21	.	60.29	156.34	39.12	53.33	69.17	.	1.21	1.21	1.36	1.21	6.01
740	AP	L	0-15	.	6.00	6.00	10.00	4.91	33.34	.	51.57	69.91	28.02	54.66	33.92	.	1.15	1.11	0.95	1.23	10.61
743	AP	U	0-15	2.62	1.33	1.67	3.33	0.61	56.12	9.51	8.35	14.68	9.99	10.78	22.63	1.43	1.52	1.43	1.38	1.43	3.52
743	AP	M	0-15	5.85	2.00	2.67	6.67	1.31	65.01	18.92	24.19	21.87	19.38	36.37	29.62	1.41	1.43	1.28	1.24	1.22	7.45
743	AP	L	0-15	7.16	3.00	5.00	6.33	1.97	46.61	20.02	25.47	25.03	24.48	31.70	16.46	1.33	1.24	1.11	1.26	1.01	10.68
744	AP	U	0-15	.	6.00	5.00	12.67	7.23	44.26	.	43.86	42.30	38.05	33.86	11.39	.	1.28	1.07	1.42	.	14.02
744	AP	M	0-15	.	4.33	5.67	18.33	13.01	63.43	.	60.89	56.98	52.14	48.83	9.70	.	1.13	1.03	1.24	.	9.27
744	AP	L	0-15	.	4.67	7.00	12.67	8.13	41.40	.	59.63	55.62	56.73	49.46	7.73	.	1.10	1.14	1.35	.	11.22
746	AP	U	0-15	2.32	3.67	4.00	5.67	2.47	37.43	25.67	27.71	22.41	24.73	46.06	32.58	1.05	1.27	1.64	1.29	1.49	16.69
746	AP	M	0-15	2.57	6.67	4.33	8.00	5.19	39.14	31.27	50.69	28.39	39.14	75.38	42.39	0.95	1.04	1.40	1.12	1.26	15.58
746	AP	L	0-15	26.40	7.00	2.00	7.00	4.99	102.12	36.88	51.91	32.72	44.49	67.26	29.28	1.03	1.11	1.47	1.11	0.87	19.69
			Mean	7.5	6.4	6.1	10.6	6.3		24.97	42.85	49.88	33.99	42.94		1.32	1.34	1.31	1.33	1.26	
			Max	26.4	22.7	17.7	52.7	18.9		51.65	76.97	189.75	70.70	78.36		1.63	1.66	1.64	1.71	1.68	
			Min	2.3	1.3	1.7	3.3	0.6		9.51	8.35	13.58	9.99	10.78		0.95	1.04	1.03	0.95	0.85	
			SD	6.1	4.3	3.1	9.6	4.2		12.10	14.84	41.09	15.93	16.12		0.18	0.17	0.16	0.19	0.24	
			CV by year (%)	82.23	66.18	51.11	91.40	67.13		48.47	34.64	82.38	46.87	37.55		13.98	12.94	12.27	14.20	19.33	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	Light Fraction _{mass} (mg/g)					CV across years (%)	Hot KCl NH ₄ -N (ppm)					CV across years (%)	Bulk Density (g/cm ³)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
769	MM	U	0-15	7.35	3.67	4.67	13.00	1.85	71.05	20.59	20.19	19.45	29.52	17.82	21.38	1.45	1.33	1.56	1.39	1.59	7.54
769	MM	M	0-15	12.48	4.67	6.00	15.00	5.29	54.36	26.12	25.38	23.01	34.31	26.56	15.77	1.29	1.01	1.52	1.34	1.42	14.56
769	MM	L	0-15	8.43	5.67	6.67	9.00	5.00	24.86	27.33	31.29	23.45	32.70	26.07	13.48	1.42	1.22	1.46	1.20	1.43	9.32
781	MM	U	0-15	6.89	3.67	8.33	7.67	2.13	47.00	50.11	18.57	21.42	16.20	34.78	50.31	.	1.08	1.35	1.08	1.25	11.21
781	MM	M	0-15	8.36	2.00	7.67	10.00	2.78	57.72	24.65	17.21	24.48	19.83	38.38	32.79	.	1.18	1.20	1.12	1.43	11.03
781	MM	L	0-15	6.86	4.67	7.33	14.67	4.22	55.66	25.29	26.33	23.06	24.44	34.24	16.48	.	0.99	1.15	1.21	1.40	14.26
786	MM	U	0-15	39.35	11.00	11.33	15.33	7.99	75.07	27.68	16.32	15.66	20.45	17.74	25.00	1.14	1.48	1.35	1.22	1.27	10.15
786	MM	M	0-15	14.96	17.00	6.67	12.33	7.40	39.01	22.40	22.47	12.05	17.39	25.62	26.65	1.17	1.47	1.32	1.31	1.57	11.21
786	MM	L	0-15	10.72	5.33	4.00	10.33	13.09	44.33	16.25	13.30	12.40	17.81	29.43	38.34	1.51	1.63	1.59	1.33	1.32	9.78
791	MM	U	0-15	6.67	4.00	9.33	10.00	2.43	50.65	20.84	24.09	20.41	20.97	18.12	10.20	1.06	1.31	1.32	1.47	1.53	13.60
791	MM	M	0-15	2.41	3.00	6.00	7.00	2.27	53.29	11.70	12.76	18.12	17.79	10.88	24.20	1.11	1.23	1.24	1.35	1.59	13.80
791	MM	L	0-15	4.40	4.67	9.00	9.67	5.66	37.13	25.34	55.58	22.72	29.14	31.02	40.17	0.95	1.02	0.97	1.03	1.44	18.77
793	MM	U	0-15	3.23	3.67	3.67	5.33	2.43	28.95	12.17	13.40	15.00	16.80	14.44	12.10	1.32	1.27	1.44	1.40	1.65	10.34
793	MM	M	0-15	2.56	4.33	4.67	6.67	1.26	53.20	12.28	12.63	16.44	18.34	13.00	18.58	1.37	1.30	1.31	1.43	1.73	12.41
793	MM	L	0-15	3.81	3.33	5.33	5.67	1.91	38.30	17.87	18.86	17.96	21.75	29.42	23.01	1.32	1.22	1.28	1.52	1.72	14.57
			Mean	9.2	5.4	6.7	10.1	4.4		22.71	21.89	19.04	22.50	24.50		1.26	1.25	1.34	1.29	1.49	
			Max	39.4	17.0	11.3	15.3	13.1		50.11	55.58	24.48	34.31	38.38		1.51	1.63	1.59	1.52	1.73	
			Min	2.4	2.0	3.7	5.3	1.3		11.70	12.63	12.05	16.20	10.88		0.95	0.99	0.97	1.03	1.25	
			SD	9.08	3.79	2.15	3.34	3.19		9.41	10.86	4.07	6.06	8.63		0.17	0.18	0.16	0.15	0.15	
			CV by year (%)	98.41	70.51	32.18	33.10	72.96		41.45	49.61	21.36	26.95	35.21		13.58	14.71	12.25	11.22	10.18	
798	FG	U	0-15	5.69	37.33	6.00	16.67	7.39	92.21	19.72	38.48	19.68	31.46	39.29	32.45	1.04	1.26	1.44	1.14	1.30	12.34
798	FG	M	0-15	7.72	13.67	7.33	19.00	3.63	59.03	27.25	34.74	21.43	24.75	25.07	18.68	1.20	1.20	1.41	1.18	1.20	7.83
798	FG	L	0-15	10.26	24.33	4.67	16.67	8.66	59.68	31.29	44.54	19.57	28.95	48.02	33.94	1.00	1.14	1.35	1.12	1.31	12.24
800	FG	U	0-15	4.75	2.00	4.00	9.33	1.55	71.68	34.60	41.49	36.99	34.75	32.36	9.60	1.32	1.37	1.13	1.41	1.53	10.82
800	FG	M	0-15	4.92	2.00	4.67	11.67	1.40	82.73	33.35	27.44	38.78	47.34	31.41	21.59	1.16	1.38	1.27	1.41	1.55	10.89
800	FG	L	0-15	3.95	1.33	6.00	17.33	0.89	113.86	30.17	31.48	39.66	35.22	36.79	11.18	1.22	1.54	1.10	1.46	1.53	14.54
			Mean	6.21	13.44	5.44	15.11	3.91		29.40	36.36	29.35	33.75	35.49		1.16	1.32	1.28	1.29	1.40	
			Max	10.26	37.33	7.33	19.0	8.65		34.60	44.54	39.66	47.34	48.02		1.32	1.54	1.44	1.46	1.55	
			Min	3.95	1.33	4.0	9.33	0.88		19.72	27.44	19.57	24.75	25.07		1.00	1.14	1.10	1.12	1.20	
			SD	2.35	14.8	1.22	3.74	3.33		5.39	6.38	10.05	7.71	7.85		0.12	0.14	0.14	0.16	0.15	
			CV by year (%)	37.97	110.22	22.47	24.79	85.23		18.33	17.55	34.26	22.84	22.12		10.30	11.01	11.15	12.10	10.78	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 1. Five year summary of selected soil properties of the Ap (0-15 cm) horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	Light Fraction _{mass} (mg/g)					CV across years (%)	Hot KCl NH ₄ -N (ppm)					CV across years (%)	Bulk Density (g/cm ³)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
804	MG	U	0-15	6.30	6.00	4.67	5.00	3.36	23.09	16.76	16.69	16.39	18.72	19.20	7.43	1.50	1.22	1.82	1.52	1.57	14.02
804	MG	M	0-15	11.18	7.67	3.67	9.33	4.35	44.32	17.64	20.02	13.97	22.76	22.61	19.04	1.48	1.31	1.79	1.38	1.57	12.40
804	MG	L	0-15	9.59	7.67	5.33	12.33	9.84	29.22	23.95	26.57	16.27	30.32	33.23	25.02	1.15	1.01	1.53	1.24	1.28	15.38
806	MG	U	0-15	0.73	1.33	2.33	3.33	1.14	59.43	9.82	6.32	12.56	7.04	14.99	36.11	1.42	1.41	1.47	1.53	1.60	5.39
806	MG	M	0-15	1.77	2.67	2.33	3.33	1.89	26.40	10.59	12.57	12.69	9.54	10.44	12.50	1.45	1.34	1.58	1.59	1.61	7.66
806	MG	L	0-15	5.02	0.33	5.00	7.00	2.51	65.07	16.68	11.21	16.42	20.98	23.55	26.66	1.40	1.13	1.44	1.31	1.33	9.04
809	MG	U	0-15	2.29	2.67	2.67	5.00	1.81	42.74	7.12	6.81	12.02	11.04	9.60	24.86	1.56	1.52	1.51	1.61	1.70	4.92
809	MG	M	0-15	4.53	2.67	2.67	5.67	2.86	36.97	13.07	12.11	12.48	17.51	22.99	29.76	1.41	1.43	1.57	1.41	1.50	4.75
809	MG	L	0-15	3.55	2.00	4.00	2.67	4.00	27.19	15.70	14.28	11.56	12.36	27.19	39.12	1.44	1.27	1.49	1.53	1.40	7.02
812	MG	U	0-15	3.55	1.33	2.33	3.00	1.37	42.41	6.96	6.37	15.62	6.45	10.10	43.46	.	1.43	1.60	1.69	1.68	7.52
812	MG	M	0-15	2.98	2.67	1.33	2.33	1.58	32.33	7.90	5.57	13.31	4.68	8.69	42.05	.	1.51	1.73	1.59	1.48	7.09
812	MG	L	0-15	4.54	2.00	3.00	3.67	0.89	50.57	10.03	6.46	17.28	6.78	11.11	42.35	.	1.27	1.73	1.61	1.59	12.69
815	MG	U	0-15	2.22	3.33	4.00	4.67	3.11	26.75	4.94	6.57	17.95	5.21	7.49	64.28	1.37	1.41	1.43	1.57	1.84	12.64
815	MG	M	0-15	2.40	2.67	3.00	7.33	2.70	57.67	6.98	9.22	12.87	11.68	9.68	22.64	1.44	1.32	1.69	1.60	1.65	10.08
815	MG	L	0-15	6.36	5.00	5.33	5.67	3.30	22.21	31.47	23.40	27.20	22.87	34.29	17.92	1.28	1.15	1.28	1.40	1.53	10.81
823	MG	U	0-15	2.47	1.00	4.00	3.67	1.56	51.11	7.58	11.37	17.47	9.52	7.93	37.43	.	1.47	.	.	.	.
823	MG	M	0-15	2.85	2.33	6.67	4.33	2.49	48.73	24.06	18.33	24.84	20.94	26.95	14.75	.	1.32	.	.	.	.
823	MG	L	0-15	5.36	2.67	4.67	5.33	1.47	44.77	27.47	18.03	25.47	24.44	33.04	21.10	.	1.23	.	.	.	.
1828	MG	U	0-15	1.75	2.67	2.67	3.33	1.42	32.74	3.91	3.98	4.66	4.40	4.50	7.67	1.38	.	1.44	1.54	1.72	9.69
1828	MG	M	0-15	5.60	1.67	8.00	6.00	2.11	57.88	15.73	8.17	15.54	15.39	14.29	23.22	1.18	.	1.32	1.36	1.73	16.74
1828	MG	L	0-15	3.57	1.33	4.00	3.33	1.53	44.79	9.33	16.79	16.71	15.80	8.17	31.78	1.41	.	1.36	1.37	1.71	11.38
2828	MG	U	0-15	.	.	2.00	3.67	2.64	30.37	.	.	20.00	19.59	32.75	31.03	.	.	1.54	1.50	1.28	9.72
2828	MG	M	0-15	.	.	3.00	3.67	3.58	10.58	.	.	31.87	17.93	29.01	28.03	.	.	1.54	1.36	1.56	7.41
2828	MG	L	0-15	.	.	2.00	3.33	2.35	26.99	.	.	31.57	18.80	32.50	27.71	.	.	1.32	1.37	1.52	7.42
			Mean	4.2	2.9	3.7	4.9	2.7		13.70	12.42	17.36	14.78	18.93		1.39	1.32	1.53	1.48	1.56	
			Max	11.2	7.7	8.0	12.3	9.8		31.47	26.57	31.87	30.32	34.29		1.56	1.52	1.82	1.69	1.84	
			Min	0.7	0.3	1.3	2.3	0.9		3.91	3.98	4.66	4.40	4.50		1.15	1.01	1.28	1.24	1.28	
			SD	2.6	2.0	1.6	2.3	1.8		7.73	6.36	6.56	7.20	10.22		0.11	0.14	0.15	0.12	0.15	
			CV by year (%)	61.22	68.54	43.06	47.19	67.33		56.42	51.23	37.75	48.73	53.99		7.95	10.46	10.09	8.22	9.59	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 0-15cm depth

