Appendix A.
Procedure for the Classification and Mapping of Ecosystem Types and Cover Types

In the following appendix, we present a brief description of the procedures of sampling and mapping used in the course of nine months of field work and hundreds of hours of office time. Sampling was designed principally for the ecosystem classification and mapping effort but was equally valuable in developing the cover type classification and map. Procedures used in mapping both ecosystems and cover types are presented.

Sampling

Reconnaissance Sampling

Reconnaissance sampling was used to allow the field team to examine a large area each day, and thus to gain a familiarity with the spatial variation in physiography, soil, and vegetation over the entire Reserve Area in a relatively short time. Representative plots were sampled within areas of relatively homogeneous physiography and vegetation.

The soil profile was described to a depth of 70-100 cm (27-39 in). Slope percent, aspect, and slope position for the sample were recorded. The overstory was sampled using a 10 basal area factor (BAF) prism. The woody understory was listed by species in order of abundance, and the ground cover was recorded by species and seven abundance classes. Forty-eight reconnaissance plots were sampled during the 1987 summer field season.

Transect Sampling

Nine transects were sampled to study the correlations of physiography, soil, and vegetation along mountain slopes. The transects ranged from 900 to 1300 m (2970 - 4290 ft) long. Plots were taken every 100 m (330 ft) along the line. The data recorded were similar to that recorded for reconnaissance plots. However the soil was described only to a depth of 25-45 cm (10-18 in), sufficient to examine the E or A surface horizon and the upper B horizon.

Two transects were also run in bedrock ravines. The narrow width and extremely steep side slopes of the ravines made conventional fixed plot sampling difficult, and transects were an ideal way of summarizing vegetative composition and the shape and slope of the ravine along its length.

Ecosystem Plot Sampling

Ecosystem plot sampling was the main source of data for the ecosystem classification. The procedure described here, similar to that of Spies and Barnes (1985a), was that used for sampling in upland areas, whereas smaller plots, 10 X 20 m (33 X 66 ft), were used in wetlands. In all, 93 upland and 32 wetland ecosystem plot samples were taken.

Ecosystem plots were located randomly within representative areas of ecosystems as they were defined at the time of sampling. This was done by first

locating the approximate center of the area and walking a random azimuth and distance to locate the plot. The upland ecosystem plots were 15 X 30 m (50 X 100 ft) in size, subdivided into nine 5 X 10 m (16.7 X 33 ft) subplots using wooden stakes and string.

The central 5 X 30 m (16.7 X 100 ft) row of subplots was used for assessing the species composition and coverage of the ground vegetation. A soil pit was located in a subplot randomly selected from the remaining six outside subplots. The pit was located in an area between pits and mounds. The soil profile was described to a depth of 150 cm (58 in) by standard Soil Conservation Service techniques. Samples of all mineral soil horizons were collected for lab analysis.

The following physiographic and topographic information was recorded at each plot.

Landform - identified by the geomorphic or geologic structure on which the plot was located.

Parent Material - kind of material from which the soil developed.

Topographic Position - the position of the plot in reference to the larger landscape feature on which it is located (footslope, midslope, upper slope, etc.).

Elevation - distance in meters above sea level as determined from the topographic map.

Aspect - The direction the slope faces, the downslope azimuth.

Slope Percent - percent slope measured from the horizontal.

Distance to Surface Water - distance to the nearest stream, swamp, or lake as measured from the topographic map or paced in the field.

Class of Surface Water - stream, lake, river, swamp, etc.

Microtopography - the topographic form of the land surface on a small scale. Pit and mound microtopography is common.

Cross-sectional diagrams were also drawn of the plot locality. Normally two profiles were drawn, one parallel and one perpendicular to the land contour.

