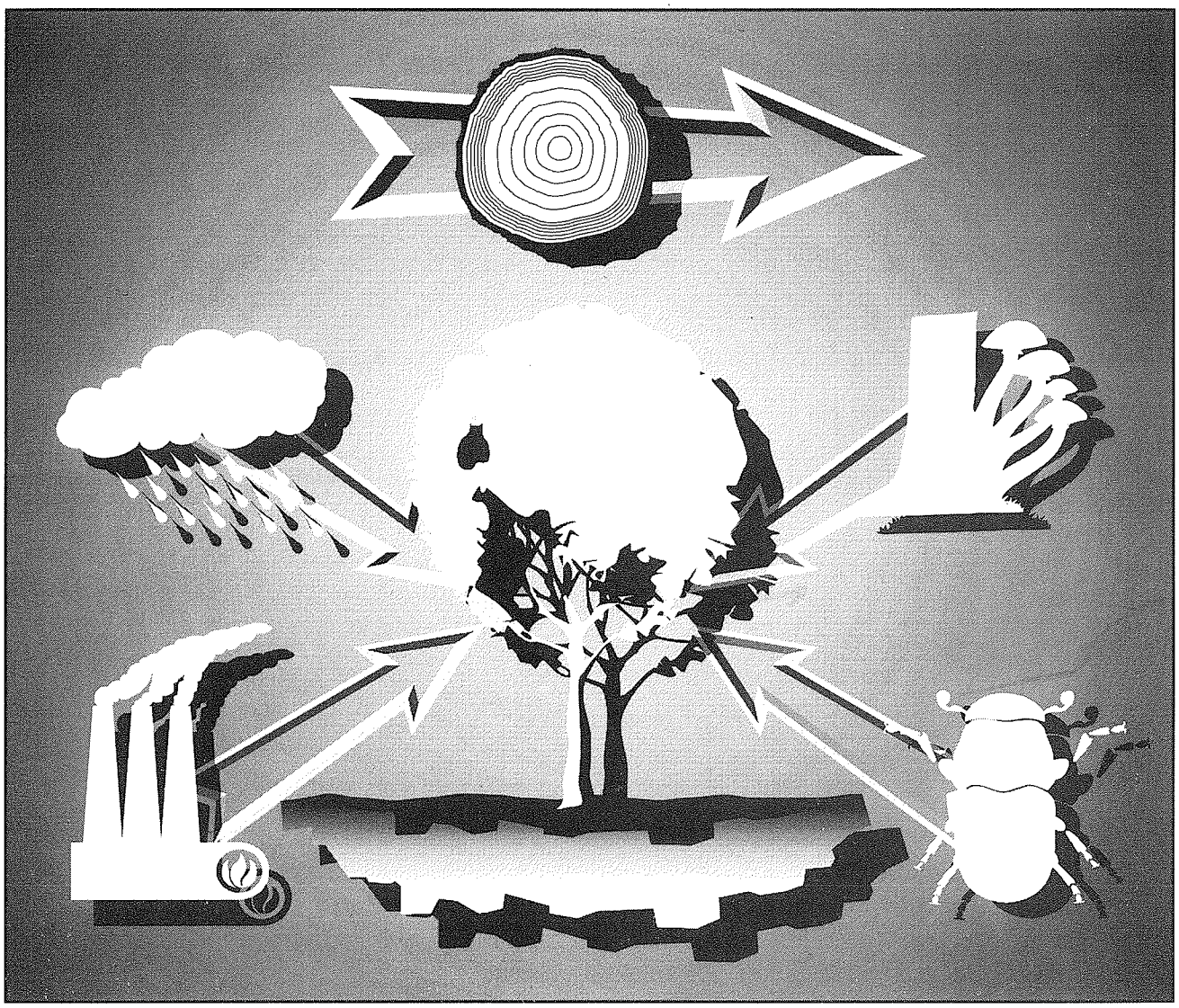
Appendix to sulfur impacts on forest health in west-central Alberta

D.G. Maynard, J.J. Stadt, K.I. Mallett, W.J.A. Volney

Northwest Region • Information Report NOR-X-334-1



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The Canadian Forest Service's Northwest Region is responsible for fulfilling the federal role in forestry research, regional development, and technology transfer in Alberta, Saskatchewan, Manitoba, and the Northwest Territories. The main objectives are research and regional development in support of improved forest management for the economic, social, and environmental benefit of all Canadians. The Northwest Region also has responsibility for the implementation of federal–provincial forestry agreements within its three provinces and territory.

Regional activities are directed from the Northern Forestry Centre in Edmonton, Alberta, and there are district offices in Prince Albert, Saskatchewan, and Winnipeg, Manitoba. The Northwest Region is one of six regions and two national forestry institutes of the Canadian Forest Service, which has its headquarters in Ottawa, Ontario.

Service canadien des forêts, région du Nord–Ouest, représente le gouvernement fédéral en Alberta, en Saskatchewan, au Manitoba et dans les Territoires du Nord–Ouest en ce qui a trait aux recherches forestières, à l'aménagement du territoire et au transfert de technologie. Cet organisme s'intéresse surtout à la recherche et à l'aménagement du territoire en vue d'améliorer l'aménagement forestier afin que tous les Canadiens puissent en profiter aux points de vue économique, social et environnemental. Le bureau de la région du Nord–Ouest est également responsable de la mise en oeuvre des ententes forestières fédérales–provinciales au sein de ces trois provinces et du territoire concerné.

Les activités régionales sont gérées à partir du Centre de foresterie du Nord dont le bureau est à Edmonton (Alberta); on trouve également des bureaux de district à Prince Albert (Saskatchewan) et à Winnipeg (Manitoba). La région du Nord–Ouest correspond à l'une des six régions de Service canadien des forêts, dont le bureau principal est à Ottawa (Ontario). Elle représente également deux des instituts nationaux de foresterie de ce Ministère.

APPENDIX TO SULFUR IMPACTS ON FOREST HEALTH IN WEST-CENTRAL ALBERTA

D.G. Maynard, J.J. Stadt, K.I. Mallett, and W.J.A. Volney

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This appendix is supplemental to Information Report NOR-X-334 "Sulfur impacts on forest health in west-central Alberta". The majority of the data in this appendix were not included in the original report because of the large amount of information collected during the 10 years of this study, and the data were not directly related to the discussion in the report. The data were relevant to the overall conclusions assessing the impact of the two sour gas processing plants on forest health. It is the authors' intent with this appendix to provide a compilation of the data collected that may provide useful baseline information on the forest ecosystems in west-central Alberta. This data has been compiled with estimates of variability (95% confidence limits) where appropriate (e.g., soil and foliar chemistry data), but no detailed interpretation is presented. The reader is referred to Information Report NOR-X-334 for an interpretation of the data presented. The full citation for that report is: Maynard, D.G.; Stadt, J.J.; Mallett, K.I.; Volney, W.J.A. 1994. *Sulfur impacts on forest health in west-central Alberta.* Nat. Resour. Can., Can. For. Serv., Northwest Reg., North. For. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-334.

CONTENTS

APPENDIXES

Note

The exclusion of certain manufactured products does not necessarily imply disapproval nor does the mention of other products imply endorsement by the Canadian Forest Service.

APPENDIX 1

pH, Extractable and Total Elements

Appendix 1. Site 1 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements 1981	Extractable elements 1985	Extractable elements 1991	Total elements 1981	Total elements 1985	Total elements 1991
LFH						
pH	2.5 ± 0.2	2.5 ± 0.5	2.5 ± 0.5	N.A.[a]	N.A.	N.A.
Sulfur	12 200 ± 6 130	4 330 ± 952	3 220 ± 1 480	58 600 ± 12 900	48 000 ± 12 400	12 500 ± 6 750
Calcium	10 500 ± 5 470	6 600 ± 3 380	3 500 ± 2 440	11 700 ± 6 350	9 340 ± 9 900	3 790 ± 3 080
Magnesium	237 ± 89	520 ± 299	136 ± 169	735 ± 443	1 190 ± 1 090	308 ± 84
Potassium	879 ± 452	173 ± 35	107 ± 14	1 880 ± 624	973 ± 329	345 ± 77
Manganese	569 ± 806	41 ± 19	20 ± 9	660 ± 986	45 ± 17	33 ± 9
Aluminum	859 ± 493	115 ± 74	133 ± 78	8 070 ± 4 670	4 250 ± 1 870	1 750 ± 721
Iron	414 ± 139	49 ± 37	421 ± 235	3 550 ± 2 390	2 870 ± 1 210	3 610 ± 1 280
Phosphorus	417 ± 118	36 ± 14	52 ± 14	1 220 ± 343	492 ± 65	605 ± 67
IAe						
pH	4.1 ± 0.6	3.3 ± 0.1	2.8 ± 0.4	N.A.	N.A.	N.A.
Sulfur	204 ± 99	341 ± 50	184 ± 81	450 ± 112	495 ± 108	405 ± 158
Calcium	845 ± 315	592 ± 159	644 ± 361	6 650 ± 984	5 500 ± 962	4 860 ± 1 610
Magnesium	43 ± 35	73 ± 17	39 ± 22	3 600 ± 212	3 400 ± 336	3 360 ± 776
Potassium	140 ± 22	122 ± 22	109 ± 25	17 200 ± 1 220	14 400 ± 838	18 700 ± 1 190
Manganese	220 ± 189	90 ± 108	8 ± 2	564 ± 365	445 ± 369	197 ± 83
Aluminum	414 ± 125	634 ± 166	181 ± 86	59 700 ± 3 760	55 500 ± 3 120	60 500 ± 6 800
Iron	22 ± 22	95 ± 34	106 ± 26	14 300 ± 2 600	17 000 ± 736	14 300 ± 4 650
Phosphorus	N.D.[b]	N.D.	N.D.	973 ± 359	1 410 ± 303	648 ± 232
Bm						
pH	5.3 ± 0.4	4.2 ± 0.0	3.9 ± 0.2	N.A.	N.A.	N.A.
Sulfur	183 ± 82	953 ± 372	635 ± 314	517 ± 104	1 550 ± 610	922 ± 267
Calcium	914 ± 305	393 ± 133	328 ± 319	5 540 ± 859	5 900 ± 1 190	3 320 ± 832
Magnesium	75 ± 40	40 ± 12	18 ± 19	4 320 ± 405	4 340 ± 160	4 730 ± 1 740
Potassium	209 ± 62	179 ± 31	138 ± 50	15 000 ± 884	13 600 ± 848	17 700 ± 2 710
Manganese	63 ± 66	78 ± 34	12 ± 9	367 ± 94	646 ± 138	465 ± 180
Aluminum	191 ± 96	620 ± 40	796 ± 518	72 400 ± 8 210	71 100 ± 7 860	75 800 ± 14 800
Iron	6 ± 5	21 ± 14	25 ± 17	23 900 ± 3 140	28 200 ± 2 890	24 900 ± 7 080
Phosphorus	N.D.	N.D.	N.D.	1 620 ± 415	2 300 ± 662	1 150 ± 343
IIAe						
pH	5.1 ± 0.4	4.2 ± 0.2	3.9 ± 0.2	N.A.	N.A.	N.A.
Sulfur	46 ± 30	239 ± 202	157 ± 51	208 ± 65	328 ± 261	285 ± 56
Calcium	1 130 ± 433	296 ± 154	241 ± 134	3 910 ± 190	2 910 ± 920	2 710 ± 839
Magnesium	233 ± 117	45 ± 14	23 ± 7	4 800 ± 454	4 230 ± 322	4 910 ± 1 020
Potasium	92 ± 41	99 ± 72	89 ± 10	17 300 ± 418	16 100 ± 1 210	19 100 ± 2 550
Manganese	8 ± 5	45 ± 24	11 ± 9	159 ± 22	234 ± 112	285 ± 243
Aluminum	98 ± 48	420 ± 142	667 ± 264	54 000 ± 3 480	52 400 ± 8 510	60 500 ± 8 720
Iron	3 ± 2	13 ± 7	6 ± 1	18 900 ± 1 930	17 100 ± 3 620	21 700 ± 6 810
Phosphorus	N.D.	N.D.	N.D.	552 ± 98	514 ± 299	529 ± 128

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 2 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.3 ± 1.1	3.9 ± 1.3	4.8 ± 1.2	N.A.[a]	N.A.	N.A.
Sulfur	2 280 ± 1 260	1 150 ± 259	322 ± 103	16 000 ± 11 600	11 000 ± 5 750	2 900 ± 1 170
Calcium	6 820 ± 3 990	6 820 ± 3 260	8 490 ± 5 710	12 900 ± 14 900	16 800 ± 26 600	10 000 ± 7 180
Magnesium	333 ± 182	353 ± 81	298 ± 150	857 ± 435	1 450 ± 1 940	679 ± 438
Potassium	965 ± 319	348 ± 246	286 ± 86	1 880 ± 596	1 010 ± 566	458 ± 169
Manganese	611 ± 590	137 ± 199	52 ± 20	858 ± 884	202 ± 325	87 ± 40
Aluminum	267 ± 242	50 ± 65	75 ± 88	7 100 ± 2 750	4 300 ± 2 980	2 060 ± 1 040
Iron	59 ± 83	10 ± 12	45 ± 48	2 130 ± 1 300	2 730 ± 1 780	3 140 ± 2 380
Phosphorus	318 ± 42	62 ± 53	77 ± 30	1 150 ± 165	586 ± 148	718 ± 62
IAe						
pH	4.7 ± 0.7	3.9 ± 0.6	3.7 ± 0.3	N.A.	N.A.	N.A.
Sulfur	45 ± 9	130 ± 43	44 ± 15	229 ± 22	171 ± 40	212 ± 51
Calcium	769 ± 320	524 ± 262	325 ± 209	5 330 ± 1 180	5 300 ± 952	3 910 ± 1 010
Magnesium	98 ± 36	44 ± 15	22 ± 10	3 210 ± 251	2 960 ± 240	2 980 ± 483
Potassium	136 ± 34	118 ± 25	113 ± 52	16 100 ± 1 400	15 100 ± 739	16 600 ± 824
Manganese	117 ± 74	93 ± 89	18 ± 20	449 ± 109	430 ± 259	276 ± 102
Aluminum	300 ± 230	503 ± 176	627 ± 180	50 600 ± 5 280	52 700 ± 2 430	58 300 ± 4 200
Iron	17 ± 27	35 ± 35	60 ± 40	12 300 ± 989	12 600 ± 1 490	12 900 ± 4 110
Phosphorus	N.D.[b]	N.D.	N.D.	643 ± 163	620 ± 130	881 ± 525
Bm						
pH	5.7 ± 0.5	4.8 ± 0.5	4.6 ± 0.6	N.A.	N.A.	N.A.
Sulfur	56 ± 31	408 ± 268	282 ± 182	295 ± 79	748 ± 490	536 ± 267
Calcium	931 ± 482	808 ± 325	333 ± 309	5 080 ± 1 090	5 730 ± 1 060	3 050 ± 524
Magnesium	116 ± 48	44 ± 5	16 ± 13	3 900 ± 284	4 430 ± 315	3 840 ± 503
Potassium	236 ± 130	244 ± 83	132 ± 47	14 400 ± 1 400	13 700 ± 694	15 800 ± 1 760
Manganese	75 ± 55	125 ± 88	22 ± 21	833 ± 565	909 ± 520	379 ± 286
Aluminum	187 ± 221	373 ± 325	306 ± 179	64 300 ± 9 450	68 600 ± 6 510	67 900 ± 6 760
Iron	10 ± 22	8 ± 8	12 ± 12	23 000 ± 4 420	29 100 ± 3 280	21 600 ± 3 170
Phosphorus	N.D.	N.D.	N.D.	1 670 ± 530	1 850 ± 570	1 240 ± 313
IIAe						
pH	5.4 ± 0.3	5.0 ± 0.2	4.8 ± 0.1	N.A.	N.A.	N.A.
Sulfur	22 ± 12	92 ± 44	54 ± 24	171 ± 59	170 ± 100	175 ± 43
Calcium	1 290 ± 931	923 ± 269	1 410 ± 388	3 520 ± 367	3 770 ± 319	3 330 ± 351
Magnesium	254 ± 196	108 ± 59	196 ± 85	4 910 ± 926	4 440 ± 585	5 100 ± 1 070
Potasium	120 ± 78	107 ± 42	120 ± 45	16 400 ± 1 210	15 900 ± 719	17 500 ± 1 920
Manganese	13 ± 13	43 ± 33	24 ± 23	214 ± 48	243 ± 37	233 ± 31
Aluminum	80 ± 70	80 ± 50	160 ± 32	51 900 ± 8 290	51 500 ± 2 520	60 500 ± 7 540
Iron	2 ± 2	3 ± 2	3 ± 1	19 800 ± 3 590	18 300 ± 1 960	21 000 ± 4 210
Phosphorus	N.D.	N.D.	N.D.	463 ± 37	469 ± 99	558 ± 83

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 3 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.6 ± 0.6	4.5 ± 0.3	4.4 ± 0.4	N.A.[a]	N.A.	N.A.
Sulfur	219 ± 61	116 ± 25	154 ± 52	1 150 ± 240	945 ± 195	1 210 ± 298
Calcium	4 120 ± 1 640	4 010 ± 1 160	3 560 ± 1 170	5 040 ± 2 000	4 390 ± 1 290	3 610 ± 1 210
Magnesium	625 ± 130	703 ± 156	499 ± 145	1 250 ± 366	1 150 ± 214	848 ± 525
Potassium	864 ± 288	1 360 ± 356	879 ± 411	2 030 ± 475	2 000 ± 226	1 120 ± 364
Manganese	987 ± 870	422 ± 101	704 ± 541	1 660 ± 1 670	936 ± 891	822 ± 655
Aluminum	241 ± 201	77 ± 62	246 ± 73	8 510 ± 2 670	7 700 ± 2 380	3 020 ± 1 940
Iron	61 ± 76	15 ± 12	68 ± 35	4 130 ± 1 890	4 700 ± 1 850	3 700 ± 3 060
Phosphorus	305 ± 88	125 ± 103	223 ± 119	1 090 ± 197	943 ± 173	1 120 ± 291
IAe						
pH	4.8 ± 0.8	4.7 ± 0.5	4.3 ± 0.5	N.A.	N.A.	N.A.
Sulfur	26 ± 9	18 ± 9	18 ± 11	192 ± 43	83 ± 38	228 ± 130
Calcium	1 040 ± 227	894 ± 231	991 ± 790	4 330 ± 1 280	3 620 ± 597	3 020 ± 1 200
Magnesium	186 ± 42	213 ± 71	190 ± 137	3 280 ± 221	3 270 ± 917	3 170 ± 909
Potassium	122 ± 27	144 ± 81	160 ± 107	14 700 ± 941	12 400 ± 824	12 200 ± 1 930
Manganese	83 ± 123	65 ± 97	86 ± 127	249 ± 173	247 ± 190	504 ± 814
Aluminum	341 ± 257	463 ± 355	466 ± 155	47 500 ± 3 610	46 700 ± 10 040	51 500 ± 11 200
Iron	44 ± 47	61 ± 45	44 ± 35	14 000 ± 2 160	18 400 ± 5 050	18 000 ± 4 220
Phosphorus	N.D.[b]	N.D.	N.D.	446 ± 113	578 ± 292	626 ± 292
Bm						
pH	5.4 ± 0.6	5.3 ± 0.5	5.3 ± 0.3	N.A.	N.A.	N.A.
Sulfur	23 ± 8	19 ± 5	16 ± 8	174 ± 22	87 ± 23	201 ± 103
Calcium	1 180 ± 811	1 210 ± 437	1 420 ± 946	4 510 ± 2 000	6 030 ± 2 000	3 820 ± 1 650
Magnesium	239 ± 145	241 ± 120	309 ± 209	4 440 ± 890	5 080 ± 1 300	4 880 ± 1 240
Potassium	161 ± 96	207 ± 88	175 ± 119	14 500 ± 1 460	13 500 ± 1 470	14 100 ± 2 340
Manganese	45 ± 107	50 ± 104	16 ± 28	341 ± 394	502 ± 339	440 ± 439
Aluminum	268 ± 262	312 ± 293	265 ± 86	59 100 ± 13 000	70 000 ± 17 100	70 700 ± 20 700
Iron	21 ± 34	17 ± 16	14 ± 16	22 100 ± 3 560	31 000 ± 5 760	27 500 ± 7 490
Phosphorus	N.D.	N.D.	N.D.	710 ± 300	1 360 ± 916	801 ± 187
IIAe						
pH	5.4 ± 0.4	5.6 ± 0.3	5.2 ± 0.4	N.A.	N.A.	N.A.
Sulfur	22 ± 9	14 ± 7	18 ± 8	155 ± 36	38 ± 14	173 ± 80
Calcium	1 450 ± 679	1 710 ± 744	1 870 ± 1 020	4 060 ± 1 300	3 970 ± 991	3 880 ± 946
Magnesium	325 ± 242	384 ± 230	393 ± 215	4 730 ± 1 780	5 060 ± 1 090	5 180 ± 1 690
Potasium	123 ± 72	124 ± 95	164 ± 60	15 500 ± 1 280	14 900 ± 1 050	14 600 ± 2 580
Manganese	22 ± 18	23 ± 21	7 ± 5	239 ± 73	319 ± 220	345 ± 221
Aluminum	120 ± 139	96 ± 117	146 ± 99	55 100 ± 12 800	54 900 ± 10 200	64 000 ± 9 750
Iron	4 ± 4	3 ± 5	3 ± 6	21 300 ± 10 300	22 700 ± 7 060	23 500 ± 7 100
Phosphorus	N.D.	N.D.	N.D.	503 ± 149	502 ± 169	541 ± 111

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 4 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.7 ± 0.3	5.2 ± 0.4	5.3 ± 0.4	N.A.[a]	N.A.	N.A.
Sulfur	142 ± 45	69 ± 50	56 ± 15	659 ± 354	643 ± 314	547 ± 133
Calcium	3 790 ± 616	4 100 ± 2 050	2 810 ± 669	3 720 ± 1 200	4 710 ± 2 810	3 170 ± 869
Magnesium	490 ± 138	667 ± 340	338 ± 89	1 290 ± 411	1 630 ± 435	1 040 ± 171
Potassium	541 ± 221	1 100 ± 618	311 ± 84	2 050 ± 546	2 260 ± 495	704 ± 125
Manganese	1 120 ± 154	354 ± 98	516 ± 113	1 530 ± 1 560	1 090 ± 461	1 110 ± 331
Aluminum	185 ± 46	36 ± 22	156 ± 89	10 700 ± 3 860	10 800 ± 3 290	6 220 ± 2 340
Iron	24 ± 7	6 ± 5	4 ± 6	5 390 ± 1 560	6 620 ± 2 420	7 650 ± 1 830
Phosphorus	172 ± 58	64 ± 77	38 ± 21	717 ± 320	792 ± 243	825 ± 184
IAe						
pH	4.9 ± 0.3	4.9 ± 0.2	5.2 ± 0.4	N.A.	N.A.	N.A.
Sulfur	29 ± 9	19 ± 6	17 ± 4	218 ± 76	79 ± 44	211 ± 50
Calcium	1 080 ± 199	907 ± 390	1 020 ± 278	5 070 ± 932	4 540 ± 468	4 320 ± 540
Magnesium	137 ± 36	126 ± 40	126 ± 43	2 950 ± 353	2 350 ± 115	2 550 ± 283
Potassium	128 ± 27	89 ± 36	122 ± 27	14 300 ± 1 170	12 200 ± 948	13 600 ± 1 350
Manganese	348 ± 117	271 ± 228	178 ± 41	808 ± 521	1 160 ± 1 420	1 410 ± 544
Aluminum	172 ± 93	192 ± 109	192 ± 107	46 000 ± 5 180	41 200 ± 2 600	48 200 ± 4 050
Iron	7 ± 7	7 ± 6	1 ± 1	13 300 ± 1 920	12 800 ± 1 770	13 700 ± 2 970
Phosphorus	N.D.[b]	N.D.	N.D.	665 ± 195	609 ± 218	784 ± 238
Bm						
pH	5.5 ± 0.6	5.4 ± 0.4	5.9 ± 0.7	N.A.	N.A.	N.A.
Sulfur	19 ± 7	18 ± 3	13 ± 7	221 ± 72	96 ± 17	132 ± 75
Calcium	684 ± 387	518 ± 271	672 ± 292	4 580 ± 1 240	5 280 ± 1 170	2 930 ± 605
Magnesium	102 ± 71	74 ± 36	108 ± 69	3 620 ± 353	3 380 ± 436	2 970 ± 425
Potassium	141 ± 42	172 ± 42	116 ± 43	13 100 ± 1 010	12 400 ± 1 160	12 800 ± 1 430
Manganese	74 ± 92	44 ± 11	15 ± 11	474 ± 257	642 ± 230	402 ± 204
Aluminum	216 ± 128	252 ± 211	111 ± 115	60 000 ± 16 900	60 100 ± 9 240	51 900 ± 5 000
Iron	5 ± 3	6 ± 8	1 ± 3	20 300 ± 4 150	24 200 ± 3 420	16 700 ± 520
Phosphorus	N.D.	N.D.	N.D.	1 130 ± 379	1 430 ± 269	790 ± 272
IIAe						
pH	5.4 ± 0.3	5.7 ± 0.2	5.9 ± 0.7	N.A.	N.A.	N.A.
Sulfur	14 ± 3	6 ± 1	10 ± 1	158 ± 21	30 ± 8	102 ± 30
Calcium	1 110 ± 187	652 ± 173	961 ± 441	3 550 ± 370	2 970 ± 258	2 850 ± 345
Magnesium	233 ± 53	136 ± 43	197 ± 100	4 300 ± 518	3 260 ± 336	3 840 ± 454
Potasium	83 ± 24	60 ± 13	131 ± 98	14 600 ± 741	13 800 ± 427	13 400 ± 1 470
Manganese	22 ± 25	21 ± 22	8 ± 4	246 ± 155	196 ± 84	208 ± 73
Aluminum	69 ± 105	42 ± 32	90 ± 129	47 400 ± 3 850	41 400 ± 1 680	47 600 ± 1 970
Iron	2 ± 4	1 ± 2	1 ± 3	19 000 ± 2 770	15 100 ± 1 160	17 600 ± 807
Phosphorus	N.D.	N.D.	N.D.	529 ± 356	312 ± 62	463 ± 192

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 5 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.9 ± 1.1	5.2 ± 1.4	6.7 ± 0.8	N.A.[a]	N.A.	N.A.
Sulfur	796 ± 428	320 ± 61	490 ± 140	2 340 ± 624	3 810 ± 1 210	5 430 ± 2 440
Calcium	8 010 ± 4 860	7 440 ± 2 720	18 200 ± 4 380	12 700 ± 12 900	17 800 ± 10 200	30 200 ± 13 500
Magnesium	411 ± 51	293 ± 92	526 ± 156	958 ± 468	948 ± 452	1 300 ± 377
Potassium	883 ± 344	872 ± 187	568 ± 217	1 700 ± 628	1 580 ± 642	813 ± 164
Manganese	447 ± 318	195 ± 260	373 ± 150	614 ± 601	718 ± 1 150	1 000 ± 258
Aluminum	160 ± 124	25 ± 29	15 ± 9	6 560 ± 4 400	6 910 ± 4 090	3 040 ± 1 170
Iron	26 ± 21	5 ± 4	3 ± 2	3 110 ± 1 890	3 560 ± 2 060	3 130 ± 1 110
Phosphorus	335 ± 50	66 ± 59	173 ± 39	1 080 ± 298	840 ± 237	1 040 ± 257
IAe						
pH	4.6 ± 0.3	4.5 ± 0.3	5.5 ± 1.2	N.A.	N.A.	N.A.
Sulfur	29 ± 16	47 ± 22	42 ± 7	234 ± 62	68 ± 57	201 ± 39
Calcium	716 ± 297	956 ± 770	1 980 ± 1 300	5 220 ± 1 390	4 200 ± 2 860	5 480 ± 1 220
Magnesium	101 ± 42	51 ± 29	70 ± 43	3 330 ± 395	2 320 ± 1 250	2 890 ± 499
Potassium	99 ± 19	101 ± 27	124 ± 26	16 300 ± 1 820	9 680 ± 9 160	15 400 ± 1 380
Manganese	72 ± 102	123 ± 171	62 ± 66	399 ± 411	412 ± 300	922 ± 1 270
Aluminum	546 ± 114	464 ± 104	208 ± 271	53 300 ± 7 800	38 400 ± 24 900	53 800 ± 5 060
Iron	44 ± 37	27 ± 25	10 ± 12	12 700 ± 1 660	9 820 ± 3 960	12 600 ± 3 460
Phosphorus	N.D.[b]	N.D.	N.D.	668 ± 334	419 ± 160	617 ± 451
Bm						
pH	5.6 ± 0.2	5.4 ± 0.5	5.2 ± 0.2	N.A.	N.A.	N.A.
Sulfur	44 ± 9	65 ± 17	82 ± 64	272 ± 33	165 ± 61	228 ± 101
Calcium	996 ± 385	1 070 ± 402	950 ± 191	4 690 ± 759	6 060 ± 2 930	3 840 ± 942
Magnesium	135 ± 68	142 ± 158	72 ± 80	4 520 ± 633	4 770 ± 1 360	3 780 ± 690
Potassium	146 ± 37	187 ± 67	132 ± 36	14 300 ± 1 580	14 300 ± 883	14 200 ± 1 320
Manganese	36 ± 40	57 ± 36	15 ± 16	505 ± 390	619 ± 299	406 ± 175
Aluminum	330 ± 259	294 ± 411	214 ± 161	70 700 ± 6 840	67 900 ± 12 500	67 400 ± 7 480
Iron	20 ± 26	15 ± 31	9 ± 8	26 000 ± 5 790	28 700 ± 6 950	21 000 ± 896
Phosphorus	N.D.	N.D.	N.D.	1 670 ± 1 010	1 790 ± 1 030	1 210 ± 723
IIAe						
pH	5.5 ± 0.3	5.4 ± 0.5	5.1 ± 0.2	N.A.	N.A.	N.A.
Sulfur	19 ± 4	35 ± 17	37 ± 10	175 ± 16	70 ± 33	132 ± 19
Calcium	937 ± 314	1 210 ± 406	1 360 ± 802	3 520 ± 664	3 670 ± 547	3 290 ± 484
Magnesium	177 ± 79	245 ± 165	259 ± 194	4 740 ± 590	5 010 ± 1 160	4 820 ± 953
Potasium	79 ± 29	100 ± 64	110 ± 61	17 600 ± 1 550	16 400 ± 1 290	16 700 ± 961
Manganese	8 ± 1	18 ± 24	5 ± 7	222 ± 30	296 ± 170	222 ± 138
Aluminum	127 ± 132	142 ± 247	127 ± 61	53 800 ± 5 360	53 900 ± 7 080	57 600 ± 6 970
Iron	5 ± 7	3 ± 6	2 ± 3	18 700 ± 2 670	20 700 ± 6 240	20 700 ± 4 610
Phosphorus	N.D.	N.D.	N.D.	539 ± 161	563 ± 246	674 ± 314

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 6 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	5.5 ± 0.3	5.0 ± 0.7	5.0 ± 0.5	N.A.[a]	N.A.	N.A.
Sulfur	150 ± 29	84 ± 37	125 ± 43	790 ± 237	643 ± 266	978 ± 237
Calcium	5 740 ± 1 920	3 800 ± 518	4 770 ± 1 070	6 970 ± 2 660	5 560 ± 1 460	4 980 ± 1 260
Magnesium	814 ± 204	824 ± 261	654 ± 140	2 030 ± 287	1 530 ± 618	1 090 ± 394
Potassium	629 ± 237	1 280 ± 569	689 ± 276	2 700 ± 233	2 140 ± 156	929 ± 82
Manganese	751 ± 149	314 ± 108	894 ± 358	1 070 ± 185	627 ± 3 800	1 540 ± 593
Aluminum	149 ± 98	39 ± 22	123 ± 70	13 800 ± 2 540	8 610 ± 5 420	4 780 ± 3 580
Iron	25 ± 15	10 ± 5	29 ± 30	7 240 ± 1 080	5 390 ± 3 800	5 890 ± 2 850
Phosphorus	175 ± 61	94 ± 43	141 ± 91	796 ± 153	664 ± 102	956 ± 120
IAe						
pH	5.3 ± 0.6	5.0 ± 0.4	4.6 ± 0.9	N.A.	N.A.	N.A.
Sulfur	26 ± 10	26 ± 19	22 ± 25	291 ± 79	96 ± 88	227 ± 160
Calcium	1 060 ± 700	925 ± 586	1 010 ± 1 170	4 240 ± 726	4 060 ± 597	3 570 ± 2 090
Magnesium	240 ± 129	228 ± 127	204 ± 182	3 020 ± 363	2 560 ± 453	2 440 ± 1 010
Potassium	106 ± 43	83 ± 36	172 ± 155	12 500 ± 611	11 400 ± 999	11 400 ± 1 560
Manganese	136 ± 51	110 ± 89	192 ± 179	791 ± 720	421 ± 307	1 000 ± 912
Aluminum	235 ± 171	236 ± 122	227 ± 160	45 000 ± 3 350	41 400 ± 5 790	42 700 ± 13 400
Iron	16 ± 20	22 ± 17	9 ± 12	15 400 ± 2 770	13 800 ± 3 970	14 900 ± 4 810
Phosphorus	N.D.[b]	N.D.	N.D.	683 ± 192	477 ± 223	591 ± 507
Bm						
pH	5.5 ± 0.4	5.5 ± 0.2	5.5 ± 0.4	N.A.	N.A.	N.A.
Sulfur	24 ± 13	24 ± 12	16 ± 17	229 ± 40	100 ± 57	188 ± 82
Calcium	472 ± 139	577 ± 36	579 ± 346	3 480 ± 613	4 040 ± 1 170	3 070 ± 2 310
Magnesium	118 ± 30	127 ± 18	138 ± 51	3 840 ± 371	3 290 ± 413	3 410 ± 437
Potassium	135 ± 95	126 ± 47	140 ± 110	12 500 ± 530	11 800 ± 731	11 700 ± 699
Manganese	32 ± 21	37 ± 32	42 ± 50	350 ± 128	450 ± 298	541 ± 529
Aluminum	358 ± 155	216 ± 84	225 ± 190	60 800 ± 11 900	55 700 ± 8 050	56 300 ± 19 900
Iron	12 ± 8	9 ± 10	5 ± 5	22 300 ± 3 650	22 200 ± 3 790	20 700 ± 3 520
Phosphorus	N.D.	N.D.	N.D.	1 020 ± 222	969 ± 396	838 ± 521
IIAe						
pH	5.7 ± 0.2	5.6 ± 0.2	5.5 ± 0.5	N.A.	N.A.	N.A.
Sulfur	11 ± 3	8 ± 1	15 ± 3	166 ± 12	29 ± 6	146 ± 20
Calcium	793 ± 170	641 ± 110	1 470 ± 385	2 740 ± 184	2 450 ± 185	2 550 ± 317
Magnesium	156 ± 31	139 ± 24	313 ± 117	3 790 ± 295	3 140 ± 295	4 360 ± 838
Potasium	68 ± 30	77 ± 30	113 ± 55	14 100 ± 574	12 800 ± 535	12 900 ± 2 070
Manganese	19 ± 14	21 ± 19	15 ± 10	217 ± 55	222 ± 115	357 ± 215
Aluminum	61 ± 30	62 ± 36	188 ± 202	44 400 ± 2 200	40 900 ± 3 360	53 200 ± 6 640
Iron	1 ± 2	2 ± 2	4 ± 6	17 500 ± 1 480	16 600 ± 1 890	24 900 ± 6 680
Phosphorus	N.D.	N.D.	N.D.	357 ± 101	294 ± 71	632 ± 284

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 7 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.9 ± 1.0	4.4 ± 0.2	4.6 ± 0.3	N.A.[a]	N.A.	N.A.
Sulfur	208 ± 55	92 ± 25	123 ± 22	1 030 ± 190	719 ± 171	1 060 ± 331
Calcium	4 970 ± 1 190	3 760 ± 905	3 610 ± 632	5 500 ± 1 440	3 700 ± 1 250	3 630 ± 238
Magnesium	596 ± 178	594 ± 79	468 ± 76	1 400 ± 390	921 ± 235	768 ± 63
Potassium	1 090 ± 533	1 100 ± 232	658 ± 155	2 480 ± 580	1 630 ± 298	893 ± 86
Manganese	1 120 ± 667	506 ± 118	570 ± 259	1 580 ± 1 320	702 ± 131	682 ± 318
Aluminum	196 ± 102	60 ± 19	247 ± 115	11 100 ± 3 500	5 870 ± 2 920	3 360 ± 859
Iron	41 ± 34	9 ± 3	84 ± 58	5 360 ± 2 870	3 160 ± 1 750	4 010 ± 865
Phosphorus	367 ± 120	120 ± 40	174 ± 55	1 120 ± 205	680 ± 153	969 ± 182
IAe						
pH	4.4 ± 0.4	4.5 ± 0.5	4.4 ± 0.5	N.A.	N.A.	N.A.
Sulfur	15 ± 2	19 ± 11	12 ± 3	188 ± 29	62 ± 62	186 ± 65
Calcium	392 ± 294	472 ± 354	385 ± 191	4 560 ± 1 130	5 100 ± 2 160	3 350 ± 659
Magnesium	67 ± 30	87 ± 66	80 ± 9	2 870 ± 346	2 710 ± 555	2 820 ± 1 410
Potassium	64 ± 14	71 ± 30	107 ± 35	14 900 ± 579	13 600 ± 2 540	14 200 ± 1 570
Manganese	66 ± 79	105 ± 63	145 ± 153	322 ± 233	534 ± 264	877 ± 1 030
Aluminum	477 ± 94	397 ± 148	544 ± 190	49 600 ± 3 540	47 800 ± 8 350	53 100 ± 13 500
Iron	42 ± 26	29 ± 27	39 ± 63	11 500 ± 1 850	13 400 ± 3 160	16 400 ± 10 800
Phosphorus	N.D.[b]	N.D.	N.D.	441 ± 119	615 ± 438	632 ± 478
Bm						
pH	5.5 ± 0.4	5.1 ± 0.5	5.7 ± 0.3	N.A.	N.A.	N.A.
Sulfur	25 ± 18	18 ± 13	24 ± 29	215 ± 88	77 ± 49	147 ± 54
Calcium	810 ± 691	618 ± 363	905 ± 367	3 760 ± 1 590	3 900 ± 1 040	3 350 ± 1 470
Magnesium	148 ± 166	113 ± 71	178 ± 108	4 250 ± 996	3 520 ± 616	2 910 ± 790
Potassium	78 ± 30	112 ± 40	92 ± 43	13 700 ± 1 310	12 800 ± 1 140	12 500 ± 1 530
Manganese	22 ± 19	61 ± 85	33 ± 21	278 ± 143	496 ± 322	690 ± 402
Aluminum	367 ± 242	388 ± 209	152 ± 187	64 400 ± 13 800	58 200 ± 8 260	59 700 ± 21 000
Iron	25 ± 23	22 ± 25	3 ± 4	24 100 ± 2 600	23 900 ± 5 960	18 900 ± 4 200
Phosphorus	N.D.	N.D.	N.D.	1 270 ± 680	1 040 ± 657	776 ± 427
IIAe						
pH	5.6 ± 0.5	5.6 ± 0.4	5.8 ± 0.2	N.A.	N.A.	N.A.
Sulfur	20 ± 8	14 ± 7	15 ± 3	163 ± 40	54 ± 16	126 ± 15
Calcium	1 360 ± 430	1 020 ± 452	1 530 ± 413	2 780 ± 230	3 400 ± 1 290	2 550 ± 775
Magnesium	295 ± 158	223 ± 73	299 ± 121	4 430 ± 1 110	4 000 ± 585	3 900 ± 1 250
Potasium	71 ± 34	81 ± 45	72 ± 24	14 200 ± 1 640	13 300 ± 1 670	13 200 ± 1 260
Manganese	83 ± 114	20 ± 12	32 ± 14	672 ± 696	379 ± 231	1 050 ± 552
Aluminum	185 ± 184	148 ± 102	80 ± 73	54 700 ± 12 300	55 000 ± 12 700	53 900 ± 10 900
Iron	5 ± 6	9 ± 12	1 ± 1	20 500 ± 6 080	23 000 ± 5 380	20 500 ± 4 080
Phosphorus	N.D.	N.D.	N.D.	561 ± 360	499 ± 385	464 ± 185

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 8 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.4 ± 0.3	4.6 ± 0.2	4.8 ± 0.7	N.A.[a]	N.A.	N.A.
Sulfur	203 ± 48	98 ± 47	130 ± 72	1 120 ± 246	764 ± 318	1 030 ± 269
Calcium	4 000 ± 1 340	4 160 ± 1 030	3 980 ± 1 560	4 590 ± 1 570	4 740 ± 1 930	4 330 ± 1 410
Magnesium	670 ± 36	833 ± 128	622 ± 200	1 340 ± 365	1 450 ± 626	1 150 ± 376
Potassium	1 020 ± 353	1 570 ± 639	856 ± 411	2 210 ± 379	2 220 ± 576	1 170 ± 310
Manganese	611 ± 519	376 ± 179	652 ± 665	732 ± 636	642 ± 469	1 090 ± 1 220
Aluminum	252 ± 139	58 ± 38	170 ± 123	7 370 ± 3 030	7 990 ± 5 640	4 060 ± 2 530
Iron	88 ± 73	15 ± 9	54 ± 76	3 890 ± 1 480	4 480 ± 3 190	4 960 ± 3 560
Phosphorus	354 ± 120	141 ± 125	170 ± 124	1 060 ± 322	870 ± 250	1 050 ± 127
IAe						
pH	5.0 ± 0.6	4.5 ± 0.2	5.3 ± 0.4	N.A.	N.A.	N.A.
Sulfur	33 ± 9	29 ± 9	35 ± 21	282 ± 53	148 ± 50	315 ± 153
Calcium	1 140 ± 253	1 120 ± 371	1 880 ± 580	4 150 ± 1 880	3 580 ± 629	4 240 ± 709
Magnesium	206 ± 105	224 ± 89	403 ± 216	4 100 ± 748	3 380 ± 500	3 630 ± 1 190
Potassium	201 ± 127	132 ± 47	238 ± 154	13 600 ± 2 090	11 500 ± 1 090	10 800 ± 2 080
Manganese	149 ± 226	197 ± 228	286 ± 353	591 ± 626	726 ± 968	833 ± 764
Aluminum	446 ± 547	481 ± 308	147 ± 124	51 100 ± 6 700	44 600 ± 3 880	48 800 ± 15 400
Iron	62 ± 115	73 ± 94	21 ± 40	18 800 ± 2 930	17 200 ± 878	16 300 ± 5 310
Phosphorus	N.D.[b]	N.D.	N.D.	1 050 ± 423	852 ± 206	889 ± 190
Bm						
pH	5.5 ± 0.6	5.2 ± 0.5	6.2 ± 0.7	N.A.	N.A.	N.A.
Sulfur	20 ± 3	17 ± 4	21 ± 11	220 ± 28	97 ± 24	176 ± 21
Calcium	1 110 ± 351	979 ± 451	2 010 ± 1 110	3 800 ± 888	4 590 ± 694	4 210 ± 1 310
Magnesium	236 ± 116	227 ± 139	380 ± 240	4 800 ± 617	4 800 ± 395	4 870 ± 418
Potassium	109 ± 50	113 ± 32	121 ± 58	14 300 ± 1 530	13 000 ± 894	12 400 ± 1 490
Manganese	78 ± 106	39 ± 46	24 ± 28	704 ± 842	479 ± 380	467 ± 210
Aluminum	241 ± 196	373 ± 266	66 ± 83	56 400 ± 3 470	58 400 ± 5 140	65 300 ± 6 180
Iron	14 ± 29	36 ± 100	1 ± 1	23 000 ± 1 060	27 500 ± 3 390	24 100 ± 1 920
Phosphorus	N.D.	N.D.	N.D.	1 070 ± 361	1 360 ± 494	1 020 ± 256
IIAe						
pH	5.6 ± 0.9	5.8 ± 0.6	6.2 ± 1.1	N.A.	N.A.	N.A.
Sulfur	22 ± 7	13 ± 2	20 ± 6	214 ± 33	46 ± 9	167 ± 34
Calcium	1 570 ± 452	1 520 ± 261	2 100 ± 703	4 360 ± 807	3 640 ± 392	4 200 ± 1 230
Magnesium	388 ± 143	383 ± 75	440 ± 215	5 440 ± 1 790	5 460 ± 556	5 480 ± 1 210
Potasium	91 ± 13	81 ± 10	96 ± 35	15 500 ± 1 490	14 500 ± 1 060	13 200 ± 2 010
Manganese	25 ± 19	13 ± 11	11 ± 11	282 ± 71	250 ± 72	364 ± 175
Aluminum	113 ± 128	131 ± 135	60 ± 72	57 800 ± 5 910	56 800 ± 2 990	63 800 ± 6 820
Iron	6 ± 15	7 ± 13	B.D.[c]	23 000 ± 5 190	25 300 ± 3 650	24 900 ± 2 990
Phosphorus	N.D.	N.D.	N.D.	769 ± 169	738 ± 209	821 ± 255

[a] N.A. = not applicable.

[b] N.D. = not determined.

[c] B.D. = below detection.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 9 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.5 ± 0.2	4.1± 0.1	4.9 ± 0.7	N.A.[a]	N.A.	N.A.
Sulfur	212 ± 27	114 ± 79	139 ± 26	1 230 ± 140	1 040 ± 242	1 220 ± 258
Calcium	3 630 ± 767	2 770 ± 315	3 910 ± 2 720	4 190 ± 989	3 560 ± 572	4 140 ± 2 920
Magnesium	499 ± 61	539 ± 122	528 ± 252	931 ± 215	740 ± 180	950 ± 331
Potassium	977 ± 291	1 360 ± 787	860 ± 143	1 960 ± 96	1 650 ± 518	1 130 ± 181
Manganese	592 ± 281	346 ± 82	422 ± 267	706 ± 376	450 ± 155	769 ± 821
Aluminum	245 ± 50	90 ± 19	278 ± 181	6 180 ± 2 970	3 650 ± 1 740	3 990 ± 1 210
Iron	52 ± 26	7 ± 1	83 ± 65	3 670 ± 2 950	2 480 ± 1 710	7 150 ± 4 030
Phosphorus	323 ± 55	137 ± 93	189 ± 12	1 230 ± 127	1 020 ± 339	1 270 ± 47
IAe						
pH	4.7 ± 0.3	4.5 ± 0.2	4.4 ± 0.1	N.A.	N.A.	N.A.
Sulfur	13 ± 2	16 ± 3	10 ± 2	213 ± 80	79 ± 19	131 ± 31
Calcium	393 ± 173	488 ± 238	399 ± 128	3 590 ± 755	5 000 ± 1 710	3 980 ± 1 810
Magnesium	54 ± 16	68 ± 19	55 ± 25	3 240 ± 1 140	2 700 ± 442	2 720 ± 587
Potassium	56 ± 6	62 ± 14	70 ± 15	13 200 ± 1 200	13 700 ± 1 270	12 800 ± 2 580
Manganese	45 ± 70	35 ± 50	46 ± 71	343 ± 205	230 ± 83	310 ± 130
Aluminum	473 ± 174	504 ± 154	496 ± 178	51 600 ± 10 100	46 300 ± 5 840	49 000 ± 7 980
Iron	33 ± 22	43 ± 24	35 ± 30	18 600 ± 6 110	14 200 ± 4 960	19 500 ± 5 720
Phosphorus	N.D.[b]	N.D.	N.D.	828 ± 457	468 ± 118	503 ± 121
Bm						
pH	5.4 ± 0.2	5.0 ± 0.2	5.2 ± 0.1	N.A.	N.A.	N.A.
Sulfur	19 ± 5	17 ± 7	14 ± 5	231 ± 39	182 ± 94	175 ± 44
Calcium	499 ± 262	610 ± 281	547 ± 217	4 190 ± 3 490	3 500 ± 1 540	1 920 ± 978
Magnesium	62 ± 48	82 ± 46	66 ± 15	3 470 ± 432	3 460 ± 634	3 210 ± 399
Potassium	86 ± 26	91 ± 33	76 ± 25	13 700 ± 3 720	11 800 ± 1 440	10 200 ± 1 120
Manganese	17 ± 14	10 ± 9	19 ± 34	348 ± 182	248 ± 84	535 ± 187
Aluminum	312 ± 164	516 ± 217	407 ± 105	54 700 ± 12 100	55 700 ± 7 640	49 100 ± 3 130
Iron	26 ± 22	60 ± 43	34 ± 18	22 900 ± 12 000	32 100 ± 11 800	37 700 ± 9 610
Phosphorus	N.D.	N.D.	N.D.	875 ± 570	1 000 ± 654	805 ± 271
IIAe						
pH	5.5 ± 0.4	5.3 ± 0.1	5.1 ± 0.1	N.A.	N.A.	N.A.
Sulfur	11 ± 4	8 ± 1	9 ± 1	206 ± 82	125 ± 19	160 ± 13
Calcium	552 ± 307	529 ± 252	633 ± 190	1 860 ± 544	1 710 ± 391	1 340 ± 246
Magnesium	107 ± 46	108 ± 68	133 ± 42	4 150 ± 745	3 550 ± 514	3 500 ± 346
Potasium	72 ± 50	68 ± 31	75 ± 21	13 000 ± 1 040	11 800 ± 1 120	9 980 ± 446
Manganese	6 ± 5	5 ± 7	3 ± 2	242 ± 73	258 ± 125	465 ± 313
Aluminum	332 ± 190	344 ± 94	343 ± 103	51 700 ± 7 670	47 600 ± 4 010	45 800 ± 2 960
Iron	14 ± 9	17 ± 10	11 ± 3	29 400 ± 3 930	28 700 ± 7 800	38 400 ± 5 840
Phosphorus	N.D.	N.D.	N.D.	557 ± 86	516 ± 96	574 ± 101

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 10 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.2 ± 0.2	3.9 ± 0.2	4.2 ± 0.1	N.A.[a]	N.A.	N.A.
Sulfur	182 ± 22	94 ± 37	112 ± 26	1 190 ± 124	929 ± 191	1 110 ± 132
Calcium	2 740 ± 806	2 700 ± 699	2 920 ± 364	3 120 ± 813	3 040 ± 505	3 010 ± 363
Magnesium	385 ± 71	434 ± 140	365 ± 76	754 ± 73	634 ± 272	509 ± 50
Potassium	824 ± 353	1 070 ± 479	651 ± 236	1 670 ± 372	1 510 ± 606	835 ± 243
Manganese	471 ± 266	408 ± 130	422 ± 88	588 ± 261	596 ± 230	509 ± 168
Aluminum	433 ± 152	126 ± 40	378 ± 45	6 140 ± 1 380	4 120 ± 2 760	2 720 ± 781
Iron	102 ± 36	9 ± 3	111 ± 16	2 660 ± 571	2 160 ± 1 580	2 540 ± 593
Phosphorus	307 ± 131	112 ± 38	171 ± 26	1 160 ± 288	894 ± 339	960 ± 158
IAe						
pH	4.1 ± 0.2	4.1 ± 0.2	4.1 ± 0.2	N.A.	N.A.	N.A.
Sulfur	18 ± 7	16 ± 5	12 ± 6	209 ± 29	56 ± 27	183 ± 65
Calcium	474 ± 515	312 ± 206	359 ± 149	5 560 ± 1 810	5 620 ± 1 790	4 550 ± 983
Magnesium	72 ± 50	65 ± 40	58 ± 30	3 200 ± 312	3 130 ± 587	2 930 ± 320
Potassium	92 ± 24	86 ± 24	112 ± 57	15 600 ± 2 850	15 500 ± 1 850	14 900 ± 3 060
Manganese	63 ± 81	81 ± 120	62 ± 32	286 ± 88	349 ± 133	328 ± 76
Aluminum	616 ± 109	604 ± 114	573 ± 169	54 400 ± 7 610	52 100 ± 5 050	55 400 ± 4 230
Iron	55 ± 41	60 ± 42	28 ± 14	12 900 ± 601	11 800 ± 1 680	12 500 ± 3 700
Phosphorus	N.D.[b]	N.D.	N.D.	445 ± 118	348 ± 67	417 ± 84
Bm						
pH	5.4 ± 0.4	5.0 ± 0.3	5.7 ± 0.4	N.A.	N.A.	N.A.
Sulfur	37 ± 15	31 ± 19	19 ± 6	306 ± 93	154 ± 64	180 ± 30
Calcium	292 ± 201	247 ± 181	462 ± 204	5 420 ± 1 310	4 610 ± 1 780	3 560 ± 1 270
Magnesium	43 ± 36	45 ± 31	64 ± 41	3 510 ± 328	3 570 ± 204	3 530 ± 418
Potassium	124 ± 18	115 ± 33	113 ± 33	13 500 ± 1 650	12 600 ± 351	13 500 ± 3 250
Manganese	75 ± 82	111 ± 41	26 ± 13	604 ± 387	763 ± 498	676 ± 353
Aluminum	319 ± 206	502 ± 299	173 ± 151	75 500 ± 13 000	66 400 ± 7 170	73 900 ± 13 200
Iron	12 ± 12	17 ± 23	6 ± 5	24 500 ± 1 010	28 900 ± 5 440	24 300 ± 3 050
Phosphorus	N.D.	N.D.	N.D.	1 030 ± 466	909 ± 348	739 ± 190
IIAe						
pH	5.7 ± 0.4	5.7 ± 0.2	5.2 ± 0.4	N.A.	N.A.	N.A.
Sulfur	22 ± 19	11 ± 4	14 ± 5	173 ± 63	60 ± 13	126 ± 16
Calcium	987 ± 673	949 ± 642	1 350 ± 511	3 170 ± 1 510	3 350 ± 2 050	2 460 ± 220
Magnesium	225 ± 171	221 ± 148	343 ± 154	4 520 ± 859	4 470 ± 504	5 040 ± 1 280
Potasium	108 ± 46	106 ± 52	109 ± 52	15 400 ± 1 350	14 800 ± 1 430	15 200 ± 3 260
Manganese	24 ± 13	20 ± 13	5 ± 3	315 ± 123	272 ± 73	213 ± 56
Aluminum	131 ± 104	92 ± 65	165 ± 176	58 300 ± 11 400	57 300 ± 12 700	58 800 ± 7 620
Iron	2 ± 4	3 ± 6	3 ± 3	21 500 ± 4 620	22 100 ± 7 010	24 200 ± 6 180
Phosphorus	N.D.	N.D.	N.D.	410 ± 192	338 ± 74	338 ± 27