Appendix 2. Five year summary of selected soil properties of the 15-30 cm horizon for 42 benchmark sites from 1998-2002.

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	pHw					CV across years (%)	pHc					CV across years (%)	EC (dS/m)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
586	PL	U	15-30	7.1	6.8	6.5	6.9	6.9	3.17	5.9	6.2	5.9	6.2	6.2	2.58	0.15	0.64	0.35	0.35	0.33	48.18
586	PL	M	15-30	7.7	7.0	7.0	7.3	7.1	4.10	6.7	6.5	6.4	6.5	6.5	1.67	0.37	0.36	0.50	0.46	0.46	14.29
586	PL	L	15-30	7.7	6.0	7.2	7.4	7.2	9.06	6.7	6.6	6.5	6.6	6.5	1.27	0.30	0.28	0.48	0.43	0.45	23.53
588	PL	U	15-30	8.7	8.2	8.1	8.1	8.0	3.39	7.9	7.6	7.6	7.5	7.6	2.15	0.45	0.56	0.43	0.39	0.69	24.23
588	PL	M	15-30	8.4	8.0	8.1	8.1	8.0	2.04	7.7	7.5	7.6	7.4	7.6	1.65	0.30	0.35	0.46	0.46	0.87	46.16
588	PL	L	15-30	6.3	7.2	7.1	7.3	7.1	5.77	6.5	6.6	6.5	6.6	6.5	0.73	0.33	0.29	0.39	0.29	0.37	13.74
590	PL	U	15-30	7.6	7.5	7.7	7.3	7.0	3.83	6.8	6.6	7.0	6.3	6.4	4.50	0.33	0.46	0.42	0.30	0.38	17.19
590	PL	M	15-30	7.3	7.2	7.1	6.9	7.0	2.18	6.6	6.4	6.2	6.1	6.3	3.14	0.61	0.22	0.17	0.20	0.27	61.35
590	PL	L	15-30	6.9	6.9	6.8	7.0	6.9	1.13	5.9	6.1	5.8	6.1	6.2	2.69	0.19	0.20	0.14	0.17	0.23	17.99
591	PL	U	15-30	6.4	7.1	6.9	6.9	7.1	4.17	5.6	6.2	6.0	6.0	6.5	5.48	0.19	0.16	0.16	0.24	0.38	40.71
591	PL	M	15-30	7.8	8.2	7.9	8.0	7.8	2.07	7.5	7.6	7.2	7.2	7.3	2.44	0.29	0.36	0.34	0.35	0.54	25.41
591	PL	L	15-30	6.5	6.8	6.5	6.7	6.4	2.42	5.7	6.2	5.8	6.0	5.8	3.46	0.34	0.40	0.30	0.52	0.64	31.57
592	PL	U	15-30	7.8	7.6	7.9	7.7	7.5	2.05	7.4	7.2	7.5	6.9	7.1	3.35	0.42	0.45	0.68	0.58	0.70	22.70
592	PL	M	15-30	7.8	7.8	7.8	7.7	7.6	1.17	7.4	7.3	7.4	7.0	7.2	2.52	0.40	0.43	0.66	0.50	0.76	28.01
592	PL	L	15-30	7.7	7.6	7.7	7.6	7.4	1.62	7.3	7.2	7.3	7.0	7.2	1.64	0.39	0.58	0.70	0.63	0.94	30.79
593	PL	U	15-30	6.4	6.7	6.3	6.5	6.3	2.63	5.6	5.9	5.3	5.4	5.5	4.32	0.33	0.34	0.28	0.35	0.42	14.63
593	PL	M	15-30	6.8	7.2	6.8	6.9	6.8	2.52	6.0	6.5	5.8	5.9	6.0	4.43	0.24	0.19	0.21	0.21	0.22	8.41
593	PL	L	15-30	6.5	6.6	6.2	6.2	6.3	2.86	5.4	5.8	5.2	5.3	5.3	4.34	0.21	0.18	0.21	0.24	0.28	16.88
594	PL	U	15-30	.	5.5	5.3	5.6	5.4	2.17	.	4.6	4.3	4.6	4.5	2.93	.	0.18	0.31	0.25	0.27	21.63
594	PL	M	15-30	.	5.4	5.5	5.7	5.6	2.40	.	4.5	4.5	4.7	4.6	2.09	.	0.19	0.19	0.21	0.23	9.41
594	PL	L	15-30	.	5.9	6.0	6.1	5.9	1.68	.	5.4	5.0	5.2	5.2	3.17	.	0.24	0.26	0.24	0.34	17.82
595	PL	U	15-30	6.0	5.8	6.9	6.5	6.5	6.96	5.2	5.7	6.3	5.5	5.7	7.11	0.66	0.50	0.74	0.50	0.75	19.73
595	PL	M	15-30	6.0	5.7	5.9	6.0	6.0	2.29	5.0	5.3	5.0	5.0	5.1	2.67	0.50	0.49	0.72	0.58	0.84	24.05
595	PL	L	15-30	5.7	6.7	5.7	6.0	6.0	6.82	4.7	5.1	4.8	4.9	5.1	3.67	0.50	0.55	0.59	0.49	0.55	7.59
599	PL	U	15-30	.	7.0	6.5	6.7	6.3	4.47	.	6.4	5.7	5.6	5.5	6.98	.	0.74	0.49	0.32	0.42	36.04
599	PL	M	15-30	.	6.9	7.0	6.8	6.4	3.88	.	6.1	6.4	5.9	5.6	5.59	.	0.50	0.90	0.46	0.45	37.66
599	PL	L	15-30	.	7.1	6.9	7.2	6.8	2.66	.	6.3	6.1	6.4	6.2	2.07	.	0.68	0.66	0.54	0.93	23.09
			Mean	7.1	6.9	6.9	6.9	6.8		6.4	6.3	6.1	6.0	6.1		0.36	0.39	0.43	0.38	0.51	
			Max	8.7	8.2	8.1	8.1	8.0		7.9	7.6	7.6	7.5	7.6		0.66	0.74	0.90	0.63	0.94	
			Min	5.7	5.4	5.3	5.6	5.4		4.7	4.5	4.3	4.6	4.5		0.15	0.16	0.14	0.17	0.22	
			SD	0.9	0.8	0.8	0.7	0.7		1.0	0.8	1.0	0.8	0.9		0.13	0.16	0.21	0.14	0.23	
			CV by year (%)	12.06	11.57	11.70	10.32	10.43		15.23	13.54	16.01	13.81	14.48		36.04	42.19	49.32	36.42	45.33	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 15-30cm depth

Appendix 2. Five year summary of selected soil properties of the 15-30 cm horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	pHw					CV across years (%)	pHc					CV across years (%)	EC (dS/m)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
615	MB	U	15-30	7.7	6.5	7.3	6.3	6.5	8.77	7.3	5.6	6.6	5.4	5.8	12.78	0.86	0.99	0.71	0.43	0.47	35.00
615	MB	M	15-30	6.1	6.3	6.3	6.5	7.1	5.97	5.9	5.8	5.5	5.8	6.7	7.53	0.30	0.29	0.27	0.54	0.76	49.51
615	MB	L	15-30	7.9	7.3	7.2	7.4	7.5	3.60	7.6	7.1	6.6	7.0	7.2	5.12	0.62	0.71	0.66	0.93	0.82	16.72
			Mean	7.2	6.7	6.9	6.8	7.0		6.9	6.2	6.2	6.1	6.6		0.59	0.66	0.55	0.63	0.68	
			Max	7.9	7.3	7.3	7.4	7.5		7.6	7.1	6.6	7.0	7.2		0.86	0.99	0.71	0.93	0.82	
			Min	6.1	6.3	6.3	6.3	6.5		5.9	5.6	5.5	5.4	5.8		0.30	0.29	0.27	0.43	0.47	
			SD	1.0	0.5	0.6	0.6	0.5		0.9	0.8	0.6	0.8	0.7		0.28	0.35	0.24	0.26	0.19	
			CV by year (%)	13.64	7.90	7.94	8.80	7.16		13.09	13.21	10.19	13.12	10.80		47.35	53.11	44.07	41.23	27.39	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 15-30cm depth