Vegetation

Coverage of the ground-cover vegetation (herbs, shrubs, and tree seedlings) was recorded in the center 5 X 30 m (16.7 x 100 ft) row of subplots, using 12 coverage classes. The coverage classes, and the percent areal coverage they correspond to are 1 (trace to < 0.025), 2(0.025-0.05), 3(0.05-0.1), 4(0.1-0.5), 5(0.5-1.0),

6(1.0-2.0), 7(2.0-4.0), 8(4.0-8.0), 9(8.0-16.0), 10(16.0-32.0), 11(32.0-64.0), 12 (64.0-100.0)

A wooden rectangular frame, whose area corresponded to 0.1% of the area of the 5 X 30 m (16.7 X 100 ft) strip of subplots, was used as an aid in estimating coverage. Understory trees, those less than 9 cm (3.5 in) diameter at breast height (dbh) and greater than 1.5 cm (0.6 in) dbh, were tallied throughout the entire 15 X 30 m (50 x 100 ft) strip by species and in one of three diameter classes: 1.4-3.8 cm, 3.9-6.4 cm, and 6.5-9.0 cm.

The overstory was tallied by species and subplot. The dbh was recorded for each stem. Where space permitted, two additional overstory samples were taken for each plot using a 10 BAF prism. The prism points were located 40 m (132 ft) on a random azimuth from opposite plot corners (#1 and #9 subplot corners).

Vegetation structure was described by estimating the coverage in percent in each of six vertical layers:

Moss-creeper: mosses, lichens, and trailing plants, typically < 10 cm

Herbaceous: herbs, shrubs, and tree seedlings, < 50 cm

Shrub-sapling: shrubs and small trees, 0.5-3.0 m

Small tree: large shrubs to trees greater than 3.0 m but below the main canopy

Subdominant: trees entering the main canopy but with a major portion of their crown below it

Dominant: trees with the major portion of their crown within the main canopy

Canopy: in addition, the combined coverage of subdominant and dominant layers was estimated.

Additional Plot Sampling

Due to the often subtle nature of variation in the composition of old-growth hemlock-northern hardwood forest, we undertook an additional, intensive sampling effort in these areas. Circular plots of 450 m^2 (4844 ft^2) were used (equal in size to the rectangular ecosystem plots). Vegetation and physiography were recorded in a manner similar to that described for ecosystem plot sampling. Surface soil samples were taken from three systematic locations within the plot. In all, 313 plots were sampled.

Mapping

Ecosystem Mapping

The preparation of maps is the heart of the ecosystem approach. Actually, it is the process of mapping, and the knowledge beforehand that the ecosystems must be mappable and explainable, that directs and shapes the entire process. The

systematic detail required by mapping provides a rigorous test of the classification and serves to refine and improve it. Two types of ecosystem mapping were used, ground mapping and mapping by aerial photographs and field checking. The 3193.5 ha (7891.3 ac) mapped area is shown in Figure 2 in the Introduction section.

Ground mapping involved walking a systematic 100 m (330 ft) grid of parallel lines and recording changes in ecosystem type along the lines. Ground mapping is time consuming but necessary in areas of subtle physiographic and soil changes that do not create sharp vegetational contrasts. In other areas, mapping was done by the use of black and white infrared photographs (nominal scale 1:15,840, actual scale 1:17,443--the average scale of 49 aerial photographs). Ecosystem boundaries were drawn on acetate overlays using combinations of topography and vegetation that were identifiable on the photographs. An understanding of the physiography, soil, and vegetation of the area acquired during the field sampling was essential to interpret the photographs properly. After drawing tentative ecosystem boundaries on the overlay, the boundaries and the identities of the map units were checked in the field.

Cover-Type Mapping

Black and white infrared photographs and acetate overlays were used in mapping cover types similarly to the mapping of ecosystem types. Initial mapping was done in the office, and the lines later revised after extensive field checking. Ecosystem and cover-type mapping were done simultaneously to minimize transportation time and to take advantage of the similarities of the two maps to minimize overall time spent mapping.

After 1:17,443 acetate drafts of the ecosystem and cover-type maps had been completed, they were overlain on a composite copy of the four U.S.G.S topographic maps blown up to the same 1:17,443 scale (original scale 1:24,000). In this way, the effects of relief distortion and tilt, encountered when using aerial photography, could be corrected for and the mapped positions of vegetative and ecological features brought into agreement with the more accurate spatial framework of the topographic maps.