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 11 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.4 ± 0.2	4.3 ± 0.4	4.6 ± 0.4	N.A.[a]	N.A.	N.A.
Sulfur	270 ± 92	158 ± 79	120 ± 38	1 010 ± 133	1 150 ± 354	1 260 ± 521
Calcium	3 400 ± 922	2 680 ± 992	3 340 ± 942	4 000 ± 1 480	3 370 ± 1 580	3 470 ± 966
Magnesium	511 ± 63	641 ± 217	466 ± 120	1 070 ± 117	1 110 ± 297	811 ± 159
Potassium	1 130 ± 406	1 430 ± 818	535 ± 211	2 070 ± 171	2 030 ± 161	847 ± 179
Manganese	830 ± 583	429 ± 101	563 ± 231	1 290 ± 929	887 ± 628	1 180 ± 1 480
Aluminum	366 ± 133	123 ± 89	420 ± 238	8 730 ± 567	7 230 ± 4 820	4 830 ± 2 530
Iron	48 ± 35	8 ± 5	69 ± 61	3 530 ± 626	4 400 ± 3 750	4 740 ± 3 490
Phosphorus	301 ± 51	141 ± 118	115 ± 101	1 370 ± 292	1 360 ± 344	1 260 ± 179
IAe						
pH	4.6 ± 0.3	4.6 ± 0.5	4.6 ± 0.3	N.A.	N.A.	N.A.
Sulfur	25 ± 4	25 ± 9	25 ± 22	280 ± 37	119 ± 62	267 ± 170
Calcium	700 ± 367	627 ± 356	954 ± 965	6 420 ± 1 380	5 170 ± 2 500	5 950 ± 498
Magnesium	94 ± 26	88 ± 62	150 ± 107	3 620 ± 298	3 040 ± 637	3 250 ± 266
Potassium	74 ± 29	92 ± 11	185 ± 124	17 400 ± 1 020	15 000 ± 2 510	19 500 ± 2 560
Manganese	158 ± 134	227 ± 173	241 ± 228	602 ± 363	925 ± 662	1 130 ± 1 190
Aluminum	362 ± 148	511 ± 257	392 ± 117	56 900 ± 3 200	51 900 ± 8 980	63 000 ± 6 140
Iron	23 ± 17	18 ± 30	5 ± 4	14 700 ± 1 090	14 000 ± 2 310	13 100 ± 2 410
Phosphorus	N.D.[b]	N.D.	N.D.	814 ± 166	675 ± 151	831 ± 371
Bm						
pH	5.1 ± 0.4	4.8 ± 0.5	5.4 ± 0.2	N.A.	N.A.	N.A.
Sulfur	33 ± 29	24 ± 7	20 ± 5	343 ± 68	192 ± 40	226 ± 45
Calcium	453 ± 328	469 ± 267	532 ± 168	5 550 ± 2 820	4 840 ± 1 680	3 080 ± 339
Magnesium	46 ± 31	70 ± 74	66 ± 38	3 630 ± 498	3 890 ± 687	3 720 ± 273
Potassium	83 ± 20	73 ± 22	91 ± 28	15 200 ± 2 740	12 700 ± 814	16 000 ± 1 020
Manganese	38 ± 19	56 ± 19	18 ± 9	544 ± 223	819 ± 480	747 ± 382
Aluminum	385 ± 110	402 ± 317	212 ± 92	65 300 ± 5 550	65 000 ± 8 090	72 700 ± 4 000
Iron	22 ± 13	19 ± 37	5 ± 3	21 600 ± 1 720	29 200 ± 5 610	22 400 ± 1 490
Phosphorus	N.D.	N.D.	N.D.	1 190 ± 461	1 300 ± 509	1 010 ± 292
IIAe						
pH	5.4 ± 0.2	5.2 ± 0.2	5.2 ± 0.4	N.A.	N.A.	N.A.
Sulfur	10 ± 2	11 ± 5	11 ± 2	200 ± 74	104 ± 33	134 ± 19
Calcium	478 ± 145	528 ± 159	875 ± 173	4 140 ± 4 160	3 140 ± 386	2 570 ± 268
Magnesium	74 ± 40	98 ± 51	207 ± 48	4 140 ± 623	4 200 ± 788	4 360 ± 523
Potasium	48 ± 6	55 ± 23	74 ± 23	17 100 ± 3 640	14 600 ± 507	17 100 ± 757
Manganese	10 ± 9	11 ± 6	3 ± 3	343 ± 176	317 ± 264	320 ± 130
Aluminum	196 ± 99	296 ± 196	217 ± 114	55 600 ± 13 700	54 000 ± 6 850	56 800 ± 6 550
Iron	8 ± 3	15 ± 23	4 ± 2	18 800 ± 1 930	22 000 ± 4 650	21 700 ± 2 410
Phosphorus	N.D.	N.D.	N.D.	521 ± 149	529 ± 232	498 ± 102

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 12 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.5 ± 0.7	5.4 ± 0.4	6.6 ± 0.6	N.A.[a]	N.A.	N.A.
Sulfur	284 ± 104	192 ± 84	224 ± 42	1 010 ± 366	1 440 ± 243	1 710 ± 170
Calcium	4 010 ± 2 000	8 630 ± 1 020	16 000 ± 5 410	4 460 ± 2 410	34 000 ± 17 800	25 100 ± 14 400
Magnesium	487 ± 133	454 ± 164	556 ± 94	1 110 ± 524	1 140 ± 1 050	968 ± 375
Potassium	978 ± 431	1 190 ± 651	490 ± 91	2 090 ± 925	1 870 ± 1 140	751 ± 256
Manganese	1 070 ± 838	237 ± 145	405 ± 187	1 700 ± 1 690	492 ± 201	1 130 ± 685
Aluminum	256 ± 104	18 ± 6 690	15 ± 5	9 200 ± 5 070	5 970 ± 8 210	3 220 ± 1 380
Iron	39 ± 31	4 ± 2	5 ± 2	3 830 ± 2 600	3 370 ± 4 960	3 410 ± 1 870
Phosphorus	289 ± 98	153 ± 138	139 ± 139	1 220 ± 508	950 ± 151	1 010 ± 35
IAe						
pH	5.1 ± 0.4	4.8 ± 0.5	5.4 ± 0.6	N.A.	N.A.	N.A.
Sulfur	25 ± 14	32 ± 10	36 ± 19	296 ± 80	144 ± 38	296 ± 121
Calcium	901 ± 335	995 ± 395	2 130 ± 1 490	6 480 ± 1 030	5 390 ± 1 540	6 970 ± 2 440
Magnesium	146 ± 107	124 ± 22	143 ± 117	3 950 ± 365	3 360 ± 565	3 290 ± 271
Potassium	105 ± 21	114 ± 36	183 ± 81	16 400 ± 1 430	14 000 ± 1 440	18 400 ± 5 360
Manganese	280 ± 369	341 ± 268	123 ± 57	1 610 ± 1 310	1 720 ± 1 640	1 240 ± 1 940
Aluminum	302 ± 156	338 ± 106	199 ± 257	59 800 ± 5 420	53 400 ± 9 820	62 200 ± 6 190
Iron	7 ± 6	6 ± 5	4 ± 7	17 700 ± 3 260	17 700 ± 4 820	14 600 ± 1 940
Phosphorus	N.D.[b]	N.D.	N.D.	799 ± 178	711 ± 525	859 ± 385
Bm						
pH	5.6 ± 0.2	5.3 ± 0.4	5.3 ± 0.2	N.A.	N.A.	N.A.
Sulfur	20 ± 4	29 ± 10	31 ± 10	270 ± 53	180 ± 80	260 ± 65
Calcium	854 ± 324	738 ± 267	806 ± 259	5 530 ± 1 230	6 360 ± 2 400	3 710 ± 1 040
Magnesium	109 ± 70	105 ± 66	92 ± 53	4 130 ± 176	4 320 ± 513	3 810 ± 416
Potassium	124 ± 69	130 ± 22	147 ± 64	15 500 ± 1 400	13 900 ± 2 200	15 800 ± 1 660
Manganese	54 ± 34	78 ± 96	42 ± 30	1 050 ± 745	1 010 ± 1 010	1 010 ± 173
Aluminum	211 ± 134	299 ± 205	354 ± 148	68 200 ± 10 700	70 600 ± 12 000	76 800 ± 8 760
Iron	6 ± 9	7 ± 18	7 ± 5	23 500 ± 5 210	29 600 ± 3 840	26 200 ± 2 960
Phosphorus	N.D.	N.D.	N.D.	1 050 ± 593	1 700 ± 996	1 050 ± 292
IIAe						
pH	5.5 ± 0.2	5.4 ± 0.2	5.3 ± 0.5	N.A.	N.A.	N.A.
Sulfur	18 ± 12	11 ± 3	21 ± 6	168 ± 38	90 ± 16	150 ± 39
Calcium	1 200 ± 471	850 ± 125	1 530 ± 591	3 240 ± 343	3 600 ± 195	2 660 ± 242
Magnesium	232 ± 110	157 ± 34	325 ± 200	4 630 ± 837	4 540 ± 509	5 140 ± 596
Potasium	134 ± 156	71 ± 39	128 ± 49	16 400 ± 1 420	15 400 ± 691	17 700 ± 3 150
Manganese	65 ± 155	14 ± 21	22 ± 39	245 ± 120	359 ± 297	298 ± 143
Aluminum	120 ± 38	167 ± 76	277 ± 145	53 600 ± 5 260	54 100 ± 4 280	65 700 ± 5 720
Iron	5 ± 4	7 ± 6	5 ± 2	20 800 ± 3 620	23 400 ± 2 330	28 500 ± 6 730
Phosphorus	N.D.	N.D.	N.D.	523 ± 121	557 ± 130	608 ± 175

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 13 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.5 ± 0.3	4.4 ± 0.3	5.0 ± 0.5	N.A.[a]	N.A.	N.A.
Sulfur	223 ± 34	69 ± 15	163 ± 37	920 ± 503	1 040 ± 174	1 670 ± 104
Calcium	4 460 ± 1 170	3 930 ± 1 520	6 180 ± 2 010	4 640 ± 1 880	4 840 ± 1 580	7 210 ± 2 330
Magnesium	626 ± 217	625 ± 307	724 ± 205	918 ± 140	1 380 ± 670	924 ± 228
Potassium	992 ± 375	1 020 ± 451	830 ± 310	1 700 ± 367	2 130 ± 822	982 ± 278
Manganese	431 ± 279	284 ± 139	790 ± 540	458 ± 325	390 ± 165	1 310 ± 946
Aluminum	208 ± 63	82 ± 47	127 ± 98	5 160 ± 1 710	8 090 ± 6 300	2 430 ± 289
Iron	38 ± 25	8 ± 8	23 ± 29	1 450 ± 652	4 070 ± 3 360	2 160 ± 405
Phosphorus	337 ± 72	92 ± 60	201 ± 48	969 ± 201	1 060 ± 209	1 200 ± 142
IAe						
pH	4.5 ± 0.3	4.1 ± 0.1	4.8 ± 0.4	N.A.	N.A.	N.A.
Sulfur	17 ± 6	23 ± 8	17 ± 6	79 ± 87	65 ± 22	184 ± 64
Calcium	1 300 ± 788	716 ± 101	1 090 ± 577	2 930 ± 944	3 970 ± 1 000	3 590 ± 2 580
Magnesium	275 ± 182	140 ± 40	169 ± 79	2 970 ± 258	3 060 ± 363	3 600 ± 1 090
Potassium	111 ± 73	83 ± 42	131 ± 45	14 200 ± 606	14 100 ± 665	13 800 ± 1 570
Manganese	5 ± 6	42 ± 47	32 ± 53	78 ± 40	176 ± 79	333 ± 433
Aluminum	448 ± 279	598 ± 164	488 ± 458	47 000 ± 3 330	49 500 ± 1 860	56 000 ± 12 600
Iron	18 ± 12	71 ± 38	38 ± 47	12 300 ± 2 170	13 400 ± 3 500	19 200 ± 9 060
Phosphorus	N.D.[b]	N.D.	N.D.	275 ± 81	468 ± 168	604 ± 196
Bm						
pH	5.0 ± 0.3	4.3 ± 0.1	5.0 ± 0.4	N.A.	N.A.	N.A.
Sulfur	19 ± 3	29 ± 19	21 ± 6	74 ± 82	128 ± 100	169 ± 94
Calcium	875 ± 394	810 ± 214	1 590 ± 382	2 230 ± 1 320	2 730 ± 1 540	2 910 ± 1 290
Magnesium	148 ± 64	154 ± 65	320 ± 206	3 860 ± 598	4 610 ± 590	5 770 ± 1 720
Potassium	102 ± 53	89 ± 40	141 ± 36	14 100 ± 1 640	14 200 ± 2 260	16 500 ± 4 940
Manganese	20 ± 50	3 ± 2	9 ± 17	93 ± 43	171 ± 60	238 ± 214
Aluminum	587 ± 370	806 ± 278	445 ± 225	54 200 ± 9 500	64 000 ± 13 100	79 100 ± 11 300
Iron	53 ± 35	104 ± 69	15 ± 10	20 000 ± 2 720	28 100 ± 7 480	28 400 ± 2 280
Phosphorus	N.D.	N.D.	N.D.	398 ± 117	818 ± 670	740 ± 271
IIAe						
pH	5.0 ± 0.2	4.4 ± 0.1	4.8 ± 0.3	N.A.	N.A.	N.A.
Sulfur	20 ± 7	16 ± 2	13 ± 5	41 ± 99	70 ± 11	143 ± 24
Calcium	879 ± 544	926 ± 448	1 010 ± 603	1 300 ± 1 230	1 810 ± 91	1 880 ± 787
Magnesium	140 ± 88	193 ± 112	195 ± 149	5 440 ± 1 820	5 040 ± 1 310	4 890 ± 1 220
Potasium	102 ± 66	92 ± 47	97 ± 56	18 000 ± 4 320	16 900 ± 3 310	15 600 ± 3 650
Manganese	73 ± 163	5 ± 5	5 ± 7	84 ± 125	157 ± 74	264 ± 227
Aluminum	550 ± 263	553 ± 137	573 ± 313	60 600 ± 15 400	59 200 ± 9 730	62 000 ± 11 400
Iron	46 ± 30	33 ± 13	37 ± 44	25 900 ± 8 180	26 100 ± 7 400	24 400 ± 5 230
Phosphorus	N.D.	N.D.	N.D.	416 ± 238	476 ± 82	502 ± 258

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 14 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.6 ± 0.3	4.4 ± 0.3	4.7 ± 0.6	N.A.[a]	N.A.	N.A.
Sulfur	187 ± 42	114 ± 22	154 ± 46	1 080 ± 391	1 040 ± 184	1 500 ± 288
Calcium	4 420 ± 978	3 980 ± 1 150	4 570 ± 1 240	4 840 ± 1 480	4 400 ± 1 770	4 940 ± 1 750
Magnesium	600 ± 52	771 ± 127	600 ± 137	1 100 ± 643	1 120 ± 503	774 ± 232
Potassium	963 ± 355	1 300 ± 394	878 ± 331	1 800 ± 874	1 570 ± 426	1 010 ± 390
Manganese	700 ± 344	455 ± 143	688 ± 591	893 ± 536	700 ± 642	932 ± 937
Aluminum	151 ± 61	61 ± 58	108 ± 79	5 640 ± 4 020	4 770 ± 4 000	1 620 ± 334
Iron	24 ± 24	5 ± 4	22 ± 20	3 220 ± 4 520	2 840 ± 2 820	1 620 ± 391
Phosphorus	284 ± 76	126 ± 74	231 ± 93	820 ± 174	781 ± 112	1 010 ± 197
IAe						
pH	4.8 ± 0.4	4.4 ± 0.3	4.8 ± 0.8	N.A.	N.A.	N.A.
Sulfur	29 ± 14	31 ± 15	24 ± 3	217 ± 112	53 ± 31	187 ± 41
Calcium	1 320 ± 767	953 ± 315	1 130 ± 436	7 280 ± 747	7 500 ± 621	7 490 ± 982
Magnesium	219 ± 164	184 ± 67	196 ± 77	4 030 ± 623	4 140 ± 713	4 600 ± 2 140
Potassium	149 ± 93	138 ± 76	190 ± 30	16 600 ± 760	16 700 ± 855	15 600 ± 2 160
Manganese	181 ± 194	180 ± 243	134 ± 89	829 ± 165	602 ± 281	889 ± 827
Aluminum	347 ± 309	329 ± 164	294 ± 287	60 000 ± 4 840	66 700 ± 4 090	71 800 ± 7 790
Iron	12 ± 11	31 ± 24	20 ± 29	17 100 ± 2 890	18 800 ± 1 760	22 800 ± 5 800
Phosphorus	N.D.[b]	N.D.	N.D.	537 ± 82	600 ± 205	550 ± 99
Bm						
pH	5.6 ± 0.4	4.8 ± 0.3	5.4 ± 0.4	N.A.	N.A.	N.A.
Sulfur	18 ± 5	24 ± 2	22 ± 8	159 ± 103	26 ± 19	190 ± 47
Calcium	883 ± 372	934 ± 703	1 520 ± 596	6 090 ± 3 140	7 410 ± 962	7 780 ± 951
Magnesium	146 ± 73	188 ± 145	287 ± 124	4 060 ± 410	4 900 ± 1 090	5 400 ± 1 300
Potassium	134 ± 97	151 ± 53	213 ± 122	13 900 ± 8 700	17 300 ± 1 550	14 400 ± 2 610
Manganese	72 ± 58	80 ± 46	42 ± 40	614 ± 110	509 ± 240	787 ± 327
Aluminum	247 ± 226	267 ± 138	193 ± 156	58 300 ± 25 300	72 800 ± 2 340	65 600 ± 41 700
Iron	11 ± 20	12 ± 11	8 ± 13	18 800 ± 2 220	22 300 ± 1 600	26 600 ± 4 960
Phosphorus	N.D.	N.D.	N.D.	529 ± 267	655 ± 372	738 ± 452
IIAe						
pH	5.7 ± 0.4	5.1 ± 0.2	5.6 ± 0.3	N.A.	N.A.	N.A.
Sulfur	22 ± 13	18 ± 8	16 ± 5	179 ± 27	–	158 ± 73
Calcium	1 400 ± 597	1 620 ± 893	1 580 ± 483	7 210 ± 955	7 690 ± 672	7 820 ± 523
Magnesium	280 ± 164	328 ± 204	309 ± 83	6 690 ± 1 590	6 300 ± 2 090	6 670 ± 1 720
Potasium	132 ± 36	163 ± 74	120 ± 40	19 400 ± 1 210	19 100 ± 901	16 000 ± 4 110
Manganese	124 ± 273	16 ± 11	9 ± 6	370 ± 242	218 ± 79	441 ± 181
Aluminum	246 ± 399	83 ± 37	74 ± 51	70 600 ± 6 590	71 400 ± 7 970	79 500 ± 4 090
Iron	10 ± 23	6 ± 2	3 ± 2	24 900 ± 5 400	23 600 ± 6 800	27 300 ± 4 040
Phosphorus	N.D.	N.D.	N.D.	383 ± 155	331 ± 87	444 ± 129

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 16 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.4 ± 0.3	4.5 ± 0.3	4.9 ± 0.6	N.A.[a]	N.A.	N.A.
Sulfur	272 ± 93	119 ± 74	128 ± 37	1 150 ± 216	987 ± 468	1 250 ± 201
Calcium	3 210 ± 764	2 710 ± 962	3 830 ± 1 200	3 530 ± 988	3 020 ± 1 080	3 970 ± 1 240
Magnesium	413 ± 26	437 ± 103	558 ± 195	1 060 ± 438	1 340 ± 593	819 ± 186
Potassium	1 010 ± 299	1 420 ± 739	822 ± 282	2 530 ± 988	2 540 ± 813	1 040 ± 291
Manganese	1 170 ± 1 170	486 ± 350	977 ± 847	1 900 ± 2 170	1 290 ± 1 200	1 780 ± 2 220
Aluminum	444 ± 182	181 ± 159	261 ± 295	10 200 ± 5 210	11 600 ± 6 260	3 190 ± 1 680
Iron	86 ± 132	11 ± 12	43 ± 60	4 780 ± 3 800	6 860 ± 3 000	3 490 ± 2 180
Phosphorus	238 ± 106	52 ± 55	154 ± 115	1 590 ± 535	1 510 ± 853	1 290 ± 407
IAe						
pH	4.8 ± 0.3	4.2 ± 0.3	4.4 ± 0.6	N.A.	N.A.	N.A.
Sulfur	21 ± 5	40 ± 20	16 ± 2	252 ± 52	110 ± 89	282 ± 139
Calcium	645 ± 276	897 ± 421	939 ± 37	5 500 ± 1 920	5 840 ± 1 010	4 830 ± 2 200
Magnesium	76 ± 37	109 ± 45	125 ± 24	3 450 ± 499	3 250 ± 623	3 900 ± 1 100
Potassium	87 ± 31	89 ± 24	166 ± 60	16 700 ± 1 180	16 300 ± 972	12 700 ± 2 120
Manganese	53 ± 77	172 ± 202	77 ± 65	564 ± 875	956 ± 1 490	1 370 ± 2 650
Aluminum	479 ± 218	452 ± 251	469 ± 202	55 800 ± 5 590	56 100 ± 6 460	64 400 ± 12 300
Iron	28 ± 35	38 ± 66	24 ± 30	13 400 ± 4 330	12 700 ± 4 930	15 500 ± 8 800
Phosphorus	N.D.[b]	N.D.	N.D.	753 ± 313	874 ± 421	804 ± 539
Bm						
pH	5.0 ± 0.2	4.5 ± 0.2	5.3 ± 0.3	N.A.	N.A.	N.A.
Sulfur	18 ± 8	22 ± 9	12 ± 4	213 ± 89	94 ± 84	251 ± 155
Calcium	650 ± 287	641 ± 569	739 ± 386	3 220 ± 1 890	3 160 ± 1 840	2 850 ± 832
Magnesium	117 ± 64	113 ± 138	136 ± 98	4 450 ± 1 020	3 560 ± 1 240	5 490 ± 1 190
Potassium	85 ± 12	80 ± 32	114 ± 29	15 400 ± 1 870	14 700 ± 1 710	12 400 ± 1 330
Manganese	24 ± 28	45 ± 100	8 ± 7	497 ± 281	355 ± 366	890 ± 982
Aluminum	488 ± 218	442 ± 277	435 ± 319	59 400 ± 10 700	55 600 ± 13 700	73 300 ± 18 800
Iron	32 ± 33	64 ± 73	31 ± 41	23 500 ± 3 300	20 200 ± 8 910	30 700 ± 6 440
Phosphorus	N.D.	N.D.	N.D.	895 ± 211	990 ± 654	1 020 ± 531
IIAe						
pH	4.9 ± 0.0	4.6 ± 0.1	5.1 ± 0.3	N.A.	N.A.	N.A.
Sulfur	19 ± 2	17 ± 5	16 ± 5	180 ± 19	52 ± 10	175 ± 31
Calcium	1 410 ± 287	754 ± 480	1 560 ± 510	2 940 ± 636	2 370 ± 448	2 860 ± 156
Magnesium	376 ± 55	174 ± 140	413 ± 159	5 860 ± 514	4 860 ± 1 140	7 060 ± 641
Potasium	120 ± 19	91 ± 57	155 ± 41	16 700 ± 757	16 000 ± 1 770	13 400 ± 493
Manganese	15 ± 11	14 ± 14	6 ± 2	373 ± 230	242 ± 53	379 ± 80
Aluminum	396 ± 155	452 ± 245	483 ± 67	60 700 ± 3 330	55 000 ± 9 240	78 200 ± 4 810
Iron	9 ± 7	26 ± 13	5 ± 3	25 900 ± 1 170	22 700 ± 5 760	33 000 ± 3 170
Phosphorus	N.D.	N.D.	N.D.	542 ± 73	582 ± 200	600 ± 180

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 17 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.5 ± 0.7	4.7 ± 0.5	4.5 ± 0.5	N.A.[a]	N.A.	N.A.
Sulfur	181 ± 29	83 ± 46	126 ± 43	1 110 ± 391	873 ± 359	1 170 ± 324
Calcium	4 030 ± 2 170	4 600 ± 2 000	3 650 ± 1 070	5 240 ± 3 690	5 210 ± 2 460	3 990 ± 1 300
Magnesium	650 ± 413	814 ± 401	514 ± 89	1 340 ± 703	1 940 ± 1 270	855 ± 396
Potassium	928 ± 232	1 140 ± 227	819 ± 233	2 390 ± 754	3 080 ± 2 180	1 070 ± 76
Manganese	560 ± 458	411 ± 178	410 ± 186	811 ± 824	811 ± 744	496 ± 246
Aluminum	228 ± 173	92 ± 99	192 ± 120	8 810 ± 3 550	12 400 ± 11 300	2 960 ± 1 530
Iron	71 ± 77	13 ± 12	67 ± 56	3 780 ± 1 250	6 490 ± 5 820	3 850 ± 2 510
Phosphorus	336 ± 207	104 ± 52	211 ± 87	1 020 ± 382	886 ± 190	1 060 ± 241
IAe						
pH	4.8 ± 0.3	4.2 ± 0.2	4.6 ± 0.3	N.A.	N.A.	N.A.
Sulfur	24 ± 12	17 ± 6	15 ± 5	197 ± 57	62 ± 50	171 ± 34
Calcium	760 ± 507	697 ± 623	556 ± 385	4 450 ± 2 800	4 270 ± 3 060	4 750 ± 2 770
Magnesium	156 ± 122	166 ± 164	106 ± 87	3 330 ± 569	3 680 ± 1 030	3 380 ± 664
Potassium	134 ± 106	95 ± 52	129 ± 29	16 100 ± 2 920	16 400 ± 1 800	12 300 ± 3 330
Manganese	79 ± 148	30 ± 47	25 ± 31	273 ± 224	198 ± 100	203 ± 52
Aluminum	443 ± 235	487 ± 118	524 ± 269	45 500 ± 6 740	55 700 ± 10 300	56 700 ± 11 500
Iron	48 ± 26	72 ± 47	67 ± 17	12 500 ± 959	16 000 ± 5 910	11 900 ± 1 960
Phosphorus	N.D.[b]	N.D.	N.D.	493 ± 202	470 ± 173	413 ± 166
Bm						
pH	5.4 ± 0.6	4.8 ± 0.7	5.2 ± 0.5	N.A.	N.A.	N.A.
Sulfur	24 ± 5	21 ± 5	20 ± 5	194 ± 40	68 ± 24	192 ± 36
Calcium	1 380 ± 610	1 550 ± 802	1 340 ± 1 090	3 940 ± 2 630	3 190 ± 1 150	3 780 ± 1 630
Magnesium	287 ± 228	360 ± 228	287 ± 293	5 220 ± 1 330	5 120 ± 1 180	5 470 ± 2 560
Potassium	200 ± 76	146 ± 72	153 ± 74	16 400 ± 4 140	16 600 ± 1 890	12 200 ± 1 740
Manganese	13 ± 26	13 ± 15	11 ± 8	328 ± 409	255 ± 248	370 ± 250
Aluminum	360 ± 244	348 ± 370	243 ± 186	68 200 ± 10 600	62 100 ± 6 580	79 100 ± 18 800
Iron	27 ± 27	40 ± 66	13 ± 14	28 700 ± 3 480	24 900 ± 4 130	30 200 ± 6 590
Phosphorus	N.D.	N.D.	N.D.	1 350 ± 1 370	677 ± 340	1 050 ± 699
IIAe						
pH	5.2 ± 0.2	5.0 ± 0.6	5.7 ± 0.2	N.A.	N.A.	N.A.
Sulfur	27 ± 3	22 ± 6	24 ± 10	177 ± 30	52 ± 29	156 ± 38
Calcium	2 350 ± 168	2 210 ± 741	2 660 ± 997	3 550 ± 331	3 380 ± 768	3 830 ± 1 510
Magnesium	525 ± 133	472 ± 186	596 ± 269	6 340 ± 1 030	6 080 ± 1 230	7 150 ± 2 350
Potasium	162 ± 33	180 ± 72	162 ± 51	18 200 ± 2 280	17 800 ± 1 270	14 200 ± 2 410
Manganese	26 ± 12	19 ± 17	13 ± 7	260 ± 84	241 ± 165	404 ± 169
Aluminum	122 ± 145	198 ± 273	68 ± 72	62 600 ± 12 400	63 800 ± 9 040	75 800 ± 20 100
Iron	2 ± 2	11 ± 19	1 ± 1	28 100 ± 6 240	27 600 ± 6 310	30 900 ± 10 700
Phosphorus	N.D.	N.D.	N.D.	580 ± 140	516 ± 93	528 ± 159

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 18 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements 1981	1985	1991	Total elements 1981	1985	1991
LFH						
pH	5.2 ± 0.8	4.9 ± 0.5	5.2 ± 0.5	N.A.[a]	N.A.	N.A.
Sulfur	183 ± 42	93 ± 68	124 ± 51	1 070 ± 222	903 ± 223	935 ± 276
Calcium	5 510 ± 2 220	4 840 ± 627	5 410 ± 972	7 510 ± 3 760	6 980 ± 2 350	6 190 ± 1 430
Magnesium	792 ± 294	847 ± 200	573 ± 40	1 450 ± 252	1 460 ± 719	992 ± 161
Potassium	1 280 ± 559	1 280 ± 764	760 ± 427	2 430 ± 463	1 910 ± 583	1 050 ± 369
Manganese	771 ± 564	351 ± 180	598 ± 425	1 270 ± 1 080	958 ± 502	904 ± 747
Aluminum	119 ± 118	31 ± 16	77 ± 40	6 670 ± 1 510	5 810 ± 2 220	2 950 ± 878
Iron	30 ± 48	8 ± 3	20 ± 14	3 520 ± 972	4 110 ± 1 850	3 800 ± 1 080
Phosphorus	338 ± 128	122 ± 97	167 ± 96	951 ± 271	915 ± 341	854 ± 282
IAe						
pH	4.9 ± 0.6	4.9 ± 0.5	4.9 ± 0.3	N.A.	N.A.	N.A.
Sulfur	13 ± 5	11 ± 4	13 ± 3	129 ± 34	62 ± 16	123 ± 34
Calcium	570 ± 372	665 ± 513	690 ± 261	3 630 ± 930	3 610 ± 639	3 430 ± 586
Magnesium	106 ± 72	112 ± 61	100 ± 25	2 070 ± 585	1 660 ± 317	1 740 ± 449
Potassium	78 ± 74	50 ± 12	77 ± 34	11 900 ± 1 260	11 100 ± 1 330	10 400 ± 816
Manganese	61 ± 74	72 ± 103	57 ± 32	332 ± 430	292 ± 297	264 ± 112
Aluminum	160 ± 169	127 ± 134	178 ± 142	33 200 ± 6 970	32 900 ± 6 470	34 500 ± 5 860
Iron	16 ± 17	17 ± 17	11 ± 12	8 790 ± 2 820	7 370 ± 842	7 500 ± 1 900
Phosphorus	N.D.[b]	N.D.	N.D.	267 ± 159	279 ± 173	296 ± 151
Bm						
pH	5.2 ± 0.3	5.4 ± 0.2	5.9 ± 0.4	N.A.	N.A.	N.A.
Sulfur	14 ± 6	9 ± 2	12 ± 2	136 ± 40	44 ± 16	87 ± 19
Calcium	803 ± 504	618 ± 441	890 ± 479	3 530 ± 564	4 130 ± 449	3 350 ± 582
Magnesium	189 ± 117	155 ± 108	172 ± 85	3 360 ± 932	3 150 ± 875	2 910 ± 428
Potassium	93 ± 31	72 ± 21	79 ± 66	12 500 ± 1 120	11 600 ± 611	10 800 ± 858
Manganese	46 ± 59	61 ± 96	14 ± 9	332 ± 291	404 ± 449	198 ± 101
Aluminum	141 ± 44	140 ± 105	65 ± 47	45 900 ± 7 120	45 600 ± 7 100	46 500 ± 5 510
Iron	8 ± 7	7 ± 14	5 ± 9	17 500 ± 4 280	18 900 ± 4 100	15 300 ± 2 550
Phosphorus	N.D.	N.D.	N.D.	558 ± 189	614 ± 299	594 ± 377
IIAe						
pH	6.2 ± 1.4	6.1 ± 1.3	6.1 ± 1.1	N.A.	N.A.	N.A.
Sulfur	19 ± 18	11 ± 10	13 ± 5	284 ± 433	22 ± 16	74 ± 11
Calcium	1 670 ± 1 670	1 250 ± 1 730	1 210 ± 360	16 000 ± 34 600	22 700 ± 51 800	3 070 ± 518
Magnesium	204 ± 97	142 ± 34	235 ± 68	6 170 ± 7 340	5 870 ± 7 960	3 500 ± 381
Potasium	59 ± 22	47 ± 16	76 ± 23	12 900 ± 2 130	11 400 ± 1 760	11 500 ± 585
Manganese	17 ± 10	16 ± 16	12 ± 6	273 ± 106	267 ± 142	227 ± 55
Aluminum	20 ± 40	49 ± 65	26 ± 33	40 400 ± 8 290	41 100 ± 8 110	41 300 ± 2 670
Iron	B.D.[c]	3 ± 5	B.D.	15 800 ± 4 730	16 000 ± 2 350	16 000 ± 2 570
Phosphorus	N.D.	N.D.	N.D.	371 ± 119	423 ± 185	334 ± 61

[a] N.A. = not applicable.

[b] N.D. = not determined.

[c] B.D. = below detection.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 19 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements 1981	Extractable elements 1985	Extractable elements 1991	Total elements 1981	Total elements 1985	Total elements 1991
LFH						
pH	5.3 ± 0.2	5.0 ± 0.3	5.4 ± 0.4	N.A.[a]	N.A.	N.A.
Sulfur	184 ± 49	70 ± 34	92 ± 20	1 170 ± 274	775 ± 202	758 ± 169
Calcium	6 530 ± 1 420	4 950 ± 1 070	5 100 ± 2 500	8 370 ± 1 840	6 050 ± 1 720	5 360 ± 2 640
Magnesium	935 ± 131	927 ± 96	607 ± 281	1 560 ± 257	1 340 ± 433	966 ± 535
Potassium	1 100 ± 367	1 290 ± 649	500 ± 156	2 190 ± 313	1 910 ± 574	782 ± 175
Manganese	1 040 ± 773	325 ± 91	881 ± 442	1 640 ± 1 050	1 120 ± 575	1 330 ± 631
Aluminum	78 ± 46	33 ± 12	30 ± 16	6 430 ± 1 480	5 380 ± 2 750	2 330 ± 678
Iron	12 ± 7	8 ± 1	5 ± 23	3 230 ± 930	3 700 ± 2 220	3 610 ± 1 380
Phosphorus	308 ± 112	117 ± 50	126 ± 37	979 ± 191	749 ± 269	634 ± 120
IAe						
pH	5.5 ± 0.3	5.2 ± 0.7	5.1 ± 0.5	N.A.	N.A.	N.A.
Sulfur	9 ± 4	7 ± 3	11 ± 4	116 ± 28	41 ± 14	113 ± 14
Calcium	502 ± 255	566 ± 215	669 ± 292	3 340 ± 679	3 140 ± 497	3 120 ± 494
Magnesium	77 ± 24	91 ± 32	95 ± 29	1 600 ± 333	1 380 ± 189	1 420 ± 411
Potassium	46 ± 19	49 ± 25	63 ± 22	11 200 ± 1 240	10 200 ± 472	9 890 ± 860
Manganese	53 ± 50	78 ± 67	89 ± 43	281 ± 222	411 ± 289	578 ± 385
Aluminum	48 ± 30	42 ± 31	44 ± 24	28 400 ± 5 650	27 800 ± 2 150	26 600 ± 5 940
Iron	4 ± 5	1 ± 3	1 ± 1	6 660 ± 1 580	6 460 ± 922	5 950 ± 2 190
Phosphorus	N.D.[b]	N.D.	N.D.	230 ± 96	243 ± 96	227 ± 45
Bm						
pH	5.6 ± 0.6	5.5 ± 0.4	5.8 ± 0.7	N.A.	N.A.	N.A.
Sulfur	13 ± 3	9 ± 1	10 ± 4	114 ± 38	33 ± 8	83 ± 17
Calcium	840 ± 587	759 ± 323	1 000 ± 546	3 620 ± 1 040	4 120 ± 509	2 890 ± 547
Magnesium	171 ± 124	161 ± 64	184 ± 82	3 160 ± 1 100	3 040 ± 536	3 030 ± 714
Potassium	101 ± 44	94 ± 30	88 ± 26	11 900 ± 1 300	10 900 ± 408	10 600 ± 886
Manganese	47 ± 72	33 ± 49	17 ± 22	561 ± 855	344 ± 375	257 ± 267
Aluminum	107 ± 119	105 ± 74	113 ± 101	38 500 ± 3 820	41 500 ± 3 440	35 900 ± 5 360
Iron	6 ± 10	6 ± 7	6 ± 9	15 100 ± 3 500	17 300 ± 2 540	13 600 ± 2 830
Phosphorus	N.D.	N.D.	N.D.	861 ± 370	878 ± 273	713 ± 268
IIAe						
pH	6.2 ± 1.3	5.8 ± 0.4	6.3 ± 0.7	N.A.	N.A.	N.A.
Sulfur	17 ± 18	8 ± 5	13 ± 8	298 ± 520	20 ± 6	76 ± 15
Calcium	1 510 ± 1 740	941 ± 751	1 480 ± 1 020	18 000 ± 40 800	4 000 ± 1 700	3 250 ± 1 340
Magnesium	187 ± 112	175 ± 118	245 ± 95	6 100 ± 8 250	3 020 ± 1 270	3 400 ± 906
Potasium	65 ± 39	68 ± 23	79 ± 22	11 500 ± 1 720	10 700 ± 989	10 600 ± 507
Manganese	12 ± 8	10 ± 10	9 ± 7	214 ± 70	186 ± 116	214 ± 96
Aluminum	17 ± 16	17 ± 14	16 ± 15	36 400 ± 9 760	37 700 ± 5 860	33 600 ± 7 050
Iron	B.D.[c]	1 ± 2	B.D.	13 900 ± 5 240	15 900 ± 4 810	13 900 ± 3 840
Phosphorus	N.D.	N.D.	N.D.	464 ± 174	435 ± 128	428 ± 114

[a] N.A. = not applicable.

[b] N.D. = not determined.

[c] B.D. = below detection.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 20 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	5.2 ± 0.6	5.2 ± 0.2	5.2 ± 0.4	N.A.[a]	N.A.	N.A.
Sulfur	168 ± 63	146 ± 83	160 ± 46	865 ± 232	1 050 ± 109	1 340 ± 389
Calcium	5 260 ± 1 570	5 750 ± 1 550	6 510 ± 1 230	6 700 ± 2 740	7 060 ± 2 200	6 820 ± 1 290
Magnesium	721 ± 197	975 ± 412	834 ± 72	1 800 ± 456	1 210 ± 233	1 220 ± 652
Potassium	929 ± 359	1 970 ± 1 570	959 ± 406	3 050 ± 628	1 990 ± 667	1 210 ± 565
Manganese	1 010 ± 528	443 ± 149	1 210 ± 664	3 140 ± 4 730	1 510 ± 699	1 760 ± 1 170
Aluminum	135 ± 117	35 ± 20	51 ± 41	12 100 ± 3 910	4 740 ± 1 690	2 750 ± 1 880
Iron	23 ± 20	6 ± 4	6 ± 5	5 530 ± 2 520	2 750 ± 1 040	3 320 ± 3 390
Phosphorus	254 ± 123	238 ± 134	256 ± 103	1 160 ± 277	1 010 ± 192	1 080 ± 375
IAe						
pH	4.9 ± 0.7	4.9 ± 0.6	4.6 ± 0.6	N.A.	N.A.	N.A.
Sulfur	16 ± 6	12 ± 5	10 ± 3	180 ± 23	64 ± 29	143 ± 25
Calcium	616 ± 461	638 ± 745	430 ± 387	5 460 ± 494	4 960 ± 777	5 320 ± 1 020
Magnesium	108 ± 61	123 ± 107	83 ± 61	2 940 ± 396	2 640 ± 767	2 430 ± 359
Potassium	123 ± 81	94 ± 73	116 ± 30	16 500 ± 1 240	15 000 ± 937	16 800 ± 1 490
Manganese	90 ± 96	112 ± 83	45 ± 62	528 ± 538	606 ± 490	317 ± 205
Aluminum	202 ± 155	150 ± 129	286 ± 133	49 000 ± 4 220	46 700 ± 1 780	41 000 ± 5 530
Iron	15 ± 16	7 ± 10	14 ± 14	11 900 ± 2 000	10 500 ± 3 620	7 950 ± 1 140
Phosphorus	N.D.[b]	N.D.	N.D.	652 ± 171	401 ± 288	417 ± 93
Bm						
pH	5.5 ± 0.5	5.6 ± 0.3	5.4 ± 0.3	N.A.	N.A.	N.A.
Sulfur	19 ± 8	14 ± 4	15 ± 10	199 ± 26	77 ± 15	151 ± 57
Calcium	604 ± 413	848 ± 1 070	460 ± 384	4 480 ± 936	5 490 ± 744	4 010 ± 754
Magnesium	82 ± 29	206 ± 289	100 ± 93	3 480 ± 327	4 470 ± 2 150	3 430 ± 845
Potassium	193 ± 174	176 ± 103	147 ± 64	14 400 ± 601	14 800 ± 1 530	14 600 ± 1 740
Manganese	26 ± 13	53 ± 40	22 ± 21	357 ± 117	571 ± 370	477 ± 382
Aluminum	189 ± 175	144 ± 85	276 ± 205	56 400 ± 5 350	59 900 ± 5 180	48 900 ± 7 190
Iron	10 ± 16	5 ± 3	16 ± 33	19 300 ± 1 760	24 200 ± 5 570	15 700 ± 2 890
Phosphorus	N.D.	N.D.	N.D.	1 380 ± 425	1 380 ± 628	1 090 ± 447
IIAe						
pH	5.2 ± 0.2	5.7 ± 0.3	5.7 ± 0.2	N.A.	N.A.	N.A.
Sulfur	14 ± 11	9 ± 7	11 ± 6	140 ± 40	45 ± 15	85 ± 15
Calcium	1 230 ± 1 110	904 ± 1 040	1 270 ± 695	4 270 ± 812	4 980 ± 511	3 650 ± 206
Magnesium	275 ± 252	214 ± 292	274 ± 163	5 230 ± 2 270	4 790 ± 2 110	4 130 ± 1 180
Potasium	96 ± 71	104 ± 116	96 ± 57	16 500 ± 2 500	15 100 ± 1 010	15 600 ± 1 980
Manganese	14 ± 9	19 ± 15	6 ± 5	292 ± 124	331 ± 134	192 ± 54
Aluminum	64 ± 44	86 ± 95	57 ± 36	52 800 ± 13 300	53 400 ± 9 480	40 300 ± 7 600
Iron	1 ± 1	2 ± 2	1 ± 1	20 200 ± 8 060	21 800 ± 8 190	14 200 ± 3 540
Phosphorus	N.D.	N.D.	N.D.	507 ± 150	509 ± 124	380 ± 79

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 21 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.6 ± 0.5	4.5 ± 0.4	4.8 ± 0.3	N.A.[a]	N.A.	N.A.
Sulfur	183 ± 65	77 ± 31	127 ± 96	968 ± 390	764 ± 282	989 ± 569
Calcium	5 890 ± 2 580	3 390 ± 1 480	4 120 ± 1 590	6 910 ± 3 270	4 320 ± 1 870	4 500 ± 1 760
Magnesium	599 ± 173	491 ± 190	510 ± 225	1 030 ± 202	964 ± 567	835 ± 242
Potassium	906 ± 415	851 ± 329	823 ± 632	1 790 ± 333	1 380 ± 750	1 030 ± 509
Manganese	663 ± 334	361 ± 214	726 ± 473	942 ± 449	814 ± 652	989 ± 669
Aluminum	128 ± 77	41 ± 21	135 ± 83	6 570 ± 1 750	4 760 ± 4 290	2 690 ± 1 210
Iron	21 ± 11	6 ± 3	32 ± 32	2 650 ± 867	3 060 ± 3 050	3 170 ± 2 030
Phosphorus	301 ± 109	92 ± 55	183 ± 139	800 ± 233	670 ± 245	888 ± 422
IAe						
pH	4.8 ± 0.5	4.6 ± 0.4	4.3 ± 0.2	N.A.	N.A.	N.A.
Sulfur	21 ± 12	16 ± 9	15 ± 6	214 ± 26	83 ± 50	143 ± 19
Calcium	894 ± 756	617 ± 505	655 ± 230	6 220 ± 571	5 330 ± 875	5 350 ± 340
Magnesium	99 ± 34	100 ± 61	98 ± 26	3 140 ± 241	2 390 ± 570	2 320 ± 102
Potassium	78 ± 19	68 ± 58	107 ± 38	15 400 ± 934	13 900 ± 1 290	14 500 ± 988
Manganese	223 ± 258	134 ± 155	88 ± 74	1 070 ± 1 200	686 ± 840	328 ± 237
Aluminum	202 ± 154	140 ± 99	307 ± 103	51 700 ± 3 990	43 900 ± 6 650	39 300 ± 1 640
Iron	15 ± 20	13 ± 15	21 ± 20	13 900 ± 1 760	10 800 ± 3 250	8 550 ± 1 070
Phosphorus	N.D.[b]	N.D.	N.D.	517 ± 160	352 ± 323	344 ± 66
Bm						
pH	5.5 ± 0.2	5.3 ± 0.1	5.6 ± 0.2	N.A.	N.A.	N.A.
Sulfur	15 ± 4	20 ± 10	12 ± 8	176 ± 21	67 ± 37	165 ± 124
Calcium	759 ± 252	835 ± 354	735 ± 180	4 780 ± 631	6 420 ± 1 760	4 410 ± 1 020
Magnesium	118 ± 42	161 ± 94	143 ± 17	3 530 ± 329	4 190 ± 1 130	3 530 ± 600
Potassium	97 ± 34	144 ± 40	77 ± 27	13 100 ± 1 310	13 000 ± 624	13 200 ± 1 600
Manganese	63 ± 55	66 ± 58	22 ± 25	600 ± 452	534 ± 313	243 ± 59
Aluminum	150 ± 76	275 ± 67	204 ± 153	53 100 ± 6 530	59 700 ± 8 600	49 300 ± 12 600
Iron	8 ± 13	20 ± 25	13 ± 14	18 200 ± 1 130	25 900 ± 6 250	16 900 ± 5 120
Phosphorus	N.D.	N.D.	N.D.	854 ± 401	1 170 ± 380	789 ± 344
IIAe						
pH	5.2 ± 0.3	5.4 ± 0.1	5.6 ± 0.1	N.A.	N.A.	N.A.
Sulfur	18 ± 6	13 ± 8	15 ± 10	155 ± 28	39 ± 27	107 ± 12
Calcium	1 450 ± 557	1 210 ± 901	1 540 ± 1 220	5 020 ± 1 470	6 120 ± 2 350	5 590 ± 2 910
Magnesium	276 ± 105	255 ± 227	329 ± 217	5 710 ± 2 000	5 790 ± 3 070	5 560 ± 2 670
Potasium	98 ± 42	80 ± 43	66 ± 15	15 600 ± 2 280	14 300 ± 1 090	15 200 ± 2 730
Manganese	44 ± 46	7 ± 11	6 ± 6	696 ± 917	240 ± 75	186 ± 54
Aluminum	88 ± 80	170 ± 148	88 ± 34	54 200 ± 8 980	57 800 ± 13 000	50 300 ± 16 300
Iron	4 ± 5	12 ± 11	4 ± 4	24 000 ± 2 440	27 400 ± 10 800	19 600 ± 6 170
Phosphorus	N.D.	N.D.	N.D.	613 ± 243	777 ± 556	612 ± 288

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 22 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.2 ± 0.4	4.3 ± 0.4	4.5 ± 0.3	N.A.[a]	N.A.	N.A.
Sulfur	180 ± 50	121 ± 109	130 ± 12	1 160 ± 168	876 ± 323	1 120 ± 158
Calcium	3 820 ± 1 380	3 350 ± 1 240	3 840 ± 885	4 360 ± 2 160	3 800 ± 1 790	3 810 ± 822
Magnesium	564 ± 89	662 ± 292	574 ± 117	950 ± 291	1 200 ± 358	873 ± 76
Potassium	902 ± 473	1 350 ± 644	742 ± 63	1 800 ± 613	1 910 ± 443	976 ± 110
Manganese	791 ± 570	446 ± 110	514 ± 284	980 ± 727	730 ± 385	575 ± 312
Aluminum	243 ± 70	129 ± 108	289 ± 171	6 290 ± 3 040	7 320 ± 5 140	3 280 ± 1 180
Iron	52 ± 32	24 ± 22	99 ± 74	2 480 ± 899	4 480 ± 3 980	3 680 ± 1 590
Phosphorus	316 ± 129	119 ± 134	183 ± 30	1 130 ± 309	1 020 ± 273	1 040 ± 65
IAe						
pH	4.2 ± 0.3	4.1 ± 0.2	4.3 ± 0.2	N.A.	N.A.	N.A.
Sulfur	20 ± 10	16 ± 4	12 ± 4	188 ± 29	19 ± 21	158 ± 52
Calcium	271 ± 278	200 ± 159	476 ± 186	5 310 ± 613	6 610 ± 1 510	5 370 ± 1 270
Magnesium	58 ± 29	55 ± 21	87 ± 53	3 220 ± 325	2 940 ± 319	3 000 ± 246
Potassium	79 ± 15	68 ± 24	102 ± 37	16 400 ± 1 740	18 500 ± 1 920	15 600 ± 2 640
Manganese	117 ± 94	54 ± 40	71 ± 118	426 ± 161	322 ± 104	359 ± 325
Aluminum	587 ± 94	460 ± 145	537 ± 194	50 300 ± 6 820	58 300 ± 5 210	50 100 ± 3 940
Iron	33 ± 15	48 ± 17	46 ± 31	13 000 ± 3 230	12 100 ± 2 220	11 900 ± 2 150
Phosphorus	N.D.[b]	N.D.	N.D.	740 ± 385	525 ± 264	551 ± 293
Bm						
pH	5.3 ± 0.6	5.0 ± 0.3	5.7 ± 0.4	N.A.	N.A.	N.A.
Sulfur	27 ± 10	27 ± 8	15 ± 7	219 ± 43	97 ± 49	133 ± 50
Calcium	458 ± 166	389 ± 165	736 ± 170	4 050 ± 850	4 350 ± 323	3 780 ± 1 230
Magnesium	84 ± 24	99 ± 34	167 ± 84	4 080 ± 319	4 100 ± 211	3 920 ± 186
Potassium	122 ± 35	144 ± 32	114 ± 24	14 600 ± 1 420	15 000 ± 2 110	13 600 ± 2 720
Manganese	108 ± 111	106 ± 91	30 ± 48	858 ± 489	690 ± 400	627 ± 530
Aluminum	269 ± 178	288 ± 59	124 ± 36	61 900 ± 8 610	68 600 ± 7 520	57 200 ± 16 700
Iron	5 ± 4	10 ± 5	2 ± 2	20 000 ± 9 360	24 600 ± 4 600	19 900 ± 4 760
Phosphorus	N.D.	N.D.	N.D.	1 560 ± 468	1 610 ± 590	1 080 ± 854
IIAe						
pH	5.4 ± 0.4	5.4 ± 0.3	5.3 ± 0.3	N.A.	N.A.	N.A.
Sulfur	15 ± 4	14 ± 2	17 ± 6	159 ± 13	31 ± 18	133 ± 23
Calcium	1 120 ± 320	731 ± 248	1 600 ± 977	3 720 ± 255	4 090 ± 1 560	3 810 ± 667
Magnesium	278 ± 107	165 ± 64	442 ± 351	5 210 ± 792	4 460 ± 343	5 780 ± 2 420
Potasium	114 ± 33	99 ± 42	149 ± 82	16 600 ± 1 130	16 000 ± 1 050	15 200 ± 2 260
Manganese	23 ± 10	46 ± 59	16 ± 13	319 ± 52	479 ± 325	348 ± 191
Aluminum	67 ± 35	89 ± 63	95 ± 21	53 200 ± 1 630	60 000 ± 14 800	57 700 ± 13 900
Iron	1 ± 1	3 ± 4	B.D.[c]	22 400 ± 2 110	20 900 ± 4 240	23 900 ± 6 850
Phosphorus	N.D.	N.D.	N.D.	616 ± 89	782 ± 624	610 ± 251

[a] N.A. = not applicable.

[b] N. D. = not determined.