Appendix 2. Five year summary of selected soil properties of the 15-30 cm horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	pHw					CV across years (%)	pHc					CV across years (%)	EC (dS/m)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
678	BT	U	15-30	5.9	5.9	6.3	6.2	6.1	2.94	4.9	5.6	5.4	5.3	5.2	4.91	0.30	1.73	0.38	0.55	0.51	84.72
678	BT	M	15-30	6.0	5.7	5.9	6.3	5.8	3.94	5.0	5.2	5.0	5.3	5.0	2.51	0.26	0.89	0.46	0.73	0.60	41.27
678	BT	L	15-30	7.1	6.8	6.9	6.8	6.9	1.69	6.6	6.5	6.1	6.2	6.5	3.37	0.24	0.71	0.40	0.52	0.72	39.70
680	BT	U	15-30	6.9	7.0	6.6	7.3	6.5	4.49	6.0	6.3	5.8	6.2	5.8	3.70	0.25	0.22	0.22	0.33	0.40	27.82
680	BT	M	15-30	6.9	7.2	6.8	7.0	6.6	3.29	6.0	6.3	6.1	6.1	5.9	2.44	0.17	0.17	0.29	0.19	0.40	41.33
680	BT	L	15-30	7.2	7.2	7.1	7.3	6.8	2.77	6.3	6.4	6.4	5.3	6.2	7.31	0.21	0.26	0.35	0.35	0.62	44.14
681	BT	U	15-30	6.9	7.2	7.1	6.9	7.1	1.94	6.3	6.3	6.3	6.1	6.4	1.49	0.41	0.22	0.20	0.23	0.33	32.26
681	BT	M	15-30	6.7	7.0	6.9	6.9	7.0	1.78	5.9	6.4	5.9	6.1	6.2	3.48	0.63	0.24	0.18	0.32	0.26	54.41
681	BT	L	15-30	7.4	7.3	7.0	6.9	7.0	2.94	6.6	6.0	6.2	6.1	6.3	3.74	0.23	0.36	0.20	0.29	0.28	22.54
684	BT	U	15-30	6.9	6.3	7.0	6.5	6.7	4.42	5.8	5.5	6.1	5.6	6.1	4.84	0.27	0.30	0.29	0.24	0.44	25.09
684	BT	M	15-30	7.0	6.4	6.6	6.3	6.6	4.25	6.2	5.7	5.8	5.4	5.9	4.91	0.17	0.23	0.22	0.31	0.40	33.92
684	BT	L	15-30	6.6	6.0	6.4	6.4	6.4	3.48	5.6	5.6	5.6	5.6	5.7	0.77	0.26	0.43	0.30	0.24	0.34	24.48
687	BT	U	15-30	6.8	6.6	6.5	6.7	7.0	2.86	6.6	6.0	5.8	5.6	6.5	7.20	0.24	0.50	0.25	0.42	0.48	33.05
687	BT	M	15-30	7.0	6.5	6.8	6.9	6.8	2.84	6.6	5.9	6.1	6.4	6.2	4.23	0.63	0.45	0.28	0.94	0.41	46.83
687	BT	L	15-30	7.9	7.8	7.7	7.3	7.5	3.39	7.5	7.4	7.3	6.8	7.3	3.78	0.72	0.69	0.69	0.80	0.86	10.07
688	BT	U	15-30	6.6	6.4	6.5	6.8	6.7	2.30	5.2	5.6	6.0	5.8	6.0	5.83	0.21	0.30	0.17	0.20	0.37	33.11
688	BT	M	15-30	6.5	6.3	6.2	6.7	6.5	3.08	5.3	5.5	5.6	5.6	5.8	3.27	0.20	0.47	0.20	0.23	0.35	40.80
688	BT	L	15-30	6.7	6.2	6.2	6.5	6.3	3.34	6.7	5.6	5.5	5.6	5.6	8.75	0.12	0.39	0.15	0.22	0.31	47.16
692	BT	U	15-30	6.1	6.3	5.6	6.1	6.0	4.36	4.7	5.4	4.7	5.4	5.2	7.02	0.13	0.13	0.18	0.28	0.27	37.43
692	BT	M	15-30	5.7	5.9	5.7	6.1	5.8	3.00	4.6	5.2	4.9	5.2	4.9	4.93	0.16	0.14	0.29	0.27	0.27	30.91
692	BT	L	15-30	5.9	6.2	5.6	6.3	6.0	4.48	5.1	5.5	4.8	5.2	5.1	4.91	0.20	0.16	0.25	0.22	0.20	15.99
703	BT	U	15-30	6.8	7.1	6.7	6.9	6.8	2.22	5.7	5.6	5.8	6.0	6.0	3.03	0.13	0.21	0.22	0.28	0.35	34.62
703	BT	M	15-30	6.4	6.2	6.5	6.6	6.5	2.40	5.3	7.3	5.5	5.7	5.8	13.38	0.13	0.29	0.19	0.30	0.37	37.27
703	BT	L	15-30	7.8	7.5	7.5	7.2	7.7	3.10	7.3	6.2	6.9	6.5	7.1	6.60	0.41	0.66	0.58	0.54	0.58	16.49
			Mean	6.7	6.6	6.6	6.7	6.6		5.9	6.0	5.8	5.8	5.9		0.28	0.42	0.29	0.37	0.42	
			Max	7.9	7.8	7.7	7.3	7.7		7.5	7.4	7.3	6.8	7.3		0.72	1.73	0.69	0.94	0.86	
			Min	5.7	5.7	5.6	6.1	5.8		4.6	5.2	4.7	5.2	4.9		0.12	0.13	0.15	0.19	0.20	
			SD	0.6	0.6	0.5	0.4	0.5		0.8	0.6	0.6	0.4	0.6		0.17	0.34	0.13	0.20	0.16	
			CV by year (%)	8.28	8.56	8.31	5.58	7.29		13.43	9.76	10.58	7.66	10.16		59.68	81.35	46.02	54.28	37.50	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 15-30cm depth

Appendix 2. Five year summary of selected soil properties of the 15-30 cm horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	pHw					CV across years (%)	pHc					CV across years (%)	EC (dS/m)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
727	AP	U	15-30	6.9	6.6	6.7	7.1	6.8	3.03	6.1	6.3	6.2	6.6	6.2	3.13	0.25	0.88	0.77	0.50	0.47	43.79
727	AP	M	15-30	6.4	5.8	5.9	6.4	6.4	4.78	5.6	5.2	5.3	5.7	5.8	4.61	0.18	0.28	0.47	0.30	0.32	33.57
727	AP	L	15-30	6.6	5.9	5.7	6.3	6.2	5.65	5.7	6.3	5.0	5.3	5.5	8.67	0.19	0.39	0.37	0.31	0.34	24.56
728	AP	U	15-30	6.9	6.5	6.9	7.2	6.9	3.71	5.4	5.8	6.2	6.4	6.2	6.51	0.50	0.61	0.34	0.79	0.76	31.21
728	AP	M	15-30	7.1	6.8	7.0	7.2	6.7	2.94	6.6	6.1	6.5	6.4	6.2	3.28	0.46	0.49	0.44	0.72	0.79	27.93
728	AP	L	15-30	6.6	6.7	7.0	6.5	6.3	3.84	6.1	6.0	6.6	5.7	5.8	5.72	0.38	0.85	0.69	0.71	0.71	25.93
730	AP	U	15-30	7.9	7.3	8.0	7.6	7.5	3.81	6.9	6.9	7.3	7.1	7.1	2.35	0.49	0.57	0.50	0.41	0.73	22.07
730	AP	M	15-30	7.2	6.7	6.8	7.0	7.0	2.81	6.2	6.0	6.0	6.7	6.5	5.17	0.38	0.31	0.27	0.65	0.60	39.24
730	AP	L	15-30	7.3	7.5	7.6	7.1	7.2	2.91	6.3	6.7	6.7	6.5	6.6	2.64	0.52	0.23	0.25	0.30	0.68	49.57
738	AP	U	15-30	6.9	6.4	6.6	6.3	6.7	3.87	6.2	5.7	5.9	5.4	5.9	5.32	0.27	0.35	0.35	0.32	0.39	13.21
738	AP	M	15-30	7.0	6.0	6.3	6.2	6.0	6.54	5.7	5.4	5.1	5.3	5.2	4.38	0.26	0.33	0.24	0.32	0.30	13.19
738	AP	L	15-30	6.9	6.1	6.2	6.3	6.2	5.05	5.4	5.6	5.0	5.3	5.6	4.61	0.31	0.41	0.37	0.25	0.31	19.01
739	AP	U	15-30	7.2	7.2	7.5	7.1	7.5	2.53	6.3	7.0	6.9	6.7	7.0	4.35	0.35	0.54	0.42	0.45	0.65	24.20
739	AP	M	15-30	7.2	7.2	7.0	7.5	7.1	2.60	6.3	6.5	6.2	6.9	6.5	4.14	0.29	0.22	0.19	0.38	0.41	32.36
739	AP	L	15-30	7.0	7.0	6.8	6.8	6.7	2.06	6.0	6.2	6.0	5.7	5.9	2.99	0.14	0.25	0.23	0.15	0.26	27.44
740	AP	U	15-30	.	7.0	7.0	6.9	7.2	1.84	.	6.3	6.2	6.0	6.6	4.17	.	0.18	0.38	0.25	0.59	51.94
740	AP	M	15-30	.	7.1	7.0	7.0	6.9	1.18	.	6.5	6.3	6.2	6.3	1.99	.	0.21	0.44	0.24	0.35	34.44
740	AP	L	15-30	.	7.5	7.7	7.6	7.6	1.09	.	7.5	7.5	7.5	7.5	0.20	.	4.43	4.76	5.33	3.27	19.53
743	AP	U	15-30	8.0	8.1	8.1	7.8	8.2	1.84	7.1	7.5	7.2	7.3	7.7	3.26	0.40	0.65	0.41	0.65	0.76	28.04
743	AP	M	15-30	7.2	7.0	7.2	7.0	7.1	1.52	6.6	6.7	6.8	6.2	6.8	3.57	0.72	1.02	0.68	0.73	1.06	21.74
743	AP	L	15-30	6.4	5.6	6.3	6.1	5.6	6.36	5.1	4.8	5.1	4.9	5.0	2.69	0.30	0.73	0.19	0.24	0.66	59.64
744	AP	U	15-30	.	6.8	6.7	6.5	6.5	2.31	.	6.2	6.0	5.8	5.8	3.41	.	0.25	0.41	0.21	0.32	30.17
744	AP	M	15-30	.	6.7	6.7	6.8	6.4	2.45	.	6.1	6.0	6.1	5.7	3.17	.	0.21	0.33	0.20	0.34	28.60
744	AP	L	15-30	.	7.1	6.5	6.7	6.4	4.64	.	6.3	5.8	6.1	5.7	4.66	.	0.33	0.36	0.17	0.29	29.77
746	AP	U	15-30	7.7	7.9	7.4	7.7	7.3	3.25	7.2	7.4	6.8	7.1	7.0	3.16	0.35	0.36	0.41	0.44	0.52	16.48
746	AP	M	15-30	6.7	7.1	6.9	7.0	6.6	3.00	5.9	6.3	6.1	6.2	5.9	2.89	0.17	0.14	0.20	0.19	0.23	18.08
746	AP	L	15-30	6.3	6.8	6.3	6.8	6.4	4.14	5.5	6.0	5.4	6.0	5.7	4.77	0.17	0.16	0.16	0.17	0.26	23.18
			Mean	7.0	6.8	6.9	6.9	6.8		6.1	6.3	6.2	6.2	6.2		0.34	0.57	0.54	0.57	0.61	
			Max	8.0	8.1	8.1	7.8	8.2		7.2	7.5	7.5	7.5	7.7		0.72	4.43	4.76	5.33	3.27	
			Min	6.3	5.6	5.7	6.1	5.6		5.1	4.8	5.0	4.9	5.0		0.14	0.14	0.16	0.15	0.23	
			SD	0.5	0.6	0.6	0.5	0.6		0.6	0.7	0.7	0.7	0.7		0.15	0.82	0.87	0.99	0.58	
			CV by year (%)	6.70	9.01	8.66	7.14	8.45		9.54	10.61	11.60	11.01	11.01		43.49	144.09	160.99	174.28	96.43	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 15-30cm depth

Appendix 2. Five year summary of selected soil properties of the 15-30 cm horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	pHw					CV across years (%)	pHc					CV across years (%)	EC (dS/m)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
769	MM	U	15-30	6.7	6.9	6.2	6.6	7.0	4.64	6.0	6.3	5.3	6.0	6.5	7.59	0.49	0.34	0.44	0.50	0.74	29.32
769	MM	M	15-30	5.5	5.9	5.7	5.8	5.7	2.62	4.8	5.2	4.9	5.2	5.0	3.42	0.53	0.28	0.39	0.53	0.49	24.21
769	MM	L	15-30	5.6	6.1	5.5	5.8	5.8	3.99	4.9	5.4	4.8	5.1	5.1	4.54	0.37	0.28	0.44	0.44	0.41	17.36
781	MM	U	15-30	6.3	6.3	5.6	6.5	6.0	5.88	5.5	5.9	4.8	5.4	5.4	7.31	0.37	0.23	0.41	0.23	0.63	44.08
781	MM	M	15-30	6.1	6.2	5.8	6.3	6.8	5.86	5.3	5.8	4.9	5.2	6.5	11.23	0.41	0.26	0.39	0.26	1.14	75.32
781	MM	L	15-30	6.2	5.8	5.5	6.2	5.7	5.17	5.7	5.1	4.5	5.0	4.8	8.85	0.71	0.23	0.43	0.35	0.48	40.70
786	MM	U	15-30	8.0	8.1	7.6	7.8	7.7	2.63	7.5	7.4	6.8	7.1	7.2	3.83	0.53	0.52	0.62	0.65	0.76	15.93
786	MM	M	15-30	7.2	7.2	7.3	7.3	7.0	1.83	6.6	6.6	6.6	6.6	6.3	2.13	0.32	0.33	0.46	0.50	0.46	19.77
786	MM	L	15-30	6.3	6.5	6.0	6.4	6.2	3.00	5.5	5.4	5.1	5.3	5.3	2.80	0.13	0.15	0.42	0.26	0.27	47.11
791	MM	U	15-30	7.0	7.1	6.9	6.7	7.4	3.83	6.0	6.6	6.2	6.0	6.9	6.17	0.19	0.29	0.49	0.18	0.61	53.76
791	MM	M	15-30	8.0	8.0	7.8	7.9	7.9	1.09	7.4	7.3	7.3	7.2	7.4	1.00	0.46	0.36	0.55	0.43	0.54	16.82
791	MM	L	15-30	6.4	6.3	6.2	6.4	6.4	1.50	5.5	5.5	5.3	5.5	5.4	1.57	0.20	0.15	0.24	0.14	0.15	24.91
793	MM	U	15-30	8.1	8.1	7.7	7.8	7.8	2.45	7.3	7.5	7.1	7.1	7.3	2.18	0.42	0.38	0.68	0.57	0.49	23.70
793	MM	M	15-30	8.2	8.1	7.8	7.5	7.9	3.51	7.4	7.6	7.2	7.0	7.3	3.25	0.34	0.34	0.49	0.49	0.47	18.57
793	MM	L	15-30	7.3	7.1	6.8	7.1	7.0	2.58	6.4	6.5	6.2	6.5	6.1	2.74	0.21	0.17	0.43	0.26	0.24	38.14
			Mean	6.9	6.9	6.6	6.8	6.8		6.1	6.3	5.8	6.0	6.2		0.38	0.29	0.46	0.39	0.53	
			Max	8.2	8.1	7.8	7.9	7.9		7.5	7.6	7.3	7.2	7.4		0.71	0.52	0.68	0.65	1.14	
			Min	5.5	5.8	5.5	5.8	5.7		4.8	5.1	4.5	5.0	4.8		0.13	0.15	0.24	0.14	0.15	
			SD	0.9	0.8	0.9	0.7	0.8		0.9	0.9	1.0	0.8	0.9		0.16	0.10	0.10	0.16	0.24	
			CV by year (%)	13.26	12.17	13.66	10.47	11.94		15.22	14.05	17.34	14.03	15.16		41.17	34.09	22.48	40.70	45.79	
798	FG	U	15-30	7.6	7.2	7.0	7.1	6.5	5.60	7.2	6.6	6.3	6.4	5.6	8.98	0.38	0.23	0.62	0.66	0.48	37.27
798	FG	M	15-30	7.5	7.5	7.2	7.8	7.6	2.76	6.8	7.1	6.5	7.1	7.4	4.95	0.25	0.39	0.47	0.60	0.84	43.91
798	FG	L	15-30	6.5	6.9	6.5	6.6	6.4	2.93	5.6	6.2	5.6	5.6	5.9	4.77	0.19	0.13	0.32	0.38	0.68	63.07
800	FG	U	15-30	6.8	6.9	6.5	6.8	6.6	2.53	6.5	6.2	5.7	6.3	5.8	5.52	0.26	0.34	0.24	0.52	0.26	35.94
800	FG	M	15-30	6.7	6.4	6.3	6.3	6.3	2.78	5.9	5.7	5.5	5.7	5.5	2.94	0.21	0.18	0.20	0.34	0.21	28.15
800	FG	L	15-30	7.0	6.5	6.8	6.3	6.4	4.58	6.2	5.8	6.2	5.6	5.6	5.04	0.21	0.20	0.57	0.25	0.19	56.92
			Mean	7.0	6.9	6.7	6.8	6.6		6.4	6.3	6.0	6.1	6.0		0.25	0.25	0.40	0.46	0.44	
			Max	7.6	7.5	7.2	7.8	7.6		7.2	7.1	6.5	7.1	7.4		0.38	0.39	0.62	0.66	0.84	
			Min	6.5	6.4	6.3	6.3	6.3		5.6	5.7	5.5	5.6	5.5		0.19	0.13	0.20	0.25	0.19	
			SD	0.4	0.4	0.3	0.6	0.5		0.6	0.5	0.4	0.6	0.7		0.07	0.10	0.18	0.16	0.27	
			CV by year (%)	6.34	6.01	5.11	8.41	7.30		9.25	8.30	7.00	10.09	12.02		27.60	40.71	43.53	34.97	61.11	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 15-30cm depth