Appendix B. Occurrence of overstory tree species and their relative density (RD), relative dominance (RDOM), and basal area per hectare (BA/ha) for selected upland ecosystem types.[1]

	Ecosystem Type		Jack Pine	Red Pine	White Pine	Red Oak	White Birch	Hemlock	Sugar Maple	Red Maple	Yellow Birch	Bass-wood	Hop-horn-beam	Striped Maple	Balsam Fir	Northern White-Cedar	White Spruce
B[2]	2	RD	76.2	20.9	2.9												
		sd*	15.62	14.98	4.40												
		RDOM	78.1	20.0	1.9												
		sd	24.17	22.94	4.17												
	$n_1=4$[3]	BA/ha	22.4	5.8	0.7												
	$n_2=8$	sd	9.11	6.31	1.60												
	3	RD	9.1	47.9	20.4	13.6				3.4							
		sd	12.86	41.98	0.03	19.28				4.82							
		RDOM	9.4	49.3	17.2	17.2				1.8							
		sd	9.83	30.82	11.27	20.50				3.94							
	$n_1=3$	BA/ha	3.7	19.7	6.3	5.9				0.5							
	$n_2=4$	sd	4.11	13.28	2.58	6.92				1.06							
	4	RD		0.0	1.4	3.5	0.0	48.8	4.5	24.3	4.3			8.2	1.7	1.7	
		sd		0.0	2.51	6.08	0.0	26.16	0.72	21.88	3.93			7.14	3.04	3.04	
		RDOM		0.8	9.5	3.0	6.0	45.2	3.6	12.6	6.5			1.5	3.3	3.4	
		sd		2.45	16.16	6.58	9.55	25.54	4.37	9.77	10.10			2.18	5.38	5.92	
	$n_1=3$	BA/ha		0.3	4.3	1.0	2.9	25.0	1.8	5.5	3.0			0.7	1.3	1.5	
	$n_2=6$	sd		0.83	7.17	2.10	5.40	16.92	2.55	3.86	4.79			1.07	1.50	2.37	
	5	RD		0.6	0.0	0.0	1.9	77.8	0.7	16.3	2.0				0.6		
		sd		1.33	0.0	0.0	1.25	1.55	1.41	3.28	4.24				1.33		
		RDOM		6.1	5.6	3.9	6.3	58.3	0.7	11.9	1.5				1.2		
		sd		9.53	10.57	6.84	8.52	26.10	1.60	10.74	3.81				2.60		
	$n_1=3$	BA/ha		3.1	2.7	2.3	3.4	29.9	0.5	6.0	1.0				0.6		
	$n_2=4$	sd		5.61	5.73	4.18	4.92	12.97	1.18	3.72	2.51				1.18		
RT	28	RD	10.0	5.0	37.8	22.2											
		sd	20.00	10.00	43.43	32.44											
		RDOM	8.9	3.4	57.9	9.9											
		sd	22.24	8.37	43.30	18.34											
	$n_1=4$	BA/ha	0.2	0.1	4.9	1.0											
	$n_2=1$	sd	0.40	0.15	4.92	2.36											
	29	RD		17.1	18.5	33.5	0.5	8.5	6.5	7.0	0.5	0.5	1.0	0.5	0.6	4.4	
		sd		19.39	17.47	33.95	1.15	11.82	11.47	6.92	1.15	1.00	2.38	1.09	1.32	9.82	
		RDOM		25.4	27.6	28.6	0.2	3.4	1.4	3.7	0.5	0.1	0.1	0.0	0.1	0.9	
		sd		30.90	38.91	25.83	0.51	6.72	4.04	4.58	1.67	0.20	0.43	0.15	0.39	2.96	
	$n_1=5$	BA/ha		8.4	8.3	8.1	0.0	1.4	0.8	1.4	0.1	0.0	0.1	0.0	0.0	0.6	
	$n_2=5$	sd		14.71	7.63	6.33	0.14	2.76	2.46	1.82	0.46	0.12	0.26	0.09	0.10	1.78	

Appendix B. (continued).