[c] B.D. = below detection.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 23 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.2 ± 0.2	4.2 ± 0.2	4.5 ± 0.2	N.A.[a]	N.A.	N.A.
Sulfur	219 ± 60	113 ± 57	146 ± 42	1 260 ± 238	952 ± 112	1 590 ± 171
Calcium	2 780 ± 632	2 850 ± 732	3 010 ± 139	3 150 ± 963	2 810 ± 703	3 190 ± 320
Magnesium	431 ± 108	590 ± 160	453 ± 25	798 ± 297	866 ± 266	661 ± 104
Potassium	976 ± 345	1 110 ± 562	886 ± 118	1 830 ± 736	1 540 ± 562	1 070 ± 150
Manganese	888 ± 803	620 ± 142	756 ± 817	1 130 ± 1 140	1 180 ± 926	913 ± 1 050
Aluminum	293 ± 72	135 ± 88	253 ± 46	6 480 ± 2 450	5 390 ± 2 360	2 720 ± 657
Iron	57 ± 32	11 ± 9	54 ± 21	2 620 ± 1 060	6 110 ± 10 200	2 840 ± 1 360
Phosphorus	302 ± 72	134 ± 115	207 ± 42	1 180 ± 354	979 ± 277	1 180 ± 271
IAe						
pH	4.1 ± 0.4	4.1 ± 0.4	4.1 ± 0.4	N.A.	N.A.	N.A.
Sulfur	18 ± 4	21 ± 3	14 ± 8	220 ± 32	41 ± 43	154 ± 65
Calcium	447 ± 102	412 ± 142	383 ± 231	4 620 ± 2 440	4 650 ± 2 450	4 990 ± 2 440
Magnesium	78 ± 20	72 ± 27	72 ± 41	3 010 ± 765	2 850 ± 819	2 910 ± 665
Potassium	99 ± 35	97 ± 43	132 ± 73	13 900 ± 4 110	14 600 ± 4 370	13 200 ± 3 460
Manganese	191 ± 165	258 ± 277	72 ± 45	601 ± 451	975 ± 1 300	361 ± 97
Aluminum	559 ± 216	438 ± 175	561 ± 120	48 200 ± 10 200	45 300 ± 7 160	49 800 ± 11 600
Iron	30 ± 34	20 ± 22	36 ± 29	21 200 ± 6 700	18 200 ± 5 010	16 300 ± 8 060
Phosphorus	N.D.[b]	N.D.	N.D.	624 ± 169	516 ± 288	435 ± 164
Bm						
pH	4.9 ± 0.4	4.7 ± 0.8	5.4 ± 0.3	N.A.	N.A.	N.A.
Sulfur	28 ± 11	26 ± 10	58 ± 71	257 ± 75	89 ± 52	210 ± 93
Calcium	268 ± 110	311 ± 178	509 ± 277	3 950 ± 1 870	3 910 ± 2 280	4 140 ± 1 950
Magnesium	39 ± 14	51 ± 12	77 ± 51	3 670 ± 194	3 500 ± 340	3 720 ± 397
Potassium	101 ± 29	132 ± 33	102 ± 36	12 600 ± 1 240	13 000 ± 544	11 200 ± 1 220
Manganese	96 ± 31	143 ± 151	51 ± 13	896 ± 466	741 ± 474	1 020 ± 387
Aluminum	491 ± 304	506 ± 400	260 ± 255	68 300 ± 9 050	63 000 ± 14 600	71 400 ± 15 000
Iron	18 ± 24	31 ± 50	5 ± 8	29 700 ± 4 860	26 700 ± 4 700	30 000 ± 3 790
Phosphorus	N.D.	N.D.	N.D.	1 520 ± 456	1 180 ± 438	1 090 ± 150
IIAe						
pH	5.2 ± 0.5	5.2 ± 0.5	5.3 ± 0.3	N.A.	N.A.	N.A.
Sulfur	17 ± 9	13 ± 6	13 ± 7	187 ± 106	21 ± 14	105 ± 25
Calcium	880 ± 454	711 ± 278	1 290 ± 773	3 810 ± 2 940	3 110 ± 2 090	3 110 ± 880
Magnesium	198 ± 150	137 ± 31	318 ± 267	4 130 ± 755	3 960 ± 665	4 900 ± 1 330
Potasium	75 ± 17	76 ± 24	96 ± 60	14 300 ± 2 780	14 400 ± 2 330	14 100 ± 1 590
Manganese	38 ± 62	29 ± 35	11 ± 11	595 ± 679	402 ± 506	293 ± 105
Aluminum	174 ± 186	190 ± 207	153 ± 90	57 300 ± 20 200	52 900 ± 14 800	55 400 ± 7 480
Iron	5 ± 8	6 ± 8	3 ± 2	23 900 ± 3 800	22 300 ± 4 220	27 300 ± 6 390
Phosphorus	N.D.	N.D.	N.D.	718 ± 582	579 ± 411	475 ± 71

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 24 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.2 ± 0.2	4.0 ± 0.1	4.4 ± 0.3	N.A.[a]	N.A.	N.A.
Sulfur	202 ± 30	166 ± 38	151 ± 42	1 220 ± 134	1 080 ± 115	1 440 ± 163
Calcium	3 100 ± 691	2 820 ± 724	3 160 ± 331	3 690 ± 1 040	3 330 ± 523	3 580 ± 487
Magnesium	450 ± 108	472 ± 48	446 ± 89	824 ± 132	663 ± 41	643 ± 151
Potassium	1 110 ± 322	1 590 ± 449	1 050 ± 435	2 100 ± 441	1 840 ± 621	1 380 ± 510
Manganese	561 ± 339	365 ± 55	398 ± 206	662 ± 391	628 ± 397	465 ± 201
Aluminum	278 ± 70	95 ± 27	287 ± 102	6 530 ± 1 440	3 550 ± 550	2 730 ± 749
Iron	59 ± 26	10 ± 4	69 ± 41	2 390 ± 685	1 730 ± 204	2 330 ± 740
Phosphorus	329 ± 93	203 ± 67	239 ± 119	1 190 ± 174	1 110 ± 222	1 360 ± 251
IAe						
pH	4.0 ± 0.2	4.2 ± 0.3	4.1 ± 0.3	N.A.	N.A.	N.A.
Sulfur	13 ± 4	14 ± 6	19 ± 12	230 ± 39	88 ± 68	254 ± 118
Calcium	262 ± 156	257 ± 220	554 ± 258	4 900 ± 2 400	5 910 ± 3 490	4 910 ± 2 180
Magnesium	44 ± 25	50 ± 41	76 ± 26	2 960 ± 695	3 080 ± 1 080	2 930 ± 683
Potassium	53 ± 20	60 ± 22	128 ± 79	15 400 ± 2 600	16 000 ± 4 580	14 200 ± 1 720
Manganese	26 ± 30	27 ± 31	68 ± 103	245 ± 45	238 ± 102	432 ± 499
Aluminum	587 ± 169	528 ± 212	707 ± 223	49 800 ± 7 030	51 800 ± 13 500	50 100 ± 6 110
Iron	43 ± 21	56 ± 24	73 ± 66	11 600 ± 696	10 500 ± 2 920	10 700 ± 2 790
Phosphorus	N.D.[b]	N.D.	N.D.	462 ± 110	377 ± 91	412 ± 119
Bm						
pH	5.2 ± 0.7	5.1 ± 0.5	5.5 ± 0.6	N.A.	N.A.	N.A.
Sulfur	46 ± 62	53 ± 72	56 ± 81	444 ± 111	404 ± 93	414 ± 176
Calcium	593 ± 218	600 ± 164	366 ± 262	3 480 ± 3 100	4 270 ± 4 150	3 630 ± 2 980
Magnesium	111 ± 78	137 ± 99	97 ± 93	4 370 ± 1 250	5 050 ± 1 640	4 210 ± 1 390
Potassium	110 ± 21	144 ± 29	112 ± 27	13 300 ± 1 010	13 400 ± 1 780	12 800 ± 612
Manganese	14 ± 21	32 ± 44	14 ± 12	337 ± 330	290 ± 121	359 ± 274
Aluminum	717 ± 612	834 ± 632	520 ± 580	67 800 ± 16 800	71 600 ± 15 300	76 200 ± 15 100
Iron	52 ± 45	76 ± 74	49 ± 60	30 100 ± 3 910	35 200 ± 10 100	29 500 ± 4 580
Phosphorus	N.D.	N.D.	N.D.	1 220 ± 490	932 ± 577	1 270 ± 879
IIAe						
pH	5.0 ± 0.3	5.1 ± 0.2	5.0 ± 0.4	N.A.	N.A.	N.A.
Sulfur	20 ± 9	17 ± 4	12 ± 5	456 ± 154	438 ± 182	327 ± 277
Calcium	596 ± 320	587 ± 256	537 ± 531	1 870 ± 508	2 480 ± 431	5 580 ± 5 140
Magnesium	158 ± 46	176 ± 53	144 ± 128	5 450 ± 1 490	6 180 ± 1 280	5 410 ± 4 230
Potasium	95 ± 36	120 ± 36	97 ± 31	14 500 ± 1 050	14 500 ± 556	14 900 ± 2 750
Manganese	9± 17	7 ± 4	14 ± 14	206 ± 133	211 ± 101	300 ± 228
Aluminum	818 ± 442	891 ± 462	664 ± 386	64 500 ± 10 700	70 200 ± 8 180	61 000 ± 5 010
Iron	32 ± 20	36 ± 24	30 ± 38	30 400 ± 8 120	34 900 ± 7 660	20 600 ± 10 400
Phosphorus	N.D.	N.D.	N.D.	824 ± 343	830 ± 258	488 ± 202

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 25 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.3 ± 0.3	4.2 ± 0.2	4.4 ± 0.2	N.A.[a]	N.A.	N.A.
Sulfur	181 ± 20	144 ± 114	155 ± 38	1 040 ± 190	970 ± 273	1 320 ± 288
Calcium	3 480 ± 658	3 440 ± 786	3 350 ± 899	4 030 ± 993	4 060 ± 734	3 800 ± 1 050
Magnesium	536 ± 139	726 ± 149	518 ± 102	1 040 ± 214	919 ± 192	749 ± 149
Potassium	887 ± 384	1 630 ± 1 040	988 ± 408	2 410 ± 315	1 960 ± 406	1 340 ± 333
Manganese	441 ± 353	338 ± 143	256 ± 247	572 ± 488	526 ± 369	292 ± 258
Aluminum	285 ± 76	87 ± 38	302 ± 91	7 840 ± 2 570	4 500 ± 3 350	2 850 ± 874
Iron	63 ± 42	13 ± 4	84 ± 42	3 710 ± 1 620	2 630 ± 2 500	4 190 ± 3 900
Phosphorus	278 ± 98	168 ± 150	223 ± 72	1 140 ± 160	966 ± 209	1 170 ± 236
IAe						
pH	4.5 ± 0.4	4.4 ± 0.3	4.5 ± 0.4	N.A.	N.A.	N.A.
Sulfur	14 ± 3	15 ± 7	8 ± 2	210 ± 18	103 ± 38	171 ± 86
Calcium	375 ± 170	448 ± 153	313 ± 63	3 400 ± 1 390	3 180 ± 1 420	3 730 ± 1 840
Magnesium	69 ± 27	89 ± 24	54 ± 10	2 360 ± 103	2 210 ± 231	2 330 ± 663
Potassium	40 ± 12	56 ± 24	61 ± 6	13 500 ± 1 670	13 300 ± 2 060	14 000 ± 3 520
Manganese	8 ± 11	46 ± 96	3 ± 4	126 ± 37	138 ± 81	153 ± 43
Aluminum	338 ± 107	350 ± 91	452 ± 91	41 600 ± 3 210	39 800 ± 4 960	46 100 ± 12 400
Iron	37 ± 22	49 ± 35	34 ± 12	14 800 ± 3 470	11 300 ± 2 370	17 900 ± 11 000
Phosphorus	N.D.[b]	N.D.	N.D.	391 ± 238	306 ± 89	415 ± 123
Bm						
pH	4.9 ± 0.3	4.9 ± 0.3	5.2 ± 0.5	N.A.	N.A.	N.A.
Sulfur	10 ± 3	9 ± 2	6 ± 3	261 ± 44	117 ± 73	180 ± 71
Calcium	431 ± 241	414 ± 205	459 ± 180	1 670 ± 691	2 780 ± 489	1 390 ± 857
Magnesium	89 ± 51	95 ± 27	98 ± 32	3 270 ± 512	2 650 ± 714	2 720 ± 246
Potassium	50 ± 21	31 ± 12	54 ± 12	13 500 ± 2 150	12 100 ± 1 600	13 400 ± 2 400
Manganese	1 ± 1	6 ± 8	1 ± 0	87 ± 30	101 ± 15	102 ± 44
Aluminum	316 ± 251	343 ± 156	344 ± 86	45 800 ± 9 060	42 700 ± 5 250	46 900 ± 3 250
Iron	36 ± 46	38 ± 29	27 ± 21	25 000 ± 15 600	17 900 ± 7 480	24 500 ± 7 580
Phosphorus	N.D.	N.D.	N.D.	769 ± 658	387 ± 356	765 ± 149
IIAe						
pH	5.1 ± 0.1	5.0 ± 0.5	5.4 ± 0.4	N.A.	N.A.	N.A.
Sulfur	8 ± 1	7 ± 2	7 ± 2	256 ± 47	241 ± 106	210 ± 74
Calcium	450 ± 72	460 ± 91	581 ± 281	1 200 ± 406	1 330 ± 469	745 ± 206
Magnesium	116 ± 17	116 ± 18	165 ± 91	3 080 ± 273	3 260 ± 138	2 980 ± 277
Potasium	44 ± 10	44 ± 7	56 ± 24	12 900 ± 983	12 100 ± 736	14 400 ± 1 480
Manganese	1 ± 0.4	2 ± 4	0.4 ± 0.1	59 ± 16	67 ± 17	53 ± 22
Aluminum	207 ± 57	218 ± 72	203 ± 47	44 300 ± 3 400	46 700 ± 1 590	50 400 ± 5 190
Iron	14 ± 5	19 ± 12	6 ± 2	22 300 ± 4 050	30 900 ± 4 680	28 600 ± 9 480
Phosphorus	N.D.	N.D.	N.D.	601 ± 325	859 ± 61	712 ± 154

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Site 26 pH, extractable and total elements (mg kg^{-1})

Elements	Extractable elements			Total elements		
	1981	1985	1991	1981	1985	1991
LFH						
pH	4.2 ± 0.5	4.3 ± 0.4	5.0 ± 0.9	N.A.[a]	N.A.	N.A.
Sulfur	255 ± 93	108 ± 45	148 ± 88	1 220 ± 457	1 070 ± 227	1 450 ± 463
Calcium	5 670 ± 3 730	5 860 ± 3 080	5 790 ± 2 810	6 460 ± 4 330	6 410 ± 4 500	6 770 ± 3 640
Magnesium	719 ± 395	766 ± 221	663 ± 294	1 120 ± 382	901 ± 302	1 050 ± 551
Potassium	1 160 ± 278	1 320 ± 377	992 ± 658	2 220 ± 335	1 680 ± 343	1 310 ± 667
Manganese	285 ± 112	276 ± 155	524 ± 425	335 ± 117	428 ± 257	820 ± 721
Aluminum	261 ± 164	47 ± 47	151 ± 226	7 040 ± 2 120	3 640 ± 2 480	3 100 ± 2 500
Iron	78 ± 56	11 ± 17	48 ± 88	2 950 ± 838	2 340 ± 1 860	4 340 ± 5 850
Phosphorus	372 ± 94	188 ± 94	230 ± 149	1 130 ± 236	899 ± 97	1 180 ± 295
IAe						
pH	4.8 ± 0.8	4.3 ± 0.4	4.6 ± 1.1	N.A.	N.A.	N.A.
Sulfur	48 ± 74	54 ± 68	29 ± 24	561 ± 960	119± 179	231 ± 138
Calcium	2 630 ± 5 510	673 ± 586	1 800 ± 2 070	10 400 ± 11 200	4 770 ± 1 800	6 460 ± 2 440
Magnesium	247 ± 397	116 ± 112	223 ± 204	3 790 ± 1 370	2 850 ± 360	3 210 ± 806
Potassium	82 ± 30	104 ± 30	192 ± 108	14 800 ± 6 700	15 400 ± 4 010	13 700 ± 2 650
Manganese	60 ± 70	97 ± 154	21 ± 19	489 ± 457	281 ± 402	242 ± 92
Aluminum	347 ± 266	453 ± 218	515 ± 447	57 600 ± 6 360	51 200 ± 7 570	61 700 ± 7 980
Iron	45 ± 27	69 ± 61	77 ± 74	19 600 ± 12 000	11 200 ± 4 990	16 900 ± 2 120
Phosphorus	N.D.[b]	N.D.	N.D.	755 ± 1 150	470 ± 144	575 ± 210
Bm						
pH	5.5 ± 0.5	5.9 ± 0.7	5.8 ± 0.5	N.A.	N.A.	N.A.
Sulfur	79 ± 150	31 ± 19	18 ± 8	733 ± 1 380	153 ± 53	162 ± 37
Calcium	3 630 ± 8 130	910 ± 821	1 330 ± 800	12 200 ± 21 000	6 050 ± 1 370	4 470 ± 621
Magnesium	351 ± 606	161 ± 115	264 ± 119	3 980 ± 903	4 050 ± 469	3 870 ± 540
Potassium	186 ± 74	129 ± 72	122 ± 86	12 700 ± 5 290	12 900 ± 948	13 500 ± 971
Manganese	99 ± 216	9 ± 5	11 ± 15	932 ± 1 370	413 ± 220	615 ± 493
Aluminum	103 ± 74	92 ± 168	110 ± 145	59 300 ± 12 100	66 500 ± 10 100	71 200 ± 7 100
Iron	13 ± 8	9 ± 16	7 ± 9	23 900 ± 3 390	25 200 ± 5 880	26 900 ± 5 020
Phosphorus	N.D.	N.D.	N.D.	1 440 ± 953	603 ± 591	967 ± 510
IIAe						
pH	5.8 ± 0.4	6.2 ± 0.7	5.7 ± 0.7	N.A.	N.A.	N.A.
Sulfur	15 ± 8	19 ± 15	11 ± 3	262 ± 81	134 ± 60	145 ± 38
Calcium	1 240 ± 619	1 310 ± 870	1 310 ± 554	3 200 ± 824	4 070 ± 1 430	3 160 ± 1 130
Magnesium	241 ± 58	253 ± 98	269 ± 67	4 120 ± 428	4 240 ± 652	3 970 ± 678
Potasium	61 ± 11	81 ± 40	61 ± 20	15 100 ± 1 600	13 100 ± 2 070	13 400 ± 2 130
Manganese	8 ± 4	9 ± 4	8 ± 9	282 ± 105	265 ± 44	363 ± 194
Aluminum	21 ± 35	23 ± 33	48 ± 65	54 300 ± 3 700	53 500 ± 6 670	55 900 ± 6 990
Iron	2 ± 2	2 ± 3	3 ± 5	23 900 ± 5 560	27 600 ± 4 230	26 500 ± 5 680
Phosphorus	N.D.	N.D.	N.D.	432 ± 348	622 ± 199	595 ± 118

[a] N.A. = not applicable.

[b] N.D. = not determined.

Note: Values are means ± 95% confidence limits.

Appendix 1. Extractable ammonium and total nitrogen for all sites sampled in 1991

Site	Extractable ammonium (mg kg^{-1})	Total nitrogen (g kg^{-1})	Site	Extractable ammonium (mg kg^{-1})	Total nitrogen (g kg^{-1})
1	31 ± 27	9.42 ± 2.23	14	280 ± 375	13.86 ± 3.59
2	74 ± 73	9.70 ± 1.36	16	247 ± 160	12.20 ± 2.98
3	132 ± 110	10.70 ± 2.81	17	197 ± 153	10.26 ± 2.58
4	75 ± 41	5.26 ± 1.29	18	107 ± 98	8.92 ± 2.56
5	81 ± 108	9.22 ± 2.67	19	67 ± 44	6.96 ± 1.29
6	98 ± 39	8.90 ± 2.42	20	343 ± 150	13.05 ± 5.17
7	60 ± 51	9.08 ± 2.45	21	100 ± 111	9.32 ± 3.78
8	105 ± 87	9.14 ± 1.72	22	136 ± 141	11.38 ± 3.48
9	196 ± 198	10.68 ± 2.22	23	245 ± 63	11.80 ± 1.61
10	102 ± 14	10.20 ± 1.20	24	79 ± 100	12.70 ± 1.10
11	98 ± 73	10.62 ± 3.57	25	138 ± 137	10.64 ± 2.37
12	157 ± 52	10.92 ± 1.31	26	311 ± 144	11.52 ± 3.70
13	242 ± 220	16.10 ± 0.98			

Note: Values are means ± 95% confidence limits (n = 5).

APPENDIX 2

Total Elemental Concentration in Vegetation

Appendix 2. Site 1 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	2 890 ± 235	2 000 ± 310	2 510 ± 468	2 460 ± 355	2 070 ± 228	2 420 ± 186
Calcium	9 540 ± 878	4 270 ± 913	12 300 ± 1 750	1 950 ± 288	3 490 ± 725	3 790 ± 697
Magnesium	1 270 ± 151	688 ± 128	1 290 ± 118	1 050 ± 144	1 090 ± 137	1 280 ± 109
Potassium	6 260 ± 450	7 340 ± 559	6 890 ± 1 050	4 700 ± 432	4 050 ± 597	5 530 ± 868
Manganese	998 ± 234	548 ± 100	667 ± 194	640 ± 87	1 220 ± 113	1 440 ± 205
Aluminum	N.D.[a]	60 ± 8	77 ± 21	N.D.	555 ± 99	780 ± 89
Iron	38 ± 13	36 ± 6	37 ± 4	72 ± 12	48 ± 15	66 ± 7
Phosphorus	1 930 ± 229	1 320 ± 197	2 300 ± 233	1 280 ± 131	921 ± 103	1 330 ± 139
Nitrogen[b]	N.D.	N.D.	10.7 ± 0.5	N.D.	N.D.	12.2 ± 0.5
	Alder			Twin-flower		
Sulfur	10 600 ± 1 080	N.S.[c]	3 860 ± 3 030	16 400 ± 3 460	5 220 ± 1 280	3 320[d]
Calcium	13 600 ± 1 500	N.S.	7 670 ± 2 030	14 700 ± 771	15 200 ± 2 260	15 400
Magnesium	2 000 ± 288	N.S.	1 790 ± 534	2 550 ± 233	1 750 ± 77	2 260
Potassium	8 430 ± 1 260	N.S.	9 310 ± 2 160	11 000 ± 1 650	21 400 ± 1 280	12 800
Manganese	2 220 ± 204	N.S.	1 410 ± 2 120	330 ± 56	286 ± 49	582
Aluminum	N.D.	N.S.	29 ± 45	N.D.	136 ± 36	253
Iron	167 ± 18	N.S.	74 ± 49	845 ± 1 240	162 ± 35	280
Phosphorus	1 180 ± 166	N.S.	2 610 ± 3 250	1 710 ± 96	1 770 ± 129	1 500
	Feather moss					
Sulfur	79 100 ± 29 900	N.D.	17 500 ± 7 730			
Calcium	4 880 ± 2 270	N.D.	22 900 ± 6 420			
Magnesium	399 ± 68	N.D.	1 400 ± 285			
Potassium	2 610 ± 703	N.D.	2 780 ± 1 110			
Manganese	108 ± 56	N.D.	369 ± 79			
Aluminum	N.D.	N.D.	1 060 ± 217			
Iron	889 ± 230	N.D.	1 320 ± 391			
Phosphorus	1 220 ± 160	N.D.	1 370 ± 260			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

[d] Only 2 samples at site 1 in 1991.

Appendix 2. Site 2 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	1 770 ± 203	1 200 ± 170	1 830 ± 349	2 030 ± 229	1 770 ± 222	1 810 ± 215
Calcium	10 030 ± 1 010	6 670 ± 1 330	8 030 ± 755	2 200 ± 381	4 110 ± 921	3 320 ± 452
Magnesium	1 020 ± 103	725 ± 63	1 080 ± 105	1 230 ± 207	1 310 ± 132	1 270 ± 153
Potassium	5 900 ± 614	6 560 ± 746	6 490 ± 433	4 610 ± 634	3 480 ± 356	4 800 ± 399
Manganese	594 ± 108	500 ± 54	900 ± 178	730 ± 185	1 480 ± 278	1 210 ± 233
Aluminum	N.D.[a]	27 ± 4	51 ± 13	N.D.	766 ± 121	848 ± 251
Iron	50 ± 6	24 ± 2	34 ± 4	86 ± 14	37 ± 6	57 ± 6
Phosphorus	1 850 ± 289	1 420 ± 235	2 320 ± 226	1 120 ± 109	1 050 ± 74	1 280 ± 88
Nitrogen[b]	N.D.	N.D.	11.4 ± 0.7	N.D.	N.D.	12.2 ± 1.2
	Alder			Twin-flower		
Sulfur	3 980 ± 397	N.S.[c]	2 820 ± 306	6 400 ± 1 100	2 670 ± 162	2 260 ± 369
Calcium	12 100 ± 922	N.S.	8 270 ± 919	15 900 ± 624	11 800 ± 784	13 600 ± 1 810
Magnesium	2 230 ± 262	N.S.	1 790 ± 275	2 960 ± 117	2 050 ± 172	1 930 ± 329
Potassium	9 730 ± 2 310	N.S.	7 960 ± 789	15 300 ± 1 350	20 100 ± 1 470	12 300 ± 1 450
Manganese	1 570 ± 357	N.S.	1 020 ± 337	300 ± 58	266 ± 67	495 ± 100
Aluminum	N.D.	N.S.	42 ± 19	N.D.	91 ± 29	196 ± 56
Iron	129 ± 19	N.S.	77 ± 7	181 ± 51	114 ± 44	184 ± 47
Phosphorus	1 470 ± 270	N.S.	2 020 ± 144	1 910 ± 192	1 520 ± 93	1 360 ± 136
	Feather moss					
Sulfur	20 700 ± 5 040	4 690 ± 712	9 590 ± 2 730			
Calcium	13 000 ± 1 660	5 290 ± 431	15 800 ± 4 060			
Magnesium	1 010 ± 494	664 ± 65	1 080 ± 204			
Potassium	5 940 ± 922	4 940 ± 418	3 430 ± 744			
Manganese	298 ± 69	119 ± 22	322 ± 113			
Aluminum	N.D.	670 ± 49	699 ± 158			
Iron	605 ± 154	800 ± 78	793 ± 162			
Phosphorus	1 520 ± 176	1 800 ± 111	1 340 ± 197			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 3 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	1 160 ± 53	619 ± 41	1 050 ± 35	1 320 ± 149	839 ± 87	1 280 ± 103
Calcium	5 080 ± 765	3 410 ± 762	7 720 ± 1 720	1 980 ± 290	2 280 ± 361	3 350 ± 386
Magnesium	952 ± 95	716 ± 104	899 ± 134	1 020 ± 103	902 ± 83	1 490 ± 158
Potassium	5 980 ± 916	5 230 ± 811	5 300 ± 811	5 560 ± 833	3 740 ± 280	5 090 ± 575
Manganese	1 800 ± 234	1 190 ± 212	728 ± 292	585 ± 67	719 ± 91	473 ± 97
Aluminum	N.D.[a]	21 ± 8	29 ± 5	N.D.	496 ± 117	576 ± 73
Iron	33 ± 8	24 ± 10	40 ± 3	69 ± 12	23 ± 10	30 ± 2
Phosphorus	1 370 ± 54	1 220 ± 145	2 040 ± 340	1 160 ± 109	897 ± 57	1 490 ± 114
Nitrogen[b]	N.D.	N.D.	13.8 ± 0.9	N.D.	N.D.	15.1 ± 0.7
	Alder			Twin-flower		
Sulfur	2 160 ± 298	N.S.[c]	2 000 ± 225	1 450 ± 67	788 ± 55	1 120 ± 110
Calcium	14 000 ± 1 500	N.S.	10 700 ± 1 500	13 900 ± 921	10 000 ± 1 230	12 400 ± 1 590
Magnesium	2 310 ± 224	N.S.	1 950 ± 310	3 580 ± 128	2 980 ± 231	3 480 ± 567
Potassium	8 430 ± 1 260	N.S.	8 060 ± 1 330	14 100 ± 772	16 800 ± 1 080	17 100 ± 3 150
Manganese	629 ± 216	N.S.	496 ± 68	362 ± 63	204 ± 47	308 ± 137
Aluminum	N.D.	N.S.	96 ± 122	N.D.	49 ± 16	145 ± 110
Iron	95 ± 9	N.S.	120 ± 104	143 ± 34	60 ± 11	126 ± 81
Phosphorus	1 380 ± 259	N.S.	1 900 ± 157	2 060 ± 144	1 490 ± 110	1 850 ± 202
	Feather moss					
Sulfur	1 260 ± 96	1 170 ± 65	1 650 ± 335			
Calcium	3 920 ± 521	3 970 ± 78	8 600 ± 2 820			
Magnesium	900 ± 153	1 200 ± 57	1 330 ± 280			
Potassium	4 740 ± 468	6 020 ± 381	5 360 ± 1 320			
Manganese	585 ± 148	642 ± 71	415 ± 153			
Aluminum	N.D.	414 ± 32	553 ± 288			
Iron	616 ± 136	337 ± 25	545 ± 275			
Phosphorus	1 340 ± 174	1 660 ± 105	1 710 ± 297			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 4 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	925 ± 63	508 ± 45	950 ± 70	1 220 ± 71	875 ± 74	1 240 ± 119
Calcium	8 730 ± 848	5 290 ± 721	8 590 ± 1 300	2 210 ± 416	2 020 ± 388	4 070 ± 863
Magnesium	1 120 ± 107	828 ± 46	1 170 ± 122	1 270 ± 105	1 040 ± 143	1 650 ± 176
Potassium	5 480 ± 420	6 450 ± 532	5 790 ± 747	3 960 ± 481	3 900 ± 240	5 210 ± 858
Manganese	860 ± 216	522 ± 144	586 ± 207	553 ± 90	685 ± 149	858 ± 256
Aluminum	N.D.[a]	38 ± 4	34 ± 6	N.D.	519 ± 45	761 ± 147
Iron	49 ± 6	38 ± 5	52 ± 7	96 ± 13	24 ± 3	60 ± 9
Phosphorus	1 670 ± 124	1 380 ± 165	2 240 ± 146	1 130 ± 109	1 030 ± 52	1 390 ± 82
Nitrogen[b]	N.D.	N.D.	11.4 ± 0.7	N.D.	N.D.	13.4 ± 0.7
	Alder			Twin-flower		
Sulfur	1 800 ± 182	N.S.[c]	2 140 ± 227	1 350 ± 58	895 ± 58	1 020 ± 58
Calcium	14 600 ± 1 970	N.S.	11 400 ± 954	14 000 ± 623	12 600 ± 569	11 700 ± 629
Magnesium	2 580 ± 330	N.S.	2 390 ± 283	3 670 ± 200	3 400 ± 90	3 340 ± 191
Potassium	8 210 ± 1 810	N.S.	9 140 ± 787	13 000 ± 658	17 900 ± 690	14 900 ± 774
Manganese	692 ± 180	N.S.	758 ± 284	238 ± 39	212 ± 45	286 ± 40
Aluminum	N.D.	N.S.	76 ± 15	N.D.	129 ± 17	163 ± 77
Iron	163 ± 51	N.S.	136 ± 17	175 ± 63	122 ± 16	198 ± 101
Phosphorus	1 480 ± 203	N.S.	1 990 ± 129	1 840 ± 73	1 720 ± 80	1 690 ± 122
	Feather moss					
Sulfur	1 270 ± 72	1 140 ± 62	1 310 ± 93			
Calcium	4 930 ± 836	4 520 ± 215	6 700 ± 1 110			
Magnesium	1 180 ± 127	1 360 ± 95	1 320 ± 154			
Potassium	5 250 ± 351	5 620 ± 330	3 940 ± 539			
Manganese	516 ± 52	530 ± 66	582 ± 88			
Aluminum	N.D.	574 ± 77	1 230 ± 764			
Iron	682 ± 58	649 ± 83	1 380 ± 765			
Phosphorus	1 290 ± 150	1 580 ± 93	1 440 ± 123			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 5 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	1 280 ± 108	918 ± 103	1 250 ± 118	1 460 ± 144	1 460 ± 144	1 690 ± 153
Calcium	9 230 ± 1 390	6 270 ± 991	9 720 ± 906	2 350 ± 394	2 610 ± 310	4 070 ± 791
Magnesium	1 170 ± 149	840 ± 120	1 200 ± 149	989 ± 112	1 120 ± 98	1 490 ± 158
Potassium	4 830 ± 643	5 380 ± 565	6 360 ± 956	5 630 ± 1 180	5 130 ± 2 260	5 640 ± 1 000
Manganese	1 000 ± 238	433 ± 94	475 ± 158	672 ± 137	807 ± 192	675 ± 94
Aluminum	N.D.[a]	44 ± 6	20 ± 4	N.D.	635 ± 80	613 ± 53
Iron	43 ± 5	46 ± 10	35 ± 6	67 ± 7	66 ± 9	54 ± 6
Phosphorus	1 840 ± 125	1 660 ± 125	2 270 ± 285	1 140 ± 123	1 250 ± 127	1 480 ± 150
Nitrogen[b]	N.D.	N.D.	12.9 ± 1.2	N.D.	N.D.	13.5 ± 1.1
	Alder			Twin-flower		
Sulfur	2 750 ± 442	N.S.[c]	2 400 ± 183	3 310 ± 350	1 710 ± 104	1 240 ± 119
Calcium	15 000 ± 2 130	N.S.	11 900 ± 1 440	15 100 ± 1 200	13 400 ± 1 680	12 000 ± 603
Magnesium	2 310 ± 255	N.S.	2 000 ± 200	2 990 ± 116	2 350 ± 167	2 280 ± 170
Potassium	6 680 ± 1 150	N.S.	7 640 ± 718	9 140 ± 616	18 400 ± 961	14 700 ± 559
Manganese	771 ± 139	N.S.	578 ± 140	317 ± 37	137 ± 22	239 ± 38
Aluminum	N.D.	N.S.	56 ± 9	N.D.	58 ± 15	98 ± 17
Iron	155 ± 21	N.S.	91 ± 7	143 ± 20	78 ± 8	70 ± 8
Phosphorus	1 460 ± 260	N.S.	1 790 ± 159	1 790 ± 124	1 750 ± 122	1 750 ± 100
	Feather moss					
Sulfur	9 880 ± 1 070	2 110 ± 138	4 600 ± 1 060			
Calcium	10 400 ± 2 630	4 280 ± 503	12 900 ± 4 080			
Magnesium	890 ± 72	960 ± 73	1 020 ± 208			
Potassium	5 380 ± 534	6 590 ± 509	3 710 ± 366			
Manganese	370 ± 56	228 ± 24	393 ± 111			
Aluminum	N.D.	470 ± 51	525 ± 74			
Iron	572 ± 47	478 ± 55	396 ± 65			
Phosphorus	1 340 ± 138	1 460 ± 107	1 190 ± 103			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 6 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	779 ± 85	499 ± 20	974 ± 79	986 ± 136	1 060 ± 107	1 090 ± 75
Calcium	7 450 ± 1 830	5 490 ± 1 190	10 400 ± 1 470	2 060 ± 386	2 750 ± 431	4 170 ± 844
Magnesium	1 020 ± 121	836 ± 139	1 520 ± 268	1 110 ± 147	1 250 ± 118	1 420 ± 234
Potassium	5 320 ± 595	6 370 ± 737	5 160 ± 571	4 000 ± 702	3 680 ± 435	4 390 ± 345
Manganese	364 ± 59	284 ± 57	1 170 ± 841	456 ± 69	918 ± 248	1 170 ± 190
Aluminum	N.D.[a]	47 ± 7	35 ± 5	N.D.	634 ± 72	827 ± 114
Iron	59 ± 10	47 ± 11	36 ± 3	87 ± 11	42 ± 5	60 ± 7
Phosphorus	1 550 ± 154	1 370 ± 202	1 940 ± 225	985 ± 135	1 220 ± 61	1 270 ± 74
Nitrogen[b]	N.D.	N.D.	10.2 ± 2.7	N.D.	N.D.	13.3 ± 0.8
	Alder			Twin-flower		
Sulfur	1 490 ± 79	N.S.[c]	N.S.	1 250 ± 85	749 ± 66	933 ± 60
Calcium	13 200 ± 1 100	N.S.	N.S.	9 260 ± 2 290	12 400 ± 1 110	10 900 ± 1 180
Magnesium	2 720 ± 360	N.S.	N.S.	2 320 ± 712	3 480 ± 179	3 030 ± 221
Potassium	7 730 ± 1 140	N.S.	N.S.	8 820 ± 2 290	17 200 ± 839	12 400 ± 635
Manganese	1 050 ± 347	N.S.	N.S.	562 ± 288	172 ± 30	497 ± 61
Aluminum	N.D.	N.S.	N.S.	N.D.	203 ± 86	215 ± 34
Iron	147 ± 31	N.S.	N.S.	343 ± 103	206 ± 86	164 ± 15
Phosphorus	1 460 ± 219	N.S.	N.S.	1 760 ± 225	1 770 ± 205	1 490 ± 91
	Feather moss					
Sulfur	1 240 ± 37	1 250 ± 55	1 320 ± 86			
Calcium	6 310 ± 325	6 550 ± 578	6 780 ± 1 680			
Magnesium	1 760 ± 79	1 780 ± 107	1 030 ± 86			
Potassium	5 550 ± 237	7 880 ± 663	3 510 ± 409			
Manganese	344 ± 47	309 ± 25	697 ± 191			
Aluminum	N.D.	800 ± 60	938 ± 187			
Iron	2 400 ± 235	955 ± 68	1 100 ± 182			
Phosphorus	1 700 ± 94	1 800 ± 135	1 180 ± 105			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 7 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	860 ± 58	492 ± 18	894 ± 54	1 220 ± 102	1 030 ± 82	1 150 ± 116
Calcium	6 650 ± 1 600	5 880 ± 1 420	8 850 ± 1 740	1 540 ± 320	2 960 ± 645	2 870 ± 488
Magnesium	989 ± 201	884 ± 136	1 120 ± 113	1 070 ± 222	1 050 ± 96	1 560 ± 333
Potassium	5 090 ± 836	4 760 ± 342	5 680 ± 626	5 120 ± 606	3 770 ± 284	4 250 ± 303
Manganese	795 ± 263	734 ± 227	834 ± 387	660 ± 112	1 090 ± 132	1 140 ± 167
Aluminum	N.D.[a]	37 ± 6	3 ± 9	N.D.	519 ± 92	629 ± 97
Iron	45 ± 6	34 ± 5	17 ± 3	66 ± 9	30 ± 3	43 ± 3
Phosphorus	1 530 ± 189	1 230 ± 77	1 920 ± 239	1 260 ± 195	1 190 ± 79	1 410 ± 116
Nitrogen[b]	N.D.	N.D.	11.1 ± 0.7	N.D.	N.D.	12.2 ± 0.9
	Alder			Twin-flower		
Sulfur	1 530 ± 215	N.S.[c]	2 150 ± 279	1 220 ± 59	751 ± 32	921 ± 50
Calcium	11 500 ± 915	N.S.	11 500 ± 1 640	12 400 ± 1 010	14 000 ± 807	11 500 ± 917
Magnesium	2 210 ± 242	N.S.	2 570 ± 344	3 090 ± 183	3 520 ± 273	3 180 ± 379
Potassium	7 050 ± 1 820	N.S.	8 900 ± 1 520	10 500 ± 1 340	15 400 ± 602	15 300 ± 1 180
Manganese	745 ± 156	N.S.	644 ± 204	360 ± 73	342 ± 59	450 ± 102
Aluminum	N.D.	N.S.	59 ± 21	N.D.	145 ± 6	90 ± 27
Iron	99 ± 10	N.S.	77 ± 6	101 ± 11	121 ± 10	73 ± 11
Phosphorus	1 360 ± 331	N.S.	1 960 ± 132	1 750 ± 140	1 720 ± 112	1 700 ± 173
	Feather moss					
Sulfur	1 180 ± 90	1 070 ± 34	1 170 ± 121			
Calcium	4 130 ± 565	4 430 ± 330	5 890 ± 1 530			
Magnesium	908 ± 50	1 220 ± 67	970 ± 190			
Potassium	5 210 ± 500	5 910 ± 322	3 650 ± 554			
Manganese	539 ± 107	515 ± 49	669 ± 130			
Aluminum	N.D.	458 ± 41	782 ± 571			
Iron	702 ± 76	443 ± 36	730 ± 621			
Phosphorus	1 250 ± 133	1 800 ± 154	1 280 ± 151			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 8 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	736 ± 56	455 ± 48	803 ± 57	1 140 ± 156	879 ± 87	1 080 ± 84
Calcium	8 670 ± 1 410	6 410 ± 1 230	8 700 ± 1 370	2 200 ± 381	2 640 ± 416	3 720 ± 1 100
Magnesium	952 ± 146	845 ± 107	979 ± 120	1 050 ± 150	1 110 ± 87	1 440 ± 199
Potassium	4 410 ± 462	4 690 ± 608	5 010 ± 567	4 640 ± 758	3 890 ± 582	4 540 ± 510
Manganese	395 ± 89	318 ± 96	731 ± 237	568 ± 115	714 ± 99	853 ± 313
Aluminum	N.D.[a]	30 ± 3	25 ± 3	N.D.	512 ± 71	666 ± 72
Iron	36 ± 11	28 ± 8	31 ± 2	74 ± 7	30 ± 2	59 ± 8
Phosphorus	1 240 ± 125	1 160 ± 114	1 850 ± 165	1 060 ± 101	1 190 ± 107	1 370 ± 94
Nitrogen[b]	N.D.	N.D.	10.7 ± 0.5	N.D.	N.D.	13.3 ± 0.4
	Alder			Twin-flower		
Sulfur	N.S.[c]	N.S.	N.S.	1 020 ± 37	675 ± 65	987 ± 100
Calcium	N.S.	N.S.	N.S.	11 600 ± 580	13 400 ± 1 630	10 000 ± 721
Magnesium	N.S.	N.S.	N.S.	3 090 ± 75	3 720 ± 179	2 940 ± 74
Potassium	N.S.	N.S.	N.S.	13 800 ± 998	14 500 ± 764	14 300 ± 904
Manganese	N.S.	N.S.	N.S.	339 ± 63	216 ± 32	301 ± 44
Aluminum	N.S.	N.S.	N.S.	N.D.	471 ± 481	91 ± 25
Iron	N.S.	N.S.	N.S.	157 ± 34	446 ± 492	75 ± 19
Phosphorus	N.S.	N.S.	N.S.	1 740 ± 88	1 500 ± 174	1 570 ± 169
	Feather moss					
Sulfur	1 010 ± 100	831 ± 36	1 060 ± 122			
Calcium	4 540 ± 415	4 370 ± 598	6 040 ± 1 380			
Magnesium	1 140 ± 148	1 230 ± 76	1 290 ± 240			
Potassium	5 230 ± 502	4 940 ± 226	3 770 ± 496			
Manganese	688 ± 178	265 ± 32	525 ± 119			
Aluminum	N.D.	305 ± 30	598 ± 109			
Iron	653 ± 52	360 ± 30	620 ± 96			
Phosphorus	1 420 ± 162	1 380 ± 87	1 330 ± 197			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 9 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	852 ± 46	550 ± 38	988 ± 55	1 200 ± 77	992 ± 100	1 120 ± 76
Calcium	6 890 ± 1 780	5 830 ± 1 480	7 680 ± 1 890	2 180 ± 499	2 260 ± 583	2 430 ± 466
Magnesium	894 ± 89	793 ± 76	1 150 ± 110	1 000 ± 185	1 040 ± 122	1 200 ± 195
Potassium	5 650 ± 644	5 860 ± 715	5 960 ± 601	4 700 ± 521	3 780 ± 401	4 630 ± 481
Manganese	1 050 ± 425	786 ± 364	925 ± 298	635 ± 155	749 ± 122	710 ± 144
Aluminum	N.D.[a]	32 ± 5	22 ± 8	N.D.	641 ± 80	789 ± 147
Iron	21 ± 3	51 ± 54	20 ± 4	54 ± 8	36 ± 13	40 ± 5
Phosphorus	1 530 ± 195	1 340 ± 143	1 960 ± 200	1 150 ± 96	1 140 ± 64	1 240 ± 89
Nitrogen[b]	N.D.	N.D.	11.0 ± 1.0	N.D.	N.D.	11.3 ± 0.7
	Alder			Twin-flower		
Sulfur	1 740 ± 118	N.S.[c]	2 100 ± 439	1 080 ± 81	769 ± 40	932 ± 72
Calcium	12 800 ± 1 520	N.S.	10 100 ± 1 360	11 700 ± 663	12 200 ± 793	10 100 ± 873
Magnesium	2 460 ± 347	N.S.	2 290 ± 187	2 920 ± 110	3 430 ± 239	2 780 ± 239
Potassium	8 000 ± 1 650	N.S.	8 530 ± 1 000	16 700 ± 1 340	17 300 ± 647	14 500 ± 804
Manganese	655 ± 100	N.S.	433 ± 104	368 ± 59	256 ± 57	353 ± 56
Aluminum	N.D.	N.S.	59 ± 10	N.D.	128 ± 29	157 ± 52
Iron	92 ± 11	N.S.	61 ± 8	168 ± 21	97 ± 16	104 ± 35
Phosphorus	1 300 ± 82	N.S.	1 870 ± 125	1 850 ± 153	1 650 ± 124	1 530 ± 123
	Feather moss					
Sulfur	1 110 ± 67	1 150 ± 55	1 140 ± 39			
Calcium	3 110 ± 171	3 420 ± 226	3 680 ± 301			
Magnesium	861 ± 68	1 220 ± 88	906 ± 101			
Potassium	5 590 ± 283	5 940 ± 383	3 590 ± 467			
Manganese	342 ± 21	436 ± 25	437 ± 70			
Aluminum	N.D.	545 ± 46	795 ± 143			
Iron	678 ± 70	412 ± 26	725 ± 159			
Phosphorus	1 480 ± 131	1 670 ± 85	1 240 ± 55			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 10 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	1 160 ± 91	582 ± 34	1 040 ± 49	1 080 ± 110	860 ± 63	1 190 ± 99
Calcium	5 050 ± 911	3 260 ± 399	4 790 ± 696	2 260 ± 320	2 310 ± 331	3 070 ± 564
Magnesium	937 ± 116	704 ± 87	1 060 ± 129	867 ± 73	1 030 ± 81	1 090 ± 102
Potassium	5 090 ± 857	4 770 ± 327	5 530 ± 492	4 400 ± 456	3 380 ± 498	4 750 ± 505
Manganese	2 040 ± 254	1 440 ± 270	1 810 ± 214	899 ± 139	838 ± 110	1 100 ± 133
Aluminum	N.D.[a]	26 ± 3	79 ± 27	N.D.	742 ± 147	852 ± 156
Iron	24 ± 10	16 ± 2	68 ± 23	56 ± 7	18 ± 3	41 ± 4
Phosphorus	1 360 ± 222	1 090 ± 92	1 550 ± 147	984 ± 117	1 010 ± 70	1 280 ± 114
Nitrogen[b]	N.D.	N.D.	9.7 ± 0.4	N.D.	N.D.	11.9 ± 0.7
	Alder			Twin-flower		
Sulfur	1 500 ± 79	N.S.[c]	N.S.	1 120 ± 54	820 ± 51	898 ± 41
Calcium	11 900 ± 717	N.S.	N.S.	11 100 ± 689	9 960 ± 698	8 840 ± 661
Magnesium	2 610 ± 159	N.S.	N.S.	3 540 ± 204	3 640 ± 336	2 960 ± 301
Potassium	8 190 ± 1 180	N.S.	N.S.	15 200 ± 786	17 700 ± 2 310	12 100 ± 985
Manganese	1 530 ± 256	N.S.	N.S.	526 ± 66	523 ± 121	646 ± 90
Aluminum	N.D.	N.S.	N.S.	N.D.	116 ± 22	161 ± 33
Iron	106 ± 10	N.S.	N.S.	145 ± 64	87 ± 17	100 ± 17
Phosphorus	1 290 ± 97	N.S.	N.S.	1 780 ± 142	1 790 ± 94	1 430 ± 109
	Feather moss					
Sulfur	1 110 ± 48	1 030 ± 39	1 120 ± 72			
Calcium	2 510 ± 123	2 720 ± 125	3 500 ± 312			
Magnesium	755 ± 45	1 050 ± 90	840 ± 78			
Potassium	5 240 ± 402	6 420 ± 627	3 820 ± 592			
Manganese	508 ± 62	742 ± 80	671 ± 110			
Aluminum	N.D.	523 ± 52	611 ± 101			
Iron	555 ± 94	308 ± 38	401 ± 100			
Phosphorus	1 170 ± 73	1 500 ± 130	1 130 ± 100			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 11 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	886 ± 78	653 ± 72	990 ± 97	1 300 ± 147	977 ± 81	1 300 ± 101
Calcium	6 410 ± 1 340	5 670 ± 797	7 380 ± 1 580	1 750 ± 396	1 940 ± 629	3 250 ± 582
Magnesium	1 010 ± 96	929 ± 81	1 210 ± 146	1 080 ± 200	954 ± 109	1 400 ± 162
Potassium	4 730 ± 722	5 220 ± 922	5 930 ± 1 240	4 780 ± 742	4 100 ± 321	4 320 ± 426
Manganese	878 ± 260	703 ± 267	878 ± 210	434 ± 112	617 ± 123	976 ± 200
Aluminum	N.D.[a]	48 ± 5	30 ± 10	N.D.	576 ± 112	772 ± 164
Iron	31 ± 3	35 ± 4	23 ± 4	66 ± 14	30 ± 7	49 ± 7
Phosphorus	1 320 ± 116	1 370 ± 288	2 100 ± 204	1 200 ± 131	1 090 ± 114	1 420 ± 119
Nitrogen[b]	N.D.	N.D.	13.8 ± 0.9	N.D.	N.D.	13.3 ± 1.0
	Alder			Twin-flower		
Sulfur	1 610 ± 144	N.S.[c]	1 980 ± 133	1 080 ± 53	858 ± 33	984 ± 71
Calcium	11 800 ± 1 300	N.S.	8 880 ± 1 270	9 750 ± 518	12 200 ± 1 560	9 330 ± 1 210
Magnesium	2 170 ± 310	N.S.	2 060 ± 222	2 860 ± 218	3 440 ± 271	3 020 ± 446
Potassium	9 080 ± 1 370	N.S.	8 610 ± 791	14 200 ± 980	18 200 ± 826	13 400 ± 879
Manganese	908 ± 181	N.S.	893 ± 317	445 ± 39	295 ± 53	474 ± 88
Aluminum	N.D.	N.S.	66 ± 15	N.D.	152 ± 19	112 ± 27
Iron	91 ± 9	N.S.	80 ± 6	145 ± 38	154 ± 48	87 ± 13
Phosphorus	1 270 ± 103	N.S.	1 870 ± 147	1 560 ± 110	1 810 ± 139	1 530 ± 140
	Feather moss					
Sulfur	1 250 ± 55	1 170 ± 56	1 260 ± 84			
Calcium	3 060 ± 285	3 440 ± 346	3 560 ± 427			
Magnesium	959 ± 127	1 130 ± 116	909 ± 116			
Potassium	5 550 ± 294	5 940 ± 542	4 030 ± 442			
Manganese	346 ± 68	289 ± 36	448 ± 103			
Aluminum	N.D.	531 ± 72	555 ± 78			
Iron	687 ± 64	432 ± 53	429 ± 46			
Phosphorus	1 440 ± 85	1 520 ± 113	1 230 ± 85			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 12 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	1 040 ± 89	712 ± 57	1 140 ± 132	1 510 ± 247	1 160 ± 82	1 420 ± 114
Calcium	6 390 ± 1 540	4 090 ± 761	9 410 ± 1 020	1 670 ± 363	2 370 ± 545	3 820 ± 626
Magnesium	728 ± 75	708 ± 67	1 190 ± 137	1 010 ± 171	1 190 ± 162	1 280 ± 165
Potassium	4 150 ± 659	4 600 ± 593	6 060 ± 744	4 690 ± 660	3 350 ± 262	4 640 ± 296
Manganese	1 140 ± 478	772 ± 385	944 ± 321	660 ± 183	859 ± 163	1 020 ± 171
Aluminum	N.D.[a]	30 ± 4	12 ± 7	N.D.	546 ± 45	828 ± 117
Iron	28 ± 3	36 ± 17	16 ± 5	53 ± 7	36 ± 4	43 ± 3
Phosphorus	1 300 ± 132	1 400 ± 222	2 150 ± 243	1 070 ± 68	1 120 ± 74	1 310 ± 114
Nitrogen[b]	N.D.	N.D.	11.5 ± 0.7	N.D.	N.D.	11.2 ± 0.9
	Alder			Twin-flower		
Sulfur	2 410 ± 308	N.S.[c]	2 600 ± 262	1 670 ± 81	1 490 ± 91	1 280 ± 121
Calcium	12 500 ± 2 150	N.S.	10 300 ± 979	8 520 ± 482	13 300 ± 885	11 200 ± 564
Magnesium	2 050 ± 260	N.S.	2 180 ± 156	2 810 ± 136	2 810 ± 119	2 760 ± 246
Potassium	7 780 ± 700	N.S.	8 920 ± 777	13 200 ± 963	16 600 ± 760	14 700 ± 912
Manganese	1 290 ± 311	N.S.	1 090 ± 353	357 ± 55	198 ± 26	370 ± 63
Aluminum	N.D.	N.S.	83 ± 21	N.D.	119 ± 9	154 ± 28
Iron	87 ± 9	N.S.	95 ± 9	141 ± 25	118 ± 8	117 ± 31
Phosphorus	1 350 ± 172	N.S.	2 060 ± 135	1 740 ± 77	1 580 ± 43	1 520 ± 106
	Feather moss					
Sulfur	2 040 ± 82	1 800 ± 53	2 580 ± 194			
Calcium	2 700 ± 354	7 890 ± 601	4 520 ± 1 480			
Magnesium	774 ± 91	1 090 ± 72	784 ± 146			
Potassium	5 730 ± 498	5 130 ± 210	4 010 ± 639			
Manganese	297 ± 104	292 ± 44	347 ± 67			
Aluminum	N.D.	509 ± 42	686 ± 145			
Iron	620 ± 96	547 ± 51	628 ± 106			
Phosphorus	1 430 ± 88	1 530 ± 74	1 420 ± 161			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 13 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	857 ± 61	652 ± 77	994 ± 95	1 380 ± 119	882 ± 92	1 210 ± 75
Calcium	7 780 ± 1 030	8 480 ± 1 420	8 690 ± 1 710	1 680 ± 263	1 820 ± 308	3 620 ± 962
Magnesium	786 ± 84	821 ± 104	1 070 ± 113	917 ± 90	989 ± 109	1 320 ± 97
Potassium	5 150 ± 532	5 470 ± 939	5 310 ± 792	5 800 ± 684	3 840 ± 391	4 350 ± 506
Manganese	541 ± 168	515 ± 149	566 ± 217	312 ± 94	578 ± 99	602 ± 198
Aluminum	N.D.[a]	31 ± 12	16 ± 4	N.D.	398 ± 63	566 ± 171
Iron	25 ± 6	38 ± 7	29 ± 8	70 ± 10	23 ± 5	44 ± 5
Phosphorus	1 310 ± 136	1 290 ± 148	1 660 ± 189	1 480 ± 226	1 050 ± 43	1 260 ± 106
Nitrogen[b]	N.D.	N.D.	11.9 ± 0.7	N.D.	N.D.	12.6 ± 0.8
	Alder			Twin-flower		
Sulfur	1 730 ± 159	N.S.[c]	2 500 ± 215	1 030 ± 50	734 ± 30	1 280 ± 106
Calcium	11 100 ± 1 320	N.S.	10 800 ± 1 040	9 820 ± 675	13 500 ± 1 410	11 400 ± 1 560
Magnesium	2 160 ± 168	N.S.	2 380 ± 170	2 900 ± 129	3 340 ± 347	3 100 ± 310
Potassium	10 400 ± 2 040	N.S.	10 200 ± 1 750	15 300 ± 1 620	13 900 ± 1 760	17 500 ± 1 360
Manganese	787 ± 366	N.S.	496 ± 168	287 ± 36	266 ± 73	294 ± 56
Aluminum	N.D.	N.S.	39 ± 16	N.D.	340 ± 174	106 ± 29
Iron	97 ± 10	N.S.	83 ± 8	142 ± 15	327 ± 187	94 ± 14
Phosphorus	1 270 ± 188	N.S.	1 990 ± 161	1 720 ± 142	1 310 ± 87	1 880 ± 194
	Feather moss					
Sulfur	1 110 ± 67	1 160 ± 54	1 580 ± 196			
Calcium	3 600 ± 337	4 190 ± 207	6 250 ± 1 770			
Magnesium	1 030 ± 83	1 240 ± 112	1 010 ± 151			
Potassium	5 590 ± 493	5 390 ± 429	3 710 ± 648			
Manganese	362 ± 85	332 ± 16	500 ± 223			
Aluminum	N.D.	992 ± 117	535 ± 129			
Iron	483 ± 77	878 ± 120	514 ± 106			
Phosphorus	1 450 ± 123	1 700 ± 97	1 440 ± 204			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 14 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	1 180 ± 109	704 ± 84	980 ± 100	1 400 ± 168	1 080 ± 81	1 200 ± 72
Calcium	6 580 ± 1 450	6 610 ± 1 280	7 020 ± 930	1 550 ± 300	2 600 ± 335	3 860 ± 644
Magnesium	801 ± 75	629 ± 105	1 010 ± 123	1 090 ± 140	1 110 ± 200	1 310 ± 176
Potassium	5 590 ± 722	4 230 ± 501	5 180 ± 567	5 860 ± 848	4 060 ± 476	4 270 ± 497
Manganese	2 080 ± 326	1 920 ± 314	1 610 ± 675	525 ± 100	871 ± 171	1 070 ± 230
Aluminum	N.D.[a]	22 ± 5	18 ± 8	N.D.	462 ± 76	625 ± 64
Iron	29 ± 5	29 ± 9	23 ± 8	66 ± 14	24 ± 3	36 ± 3
Phosphorus	1 300 ± 153	1 020 ± 92	1 700 ± 221	1 250 ± 182	1 070 ± 57	1 190 ± 84
Nitrogen[b]	N.D.	N.D.	10.6 ± 0.9	N.D.	N.D.	11.7 ± 0.9
	Alder			Twin-flower		
Sulfur	2 150 ± 273	N.S.[c]	2 450 ± 275	1 550 ± 115	900 ± 69	1 070 ± 101
Calcium	13 500 ± 865	N.S.	10 400 ± 603	12 500 ± 420	13 900 ± 700	10 400 ± 1 120
Magnesium	2 380 ± 220	N.S.	2 200 ± 189	3 510 ± 179	3 000 ± 234	2 980 ± 386
Potassium	7 330 ± 897	N.S.	9 330 ± 962	12 400 ± 991	14 600 ± 494	15 100 ± 1 200
Manganese	839 ± 363	N.S.	394 ± 94	238 ± 27	225 ± 53	391 ± 62
Aluminum	N.D.	N.S.	11 ± 5	N.D.	109 ± 9	135 ± 29
Iron	99 ± 18	N.S.	54 ± 8	263 ± 317	101 ± 12	89 ± 16
Phosphorus	1 370 ± 248	N.S.	1 970 ± 126	2 210 ± 181	1 400 ± 72	1 520 ± 154
	Feather moss					
Sulfur	1 200 ± 109	1 230 ± 72	1 400 ± 71			
Calcium	2 900 ± 279	3 020 ± 245	3 930 ± 424			
Magnesium	858 ± 109	1 060 ± 105	900 ± 64			
Potassium	5 130 ± 472	6 000 ± 275	4 210 ± 469			
Manganese	276 ± 35	366 ± 56	525 ± 101			
Aluminum	N.D.	390 ± 61	508 ± 65			
Iron	408 ± 87	354 ± 49	394 ± 72			
Phosphorus	1 230 ± 117	1 460 ± 95	1 260 ± 59			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 16 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	936 ± 240	694 ± 66	876 ± 82	1 350 ± 138	902 ± 86	1 230 ± 107
Calcium	5 910 ± 2 160	5 750 ± 1 080	6 570 ± 1 260	1 500 ± 254	1 880 ± 592	2 850 ± 613
Magnesium	782 ± 208	829 ± 106	1 080 ± 175	1 010 ± 102	981 ± 222	1 290 ± 118
Potassium	4 730 ± 1 310	4 980 ± 944	5 290 ± 368	5 040 ± 839	3 980 ± 449	5 020 ± 456
Manganese	1 560 ± 508	1 440 ± 324	652 ± 163	551 ± 105	680 ± 185	698 ± 160
Aluminum	N.D.[a]	30 ± 5	24 ± 5	N.D.	497 ± 51	568 ± 118
Iron	31 ± 13	39 ± 8	26 ± 3	70 ± 9	17 ± 3	39 ± 3
Phosphorus	1 280 ± 332	1 360 ± 181	1 910 ± 274	1 290 ± 124	1 180 ± 61	1 390 ± 79
Nitrogen[b]	N.D.	N.D.	11.8 ± 1.4	N.D.	N.D.	13.0 ± 0.6
	Alder			Twin-flower		
Sulfur	1 720 ± 109	N.S.[c]	N.S.	1 100 ± 66	737 ± 50	1 060 ± 67
Calcium	11 200 ± 1 320	N.S.	N.S.	9 360 ± 696	11 900 ± 649	10 000 ± 957
Magnesium	2 270 ± 240	N.S.	N.S.	3 160 ± 182	3 270 ± 111	3 310 ± 135
Potassium	10 500 ± 1 340	N.S.	N.S.	14 300 ± 807	15 800 ± 812	13 300 ± 1 360
Manganese	1 110 ± 552	N.S.	N.S.	310 ± 38	237 ± 41	464 ± 36
Aluminum	N.D.	N.S.	N.S.	N.D.	150 ± 45	155 ± 36
Iron	142 ± 82	N.S.	N.S.	134 ± 33	170 ± 129	93 ± 23
Phosphorus	1 500 ± 480	N.S.	N.S.	1 600 ± 166	1 490 ± 212	1 700 ± 119
	Feather moss					
Sulfur	902 ± 54	887 ± 23	1 180 ± 83			
Calcium	2 390 ± 382	2 690 ± 193	3 940 ± 885			
Magnesium	780 ± 114	939 ± 55	911 ± 69			
Potassium	4 950 ± 650	5 030 ± 302	3 730 ± 421			
Manganese	275 ± 51	383 ± 36	603 ± 166			
Aluminum	N.D.	570 ± 63	624 ± 81			
Iron	561 ± 31	493 ± 67	430 ± 55			
Phosphorus	987± 110	1 110 ± 68	1 240 ± 114			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 17 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	958 ± 70	789 ± 107	922 ± 62	1 180 ± 87	836 ± 67	1 280 ± 99
Calcium	4 680 ± 822	5 600 ± 957	7 680 ± 1 670	2 930 ± 466	1 900 ± 420	3 400 ± 396
Magnesium	846 ± 60	855 ± 74	1 060 ± 128	1 080 ± 115	934 ± 99	1 390 ± 113
Potassium	5 400 ± 755	4 810 ± 690	5 490 ± 930	4 720 ± 554	4 140 ± 692	4 430 ± 340
Manganese	1 150 ± 184	1 230 ± 237	1 290 ± 554	666 ± 119	551 ± 55	890 ± 290
Aluminum	N.D.[a]	38 ± 5	16 ± 6	N.D.	412 ± 151	601 ± 109
Iron	25 ± 10	43 ± 6	25 ± 5	77 ± 14	18 ± 3	42 ± 5
Phosphorus	1 220 ± 125	1 140 ± 116	1 920 ± 269	1 050 ± 61	961 ± 68	1 380 ± 152
Nitrogen[b]	N.D.	N.D.	11.4 ± 1.1	N.D.	N.D.	13.5 ± 0.8
	Alder			Twin-flower		
Sulfur	1 610 ± 141	N.S.[c]	2 370 ± 196	1 150 ± 43	734 ± 48	1 120 ± 113
Calcium	12 800 ± 1 160	N.S.	10 400 ± 647	12 700 ± 811	14 900 ± 1 420	10 600 ± 1 590
Magnesium	2 250 ± 182	N.S.	2 350 ± 295	2 750 ± 100	3 130 ± 100	2 670 ± 229
Potassium	8 390 ± 1 630	N.S.	8 820 ± 978	14 000 ± 1 170	15 200 ± 513	13 700 ± 1 300
Manganese	478 ± 146	N.S.	584 ± 209	345 ± 43	280 ± 34	479 ± 95
Aluminum	N.D.	N.S.	44 ± 14	N.D.	334 ± 118	150 ± 27
Iron	94 ± 10	N.S.	77 ± 8	427 ± 179	315 ± 107	161 ± 95
Phosphorus	1 230 ± 138	N.S.	2 210 ± 181	1 640 ± 150	1 530 ± 121	1 690 ± 115
	Feather moss					
Sulfur	1 040 ± 44	993 ± 73	1 340 ± 110			
Calcium	3 240 ± 395	3 620 ± 266	4 960 ± 1 340			
Magnesium	919 ± 29	1 050 ± 74	1 030 ± 121			
Potassium	5 160 ± 160	4 820 ± 263	3 870 ± 709			
Manganese	386 ± 49	536 ± 52	556 ± 116			
Aluminum	N.D.	477 ± 77	631 ± 83			
Iron	675 ± 45	497 ± 78	578 ± 116			
Phosphorus	1 240 ± 82	1 330 ± 91	1 450 ± 125			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 18 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	702 ± 87	479 ± 38	907 ± 85	979 ± 107	730 ± 63	1 090 ± 129
Calcium	5 760 ± 1 020	3 860 ± 850	6 240 ± 735	2 020 ± 268	2 430 ± 649	3 650 ± 762
Magnesium	848 ± 112	765 ± 98	1 060 ± 88	1 020 ± 94	1 010 ± 107	1 340 ± 230
Potassium	4 370 ± 867	5 940 ± 2 620	4 920 ± 462	3 970 ± 918	3 630 ± 471	4 690 ± 586
Manganese	883 ± 355	619 ± 252	1 280 ± 377	365 ± 71	625 ± 144	612 ± 152
Aluminum	N.D.[a]	30 ± 7	19 ± 3	N.D.	651 ± 112	667 ± 199
Iron	45 ± 4	48 ± 19	32 ± 3	133 ± 10	32 ± 3	59 ± 9
Phosphorus	848 ± 84	939 ± 120	1 360 ± 99	975 ± 132	1 010 ± 60	1 250 ± 95
Nitrogen[b]	N.D.	N.D.	10.2 ± 0.8	N.D.	N.D.	11.6 ± 0.5
	Alder			Twin-flower		
Sulfur	N.S.[c]	N.S.	N.S.	1 090 ± 43	737 ± 72	1 020 ± 66
Calcium	N.S.	N.S.	N.S.	11 700 ± 812	13 000 ± 740	11 600 ± 1 350
Magnesium	N.S.	N.S.	N.S.	2 470 ± 119	2 790 ± 165	2 890 ± 278
Potassium	N.S.	N.S.	N.S.	13 300 ± 948	15 200 ± 987	13 700 ± 868
Manganese	N.S.	N.S.	N.S.	319 ± 45	165 ± 26	264 ± 71
Aluminum	N.S.	N.S.	N.S.	N.D.	209 ± 91	117 ± 26
Iron	N.S.	N.S.	N.S.	365 ± 65	232 ± 119	151 ± 24
Phosphorus	N.S.	N.S.	N.S.	1 450 ± 106	1 430 ± 105	1 480 ± 183
	Feather moss					
Sulfur	1 010 ± 100	872 ± 43	1 150 ± 108			
Calcium	5 430 ± 702	6 030 ± 416	6 130 ± 1 290			
Magnesium	1 160 ± 150	1 420 ± 56	1 140 ± 96			
Potassium	4 850 ± 809	5 140 ± 257	3 920 ± 463			
Manganese	445 ± 111	297 ± 34	395 ± 195			
Aluminum	N.D.	456 ± 64	509 ± 97			
Iron	842 ± 124	607 ± 79	682 ± 93			
Phosphorus	1 180 ± 223	1 100 ± 84	1 270 ± 155			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 19 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	765 ± 75	448 ± 37	857 ± 67	988 ± 106	781 ± 67	1 030 ± 57
Calcium	6 260 ± 1 920	4 490 ± 1 100	9 990 ± 2 070	2 520 ± 599	2 260 ± 672	3 810 ± 803
Magnesium	979 ± 145	804 ± 80	1 100 ± 119	1 110 ± 200	1 010 ± 123	1 490 ± 247
Potassium	4 070 ± 732	4 350 ± 580	5 210 ± 665	4 320 ± 731	3 910 ± 375	4 490 ± 433
Manganese	901 ± 480	705 ± 277	1 140 ± 335	518 ± 112	637 ± 142	753 ± 154
Aluminum	N.D.[a]	21 ± 3	19 ± 4	N.D.	444 ± 90	508 ± 113
Iron	224 ± 459	53 ± 45	26 ± 5	78 ± 14	27 ± 4	54 ± 5
Phosphorus	988 ± 122	932 ± 80	1 590 ± 142	1 080 ± 76	1 040 ± 59	1 230 ± 52
Nitrogen[b]	N.D.	N.D.	10.6 ± 0.5	N.D.	N.D.	11.3 ± 0.8
	Alder			Twin-flower		
Sulfur	N.S.[c]	N.S.	N.S.	922 ± 29	699 ± 28	883 ± 33
Calcium	N.S.	N.S.	N.S.	10 200 ± 532	10 800 ± 574	10 900 ± 634
Magnesium	N.S.	N.S.	N.S.	2 390 ± 128	2 790 ± 165	2 860 ± 215
Potassium	N.S.	N.S.	N.S.	12 550 ± 555	16 800 ± 1 110	13 000 ± 826
Manganese	N.S.	N.S.	N.S.	249 ± 54	155 ± 38	330 ± 63
Aluminum	N.S.	N.S.	N.S.	N.D.	115 ± 12	109 ± 27
Iron	N.S.	N.S.	N.S.	183 ± 32	118 ± 17	110 ± 32
Phosphorus	N.S.	N.S.	N.S.	1 450 ± 61	1 620 ± 65	1 250 ± 77
	Feather moss					
Sulfur	1 120 ± 72	907 ± 36	1 220 ± 93			
Calcium	4 280 ± 573	3 370 ± 264	5 680 ± 625			
Magnesium	1 230 ± 191	1 300 ± 99	1 180 ± 119			
Potassium	5 390 ± 536	5 910 ± 306	3 400 ± 501			
Manganese	472 ± 123	608 ± 46	678 ± 236			
Aluminum	N.D.	325 ± 31	748 ± 182			
Iron	733 ± 74	333 ± 27	899 ± 262			
Phosphorus	1 290 ± 119	1 270 ± 105	1 200 ± 137			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 20 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	1 030 ± 107	526 ± 42	977 ± 69	1 260 ± 97	873 ± 59	1 210 ± 82
Calcium	6 890 ± 1 990	3 800 ± 1 350	8 080 ± 1 240	1 710 ± 237	2 070 ± 348	3 940 ± 731
Magnesium	971 ± 193	759 ± 186	1 140 ± 204	1 060 ± 96	929 ± 72	1 730 ± 180
Potassium	4 780 ± 675	5 260 ± 765	5 450 ± 478	4 610 ± 639	3 700 ± 275	4 820 ± 565
Manganese	1 200 ± 481	596 ± 238	1 100 ± 341	447 ± 110	477 ± 71	769 ± 187
Aluminum	N.D.[a]	21 ± 6	21 ± 4	N.D.	451 ± 47	640 ± 87
Iron	49 ± 10	39 ± 19	40 ± 18	85 ± 23	18 ± 3	48 ± 5
Phosphorus	1 250 ± 191	1 130 ± 136	2 070 ± 257	1 160 ± 117	1 080 ± 59	1 430 ± 50
Nitrogen[b]	N.D.	N.D.	13.8 ± 1.0	N.D.	N.D.	14.1 ± 0.7
	Alder			Twin-flower		
Sulfur	1 770 ± 219	N.S.[c]	1 840 ± 160	1 280 ± 59	869 ± 42	1 150 ± 81
Calcium	12 100 ± 1 250	N.S.	10 300 ± 807	12 200 ± 599	12 000 ± 386	10 100 ± 830
Magnesium	2 320 ± 221	N.S.	2 200 ± 220	3 180 ± 148	3 150 ± 256	3 490 ± 205
Potassium	7 820 ± 1 480	N.S.	7 910 ± 1 020	13 400 ± 818	18 400 ± 1 410	14 200 ± 1 160
Manganese	909 ± 231	N.S.	699 ± 260	205 ± 41	215 ± 47	420 ± 75
Aluminum	N.D.	N.S.	56 ± 12	N.D.	115 ± 20	123 ± 20
Iron	95 ± 9	N.S.	92 ± 13	126 ± 22	132 ± 86	101 ± 13
Phosphorus	1 530 ± 254	N.S.	1 910 ± 151	2 040 ± 151	1 980 ± 68	2 000 ± 98
	Feather moss					
Sulfur	1 070 ± 76	1 150 ± 50	1 160 ± 123			
Calcium	3 500 ± 940	5 230 ± 436	3 910 ± 736			
Magnesium	1 040 ± 110	1 430 ± 85	960 ± 129			
Potassium	5 980 ± 409	6 310 ± 761	3 790 ± 379			
Manganese	293 ± 89	462 ± 31	373 ± 96			
Aluminum	N.D.	487 ± 49	554 ± 94			
Iron	520 ± 95	484 ± 58	434 ± 87			
Phosphorus	1 340 ± 188	1 750 ± 91	1 270 ± 137			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 21 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	963 ± 51	492 ± 29	966 ± 97	1 130 ± 94	949 ± 112	1 170 ± 84
Calcium	9 270 ± 1 520	5 310 ± 1 200	7 390 ± 1 080	1 980 ± 358	2 600 ± 300	2 760 ± 524
Magnesium	1 190 ± 144	805 ± 84	1 110 ± 168	907 ± 128	968 ± 77	1 260 ± 192
Potassium	4 470 ± 477	5 790 ± 984	5 610 ± 315	4 040 ± 737	3 840 ± 328	5 250 ± 662
Manganese	784 ± 212	461 ± 178	924 ± 458	690 ± 152	1 020 ± 160	856 ± 210
Aluminum	N.D.[a]	25 ± 4	13 ± 6	N.D.	441 ± 74	542 ± 92
Iron	13 ± 17	48 ± 35	22 ± 4	75 ± 10	22 ± 4	40 ± 5
Phosphorus	1 320 ± 155	1 170 ± 50	1 910 ± 179	1 060 ± 90	1 040 ± 56	1 360 ± 102
Nitrogen[b]	N.D.	N.D.	11.8 ± 1.0	N.D.	N.D.	14.0 ± 1.4
	Alder			Twin-flower		
Sulfur	1 790 ± 200	N.S.[c]	2 230 ± 197	1 180 ± 62	865 ± 28	1 060 ± 101
Calcium	11 900 ± 1 240	N.S.	13 200 ± 1 580	13 300 ± 475	12 400 ± 796	11 100 ± 1 150
Magnesium	2 430 ± 247	N.S.	2 900 ± 461	3 050 ± 112	3 070 ± 175	3 300 ± 197
Potassium	6 790 ± 1 510	N.S.	8 680 ± 816	13 000 ± 1 270	18 600 ± 835	14 900 ± 770
Manganese	738 ± 186	N.S.	706 ± 241	345 ± 39	195 ± 22	413 ± 93
Aluminum	N.D.	N.S.	59 ± 12	N.D.	117 ± 11	125 ± 34
Iron	64 ± 46	N.S.	98 ± 11	1 120 ± 2 280	105 ± 9	109 ± 16
Phosphorus	1 450 ± 242	N.S.	2 190 ± 198	1 830 ± 72	1 830 ± 124	1 800 ± 122
	Feather moss					
Sulfur	1 170 ± 112	1 290 ± 70	1 240 ± 59			
Calcium	5 440 ± 747	6 050 ± 370	5 770 ± 912			
Magnesium	1 120 ± 85	1 490 ± 74	1 130 ± 158			
Potassium	5 090 ± 433	6 090 ± 300	4 060 ± 595			
Manganese	648 ± 89	696 ± 73	872 ± 256			
Aluminum	N.D.	719 ± 72	620 ± 75			
Iron	1 100 ± 143	753 ± 105	483 ± 107			
Phosphorus	1 320 ± 143	1 790 ± 107	1 370 ± 72			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 22 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	978 ± 80	584 ± 106	919 ± 41	1 060 ± 97	883 ± 50	1 230 ± 94
Calcium	7 040 ± 1 100	6 960 ± 1 280	8 190 ± 600	1 960 ± 311	2 440 ± 459	3 670 ± 1 090
Magnesium	987 ± 147	855 ± 100	1 180 ± 124	981 ± 146	983 ± 84	1 360 ± 253
Potassium	5 120 ± 671	4 140 ± 788	5 220 ± 404	4 410 ± 292	3 580 ± 277	4 540 ± 448
Manganese	1 040 ± 494	921 ± 339	1 010 ± 264	624 ± 138	837 ± 166	951 ± 235
Aluminum	N.D.[a]	59 ± 13	20 ± 2	N.D.	467 ± 61	649 ± 93
Iron	66 ± 16	53 ± 9	24 ± 4	111 ± 29	37 ± 6	51 ± 7
Phosphorus	1 560 ± 165	1 160 ± 144	1 920 ± 161	948 ± 44	1 030 ± 42	1 360 ± 91
Nitrogen[b]	N.D.	N.D.	12.0 ± 0.8	N.D.	N.D.	13.5 ± 1.3
	Alder			Twin-flower		
Sulfur	1 720 ± 234	N.S.[c]	2 240 ± 256	1 170 ± 60	597 ± 51	935 ± 91
Calcium	11 800 ± 1 310	N.S.	9 620 ± 741	12 300 ± 517	12 600 ± 1 320	10 100 ± 790
Magnesium	2 370 ± 208	N.S.	2 180 ± 146	3 570 ± 86	3 560 ± 460	2 990 ± 319
Potassium	7 190 ± 746	N.S.	9 090 ± 1 590	12 500 ± 771	12 600 ± 1 510	14 900 ± 1 140
Manganese	632 ± 163	N.S.	513 ± 139	315 ± 44	467 ± 175	446 ± 62
Aluminum	N.D.	N.S.	59 ± 8	N.D.	155 ± 21	104 ± 15
Iron	143 ± 13	N.S.	90 ± 10	231 ± 84	130 ± 19	105 ± 16
Phosphorus	1 200 ± 132	N.S.	2 120 ± 160	1 780 ± 107	1 190 ± 88	1 620 ± 139
	Feather moss					
Sulfur	1 140 ± 74	1 030 ± 37	1 060 ± 121			
Calcium	3 280 ± 320	3 650 ± 229	4 120 ± 651			
Magnesium	951 ± 81	1 230 ± 90	911 ± 128			
Potassium	5 220 ± 398	5 430 ± 206	3 240 ± 567			
Manganese	427 ± 94	461 ± 168	583 ± 160			
Aluminum	N.D.	626 ± 63	632 ± 125			
Iron	796 ± 115	658 ± 79	585 ± 133			
Phosphorus	1 300 ± 92	1 280 ± 96	1 130 ± 157			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 23 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	993 ± 110	693 ± 86	1 010 ± 109	1 040 ± 106	972 ± 93	1 280 ± 92
Calcium	6 080 ± 946	5 240 ± 1 080	6 010 ± 1 350	1 630 ± 250	2 030 ± 496	3 410 ± 660
Magnesium	1 020 ± 122	940 ± 107	1 260 ± 166	911 ± 139	941 ± 133	1 290 ± 176
Potassium	4 430 ± 475	4 890 ± 984	5 520 ± 728	4 560 ± 1 070	4 070 ± 288	4 300 ± 541
Manganese	1 520 ± 525	1 270 ± 520	1 450 ± 417	705 ± 113	819 ± 170	1 260 ± 202
Aluminum	N.D.[a]	38 ± 10	30 ± 8	N.D.	540 ± 119	715 ± 87
Iron	30 ± 13	39 ± 4	24 ± 3	47 ± 8	36 ± 9	40 ± 5
Phosphorus	1 350 ± 136	1 250 ± 152	1 970 ± 192	993 ± 76	1 120 ± 106	1 290 ± 79
Nitrogen[b]	N.D.	N.D.	12.0 ± 0.8	N.D.	N.D.	12.4 ± 0.6
	Alder			Twin-flower		
Sulfur	1 480 ± 229	N.S.[c]	N.S.	1 140 ± 39	689 ± 45	1 040 ± 78
Calcium	12 600 ± 1 880	N.S.	N.S.	10 200 ± 523	13 400 ± 1 150	9 600 ± 934
Magnesium	2 490 ± 328	N.S.	N.S.	3 480 ± 212	3 700 ± 366	2 610 ± 219
Potassium	7 350 ± 1 690	N.S.	N.S.	12 800 ± 454	12 300 ± 871	12 100 ± 843
Manganese	922 ± 191	N.S.	N.S.	445 ± 46	484 ± 44	729 ± 115
Aluminum	N.D.	N.S.	N.S.	N.D.	274 ± 40	181 ± 26
Iron	293 ± 65	N.S.	N.S.	169 ± 27	311 ± 45	111 ± 21
Phosphorus	1 030 ± 146	N.S.	N.S.	1 580 ± 165	1 270 ± 108	1 620 ± 57
	Feather moss					
Sulfur	1 250 ± 44	1 160 ± 30	1 300 ± 46			
Calcium	2 470 ± 265	4 460 ± 290	3 570 ± 419			
Magnesium	883 ± 53	1 300 ± 82	725 ± 87			
Potassium	5 430 ± 379	5 360 ± 328	3 460 ± 501			
Manganese	456 ± 45	601 ± 141	656 ± 96			
Aluminum	N.D.	964 ± 73	662 ± 95			
Iron	466 ± 47	963 ± 100	424 ± 76			
Phosphorus	1 200 ± 71	1 220 ± 71	1 180 ± 110			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 24 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	859 ± 77	509 ± 41	1 010 ± 67	1 050 ± 87	842 ± 101	1 080 ± 60
Calcium	6 380 ± 1 210	3 910 ± 958	6 610 ± 1 270	2 120 ± 551	2 510 ± 419	3 280 ± 587
Magnesium	1 040 ± 129	781 ± 137	1 200 ± 111	874 ± 158	728 ± 76	995 ± 67
Potassium	4 740 ± 485	4 270 ± 838	5 520 ± 586	4 030 ± 454	3 400 ± 332	4 390 ± 554
Manganese	644 ± 205	384 ± 136	873 ± 538	672 ± 167	793 ± 225	670 ± 167
Aluminum	N.D.[a]	30 ± 4	36 ± 11	N.D.	688 ± 173	670 ± 80
Iron	10 ± 7	34 ± 17	22 ± 5	60 ± 8	20 ± 4	50 ± 6
Phosphorus	1 270 ± 73	1 130 ± 173	1 800 ± 127	976 ± 71	891 ± 67	1 080 ± 86
Nitrogen[b]	N.D.	N.D.	10.8 ± 0.4	N.D.	N.D.	11.0 ± 0.6
	Alder			Twin-flower		
Sulfur	1 680 ± 327	N.S.[c]	2 330 ± 189	1 110 ± 47	792 ± 54	971 ± 22
Calcium	9 850 ± 662	N.S.	7 900 ± 959	11 100 ± 498	13 000 ± 860	8 860 ± 686
Magnesium	2 250 ± 223	N.S.	2 260 ± 167	2 600 ± 124	3 360 ± 243	2 340 ± 263
Potassium	7 200 ± 1 070	N.S.	9 840 ± 844	13 200 ± 1 080	15 100 ± 1 300	12 700 ± 1 080
Manganese	350 ± 152	N.S.	220 ± 115	328 ± 102	303 ± 60	417 ± 81
Aluminum	N.D.	N.S.	110 ± 21	N.D.	169 ± 53	280 ± 41
Iron	47 ± 12	N.S.	77 ± 11	206 ± 52	127 ± 37	196 ± 40
Phosphorus	1 420 ± 174	N.S.	2 280 ± 166	1 640 ± 140	1 700 ± 115	1 530 ± 186
	Feather moss					
Sulfur	1 150 ± 57	723 ± 35	1 270 ± 71			
Calcium	2 900 ± 139	2 500 ± 242	3 810 ± 282			
Magnesium	715 ± 29	986 ± 96	894 ± 83			
Potassium	4 890 ± 182	5 070 ± 418	3 160 ± 599			
Manganese	464 ± 62	205 ± 28	353 ± 68			
Aluminum	N.D.	194 ± 28	865 ± 166			
Iron	752 ± 98	224 ± 33	806 ± 177			
Phosphorus	1 190 ± 98	1 040 ± 111	1 270 ± 93			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 25 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	994 ± 98	507 ± 37	981 ± 80	1 100 ± 71	869 ± 66	1 210 ± 106
Calcium	7 190 ± 1 370	4 750 ± 720	8 590 ± 1 560	1 790 ± 480	2 630 ± 394	3 910 ± 852
Magnesium	766 ± 114	669 ± 69	1 070 ± 114	894 ± 141	945 ± 154	1 360 ± 186
Potassium	6 160 ± 1 010	6 410 ± 1 330	6 180 ± 820	4 980 ± 710	4 040 ± 979	4 930 ± 750
Manganese	524 ± 431	338 ± 305	310 ± 136	362 ± 87	351 ± 81	565 ± 129
Aluminum	N.D.[a]	14 ± 5	10 ± 5	N.D.	735 ± 110	459 ± 197
Iron	18 ± 2	24 ± 4	23 ± 2	68 ± 57	20 ± 3	39 ± 6
Phosphorus	1 600 ± 266	1 240 ± 174	1 990 ± 256	1 140 ± 50	1 050 ± 77	1 300 ± 106
Nitrogen[b]	N.D.	N.D.	13.7 ± 1.5	N.D.	N.D.	13.4 ± 1.4
	Alder			Twin-flower		
Sulfur	1 310 ± 97	N.S.[c]	2 210 ± 236	1 140 ± 53	735 ± 39	968 ± 53
Calcium	8 860 ± 1 410	N.S.	11 000 ± 1 730	11 600 ± 1 030	14 700 ± 874	10 100 ± 870
Magnesium	2 010 ± 292	N.S.	2 600 ± 240	3 360 ± 312	4 140 ± 419	2 880 ± 248
Potassium	7 300 ± 1 470	N.S.	9 250 ± 756	12 700 ± 662	15 300 ± 852	12 700 ± 1 260
Manganese	193 ± 80	N.S.	386 ± 257	282 ± 46	174 ± 35	331 ± 87
Aluminum	N.D.	N.S.	54 ± 27	N.D.	212 ± 105	153 ± 49
Iron	77 ± 15	N.S.	90 ± 24	133 ± 25	190 ± 143	107 ± 23
Phosphorus	1 170 ± 155	N.S.	2 180 ± 247	1 730 ± 142	1 680 ± 129	1 570 ± 197
	Feather moss					
Sulfur	1 050 ± 55	966 ± 42	1 210 ± 100			
Calcium	3 260 ± 314	3 630 ± 297	4 880 ± 723			
Magnesium	967 ± 97	1 200 ± 68	1 040 ± 149			
Potassium	5 090 ± 497	5 660 ± 385	4 150 ± 479			
Manganese	507 ± 150	404 ± 34	421 ± 181			
Aluminum	N.D.	585 ± 127	473 ± 99			
Iron	447 ± 45	444 ± 161	407 ± 71			
Phosphorus	1 170 ± 101	1 430 ± 135	1 320 ± 149			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