Appendix 2. Five year summary of selected soil properties of the 15-30 cm horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	pHw					CV across years (%)	pHc					CV across years (%)	EC (dS/m)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
804	MG	U	15-30	7.3	6.6	6.7	6.7	6.6	4.39	6.6	5.9	5.8	5.9	6.1	5.25	0.34	0.45	0.18	0.38	0.67	44.29
804	MG	M	15-30	6.9	6.8	7.5	7.6	7.5	5.15	5.9	6.0	6.8	6.9	6.9	7.77	0.39	0.73	0.65	1.64	1.60	57.70
804	MG	L	15-30	6.2	6.5	7.3	6.3	5.8	8.61	5.2	5.8	6.8	5.6	5.2	11.53	0.47	0.65	1.11	0.39	0.93	43.15
806	MG	U	15-30	8.5	8.1	7.5	7.7	7.7	5.10	7.6	7.5	6.9	7.1	7.0	4.34	0.57	0.57	0.96	0.81	0.86	23.40
806	MG	M	15-30	7.2	7.7	6.8	7.7	8.1	6.72	6.3	7.3	6.0	7.2	7.3	9.12	0.20	0.54	0.66	1.02	1.01	50.20
806	MG	L	15-30	5.9	5.8	6.0	7.0	7.2	10.45	5.0	5.1	5.1	6.7	6.8	16.09	0.19	0.18	0.50	0.87	0.81	64.31
809	MG	U	15-30	8.4	8.2	7.8	7.9	8.0	3.03	7.6	7.6	7.1	7.4	7.3	2.87	0.34	0.41	0.51	0.49	0.57	19.39
809	MG	M	15-30	6.7	7.6	7.5	6.8	7.2	5.61	5.9	7.1	7.0	6.0	6.5	8.65	0.21	0.44	0.61	0.43	0.58	34.85
809	MG	L	15-30	6.3	6.9	6.7	6.8	6.6	3.46	5.5	6.0	5.9	6.0	5.8	3.46	0.17	0.18	0.22	0.35	0.53	52.46
812	MG	U	15-30	8.2	8.2	8.0	7.9	8.0	1.52	7.8	8.1	7.5	7.2	7.7	4.48	1.38	1.13	1.11	0.76	1.62	26.99
812	MG	M	15-30	8.3	8.4	8.1	7.9	8.3	2.26	7.8	8.4	7.6	7.3	7.7	5.36	0.78	0.83	1.60	1.66	0.70	42.53
812	MG	L	15-30	8.2	8.4	8.1	8.0	8.3	2.05	7.8	8.3	7.6	7.4	7.8	4.34	1.54	1.05	1.13	1.61	0.81	27.59
815	MG	U	15-30	8.5	8.3	8.2	8.1	8.1	2.11	7.8	7.7	7.4	7.3	7.5	2.71	0.38	0.31	0.44	0.48	0.45	16.57
815	MG	M	15-30	8.4	8.2	8.1	7.9	8.0	2.30	7.7	7.5	7.4	7.2	7.4	2.49	0.42	0.33	0.55	0.57	0.50	20.71
815	MG	L	15-30	6.7	6.7	6.6	6.8	6.4	2.14	5.8	5.8	5.7	5.8	5.5	2.40	0.23	0.21	0.34	0.34	0.21	25.17
823	MG	U	15-30	8.1	8.1	8.0	7.9	8.0	0.91	7.7	7.7	7.4	7.4	7.6	1.97	1.75	1.28	0.91	1.68	1.12	26.75
823	MG	M	15-30	7.6	7.5	7.4	7.7	7.5	1.29	7.0	6.8	6.7	6.9	6.9	1.71	0.86	0.60	0.65	0.58	0.65	16.68
823	MG	L	15-30	7.6	7.4	7.2	7.6	7.3	2.38	7.1	6.7	6.5	6.9	6.8	3.24	0.77	0.45	0.82	0.59	0.85	24.50
1828	MG	U	15-30	8.6	8.5	8.2	8.1	8.1	2.75	7.7	8.6	7.5	7.4	7.6	6.17	0.35	0.35	0.37	0.41	0.44	10.43
1828	MG	M	15-30	7.2	7.5	7.4	7.5	7.3	1.74	6.4	7.3	6.6	6.8	6.7	4.97	0.27	0.24	0.28	0.52	0.28	35.30
1828	MG	L	15-30	8.0	7.8	7.3	7.3	7.7	4.27	7.3	7.6	6.5	6.5	7.1	7.20	0.34	0.34	0.22	0.42	0.39	22.31
2828	MG	U	15-30	.	.	7.6	7.5	7.7	1.59	.	.	7.0	7.0	7.2	1.88	.	.	0.48	0.59	0.67	16.45
2828	MG	M	15-30	.	.	6.8	7.4	7.4	4.74	.	.	6.3	6.9	7.1	6.10	.	.	0.48	0.62	0.76	22.56
2828	MG	L	15-30	.	.	7.3	7.5	7.6	2.08	.	.	6.9	7.0	7.2	2.23	.	.	0.74	0.58	0.60	13.62
			Mean	7.6	7.6	7.4	7.5	7.5		6.8	7.1	6.8	6.8	6.9		0.57	0.54	0.65	0.74	0.73	
			Max	8.6	8.5	8.2	8.1	8.3		7.8	8.6	7.6	7.4	7.8		1.75	1.28	1.60	1.68	1.62	
			Min	5.9	5.8	6.0	6.3	5.8		5.0	5.1	5.1	5.6	5.2		0.17	0.18	0.18	0.34	0.21	
			SD	0.9	0.8	0.6	0.5	0.6		1.0	1.0	0.7	0.6	0.7		0.46	0.31	0.35	0.45	0.35	
			CV by year (%)	11.28	10.07	7.98	6.74	8.54		14.12	13.93	10.01	8.25	10.02		80.93	58.43	54.09	60.30	47.45	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 15-30cm depth

Appendix 2. Five year summary of selected soil properties of the 15-30 cm horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	NH ₄ -N (mg/kg)					CV across years (%)	NO ₃ -N (mg/kg)					CV across years (%)	P (mg/kg)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
586	PL	U	15-30	1.8	0.6	1.2	0.3	0.5	69.69	0.9	0.5	1.0	1.0	1.5	36.36	9	8	6	5	7	22.83
586	PL	M	15-30	0.7	0.5	0.8	0.3	1.4	55.57	0.9	0.5	1.1	2.3	1.2	56.15	9	6	10	9	9	17.05
586	PL	L	15-30	0.5	0.5	0.6	0.3	1.2	55.98	7.9	0.5	1.4	1.0	1.0	131.92	6	5	7	5	7	17.76
588	PL	U	15-30	0.4	0.9	0.6	0.3	1.2	53.70	2.1	6.9	1.0	2.0	22.1	129.56	2	1	5	5	5	54.15
588	PL	M	15-30	0.4	0.6	0.6	0.3	1.8	82.49	5.0	1.6	4.9	2.8	29.3	132.78	8	4	6	5	6	26.04
588	PL	L	15-30	0.5	1.0	3.9	0.3	1.3	104.15	3.9	1.8	2.4	2.2	8.8	76.17	25	31	20	21	26	17.58
590	PL	U	15-30	0.5	2.4	0.5	0.5	0.6	92.30	1.1	8.1	1.9	2.3	2.8	86.10	10	9	9	10	11	8.03
590	PL	M	15-30	0.7	0.8	0.6	0.5	2.0	66.12	8.8	1.6	1.0	1.0	1.7	119.11	7	8	8	5	13	34.70
590	PL	L	15-30	0.7	1.4	0.6	0.4	0.6	53.44	5.2	3.0	1.0	1.0	1.6	75.66	10	10	5	5	9	30.62
591	PL	U	15-30	0.5	0.5	0.5	0.6	1.8	75.39	1.3	1.2	1.4	4.4	6.7	82.21	6	2	5	5	5	32.97
591	PL	M	15-30	0.3	0.1	1.3	0.5	1.7	87.66	17.9	1.1	2.7	4.4	11.0	94.01	4	2	5	5	5	31.04
591	PL	L	15-30	0.2	0.7	3.3	0.7	1.4	95.69	4.5	12.8	13.2	44.6	40.1	78.28	15	15	15	18	19	11.61
592	PL	U	15-30	0.3	0.3	0.8	0.8	0.9	48.03	4.1	3.5	7.8	5.5	7.6	34.52	10	16	8	8	10	31.04
592	PL	M	15-30	0.3	0.8	0.5	0.7	1.7	66.77	12.4	1.6	8.5	3.8	11.4	62.67	5	5	7	5	9	26.32
592	PL	L	15-30	0.3	1.2	0.9	0.3	1.5	62.24	3.0	16.7	25.9	12.2	27.7	59.42	15	21	22	15	18	17.28
593	PL	U	15-30	0.2	0.8	0.3	0.6	2.9	114.72	3.2	1.0	1.2	1.0	4.5	73.14	4	3	5	5	5	20.33
593	PL	M	15-30	0.4	1.0	0.3	0.7	1.6	66.08	1.7	0.5	1.5	1.0	2.7	55.80	8	4	5	5	5	27.52
593	PL	L	15-30	0.2	1.0	0.3	0.6	3.1	115.70	.	0.5	2.1	1.0	4.8	91.23	8	6	7	6	7	14.22
594	PL	U	15-30	.	1.6	0.3	0.7	1.9	66.98	.	2.3	1.1	1.0	1.0	47.04	.	4	5	5	5	11.07
594	PL	M	15-30	.	1.0	0.3	0.6	2.0	74.26	.	1.6	1.0	1.0	1.0	26.09	.	5	6	7	8	20.92
594	PL	L	15-30	.	4.3	0.3	0.4	0.9	127.28	16.6	1.7	1.0	1.0	1.0	162.09	.	8	8	8	11	17.42
595	PL	U	15-30	0.7	2.1	0.5	0.3	0.7	83.11	8.1	16.5	8.9	9.2	3.8	49.18	8	4	9	5	5	34.16
595	PL	M	15-30	0.8	2.5	1.4	0.3	0.8	72.15	8.8	11.4	17.8	12.5	25.2	42.98	4	3	8	5	5	40.01
595	PL	L	15-30	2.2	0.6	0.8	0.5	0.5	80.76	.	13.7	6.0	8.9	4.5	49.01	6	6	9	9	9	20.28
599	PL	U	15-30	.	0.5	1.3	0.3	2.9	94.85	.	7.3	16.7	3.2	3.4	82.58	.	2	5	5	5	35.29
599	PL	M	15-30	.	0.3	1.4	0.3	2.7	97.14	.	5.5	16.8	7.0	9.9	51.01	.	3	5	5	5	22.49
599	PL	L	15-30	.	1.0	4.3	0.3	1.8	94.22	40.2	6.2	1.4	1.5	11.9	132.51	.	2	1	5	6	75.02
			Mean	0.6	1.1	1.0	0.5	1.5		7.5	4.8	5.6	5.1	9.2		9	7	8	7	9	
			Max	2.2	4.3	4.3	0.8	3.1		40.2	16.7	25.9	44.6	40.1		25	31	22	21	26	
			Min	0.2	0.1	0.3	0.3	0.5		0.9	0.5	1.0	1.0	1.0		2	1	1	5	5	
			SD	0.4	0.9	1.1	0.2	0.7		9.0	5.2	6.8	8.7	10.6		5	7	5	4	5	
			CV by year (%)	72.22	83.23	105.24	36.57	48.05		120.56	108.20	122.64	170.06	115.18		60.24	95.57	60.26	59.30	59.94	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 15-30cm depth