	Ecosystem Type		Jack Pine	Red Pine	White Pine	Red Oak	White Birch	Hemlock	Sugar Maple	Red Maple	Yellow Birch	Basswood	Hop-hornbeam	Striped Maple	Balsam Fir	Northern White-Cedar	White Spruce
RT	30	RD			20.1	0.0	0.7	52.5	9.7	14.9		0.0	0.7			0.0	
		sd			15.81	0.0	1.20	10.37	9.39	5.59		0.0	1.20			0.0	
		RDOM			37.5	1.4	1.1	38.0	5.4	6.4		1.4	0.1			5.6	
		sd			33.33	2.80	2.50	11.94	4.90	7.30		2.80	0.20			11.10	
	n_1=3	BA/ha			18.3	0.6	0.6	18.7	2.7	3.4		0.6	0.0			2.4	
	n_2=3	sd			15.75	1.20	1.43	8.37	2.86	4.40		1.20	0.11			4.80	
	31	RD						28.8	46.1	1.7	2.7	6.9	4.7	7.5		1.1	0.7
		sd						88.41	9.74	4.15	4.33	2.78	5.79	18.75		2.65	1.70
		RDOM						43.6	37.1	2.5	1.7	7.8	3.4	2.3		1.1	0.3
		sd						24.40	21.33	6.25	2.59	3.48	6.12	5.85		2.80	0.85
	n_1=5	BA/ha						13.6	10.5	1.0	0.7	2.1	0.7	0.7		0.4	0.1
	n_2=9	sd						9.80	7.87	2.47	1.05	1.32	1.00	1.83		1.06	0.14
MSF	7	RD					0.2	43.6	32.7	2.2	7.7	2.5	4.2	4.8	2.1		
		sd					1.11	30.93	24.80	3.84	7.36	4.66	8.08	12.18	3.87		
		RDOM					0.6	34.5	44.6	3.0	10.4	5.1	0.6	0.5	0.5		
		sd					2.67	31.52	32.67	5.30	11.00	10.67	1.87	1.54	1.43		
	n_1=23	BA/ha					0.4	18.5	18.6	1.5	4.9	2.7	0.2	0.2	0.2		
	n_2=12	sd					1.49	19.72	12.85	2.46	5.70	5.76	0.53	0.55	0.49		
	8	RD			0.2	0.2		45.7	29.8	1.6	8.2	3.0	6.6	2.6	1.6	0.1	0.1
		sd			1.14	0.99		23.04	18.93	4.08	7.79	4.55	7.72	5.85	3.66	0.66	0.48
		RDOM			0.3	0.4		34.8	41.9	2.8	10.9	6.6	1.3	0.2	0.7	0.1	0.0
		sd			1.63	2.96		22.45	24.94	5.68	12.11	10.34	2.25	0.76	2.31	0.45	0.04
	n_1=43	BA/ha			0.2	0.1		17.5	18.1	1.4	5.4	3.0	0.6	0.1	0.3	0.0	0.0
	n_2=20	sd			1.00	1.03		12.73	10.71	3.21	6.24	5.03	0.99	0.31	0.97	0.27	0.02
	9	RD						46.4	35.9		8.8	0.0	8.8				
		sd						1.54	13.58		6.15	0.0	6.15				
		RDOM						25.6	56.5		10.6	6.7	0.6				
		sd						13.85	10.13		4.01	13.35	0.95				
	n_1=2	BA/ha						12.8	28.8		5.3	12.30	0.4				
	n_2=2	sd						6.78	11.17		2.45	4.59	0.54				
	11	RD			0.7	0.3		51.9	17.8	7.4	10.3	0.6	1.3	2.0	4.6	1.1	1.9
		sd			2.23	1.20		19.61	14.96	7.63	8.68	2.67	2.36	5.57	6.44	2.58	3.56
		RDOM			2.2	0.3		57.4	14.9	9.2	11.6	1.2	0.3	0.3	0.9	1.6	0.7
		sd			7.39	1.52		21.16	16.65	11.95	8.92	5.66	0.65	1.04	1.73	2.87	1.73
	n_1=17	BA/ha			1.4	0.2		36.5	8.3	4.8	6.7	0.5	0.1	0.1	0.4	1.1	0.4
	n_2=2	sd			4.80	1.10		17.56	10.27	4.70	5.65	2.52	0.34	0.23	0.83	1.78	0.98

Appendix B. (continued).