Appendix 2. Site 26 total elemental concentration in vegetation (mg kg^{-1})

Elements	1981	1985	1991	1981	1985	1991
	Spruce			Pine		
Sulfur	1 210 ± 113	739 ± 85	969 ± 90	1 220 ± 93	1 010 ± 104	1 300 ± 96
Calcium	6 560 ± 594	4 660 ± 657	8 390 ± 1 840	2 110 ± 321	1 920 ± 197	3 780 ± 546
Magnesium	1 020 ± 129	835 ± 60	994 ± 117	1 070 ± 88	1 140 ± 166	1 480 ± 162
Potassium	5 060 ± 797	4 940 ± 1 390	5 790 ± 705	5 080 ± 933	3 830 ± 577	4 670 ± 454
Manganese	1 240 ± 222	957 ± 225	1 310 ± 488	297 ± 107	351 ± 154	899 ± 235
Aluminum	N.D.[a]	29 ± 6	18 ± 5	N.D.	406 ± 228	628 ± 192
Iron	28 ± 23	112 ± 181	23 ± 6	103 ± 90	21 ± 3	46 ± 5
Phosphorus	1 400 ± 223	1 260 ± 308	1 670 ± 149	1 070 ± 94	1 030 ± 60	1 280 ± 79
Nitrogen[b]	N.D.	N.D.	10.3 ± 1.0	N.D.	N.D.	11.5 ± 0.6
	Alder			Twin-flower		
Sulfur	1 530 ± 102	N.S.[c]	2 580 ± 386	1 120 ± 80	760 ± 42	1 090 ± 60
Calcium	9 460 ± 969	N.S.	12 400 ± 1 480	11 400 ± 1 100	13 900 ± 1 290	11 800 ± 1 020
Magnesium	2 160 ± 179	N.S.	2 940 ± 394	2 960 ± 261	3 520 ± 239	3 590 ± 283
Potassium	6 250 ± 1 280	N.S.	9 840 ± 1 700	13 100 ± 385	14 200 ± 619	12 000 ± 1 020
Manganese	285 ± 44	N.S.	384 ± 156	245 ± 31	227 ± 27	534 ± 103
Aluminum	N.D.	N.S.	84 ± 17	N.D.	188 ± 64	179 ± 32
Iron	92 ± 23	N.S.	127 ± 32	401 ± 225	165 ± 57	152 ± 14
Phosphorus	1 090 ± 63	N.S.	2 050 ± 200	1 690 ± 133	1 570 ± 89	1 650 ± 120
	Feather moss					
Sulfur	1 140 ± 64	1 190 ± 157	1 270 ± 103			
Calcium	4 600 ± 712	5 630 ± 868	5 690 ± 1 190			
Magnesium	996 ± 113	1 210 ± 166	1 140 ± 146			
Potassium	4 780 ± 492	5 740 ± 429	3 370 ± 270			
Manganese	361 ± 86	206 ± 43	696 ± 180			
Aluminum	N.D.	332 ± 45	668 ± 112			
Iron	783 ± 112	422 ± 40	551 ± 94			
Phosphorus	1 320 ± 157	1 830 ± 246	1 240 ± 137			

[a] N.D. = not determined.

[b] Total nitrogen units are g kg^{-1}.

[c] N.S. = not sampled.

APPENDIX 3

Soil Quadrat and Foliar Chemistry Collected in 1991

Appendix 3. Site 1 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	5.6 ± 0.7	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	3 240 ± 1 120	19 600 ± 4 660	1 800 ± 196	1 830 ± 132	4 450 ± 1 700	N.S.[b]
Calcium	19 800 ± 2 640	35 100 ± 7 530	7 600 ± 1 050	2 210 ± 348	24 000 ± 2 690	N.S.
Magnesium	403 ± 46	1 530 ± 293	1 160 ± 106	1 070 ± 76	3 920 ± 661	N.S.
Potassium	301 ± 61	460 ± 63	9 370 ± 654	7 270 ± 1 150	14 600 ± 479	N.S.
Manganese	140 ± 44	311 ± 142	356 ± 109	851 ± 86	277 ± 237	N.S.
Aluminum	28 ± 30	1 560 ± 280	55 ± 15	544 ± 55	415 ± 171	N.S.
Iron	39 ± 43	2 560 ± 326	39 ± 16	45 ± 4	71 ± 61	N.S.
Phosphorus	102 ± 15	690 ± 59	2 560 ± 226	1 780 ± 183	3 350 ± 1 090	N.S.
Nitrogen[c]	7 ± 7	14.9 ± 12.1	N.D.[d]	N.D.	N.D.	N.S.

[a] N.A. = not applicable.
[b] N.S. = not sampled.
[c] Total nitrogen units are g kg^{-1}.
[d] N.D. = not determined.

Appendix 3. Site 2 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	5.1 ± 0.5	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	555 ± 73	4 520 ± 719	1 440 ± 201	1 450 ± 132	3 440 ± 262	N.S.[b]
Calcium	11 300 ± 2 740	18 900 ± 8 520	5 380 ± 441	1 800 ± 262	21 000 ± 900	N.S.
Magnesium	384 ± 59	933 ± 309	1 110 ± 108	1 060 ± 138	3 450 ± 386	N.S.
Potassium	487 ± 91	645 ± 106	9 690 ± 645	2 490 ± 444	13 600 ± 1 050	N.S.
Manganese	185 ± 78	344 ± 199	564 ± 128	709 ± 142	277 ± 49	N.S.
Aluminum	65 ± 33	1 630 ± 309	41 ± 8	612 ± 220	348 ± 63	N.S.
Iron	22 ± 11	1 970 ± 332	32 ± 4	35 ± 4	97 ± 30	N.S.
Phosphorus	141 ± 20	900 ± 86	2 620 ± 222	1 520 ± 93	3 150 ± 202	N.S.
Nitrogen[c]	12 ± 16	12.9 ± 1.2	N.D.[d]	N.D.	N.D.	N.S.

[a] N.A. = not applicable.
[b] N.S. = not sampled.
[c] Total nitrogen units are g kg^{-1}.
[d] N.D. = not determined.

Appendix 3. Site 3 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	5.5 ± 0.3	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	162 ± 17	1 550 ± 140	1 080 ± 52	1 310 ± 116	2 610 ± 216	N.S.[b]
Calcium	9 280 ± 1 610	10 600 ± 1 980	5 080 ± 1 250	2 290 ± 261	23 600 ± 730	N.S.
Magnesium	1 050 ± 139	1 510 ± 181	978 ± 97	1 400 ± 107	6 180 ± 308	N.S.
Potassium	777 ± 75	1 120 ± 86	7 870 ± 1 080	5 970 ± 860	13 600 ± 792	N.S.
Manganese	472 ± 80	1 410 ± 310	501 ± 236	338 ± 67	160 ± 49	N.S.
Aluminum	43 ± 23	3 730 ± 789	28 ± 6	456 ± 34	324 ± 82	N.S.
Iron	6 ± 4	3 990 ± 837	36 ± 6	28 ± 5	97 ± 13	N.S.
Phosphorus	146 ± 24	1 220 ± 84	2 500 ± 279	1 750 ± 149	3 120 ± 187	N.S.
Nitrogen[c]	230 ± 65	14.2 ± 1.3	N.D.[d]	N.D.	N.D.	N.S.

[a] N.A. = not applicable.
[b] N.S. = not sampled.
[c] Total nitrogen units are g kg^{-1}.
[d] N.D. = not determined.

Appendix 3. Site 4 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	5.4 ± 0.2	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	78 ± 13	695 ± 122	966 ± 68	1 140 ± 123	2 630 ± 347	1 240 ± 41
Calcium	4 790 ± 775	5 290 ± 931	5 320 ± 706	2 240 ± 421	20 900 ± 1 180	5 490 ± 288
Magnesium	587 ± 77	1 290 ± 102	1 210 ± 157	1 270 ± 75	5 530 ± 347	1 230 ± 76
Potassium	420 ± 75	911 ± 78	8 750 ± 780	6 340 ± 1 550	11 800 ± 529	4 080 ± 334
Manganese	458 ± 83	1 360 ± 214	355 ± 120	448 ± 105	159 ± 27	1 700 ± 178
Aluminum	91 ± 33	6 240 ± 1 310	28 ± 6	513 ± 100	378 ± 41	250 ± 35
Iron	4 ± 2	6 900 ± 1 020	48 ± 8	34 ± 8	116 ± 26	202 ± 43
Phosphorus	59 ± 16	959 ± 74	2 610 ± 187	1 610 ± 115	3 510 ± 214	1 210 ± 82
Nitrogen[b]	62 ± 22	6.5 ± 1.2	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.
[b] Total nitrogen units are g kg^{-1}.
[c] N.D. = not determined.

Appendix 3. Site 5 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	6.7 ± 0.2	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	409 ± 69	2 630 ± 498	1 150 ± 50	1 350 ± 138	3 100 ± 314	1 560 ± 273
Calcium	17 600 ± 1 780	28 700 ± 5 640	5 680 ± 473	2 240 ± 436	22 600 ± 872	8 320 ± 1 560
Magnesium	544 ± 53	1 430 ± 238	1 100 ± 112	1 210 ± 79	4 480 ± 409	932 ± 97
Potassium	416 ± 46	725 ± 51	9 340 ± 629	7 140 ± 1 380	13 100 ± 932	3 900 ± 545
Manganese	308 ± 41	1 520 ± 299	253 ± 88	383 ± 53	128 ± 34	825 ± 176
Aluminum	15 ± 4	2 890 ± 452	11 ± 4	403 ± 45	302 ± 53	155 ± 36
Iron	6 ± 2	3 050 ± 582	31 ± 9	36 ± 5	68 ± 6	87 ± 25
Phosphorus	124 ± 15	889 ± 66	2 610 ± 228	1 700 ± 184	3 600 ± 294	1 130 ± 109
Nitrogen[b]	76 ± 20	8.5 ± 0.8	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.

[b] Total nitrogen units are g kg^{-1}.

[c] N.D. = not determined.

Appendix 3. Site 6 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	5.0 ± 0.2	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	146 ± 16	969 ± 67	930 ± 88	1 150 ± 81	3 030 ± 392	1 240 ± 91
Calcium	5 700 ± 838	6 590 ± 1 370	6 200 ± 854	2 350 ± 472	22 100 ± 946	5 510 ± 386
Magnesium	703 ± 68	931 ± 81	1 390 ± 173	1 280 ± 151	5 760 ± 362	1 140 ± 87
Potassium	660 ± 95	907 ± 85	7 690 ± 480	5 520 ± 351	11 500 ± 826	3 350 ± 243
Manganese	802 ± 104	1 270 ± 236	672 ± 491	631 ± 90	269 ± 46	1 800 ± 165
Aluminum	132 ± 34	2 930 ± 463	23 ± 6	631 ± 85	470 ± 63	409 ± 121
Iron	26 ± 11	3 920 ± 606	31 ± 14	37 ± 5	107 ± 16	405 ± 153
Phosphorus	142 ± 19	799 ± 55	2 250 ± 151	1 560 ± 88	3 500 ± 197	1 130 ± 48
Nitrogen[b]	76 ± 25	8.2 ± 0.5	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.

[b] Total nitrogen units are g kg^{-1}.

[c] N.D. = not determined.

Appendix 3. Site 7 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	4.7 ± 0.1	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	135 ± 12	1 110 ± 95	932 ± 67	1 060 ± 91	2 560 ± 200	1 200 ± 105
Calcium	4 680 ± 655	5 150 ± 898	5 440 ± 1 310	1 710 ± 375	21 100 ± 1 120	4 870 ± 499
Magnesium	584 ± 52	754 ± 67	1 270 ± 83	1 400 ± 287	5 370 ± 343	1 020 ± 97
Potassium	740 ± 85	995 ± 90	8 510 ± 901	4 930 ± 374	13 900 ± 1 030	4 060 ± 264
Manganese	638 ± 108	820 ± 197	594 ± 284	650 ± 88	216 ± 41	1 840 ± 203
Aluminum	176 ± 39	2 240 ± 375	20 ± 14	432 ± 83	324 ± 48	159 ± 46
Iron	51 ± 15	2 640 ± 506	80 ± 122	28 ± 4	70 ± 13	90 ± 44
Phosphorus	205 ± 24	954 ± 72	2 400 ± 198	1 590 ± 157	3 620 ± 204	1 150 ± 49
Nitrogen[b]	65 ± 14	8.7 ± 0.7	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.

[b] Total nitrogen units are g kg^{-1}.

[c] N.D. = not determined.

Appendix 3. Site 8 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	5.5 ± 0.2	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	111 ± 10	975 ± 105	809 ± 61	1 050 ± 70	2 460 ± 243	1 110 ± 111
Calcium	4 900 ± 603	5 950 ± 854	5 280 ± 1 130	2 130 ± 598	19 900 ± 815	5 070 ± 482
Magnesium	743 ± 94	1 360 ± 131	1 060 ± 111	1 300 ± 74	5 620 ± 323	1 130 ± 161
Potassium	746 ± 106	1 280 ± 109	7 710 ± 465	5 140 ± 473	14 300 ± 1 150	4 310 ± 735
Manganese	678 ± 109	1 280 ± 250	436 ± 138	484 ± 149	197 ± 53	1 320 ± 417
Aluminum	82 ± 26	4 320 ± 662	B.D.[b]	472 ± 58	381 ± 58	183 ± 107
Iron	14 ± 12	4 970 ± 798	10 ± 5	45 ± 4	62 ± 15	162 ± 150
Phosphorus	124 ± 27	1 020 ± 74	2 300 ± 158	1 470 ± 93	3 950 ± 292	1 250 ± 80
Nitrogen[c]	149 ± 57	9.0 ± 0.8	N.D.[d]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.

[b] B.D. = below detection.

[c] Total nitrogen units are g kg^{-1}.

[d] N.D. = not determined.

Appendix 3. Site 9 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	4.8 ± 0.3	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	166 ± 27	1 380 ± 78	922 ± 53	1 040 ± 79	2 330 ± 325	N.S.[b]
Calcium	5 150 ± 2 370	4 620 ± 647	4 950 ± 1 530	1 410 ± 229	18 000 ± 3 120	N.S.
Magnesium	510 ± 65	722 ± 81	1 150 ± 71	1 200 ± 143	5 270 ± 1 150	N.S.
Potassium	832 ± 119	1 080 ± 128	8 650 ± 803	4 800 ± 576	12 800 ± 2 570	N.S.
Manganese	499 ± 105	673 ± 154	586 ± 195	422 ± 80	368 ± 350	N.S.
Aluminum	179 ± 36	2 200 ± 194	23 ± 6	546 ± 122	379 ± 46	N.S.
Iron	39 ± 13	2 760 ± 679	22 ± 2	29 ± 3	71 ± 43	N.S.
Phosphorus	221 ± 31	1 190 ± 71	2 340 ± 207	1 450 ± 106	2 980 ± 518	N.S.
Nitrogen[c]	121 ± 39	12.2 ± 1.0	N.D.[d]	N.D.	N.D.	N.S.

[a] N.A. = not applicable.
[b] N.S. = not sampled.
[c] Total nitrogen units are g kg^{-1}.
[d] N.D. = not determined.

Appendix 3. Site 10 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	4.3 ± 0.1	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	102 ± 9	985 ± 71	934 ± 31	1 110 ± 89	2 040 ± 201	1 220 ± 76
Calcium	2 500 ± 244	2 930 ± 291	2 660 ± 214	1 620 ± 302	17 700 ± 1 080	4 710 ± 325
Magnesium	365 ± 30	485 ± 45	1 020 ± 108	1 040 ± 64	4 930 ± 333	1 110 ± 111
Potassium	673 ± 93	791 ± 101	8 020 ± 442	4 830 ± 419	11 100 ± 880	3 990 ± 366
Manganese	374 ± 73	442 ± 97	1 100 ± 161	579 ± 100	300 ± 44	1 720 ± 169
Aluminum	279 ± 28	1 620 ± 291	66 ± 43	567 ± 125	332 ± 54	212 ± 33
Iron	57 ± 9	1 420 ± 340	62 ± 50	23 ± 3	64 ± 8	108 ± 31
Phosphorus	147 ± 17	783 ± 89	1 800 ± 136	1 470 ± 111	2 640 ± 307	1 120 ± 62
Nitrogen[b]	134 ± 26	8.8 ± 0.8	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.
[b] Total nitrogen units are g kg^{-1}.
[c] N.D. = not determined.

Appendix 3. Site 11 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	4.8 ± 0.2	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	136 ± 10	1 280 ± 108	970 ± 88	1 260 ± 86	2 230 ± 290	1 210 ± 242
Calcium	3 130 ± 303	3 920 ± 502	5 060 ± 822	1 800 ± 262	20 500 ± 2 200	4 370 ± 1 410
Magnesium	548 ± 66	835 ± 101	1 190 ± 134	1 160 ± 76	5 100 ± 561	924 ± 260
Potassium	785 ± 80	993 ± 102	8 090 ± 1 090	5 930 ± 494	12 300 ± 1 060	3 680 ± 955
Manganese	718 ± 136	1 130 ± 320	588 ± 125	576 ± 122	263 ± 38	1 400 ± 353
Aluminum	192 ± 40	2 740 ± 700	27 ± 7	511 ± 103	381 ± 89	188 ± 37
Iron	29 ± 11	2 870 ± 798	25 ± 3	35 ± 4	69 ± 11	96 ± 2
Phosphorus	149 ± 23	1 080 ± 89	2 470 ± 253	1 760 ± 130	2 510 ± 278	1 180 ± 279
Nitrogen[b]	230 ± 60	11.8 ± 0.7	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.

[b] Total nitrogen units are g kg^{-1}.

[c] N.D. = not determined.

Appendix 3. Site 12 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	5.1 ± 0.3	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	251 ± 31	1 980 ± 176	1 140 ± 132	1 270 ± 87	2 750 ± 272	1 460 ± 116
Calcium	7 030 ± 1 600	9 740 ± 2 930	9 410 ± 1 020	1 940 ± 206	21 400 ± 1 120	4 940 ± 911
Magnesium	532 ± 89	845 ± 127	1 190 ± 137	1 090 ± 93	5 180 ± 306	1 120 ± 156
Potassium	810 ± 92	1 110 ± 119	6 060 ± 744	5 940 ± 631	13 500 ± 937	4 640 ± 735
Manganese	752 ± 181	1 430 ± 405	944 ± 321	521 ± 80	262 ± 46	1 440 ± 357
Aluminum	107 ± 42	3 020 ± 605	12 ± 7	536 ± 81	394 ± 67	189 ± 39
Iron	18 ± 11	3 170 ± 802	16 ± 5	26 ± 2	87 ± 13	112 ± 22
Phosphorus	178 ± 24	1 140 ± 94	2 150 ± 243	1 610 ± 120	3 620 ± 289	1 400 ± 152
Nitrogen[b]	138 ± 54	11.6 ± 0.8	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.

[b] Total nitrogen units are g kg^{-1}.

[c] N.D. = not determined.

Appendix 3. Site 13 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	5.4 ± 0.1	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	186 ± 15	1 660 ± 83	936 ± 79	1 220 ± 104	2 740 ± 182	N.S.[b]
Calcium	10 100 ± 2 630	10 400 ± 1 590	5 340 ± 994	2 000 ± 470	21 900 ± 918	N.S.
Magnesium	945 ± 118	1 190 ± 96	1 060 ± 104	1 110 ± 81	5 900 ± 461	N.S.
Potassium	887 ± 108	1 160 ± 116	9 070 ± 1 100	5 780 ± 697	15 300 ± 1 820	N.S.
Manganese	690 ± 149	1 070 ± 265	345 ± 127	344 ± 83	148 ± 33	N.S.
Aluminum	68 ± 21	3 160 ± 592	12 ± 5	376 ± 104	283 ± 83	N.S.
Iron	13 ± 5	3 110 ± 639	24 ± 5	31 ± 4	87 ± 10	N.S.
Phosphorus	198 ± 26	1 240 ± 99	2 150 ± 210	1 630 ± 179	3 090 ± 448	N.S.
Nitrogen[c]	261 ± 69	14.4 ± 0.8	N.D.[d]	N.D.	N.D.	N.S.

[a] N.A. = not applicable.
[b] N.S. = not sampled.
[c] Total nitrogen units are g kg^{-1}.
[d] N.D. = not determined.

Appendix 3. Site 14 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	4.8 ± 0.1	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	168 ± 14	1 410 ± 81	934 ± 87	1 230 ± 47	2 930 ± 284	1 230 ± 102
Calcium	5 030 ± 482	5 240 ± 610	4 590 ± 731	2 060 ± 354	20 500 ± 1 080	4 360 ± 379
Magnesium	771 ± 56	906 ± 118	1 070 ± 68	1 200 ± 122	6 550 ± 302	1 100 ± 118
Potassium	1 000 ± 125	1 210 ± 136	8 580 ± 857	6 000 ± 500	12 600 ± 588	4 130 ± 488
Manganese	735 ± 135	770 ± 144	969 ± 386	580 ± 136	208 ± 28	1 420 ± 378
Aluminum	126 ± 23	1 940 ± 303	8 ± 3	450 ± 41	303 ± 62	172 ± 39
Iron	34 ± 10	2 070 ± 443	20 ± 7	25 ± 3	78 ± 11	78 ± 18
Phosphorus	254 ± 30	1 070 ± 78	2 080 ± 237	1 530 ± 88	3 660 ± 421	1 150 ± 113
Nitrogen[b]	146 ± 75	12.6 ± 0.8	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.
[b] Total nitrogen units are g kg^{-1}.
[c] N.D. = not determined.

Appendix 3. Site 16 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	4.8 ± 0.2	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	140 ± 20	1 330 ± 122	849 ± 62	1 180 ± 78	2 510 ± 342	1 260 ± 111
Calcium	4 320 ± 957	4 890 ± 1 270	4 110 ± 775	1 630 ± 419	22 300 ± 1 620	4 400 ± 344
Magnesium	637 ± 60	748 ± 92	1 090 ± 140	1 110 ± 75	5 110 ± 519	920 ± 148
Potassium	864 ± 124	1 150 ± 143	8 120 ± 504	6 360 ± 710	12 100 ± 1 710	3 870 ± 485
Manganese	685 ± 215	1 120 ± 625	421 ± 116	409 ± 93	268 ± 33	1 570 ± 159
Aluminum	211 ± 55	2 260 ± 729	16 ± 3	403 ± 85	388 ± 86	222 ± 49
Iron	73 ± 41	2 180 ± 800	21 ± 4	26 ± 3	72 ± 15	123 ± 40
Phosphorus	197 ± 33	1 250 ± 183	2 270 ± 250	1 710 ± 153	3 060 ± 420	1 250 ± 88
Nitrogen[b]	193 ± 71	11.2 ± 0.8	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.

[b] Total nitrogen units are g kg^{-1}.

[c] N.D. = not determined.

Appendix 3. Site 18 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	5.2 ± 0.2	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	172 ± 21	1 120 ± 109	877 ± 71	1 040 ± 97	2 860 ± 375	1 160 ± 175
Calcium	5 900 ± 1 150	7 330 ± 1 620	3 940 ± 382	2 180 ± 359	19 900 ± 921	6 460 ± 943
Magnesium	762 ± 159	1 030 ± 158	1 190 ± 86	1 190 ± 139	5 900 ± 479	1 240 ± 126
Potassium	902 ± 97	1 230 ± 117	7 600 ± 517	5 900 ± 1 110	13 300 ± 579	4 360 ± 349
Manganese	586 ± 132	798 ± 210	857 ± 240	372 ± 84	133 ± 37	875 ± 422
Aluminum	95 ± 25	2 100 ± 295	11 ± 3	480 ± 128	260 ± 108	162 ± 43
Iron	38 ± 13	2 680 ± 355	22 ± 5	27 ± 5	88 ± 14	163 ± 41
Phosphorus	208 ± 23	945 ± 74	1 740 ± 117	1 410 ± 133	3 920 ± 501	1 250 ± 93
Nitrogen[b]	105 ± 47	10.0 ± 0.8	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.

[b] Total nitrogen units are g kg^{-1}.

[c] N.D. = not determined.

Appendix 3. Site 19 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	5.2 ± 0.2	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	103 ± 19	779 ± 122	835 ± 79	958 ± 51	2 160 ± 201	821 ± 144
Calcium	4 390 ± 830	5 500 ± 1 040	6 390 ± 1 400	2 130 ± 466	19 000 ± 940	5 850 ± 1 070
Magnesium	591 ± 107	1 040 ± 114	1 160 ± 90	1 290 ± 141	5 030 ± 286	1 200 ± 113
Potassium	505 ± 99	934 ± 80	7 410 ± 793	5 500 ± 634	12 500 ± 818	5 020 ± 863
Manganese	548 ± 123	1 070 ± 292	717 ± 248	420 ± 91	203 ± 47	629 ± 442
Aluminum	46 ± 17	2 380 ± 241	13 ± 2	353 ± 52	260 ± 34	109 ± 50
Iron	13 ± 6	3 760 ± 474	27 ± 9	36 ± 4	51 ± 8	111 ± 45
Phosphorus	122 ± 27	679 ± 77	1 840 ± 96	1 390 ± 92	3 450 ± 287	1 180 ± 91
Nitrogen[b]	49 ± 22	6.5 ± 1.0	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.
[b] Total nitrogen units are g kg^{-1}.
[c] N.D. = not determined.

Appendix 3. Site 20 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	4.9 ± 0.1	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	180 ± 13	1 670 ± 129	971 ± 53	1 160 ± 88	2 540 ± 272	1 350 ± 97
Calcium	5 420 ± 631	6 860 ± 913	4 720 ± 891	2 090 ± 309	21 100 ± 1 580	5 070 ± 220
Magnesium	811 ± 104	1 100 ± 130	1 120 ± 151	1 320 ± 98	5 660 ± 600	1 290 ± 67
Potassium	889 ± 91	1 160 ± 105	8 700 ± 453	6 100 ± 560	14 400 ± 1 160	4 560 ± 425
Manganese	781 ± 140	1 260 ± 301	643 ± 204	427 ± 110	229 ± 38	1 740 ± 192
Aluminum	80 ± 25	2 000 ± 237	14 ± 6	424 ± 47	310 ± 58	237 ± 40
Iron	12 ± 6	1 940 ± 335	18 ± 2	28 ± 3	85 ± 21	112 ± 26
Phosphorus	228 ± 21	1 320 ± 84	2 560 ± 261	1 720 ± 128	3 010 ± 293	1 390 ± 99
Nitrogen[b]	478 ± 118	14.7 ± 1.4	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.
[b] Total nitrogen units are g kg^{-1}.
[c] N.D. = not determined.

Appendix 3. Site 21 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	5.1 ± 0.2	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	197 ± 21	1 350 ± 105	913 ± 75	1 100 ± 73	2 710 ± 186	1 320 ± 69
Calcium	6 530 ± 867	8 180 ± 1 540	4 610 ± 755	1 520 ± 279	21 600 ± 1 080	5 440 ± 300
Magnesium	705 ± 61	928 ± 83	1 110 ± 131	1 230 ± 146	5 680 ± 407	1 250 ± 111
Potassium	950 ± 99	1 090 ± 107	8 670 ± 661	5 020 ± 542	13 100 ± 462	4 440 ± 367
Manganese	955 ± 103	1 660 ± 283	563 ± 261	482 ± 110	246 ± 42	1 850 ± 288
Aluminum	75 ± 18	1 770 ± 236	14 ± 6	394 ± 88	308 ± 59	235 ± 43
Iron	10 ± 3	1 750 ± 262	24 ± 3	29 ± 3	78 ± 10	127 ± 21
Phosphorus	242 ± 24	1 060 ± 75	2 170 ± 160	1 480 ± 93	3 550 ± 297	1 350 ± 80
Nitrogen[b]	196 ± 55	12.0 ± 1.0	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.

[b] Total nitrogen units are g kg^{-1}.

[c] N.D. = not determined.

Appendix 3. Site 22 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	4.7 ± 0.1	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	165 ± 15	1 240 ± 99	953 ± 62	1 130 ± 88	2 180 ± 136	1 100 ± 94
Calcium	3 720 ± 319	4 460 ± 483	5 050 ± 373	2 010 ± 525	18 800 ± 643	4 410 ± 441
Magnesium	587 ± 48	806 ± 82	1 240 ± 104	1 210 ± 186	5 560 ± 239	999 ± 94
Potassium	906 ± 111	1 130 ± 116	8 450 ± 737	5 910 ± 583	13 300 ± 567	3 730 ± 538
Manganese	649 ± 137	810 ± 175	632 ± 163	530 ± 121	231 ± 42	1 540 ± 167
Aluminum	188 ± 38	2 450 ± 403	10 ± 3	430 ± 63	355 ± 69	250 ± 63
Iron	53 ± 16	2 270 ± 380	23 ± 13	30 ± 4	64 ± 11	175 ± 63
Phosphorus	219 ± 28	1 120 ± 95	2 510 ± 163	1 650 ± 111	3 600 ± 279	1 100 ± 104
Nitrogen[b]	200 ± 60	10.9 ± 0.9	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.

[b] Total nitrogen units are g kg^{-1}.

[c] N.D. = not determined.

Appendix 3. Site 23 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	4.4 ± 0.1	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	150 ± 12	1 320 ± 95	1 040 ± 76	1 170 ± 79	2 550 ± 273	1 230 ± 84
Calcium	2 660 ± 167	3 100 ± 203	3 780 ± 808	1 760 ± 235	20 100 ± 832	4 150 ± 432
Magnesium	381 ± 21	572 ± 39	1 260 ± 102	1 060 ± 95	5 170 ± 332	854 ± 69
Potassium	752 ± 73	927 ± 72	8 950 ± 534	6 440 ± 942	11 600 ± 829	3 430 ± 266
Manganese	506 ± 107	688 ± 198	956 ± 264	637 ± 94	373 ± 48	1 710 ± 184
Aluminum	305 ± 38	2 210 ± 316	25 ± 7	458 ± 52	400 ± 50	218 ± 24
Iron	81 ± 22	2 360 ± 760	24 ± 3	22 ± 4	68 ± 13	95 ± 19
Phosphorus	225 ± 20	1 100 ± 61	2 400 ± 198	1 600 ± 116	3 250 ± 274	1 090 ± 48
Nitrogen[b]	170 ± 29	10.8 ± 1.0	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.

[b] Total nitrogen units are g kg^{-1}.

[c] N.D. = not determined.

Appendix 3. Site 24 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	4.6 ± 0.1	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	158 ± 11	1 380 ± 109	985 ± 38	1 020 ± 62	2 570 ± 199	1 280 ± 88
Calcium	3 420 ± 429	4 460 ± 694	3 760 ± 775	1 570 ± 249	18 500 ± 566	4 990 ± 724
Magnesium	442 ± 66	700 ± 88	1 160 ± 80	945 ± 71	5 400 ± 367	1 230 ± 254
Potassium	886 ± 139	1 150 ± 129	7 540 ± 701	5 960 ± 397	14 900 ± 1 200	4 050 ± 503
Manganese	318 ± 76	455 ± 121	501 ± 271	322 ± 54	206 ± 65	1 850 ± 123
Aluminum	234 ± 39	2 310 ± 267	23 ± 9	461 ± 61	448 ± 65	257 ± 59
Iron	64 ± 16	2 090 ± 269	23 ± 11	27 ± 3	75 ± 18	92 ± 32
Phosphorus	220 ± 31	1 160 ± 70	2 260 ± 162	1 470 ± 104	3 730 ± 414	1 280 ± 115
Nitrogen[b]	133 ± 41	12.4 ± 1.5	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.

[b] Total nitrogen units are g kg^{-1}.

[c] N.D. = not determined.

Appendix 3. Site 25 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	5.2 ± 0.3	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	190 ± 14	1 460 ± 112	1 000 ± 73	1 210 ± 74	2 450 ± 212	1 200 ± 67
Calcium	7 470 ± 1 570	8 480 ± 1 700	5 380 ± 1 030	1 780 ± 325	20 000 ± 1 080	5 070 ± 281
Magnesium	1 040 ± 167	1 290 ± 212	1 040 ± 69	1 140 ± 137	5 240 ± 456	1 100 ± 103
Potassium	1 040 ± 115	1 400 ± 113	9 490 ± 870	6 540 ± 585	12 600 ± 755	3 750 ± 267
Manganese	493 ± 144	663 ± 211	181 ± 72	274 ± 59	162 ± 59	1 210 ± 208
Aluminum	102 ± 56	2 520 ± 722	12 ± 7	289 ± 125	347 ± 135	218 ± 73
Iron	28 ± 24	2 850 ± 1 000	26 ± 8	24 ± 4	77 ± 12	123 ± 25
Phosphorus	294 ± 40	1 190 ± 71	2 500 ± 268	1 690 ± 96	3 400 ± 350	1 290 ± 77
Nitrogen[b]	326 ± 115	13.2 ± 2.3	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.