Appendix 2. Five year summary of selected soil properties of the 15-30 cm horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	NH ₄ -N (mg/kg)					CV across years (%)	NO ₃ -N (mg/kg)					CV across years (%)	P (mg/kg)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
615	MB	U	15-30	0.1	1.8	1.3	0.3	1.9	78.63	10.0	48.7	11.5	1.0	1.4	135.69	170	108	63	32	29	73.67
615	MB	M	15-30	0.3	1.6	1.4	2.2	2.1	50.17	25.0	18.9	5.5	1.0	1.7	104.41	17	9	10	6	9	41.58
615	MB	L	15-30	0.5	2.4	1.6	0.6	1.9	57.91	6.0	39.5	21.4	2.2	4.7	106.63	5	6	7	6	8	16.91
			Mean	0.3	1.9	1.4	1.0	2.0		13.7	35.7	12.8	1.4	2.6		64	41	27	15	15	
			Max	0.5	2.4	1.6	2.2	2.1		25.0	48.7	21.4	2.2	4.7		170	108	63	32	29	
			Min	0.1	1.6	1.3	0.3	1.9		6.0	18.9	5.5	1.0	1.4		5	6	7	6	8	
			SD	0.2	0.4	0.2	1.0	0.1		10.0	15.3	8.0	0.7	1.8		92	58	32	15	12	
			CV by year (%)	66.67	21.53	10.66	98.89	5.87		73.29	42.74	62.73	50.07	70.19		143.74	141.57	118.64	104.73	78.69	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 15-30cm depth

Appendix 2. Five year summary of selected soil properties of the 15-30 cm horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	NH ₄ -N (mg/kg)					CV across years (%)	NO ₃ -N (mg/kg)					CV across years (%)	P (mg/kg)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
678	BT	U	15-30	1.2	6.9	1.6	2.3	1.7	86.10	6.9	84.5	5.5	6.0	11.1	151.51	12	14	8	5	7	39.30
678	BT	M	15-30	1.1	1.3	1.9	3.2	2.2	43.54	3.0	57.6	13.0	13.0	14.2	106.16	5	12	9	7	10	32.31
678	BT	L	15-30	0.7	3.6	1.0	2.3	2.1	59.44	2.8	19.7	9.5	5.6	8.6	69.43	25	41	12	28	26	39.04
680	BT	U	15-30	0.8	3.1	0.3	2.4	3.2	68.23	0.4	5.4	1.0	1.0	1.0	116.55	4	4	5	5	5	11.91
680	BT	M	15-30	0.8	2.9	0.9	1.0	2.8	62.57	1.2	2.1	3.3	1.0	1.8	48.37	6	3	6	5	9	36.74
680	BT	L	15-30	2.5	2.8	0.3	0.4	3.3	74.87	7.8	4.8	1.8	1.3	2.0	77.97	5	8	8	5	13	42.24
681	BT	U	15-30	0.7	0.5	0.6	0.3	4.2	132.85	9.0	2.9	1.0	1.0	1.4	111.49	4	4	5	5	5	12.20
681	BT	M	15-30	2.0	0.4	1.1	0.3	1.1	70.49	8.2	5.0	1.0	1.0	1.6	94.53	3	4	5	5	5	20.33
681	BT	L	15-30	0.7	0.6	0.6	0.3	1.3	54.75	21.3	5.5	1.0	1.0	1.0	147.55	2	4	5	5	5	31.04
684	BT	U	15-30	1.1	0.4	1.0	0.6	1.6	49.43	1.4	2.4	1.0	1.0	1.0	44.61	20	23	18	17	20	12.33
684	BT	M	15-30	1.5	0.6	1.1	0.8	1.1	33.69	1.2	3.8	2.0	1.0	1.0	66.20	17	25	17	22	25	18.99
684	BT	L	15-30	1.3	1.3	1.0	1.0	1.8	26.13	5.5	26.2	11.3	2.0	1.1	111.82	6	63	87	71	86	53.08
687	BT	U	15-30	0.3	3.0	0.7	0.3	2.6	96.98	1.2	3.9	1.9	1.0	1.9	57.96	7	10	9	20	10	45.74
687	BT	M	15-30	0.3	2.5	0.7	0.3	0.9	96.74	1.5	4.4	2.5	1.8	1.9	48.52	11	21	12	60	13	88.78
687	BT	L	15-30	1.1	2.7	1.3	1.4	1.9	38.41	4.5	1.7	4.7	2.4	2.7	41.58	9	12	10	30	14	58.36
688	BT	U	15-30	0.3	0.8	0.3	0.5	2.8	111.96	3.1	9.4	3.9	1.0	3.7	73.83	4	6	5	7	9	29.52
688	BT	M	15-30	0.3	1.0	0.3	0.7	1.9	79.25	2.7	24.1	5.1	1.9	4.7	120.27	2	6	5	5	6	33.61
688	BT	L	15-30	0.3	1.1	0.3	0.5	2.1	89.79	2.5	15.3	7.3	4.4	8.9	64.37	25	21	27	29	41	26.33
692	BT	U	15-30	2.1	1.9	1.0	2.5	5.5	66.53	0.1	0.5	2.1	2.1	3.4	82.01	2	4	5	5	6	35.38
692	BT	M	15-30	1.3	1.6	1.8	0.9	4.6	72.10	0.4	2.8	3.6	1.6	3.3	56.34	1	2	5	5	5	54.15
692	BT	L	15-30	3.4	2.5	3.9	1.0	4.5	43.87	3.2	4.9	10.4	2.1	3.3	69.32	2	5	5	5	5	30.49
703	BT	U	15-30	1.5	1.7	1.0	0.3	1.2	48.89	0.1	1.7	1.0	1.0	1.0	59.20	3	3	5	5	5	26.08
703	BT	M	15-30	1.6	3.9	0.7	0.9	2.1	69.46	0.1	5.0	1.1	1.0	1.1	115.29	2	3	5	5	5	35.36
703	BT	L	15-30	0.5	1.0	2.6	1.3	1.2	59.32	12.9	14.1	5.2	1.3	2.9	80.61	13	16	16	14	12	12.51
			Mean	1.1	2.0	1.1	1.1	2.4		4.2	12.8	4.2	2.3	3.5		8	13	12	15	14	
			Max	3.4	6.9	3.9	3.2	5.5		21.3	84.5	13.0	13.0	14.2		25	63	87	71	86	
			Min	0.3	0.4	0.3	0.3	0.9		0.1	0.5	1.0	1.0	1.0		1	2	5	5	5	
			SD	0.8	1.5	0.8	0.9	1.3		4.9	19.7	3.6	2.7	3.6		7	14	17	18	18	
			CV by year (%)	68.09	74.74	76.48	81.31	52.17		117.39	153.67	86.97	114.49	100.91		91.54	109.14	137.95	115.15	122.02	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 15-30cm depth

Appendix 2. Five year summary of selected soil properties of the 15-30 cm horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	NH ₄ -N (mg/kg)					CV across years (%)	NO ₃ -N (mg/kg)					CV across years (%)	P (mg/kg)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
727	AP	U	15-30	0.9	1.6	4.9	0.5	2.2	85.37	4.4	49.3	50.0	4.3	5.9	107.74	7	38	35	10	18	65.25
727	AP	M	15-30	1.6	1.2	16.4	2.1	2.6	136.69	3.5	31.1	41.4	6.4	7.8	94.70	2	10	6	6	6	48.04
727	AP	L	15-30	1.2	1.6	2.6	0.7	3.2	55.40	4.8	41.9	13.7	6.7	8.0	102.50	2	10	8	6	7	45.65
728	AP	U	15-30	0.5	0.8	0.4	1.2	2.4	76.48	1.3	9.0	5.9	4.4	12.9	66.37	5	13	7	5	11	43.90
728	AP	M	15-30	0.6	0.8	0.7	0.9	6.9	138.04	9.6	17.7	11.8	9.2	29.1	53.85	5	12	8	9	16	41.21
728	AP	L	15-30	0.9	1.0	0.3	2.7	6.7	112.56	9.8	35.4	24.8	26.8	53.4	53.22	44	61	66	72	60	17.26
730	AP	U	15-30	0.7	3.1	0.3	2.8	1.8	71.11	4.1	3.1	3.2	1.3	10.0	77.01	4	9	5	5	6	33.07
730	AP	M	15-30	1.7	3.2	0.3	1.8	4.5	69.74	7.8	4.4	3.1	2.0	11.1	65.90	4	11	5	5	10	46.10
730	AP	L	15-30	1.0	2.5	0.3	1.4	1.6	59.17	6.7	2.4	1.3	2.3	13.6	97.06	10	5	5	7	11	34.91
738	AP	U	15-30	0.7	2.8	5.1	4.5	1.7	62.46	2.4	9.6	3.7	1.4	3.0	80.20	5	17	7	12	12	44.62
738	AP	M	15-30	0.5	3.0	0.3	6.5	1.3	111.04	1.6	11.6	2.0	2.5	1.9	109.83	5	20	9	16	14	45.94
738	AP	L	15-30	0.6	3.1	0.3	1.4	1.2	83.09	3.6	13.1	6.1	2.1	2.0	85.98	6	13	9	9	11	27.45
739	AP	U	15-30	1.3	2.4	0.3	0.8	2.1	62.53	2.2	2.8	4.0	1.0	5.5	55.19	6	5	8	5	6	19.18
739	AP	M	15-30	0.7	2.4	0.3	0.6	1.9	76.46	1.0	2.0	2.1	1.0	4.1	62.06	7	5	6	6	7	14.61
739	AP	L	15-30	1.1	2.5	0.3	1.6	1.4	57.82	.	1.1	2.2	1.0	3.7	62.85	4	4	5	5	6	16.11
740	AP	U	15-30	.	3.2	1.8	0.3	5.0	78.53	.	0.9	2.7	1.7	5.1	69.82	.	2	5	5	8	47.28
740	AP	M	15-30	.	3.0	4.0	0.5	1.8	65.70	.	2.2	11.9	2.2	5.8	82.67	.	4	6	5	9	39.61
740	AP	L	15-30	.	3.3	9.2	0.4	2.2	101.43	5.8	7.6	17.7	15.6	23.8	52.66	.	24	45	35	54	32.85
743	AP	U	15-30	0.9	0.6	0.3	0.7	2.6	89.03	0.8	16.8	1.9	1.4	15.2	111.70	4	17	7	7	6	63.89
743	AP	M	15-30	3.2	0.8	0.3	1.4	1.8	74.37	2.9	19.2	4.4	3.2	20.1	88.94	4	21	8	11	10	58.03
743	AP	L	15-30	3.5	0.8	0.4	2.4	1.6	72.70	.	28.5	2.8	4.3	29.8	90.41	6	12	7	8	12	31.63
744	AP	U	15-30	.	9.3	0.3	0.6	1.9	139.35	.	1.6	3.7	1.6	4.9	55.11	.	3	5	6	5	26.47
744	AP	M	15-30	.	0.3	0.3	0.5	1.8	99.27	.	3.6	5.7	4.9	6.5	23.92	.	7	6	8	10	21.57
744	AP	L	15-30	.	0.7	0.3	0.5	2.2	92.93	7.8	8.1	5.5	6.8	7.6	14.67	.	9	9	12	12	14.37
746	AP	U	15-30	0.2	0.7	0.9	0.3	1.0	54.11	4.0	4.6	8.1	4.4	5.8	31.01	3	6	8	5	5	35.81
746	AP	M	15-30	1.1	0.6	0.4	0.5	1.4	53.40	2.6	1.3	5.8	3.9	7.2	57.33	6	4	5	6	7	18.97
746	AP	L	15-30	2.2	0.8	1.0	0.7	1.2	51.40	36.3	6.1	8.9	4.4	7.8	104.75	6	6	9	7	8	16.21
			Mean	1.2	2.1	1.9	1.4	2.4		5.9	12.4	9.4	4.7	11.5		7	13	11	11	13	
			Max	3.5	9.3	16.4	6.5	6.9		36.3	49.3	50.0	26.8	53.4		44	61	66	72	60	
			Min	0.2	0.3	0.3	0.3	1.0		0.8	0.9	1.3	1.0	1.9		2	2	5	5	5	
			SD	0.9	1.8	3.6	1.4	1.6		7.7	11.6	8.8	5.5	11.5		9	12	14	14	13	
			CV by year (%)	72.83	87.53	187.31	100.73	64.72		130.82	93.22	93.33	117.95	99.56		129.10	90.29	119.57	128.17	104.78	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 15-30cm depth