	Ecosystem Type		Jack Pine	Red Pine	White Pine	Red Oak	White Birch	Hemlock	Sugar Maple	Red Maple	Yellow Birch	Bass-wood	Hop-hoen-beam	Striped Maple	Balsam Fir	Northern White-Cedar	White Spruce
MSF	12	RD				0.0		52.4	16.0	6.8	7.7	0.9	0	8.1	3.9	3.4	0.9
		sd				0.0		15.72	12.16	13.51	4.65	1.80	0	2.62	2.85	3.20	1.80
		RDOM				0.7		42.1	17.3	15.4	9.5	3.6	0.9	6.4	0.4	2.6	1.0
		sd				2.05		18.09	8.09	21.81	14.20	6.51	2.55	8.65	0.21	5.87	2.55
	$n_1=4$	BA/ha				0.3		21.7	8.1	8.3	3.7	1.8	0.3	3.6	0.2	0.9	0.6
	$n_2=3$	sd				0.58		13.14	3.76	12.97	4.45	3.53	0.98	4.57	0.04	1.68	1.58
	20	RD		0.2			0.5	60.7	19.0	2.9	11.8	0.5	0.5		3.41		0.4
		sd		0.70			2.56	23.28	16.97	4.06	6.57	1.58	1.64		8.09		1.31
		RDOM		0.8			0.5	48.5	28.2	3.9	16.2	1.2	0.0		0.62		0.2
		sd		3.26			1.63	23.06	19.78	7.09	10.74	2.78	0.12		1.61		1.19
	$n_1=25$	BA/ha		0.5			0.1	29.2	15.3	2.0	9.2	0.7	0.0		0.29		0.2
	$n_2=7$	sd		2.38			0.64	17.82	9.93	3.38	5.77	1.52	0.04		0.76		0.85
	21	RD		0.0	0.0	0.2	0.9	58.8	29.3	1.3	5.7	3.1	5.8	0.3	0.5	0.6	0.0
		sd		0.27	0.46	1.00	0.32	26.85	24.08	3.26	6.16	5.64	7.97	1.10	1.91	1.83	0.1
		RDOM		0.3	0.1	0.4	0.1	45.0	36.6	1.7	8.2	5.5	1.4	0.0	0.1	0.5	0.5
		sd		3.06	0.92	2.01	0.52	27.00	25.98	4.38	9.72	7.90	2.46	0.15	0.50	1.83	0.06
	$n_1=86$	BA/ha		0.2	0.1	0.2	0.0	25.1	17.0	1.1	3.9	2.6	0.6	0.0	0.0	0.5	0.0
	$n_2=6$	sd		2.20	0.53	0.98	0.38	17.00	11.05	2.80	4.30	11.50	0.91	0.07	0.17	1.20	0.03
	22	RD		0.1	0.0	0.5	0.2	57.1	19.7	2.1	6.5	4.2	6.8	1.8	0.7	0.0	
		sd		0.49	0.39	1.91	1.30	20.61	15.34	4.21	5.18	6.00	7.39	5.89	2.09	0.41	
		RDOM		0.2	0.1	0.6	0.4	46.4	31.1	2.2	8.5	6.8	1.8	0.4	0.2	0.0	
		sd		1.70	0.81	3.10	2.73	22.60	20.01	4.33	8.40	8.88	3.44	2.38	0.65	0.18	
	$n_1=67$	BA/ha		0.2	0.1	0.4	0.1	26.0	15.0	1.2	4.4	3.6	0.7	0.1	0.1	0.0	
	$n_2=6$	sd		1.30	0.52	1.54	0.95	16.28	8.53	2.26	4.14	4.69	1.01	0.47	0.30	0.13	
	23	RD				1.9		50.5	29.8	1.8	6.1	3.1	5.0	0.4	0.9	0.1	0.1
		sd				3.57		19.68	20.40	3.90	5.79	4.84	8.58	1.14	1.54	0.50	0.50
		RDOM				3.5		38.6	42.2	2.6	8.2	2.6	0.9	0.0	0.1	0.1	0.0
		sd				7.00		26.31	30.26	4.83	9.20	5.92	1.57	0.09	0.20	0.39	0.18
	$n_1=17$	BA/ha				1.9		21.5	18.3	1.1	4.1	1.4	0.4	0.0	0.1	0.0	0.0
	$n_2=8$	sd				4.02		17.25	10.04	2.13	4.47	3.08	0.71	0.05	0.32	0.18	0.11
	24	RD					0.0	54.4	33.1		3.6	4.5	3.8	0.7			
		sd					0.0	42.28	26.71		7.89	6.34	6.81	2.17			
		RDOM					0.9	49.2	38.3		2.8	8.4	0.3	0.0			
		sd					3.29	36.36	34.09		8.73	12.26	0.52	0.14			
	$n_1=9$	BA/ha					0.5	30.1	17.9		1.2	3.8	0.3	0.0			
	$n_2=6$	sd					1.92	25.46	14.18		3.76	4.62	0.17	0.07			