[b] Total nitrogen units are g kg^{-1}.

[c] N.D. = not determined.

Appendix 3. Site 26 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	4.9 ± 0.3	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	180 ± 21	1 320 ± 144	921 ± 75	1 180 ± 67	3 050 ± 426	1 270 ± 98
Calcium	5 510 ± 1 710	6 070 ± 1 820	4 870 ± 1 160	1 930 ± 242	20 500 ± 1 340	5 150 ± 358
Magnesium	722 ± 159	882 ± 211	993 ± 94	1 180 ± 86	6 170 ± 537	1 230 ± 98
Potassium	1 150 ± 121	1 400 ± 160	8 750 ± 626	6 410 ± 659	10 400 ± 724	3 680 ± 325
Manganese	593 ± 230	1 000 ± 611	757 ± 268	452 ± 108	238 ± 45	1 740 ± 244
Aluminum	175 ± 46	1 970 ± 480	16 ± 6	416 ± 118	461 ± 103	234 ± 57
Iron	45 ± 16	2 760 ± 1 620	23 ± 10	28 ± 3	96 ± 10	166 ± 37
Phosphorus	284 ± 41	1 170 ± 152	2 060 ± 196	1 560 ± 60	4 130 ± 327	1 230 ± 110
Nitrogen[b]	167 ± 75	10.9 ± 1.1	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.

[b] Total nitrogen units are g kg^{-1}.

[c] N.D. = not determined.

Appendix 3. Site 30 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	4.7 ± 0.1	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	179 ± 17	1 650 ± 100	1 010 ± 90	1 220 ± 56	2 460 ± 315	1 190 ± 80
Calcium	3 820 ± 424	4 310 ± 538	5 940 ± 1 030	1 870 ± 196	20 700 ± 2 380	3 940 ± 470
Magnesium	543 ± 62	725 ± 86	1 230 ± 113	1 120 ± 98	5 440 ± 960	900 ± 108
Potassium	899 ± 128	1 180 ± 127	8 810 ± 944	6 120 ± 458	13 000 ± 546	3 910 ± 352
Manganese	641 ± 78	872 ± 147	620 ± 133	690 ± 100	307 ± 26	1 520 ± 189
Aluminum	171 ± 37	2 290 ± 397	20 ± 4	528 ± 86	398 ± 105	195 ± 43
Iron	32 ± 10	2 240 ± 593	24 ± 5	30 ± 3	79 ± 10	88 ± 21
Phosphorus	197 ± 16	1 210 ± 104	2 250 ± 205	1 680 ± 142	3 580 ± 454	1 210 ± 89
Nitrogen[b]	165 ± 26	11.4 ± 0.9	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.
[b] Total nitrogen units are g kg^{-1}.
[c] N.D. = not determined.

Appendix 3. Site 31 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	5.2 ± 0.3	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	156 ± 46	1 170 ± 249	991 ± 55	1 090 ± 101	2 320 ± 164	1 180 ± 79
Calcium	5 800 ± 2 290	6 390 ± 2 610	4 630 ± 1 130	1 590 ± 387	20 900 ± 1 650	4 290 ± 562
Magnesium	782 ± 295	1 170 ± 177	1 110 ± 97	1 180 ± 109	5 750 ± 681	982 ± 102
Potassium	653 ± 124	1 000 ± 138	8 890 ± 1 130	4 890 ± 633	13 900 ± 1 000	3 980 ± 344
Manganese	903 ± 136	1 680 ± 358	950 ± 344	424 ± 100	259 ± 65	1 540 ± 253
Aluminum	163 ± 55	4 480 ± 938	57 ± 35	518 ± 80	342 ± 63	244 ± 22
Iron	12 ± 4	5 060 ± 1 130	62 ± 34	27 ± 3	60 ± 12	99 ± 19
Phosphorus	144 ± 66	1 190 ± 140	2 340 ± 175	1 610 ± 123	3 350 ± 444	1 290 ± 83
Nitrogen[b]	255 ± 89	9.6 ± 1.7	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.
[b] Total nitrogen units are g kg^{-1}.
[c] N.D. = not determined.

Appendix 3. Site 32 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	4.9 ± 0.2	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	167 ± 19	1 530 ± 135	1 020 ± 71	1 250 ± 190	2 510 ± 195	N.S.[b]
Calcium	5 430 ± 1 100	5 770 ± 1 100	5 650 ± 1 070	1 420 ± 286	20 500 ± 629	N.S.
Magnesium	700 ± 101	842 ± 126	1 120 ± 87	1 180 ± 173	5 710 ± 312	N.S.
Potassium	741 ± 87	931 ± 80	7 460 ± 858	5 700 ± 765	14 200 ± 424	N.S.
Manganese	502 ± 101	716 ± 194	422 ± 127	308 ± 57	176 ± 24	N.S.
Aluminum	160 ± 45	2 170 ± 209	16 ± 2	493 ± 99	393 ± 64	N.S.
Iron	26 ± 10	3 270 ± 734	21 ± 2	34 ± 7	65 ± 15	N.S.
Phosphorus	211 ± 28	1 240 ± 109	2 430 ± 289	1 830 ± 222	3 460 ± 262	N.S.
Nitrogen[c]	285 ± 86	13.2 ± 1.3	N.D.[d]	N.D.	N.D.	N.S.

[a] N.A. = not applicable.
[b] N.S. = not sampled.
[c] Total nitrogen units are g kg^{-1}.
[d] N.D. = not determined.

Appendix 3. Site 33 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	4.9 ± 0.4	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	186 ± 28	1 440 ± 226	897 ± 62	1 140 ± 55	2 770 ± 229	1 360 ± 62
Calcium	5 690 ± 2 450	6 170 ± 2 660	5 360 ± 785	1 850 ± 356	20 600 ± 1 260	4 940 ± 226
Magnesium	743 ± 208	921 ± 299	1 120 ± 112	1 090 ± 115	5 520 ± 369	1 180 ± 130
Potassium	926 ± 144	1 200 ± 178	9 440 ± 782	5 840 ± 624	11 500 ± 566	4 010 ± 247
Manganese	788 ± 211	1 050 ± 353	703 ± 108	566 ± 93	296 ± 35	1 920 ± 154
Aluminum	184 ± 40	2 490 ± 699	17 ± 6	410 ± 83	465 ± 99	214 ± 27
Iron	29 ± 8	2 430 ± 735	21 ± 4	16 ± 2	101 ± 30	99 ± 28
Phosphorus	227 ± 32	1 120 ± 140	2 410 ± 104	1 610 ± 131	3 200 ± 337	1 170 ± 44
Nitrogen[b]	270 ± 87	10.7 ± 1.3	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.
[b] Total nitrogen units are g kg^{-1}.
[c] N.D. = not determined.

Appendix 3. Site 34 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	5.0 ± 0.4	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	447 ± 80	3 550 ± 633	1 100 ± 85	1 480 ± 110	3 550 ± 338	2 330 ± 402
Calcium	7 700 ± 2 120	11 600 ± 4 940	4 910 ± 798	2 020 ± 374	24 100 ± 1 520	5 330 ± 309
Magnesium	315 ± 38	598 ± 130	1 020 ± 107	1 060 ± 91	4 910 ± 436	1 130 ± 210
Potassium	607 ± 82	778 ± 91	8 570 ± 812	6 930 ± 1 403	14 300 ± 240	3 930 ± 357
Manganese	255 ± 94	528 ± 299	462 ± 105	657 ± 124	226 ± 36	1 640 ± 268
Aluminum	109 ± 38	2 040 ± 348	26 ± 8	478 ± 68	364 ± 60	192 ± 51
Iron	31 ± 11	2 180 ± 465	18 ± 3	38 ± 5	75 ± 12	107 ± 30
Phosphorus	145 ± 23	933 ± 76	2 270 ± 223	1 610 ± 141	4 300 ± 481	1 120 ± 71
Nitrogen[b]	110 ± 48	10.6 ± 1.5	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.

[b] Total nitrogen units are g kg^{-1}.

[c] N.D. = not determined.

Appendix 3. Site 35 soil quadrat and foliar chemistry collected in 1991 (mg kg^{-1})

Elements	LFH elements		Spruce current needles	Pine current needles	Bunchberry	Bog cranberry
	Extractable	Total				
pH	4.9 ± 0.2	N.A.[a]	N.A.	N.A.	N.A.	N.A.
Sulfur	123 ± 13	1 330 ± 114	932 ± 67	1 210 ± 72	2 440 ± 239	1 320 ± 78
Calcium	4 750 ± 809	5 590 ± 1 030	5 060 ± 1 160	1 920 ± 174	19 900 ± 1 360	4 890 ± 552
Magnesium	726 ± 103	834 ± 123	1 150 ± 130	1 170 ± 106	5 960 ± 631	1 030 ± 67
Potassium	704 ± 83	1 020 ± 113	8 490 ± 692	5 670 ± 453	15 200 ± 1 130	4 330 ± 308
Manganese	689 ± 166	1 010 ± 319	795 ± 294	467 ± 97	224 ± 51	1 840 ± 143
Aluminum	99 ± 33	1 530 ± 205	19 ± 9	404 ± 76	312 ± 87	196 ± 22
Iron	22 ± 11	1 830 ± 517	27 ± 9	31 ± 6	72 ± 20	94 ± 15
Phosphorus	191 ± 20	1 040 ± 93	2 380 ± 350	1 680 ± 137	3 780 ± 528	1 220 ± 39
Nitrogen[b]	213 ± 76	11.4 ± 1.0	N.D.[c]	N.D.	N.D.	N.D.

[a] N.A. = not applicable.

[b] Total nitrogen units are g kg^{-1}.

[c] N.D. = not determined.

APPENDIX 4

Species Statistics, Condition, and Pest Agents in 1991

Appendix 4. Site 1 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Black spruce	1	0.03	96.00	86.00
Lodgepole pine	214	31.01	144.89	133.40
Trembling aspen	49	2.84	109.35	120.04
White spruce	14	0.82	109.07	91.79
Total	278[a]	34.69	136.67	128.71

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Black spruce	0	0	0	1	1
Lodgepole pine	7	42	17	149	215
Trembling aspen	7	14	8	21	50
White spruce	0	0	1	13	14
Total	14	56	26	184	280[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Black spruce	Lodgepole pine	Trembling aspen	White spruce	Total
Armillaria root rot	0	1	1	0	2
Aspen white rot	0	0	1	0	1
Cytospora canker	0	0	2	0	2
Insect damage (unidentified)	0	2	0	0	2
Needle cast	0	8	0	0	8
No agents on a dead tree	0	45	16	0	61
No agents on a live tree	1	73	9	8	91
Peniophora polygonia	0	0	4	0	4
Root collar weevil	0	10	0	0	10
Suppressed	0	11	0	0	11
Unidentified crown agent	0	6	8	4	18
Unidentified root agent	0	1	2	0	3
Unidentified stem agent	0	66	12	2	80
Unidentified terminal agent	0	6	1	0	7
Western gall rust	0	2	0	0	2
Total	1	231	56	14	302

Appendix 4. Site 2 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Lodgepole pine	134	34.98	171.19	173.71
Trembling aspen	43	4.05	127.91	130.74
White spruce	11	2.45	182.18	129.91
Total	188[a]	41.49	161.94	161.26

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Lodgepole pine	3	18	7	107	135
Trembling aspen	0	15	7	21	43
White spruce	0	0	0	11	11
Total	3	33	14	139	189[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Lodgepole pine	Trembling aspen	White spruce	Total
Armillaria root rot	1	0	0	1
Aspen white rot	0	1	0	1
Needle cast	3	0	0	3
No agents on a dead tree	19	15	0	34
No agents on a live tree	34	16	11	61
Old insect damage	14	0	0	14
Scar	0	1	0	1
Suppressed	2	0	0	2
Unidentified crown agent	4	7	0	11
Unidentified stem agent	56	6	0	62
Unidentified terminal agent	10	1	0	11
Western gall rust	1	0	0	1
Total	144	47	11	202

Appendix 4. Site 3 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Lodgepole pine	30	28.96	297.63	223.07
Trembling aspen	13	14.49	349.85	278.69
White spruce	1	0.10	167.00	110.00
Total	44[a]	43.54	310.09	236.93

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead + 1	Decline	Healthy	Total
Lodgepole pine	4	1	25	30
Trembling aspen	1	0	12	13
White spruce	0	0	1	1
Total	5	1	38	44[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Lodgepole pine	Trembling aspen	White spruce	Total
Aspen white rot	0	2	0	2
Needle cast	2	0	0	2
No agents on a dead tree	3	0	0	3
No agents on a live tree	9	3	1	13
Scar	0	1	0	1
Unidentified crown agent	2	0	0	2
Unidentified root agent	1	0	0	1
Unidentified stem agent	15	7	0	22
Unidentified terminal agent	4	0	0	4
Total	36	13	1	50

Appendix 4. Site 4 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Balsam fir	1	0.02	69.00	85.00
Balsam poplar	1	0.03	103.00	85.00
Lodgepole pine	118	32.59	177.70	176.72
Trembling aspen	45	7.94	154.84	168.44
White spruce	11	2.07	158.91	129.82
Total	176[a]	42.64	169.64	170.67

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Balsam fir	0	0	0	1	1
Balsam poplar	0	0	1	0	1
Lodgepole pine	6	29	10	74	119
Trembling aspen	0	7	2	36	45
White spruce	0	0	0	11	11
Total	6	36	13	122	177[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Balsam fir	Balsam poplar	Lodgepole pine	Trembling aspen	White spruce	Total
Armillaria root rot	0	0	4	0	0	4
Needle cast	0	0	7	0	0	7
No agents on a dead tree	0	0	30	7	0	37
No agents on a live tree	0	0	47	31	11	89
Old insect damage	0	0	2	0	0	2
Poplar wood borer	0	0	0	1	0	1
Root collar weevil	0	0	3	0	0	3
Scar	0	0	1	0	0	1
Suppressed	0	0	1	1	0	2
Trichopum abietinus	0	0	1	0	0	1
Unidentified crown agent	0	0	8	2	0	10
Unidentified stem agent	1	0	25	5	0	31
Unidentified terminal agent	0	1	5	0	0	6
Total	1	1	134	47	11	194

Appendix 4. Site 5 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Balsam fir	1	0.25	239.00	140.00
Lodgepole pine	138	63.78	207.46	218.28
White spruce	9	1.78	138.67	109.22
Total	148[a]	65.81	203.49	211.11

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Balsam fir	0	1	0	0	1
Lodgepole pine	6	18	8	106	138
White spruce	0	0	0	9	9
Total	6	19	8	115	148[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Balsam fir	Lodgepole pine	White spruce	Total
Armillaria root rot	0	3	0	3
Needle cast	0	12	0	12
No agents on a dead tree	1	16	0	17
No agents on a live tree	0	36	9	45
Root collar weevil	0	2	0	2
Unidentified crown agent	0	11	0	11
Unidentified root agent	0	2	0	2
Unidentified stem agent	0	74	0	74
Unidentified terminal agent	0	8	0	8
Total	1	164	9	174

Appendix 4. Site 6 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Balsam fir	2	0.52	203.00	183.00
Black spruce	2	0.23	134.50	107.50
Lodgepole pine	90	32.84	206.67	188.76
Trembling aspen	11	0.58	100.55	112.09
White spruce	26	6.68	198.73	153.54
Total	131[a]	40.85	195.02	174.00

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Balsam fir	0	0	0	2	2
Black spruce	0	0	0	2	2
Lodgepole pine	1	15	4	70	90
Trembling aspen	0	0	0	11	11
White spruce	0	1	0	25	26
Total	1	16	4	110	131[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Balsam fir	Black spruce	Lodgepole pine	Trembling aspen	White spruce	Total
Armillaria root rot	0	0	1	0	0	1
Needle cast	0	0	4	0	0	4
No agents on a dead tree	0	0	15	0	1	16
No agents on a live tree	2	2	48	11	22	85
Old insect damage	0	0	6	0	0	6
Unidentified crown agent	0	0	3	0	0	3
Unidentified stem agent	0	0	15	0	2	17
Unidentified terminal agent	0	0	5	0	1	6
Western gall rust	0	0	1	0	0	1
Total	2	2	98	11	26	139

Appendix 4. Site 7 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Balsam fir	1	0.66	284.00	260.00
Black spruce	6	0.21	94.33	98.00
Lodgepole pine	113	50.74	213.81	220.81
Trembling aspen	5	3.85	293.80	235.60
White spruce	37	8.25	171.35	151.51
Total	162[a]	63.72	202.59	201.14

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Topped	Total
Balsam fir	0	0	0	1	0	1
Black spruce	0	2	0	4	0	6
Lodgepole pine	2	24	9	78	0	113
Trembling aspen	0	0	0	5	0	5
White spruce	1	2	2	30	2	37
Total	3	28	11	118	2	162[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Balsam fir	Black spruce	Lodgepole pine	Trembling aspen	White spruce	Total
Armillaria root rot	0	0	1	0	0	1
Aspen white rot	0	0	0	1	0	1
Frost damage	0	0	1	0	0	1
Mechanical damage	0	0	6	0	1	7
Needle cast	0	0	3	0	0	3
No agents on a dead tree	0	2	22	0	3	27
No agents on a live tree	1	4	52	4	31	92
Root collar weevil	0	0	4	0	0	4
Standing water	0	0	0	0	1	1
Suppressed	0	0	2	0	0	2
Unidentified crown agent	0	0	12	0	0	12
Unidentified stem agent	0	0	6	0	1	7
Unidentified terminal agent	0	0	12	0	0	12
Total	1	6	121	5	37	170

Appendix 4. Site 8 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Black spruce	12	0.73	110.50	89.83
Lodgepole pine	91	21.75	174.05	147.91
Trembling aspen	27	2.81	103.81	113.67
White spruce	6	1.20	167.50	132.17
Total	136[a]	26.48	154.21	135.20

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Topped	Total
Black spruce	0	2	0	10	0	12
Lodgepole pine	2	21	10	57	1	91
Trembling aspen	0	0	0	27	0	27
White spruce	0	0	0	6	0	6
Total	2	23	10	100	1	136[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Black spruce	Lodgepole pine	Trembling aspen	White spruce	Total
Animal	0	0	1	0	1
Aspen white rot	0	0	1	0	1
Insect damage (unidentified)	0	1	0	0	1
Mechanical damage	0	1	0	0	1
Needle cast	0	9	0	1	10
No agents on a dead tree	1	22	0	0	23
No agents on a live tree	9	31	22	5	67
Phellinus pini	0	1	0	0	1
Root collar weevil	0	1	0	0	1
Terminal weevil	0	1	0	0	1
Unidentified crown agent	1	6	0	0	7
Unidentified stem agent	0	22	2	1	25
Unidentified terminal agent	0	4	1	0	5
Western gall rust	0	2	0	0	2
Yellow witches' broom	1	0	0	0	1
Total	12	101	27	7	147

Appendix 4. Site 9 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Lodgepole pine	206	55.97	172.05	174.73
White spruce	3	0.19	110.33	76.00
Total	209[a]	56.16	171.17	173.30

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Topped	Total
Lodgepole pine	4	50	13	140	0	207
White spruce	0	0	0	2	1	3
Total	4	50	13	142	1	210[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Lodgepole pine	White spruce	Total
Armillaria root rot	3	0	3
Atropellis canker	5	0	5
Mechanical damage	9	0	9
Needle cast	6	0	6
No agents on a dead tree	52	0	52
No agents on a live tree	23	2	25
Root collar weevil	30	0	30
Scar	1	0	1
Suppressed	3	1	4
Unidentified crown agent	9	0	9
Unidentified stem agent	95	0	95
Unidentified terminal agent	18	0	18
Western gall rust	1	0	1
Total	255	3	258

Appendix 4. Site 10 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Black spruce	72	4.02	117.31	108.51
Lodgepole pine	379	34.23	122.90	134.20
Total	451[a]	38.25	122.00	130.13

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Topped	Total
Black spruce	0	7	2	61	2	72
Lodgepole pine	6	87	51	233	2	379
Total	6	94	53	294	4	451[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Black spruce	Lodgepole pine	Total
Armillaria root rot	0	1	1
Elytroderma deformans	0	3	3
Needle cast	1	0	1
No agents on a dead tree	7	91	98
No agents on a live tree	56	183	239
Root collar weevil	0	1	1
Scar	0	3	3
Unidentified crown agent	3	61	64
Unidentified stem agent	3	49	52
Unidentified terminal agent	1	1	2
Yellow witches' broom	2	0	2
Total	73	393	466

Appendix 4. Site 11 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Black spruce	1	0.06	178.00	60.00
Lodgepole pine	108	67.02	243.07	224.68
White spruce	1	0.09	168.00	99.00
Total	110[a]	67.17	241.80	222.04

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Black spruce	0	1	0	0	1
Lodgepole pine	2	12	2	92	108
White spruce	0	0	0	1	1
Total	2	13	2	93	110[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Black spruce	Lodgepole pine	White spruce	Total
Armillaria root rot	0	1	0	1
Mechanical damage	0	2	0	2
Needle cast	0	2	0	2
No agents on a dead tree	1	13	0	14
No agents on a live tree	0	38	1	39
Root collar weevil	0	2	0	2
Scar	0	4	0	4
Unidentified crown agent	0	5	0	5
Unidentified stem agent	0	46	0	46
Unidentified terminal agent	0	6	0	6
Total	1	119	1	121

Appendix 4. Site 12 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Black spruce	2	0.09	60.50	114.50
Lodgepole pine	117	29.09	146.87	138.09
Trembling aspen	13	6.88	272.38	184.77
White spruce	6	0.50	140.67	103.67
Total	138[a]	36.57	157.17	140.65

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Black spruce	0	0	0	2	2
Lodgepole pine	1	21	5	90	117
Trembling aspen	1	0	1	11	13
White spruce	0	0	0	6	6
Total	2	21	6	109	138[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Black spruce	Lodgepole pine	Trembling aspen	White spruce	Total
Animal	0	1	3	0	4
Bark beetles	0	1	0	0	1
Frost damage	0	0	3	0	3
Mechanical damage	0	1	1	0	2
Needle cast	0	8	0	0	8
No agents on a dead tree	0	22	0	0	22
No agents on a live tree	1	25	1	4	31
Peniophora polygonia	0	0	1	0	1
Scar	0	19	2	0	21
Suppressed	0	1	0	0	1
Unidentified crown agent	1	4	0	0	5
Unidentified stem agent	1	43	6	1	51
Unidentified terminal agent	1	13	0	0	14
Western gall rust	0	3	0	0	3
Yellow witches' broom	0	0	0	1	1
Total	4	141	17	6	168

Appendix 4. Site 13 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Black spruce	6	0.29	111.50	93.17
Lodgepole pine	57	26.04	244.12	183.27
Trembling aspen	1	1.70	493.00	225.00
White spruce	48	6.48	128.96	101.56
Total	112[a]	34.51	189.88	140.35

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Black spruce	0	0	0	6	6
Lodgepole pine	4	7	4	42	57
Trembling aspen	0	0	0	1	1
White spruce	0	0	0	48	48
Total	4	7	4	97	112[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Black spruce	Lodgepole pine	Trembling aspen	White spruce	Total
Atropellis canker	0	1	0	0	1
Needle cast	0	4	0	0	4
No agents on a dead tree	0	6	0	0	6
No agents on a live tree	6	18	1	43	68
Root collar weevil	0	1	0	0	1
Unidentified crown agent	0	3	0	0	3
Unidentified stem agent	0	24	0	3	27
Unidentified terminal agent	0	11	0	2	13
Total	6	68	1	48	123

Appendix 4. Site 14 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Balsam fir	1	0.13	163.00	143.00
Black spruce	1	0.08	146.00	118.00
Lodgepole pine	239	47.66	158.61	161.57
Total	241[a]	47.87	158.57	161.31

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Balsam fir	0	0	0	1	1
Black spruce	0	0	0	1	1
Lodgepole pine	6	46	14	175	241
Total	6	46	14	177	243[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Balsam fir	Black spruce	Lodgepole pine	Total
Animal	0	0	1	1
Armillaria root rot	0	0	4	4
Insect damage (unidentified)	0	0	1	1
Mechanical damage	0	0	1	1
Needle cast	0	0	11	11
No agents on a dead tree	0	0	47	47
No agents on a live tree	1	0	95	96
Root collar weevil	0	0	1	1
Scar	0	4	1	1
Suppressed	0	0	3	3
Unidentified crown agent	0	0	12	12
Unidentified stem agent	0	1	68	69
Unidentified terminal agent	0	0	24	24
Western gall rust	0	0	1	1
Total	1	1	270	272

Appendix 4. Site 16 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Balsam fir	1	0.01	83.00	55.00
Black spruce	34	1.33	103.35	77.18
Lodgepole pine	227	34.20	151.45	140.39
White spruce	4	0.80	198.50	102.00
Total	266[a]	36.34	145.76	131.62

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Balsam fir	0	0	0	1	1
Black spruce	0	2	0	32	34
Lodgepole pine	8	42	14	163	227
White spruce	0	0	0	4	4
Total	8	44	14	200	266[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Balsam fir	Black spruce	Lodgepole pine	White spruce	Total
Animal	0	0	2	0	2
Armillaria root rot	0	0	3	0	3
Mechanical damage	0	0	2	0	2
Needle cast	0	0	15	0	15
No agents on a dead tree	0	2	41	0	43
No agents on a live tree	0	30	56	3	89
Root collar weevil	0	0	5	0	5
Scar	0	0	1	0	1
Standing water	0	0	1	0	1
Suppressed	0	0	3	0	3
Unidentified crown agent	0	0	15	1	16
Unidentified root agent	0	0	1	0	1
Unidentified stem agent	1	0	105	0	106
Unidentified terminal agent	0	2	8	0	10
Total	1	34	258	4	297

Appendix 4. Site 17 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Black spruce	42	2.97	126.45	118.27
Lodgepole pine	111	17.20	149.45	161.56
Total	153[a]	20.17	143.14	149.65

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Black spruce	1	5	0	36	42
Lodgepole pine	1	37	0	69	111
Total	2	42	4	105	153[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Black spruce	Lodgepole pine	Total
Armillaria root rot	0	1	1
Mechanical damage	0	7	7
No agents on a dead tree	5	36	41
No agents on a live tree	31	54	85
Unidentified crown agent	4	2	6
Unidentified stem agent	2	10	12
Unidentified terminal agent	0	3	3
Total	42	113	155

Appendix 4. Site 18 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Black spruce	151	6.97	101.66	97.91
Lodgepole pine	47	10.94	159.13	120.30
Trembling aspen	27	2.39	119.56	114.07
White spruce	12	4.30	238.58	175.83
Total	237[a]	24.60	122.03	108.14

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Black spruce	0	1	3	147	151
Lodgepole pine	1	9	4	33	47
Trembling aspen	0	1	5	21	27
White spruce	0	0	0	12	12
Total	1	11	12	213	237[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Black spruce	Lodgepole pine	Trembling aspen	White spruce	Total
Animal	0	0	0	1	1
Aspen white rot	0	0	4	0	4
Bark beetles	0	1	0	0	1
Hypoxylon canker	0	0	1	0	1
Insect damage (unidentified)	0	1	0	0	1
Mechanical damage	0	0	2	0	2
Needle cast	0	5	0	0	5
No agents on a dead tree	1	10	1	0	12
No agents on a live tree	134	26	12	11	183
Old insect damage	0	3	0	0	3
Unidentified crown agent	8	4	4	0	16
Unidentified stem agent	7	2	4	1	14
Unidentified terminal agent	2	1	0	0	3
Yellow witches' broom	1	0	0	0	1
Total	153	53	28	13	247

Appendix 4. Site 19 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Black spruce	14	0.54	104.50	90.85
Lodgepole pine	101	18.01	166.62	125.61
White spruce	4	0.29	130.75	90.25
Total	119[a]	18.83	158.11	120.58

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Black spruce	0	2	0	12	14
Lodgepole pine	1	17	6	77	101
White spruce	0	0	0	4	4
Total	1	19	6	93	119[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Black spruce	Lodgepole pine	White spruce	Total
Adelges cooleyi	1	0	0	1
Armillaria root rot	0	1	0	1
Mechanical damage	0	1	0	1
Needle cast	0	4	0	4
No agents on a dead tree	2	16	0	18
No agents on a live tree	10	46	4	60
Old insect damage	0	6	0	6
Scar	0	4	0	4
Suppressed	0	3	0	3
Unidentified crown agent	0	3	0	3
Unidentified stem agent	1	16	0	17
Unidentified terminal agent	0	9	0	9
Western gall rust	0	1	0	1
Total	14	110	4	128

Appendix 4. Site 20 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Balsam fir	1	0.11	168.00	124.00
Black spruce	1	0.14	0.00	148.00
Lodgepole pine	95	50.12	230.64	214.60
White spruce	5	1.30	212.60	142.60
Total	102[a]	51.67	226.88	209.53

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Balsam fir	0	0	0	1	1
Black spruce	0	0	0	1	1
Lodgepole pine	3	25	4	63	95
White spruce	0	0	0	5	5
Total	3	25	4	70	102[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Balsam fir	Black spruce	Lodgepole pine	White spruce	Total
Armillaria root rot	0	0	2	0	2
Mechanical damage	0	0	5	0	5
Needle cast	0	1	0	3	4
No agents on a dead tree	0	0	27	0	27
No agents on a live tree	0	0	24	2	26
Root collar weevil	0	0	1	0	1
Scar	0	0	13	0	13
Unidentified crown agent	1	0	5	0	6
Unidentified stem agent	0	1	26	0	27
Total	1	2	103	5	111

Appendix 4. Site 21 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Balsam fir	1	0.04	104.00	117.00
Balsam poplar	1	0.02	76.00	103.00
Lodgepole pine	215	39.21	156.13	154.65
White spruce	43	3.80	128.26	106.42
Total	260[a]	43.07	151.01	146.27

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Balsam fir	0	0	0	1	1
Balsam poplar	0	0	0	1	1
Lodgepole pine	2	57	14	142	215
White spruce	0	2	0	41	43
Total	2	59	14	185	260[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Balsam fir	Balsam poplar	Lodgepole pine	White spruce	Total
Armillaria root rot	0	0	1	0	1
Mechanical damage	0	0	1	0	1
No agents on a dead tree	0	0	57	2	59
No agents on a live tree	1	1	86	40	128
Root collar weevil	0	0	1	0	1
Scar	0	0	8	1	9
Unidentified crown agent	0	0	20	0	20
Unidentified stem agent	0	0	47	0	47
Total	1	1	221	43	266

Appendix 4. Site 22 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Balsam fir	1	0.02	88.00	65.00
Black spruce	4	0.30	134.25	119.50
Lodgepole pine	133	53.54	215.20	210.08
White spruce	16	2.88	166.44	124.56
Total	154[a]	56.74	207.21	197.90

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Balsam fir	0	0	0	1	1
Black spruce	0	0	0	4	4
Lodgepole pine	1	21	8	103	133
White spruce	0	0	0	16	16
Total	1	21	8	124	154[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Balsam fir	Black spruce	Lodgepole pine	White spruce	Total
Mechanical damage	0	0	2	0	2
Needle cast	0	0	5	0	5
No agents on a dead tree	0	0	21	0	21
No agents on a live tree	1	4	67	14	86
Root collar weevil	0	0	1	0	1
Scar	0	0	1	0	1
Unidentified crown agent	0	0	5	0	5
Unidentified root agent	0	0	1	0	1
Unidentified stem agent	0	0	21	1	22
Unidentified terminal agent	0	0	16	1	17
Total	1	4	140	16	161

Appendix 4. Site 23 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Balsam fir	3	0.28	121.67	130.00
Black spruce	3	0.06	79.00	81.67
Lodgepole pine	186	57.99	184.87	194.23
White spruce	3	0.20	111.33	80.00
Total	195[a]	58.53	181.14	189.73

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead + 1	Decline	Healthy	Total
Balsam fir	1	0	2	3
Black spruce	1	0	2	3
Lodgepole pine	23	17	146	186
White spruce	0	0	3	3
Total	25	17	153	195[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Balsam fir	Black spruce	Lodgepole pine	White spruce	Total
Mechanical damage	0	0	4	0	4
Needle cast	0	0	10	0	10
No agents on a dead tree	1	1	23	0	25
No agents on a live tree	2	2	57	2	63
Root collar weevil	0	0	2	0	2
Scar	0	0	8	0	8
Suppressed	0	0	2	0	2
Unidentified crown agent	0	0	10	0	10
Unidentified stem agent	0	0	86	1	87
Unidentified terminal agent	0	0	6	0	6
Western gall rust	0	0	1	0	1
Total	3	3	209	3	218

Appendix 4. Site 24 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Lodgepole pine	324	28.52	129.31	111.71
White spruce	2	0.07	101.50	88.00
Total	326[a]	28.58	129.13	111.56

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Topped	Total
Lodgepole pine	2	63	29	229	1	324
White spruce	0	0	0	2	0	2
Total	2	63	29	231	1	326[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Lodgepole pine	White spruce	Total
Armillaria root rot	1	0	1
Atropellis canker	1	0	1
Mechanical damage	7	0	7
Needle cast	15	0	15
No agents on a dead tree	61	0	61
No agents on a live tree	121	2	123
Root collar weevil	3	0	3
Scar	2	0	2
Suppressed	4	0	4
Unidentified crown agent	17	0	17
Unidentified root agent	1	0	1
Unidentified stem agent	93	0	93
Unidentified terminal agent	26	0	26
Total	352	2	354

Appendix 4. Site 25 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Lodgepole pine	113	45.46	226.27	180.62
Trembling aspen	2	0.53	195.00	169.50
White spruce	3	2.19	294.33	183.33
Total	118[a]	48.19	227.47	180.50

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Lodgepole pine	1	15	13	84	113
Trembling aspen	0	0	0	2	21
White spruce	0	0	0	3	3
Total	1	15	13	89	118[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Lodgepole pine	Trembling aspen	White spruce	Total
Elytroderma deformans	2	0	0	2
Needle cast	2	0	0	2
No agents on a dead tree	16	0	0	16
No agents on a live tree	62	1	0	63
Scar	7	0	0	7
Spruce needle rust	0	0	3	3
Unidentified crown agent	14	0	0	14
Unidentified stem agent	15	1	0	16
Western gall rust	1	0	0	1
Total	119	2	3	124

Appendix 4. Site 26 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Balsam poplar	2	0.00	92.00	50.00
Black spruce	23	2.32	134.04	120.87
Lodgepole pine	204	45.98	166.16	179.66
Trembling aspen	6	3.54	277.33	211.50
White spruce	4	0.77	165.25	141.75
Total	239[a]	52.61	165.22	173.55

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Balsam poplar	0	0	1	1	2
Black spruce	0	2	2	19	23
Lodgepole pine	3	54	11	136	204
Trembling aspen	0	0	0	6	6
White spruce	0	0	0	4	4
Total	3	56	14	166	239[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Balsam poplar	Black spruce	Lodgepole pine	Trembling aspen	White spruce	Total
Armillaria root rot	0	0	1	0	0	1
Elytroderma deformans	0	0	20	0	0	20
Needle cast	0	7	0	0	2	9
No agents on a dead tree	0	2	54	0	0	56
No agents on a live tree	0	11	100	5	1	117
Phellinus pini	0	0	1	0	0	1
Root collar weevil	0	0	1	0	0	1
Scar	0	0	2	0	0	2
Spruce needle rust	0	0	0	0	2	2
Unidentified crown agent	0	1	17	0	0	18
Unidentified stem agent	2	0	17	1	0	20
Western gall rust	0	0	1	0	0	1
Yellow witches' broom	0	3	0	0	0	3
Total	2	24	214	6	5	251

Appendix 4. Site 30 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Lodgepole pine	128	45.94	203.74	204.62
White spruce	1	0.54	275.00	228.00
Total	129[a]	46.48	204.29	204.80

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead + 1	Decline	Healthy	Total
Lodgepole pine	12	3	113	128
White spruce	0	0	1	1
Total	12	3	114	129[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Lodgepole pine	White spruce	Total
Mechanical damage	3	0	3
Needle cast	2	0	2
No agents on a dead tree	12	0	12
No agents on a live tree	40	1	41
Root collar weevil	2	0	2
Unidentified crown agent	5	0	5
Unidentified stem agent	62	0	62
Unidentified terminal agent	15	0	15
Total	141	1	142

Appendix 4. Site 31 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Lodgepole pine	140	51.60	204.38	201.99
Trembling aspen	3	0.92	231.33	154.33
White spruce	1	0.04	119.00	79.00
Total	144[a]	52.56	204.35	200.00

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead + 1	Decline	Healthy	Total
Lodgepole pine	38	9	93	140
Trembling aspen	1	0	2	3
White spruce	0	0	1	1
Total	39	9	96	144[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Lodgepole pine	Trembling aspen	White spruce	Total
Aspen white rot	0	1	0	1
Elytroderma deformans	1	0	0	1
No agents on a dead tree	37	1	0	38
No agents on a live tree	33	1	1	35
Unidentified crown agent	9	0	0	9
Unidentified stem agent	67	0	0	67
Western gall rust	1	0	0	1
Total	148	3	1	152

Appendix 4. Site 32 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Lodgepole pine	150	39.59	179.27	174.49
White spruce	3	0.08	100.33	69.00
Total	153[a]	39.67	177.73	172.37

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead + 1	Decline	Healthy	Total
Lodgepole pine	33	8	109	150
White spruce	0	0	3	3
Total	33	8	112	153[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Lodgepole pine	White spruce	Total
Mechanical damage	2	0	2
Needle cast	4	0	4
No agents on a dead tree	33	0	33
No agents on a live tree	24	3	27
Root collar weevil	1	0	1
Scar	1	0	1
Unidentified crown agent	6	0	6
Unidentified stem agent	83	0	83
Unidentified terminal agent	10	0	10
Western gall rust	1	0	1
Total	165	3	168

Appendix 4. Site 33 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Black spruce	2	0.27	171.00	107.50
Lodgepole pine	183	39.43	167.87	177.13
Trembling aspen	1	0.08	151.00	115.00
White spruce	10	0.38	98.90	85.10
Total	196[a]	40.16	164.30	171.37

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Black spruce	0	0	0	2	2
Lodgepole pine	5	42	7	129	183
Trembling aspen	0	0	0	1	1
White spruce	0	0	0	10	10
Total	5	42	7	142	196[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Black spruce	Lodgepole pine	Trembling aspen	White spruce	Total
Armillaria root rot	0	4	0	0	4
Insect damage (unidentified)	0	6	0	0	6
Mechanical damage	0	2	0	0	2
Needle cast	1	7	0	0	8
No agents on a dead tree	0	42	0	0	42
No agents on a live tree	1	72	0	9	82
Root collar weevil	0	2	0	0	2
Standing water	0	7	1	0	8
Unidentified crown agent	0	7	0	0	7
Unidentified stem agent	0	38	0	0	38
Unidentified terminal agent	0	12	0	1	13
Total	2	199	1	10	212

Appendix 4. Site 34 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Lodgepole pine	200	40.98	151.85	160.72
Trembling aspen	24	3.41	116.46	130.54
White spruce	7	0.12	77.71	66.57
Total	231[a]	44.51	145.93	154.65

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Lodgepole pine	9	34	24	133	200
Trembling aspen	2	5	7	10	24
White spruce	0	0	0	7	7
Total	11	39	31	150	231[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Lodgepole pine	Trembling aspen	White spruce	Total
Armillaria root rot	7	0	0	7
Aspen white rot	0	1	0	1
Atropellis canker	4	0	0	4
Clear wing moth	1	0	0	1
Mechanical damage	1	0	0	1
Needle cast	38	0	0	38
No agents on a dead tree	34	6	0	40
No agents on a live tree	42	8	6	56
Root collar weevil	8	0	0	8
Suppressed	20	5	0	25
Unidentified bracket fungi	1	0	0	1
Unidentified crown agent	16	3	0	19
Unidentified root agent	1	0	0	1
Unidentified stem agent	70	4	1	75
Unidentified terminal agent	11	0	0	11
Western gall rust	5	0	0	5
Total	258	28	7	293

Appendix 4. Site 35 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Black spruce	8	0.66	125.13	115.00
Lodgepole pine	145	47.28	185.57	188.93
White spruce	9	0.14	80.78	57.33
Total	162[a]	48.08	176.76	177.69

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead + 1	Decline	Healthy	Total
Black spruce	2	0	6	8
Lodgepole pine	32	5	108	145
White spruce	0	0	9	9
Total	34	5	123	162[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Black spruce	Lodgepole pine	White spruce	Total
Insect damage (unidentified)	0	1	0	1
Mechanical damage	0	1	0	1
Needle cast	0	9	0	9
No agents on a dead tree	2	28	0	30
No agents on a live tree	5	27	9	41
Unidentified crown agent	0	11	0	11
Unidentified root agent	0	1	0	1
Unidentified stem agent	1	74	0	75
Unidentified terminal agent	1	16	0	17
Total	9	168	9	186

Appendix 4. Site 40 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Balsam poplar	20	5.11	176.70	128.25
Lodgepole pine	14	0.96	113.79	76.83
Choke cherry	7	0.00	71.57	61.43
Trembling aspen	69	21.93	191.46	177.69
White spruce	9	1.14	165.67	97.22
Total	119[a]	29.15	170.84	145.47

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Balsam poplar	4	0	3	13	20
Lodgepole pine	1	5	0	8	14
Choke cherry	1	0	0	6	7
Trembling aspen	17	1	6	45	69
White spruce	0	0	0	9	9
Total	23	6	9	81	119[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Balsam poplar	Lodgepole pine	Choke cherry	Trembling aspen	White spruce	Total
Ambrosia beetle	0	0	0	1	0	1
Armillaria root rot	3	0	0	10	0	13
Aspen white rot	0	0	0	1	0	1
Frost damage	0	0	0	2	9	11
Hypoxylon canker	0	0	0	19	0	19
No agents on a dead tree	0	5	1	2	0	8
No agents on a live tree	11	6	5	39	0	61
Shepherd's crook	2	0	0	1	0	3
Suppressed	0	1	0	0	0	1
Trunk canker	0	0	0	2	0	2
Unidentified crown agent	0	0	0	0	2	2
Unidentified stem agent	2	2	1	2	0	7
Unidentified terminal agent	2	0	0	1	0	3
Total	20	14	7	80	11	132

Appendix 4. Site 41 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Lodgepole pine	7	1.33	160.86	117.86
Willow spp.	1	0.00	64.00	46.00
Trembling aspen	135	28.75	157.01	146.11
White spruce	5	0.21	104.40	66.40
Total	148[a]	30.29	154.79	141.37

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Lodgepole pine	0	4	0	3	7
Willow spp.	0	0	0	1	1
Trembling aspen	3	1	1	130	135
White spruce	0	0	0	5	5
Total	3	5	1	139	148[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Lodgepole pine	Willow spp.	Trembling aspen	White spruce	Total
Armillaria root rot	0	0	1	0	1
Aspen white rot	0	0	24	0	24
Frost damage	0	0	7	0	7
Hypoxylon canker	0	0	2	0	2
No agents on a dead tree	4	0	1	0	5
No agents on a live tree	3	1	71	4	79
Peniophora polygonia	0	0	4	0	4
Shepherd's crook	0	0	9	0	9
Spruce needle rust	0	0	0	1	1
Suppressed	0	0	1	0	1
Trunk canker	0	0	1	0	1
Unidentified stem agent	0	0	22	0	22
Unidentified terminal agent	0	0	2	0	2
Total	7	1	145	5	158

Appendix 4. Site 42 species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Lodgepole pine	18	7.99	229.83	161.67
Willow spp.	1	0.00	53.00	0.00
Trembling aspen	102	14.12	131.85	130.00
White spruce	6	0.58	150.00	91.67
Total	127[a]	22.70	145.97	132.72

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Total
Lodgepole pine	0	1	1	16	18
Willow spp.	0	0	0	1	1
Trembling aspen	43	3	5	51	102
White spruce	0	0	1	5	6
Total	43	4	7	73	127[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Lodgepole pine	Willow spp.	Trembling aspen	White spruce	Total
Ambrosia beetle	0	0	3	0	3
Armillaria root rot	0	0	28	0	28
Aspen white rot	0	0	1	0	1
Hypoxylon canker	0	0	41	0	41
No agents on a dead tree	1	0	3	0	4
No agents on a live tree	11	0	39	0	50
Suppressed	1	0	0	0	1
Unidentified bracket fungi	0	0	1	0	1
Unidentified crown agent	0	0	0	6	6
Unidentified stem agent	6	1	18	0	25
Western gall rust	1	0	0	0	1
Total	20	1	134	6	161

Appendix 4. Site A species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Black spruce	1	0.00	51.00	39.20
Lodgepole pine	174	0.51	37.70	35.69
Trembling aspen	17	0.02	27.71	38.74
Total	192[a]	0.53	36.89	35.98

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Decline	Healthy	Total
Black spruce	0	0	1	1
Lodgepole pine	18	3	153	174
Trembling aspen	0	0	17	17
Total	18	3	171	192[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Black spruce	Lodgepole pine	Trembling aspen	Total
Armillaria root rot	0	17	0	17
Melampsora spp. (leaf rust of aspen)	0	0	3	3
Mites	0	0	1	1
No agents on a live tree	0	138	0	138
Pitch blister moths	0	3	0	3
Root collar weevil	0	2	0	2
Shepherd's crook	0	0	17	17
Spruce needle rust	1	0	0	1
Suppressed	0	6	0	6
Terminal weevil	0	1	0	1
Unidentified crown agent	0	1	0	1
Unidentified root agent	0	1	0	1
Unidentified stem agent	0	0	1	1
Unidentified terminal agent	0	5	0	5
Western gall rust	0	1	0	1
Total	1	175	22	198

Appendix 4. Site B species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Black spruce	2	0.01	37.00	37.50
Lodgepole pine	139	1.46	59.98	49.92
Trembling aspen	10	0.02	34.60	44.47
White spruce	1	0.00	14.00	19.60
Total	152[a]	1.49	57.70	49.20

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Decline	Healthy	Total
Black spruce	0	0	2	2
Lodgepole pine	21	1	117	139
Trembling aspen	0	0	10	10
White spruce	0	0	1	1
Total	21	1	130	152[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Black spruce	Lodgepole pine	Trembling aspen	White spruce	Total
Armillaria root rot	0	14	0	0	14
Needle cast	0	19	0	0	19
No agents on a live tree	2	87	3	0	92
Root collar weevil	0	7	0	0	7
Shepherd's crook	0	0	6	0	6
Spruce needle rust	0	0	0	1	1
Suppressed	0	3	0	0	3
Unidentified stem agent	0	5	1	0	6
Unidentified terminal agent	0	5	0	0	5
Western gall rust	0	2	0	0	2
Total	2	142	10	1	155

Appendix 4. Site C species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Lodgepole pine	400	0.83	34.83	33.04
Trembling aspen	2	0.00	19.50	29.05
Total	402[a]	0.83	34.75	33.02

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Healthy	Total
Lodgepole pine	12	388	400
Trembling aspen	0	2	2
Total	12	390	402[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Lodgepole pine	Trembling aspen	Total
Animal	1	0	1
Armillaria root rot	11	0	11
No agents on a live tree	319	0	319
Root collar weevil	1	0	1
Shepherd's crook	0	2	2
Suppressed	34	0	34
Terminal weevil	2	0	2
Unidentified crown agent	1	0	1
Unidentified terminal agent	31	0	31
Total	400	2	402

Appendix 4. Site D species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Balsam fir	2	0.00	9.50	21.85
Lodgepole pine	533	0.54	26.21	27.75
Trembling aspen	2	0.00	22.50	25.00
Total	537[a]	0.54	26.14	27.72

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Decline	Healthy	Total
Balsam fir	0	0	2	2
Lodgepole pine	37	6	490	533
Trembling aspen	0	0	2	2
Total	37	6	494	537[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Balsam fir	Lodgepole pine	Trembling aspen	Total
Animal	0	1	0	1
Armillaria root rot	0	40	0	40
No agents on a live tree	0	443	0	443
Pine bark aphids	0	3	0	3
Pitch blister moths	0	6	0	6
Root collar weevil	0	2	0	2
Shepherd's crook	0	0	2	2
Spruce needle rust	1	0	0	1
Suppressed	0	12	0	12
Terminal weevil	0	4	0	4
Unidentified crown agent	0	6	0	6
Unidentified root agent	0	1	0	1
Unidentified terminal agent	2	14	0	16
Western gall rust	0	6	0	6
Total	3	538	2	543

Appendix 4. Site E species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Lodgepole pine	566	0.84	30.41	30.79
Trembling aspen	28	0.02	23.46	36.69
Total	594[a]	0.86	30.08	31.07

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Decline	Healthy	Total
Lodgepole pine	34	14	518	566
Trembling aspen	0	0	28	28
Total	34	14	546	594[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Lodgepole pine	Trembling aspen	Total
Armillaria root rot	38	0	38
Mites	0	1	1
Needle cast	1	0	1
No agents on a live tree	437	0	437
Pine bark aphids	3	0	3
Root collar weevil	2	0	2
Shepherd's crook	0	28	28
Suppressed	64	0	64
Terminal weevil	5	0	5
Unidentified stem agent	2	1	3
Unidentified terminal agent	14	0	14
Western gall rust	3	0	3
Total	569	30	599

Appendix 4. Site F species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Lodgepole pine	94	1.78	82.41	61.00
Trembling aspen	12	0.01	25.25	38.02
Total	106[a]	1.79	75.94	58.40

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Decline	Healthy	Total
Lodgepole pine	7	1	86	94
Trembling aspen	0	0	12	12
Total	7	1	98	106[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by pest agent

Agent	Lodgepole pine	Trembling aspen	Total
Armillaria root rot	4	0	4
No agents on a live tree	44	0	44
Root collar weevil	3	0	3
Shepherd's crook	0	12	12
Suppressed	2	0	2
Unidentified stem agent	2	0	2
Unidentified terminal agent	4	0	4
Western gall rust	37	0	37
Total	96	12	108

Appendix 4. Sites 1–35 total species statistics, condition, and pest agents in 1991

Species statistics

Species	Density (no. of trees)	Total volume (m^3/ha)	Mean dbh (mm)	Mean height (dm)
Balsam fir	13	2.03	151.46	134.23
Balsam poplar	4	0.05	90.75	79.33
Black spruce	385	21.30	110.79	101.76
Lodgepole pine	4742	1222.65	171.66	167.47
Trembling aspen	271	56.01	150.77	145.23
White spruce	300	48.48	150.65	118.30
Total	5715[a]	1350.52	165.37	159.25

[a] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Frequency of species by condition[a]

Species	Dead	Dead + 1	Decline	Healthy	Topped	Total
Balsam fir	0	2	0	11	0	13
Balsam poplar	0	0	2	2	0	4
Black spruce	1	27	7	348	2	385
Lodgepole pine	87	948	335	3368	4	4742
Trembling aspen	10	44	30	187	0	271
White spruce	1	5	3	288	3	300
Total	99	1026	377	4204	9	5715[b]

[a] Dead = tree died in the last year; dead + 1 = tree dead more than one year; decline = declining; healthy = healthy; topped = topped.

[b] Totals may not match between species statistics table and frequency of species by condition table because trees were not standing when measurement survey was done.