Appendix 2. Five year summary of selected soil properties of the 15-30 cm horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	NH ₄ -N (mg/kg)					CV across years (%)	NO ₃ -N (mg/kg)					CV across years (%)	P (mg/kg)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
769	MM	U	15-30	0.3	0.6	1.5	2.3	2.2	66.03	18.5	13.4	11.6	10.6	11.3	24.57	5	7	21	17	11	54.98
769	MM	M	15-30	0.8	0.6	0.3	2.2	0.9	75.03	23.6	9.8	17.0	14.5	13.3	32.94	13	10	16	13	14	16.48
769	MM	L	15-30	3.9	0.5	0.3	2.3	0.6	103.28	24.3	8.1	10.7	14.5	14.8	42.48	13	9	15	15	10	22.00
781	MM	U	15-30	2.5	0.3	0.4	0.3	1.9	98.92	10.8	2.0	13.7	2.3	22.7	83.71	13	5	31	30	20	56.26
781	MM	M	15-30	2.3	0.9	0.3	0.6	2.3	75.39	16.0	4.2	13.2	2.5	22.9	72.11	17	6	17	28	17	46.31
781	MM	L	15-30	2.3	0.4	0.7	0.4	0.8	89.40	5.4	4.2	15.2	2.8	12.7	68.56	14	10	28	28	17	42.01
786	MM	U	15-30	2.0	4.7	1.8	3.7	1.1	55.97	3.9	9.2	5.5	4.0	6.9	37.77	14	7	8	10	8	29.59
786	MM	M	15-30	1.5	0.8	0.7	1.6	1.9	40.16	2.5	6.6	3.9	5.2	3.4	37.20	4	3	9	5	5	45.74
786	MM	L	15-30	0.5	1.0	0.7	1.1	0.6	35.03	5.1	1.6	13.8	3.9	1.5	97.83	11	10	17	14	15	21.51
791	MM	U	15-30	0.8	0.7	1.1	1.3	0.6	33.00	4.4	1.3	8.4	1.0	4.0	78.15	7	4	9	8	7	25.87
791	MM	M	15-30	0.1	1.4	0.5	0.9	1.1	64.08	4.5	2.1	10.9	1.8	6.0	72.86	8	5	9	10	7	22.91
791	MM	L	15-30	0.5	1.4	0.8	0.8	1.1	37.59	5.2	3.8	9.2	1.7	2.3	67.15	19	20	21	25	23	11.49
793	MM	U	15-30	0.9	1.3	0.5	0.8	1.2	34.81	4.8	1.6	23.2	11.3	5.5	91.99	7	9	7	12	8	24.47
793	MM	M	15-30	1.3	0.7	1.1	4.0	0.7	89.89	2.9	1.1	9.0	5.9	5.8	61.61	4	6	5	9	5	33.32
793	MM	L	15-30	1.2	0.7	0.5	0.9	0.7	32.41	10.2	1.1	16.4	5.2	3.3	84.46	7	7	7	9	7	10.89
			Mean	1.4	1.1	0.7	1.5	1.2		9.5	4.7	12.1	5.8	9.1		10	8	15	16	12	
			Max	3.9	4.7	1.8	4.0	2.3		24.3	13.4	23.2	14.5	22.9		19	20	31	30	23	
			Min	0.1	0.3	0.3	0.3	0.6		2.5	1.1	3.9	1.0	1.5		4	3	5	5	5	
			SD	1.0	1.1	0.5	1.2	0.6		7.5	3.9	4.8	4.6	7.0		5	4	8	8	6	
			CV by year (%)	74.26	99.51	61.36	74.56	52.33		79.54	82.71	39.97	79.56	76.52		45.65	51.27	54.36	53.09	49.17	
798	FG	U	15-30	0.5	0.9	0.4	1.2	0.6	48.02	2.4	1.8	5.1	4.8	13.4	84.67	8	5	12	16	12	40.30
798	FG	M	15-30	0.5	0.7	0.3	0.5	0.9	39.68	2.4	2.3	5.1	2.3	17.7	112.12	5	6	13	11	13	40.06
798	FG	L	15-30	0.2	0.8	0.4	1.2	1.9	77.02	7.8	1.0	4.6	3.6	15.9	87.21	8	7	10	16	10	35.56
800	FG	U	15-30	3.8	1.2	0.7	3.8	0.3	87.42	5.5	3.6	18.4	7.0	5.9	72.92	7	4	10	10	9	31.98
800	FG	M	15-30	3.4	1.3	1.0	4.9	1.8	66.83	7.5	3.1	18.2	10.6	5.7	64.45	12	7	13	9	11	23.25
800	FG	L	15-30	4.7	0.7	0.3	3.4	1.9	83.95	17.0	2.8	8.8	5.5	6.2	67.31	11	7	14	14	13	25.59
			Mean	2.2	0.9	0.5	2.5	1.2		7.1	2.4	10.0	5.6	10.8		9	6	12	13	11	
			Max	4.7	1.3	1.0	4.9	1.9		17.0	3.6	18.4	10.6	17.7		12	7	14	16	13	
			Min	0.2	0.7	0.3	0.5	0.3		2.4	1.0	4.6	2.3	5.7		5	4	10	9	9	
			SD	2.0	0.3	0.3	1.8	0.7		5.4	0.9	6.6	2.9	5.5		3	1	2	3	2	
			CV by year (%)	91.67	27.66	55.65	70.78	57.87		75.95	38.61	65.57	51.78	50.98		30.45	21.08	13.94	25.61	14.97	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 15-30cm depth

Appendix 2. Five year summary of selected soil properties of the 15-30 cm horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	NH ₄ -N (mg/kg)					CV across years (%)	NO ₃ -N (mg/kg)					CV across years (%)	P (mg/kg)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
804	MG	U	15-30	0.8	0.3	0.3	2.5	1.0	92.91	3.8	12.1	1.7	7.9	20.6	81.45	10	5	6	8	5	32.01
804	MG	M	15-30	0.4	2.6	1.4	4.6	0.8	86.68	5.5	24.0	3.7	20.8	47.1	86.61	9	8	8	12	9	17.65
804	MG	L	15-30	2.0	0.8	1.8	3.6	0.8	64.34	3.4	21.1	6.0	12.0	39.2	88.60	9	5	11	8	6	31.16
806	MG	U	15-30	0.4	0.6	0.5	2.8	0.9	97.08	1.8	2.5	11.1	7.7	7.4	63.86	8	11	15	14	6	36.58
806	MG	M	15-30	1.2	0.1	0.3	1.7	2.0	79.25	1.3	2.4	9.4	4.8	6.6	66.41	4	4	13	11	6	56.01
806	MG	L	15-30	0.7	4.1	0.3	3.1	1.9	79.09	2.4	4.3	16.8	14.1	7.8	68.33	12	25	14	11	8	46.63
809	MG	U	15-30	0.4	0.6	0.3	1.9	1.0	77.97	2.0	4.1	2.6	1.9	6.5	56.25	6	7	10	7	6	21.43
809	MG	M	15-30	1.0	0.8	0.3	0.5	0.7	40.37	2.5	3.7	6.5	11.4	16.4	71.21	8	4	9	10	5	34.47
809	MG	L	15-30	0.4	1.8	0.4	0.4	0.7	80.44	6.7	0.9	3.8	9.4	16.8	80.87	11	11	9	9	9	11.42
812	MG	U	15-30	4.2	0.1	0.6	0.5	1.7	116.66	5.1	0.8	3.4	1.3	3.6	62.20	16	9	10	7	9	33.14
812	MG	M	15-30	4.2	0.1	0.5	0.5	1.1	130.93	3.9	1.3	2.6	1.0	6.3	71.69	13	15	13	9	28	45.75
812	MG	L	15-30	4.1	0.1	0.5	3.2	1.2	95.69	11.2	1.6	3.3	3.8	4.5	75.88	12	49	37	41	11	58.15
815	MG	U	15-30	3.9	0.7	0.3	0.5	1.0	117.12	3.7	0.7	6.5	5.9	3.4	56.91	2	5	6	5	5	33.87
815	MG	M	15-30	3.5	0.9	0.3	0.7	0.8	101.81	4.0	1.9	8.7	8.5	4.7	53.21	3	7	8	12	7	43.66
815	MG	L	15-30	2.7	0.8	0.3	0.5	0.8	94.88	10.3	3.1	7.8	9.3	3.5	48.77	33	38	36	31	40	9.84
823	MG	U	15-30	10.6	0.5	4.7	0.3	1.2	125.75	9.5	5.3	13.2	1.2	17.8	68.97	11	14	16	10	29	47.71
823	MG	M	15-30	8.2	1.5	1.0	0.8	1.0	128.67	8.1	5.6	11.0	1.8	7.8	49.77	12	12	19	15	22	27.89
823	MG	L	15-30	4.7	0.5	0.6	0.5	0.9	129.08	2.5	4.4	14.0	2.6	12.0	77.20	21	14	18	12	16	21.69
1828	MG	U	15-30	0.3	8.9	0.3	0.4	1.7	161.12	2.6	6.5	1.0	3.7	4.0	56.79	5	3	5	5	5	20.11
1828	MG	M	15-30	1.7	0.1	0.3	0.5	0.4	105.70	1.7	9.5	1.5	9.2	3.3	79.33	10	3	7	6	7	39.29
1828	MG	L	15-30	2.2	0.1	0.3	0.4	0.9	108.92	.	12.1	1.4	8.4	3.8	74.27	5	5	9	7	7	23.41
2828	MG	U	15-30	.	.	0.4	0.4	0.9	50.53	.	.	2.3	2.4	5.2	50.15	.	.	8	10	15	34.35
2828	MG	M	15-30	.	.	0.3	0.4	1.0	65.65	.	.	2.8	2.2	6.1	57.50	.	.	10	8	14	26.52
2828	MG	L	15-30	.	.	36.5	0.3	0.9	164.74	.	.	2.2	2.8	4.1	31.73	.	.	9	14	13	25.89
			Mean	2.7	1.2	2.2	1.3	1.0		4.6	6.1	6.0	6.4	10.8		10	12	13	12	12	
			Max	10.6	8.9	36.5	4.6	2.0		11.2	24.0	16.8	20.8	47.1		33	49	37	41	40	
			Min	0.3	0.1	0.3	0.3	0.4		1.3	0.7	1.0	1.0	3.3		2	3	5	5	5	
			SD	2.7	2.0	7.4	1.3	0.4		3.0	6.4	4.6	4.9	11.2		7	12	8	8	9	
			CV by year (%)	98.70	162.21	336.54	99.64	38.04		65.61	105.57	76.24	77.02	104.44		65.06	97.72	64.55	68.90	77.22	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 15-30cm depth