Appendix B (continued).

	Ecosystem Type		Jack Pine	Red Pine	White Pine	Red Oak	White Birch	Hemlock	Sugar Maple	Red Maple	Yellow Birch	Basswood	Hop-hornbeam	Striped Maple	Balsam Fir	Northern White-Cedar	White Spruce
MSF	25	RD				0.2		31.6	45.8	0.2	8.1	4.6	5.3	4.1			
		sd				0.73		25.76	24.68	0.73	4.82	5.33	7.66	11.08			
		RDOM				0.4		25.2	57.2	0.0	9.7	6.8	0.6	0.3			
		sd				0.41		19.82	25.84	0.13	9.28	6.57	0.77	0.79			
	n_1=10	BA/ha				0.2		13.4	25.7	0.0	4.5	3.6	0.3	0.1			
	n_2=2	sd				0.72		11.45	10.79	0.06	3.83	3.32	0.40	0.28			
	26	RD		3.3	3.3	3.2	3.2	60.4	1.8	19.7				2.0	1.1	0.5	1.1
		sd		3.78	2.32	5.44	2.31	14.44	2.11	8.05				3.05	2.63	1.32	2.63
		RDOM		6.1	5.7	6.6	2.7	58.1	1.1	14.3				1.4	0.9	0.3	1.2
		sd		7.66	4.87	9.86	3.98	14.79	1.91	4.01				2.63	1.95	0.86	2.27
	n_1=6	BA/ha		2.6	2.6	2.8	1.1	27.6	0.6	7.1				0.6	0.4	0.1	0.4
	n_2=2	sd		3.27	2.11	3.89	1.56	9.21	0.91	2.90				1.04	0.77	0.43	0.84
	27	RD			0.2	0.3		69.6	12.0	6.0	7.1	0.9	3.3	0.3			
		sd			0.77	1.02		9.69	7.26	8.68	5.60	1.43	4.26	1.02			
		RDOM			0.1	0.4		66.8	14.3	8.5	5.6	2.3	1.0	0.0			
		sd			0.56	1.29		14.98	15.06	8.53	5.16	3.80	1.56	0.09			
	n_1=9	BA/ha			0.1	0.2		37.5	7.3	4.9	3.1	1.3	0.5	0.0			
	n_2=4	sd			0.27	0.66		11.66	6.14	4.70	3.38	2.09	0.77	0.04			
M	35	RD			0.3		0.0	36.8	45.8	0	4.7	6.1	2.7	2.0	0.5	0.4	0.4
		sd			3.26		0.00	31.08	35.55	0	8.49	8.95	3.93	5.58	1.88	1.50	1.39
		RDOM			2.2		0.1	29.0	50.8	0.4	5.7	9.5	0.4	0.3	0.2	0.8	0.2
		sd			8.65		0.65	26.14	33.54	1.35	8.39	13.61	0.78	1.18	0.81	2.84	0.76
	n_1=23	BA/ha			1.5		0.1	15.6	20.7	0.2	3.3	4.9	0.2	0.1	0.1	0.5	0.1
	n_2=8	sd			5.82		0.42	15.39	12.98	0.88	4.82	7.70	0.29	0.32	0.46	1.85	0.50
	36	RD			0.6			69.0	9.1	1.2	8.4	1.3		9.5	0.4		
		sd			1.84			22.07	10.07	2.22	10.67	2.85		15.73	1.30		
		RDOM			1.1			50.2	4.4	1.1	8.8	2.1		1.4	0.1		
		sd			3.71			11.13	6.00	1.96	9.28	4.63		2.36	0.21		
	n_1=11	BA/ha			0.4			38.8	2.1	0.5	3.8	0.9		0.6	0.0		
	n_2=5	sd			1.40			12.95	3.58	1.06	4.93	2.03		1.05	0.08		

[1]Relative density was calculated using only plot samples; relative dominance and basal area per hectare were calculated using both plot and prism samples.