Appendix 4. Sites 1–35 total species statistics, condition, and pest agents in 1991 concluded

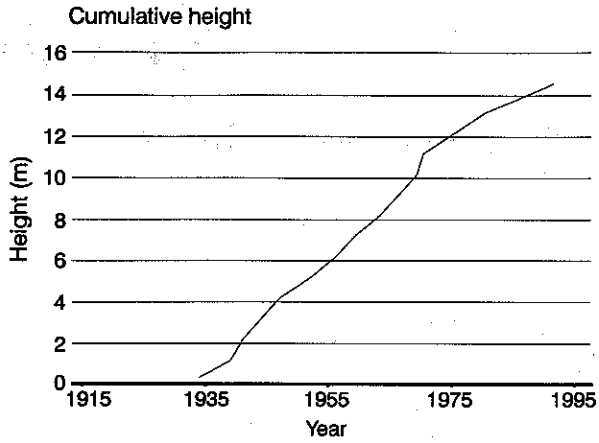
Frequency of species by pest agent

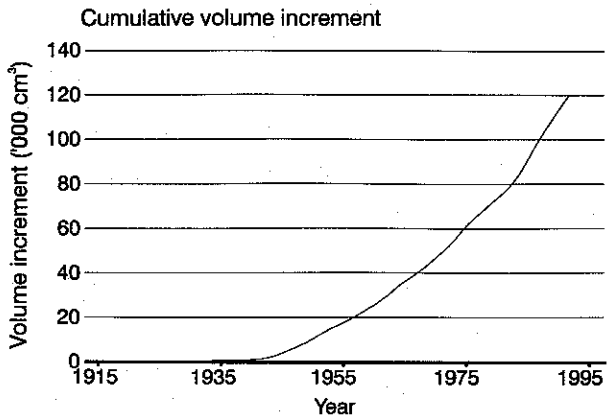
Agent	Balsam fir	Balsam poplar	Black spruce	Lodgepole pine	Trembling aspen	White spruce	Total
Adelges cooleyi	0	0	1	0	0	0	1
Animal	0	0	0	4	4	1	9
Armillaria root rot	0	0	0	41	1	0	42
Aspen white rot	0	0	0	0	12	0	12
Atropellis canker	0	0	0	11	0	0	11
Bark beetles	0	0	0	2	0	0	2
Clear wing moth	0	0	0	1	0	0	1
Cytospora canker	0	0	0	0	2	0	2
Elytroderma deformans	0	0	0	26	0	0	26
Frost	0	0	0	1	3	0	4
Hypoxylon canker	0	0	0	0	1	0	1
Insect damage (unidentified)	0	0	0	12	0	0	12
Mechanical damage	0	0	0	58	3	1	62
Needle cast	0	0	10	195	0	6	211
No agents on a dead tree	2	0	26	951	46	6	1031
No agents on a live tree	8	1	307	1649	125	256	2346
Old insect damage	0	0	0	31	0	0	31
Peniphora polygonia	0	0	0	0	5	0	5
Phellinus pini	0	0	0	2	0	0	2
Poplar wood borer	0	0	0	0	1	0	1
Root collar weevil	0	0	0	82	0	0	82
Scar	0	0	0	76	4	1	81
Spruce needle rust	0	0	0	0	0	5	5
Standing water	0	0	0	8	1	1	10
Suppressed	0	0	0	55	6	1	62
Terminal weevil	0	0	0	1	0	0	1
Trichopum abietinus	0	0	0	1	0	0	1
Unidentified bracket fungi	0	0	0	1	0	0	1
Unidentified crown agent	1	0	18	312	24	5	360
Unidentified root agent	0	0	0	9	2	0	11
Unidentified stem agent	2	2	17	1436	48	14	1519
Unidentified terminal agent	0	1	7	260	3	5	276
Western gall rust	0	0	0	22	0	0	22
Yellow witches' broom	0	0	7	0	0	1	8
Total	14	4	393	5247	291	303	6251

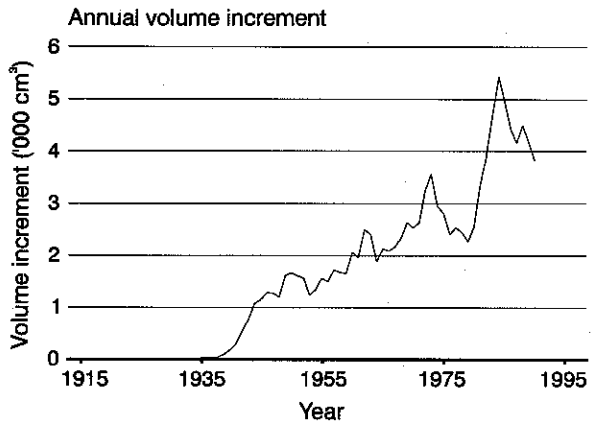
APPENDIX 5

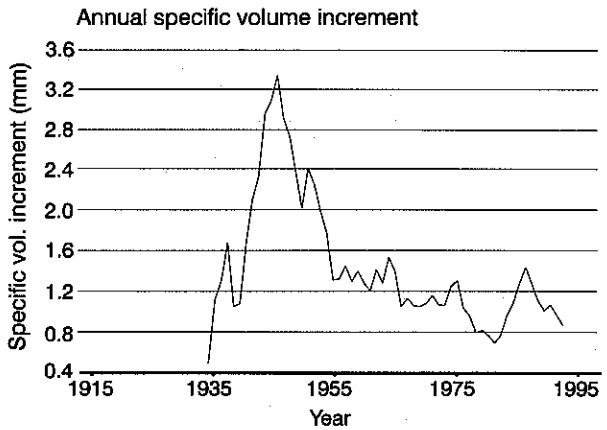
Tree Growth Characteristics

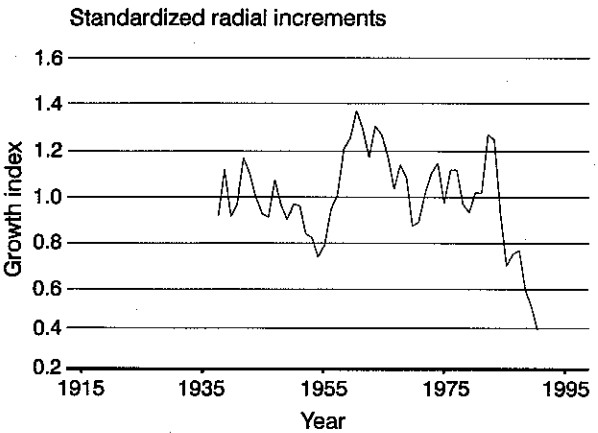
Appendix 5. Site 1 tree growth characteristics



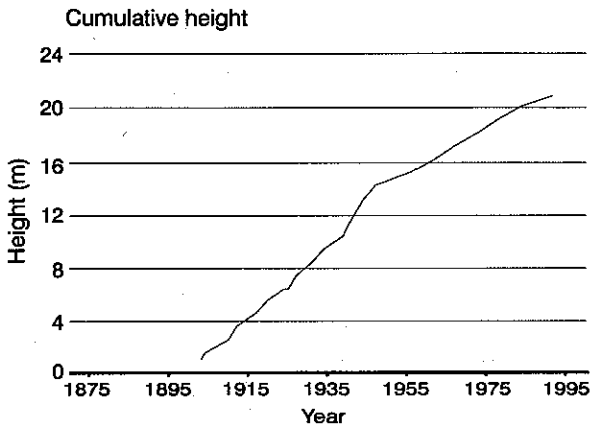


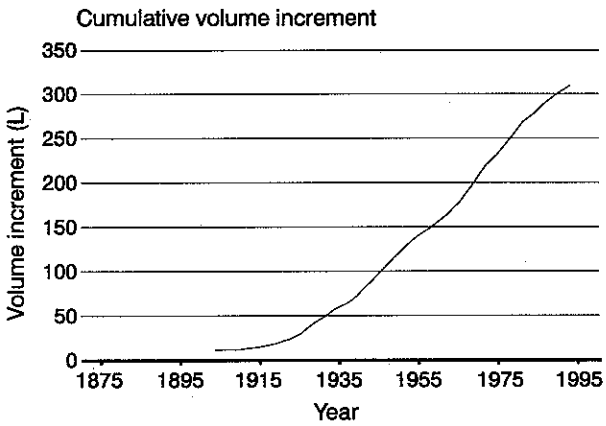


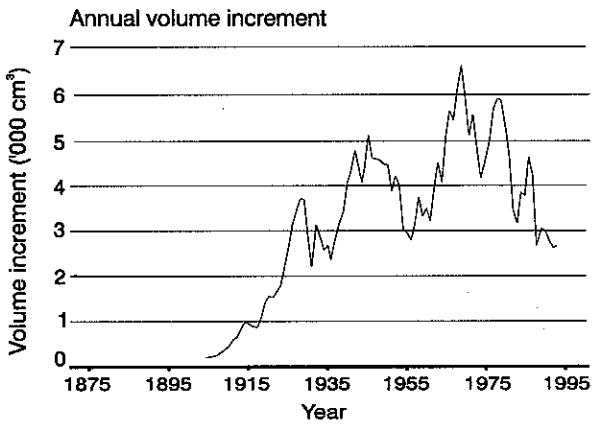


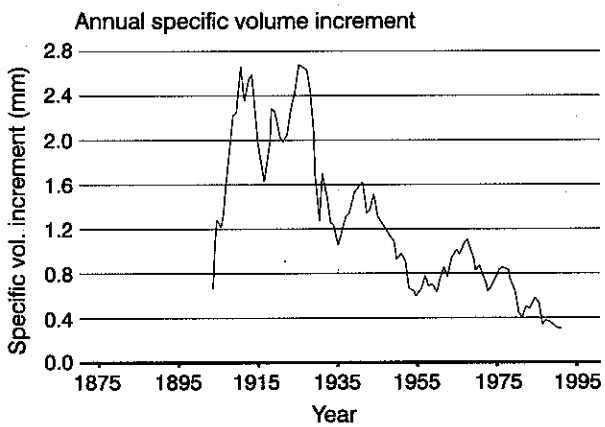


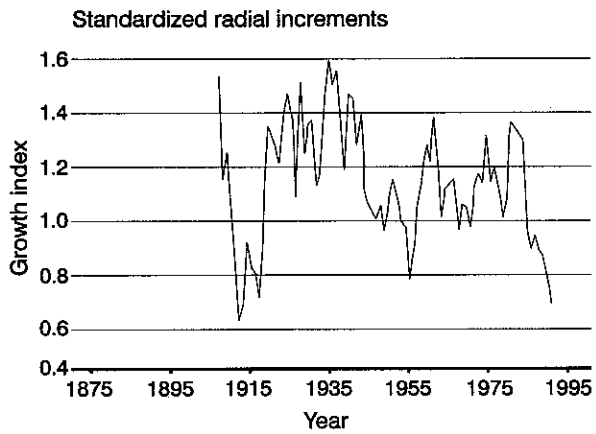
Appendix 5. Site 2 tree growth characteristics



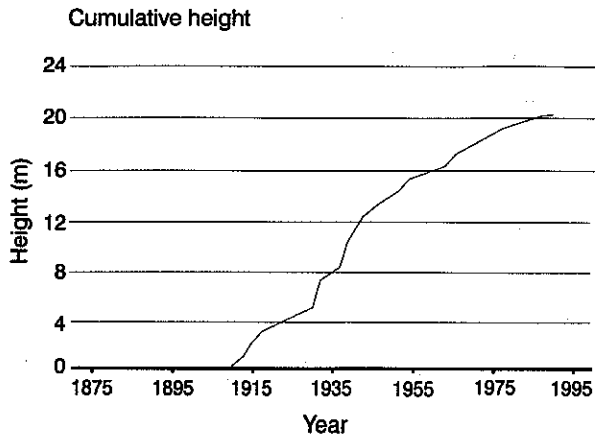


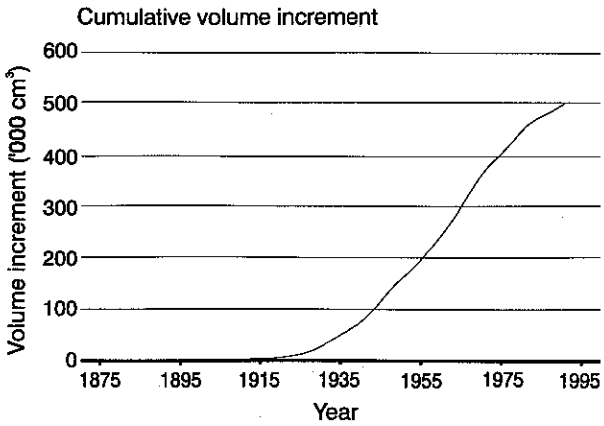


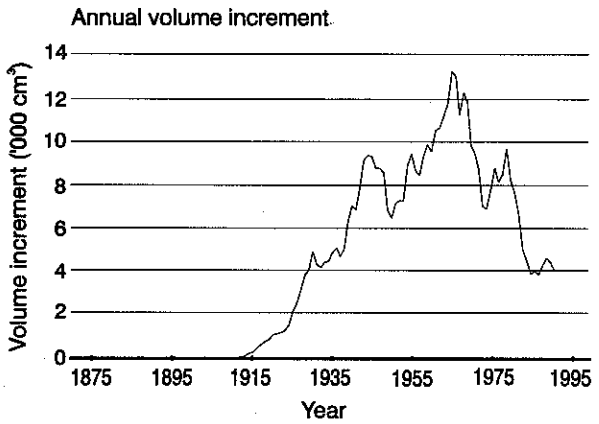


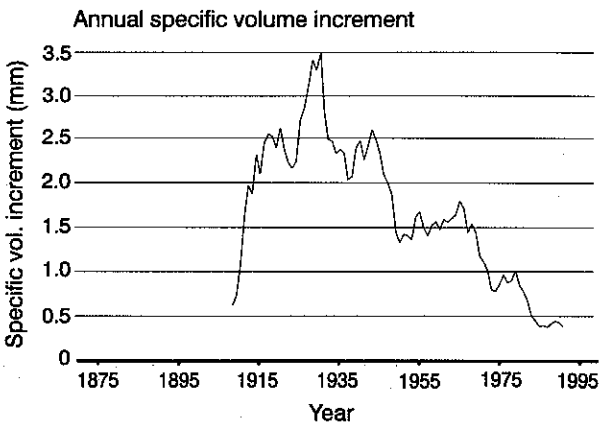


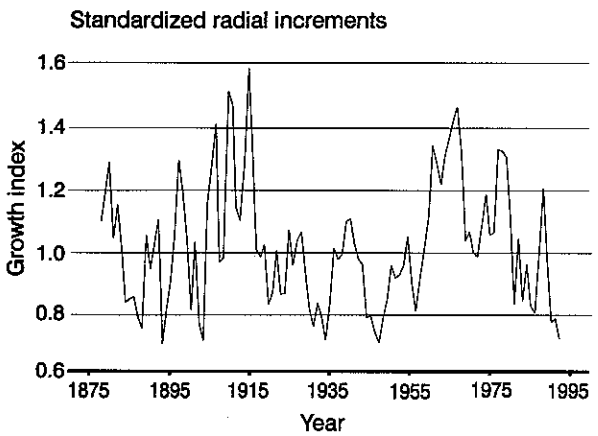
Appendix 5. Site 3 tree growth characteristics



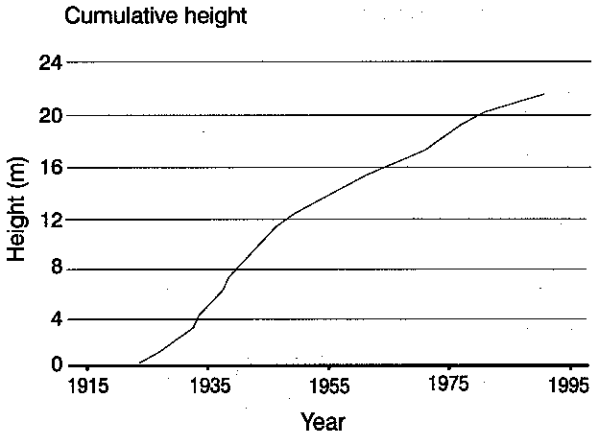


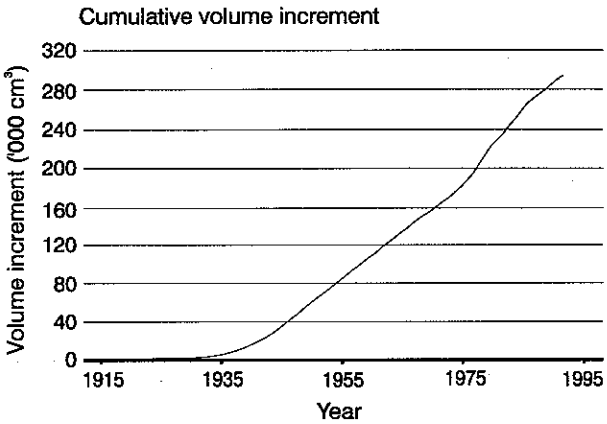


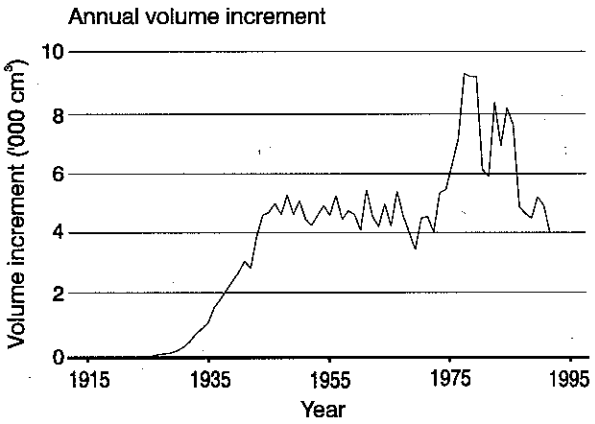


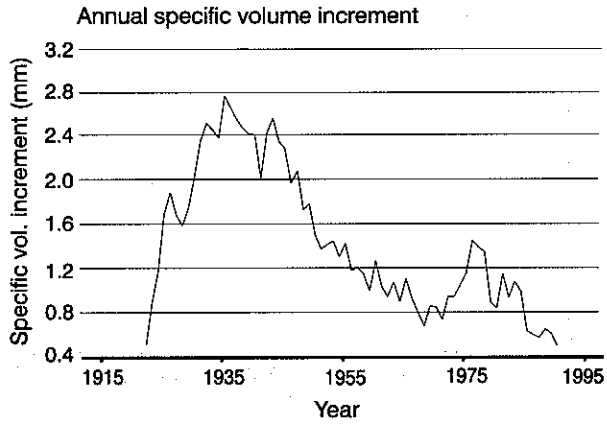


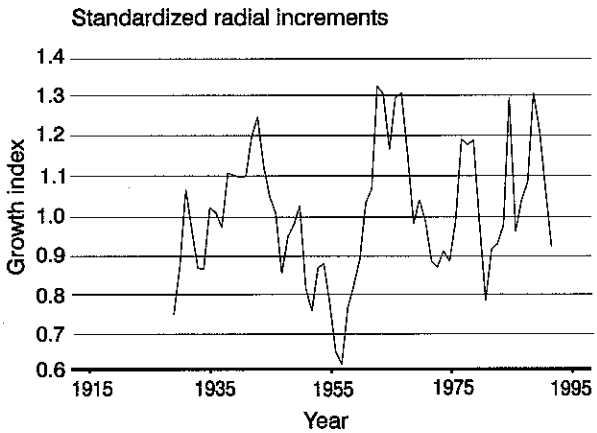
Appendix 5. Site 4 tree growth characteristics



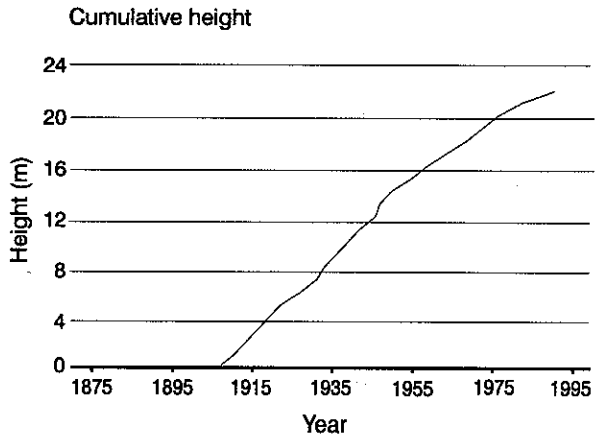


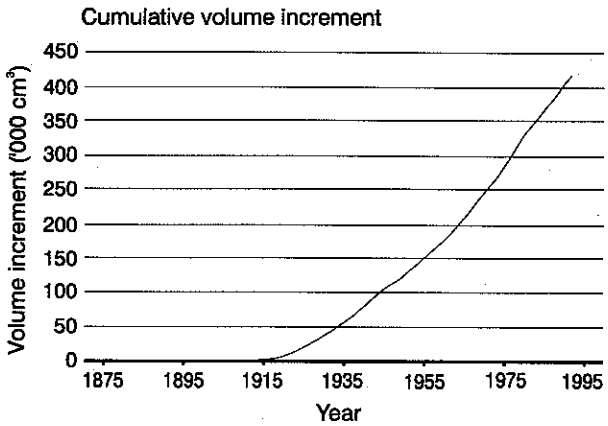


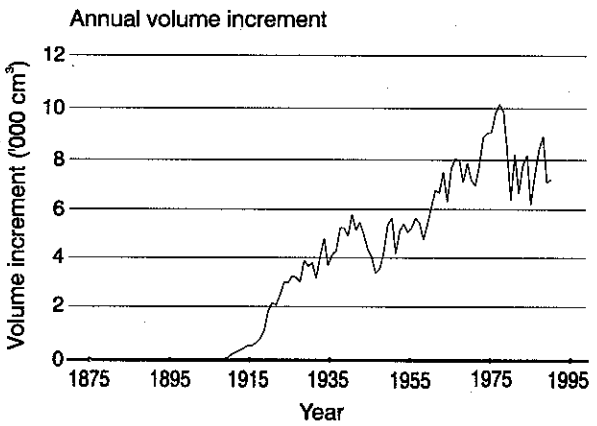


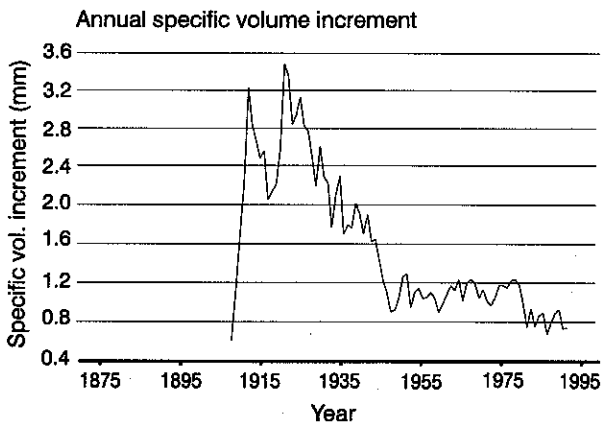


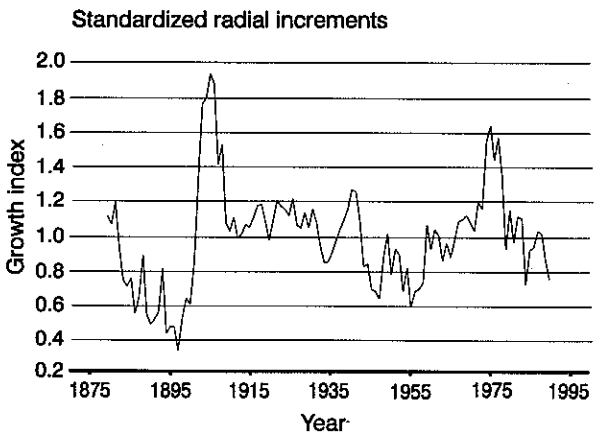
Appendix 5. Site 5 tree growth characteristics



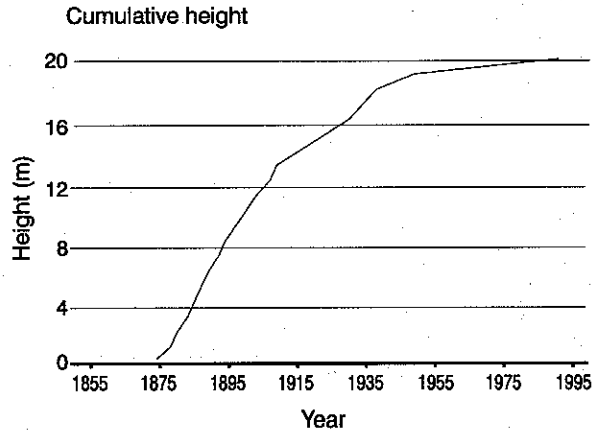


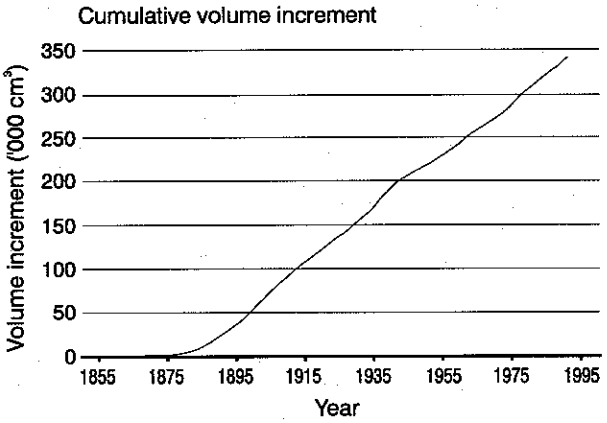


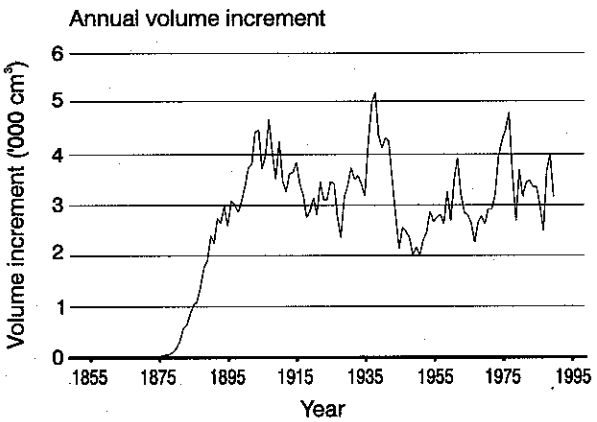


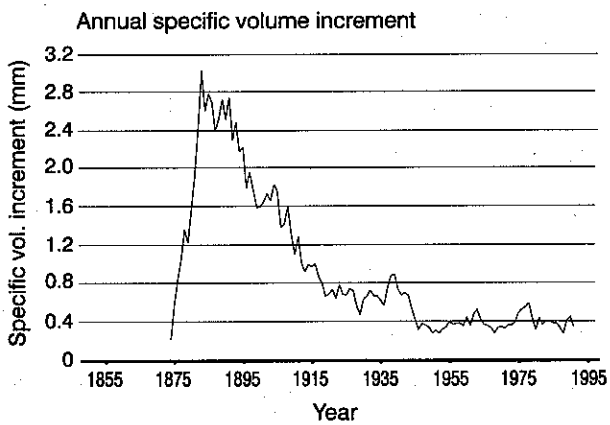


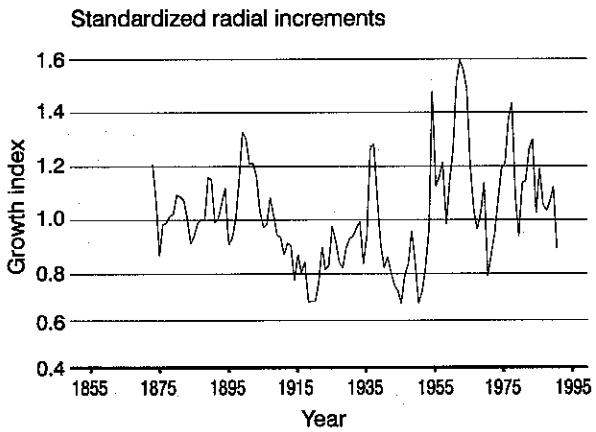
Appendix 5. Site 6 tree growth characteristics



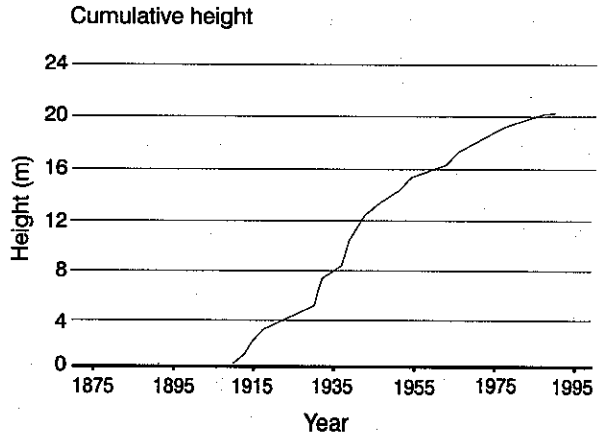


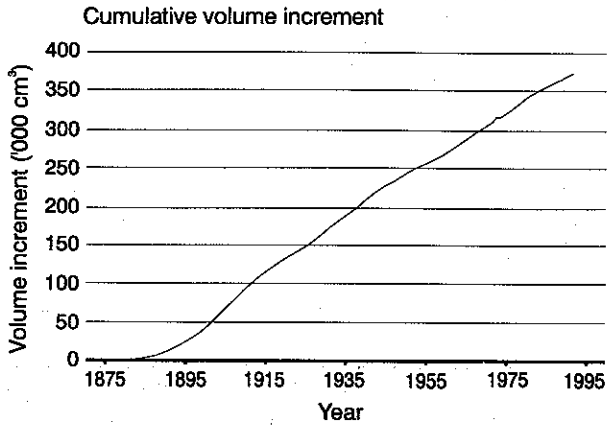


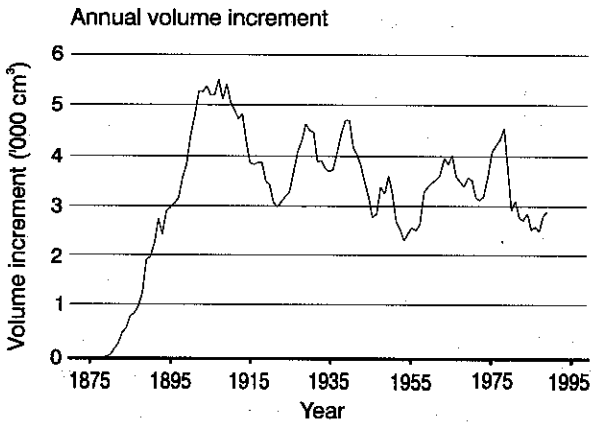


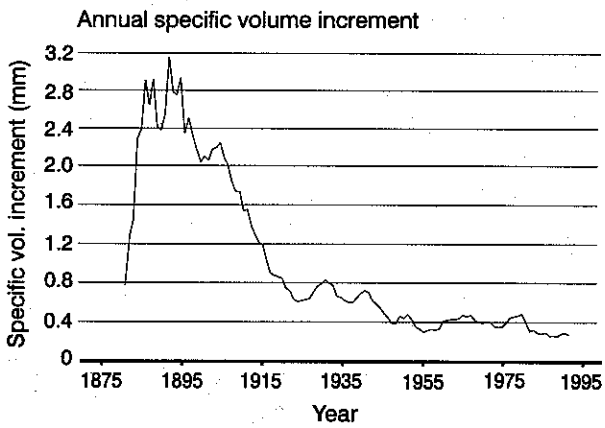


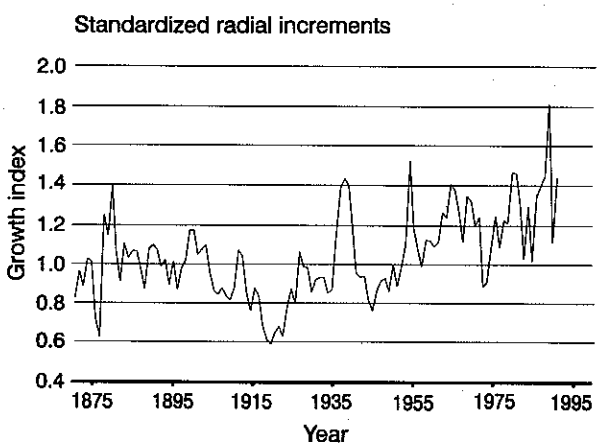
Appendix 5. Site 7 tree growth characteristics





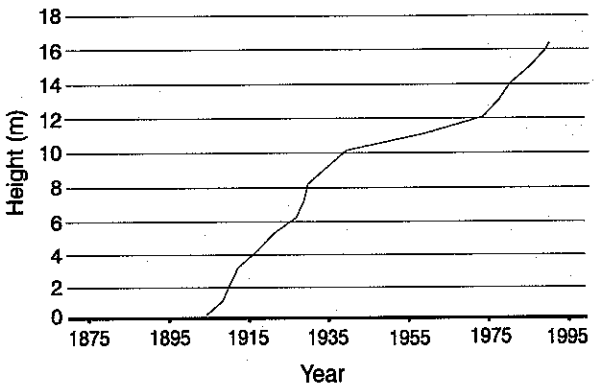




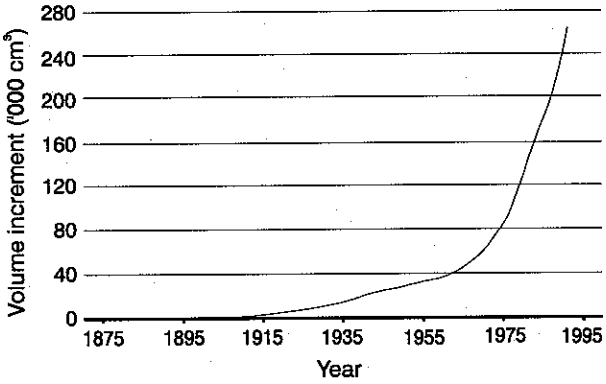


Appendix 5. Site 8 tree growth characteristics

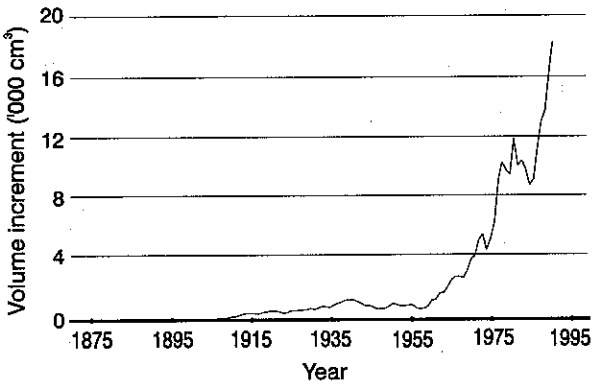
Cumulative height



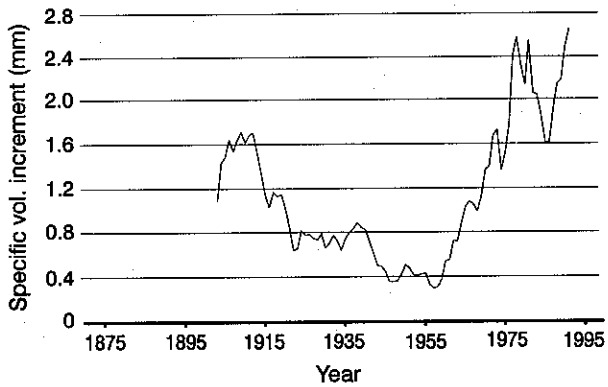
Cumulative volume increment



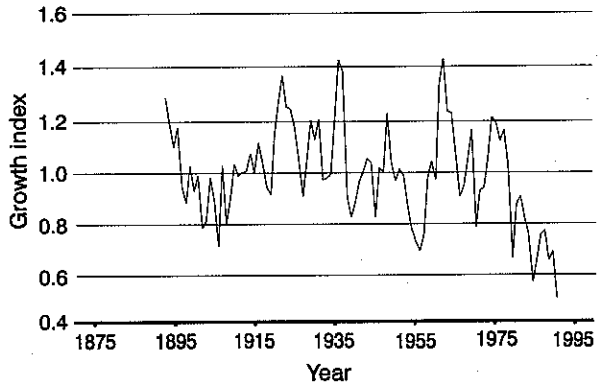
Annual volume increment



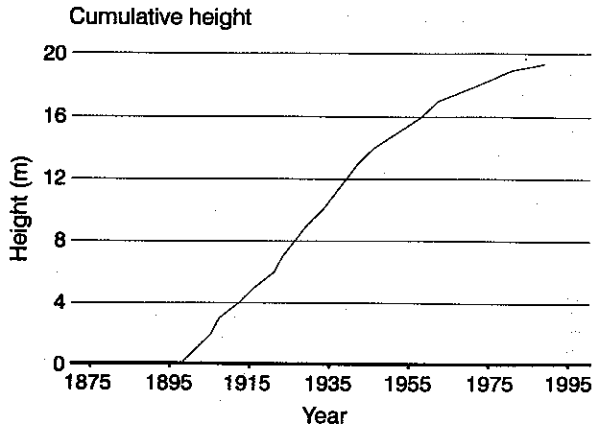
Annual specific volume increment

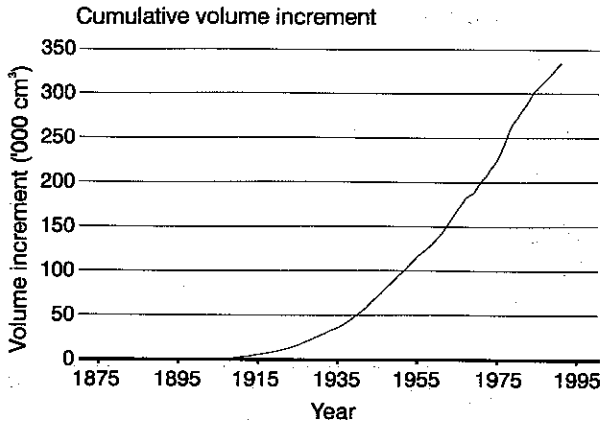


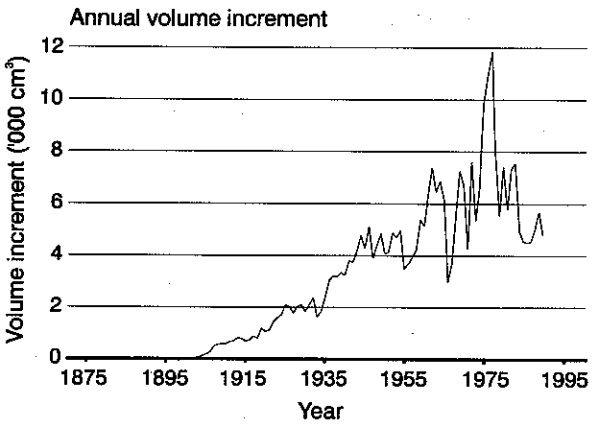
Standardized radial increments

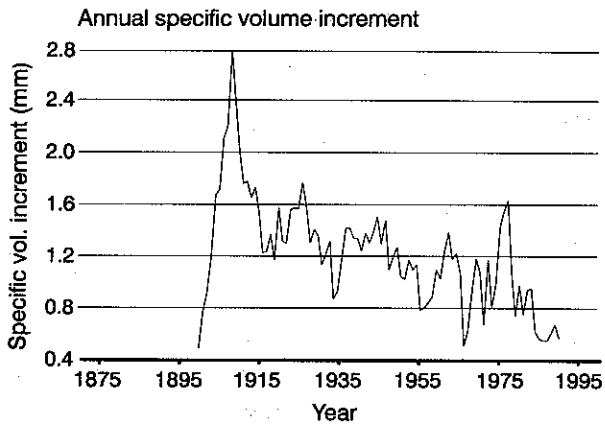


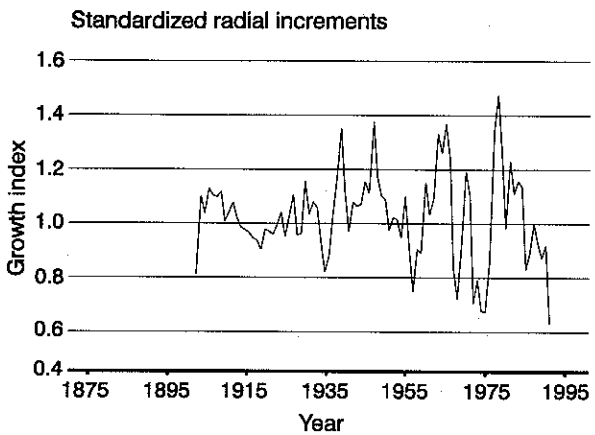
Appendix 5. Site 9 tree growth characteristics



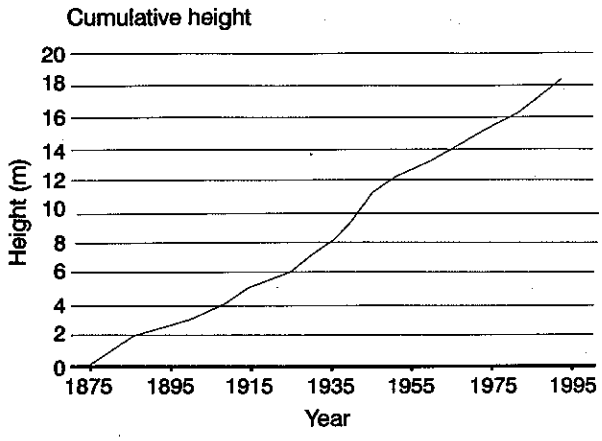


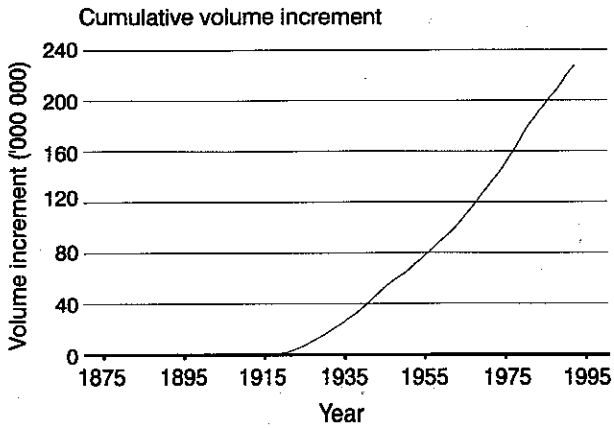


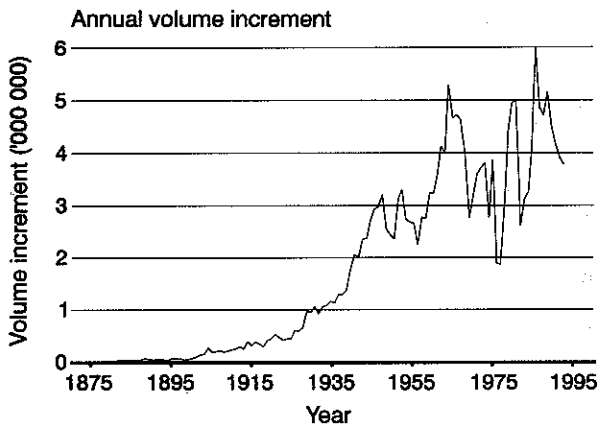


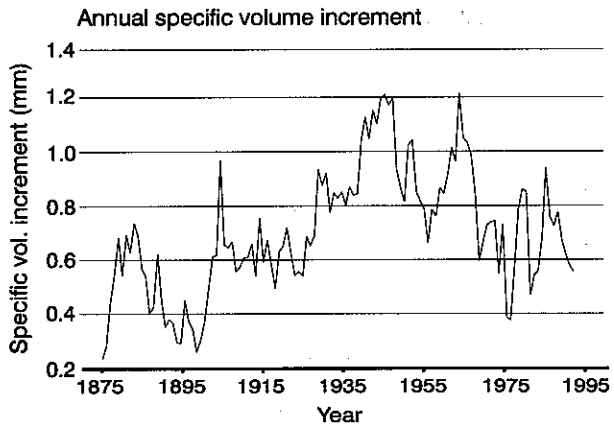


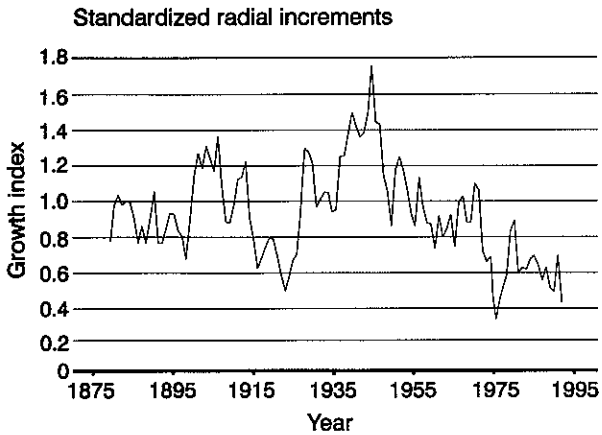
Appendix 5. Site 10 tree growth characteristics



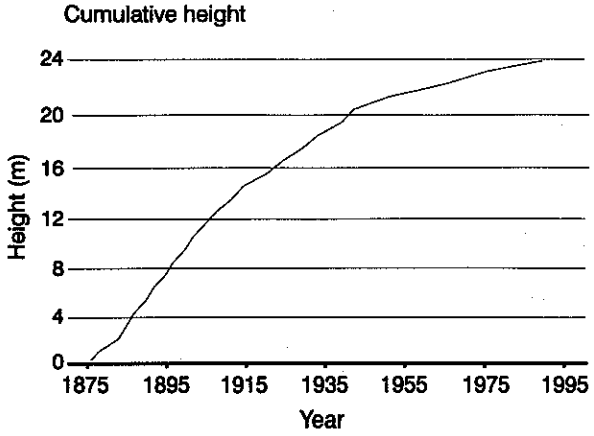


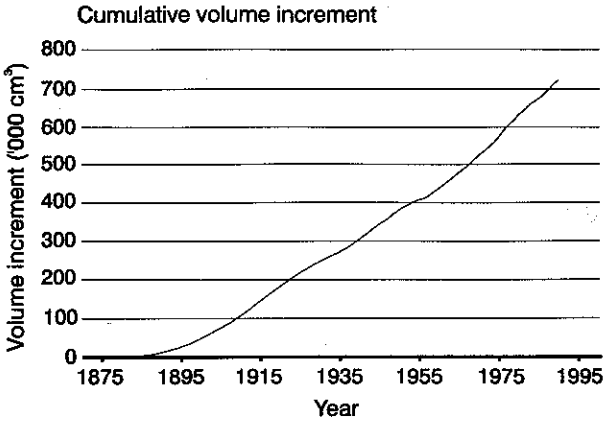


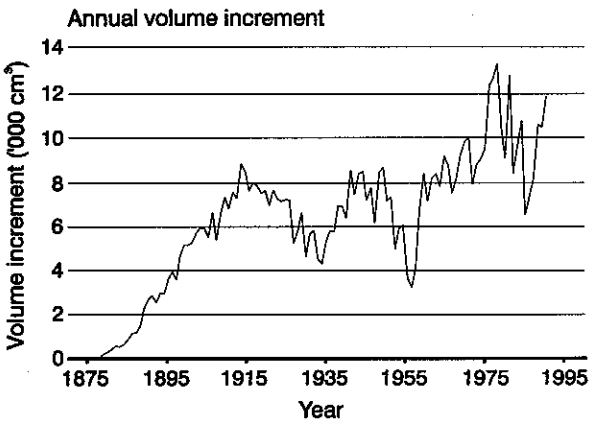


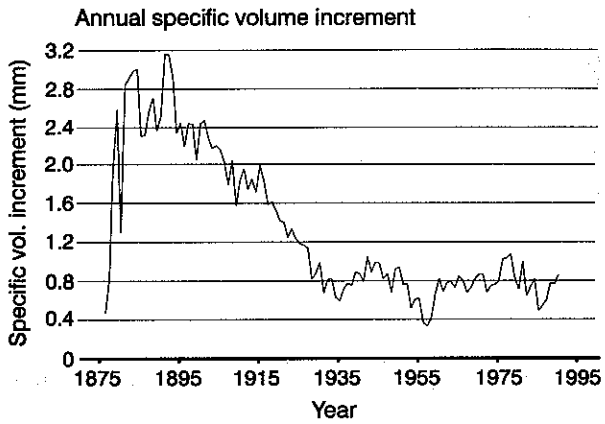


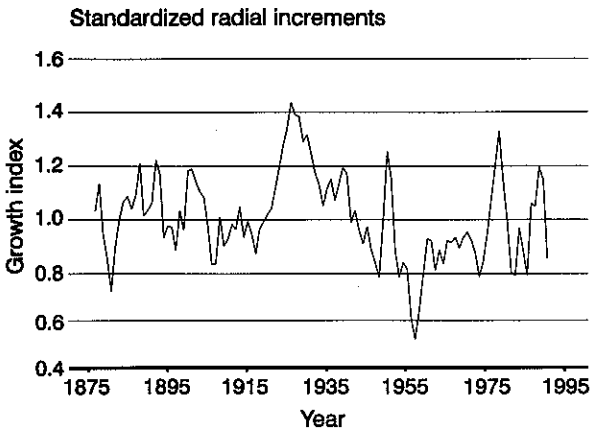
Appendix 5. Site 11 tree growth characteristics



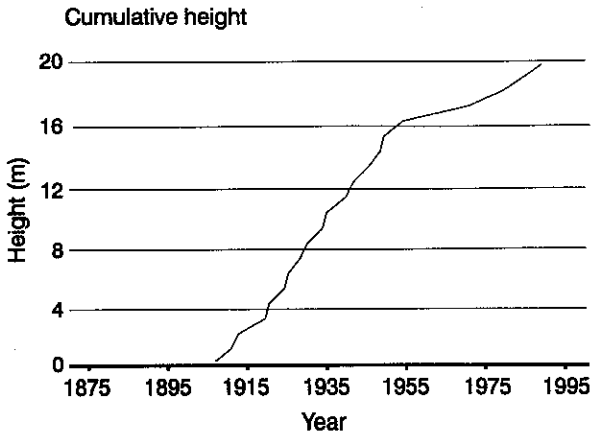


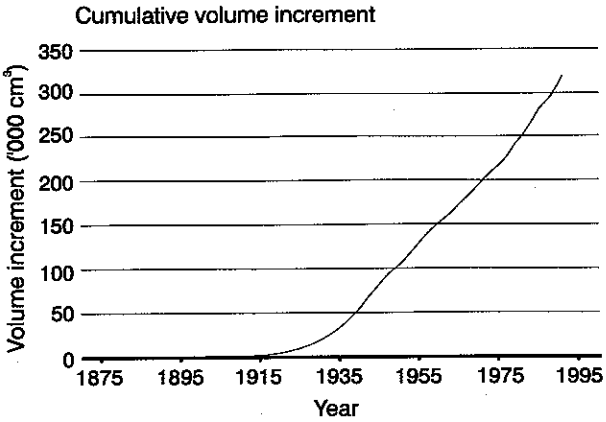


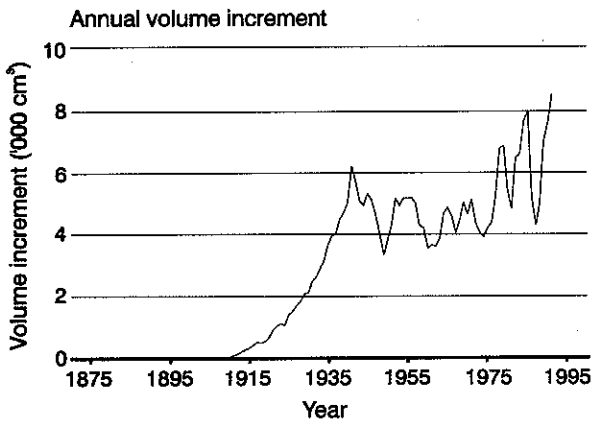


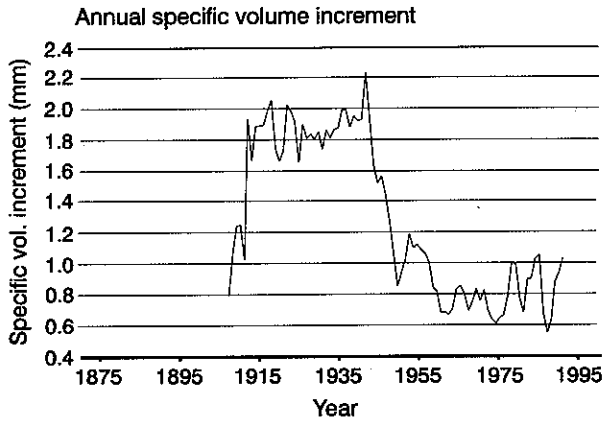


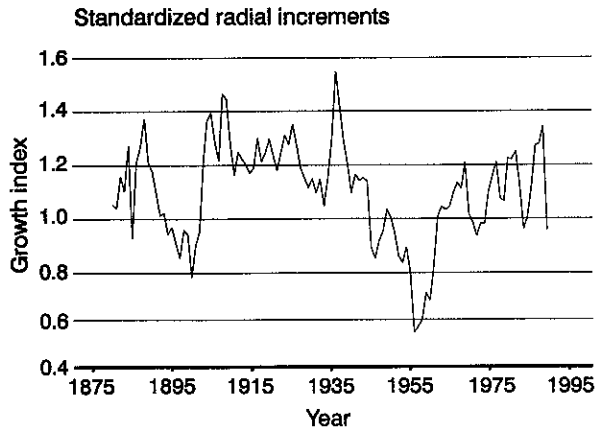
Appendix 5. Site 12 tree growth characteristics



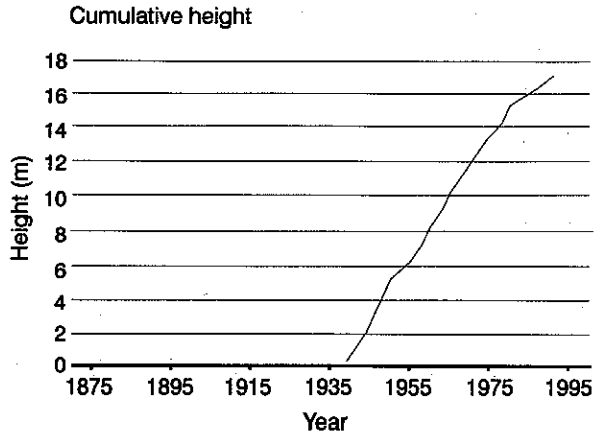


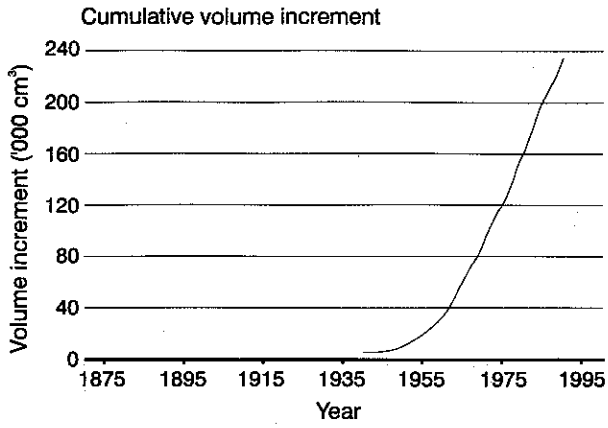


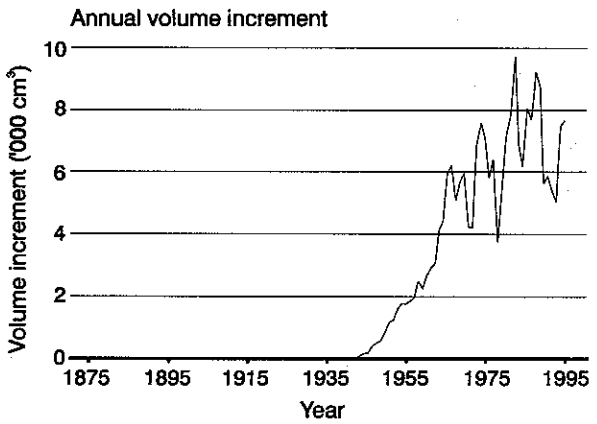


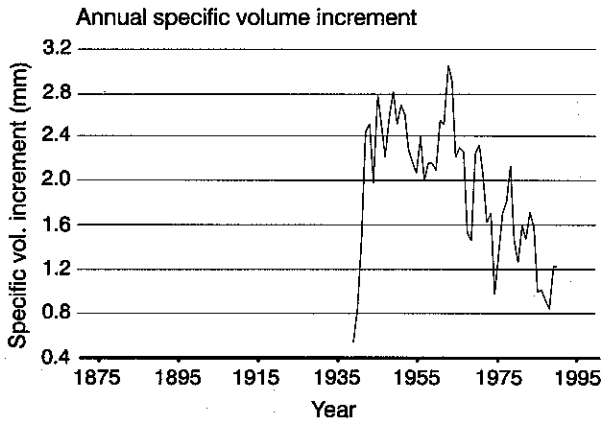


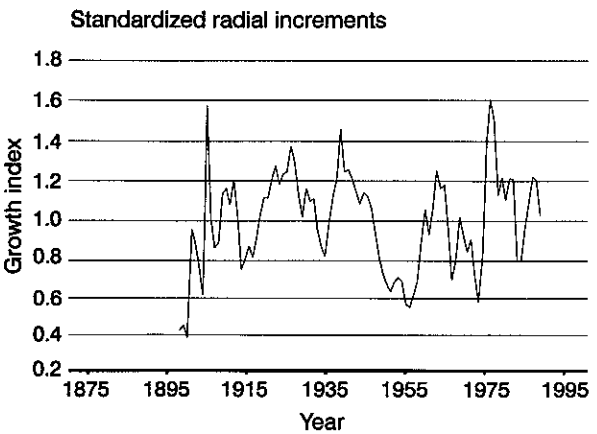
Appendix 5. Site 13 tree growth characteristics



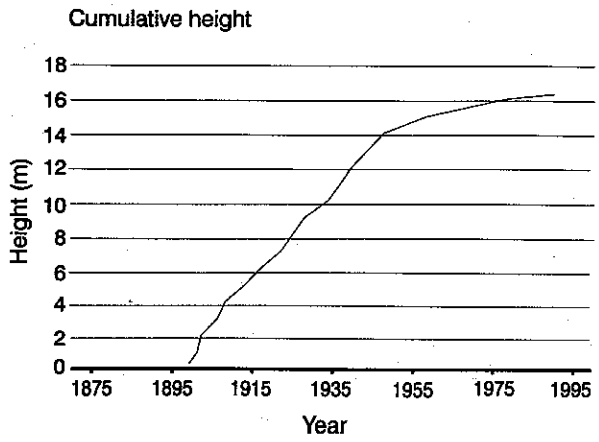


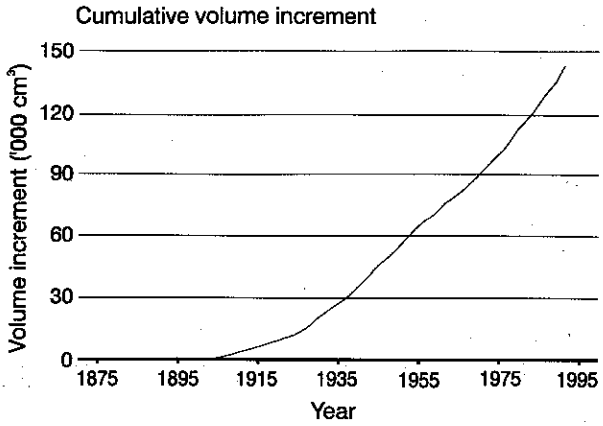


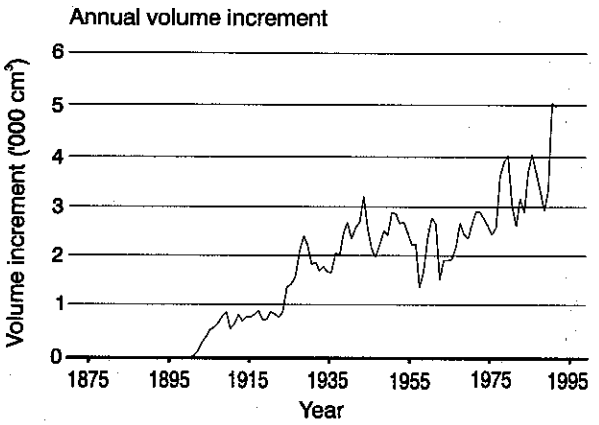


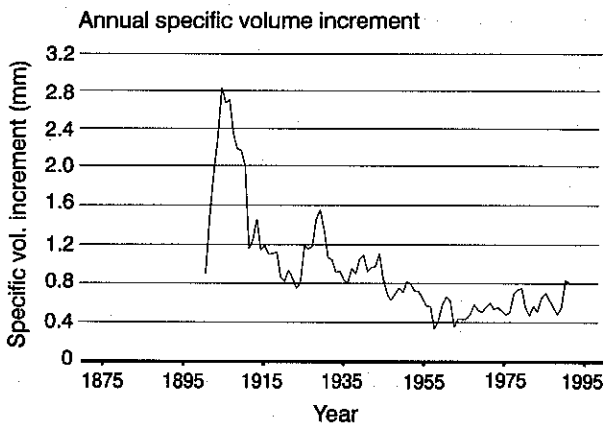


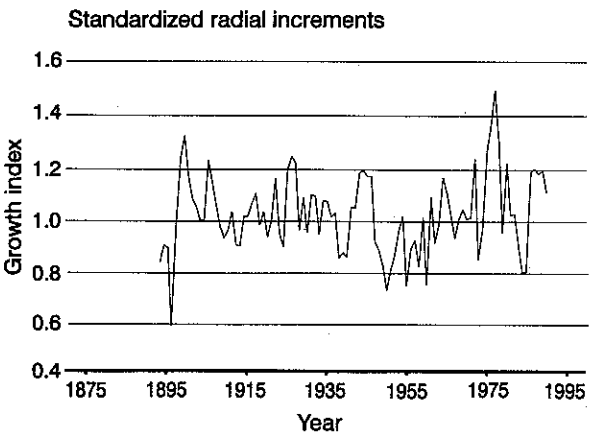
Appendix 5. Site 14 tree growth characteristics