Appendix 2. Five year summary of selected soil properties of the 15-30 cm horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	K (mg/kg)					CV across years (%)	S (mg/kg)					CV across years (%)	OM (%)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
586	PL	U	15-30	138	145	181	156	297	35.75	8.6	46.7	19.0	19.7	18.2	63.69	.	.	.	2.39	2.40	0.38
586	PL	M	15-30	113	115	180	138	271	40.35	13.4	17.3	19.0	14.1	35.0	44.65	.	.	.	2.87	2.70	4.41
586	PL	L	15-30	180	136	193	156	251	23.90	17.5	14.1	21.0	34.4	18.8	36.92	.	.	.	3.23	2.30	23.80
588	PL	U	15-30	120	263	172	134	254	35.35	14.3	17.0	26.2	18.8	15.6	25.47	.	.	.	3.71	3.50	4.04
588	PL	M	15-30	155	235	186	157	233	20.32	6.5	3.0	15.3	10.6	12.4	50.82	.	.	.	3.67	3.30	7.51
588	PL	L	15-30	153	219	164	160	236	20.54	11.5	9.7	24.5	19.1	16.8	36.50	.	.	.	3.42	3.70	5.56
590	PL	U	15-30	122	101	89	83	141	22.51	8.2	2.2	8.9	4.7	4.3	49.60	.	.	.	2.11	1.60	19.57
590	PL	M	15-30	119	146	105	110	162	19.17	12.1	4.2	6.3	6.6	4.4	47.51	.	.	.	2.54	2.00	16.93
590	PL	L	15-30	106	144	116	104	138	15.11	4.7	4.9	7.7	4.4	4.4	27.01	.	.	.	2.52	1.90	19.84
591	PL	U	15-30	124	134	130	84	203	31.69	3.9	3.2	4.6	2.1	3.9	26.28	.	.	.	2.56	2.40	4.51
591	PL	M	15-30	101	153	143	81	176	29.79	9.3	4.9	4.2	7.2	3.4	41.66	.	.	.	3.10	2.60	12.50
591	PL	L	15-30	109	142	122	92	170	23.76	13.0	9.6	15.8	13.3	12.6	17.19	.	.	.	12.30	11.70	3.54
592	PL	U	15-30	170	251	196	159	257	21.95	5.0	17.1	6.2	7.1	5.4	61.99	.	.	.	4.58	4.80	3.26
592	PL	M	15-30	107	204	225	161	274	32.67	6.6	6.2	5.5	6.5	5.5	8.78	.	.	.	4.41	4.20	3.50
592	PL	L	15-30	163	263	185	140	243	26.38	7.1	16.2	17.2	7.6	7.4	46.15	.	.	.	11.99	10.50	9.39
593	PL	U	15-30	245	224	178	164	251	18.63	34.2	10.4	30.0	17.7	10.6	53.51	.	.	.	5.22	4.90	4.47
593	PL	M	15-30	269	294	227	193	359	23.73	8.7	5.1	7.9	5.0	4.7	29.67	.	.	.	4.17	4.10	1.18
593	PL	L	15-30	243	299	244	192	347	22.46	10.4	12.9	7.8	6.5	6.8	30.76	.	.	.	3.14	3.00	3.16
594	PL	U	15-30	.	190	140	134	163	16.21	.	5.1	10.4	11.4	11.4	31.59	.	.	.	3.70	2.40	30.14
594	PL	M	15-30	.	291	165	131	193	35.38	.	2.9	6.4	8.1	9.2	41.34	.	.	.	3.67	2.90	16.50
594	PL	L	15-30	.	289	206	168	227	22.78	.	9.7	12.0	9.7	13.6	17.06	.	.	.	3.57	3.20	7.65
595	PL	U	15-30	174	162	260	155	347	37.72	58.3	25.9	68.0	59.2	42.0	33.02	.	.	.	5.95	5.60	4.26
595	PL	M	15-30	124	169	199	155	178	16.94	51.8	22.4	24.0	39.4	23.0	40.71	.	.	.	5.98	4.50	19.98
595	PL	L	15-30	211	223	235	189	319	21.08	35.5	18.4	29.9	24.2	63.8	51.36	.	.	.	4.90	4.40	7.55
599	PL	U	15-30	.	273	220	174	306	23.87	.	9.9	40.0	8.1	9.0	92.64	.	.	.	6.80	7.10	3.10
599	PL	M	15-30	.	221	232	174	315	24.93	.	12.3	4.9	8.9	9.6	34.22	.	.	.	7.15	7.30	1.45
599	PL	L	15-30	.	215	18	179	299	66.24	.	32.3	19.4	16.5	56.0	57.96	.	.	.	5.52	5.80	3.54
		Mean		155	204	174	145	245		16.2	12.7	17.1	14.5	15.8		.	.	.	4.64	4.25	
		Max		269	299	260	193	359		58.3	46.7	68.0	59.2	63.8		.	.	.	12.30	11.70	
		Min		101	101	18	81	138		3.9	2.2	4.2	2.1	3.4		.	.	.	2.11	1.60	
		SD		51	61	55	34	66		15.7	7.7	14.2	12.8	16.0		.	.	.	2.56	2.50	
		CV by year (%)		33.28	29.90	31.67	23.54	26.88		96.71	60.84	82.74	88.52	101.10		.	.	.	55.27	58.85	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 15-30cm depth

Appendix 2. Five year summary of selected soil properties of the 15-30 cm horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	K (mg/kg)					CV across years (%)	S (mg/kg)					CV across years (%)	OM (%)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
615	MB	U	15-30	1320	502	381	173	274	86.49	23.9	14.1	13.0	6.0	8.8	51.89	.	.	.	3.20	3.80	12.12
615	MB	M	15-30	152	156	134	108	114	16.38	16.3	6.3	7.9	10.2	12.7	37.12	.	.	.	3.70	4.50	13.80
615	MB	L	15-30	98	124	93	78	108	17.19	9.7	10.1	22.0	18.5	23.0	38.38	.	.	.	11.10	17.10	30.09
			Mean	523	261	203	119	165		16.6	10.2	14.3	11.6	14.8		.	.	.	6.00	8.47	
			Max	1320	502	381	173	274		23.9	14.1	22.0	18.5	23.0		.	.	.	11.10	17.10	
			Min	98	124	93	78	108		9.7	6.3	7.9	6.0	8.8		.	.	.	3.20	3.80	
			SD	690	210	156	48	94		7.1	3.9	7.1	6.4	7.3		.	.	.	4.42	7.48	
			CV by year (%)	131.94	80.41	76.87	40.62	56.95		42.72	38.36	49.93	55.11	49.46		.	.	.	73.73	88.40	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 15-30cm depth

Appendix 2. Five year summary of selected soil properties of the 15-30 cm horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	K (mg/kg)					CV across years (%)	S (mg/kg)					CV across years (%)	OM (%)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
678	BT	U	15-30	193	206	128	154	144	20.11	9.5	15.8	13.6	37.8	16.5	59.30	.	.	.	3.80	3.40	7.86
678	BT	M	15-30	154	202	141	143	148	16.06	6.4	17.0	24.0	41.2	26.0	55.74	.	.	.	4.20	4.50	4.88
678	BT	L	15-30	253	344	191	218	304	23.76	8.7	23.8	15.3	14.6	41.0	60.83	.	.	.	7.10	7.10	0.00
680	BT	U	15-30	113	122	112	81	152	21.74	11.5	5.4	6.4	5.7	5.9	36.69	.	.	.	1.51	1.90	15.99
680	BT	M	15-30	103	99	80	112	104	11.95	4.5	3.7	6.3	3.6	6.3	27.51	.	.	.	1.72	5.70	75.83
680	BT	L	15-30	97	77	58	82	114	24.64	4.0	3.8	4.8	5.0	6.5	22.17	.	.	.	2.10	5.30	61.05
681	BT	U	15-30	64	79	77	80	81	9.21	3.0	2.8	4.0	4.4	4.9	23.71	.	.	.	4.20	2.70	30.74
681	BT	M	15-30	90	71	65	71	77	12.73	5.2	2.5	5.4	2.4	3.5	37.65	.	.	.	4.70	2.60	40.68
681	BT	L	15-30	79	76	95	77	94	11.22	2.4	3.4	4.0	4.2	4.8	24.13	.	.	.	3.80	3.80	0.00
684	BT	U	15-30	104	125	134	105	125	11.20	4.4	9.3	8.1	3.8	11.2	43.13	.	.	.	1.50	1.20	15.71
684	BT	M	15-30	81	170	118	106	130	27.21	1.9	5.7	6.5	5.7	7.4	38.61	.	.	.	2.80	2.30	13.86
684	BT	L	15-30	193	319	247	201	265	20.93	2.8	12.9	9.7	5.5	4.4	58.77	.	.	.	4.60	3.90	11.65
687	BT	U	15-30	76	91	69	70	115	22.98	3.6	2.8	8.7	5.6	3.5	49.50	.	.	.	0.87	1.00	9.99
687	BT	M	15-30	89	116	71	95	103	17.61	10.6	5.6	6.7	27.0	5.2	83.35	.	.	.	3.06	0.90	77.11
687	BT	L	15-30	89	90	74	81	146	29.82	44.7	33.0	16.9	30.6	5.2	58.63	.	.	.	4.75	4.50	3.81
688	BT	U	15-30	133	210	120	154	265	34.15	6.5	3.7	6.2	4.1	4.1	26.74	.	.	.	4.29	4.00	4.95
688	BT	M	15-30	126	202	115	118	252	37.87	6.2	3.9	14.3	4.0	6.8	60.50	.	.	.	6.60	6.10	5.55
688	BT	L	15-30	177	366	151	154	339	44.64	1.6	3.8	9.3	4.4	30.0	118.47	.	.	.	9.03	9.10	0.54
692	BT	U	15-30	296	221	323	254	476	31.44	6.7	2.6	10.5	21.8	5.1	80.65	.	.	.	6.90	4.70	26.82
692	BT	M	15-30	284	204	321	254	395	24.67	4.9	2.9	12.2	4.7	5.0	60.59	.	.	.	8.00	6.10	19.06
692	BT	L	15-30	227	226	238	187	290	15.81	2.4	2.8	9.9	4.3	3.7	65.76	.	.	.	7.20	6.80	4.04
703	BT	U	15-30	71	93	80	79	150	33.76	3.5	2.0	4.2	2.8	3.8	26.58	.	.	.	1.34	1.60	12.35
703	BT	M	15-30	42	116	77	69	98	35.13	3.0	4.2	3.4	2.2	8.2	55.81	.	.	.	1.28	1.10	10.75
703	BT	L	15-30	57	123	109	112	142	29.11	19.1	14.7	3.9	6.1	14.3	55.00	.	.	.	5.83	4.50	18.18
			Mean	133	165	133	127	188		7.4	7.8	8.9	10.5	9.7		.	.	.	4.22	3.95	
			Max	296	366	323	254	476		44.7	33.0	24.0	41.2	41.0		.	.	.	9.03	9.10	
			Min	42	71	58	69	77		1.6	2.0	3.4	2.2	3.5		.	.	.	0.87	0.90	
			SD	73	87	77	58	109		8.9	7.9	5.0	11.8	9.6		.	.	.	2.36	2.19	
			CV by year (%)	54.98	52.81	57.78	45.51	57.85		120.17	100.66	56.50	112.67	98.70		.	.	.	55.96	55.37	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 15-30cm depth

Appendix 2. Five year summary of selected soil properties of the 15-30 cm horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	K (mg/kg)					CV across years (%)	S (mg/kg)					CV across years (%)	OM (%)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
727	AP	U	15-30	378	897	560	238	407	50.74	5.5	21.0	17.0	8.4	8.0	55.56	.	.	.	8.57	10.80	16.30
727	AP	M	15-30	168	330	195	215	266	27.35	17.0	11.4	17.7	18.2	6.7	35.29	.	.	.	10.69	10.60	0.62
727	AP	L	15-30	101	200	133	104	160	29.60	6.1	16.4	24.0	20.4	12.0	44.51	.	.	.	10.87	10.20	4.50
728	AP	U	15-30	113	146	98	88	141	21.92	20.2	4.6	8.6	24.0	7.9	65.06	.	.	.	2.83	3.00	4.10
728	AP	M	15-30	118	191	110	116	199	30.04	13.8	5.2	12.1	9.6	7.9	34.90	.	.	.	7.43	8.20	6.93
728	AP	L	15-30	451	805	441	681	523	27.26	11.8	5.9	15.0	12.4	9.6	31.18	.	.	.	11.46	12.00	3.29
730	AP	U	15-30	149	214	130	104	180	27.69	5.0	1.8	4.7	2.1	3.3	42.79	.	.	.	1.83	1.30	23.95
730	AP	M	15-30	112	161	109	136	193	24.83	4.9	3.1	9.6	19.6	4.1	82.53	.	.	.	3.81	3.00	16.84
730	AP	L	15-30	169	127	109	118	186	23.77	46.9	4.9	2.4	2.8	3.6	160.47	.	.	.	2.93	2.70	5.75
738	AP	U	15-30	166	204	126	150	210	20.88	13.4	3.5	11.6	14.3	14.2	39.91	.	.	.	2.89	3.50	13.48
738	AP	M	15-30	174	204	74	143	196	33.26	18.0	5.7	11.1	13.2	9.9	38.97	.	.	.	3.25	2.80	10.48
738	AP	L	15-30	120	249	85	109	207	45.72	14.2	9.2	13.8	8.1	14.4	25.31	.	.	.	3.91	4.80	14.43
739	AP	U	15-30	188	215	153	115	216	24.30	4.3	9.0	2.7	3.4	4.9	50.87	.	.	.	2.57	2.50	2.01
739	AP	M	15-30	141	103	91	96	149	23.21	3.3	3.7	4.2	3.0	4.9	19.55	.	.	.	1.53	1.70	7.49
739	AP	L	15-30	172	198	162	114	229	24.57	3.6	7.6	3.0	4.1	4.9	38.76	.	.	.	1.89	1.20	31.65
740	AP	U	15-30	.	116	118	92	210	38.82	.	5.6	8.2	9.5	6.8	22.57	.	.	.	2.61	2.90	7.52
740	AP	M	15-30	.	120	85	86	215	48.36	.	3.9	9.2	9.3	6.9	34.65	.	.	.	5.63	7.30	18.28
740	AP	L	15-30	.	197	212	188	575	64.29	.	1160	370	1414	576	55.52	.	.	.	5.78	10.90	43.43
743	AP	U	15-30	169	290	136	198	323	35.86	5.4	2.5	5.4	25.0	13.0	88.83	.	.	.	2.77	2.40	10.22
743	AP	M	15-30	207	365	179	217	382	35.45	4.8	2.7	8.9	8.5	6.2	41.69	.	.	.	4.74	4.60	2.15
743	AP	L	15-30	137	248	141	126	238	33.54	6.2	6.5	7.9	8.9	10.2	20.99	.	.	.	4.22	3.80	7.44
744	AP	U	15-30	.	153	129	106	183	23.23	.	3.4	3.5	5.8	4.3	26.28	.	.	.	3.61	3.50	2.15
744	AP	M	15-30	.	155	127	132	175	15.05	.	3.4	5.0	5.9	12.5	59.87	.	.	.	5.10	4.00	17.07
744	AP	L	15-30	.	141	134	88	165	24.29	.	6.5	7.1	8.3	12.8	32.80	.	.	.	8.50	8.60	0.86
746	AP	U	15-30	129	110	126	105	178	22.36	2.6	2.5	3.9	2.7	5.2	34.21	.	.	.	6.20	4.70	19.48
746	AP	M	15-30	131	107	130	95	158	19.63	2.8	3.0	4.1	3.8	4.7	21.35	.	.	.	7.82	8.90	9.16
746	AP	L	15-30	114	143	130	135	160	12.40	3.0	3.0	3.7	2.7	6.3	39.51	.	.	.	8.45	11.50	21.61
			Mean	172	237	156	152	238		10.1	48.7	22.0	61.8	28.9		.	.	.	5.26	5.61	
			Max	451	897	560	681	575		46.9	1160	370	1414	576		.	.	.	11.46	12.00	
			Min	101	103	74	86	141		2.6	1.8	2.4	2.1	3.3		.	.	.	1.53	1.20	
			SD	74	139	69	115	108		10.3	226.5	71.1	275.5	111.5		.	.	.	2.96	3.50	
			CV by year (%)	43.18	58.59	44.28	75.93	45.21		101.90	464.62	323.08	445.83	385.27		.	.	.	56.27	62.36	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 15-30cm depth