[2]Row Ecosystem Groupings: B--Nipissing age beach landforms, RT--Exposed crystalline bedrock terrain, MSF--Mountain slopes and flats, M--Miscellaneous.

[3]n_1 = number of plot samples per ecosystem type.

n_2 = number of prism point samples per ecosystem type.

* = standard deviation.

Appendix C. Occurrence of upland ecological species groups on selected upland ecosystem types.[1]

		ECOSYSTEM TYPES[2]																							
		B				RT				MSF														M	
Ecological		2	3	4	5	28	29	30	31	7	8	9	11	12	20	21	22	23	24	25	26	27	35	36
Species Group	N_a[3]	4	2	3	3	4	4	4	5	24	39	5	18	4	25	90	67	17	9	10	6	9	24	11
	N_b[4]																							
Cladonia	7	2.8	0.5			4.5	2.5	0.5			<.1				<.1	<.1					0.5			
Gaylussacia	3	2.0	1.5	0.3			0.5						0.1				<.1				0.3			
Woodsia	21	0.3				6.5	2.5	0.3	0.4		<.1	0.2	0.1			<.1	<.1							
Comandra	11					2.0	2.8	0.3	0.8		<.1						<.1				0.2		<.1	
Vaccinium	3	1.9	2.5	0.7	0.7	1.0	2.0	0.5		0.1			0.2		<.1	<.1	<.1		0.2		1.0	0.1		
Pteridium	1	1.0	1.0	0.3	0.7		0.3			0.2	0.1	0.2	0.7		0.4	0.1	0.1	0.2			0.8	0.1		0.1
Maianthemum	7	1.3	2.5	5.0	2.7	1.8	3.8	5.3	5.0	5.4	5.1	4.2	6.4	6.0	5.8	5.5	5.6	6.1	5.4	6.0	2.7	6.1	5.4	5.7
Polygonatum	4			0.7	0.7	1.0	0.3	1.0	2.4	2.0	2.4	1.4	2.8	1.5	2.8	2.8	3.2	2.9	1.8	2.7	0.7	2.8	2.3	3.0
Polypodium	2					0.5	0.5	0.8	0.2		<.1		0.5		<.1	<.1	<.1	0.1	0.3	0.4				0.4
Goodyera	6			1.7	1.3			0.5	0.2	0.5	0.7	0.2	1.1	1.0	0.4	0.8	1.2	0.8	0.1	0.1	1.0	0.9	0.4	1.0
Gymnocarpium	5			1.0				0.5	1.8	1.0	1.1	1.0	1.2	2.3	0.9	1.0	1.0	1.5	1.2	2.1		0.3	2.4	1.4
Botrychium	13								2.2	1.0	1.4	2.2	1.5	2.0	0.8	1.5	0.9	2.7	3.1	3.8	0.2	0.4	5.0	2.9
Corylus	3						0.3	0.3	0.8	0.2	0.2	0.4	0.8	0.8	0.6	0.4	0.6	1.2	0.4	1.2		0.1	1.2	1.0
Arisaema	11										0.1		0.1			<.1	<.1			0.3			0.4	0.1
Coptis	6			1.0			0.3	0.3	0.2	0.4			1.8	2.5	0.5	0.2	0.3	0.4		0.2		0.1	0.4	0.6
Impatiens	6												0.3	0.5						0.2			0.3	

[1]Numbers in body of table are the average number of species of each species group per 450 m^2 plot.

[2]Ecosystems are grouped by: B--Nipissing age beach landforms, RT--Exposed crystalline bedrock terrain, MSF--Mountain slopes and flats, M--Miscellaneous.

[3]N_a = number of plot samples per ecosystem type.

[4]N_b = total number of species for each species group.