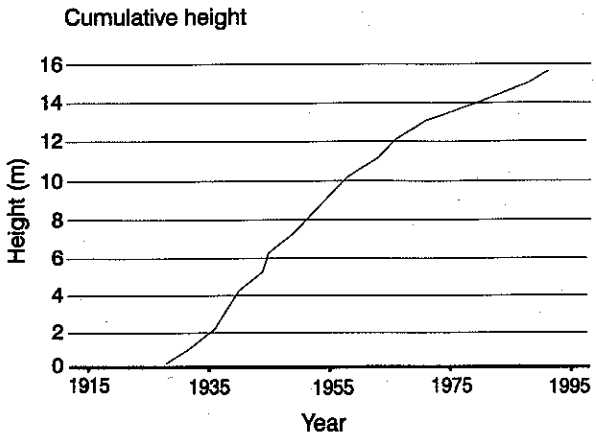


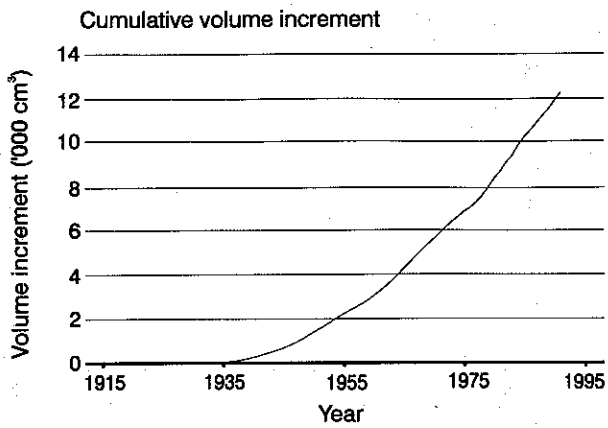


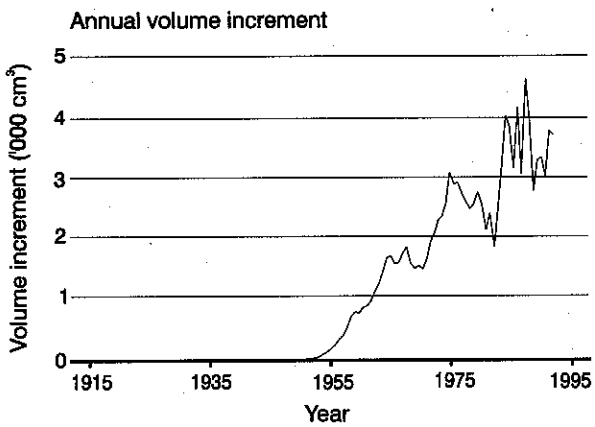


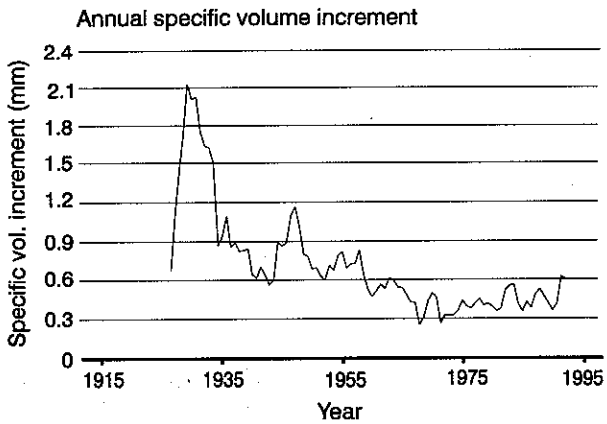


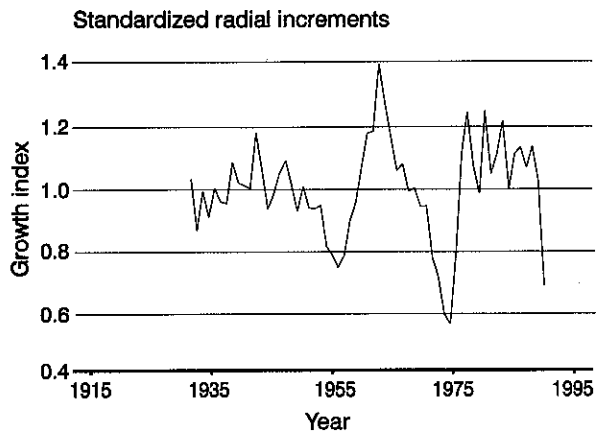
Appendix 5. Site 16 tree growth characteristics



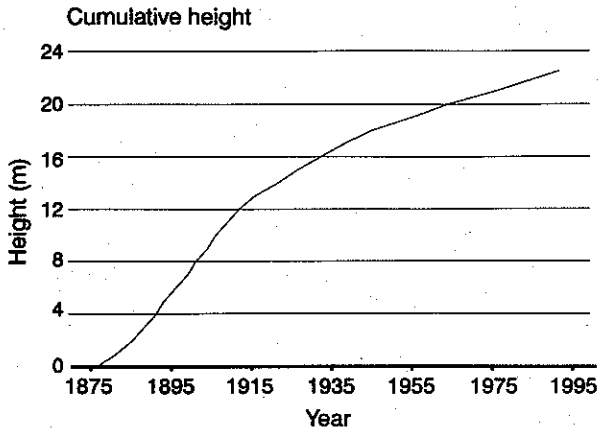


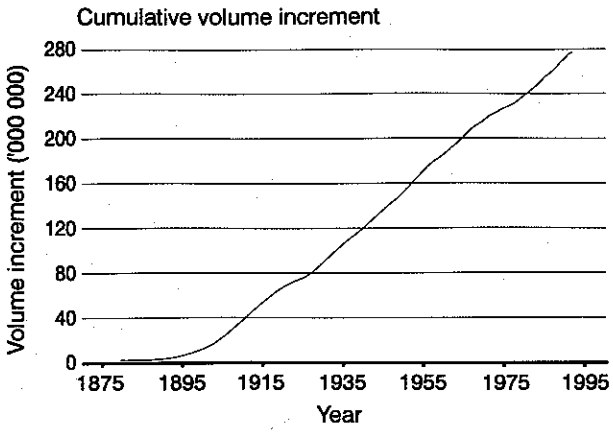


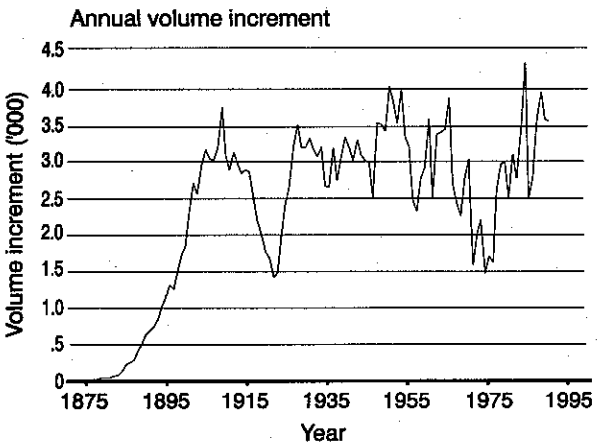


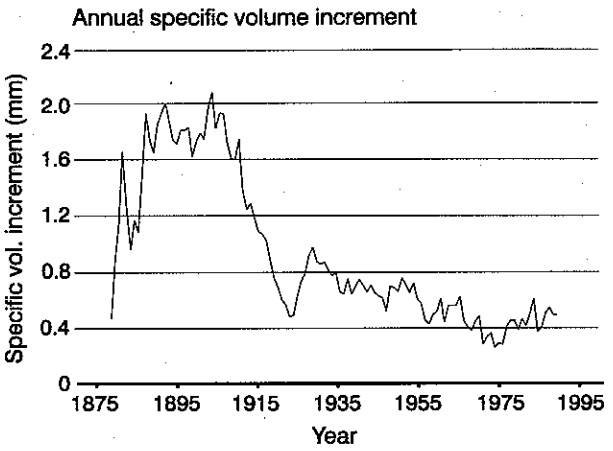


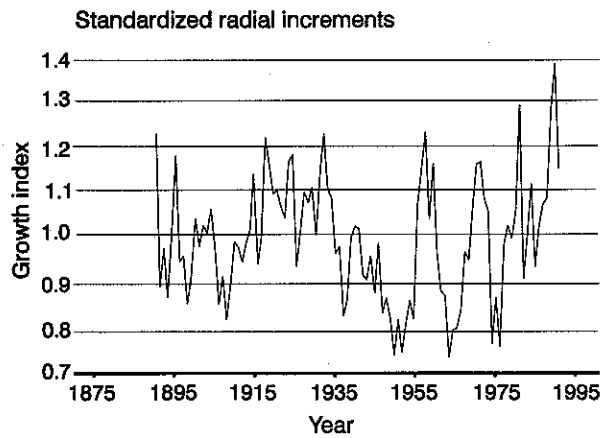
Appendix 5. Site 17 tree growth characteristics



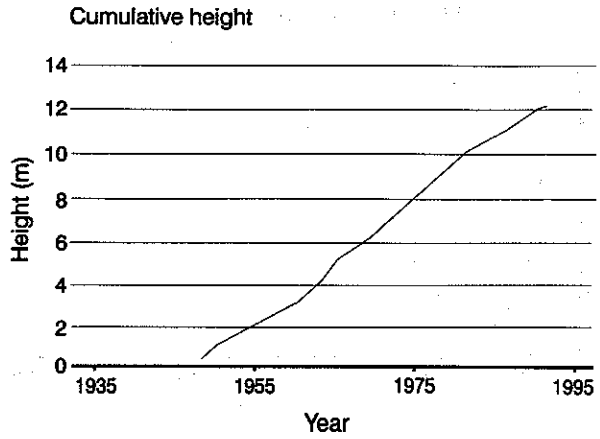


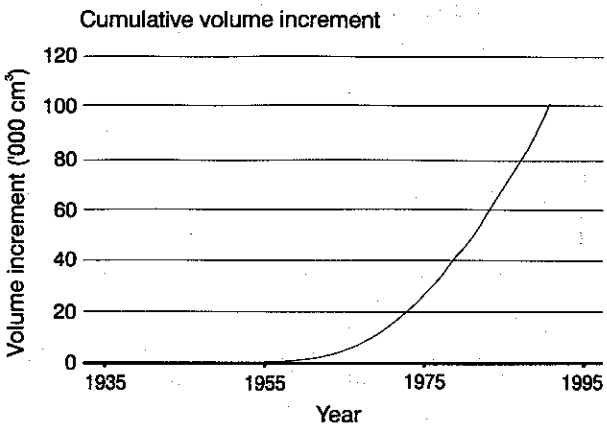


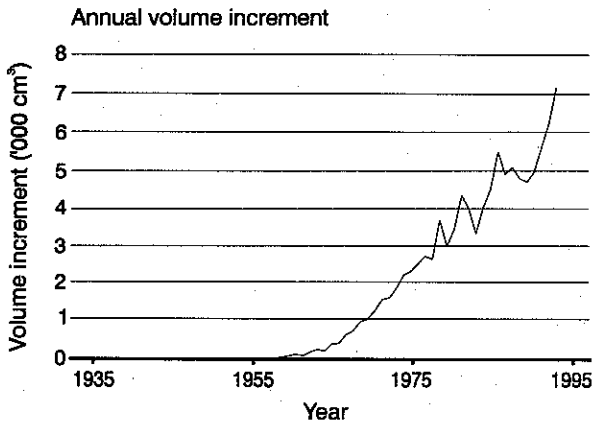


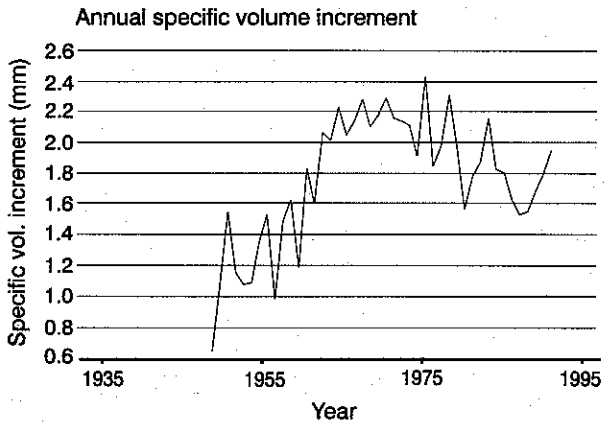


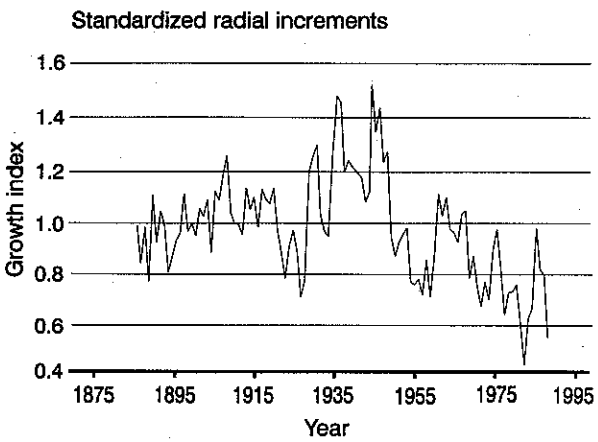
Appendix 5. Site 18 tree growth characteristics



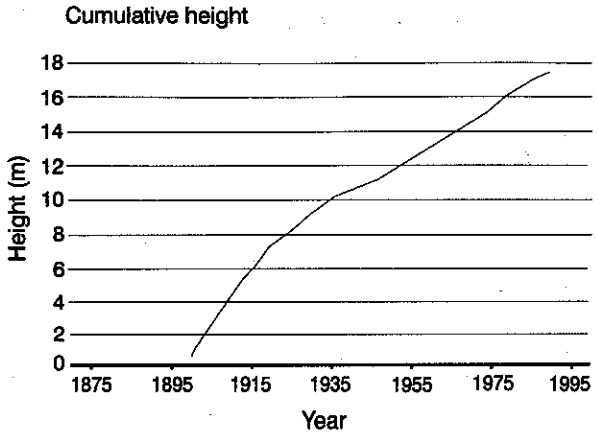


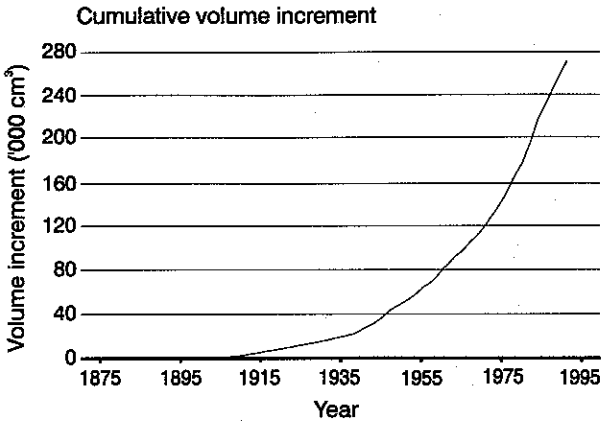


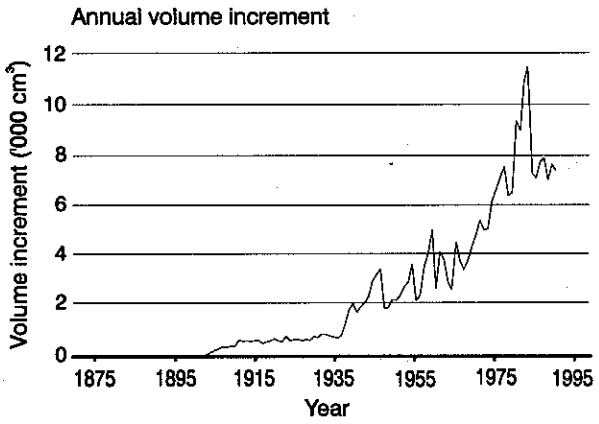


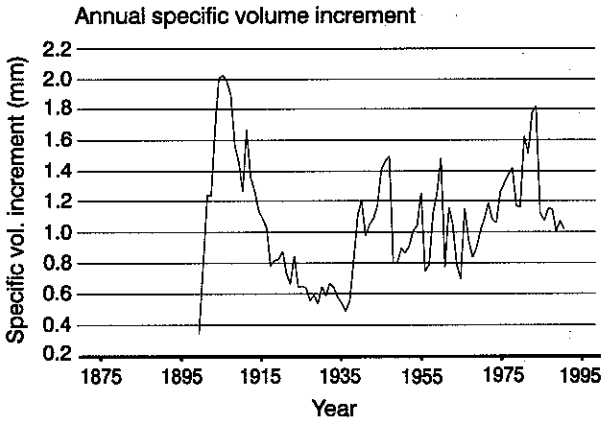


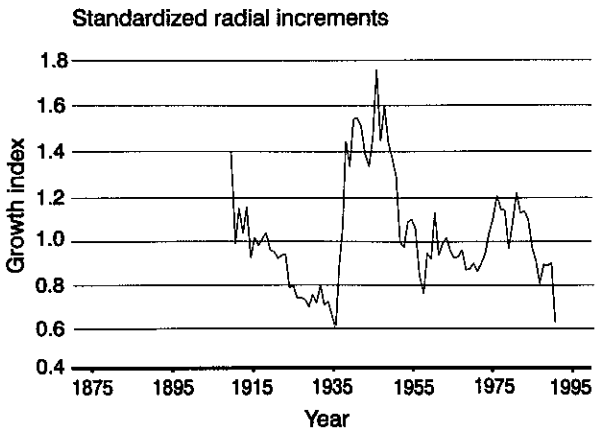
Appendix 5. Site 19 tree growth characteristics



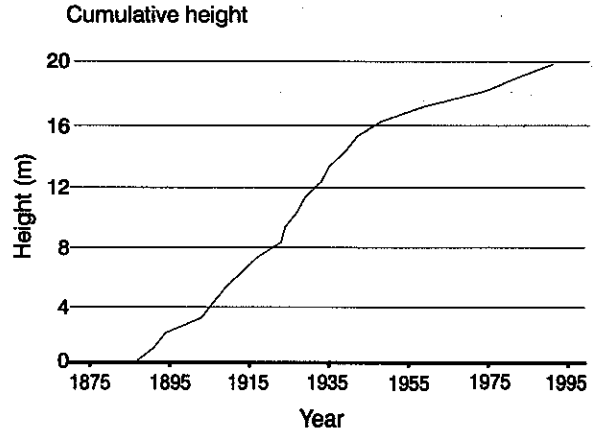


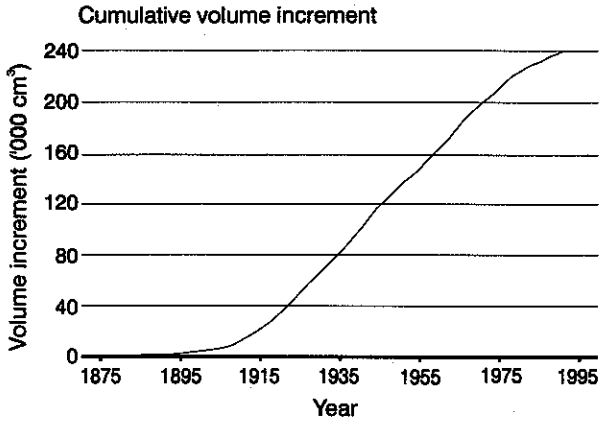


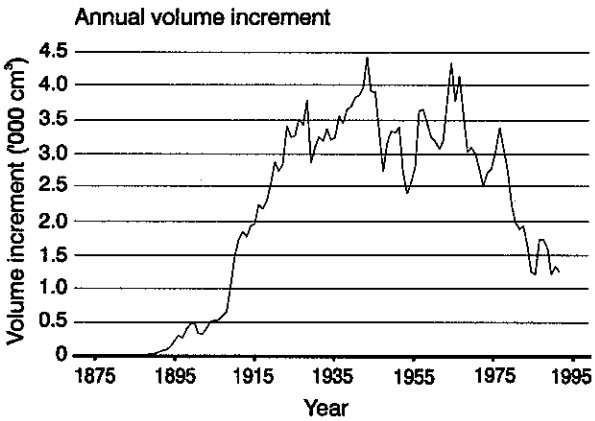


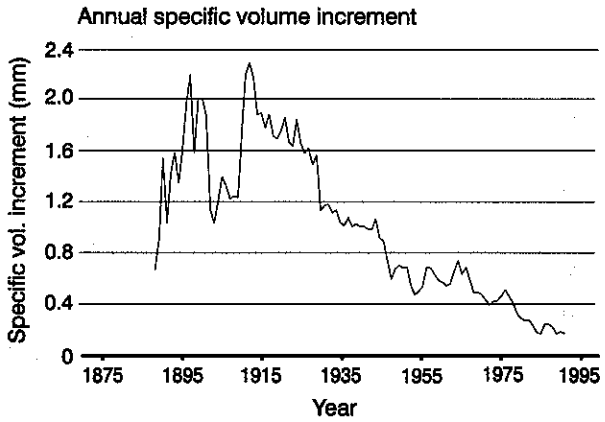


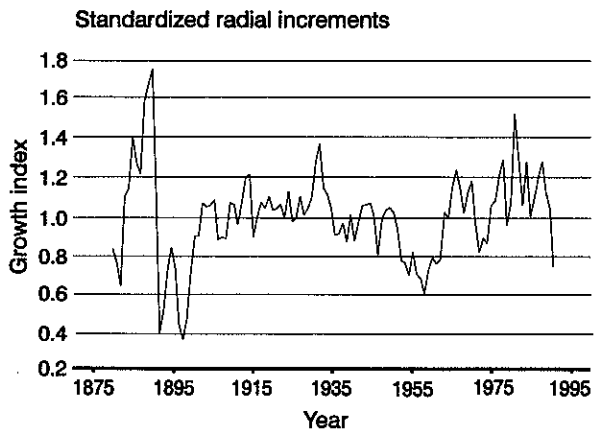
Appendix 5. Site 20 tree growth characteristics



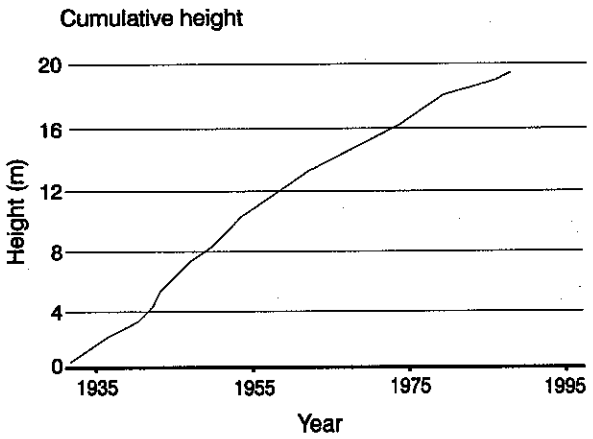


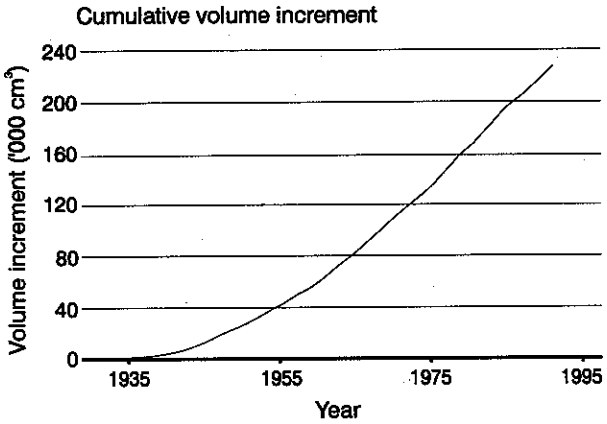


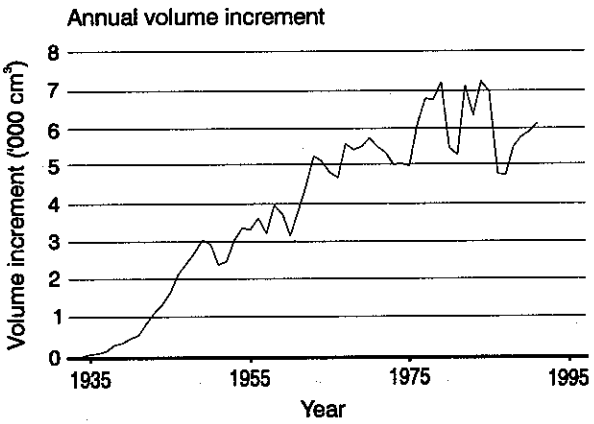


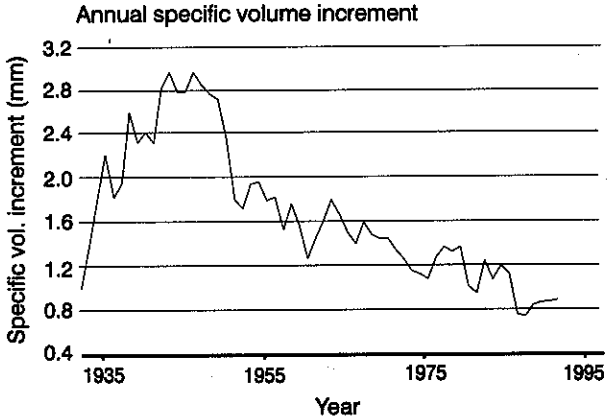


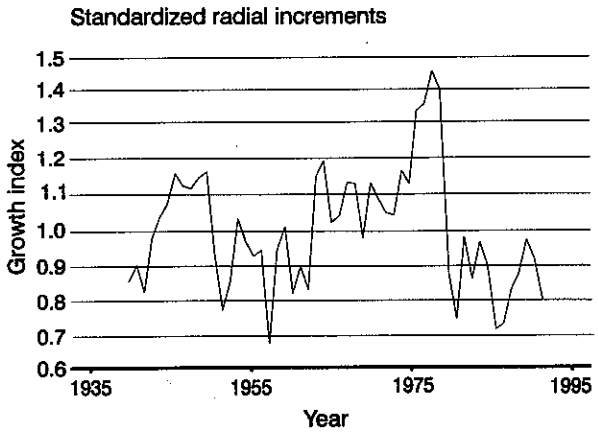
Appendix 5. Site 21 tree growth characteristics



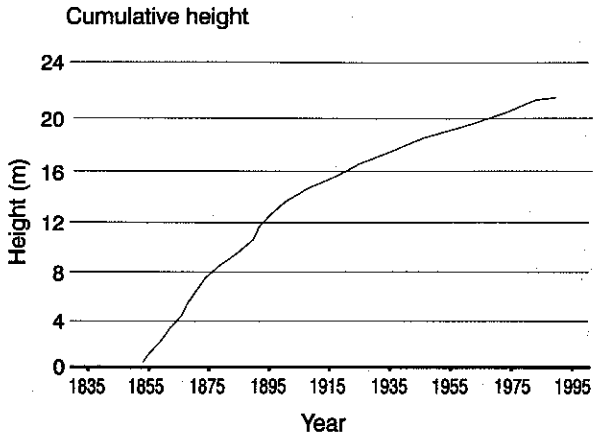


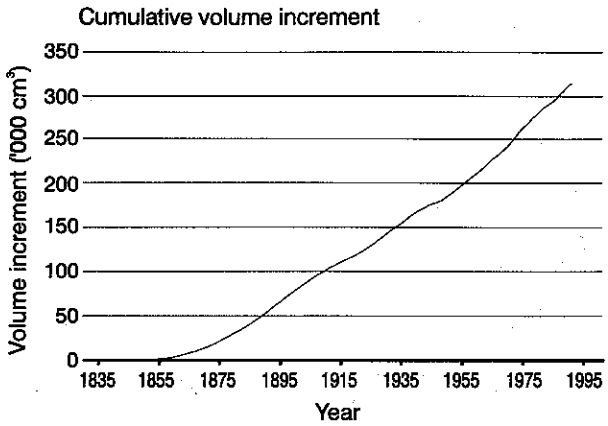


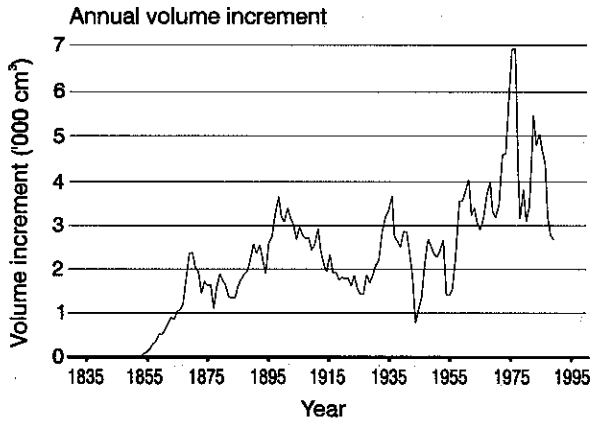


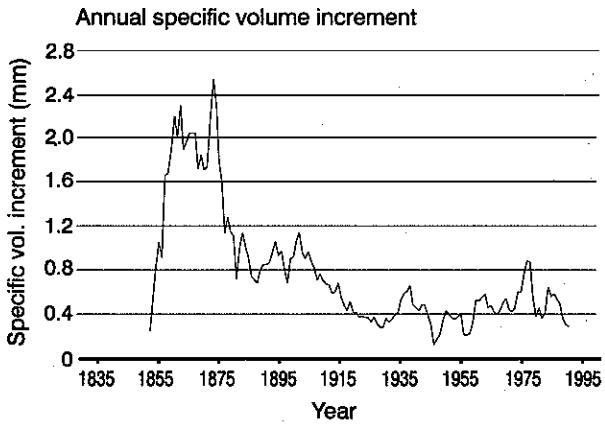


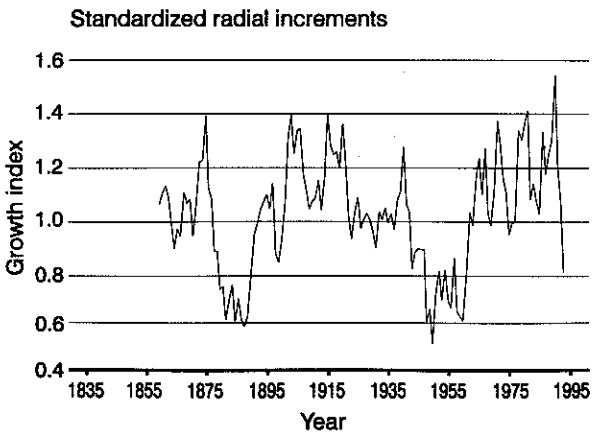
Appendix 5. Site 22 tree growth characteristics



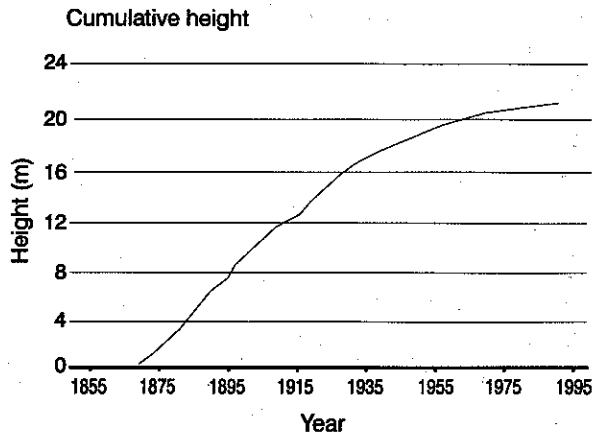


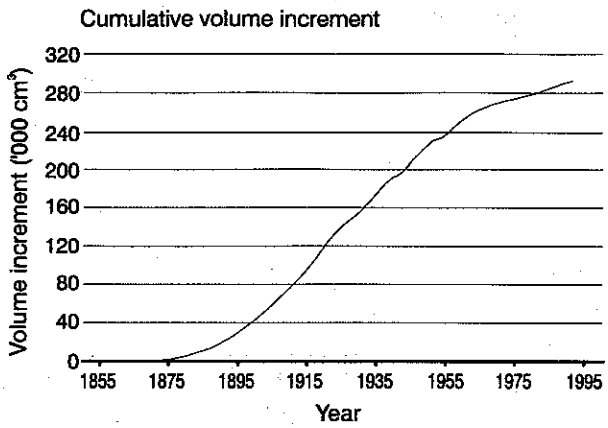


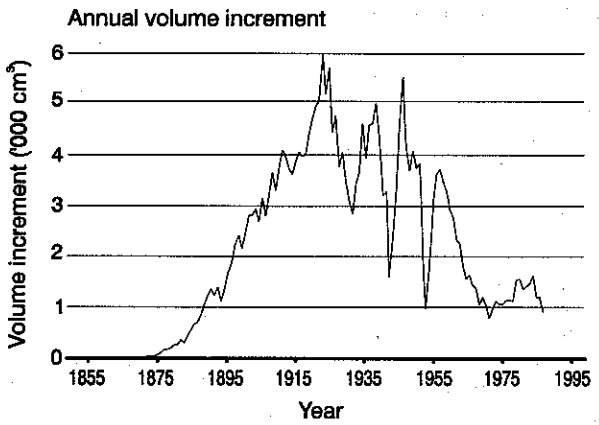


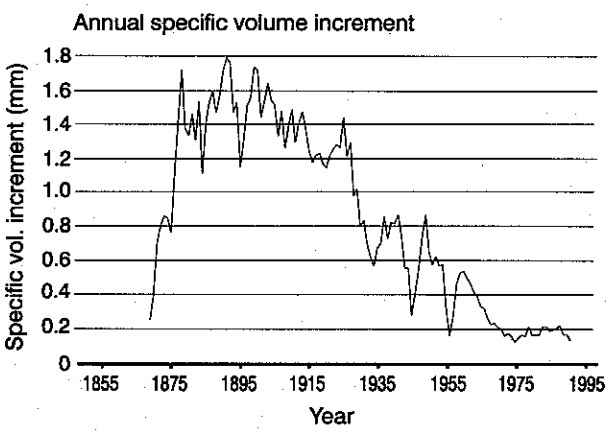


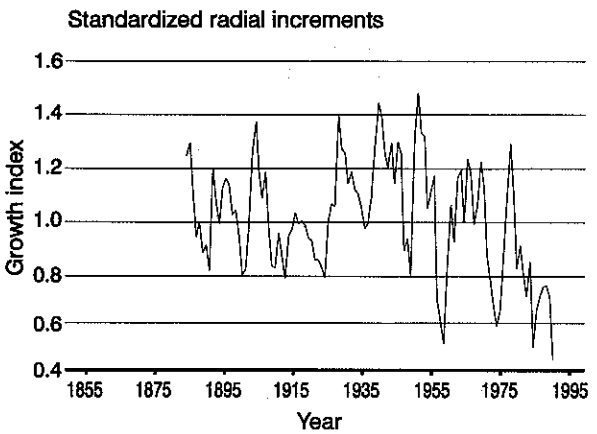
Appendix 5. Site 23 tree growth characteristics



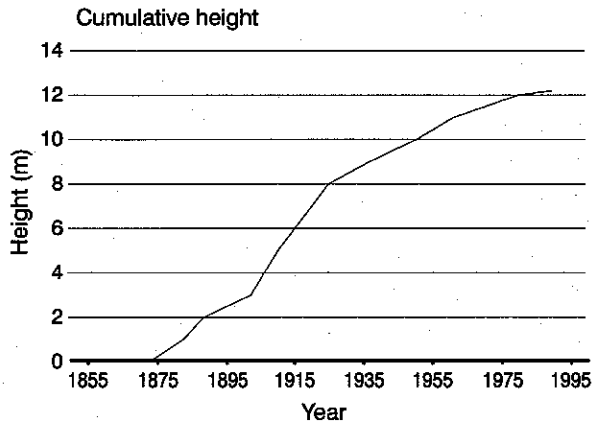


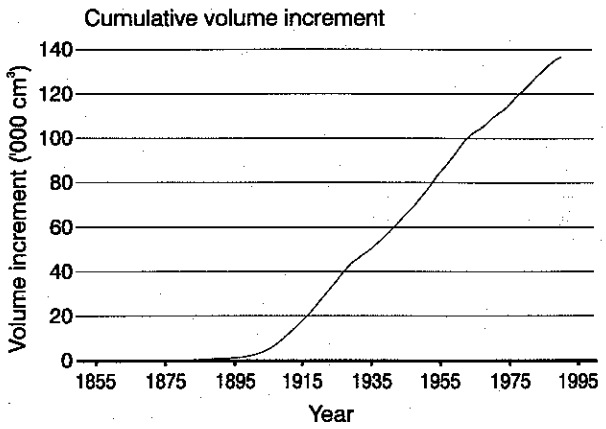


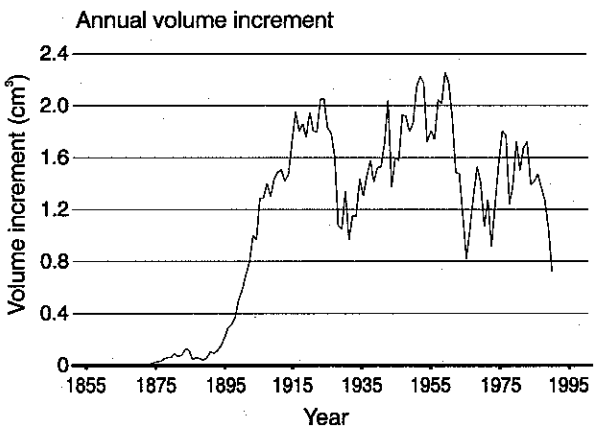


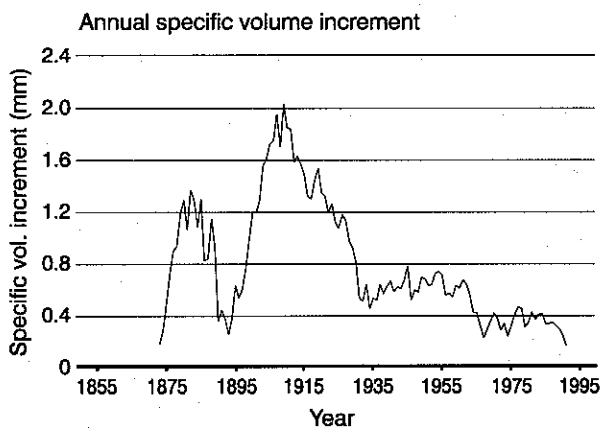


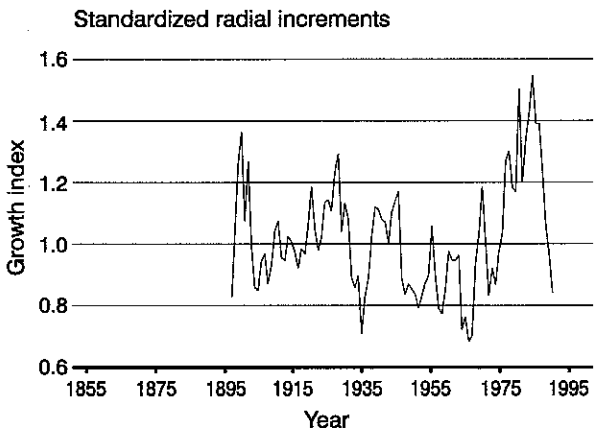
Appendix 5. Site 24 tree growth characteristics



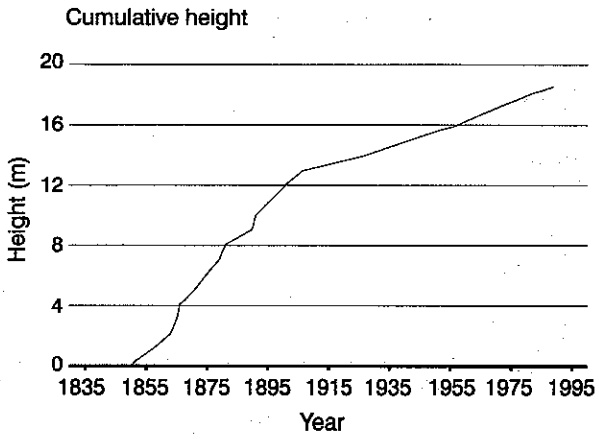


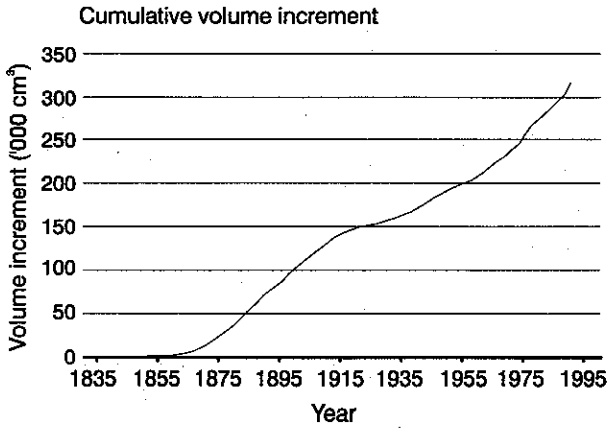


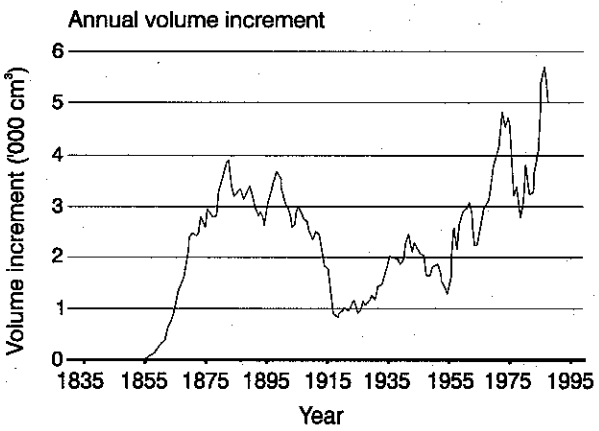


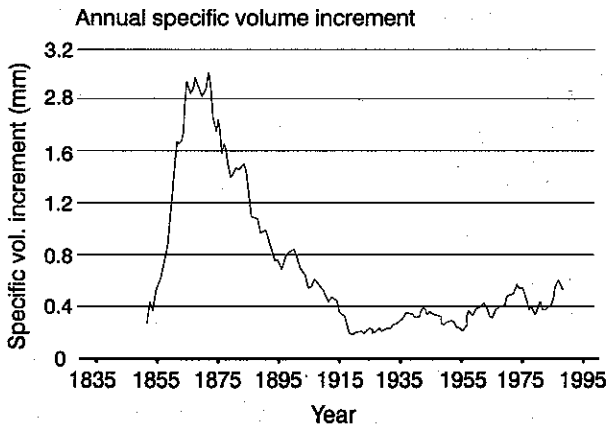


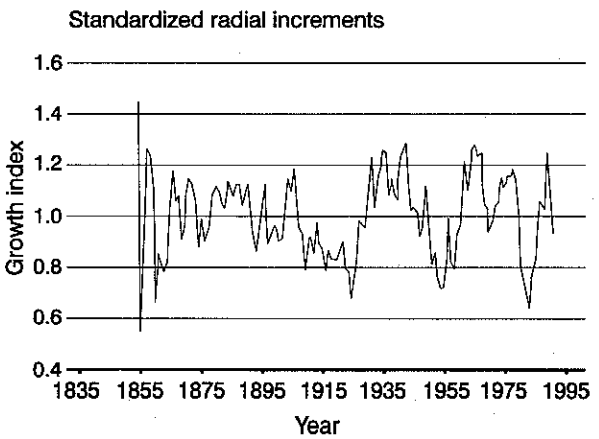
Appendix 5. Site 25 tree growth characteristics



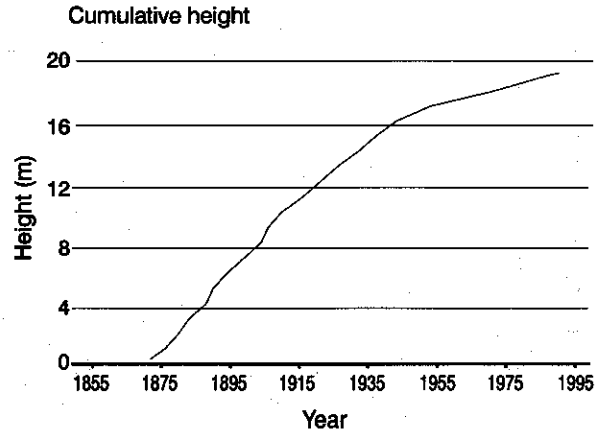


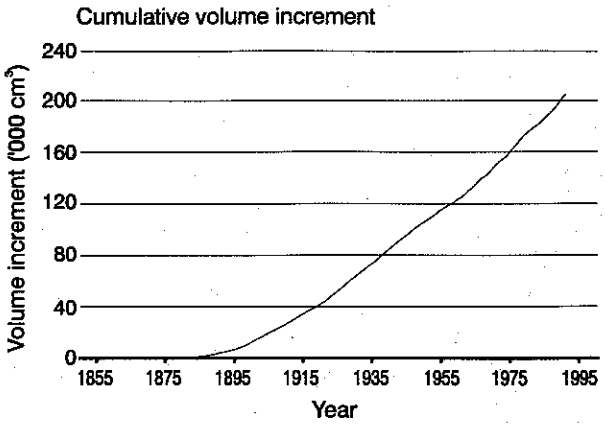


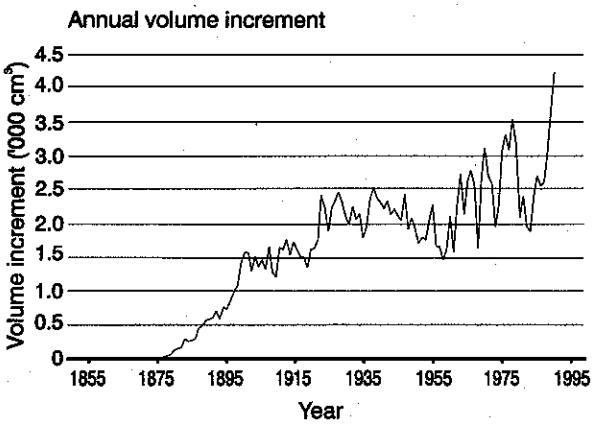


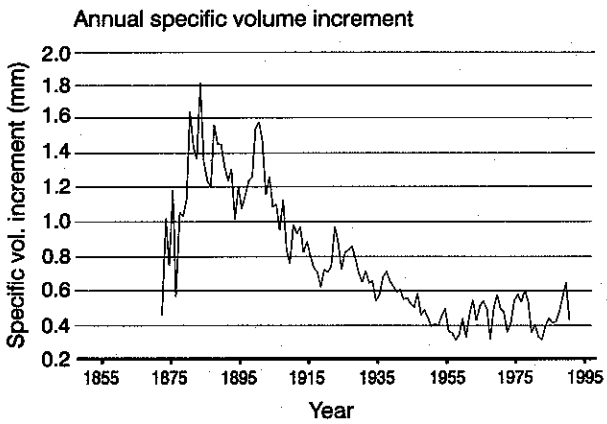


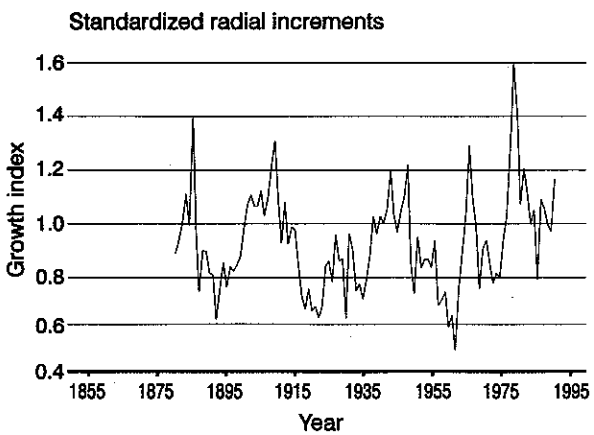
Appendix 5. Site 26 tree growth characteristics



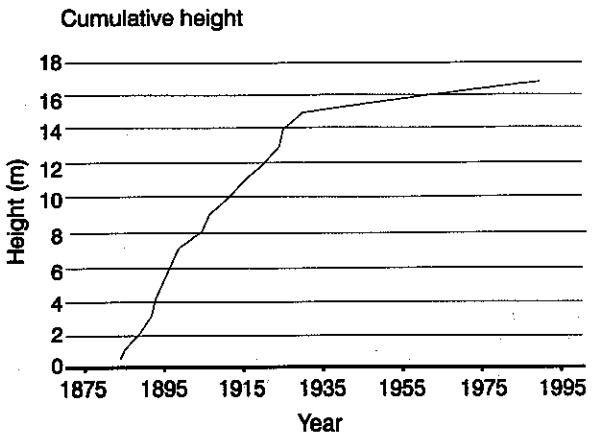


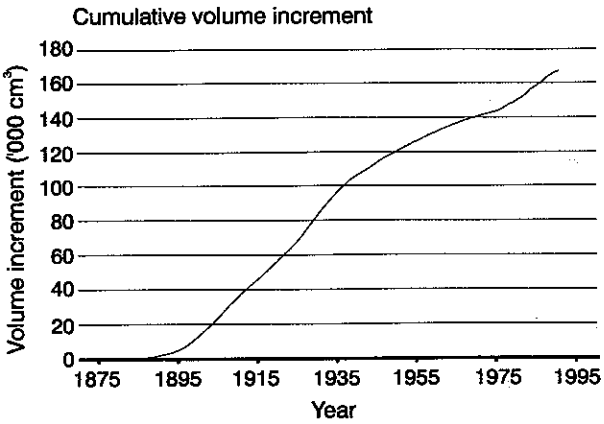


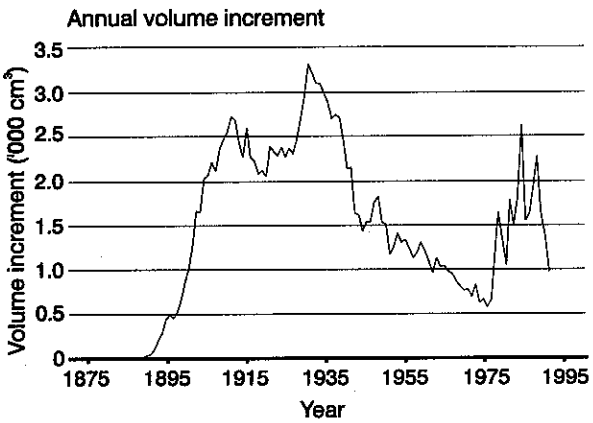


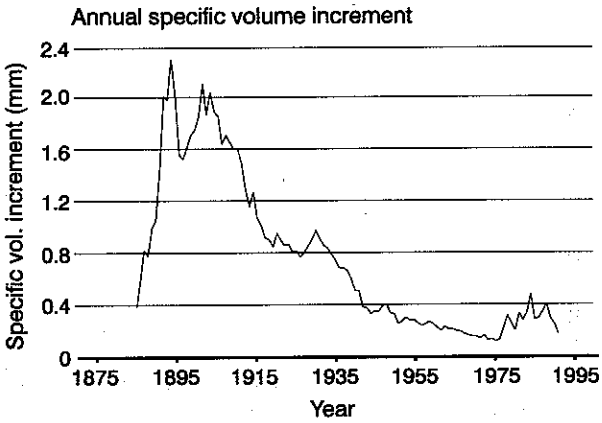


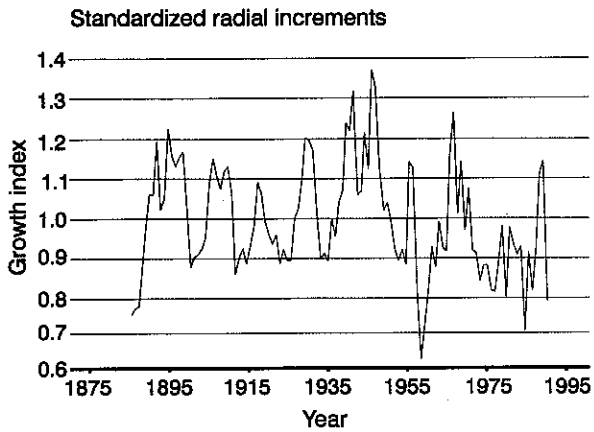
Appendix 5. Site 30 tree growth characteristics



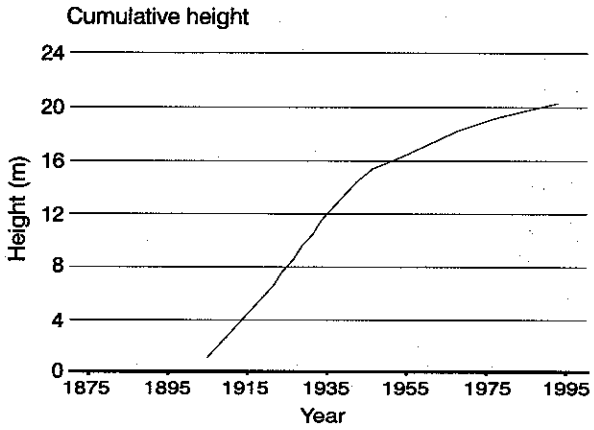


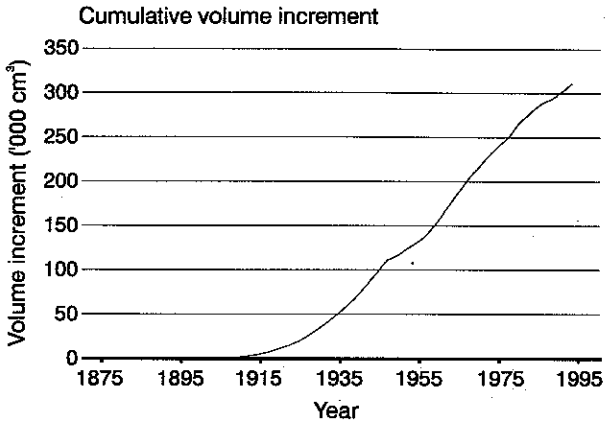


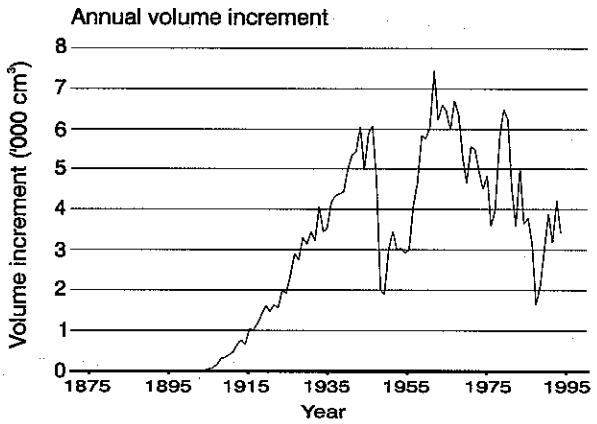


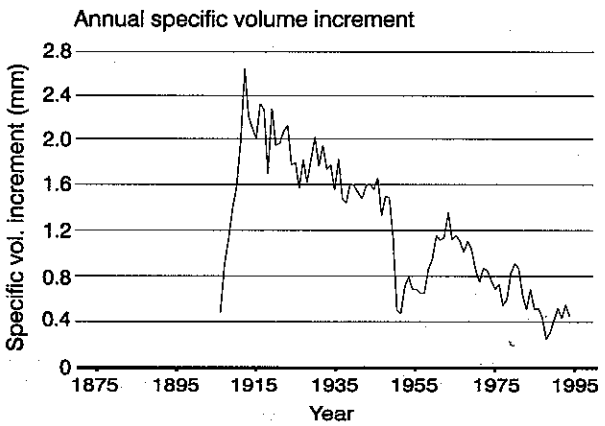


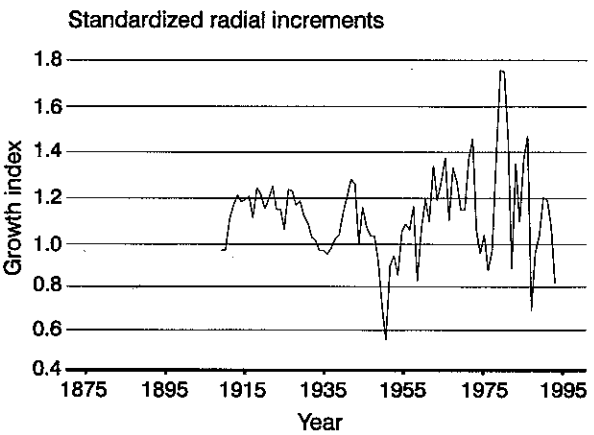
Appendix 5. Site 31 tree growth characteristics