Appendix 2. Five year summary of selected soil properties of the 15-30 cm horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	K (mg/kg)					CV across years (%)	S (mg/kg)					CV across years (%)	OM (%)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
769	MM	U	15-30	208	216	201	187	312	22.20	10.3	3.4	17.8	15.3	23.2	53.81	.	.	.	3.26	2.80	10.71
769	MM	M	15-30	433	205	192	206	220	40.66	9.4	6.3	10.9	13.3	14.5	29.80	.	.	.	3.05	3.50	9.62
769	MM	L	15-30	253	298	250	253	331	13.07	8.8	3.0	11.0	10.4	7.5	39.16	.	.	.	4.48	4.20	4.51
781	MM	U	15-30	214	231	258	214	257	9.28	1.7	4.1	12.0	8.4	9.2	58.34	.	.	.	4.62	4.30	5.13
781	MM	M	15-30	283	260	230	223	266	9.93	1.8	3.7	13.3	11.6	7.9	64.44	.	.	.	4.65	4.00	10.58
781	MM	L	15-30	195	137	173	203	147	16.96	14.0	4.5	13.7	14.1	8.2	39.97	.	.	.	5.00	4.10	14.03
786	MM	U	15-30	492	357	188	268	365	34.20	6.6	3.2	4.1	5.9	6.1	28.10	.	.	.	3.20	2.40	20.14
786	MM	M	15-30	238	141	243	167	177	23.39	3.9	1.8	4.3	2.7	5.4	38.60	.	.	.	2.53	2.30	6.79
786	MM	L	15-30	193	167	177	163	243	17.21	1.3	1.4	3.5	2.7	7.0	73.09	.	.	.	1.34	1.50	8.07
791	MM	U	15-30	221	209	178	197	232	10.14	2.3	1.9	1.9	1.0	2.9	34.64	.	.	.	2.80	2.50	8.00
791	MM	M	15-30	217	167	164	193	205	12.29	1.9	1.8	1.9	1.0	2.8	33.93	.	.	.	3.50	3.00	10.88
791	MM	L	15-30	622	587	448	411	542	17.27	2.7	2.2	1.9	1.0	2.4	31.11	.	.	.	4.50	3.50	17.68
793	MM	U	15-30	184	180	158	164	188	7.44	3.1	2.3	2.8	1.4	3.0	26.81	.	.	.	3.80	3.30	9.96
793	MM	M	15-30	166	193	166	180	200	8.54	2.6	2.4	2.6	1.0	3.0	33.16	.	.	.	2.80	2.60	5.24
793	MM	L	15-30	245	236	181	188	273	17.44	2.6	2.8	3.2	1.0	3.2	35.54	.	.	.	2.70	2.40	8.32
			Mean	278	239	214	214	264		4.9	3.0	7.0	6.1	7.1		.	.	.	3.48	3.09	
			Max	622	587	448	411	542		14.0	6.3	17.8	15.3	23.2		.	.	.	5.00	4.30	
			Min	166	137	158	163	147		1.3	1.4	1.9	1.0	2.4		.	.	.	1.34	1.50	
			SD	132	113	73	62	97		4.0	1.3	5.4	5.5	5.6		.	.	.	1.02	0.83	
			CV by year (%)	47.45	47.14	33.96	28.93	36.86		81.18	43.12	77.84	91.25	78.33		.	.	.	29.18	26.92	
798	FG	U	15-30	131	226	172	216	318	32.94	2.1	2.6	3.2	11.8	13.1	82.48	.	.	.	6.01	4.90	14.40
798	FG	M	15-30	166	155	142	130	201	17.13	4.9	2.4	5.8	9.4	16.8	71.19	.	.	.	4.46	5.20	10.85
798	FG	L	15-30	339	253	228	282	344	17.79	4.2	3.3	9.7	11.9	18.6	65.28	.	.	.	4.63	4.20	6.89
800	FG	U	15-30	483	545	418	381	600	18.48	2.0	3.7	5.1	1.0	3.7	51.86	.	.	.	5.80	5.70	1.23
800	FG	M	15-30	640	580	465	440	610	16.33	2.2	1.9	2.8	1.8	3.4	28.17	.	.	.	5.80	5.50	3.75
800	FG	L	15-30	563	555	449	477	560	10.32	3.9	3.0	3.1	3.0	3.2	11.42	.	.	.	6.50	6.00	5.66
			Mean	387	386	312	321	439		3.2	2.8	5.0	6.5	9.8		.	.	.	5.53	5.25	
			Max	640	580	465	477	610		4.9	3.7	9.7	11.9	18.6		.	.	.	6.50	6.00	
			Min	131	155	142	130	201		2.0	1.9	2.8	1.0	3.2		.	.	.	4.46	4.20	
			SD	210	194	148	135	173		1.3	0.6	2.6	5.1	7.2		.	.	.	0.81	0.64	
			CV by year (%)	54.31	50.30	47.27	42.08	39.48		39.39	23.05	53.00	78.69	73.45		.	.	.	14.63	12.21	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 15-30cm depth

Appendix 2. Five year summary of selected soil properties of the 15-30 cm horizon for 42 benchmark sites from 1998-2002 (continued).

Site #	Eco-region ¹	Slope Position ²	Depth (cm)	K (mg/kg)					CV across years (%)	S (mg/kg)					CV across years (%)	OM (%)					CV across years (%)
				1998	1999	2000	2001	2002		1998	1999	2000	2001	2002		1998	1999	2000	2001	2002	
804	MG	U	15-30	149	146	139	141	156	4.60	5.3	2.2	5.3	5.0	5.1	29.18	.	.	.	1.99	1.50	19.79
804	MG	M	15-30	161	144	127	210	274	32.46	8.8	6.8	4.1	25.0	12.0	71.98	.	.	.	2.95	2.30	17.58
804	MG	L	15-30	322	343	222	352	433	22.63	13.7	11.9	4.1	8.0	7.3	42.46	.	.	.	3.08	2.80	6.67
806	MG	U	15-30	206	216	227	223	281	12.70	5.5	2.5	11.9	8.9	7.0	49.39	.	.	.	2.09	1.60	18.85
806	MG	M	15-30	180	213	194	158	220	12.97	2.5	1.7	11.9	28.2	10.8	96.83	.	.	.	1.75	1.10	32.14
806	MG	L	15-30	288	508	274	226	305	34.01	8.3	8.5	10.2	11.0	3.0	38.07	.	.	.	2.74	2.10	18.70
809	MG	U	15-30	198	231	209	187	258	13.10	2.6	1.6	2.9	1.0	2.5	36.55	.	.	.	1.95	1.50	18.52
809	MG	M	15-30	306	164	212	236	244	22.21	5.9	1.5	2.5	1.6	3.3	60.38	.	.	.	2.25	1.50	28.37
809	MG	L	15-30	322	222	205	205	359	27.62	4.4	5.2	2.6	6.6	7.6	36.86	.	.	.	2.51	1.90	19.45
812	MG	U	15-30	230	259	204	145	270	22.59	83.1	92.5	47.0	26.4	129.0	53.04	.	.	.	1.83	1.80	1.05
812	MG	M	15-30	266	242	185	157	353	31.74	17.7	40.5	93.0	120.4	11.4	84.78	.	.	.	1.72	1.90	7.03
812	MG	L	15-30	247	448	271	269	222	30.81	116.0	79.7	53.0	115.4	26.0	50.36	.	.	.	1.99	1.50	19.86
815	MG	U	15-30	144	135	112	146	180	17.09	1.3	1.8	1.0	1.0	2.6	43.95	.	.	.	1.74	1.10	31.79
815	MG	M	15-30	146	163	143	211	221	20.76	1.4	1.3	1.0	1.3	3.1	52.15	.	.	.	1.94	1.30	27.83
815	MG	L	15-30	665	698	544	531	560	12.73	2.5	3.5	6.3	6.9	4.0	40.63	.	.	.	2.38	2.00	12.12
823	MG	U	15-30	238	311	242	197	350	23.07	156.0	72.5	23.0	116.2	58.0	60.87	.	.	.	2.74	2.90	3.93
823	MG	M	15-30	361	331	267	251	308	14.86	14.3	6.6	25.0	15.2	11.0	47.21	.	.	.	2.30	2.30	0.00
823	MG	L	15-30	645	462	400	315	543	26.97	15.0	7.7	21.0	15.2	38.0	58.97	.	.	.	2.52	2.70	4.79
1828	MG	U	15-30	160	107	93	103	196	33.58	0.9	1.0	1.0	1.0	1.8	32.59	.	.	.	1.27	0.80	32.06
1828	MG	M	15-30	371	314	239	240	382	22.21	1.9	1.3	1.6	4.5	2.5	53.80	.	.	.	2.25	1.50	28.40
1828	MG	L	15-30	273	313	300	287	368	11.85	1.8	3.2	2.6	3.7	2.2	27.81	.	.	.	2.14	1.70	16.07
2828	MG	U	15-30	.	.	150	161	241	26.97	.	.	3.4	12.6	6.6	62.18	.	.	.	2.58	2.20	11.30
2828	MG	M	15-30	.	.	141	134	237	33.83	.	.	6.7	10.6	3.9	47.83	.	.	.	2.36	2.80	12.21
2828	MG	L	15-30	.	.	192	184	277	23.66	.	.	5.9	10.3	9.8	27.80	.	.	.	2.62	2.60	0.60
			Mean	280	284	221	220	302		22.3	16.8	14.5	23.2	15.4		.	.	.	2.24	1.89	
			Max	665	698	544	531	560		156.0	92.5	93.0	120.4	129.0		.	.	.	3.08	2.90	
			Min	144	107	93	103	156		0.9	1.0	1.0	1.0	1.8		.	.	.	1.27	0.80	
			SD	143	146	97	90	103		42.1	28.5	21.7	37.2	27.5		.	.	.	0.44	0.59	
			CV by year (%)	51.19	51.47	43.93	40.83	34.15		188.55	169.56	150.28	160.48	179.10		.	.	.	19.50	31.17	

¹Ecoregions: PL (Peace Lowlands); MB (Mixed Boreal Uplands); BT (Boreal Transition); AP (Aspen Parkland); MM (Moist Mixed Grassland) FG (Fescue Grassland) MG (Mixed Grassland)

²U,M and L indicate upper, mid and lower slope positions for the Ap horizon or 15-30cm depth