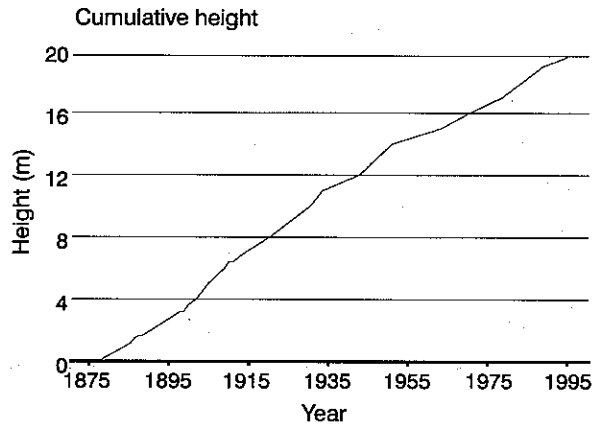


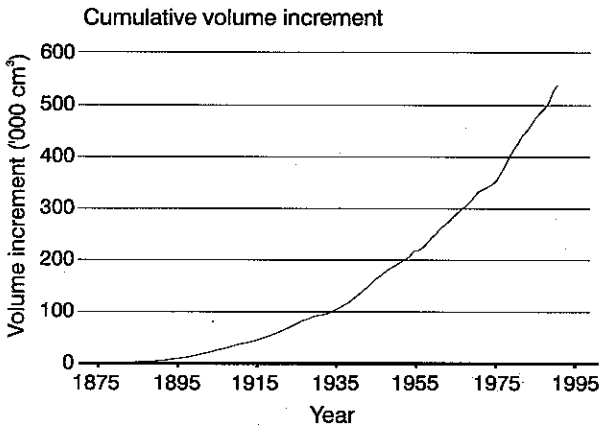


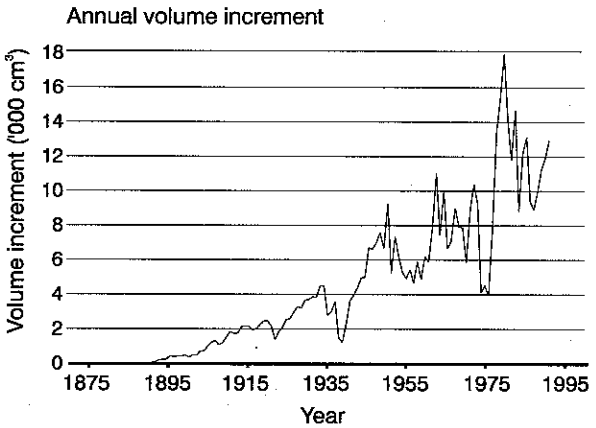


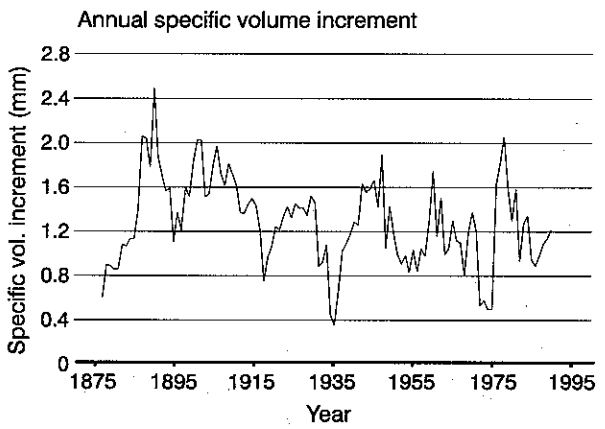


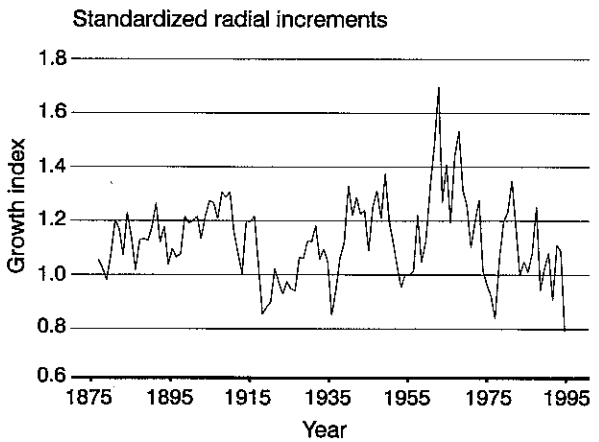
Appendix 5. Site 32 tree growth characteristics



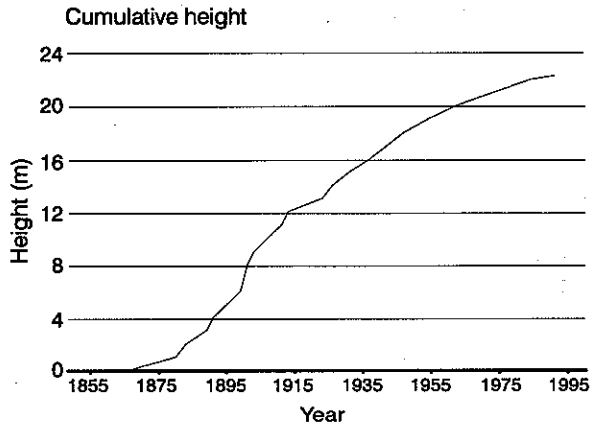


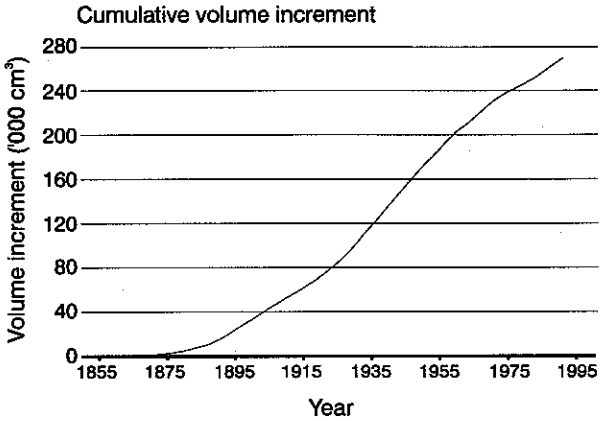


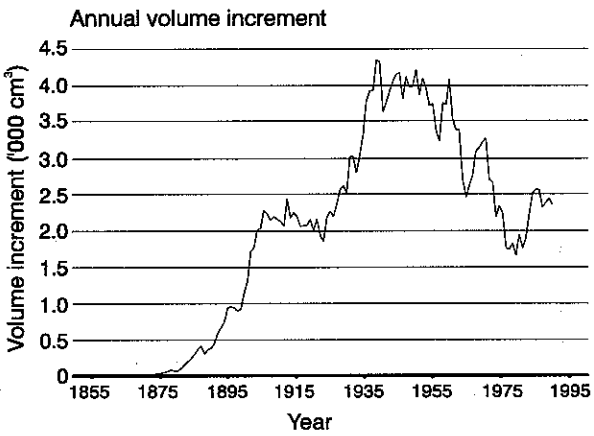


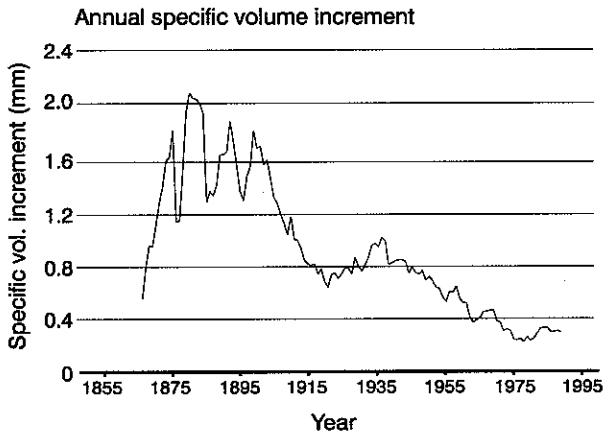


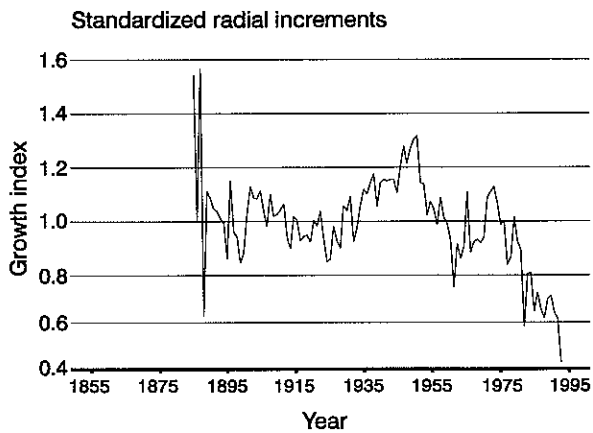
Appendix 5. Site 33 tree growth characteristics





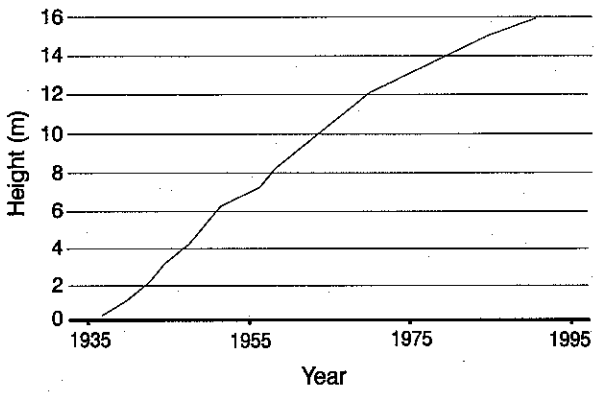




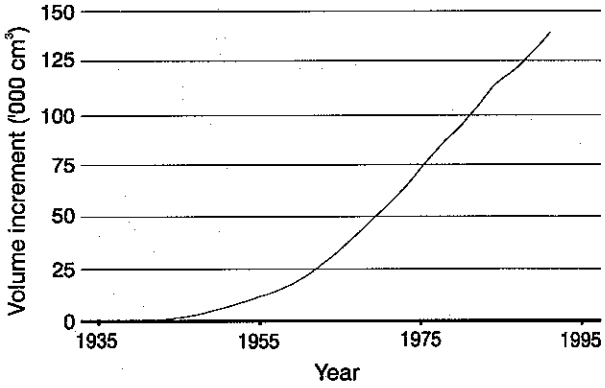


Appendix 5. Site 34 tree growth characteristics

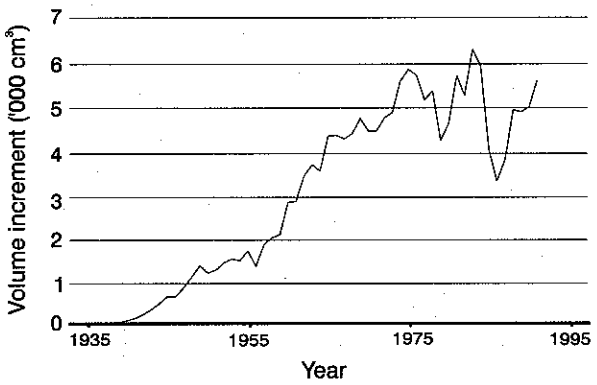
Cumulative height



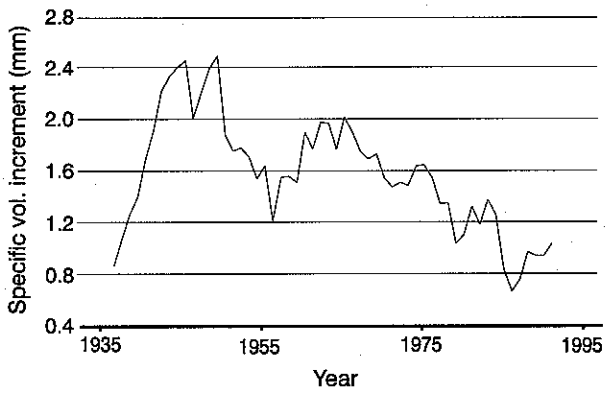
Cumulative volume increment



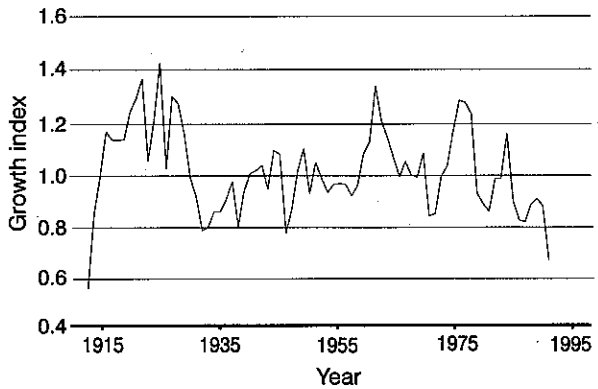
Annual volume increment



Annual specific volume increment



Standardized radial increments



APPENDIX 6

pH, Extractable and Total Elements in LFH and Total Elements in the Vegetation of Young Pine and Aspen in 1992

Appendix 6. Site A pH, extractable and total elements in LFH and total elements in the vegetation of young pine and aspen in 1992 (mg kg^{-1})

LFH quadrat pH and elemental statistics (n = 20)

Elements	1.0 *M* NH_4Cl extractable	Totals
pH	N.A.[a]	4.7 ± 0.2
Sulfur	92 ± 13	966 ± 168
Calcium	3 360 ± 497	4 200 ± 830
Magnesium	358 ± 41	942 ± 187
Potassium	543 ± 92	814 ± 137
Manganese	306 ± 79	736 ± 469
Aluminum	215 ± 39	4 870 ± 1 790
Iron	42 ± 17	6 230 ± 2 000
Phosphorus	72 ± 17	855 ± 124

[a] N.A. = not applicable.

Foliage concentrations

Elements	Current pine needles	1-year-old pine needles	Bunchberry	Fireweed
Sulfur	1 220 ± 65	1 170 ± 61	2 590 ± 202	1 960 ± 152
Calcium	1 880 ± 318	2 800 ± 531	18 700 ± 903	8 950 ± 752
Magnesium	1 190 ± 124	917 ± 101	6 660 ± 432	4 050 ± 425
Potassium	5 990 ± 282	3 970 ± 250	12 100 ± 1 000	13 400 ± 724
Manganese	515 ± 63	777 ± 153	284 ± 38	140 ± 32
Aluminum	397 ± 56	807 ± 2	475 ± 58	32 ± 6
Iron	22 ± 4	23 ± 8	110 ± 30	70 ± 11
Phosphorus	2 320 ± 196	1 170 ± 46	5 010 ± 243	5 040 ± 412
Nitrogen	N.D.[a]	N.D.	N.D.	N.D.
	Twin-flower	Feather moss	Rose	
Sulfur	1 180 ± 50	1 540 ± 54	2 550 ± 346	
Calcium	11 800 ± 636	4 540 ± 392	12 200 ± 1 120	
Magnesium	3 200 ± 191	1 160 ± 178	4 110 ± 444	
Potassium	13 100 ± 1 240	5 040 ± 350	12 000 ± 972	
Manganese	417 ± 74	602 ± 120	231 ± 75	
Aluminum	276 ± 254	355 ± 58	12 ± 3	
Iron	293 ± 260	469 ± 73	43 ± 4	
Phosphorus	1 740 ± 131	1 680 ± 157	5 090 ± 798	
Nitrogen	N.D.	N.D.	N.D.	

[a] N.D. = not determined.

Appendix 6. Site B pH, extractable and total elements in LFH and total elements in the vegetation of young pine and aspen in 1992 (mg kg^{-1})

LFH quadrat pH and elemental statistics (n = 20)

Elements	1.0 *M* NH_4Cl extractable	Totals
pH	N.A.[a]	5.1 ± 0.2
Sulfur	135 ± 18	892 ± 114
Calcium	4 690 ± 1 170	4 910 ± 1 350
Magnesium	618 ± 110	1 170 ± 270
Potassium	790 ± 121	983 ± 123
Manganese	685 ± 156	1 690 ± 499
Aluminum	107 ± 35	3 770 ± 1 180
Iron	17 ± 9	5 120 ± 1 600
Phosphorus	151 ± 40	1 020 ± 227

[a] N.A. = not applicable.

Foliage concentrations

Elements	Current pine needles	1-year-old pine needles	Bunchberry	Fireweed
Sulfur	1 400 ± 54	1 140 ± 65	2 340 ± 183	1 910 ± 139
Calcium	1 390 ± 123	3 310 ± 393	16 500 ± 930	8 700 ± 1 200
Magnesium	1 110 ± 47	1 070 ± 102	5 510 ± 309	4 030 ± 245
Potassium	6 200 ± 287	3 220 ± 189	14 300 ± 491	16 700 ± 719
Manganese	469 ± 57	998 ± 174	275 ± 64	124 ± 23
Aluminum	345 ± 40	797 ± 87	370 ± 17	17 ± 7
Iron	B.D.[a]	47 ± 7	57 ± 11	58 ± 18
Phosphorus	2 440 ± 106	1 260 ± 75	4 600 ± 340	5 480 ± 492
Nitrogen	N.D.[b]	N.D.	N.D.	N.D.
	Twin-flower	Feather moss	Rose	
Sulfur	997 ± 43	1 150 ± 85	2 780 ± 237	
Calcium	9 660 ± 683	4 750 ± 637	10 600 ± 941	
Magnesium	2 530 ± 171	1 420 ± 252	4 240 ± 318	
Potassium	12 500 ± 970	4 180 ± 441	13 500 ± 946	
Manganese	562 ± 99	534 ± 79	353 ± 109	
Aluminum	177 ± 39	532 ± 129	17 ± 9	
Iron	169 ± 22	632 ± 152	65 ± 18	
Phosphorus	1 550 ± 94	1 360 ± 138	5 520 ± 428	
Nitrogen	N.D.	N.D.	N.D.	

[a] B.D. = below detection.

[b] N.D. = not determined.

Appendix 6. Site C pH, extractable and total elements in LFH and total elements in the vegetation of young pine and aspen in 1992 (mg kg^{-1})

LFH quadrat pH and elemental statistics (n = 20)

Elements	1.0 *M* NH_4Cl extractable	Totals
pH	N.A.[a]	5.1 ± 0.2
Sulfur	171 ± 34	1 370 ± 251
Calcium	4 480 ± 803	5 640 ± 1 090
Magnesium	703 ± 174	1 200 ± 195
Potassium	941 ± 235	1 350 ± 241
Manganese	609 ± 149	1 570 ± 668
Aluminum	209 ± 96	4 150 ± 1 230
Iron	23 ± 13	5 780 ± 2 120
Phosphorus	157 ± 44	1 190 ± 143

[a] N.A. = not applicable.

Foliage concentrations

Elements	Current pine needles	1-year-old pine needles	Bunchberry	Fireweed
Sulfur	1 690 ± 90	1 170 ± 126	2 680 ± 298	2 040 ± 282
Calcium	1 980 ± 211	3 200 ± 478	19 000 ± 872	8 520 ± 556
Magnesium	1 450 ± 95	1 080 ± 160	6 100 ± 195	4 160 ± 351
Potassium	5 780 ± 466	3 190 ± 341	12 600 ± 755	14 100 ± 1 550
Manganese	773 ± 106	1 160 ± 157	272 ± 43	150 ± 35
Aluminum	443 ± 52	885 ± 113	447 ± 168	20 ± 4
Iron	38 ± 6	42 ± 4	123 ± 95	65 ± 9
Phosphorus	2 660 ± 135	1 280 ± 66	3 840 ± 425	4 970 ± 407
Nitrogen	N.D.[a]	N.D.	N.D.	N.D.

Elements	Twin-flower	Feather moss	Rose
Sulfur	1 340 ± 96	1 610 ± 79	2 740 ± 317
Calcium	12 000 ± 1 360	4 040 ± 548	10 100 ± 947
Magnesium	3 240 ± 223	1 200 ± 84	3 620 ± 353
Potassium	12 900 ± 1 370	6 040 ± 435	12 500 ± 1 190
Manganese	359 ± 56	412 ± 104	495 ± 99
Aluminum	148 ± 30	91 ± 145	37 ± 36
Iron	155 ± 25	370 ± 100	53 ± 29
Phosphorus	1 930 ± 157	1 830 ± 192	4 190 ± 782
Nitrogen	N.D.	N.D.	N.D.

[a] N.D. = not determined.

Appendix 6. Site D pH, extractable and total elements in LFH and total elements in the vegetation of young pine and aspen in 1992 (mg kg^{-1})

LFH quadrat pH and elemental statistics (n = 20)

Elements	1.0 *M* NH_4Cl extractable	Totals
pH	N.A.[a]	5.7 ± 0.2
Sulfur	143 ± 17	1 200 ± 172
Calcium	6 160 ± 933	7 480 ± 1 290
Magnesium	862 ± 120	1 380 ± 171
Potassium	925 ± 118	1 480 ± 186
Manganese	432 ± 85	903 ± 223
Aluminum	53 ± 32	3 650 ± 934
Iron	12 ± 7	5 240 ± 1 390
Phosphorus	164 ± 28	1 150 ± 108

[a] N.A. = not applicable.

Foliage concentrations

Elements	Current pine needles	1-year-old pine needles	Bunchberry	Fireweed
Sulfur	1 620 ± 106	1 060 ± 81	2 610 ± 214	1 700 ± 109
Calcium	2 190 ± 274	3 250 ± 338	17 800 ± 750	8 500 ± 686
Magnesium	1 420 ± 105	896 ± 121	5 270 ± 283	4 050 ± 416
Potassium	5 970 ± 391	3 610 ± 245	14 300 ± 790	15 300 ± 1 240
Manganese	669 ± 103	841 ± 155	196 ± 20	170 ± 54
Aluminum	394 ± 49	690 ± 67	325 ± 54	23 ± 5
Iron	32 ± 3	32 ± 7	69 ± 32	54 ± 12
Phosphorus	2 940 ± 272	1 270 ± 74	3 820 ± 239	5 350 ± 373
Nitrogen	N.D.[a]	N.D.	N.D.	N.D.
	Twin-flower	Feather moss	Rose	
Sulfur	1 060 ± 63	1 570 ± 180	2 430 ± 272	
Calcium	10 500 ± 1 100	7 070 ± 1 440	11 100 ± 1 170	
Magnesium	2 930 ± 208	1 660 ± 187	3 750 ± 369	
Potassium	14 000 ± 809	4 930 ± 462	15 700 ± 1 130	
Manganese	320 ± 68	548 ± 166	260 ± 85	
Aluminum	108 ± 25	509 ± 145	13 ± 4	
Iron	121 ± 19	604 ± 183	54 ± 7	
Phosphorus	1 820 ± 192	1 960 ± 190	4 600 ± 281	
Nitrogen	N.D.	N.D.	N.D.	

[a] N.D. = not determined.

Appendix 6. Site E pH, extractable and total elements in LFH and total elements in the vegetation of young pine and aspen in 1992 (mg kg^{-1})

LFH quadrat pH and elemental statistics (n = 20)

Elements	1.0 *M* NH_4Cl extractable	Totals
pH	N.A.[a]	5.6 ± 0.2
Sulfur	93 ± 16	883 ± 200
Calcium	4 530 ± 742	5 970 ± 1 180
Magnesium	515 ± 73	1 480 ± 163
Potassium	672 ± 86	1 350 ± 72
Manganese	295 ± 67	1 300 ± 437
Aluminum	58 ± 27	5 560 ± 870
Iron	6 ± 3	10 800 ± 3 300
Phosphorus	59 ± 20	995 ± 82

[a] N.A. = not applicable.

Foliage concentrations

Elements	Current pine needles	1-year-old pine needles	Bunchberry	Fireweed
Sulfur	1 310 ± 104	969 ± 61	2 680 ± 217	1 950 ± 201
Calcium	1 930 ± 391	2 960 ± 509	20 700 ± 928	10 000 ± 586
Magnesium	1 100 ± 100	809 ± 92	5 630 ± 241	3 940 ± 374
Potassium	6 030 ± 346	3 810 ± 438	14 600 ± 741	14 200 ± 1 010
Manganese	557 ± 149	743 ± 142	208 ± 33	123 ± 19
Aluminum	339 ± 75	614 ± 101	416 ± 52	23 ± 9
Iron	17 ± 3	31 ± 10	91 ± 24	58 ± 11
Phosphorus	2 400 ± 202	1 140 ± 79	4 060 ± 231	4 840 ± 688
Nitrogen	N.D.[a]	N.D.	N.D.	N.D.

	Twin-flower	Feather moss	Rose
Sulfur	1 090 ± 77	1 490 ± 118	2 590 ± 150
Calcium	12 300 ± 998	6 230 ± 883	10 400 ± 1 110
Magnesium	2 950 ± 297	1 550 ± 209	3 690 ± 391
Potassium	13 800 ± 1 350	5 070 ± 500	14 200 ± 743
Manganese	267 ± 45	561 ± 128	212 ± 58
Aluminum	162 ± 52	708 ± 164	12 ± 7
Iron	195 ± 93	830 ± 177	51 ± 26
Phosphorus	1 850 ± 141	1 860 ± 172	4 280 ± 275
Nitrogen	N.D.	N.D.	N.D.

[a] N.D. = not determined.

Appendix 6. Site F pH, extractable and total elements in LFH and total elements in the vegetation of young pine and aspen in 1992 (mg kg^{-1})

LFH quadrat pH and elemental statistics (n = 20)

Elements	1.0 *M* NH_4Cl extractable	Totals
pH	N.A.[a]	5.3 ± 0.2
Sulfur	125 ± 19	1 030 ± 118
Calcium	4 740 ± 924	6 490 ± 1 340
Magnesium	634 ± 136	1 250 ± 159
Potassium	860 ± 158	1 490 ± 234
Manganese	382 ± 91	824 ± 191
Aluminum	117 ± 54	3 340 ± 592
Iron	21 ± 8	3 950 ± 913
Phosphorus	130 ± 36	1 050 ± 82

[a] N.A. = not applicable.

Foliage concentrations

Elements	Current pine needles	1-year-old pine needles	Bunchberry	Fireweed
Sulfur	1 430 ± 111	1 090 ± 67	2 580 ± 292	1 930 ± 202
Calcium	1 870 ± 276	3 820 ± 996	16 000 ± 1 380	8 300 ± 883
Magnesium	1 120 ± 65	1 020 ± 113	5 090 ± 576	4 210 ± 328
Potassium	5 910 ± 726	3 290 ± 310	13 900 ± 1 510	17 200 ± 1 850
Manganese	463 ± 69	907 ± 192	182 ± 17	128 ± 21
Aluminum	358 ± 47	783 ± 4	16 ± 49	32 ± 10
Iron	43 ± 46	30 ± 7	71 ± 9	72 ± 10
Phosphorus	2 450 ± 278	1 200 ± 66	4 450 ± 705	5 980 ± 649
Nitrogen	N.D.[a]	N.D.	N.D.	N.D.
	Twin-flower	Feather moss	Rose	
Sulfur	1 000 ± 67	1 250 ± 118	2 480 ± 153	
Calcium	9 460 ± 1 270	5 520 ± 1 320	10 700 ± 971	
Magnesium	2 370 ± 277	1 600 ± 376	3 740 ± 107	
Potassium	12 200 ± 2 100	6 300 ± 2 140	13 500 ± 970	
Manganese	319 ± 67	378 ± 84	282 ± 52	
Aluminum	213 ± 91	431 ± 115	18 ± 5	
Iron	185 ± 93	400 ± 94	46 ± 7	
Phosphorus	1 620 ± 202	1 550 ± 181	4 770 ± 410	
Nitrogen	N.D.	N.D.	N.D.	

[a] N.D. = not determined.

Appendix 6. Site 40 pH, extractable and total elements in LFH and total elements in the vegetation of young pine and aspen in 1992 (mg kg^{-1})

LFH quadrat pH and elemental statistics (n = 20)

Elements	1.0 *M* NH_4Cl extractable	Totals
pH	N.A.[a]	7.0 ± 0.1
Sulfur	143 ± 110	7 540 ± 2 080
Calcium	49 200 ± 10 900	44 900 ± 8 520
Magnesium	522 ± 52	3 650 ± 944
Potassium	648 ± 59	1 160 ± 116
Manganese	75 ± 13	835 ± 226
Aluminum	7 ± 1	2 140 ± 667
Iron	4 ± 1	3 040 ± 805
Phosphorus	143 ± 18	1 290 ± 79

[a] N.A. = not applicable.

Foliage concentrations

Elements	Aspen	Alder	Bunchberry
Sulfur	4 260 ± 339	2 830 ± 533	4 160 ± 491
Calcium	16 000 ± 2 970	9 370 ± 1 480	24 700 ± 1 120
Magnesium	1 960 ± 399	1 850 ± 171	4 560 ± 419
Potassium	15 500 ± 1 870	8 450 ± 950	13 500 ± 887
Manganese	124 ± 16	684 ± 259	128 ± 35
Aluminum	19 ± 10	26 ± 12	232 ± 93
Iron	58 ± 11	78 ± 13	74 ± 19
Phosphorus	3 140 ± 378	2 390 ± 201	5 230 ± 337
Nitrogen	N.D.[a]	N.D.	N.D.
	Fireweed	Twin-flower	Strawberry
Sulfur	4 130 ± 457	5 370 ± 1 880	3 250 ± 417
Calcium	11 100 ± 790	15 200 ± 1 240	15 200 ± 793
Magnesium	4 240 ± 353	2 410 ± 197	3 920 ± 190
Potassium	21 100 ± 1 870	17 200 ± 1 030	18 800 ± 1 240
Manganese	107 ± 41	117 ± 41	113 ± 35
Aluminum	14 ± 8	91 ± 23	17 ± 10
Iron	84 ± 14	165 ± 33	72 ± 12
Phosphorus	7 400 ± 545	2 680 ± 243	5 370 ± 347
Nitrogen	N.D.	N.D.	N.D.

[a] N.D. = not determined.

Appendix 6. Site 41 pH, extractable and total elements in LFH and total elements in the vegetation of young pine and aspen in 1992 (mg kg^{-1})

LFH quadrat pH and elemental statistics (n = 20)

Elements	1.0 *M* NH_4Cl extractable	Totals
pH	N.A.[a]	6.6 ± 0.2
Sulfur	136 ± 32	1 330 ± 294
Calcium	8 220 ± 2 110	12 000 ± 2 260
Magnesium	1 010 ± 200	2 160 ± 86
Potassium	749 ± 178	1 520 ± 132
Manganese	222 ± 80	1 080 ± 185
Aluminum	11 ± 4	4 700 ± 1 080
Iron	3 ± 1	6 970 ± 1 540
Phosphorus	134 ± 52	1 260 ± 163

[a] N.A. = not applicable.

Foliage concentrations

Elements	Aspen	Willow	Bunchberry
Sulfur	2 300 ± 160	2 780 ± 373	2 550 ± 205
Calcium	11 600 ± 784	13 800 ± 920	18 700 ± 913
Magnesium	2 310 ± 153	2 480 ± 185	6 440 ± 416
Potassium	13 800 ± 2 590	13 800 ± 835	15 400 ± 1 650
Manganese	91 ± 16	78 ± 13	130 ± 28
Aluminum	4 ± 4	9 ± 3	267 ± 81
Iron	48 ± 3	70 ± 10	77 ± 27
Phosphorus	2 750 ± 212	4 260 ± 835	4 810 ± 366
Nitrogen	N.D.[a]	N.D.	N.D.
	Fireweed	Twin-flower	Strawberry
Sulfur	2 190 ± 210	1 090 ± 87	1 460 ± 90
Calcium	8 740 ± 576	11 400 ± 982	11 600 ± 610
Magnesium	4 370 ± 314	2 810 ± 234	4 210 ± 296
Potassium	18 000 ± 1 690	14 000 ± 942	18 500 ± 1 860
Manganese	110 ± 18	202 ± 50	260 ± 66
Aluminum	23 ± 6	113 ± 42	32 ± 33
Iron	84 ± 10	146 ± 38	73 ± 31
Phosphorus	6 020 ± 829	1 910 ± 244	3 900 ± 268
Nitrogen	N.D.	N.D.	N.D.

[a] N.D. = not determined.

Appendix 6. Site 42 pH, extractable and total elements in LFH and total elements in the vegetation of young pine and aspen in 1992 (mg kg^{-1})

LFH quadrat pH and elemental statistics (n = 20)

Elements	1.0 *M* NH_4Cl extractable	Totals
pH	N.A.[a]	5.6 ± 0.7
Sulfur	3 860 ± 869	28 300 ± 6 300
Calcium	16 400 ± 2 530	42 300 ± 9 150
Magnesium	364 ± 66	3 260 ± 877
Potassium	323 ± 72	501 ± 80
Manganese	102 ± 37	267 ± 93
Aluminum	18 ± 22	946 ± 153
Iron	14 ± 16	2 110 ± 333
Phosphorus	117 ± 26	893 ± 79

[a] N.A. = not applicable.

Foliage concentrations

Elements	Aspen	Willow	Bunchberry	Fireweed
Sulfur	5 200 ± 605	7 410 ± 1 100	6 550 ± 185	3 830 ± 246
Calcium	13 800 ± 1 900	16 100 ± 1 760	26 200 ± 748	13 800 ± 1 380
Magnesium	2 050 ± 268	2 200 ± 205	3 940 ± 626	3 170 ± 313
Potassium	19 000 ± 2 430	20 000 ± 4 220	11 900 ± 1 540	15 800 ± 1 450
Manganese	213 ± 35	546 ± 163	266 ± 22	401 ± 72
Aluminum	29 ± 7	22 ± 11	479 ± 99	36 ± 10
Iron	56 ± 4	56 ± 5	81 ± 14	69 ± 11
Phosphorus	3 930 ± 541	4 480 ± 504	4 070 ± 913	4 980 ± 643
Nitrogen	N.D.[a]	N.D.	N.D.	N.D.
	Blueberry	Wild sarsaparilla	Alder	
Sulfur	5 020 ± 551	4 620 ± 528	3 250 ± 426	
Calcium	6 390 ± 897	12 100 ± 1 090	9 440 ± 2 190	
Magnesium	1 970 ± 349	1 490 ± 212	1 800 ± 288	
Potassium	6 470 ± 1 140	17 400 ± 1 210	8 030 ± 770	
Manganese	3 370 ± 1 080	2 580 ± 498	1 470 ± 350	
Aluminum	191 ± 56	25 ± 11	50 ± 16	
Iron	119 ± 33	64 ± 9	85 ± 18	
Phosphorus	1 870 ± 305	3 270 ± 190	2 470 ± 224	
Nitrogen	N.D.	N.D.	N.D.	

[a] N.D. = not determined.

APPENDIX 7

Site Locations and Soil Descriptions

Appendix 7. Site 6 location and soil descriptions (sites established in 1991 and 1992)

Mature lodgepole pine site description (relocated across Highway 752)

Location:	NW-07-38-09-W5
Parent material:	Glaciofluvial (mixed)
Elevation:	1095 m
Drainage:	Well drained
Slope and aspect:	Level
Classification:	Brunisolic Gray Luvisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LF	10–0	5YR 3/2 (m) 5YR 3/3 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ae	0–2	10YR 5/3 (m) 10YR 6/4 (d)	L	42	44	14
Bm	2–11	7.5YR 4/4 (m)	L	38	36	26
Ae_2	11–23	10YR 5/4 (m) 10YR 7/3 (d)	L	42	36	22
Btj	23–38	10YR 5/4 (m) 10YR 6/4 (d)	CL	42	24	34
IIBtj	38–60	10YR 4/4 (m) 10YR 4/6 (d)	SC	54	8	38
IICk	60–80$^+$	10YR 3/3 (m) 10YR 4/3 (d)	SL	72	14	14

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

Appendix 7. Site 8 location and soil descriptions (sites established in 1991 and 1992)

Mature lodgepole pine site description (site originally established in 1981 but no detailed soil description was completed)

Location:	NW-04-39-09-W5
Parent material:	Eolian veneer/morainal till
Elevation:	1115 m
Drainage:	Moderately well drained
Slope and aspect:	Level
Classification:	Eluviated Dystric Brunisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LF	6–0	10YR 3/4 (m) 10YR 4/3 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ahe	0–7	10YR 2/2 (m) 10YR 4/4 (d)	SiL-L	28	49	23
Bm	7–18	10YR 3/4 (m) 10YR 5/3 (d)	L	28	44	28
AB	18–24	10YR 5/4 (m) 10YR 6/4 (d)	SiL-L	26	46	28
Btj	24–32	10YR 4/4 (m) 10YR 6/3 (d)	CL	22	44	34
BC	32–66	10YR 4/4 (m) 10YR 5/4 (d)	SCL	54	16	30
Ck	66+	10YR 4/2 (m) 10YR 5/3 (d)	SCL	62	18	20

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

Appendix 7. Site 16 location and soil descriptions (sites established in 1991 and 1992)

Mature lodgepole pine site description (site originally established in 1981 but no detailed soil description was completed)

Location:	SE-20-38-10-W5
Parent material:	Glaciofluvial/morainal till
Elevation:	1340 m
Drainage:	Moderately well drained
Slope and aspect:	1%, north
Classification:	Orthic Gray Luvisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LFH	5–0	2.5R 3/4 (m) 2.5R 4/6 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ae	0–11	10YR 4/2 (m) 10YR 5/3 (d)	SiL-L	28	50	22
AB	11–31	10YR 5/3 (m) 10YR 6/4 (d)	CL	30	34	36
Bt_1	31–48	10YR 4/3 (m) 10YR 5/3 (d)	C	28	22	50
Bt_2	48–60	10YR 4/2 (m) 10YR 6/3 (d)	C	28	26	46
BC	60–86	10YR 5/2 (m) 10YR 6/3 (d)	C	28	28	44
Ck	86–100+	10YR 4/2 (m) 10YR 5/3 (d)	C	26	30	44

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

Appendix 7. Site 18 location and soil descriptions (sites established in 1991 and 1992)

Mature lodgepole pine site description (site originally established in 1981 but no detailed soil description was completed)

Location:	SW-33-38-08-W5
Parent material:	Eolian
Elevation:	1022 m
Drainage:	Rapidly drained
Slope and aspect:	3%, east
Classification:	Orthic Dystric Brunisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LF	6–0	10YR 3/2 (m) 10YR 4/3 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ae_1	0–2 (discon-tinous)	5YR 6/1 (m) 10YR 6/2 (d)	SL	66	28	6
Bm	2–8	10YR 4/6 (m) 10YR 5/4 (d)	SL	62	24	14
Ae_2	8–15	10YR 5/4 (m) 10YR 6/4 (d)	SL	60	26	14
Btj	15–25	10YR 4/6 (m) 10YR 5/4 (d)	SCL	56	18	26
BC_1	25–41	10YR 5/6 (m) 10YR 5/6 (d)	SL	80	6	14
BC_2	41–54	10YR 3/3 (m) 10YR 4/3 (d)	SL	80	8	12
CK_1	54–70	10YR 4/2 (m) 10YR 5/2 (d)	S	88	6	6
Ck_2	70–110$^+$	10YR 4/2 (m) 10YR 5/2 (d)	LS	86	6	8

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

Appendix 7. Site 24 location and soil descriptions (sites established in 1991 and 1992)

Mature lodgepole pine site description (site originally established in 1981 but no detailed soil description was completed)

Location:	SE-30-36-10-W5
Parent material:	Morainal till
Elevation:	1785 m
Drainage:	Well drained
Slope and aspect:	5%, east
Classification:	Orthic Gray Luvisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LF	5–0	10YR 3/4 (m) 10YR 5/3 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ae	0–6	10YR 6/2 (m) 10YR 7/1 (d)	SiL	28	54	18
Bt	6–14	5YR 3/4 (m) 10YR 6/6 (d)	CL	24	44	32
Bt_2	14–28	10YR 5/6 (m) 10YR 6/4 (d)	SiCL-CL	20	46	34
BC	28–50	10YR 5/4 (m) 10YR 6/4 (d)	C	20	38	42
C	50–70+	10YR 5/4 (m) 10YR 6/3 (d)	N.D.[d]	N.D.	N.D.	N.D.

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

[d] N.D. = not determined.

Appendix 7. Site 25 location and soil descriptions (sites established in 1991 and 1992)

Mature lodgepole pine site description (site originally established in 1981 but no detailed soil description was completed)

Location:	SE-31-35-10-W5
Parent material:	Eolian veneer/glaciofluvial morainal
Elevation:	1466 m
Drainage:	Moderately well drained
Slope and aspect:	20%, northwest
Classification:	Orthic Gray Luvisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LF	4–0	10YR 3/4 (m) 10YR 4/3 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ae	0–5	10YR 6/2 (m) 10YR 7/1 (d)	SiL	32	54	14
Bm_1	5–10	10YR 5/3 (m) 10YR 7/3 (d)	L	32	48	20
IIBA	10–20	10YR 6/3 (m) 10YR 7/3 (d)	L	36	42	22
$IIBtj_1$	20–33	10YR 5/3 (m) 10YR 7/2 (d)	L	34	42	24
$IIBtj_2$	33–58	10YR 4/2 (m) 10YR 7/1 (d)	L	38	36	26
IIBtg	$58–70^+$	5YR 5/3 (m) 10YR 5/2 (d)	C	22	30	48

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

Appendix 7. Site 30 location and soil descriptions (sites established in 1991 and 1992)

Mature lodgepole pine site description

Location:	NE-32-36-09-W5
Parent material:	Eolian veneer/morainal till
Elevation:	1355 m
Drainage:	Well drained
Slope and aspect:	Level
Classification:	Brunisolic Gray Luvisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LF	3–0	10YR 3/4 (m) 10YR 4/6 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ae_1	0–3	10YR 5/3 (m) 10YR 6/2 (d)	SiL	30	52	18
Bm	3–10	10YR 4/6 (m) 10YR 6/6 (d)	L	34	42	24
Ae_2	10–15	10YR 5/6 (m) 10YR 6/4 (d)	L	38	44	18
$IIBt_1$	15–43	10YR 5/4 (m) 10YR 6/6 (d)	C	28	30	42
$IIBt_2$	43–65	10YR 5/6 (m) 10YR 6/6 (d)	C	28	30	42
$IIBt_3$	65–98	10YR 5/8 (m) 10YR 6/6 (d)	C	28	30	42
IIBC	98–105$^+$	10YR 5/8 (m) 10YR 6/6 (d)	CL-C	34	26	40

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

Appendix 7. Site 31 location and soil descriptions (sites established in 1991 and 1992)

Mature lodgepole pine site description

Location:	NE-17-37-09-W5
Parent material:	Eolian veneer/morainal till
Elevation:	1313 m
Drainage:	Well drained
Slope and aspect:	Level
Classification:	Brunisolic Gray Luvisol

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LF	5–0	10YR 3/2 (m) 10YR 4/6 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ae_1	0–5	10YR 4/4 (m) 10YR 5/3 (d)	SiL	30	52	18
Bm	5–13	10YR 5/6 (m) 10YR 6/6 (d)	CL	30	34	36
Ae_2	13–25	10YR 6/3 (m) 10YR 8/2 (d)	SiL	30	52	18
BA	25–44	10YR 5/4 (m) 10YR 6/4 (d)	SiL	28	56	16
$IIBt_1$	44–62	10YR 4/3 (m) 10YR 6/4 (d)	CL-C	28	32	40
$IIBt_2$	62–81	10YR 5/4 (m) 10YR 6/4 (d)	CL-C	28	32	40
IIBCg	81–84+	10YR 5/3 (m) 10YR 6/4 (d) (mottles 5YR 5/8 (m))	CL-C	28	32	40

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

Appendix 7. Site 32 location and soil descriptions (sites established in 1991 and 1992)

Mature lodgepole pine site description

Location:	SE-32-36-10-W5
Parent material:	Morainal till
Elevation:	1565 m
Drainage:	Well drained
Slope and aspect:	20%, southeast
Classification:	Eluviated Dystric Brunisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LF	4–0	10YR 2/1 (m) 10YR 3/6 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ae	0–5	10YR 5/3 (m) 10YR 7/3 (d)	C	26	32	42
Bm	5–23	10YR 5/6 (m) 10YR 6/4 (d)	CL	36	34	30
BC	23–43+	10YR 6/2 (m) 10YR 7/2 (d)	SiL	24	52	24

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

Appendix 7. Site 33 location and soil descriptions (sites established in 1991 and 1992)

Mature lodgepole pine site description

Location:	SW-08-36-09-W5
Parent material:	Eolian veneer/morainal till
Elevation:	1307 m
Drainage:	Well drained
Slope and aspect:	0.5%, northwest
Classification:	Brunisolic Gray Luvisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LF	6–0	10YR 3/2 (m) 10YR 4/6 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ae_1	0–3	10YR 6/2 (m) 10YR 6/3 (d)	SiL-L	36	48	16
Bm	3–8	10YR 5/6 (m) 10YR 5/6 (d)	CL	28	40	32
Ae_2	8–18	10YR 5/2 (m) 10YR 7/3 (d)	SiL	24	52	24
IIAB	18–38	10YR 6/6 (m) 10YR 6/3 (d)	C	26	28	46
$IIBt_1$	38–64	10YR 5/4 (m) 10YR 5/3 (d)	C	32	26	42
$IIBt_2$	64–94	10YR 5/4 (m) 10YR 5/3 (d)	CL	38	24	38
IIBC	94–110^+	10YR 4/3 (m) 10YR 6/3 (d)	CL	38	24	38

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

Appendix 7. Site 34 location and soil descriptions (sites established in 1991 and 1992)

Mature lodgepole pine site description

Location:	SW-36-37-09-W5
Parent material:	Eolian veneer/morainal till
Elevation:	1205 m
Drainage:	Well drained
Slope and aspect:	Level
Classification:	Brunisolic Gray Luvisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LF	7–0	10YR 3/2 (m) 10YR 4/3 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ae_1	0–5	10YR 5/2 (m) 10YR 6/2 (d)	SiL	30	56	14
Bm	5–13	10YR 5/6 (m) 10YR 6/4 (d)	SiL	30	54	16
Ae_2	13–22	10YR 6/3 (m) 10YR 7/3 (d)	SiL	28	56	16
$IIBt_1$	22–41	10YR 5/4 (m) 10YR 6/4 (d)	CL-C	34	26	40
$IIBt_2$	41–73	10YR 5/4 (m) 10YR 6/3 (d)	CL-C	40	20	40
IIBC	73^+	10YR 4/4 (m) 10YR 5/3 (d)	C	34	22	44

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

Appendix 7. Site 35 location and soil descriptions (sites established in 1991 and 1992)

Mature lodgepole pine site description (replaces site 17 from 1981 and 1985)

Location:	SE-28-37-10-W5
Parent material:	Glaciolacustrine (complex glacial)
Elevation:	1350 m
Drainage:	Moderately well drained
Slope and aspect:	2%, east
Classification:	Orthic Gray Luvisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LF	4–0	10YR 3/6 (m) 10YR 4/6 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ae	0–10	10YR 5/2 (m) 10YR 6/3 (d)	SiL	30	54	16
AB	10–30	7.5YR 5/6 (m) 10YR 6/4 (d)	L	30	46	24
Bt_1	30–50	10YR 4/3 (m) 10YR 6/3 (d)	C	22	28	50
Bt_2	50–61	10YR 4/4 (m) 10YR 5/4 (d)	C	26	24	50
BCg	61–82	10YR 4/1 (m) 10YR 5/3 (d)	SiCL-CL	20	46	34
Ck	82–95+	10YR 4/2 (m) 10YR 5/3 (d) (mottles 5YR 5/6 (m))	C	26	30	44

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

Appendix 7. Site 40 location and soil descriptions (sites established in 1991 and 1992)

Moderate S^0 aspen site description

Location:	NE-35-37-09-W5
Parent material:	Eolian veneer/morainal till
Elevation:	1195 m
Drainage:	Well drained
Slope and aspect:	Level
Classification:	Eluviated Dystric Brunisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LFH	10–0	10YR 2/2 (m) 10YR 3/2 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ah	0–7	10YR 2/1 (m) 10YR 2/2 (d)	N.D.[d]	N.D.	N.D.	N.D.
Ahe	7–20	10YR 3/2 (m) 10YR 3/2 (d)	SiL-L	26	50	24
Ae	20–35	10YR 4/3 (m) 10YR 5/2 (d)	CL	26	42	32
AB	35–57	10YR 5/4 (m) 10YR 6/3 (d)	CL	28	40	32
Bm_1	57–75	10YR 4/4 (m) 10YR 6/3 (d)	SiCL	20	48	32
Bm_2	75–95	10YR 5/4 (m) 10YR 6/3 (d)	SiCL-CL	20	48	32
Ck	95–100+	10YR 5/4 (m) 10YR 6/2 (d)	CL	36	28	36

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

[d] N.D. = not determined.

Appendix 7. Site 41 location and soil descriptions (sites established in 1991 and 1992)

Non-S^0 aspen site description

Location:	NE-35-37-09-W5
Parent material:	Eolian veneer/morainal till
Elevation:	1115 m
Drainage:	Well drained
Slope and aspect:	Level
Classification:	Orthic Gray Luvisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LFH	7–0	10YR 2/2 (m) 10YR 4/2 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ahe	0–10	10YR 5/3 (m) 10YR 5/3 (d)	L	30	46	24
Ae	10–26	10YR 5/2 (m) 10YR 6/4 (d)	SiL-L	28	48	24
Bt_1	26–50	10YR 5/4 (m) 10YR 6/4 (d)	CL	26	44	30
Bt_2	50–67	10YR 4/4 (m) 10YR 4/4 (d)	C	32	26	42
BCk	67–75	10YR 5/3 (m) 10YR 6/3 (d)	CL	28	40	32
Ck	75–90+	10YR 5/3 (m) 10YR 6/2 (d)	CL	26	40	34

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

Appendix 7. Site 42 location and soil descriptions (sites established in 1991 and 1992)

High S^0 aspen site description

Location:	NE-35-37-09-W5
Parent material:	Eolian veneer/morainal till
Elevation:	1206 m
Drainage:	Well drained
Slope and aspect:	Level
Classification:	Brunisolic Gray Luvisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LFH	6–0	10YR 2/2 (m) 10YR 3/3 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ae_1	0–6	10YR 5/1 (m) 10YR 3/3 (d)	SiL	22	62	16
Bm	6–10	5YR 4/4 (m) 10YR 6/4 (d)	SiL	26	56	18
Ae_2	10–23	10YR 5/3 (m) 10YR 7/3 (d)	SiL	28	52	20
$IIBt_1$	23–50	10YR 5/4 (m) 10YR 6/3 (d)	CL	40	24	36
$IIBt_2$	50–72	10YR 5/4 (m) 10YR 6/3 (d)	C	28	26	46
IIBC	72–88	10YR 4/4 (m) 10YR 5/2 (d)	CL	28	40	32
IICK	88–100	10YR 3/3 (m) 10YR 5/3 (d)	C	30	24	46
IIIC	100–127+	10YR 4/4 (m) 10YR 6/3 (d)	SiCL-CL	20	48	32

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

Appendix 7. Site A location and soil descriptions (sites established in 1991 and 1992)

Young lodgepole pine site description

Location:	NE-24-37-09-W5
Parent material:	Glaciofluvial
Elevation:	1125 m
Drainage:	Rapidly drained
Slope and aspect:	3%, northeast
Classification:	Eluviated Dystric Brunisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LF	3–0	10YR 2/4 (m) 10YR 3/2 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ae	0–3	10YR 6/2 (m) 10YR 5/2 (d)	L	51	37	12
Bm	3–10	10YR 4/6 (m) 10YR 6/4 (d)	L	48	30	22
AB	10–20	10YR 5/6 (m) 10YR 6/4 (d)	SCL	50	24	26
Btj_1	20–45	10YR 6/6 (m) 10YR 6/3 (d)	SCL	64	14	22
Btj_2	45–68	10YR 5/6 (m) 10YR 5/3 (d)	SCL-SL	70	10	20
IIC	68–78	10YR 5/4 (m) 10YR 5/3 (d)	SL	74	8	18
Ck	78–90+	10YR 4/2 (m) 10YR 5/2 (d)	SCL-SL	60	20	20

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

Appendix 7. Site B location and soil descriptions (sites established in 1991 and 1992)

Young lodgepole pine site description

Location:	SE-13-36-09-W5
Parent material:	Eolian veneer/glaciofluvial (morainal)
Elevation:	1260 m
Drainage:	Well drained
Slope and aspect:	1%, southeast
Classification:	Brunisolic Gray Luvisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LF	4–0	10YR 2/2 (m) 10YR 3/2 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ae_1	0–5	10YR 5/2 (m) 10YR 4/3 (d)	SiL	32	54	14
Bm	5–15	10YR 4/6 (m) 10YR 6/4 (d)	SiL	32	52	16
Ae_2	15–26	10YR 5/4 (m) 10YR 7/3 (d)	SiL	26	58	16
$IIBt_1$	26–36	10YR 5/6 (m) 10YR 5/4 (d)	CL	36	28	36
$IIBt_2$	36–73	10YR 4/4 (m) 10YR 5/3 (d)	CL	46	18	36
IICk	73^+	10YR 4/3 (m) 10YR 5/4 (d)	CL	44	24	32

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

Appendix 7. Site C location and soil descriptions (sites established in 1991 and 1992)

Young lodgepole pine site description

Location:	NE-32-36-09-W5
Parent material:	Eolian veneer/morainal till
Elevation:	1350 m
Drainage:	Well drained
Slope and aspect:	Level
Classification:	Brunisolic Gray Luvisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LF	5–0	10YR 4/3 (m) 10YR 4/3 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ae_1	0–5	10YR 6/2 (m) 10YR 5/2 (d)	L	38	46	16
Bm	5–10	10YR 5/8 (m) 10YR 5/6 (d)	L	42	40	18
AB	10–24	10YR 6/6 (m) 10YR 6/4 (d)	L	36	36	28
$IIBt_1$	24–54	10YR 5/6 (m) 10YR 5/4 (d)	C	28	30	42
$IIBt_2$	54–63	10YR 5/4 (m) 10YR 5/4 (d)	C	28	30	42
$IIBt_3$	63–80	10YR 5/4 (m) 10YR 6/4 (d)	C	28	32	40
BC	80–95+	10YR 5/6 (m) 10YR 5/6 (d)	CL	40	24	36

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

Appendix 7. Site D location and soil descriptions (sites established in 1991 and 1992)

Young lodgepole pine site description

Location:	NE-29-36-10-W5
Parent material:	Morainal till
Elevation:	1458 m
Drainage:	Well drained
Slope and aspect:	2%, east
Classification:	Brunisolic Gray Luvisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LF	4–0	10YR 3/4 (m) 10YR 4/3 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ahe	0–10	10YR 4/4 (m) 10YR 4/3 (d)	SiL	31	50	19
Bm	10–26	10YR 4/6 (m) 10YR 6/4 (d)	L	36	44	20
AB	26–52	10YR 5/4 (m) 10YR 6/3 (d)	CL	36	30	34
Bt	52–74	10YR 5/3 (m) 10YR 6/3 (d)	CL	32	28	40
Ck	74–88+	10YR 4/3 (m) 10YR 5/4 (d)	CL	32	28	40

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

Appendix 7. Site E location and soil descriptions (sites established in 1991 and 1992)

Young lodgepole pine site description

Location:	NW-21-37-10-W5
Parent material:	Glaciolacustrine
Elevation:	1365 m
Drainage:	Moderately well drained
Slope and aspect:	6%, east
Classification:	Orthic Gray Luvisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LF	6–0	10YR 3/4 (m) 10YR 4/3 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ahe	0–15	10YR 4/4 (m) 10YR 6/3 (d)	L	32	46	22
AB	15–20	10YR 5/4 (m) 10YR 6/4 (d)	CL	34	32	34
Bt_1	20–58	10YR 5/3 (m) 10YR 6/3 (d)	C	20	20	60
Bt_2	58–70	10YR 6/3 (m) 10YR 6/4 (d)	C	32	26	42
BC	70–90	10YR 5/3 (m) 10YR 6/4 (d)	CL	42	30	28
Ck	90–105+	10YR 5/3 (m) 10YR 6/3 (d)	L	38	36	26

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.

Appendix 7. Site F location and soil descriptions (sites established in 1991 and 1992)

Young lodgepole pine site description

Location:	34-10-W5 (section not available)
Parent material:	Eolian veneer/glaciofluvial
Elevation:	Not available
Drainage:	Rapidly drained
Slope and aspect:	1%, southeast
Classification:	Brunisolic Gray Luvisol

Soil description

Horizon	Depth (cm)	Color[a]	Texture[b]	Particle size (%)		
				Sand	Silt	Clay
LF	4–0	10YR 2/2 (m) 10YR 3/4 (d)	N.A.[c]	N.A.	N.A.	N.A.
Ae_1	0–4	10YR 5/3 (m) 10YR 6/3 (d)	L	44	40	16
Bm	4–9	10YR 4/6 (m) 10YR 5/8 (d)	L	36	38	26
Ae_2	9–20	10YR 5/4 (m) 10YR 7/3 (d)	SL	54	30	16
$IIBt_1$	20–55	10YR 5/4 (m) 10YR 6/4 (d)	SCL	52	16	32
$IIBt_2$	55–65	10YR 4/3 (m) 10YR 7/3 (d)	CL	38	26	36
IIBC	65–85	10YR 4/3 (m) 10YR 5/3 (d)	SCL	56	18	26
IIC	85–105+	10YR 3/3 (m) 10YR 5/3 (d)	SCL	46	26	28

[a] m = moist; d = dry.

[b] L = loam; CL = clay loam; S = sand; SC = sandy clay; SL = sandy loam; SiL = silt loam; SCL = sandy clay loam; SiCL = silty clay loam; LS = loamy sand; C = clay.

[c] N.A. = not applicable.