Appendix D. Occurrence of wetland and selected upland ecological species groups on wetland ecosystem types.[1]

		ECOSYSTEM TYPES									
		Nonforested				Forested					Streamside
		41	42	43	44	45	46	47	48	49	50
	N_a[2]	5	2	2	6	2	1	2	1	2	3
	N_b[3]										
Wetland Groups:											
Ledum	3					2.5	1.0				
Drosera	2	0.6				0.5					
Chamaedapline	5	1.4	0.5	0.5	0.2	1.5	1.0	1.0		0.3	
Ilex	2	0.4			0.5		2.0	0.5	1.0		0.5
Carex	4	0.4	1.5	0.5	2.0					0.7	0.5
Myrica	2	0.4	0.5	1.5	0.3						0.5
Osmunda	5	0.6	3.0	1.0	1.2		1.0	2.0		1.0	1.5
Onoclea	5	0.4	1.0		1.2			1.5	1.0	1.7	2.5
Upland Groups:											
Coptis	6		1.0				2.0	2.0			
Vaccinium	3	0.2				1.0	1.0				
Botrychium	13	0.2	0.5					1.0		1.3	1.0
Arisaema	11							1.0		0.3	0.5
Impatiens	6		1.0		0.2			1.0		1.7	0.5

[1]Numbers in body of table are the average number of species of each species group per 200 m^2 plot.

[2]N_a = number of plot samples per ecosystem type.

[3]N_b = total number of species for each species group.

Appendix E. Correspondence of the landscape ecosystem types with their constituent cover types.[1]

Ecosystem Type	Cover Types and Their Percentage (%) Occurrence in the Ecosystem Type	Ecosystem Type	Cover Types and Their Percentage (%) Occurrence in the Ecosystem Type
1	no cover type defined	27	11 (62), 12 (16), 10 (16), 17 (6)
2	1 (84), 3 (8), 2 (4), plantations and developed land (3), 5 (< 1)	28	4 (100)
3	5 (80), 3 (20)	29	5 (98), 7 (1), 2 (< 1)
4	11 (73), 6 (27)	30	6 (91), 14 (6), 7 (2), 5 (< 1), 10 (< 1), 3 (< 1), 11 (< 1), 17 (< 1)
5	6 (42), 10 (33), 11 (24)	31	12 (64), 11 (34), 13 (1), 10 (1)
6	3 (100)	32	12 (35), 7 (25), 13 (14), 11 (10), 6 (10), 3 (6)
7	11 (45), 12 (32), 10 (14), plantations and developed land (3), 16 (2), 6 (2), 13 (1), 21 (< 1), 17 (< 1), 9 (< 1)	33	12 (50), 3 (38), 6 (13)
8	11 (44), 12 (34), 6 (9), 13 (5), 22 (4), 10 (3)	34	20 (83), 11 (8), 6 (8)
9	11 (42), 12 (42), 22 (17)	35	12 (38), 11 (30), 13 (19), 22 (9), 17 (1), 10 (1), 6 (1), 18 (1)
10	12 (100)	36	10 (58), 11 (24), 6 (10), 12 (4), 7 (4)
11	11 (34), 10 (32), 12 (28), 17 (4), 6 (3)	37	2 (100)
12	17 (45), 11 (37), 22 (17), 16 (1)	38	7 (54), 10 (19), 6 (12), 11 (6), 3 (4), 2 (2), 16 (2), 8 (< 1), 12 (< 1)
13	3 (75), 7 (25)	39	7 (80), 14 (10), 11 (10)
14	12 (67), 13 (22), 11 (11)	40	14 (100)
15	17 (69), 12 (16), 13 (9), 11 (6)	41	23 (100)
16	13 (75), 12 (25)	42	23 (71), 26 (29)
17	19 (100)	43	24 (100)
18	28 (50), 15 (27), 17 (23)	44	25 (100)
19	2 (73), 4 (18), 7 (9)	45	27 (100)
20	11 (56), 12 (26), 10 (11), 7 (3), 16 (3), 6 (1)	46	28 (100)
21	11 (49), 12 (32), 22 (6), 13 (6), 10 (5), 17 (1), 6 (1), 14 (< 1)	47	28 (100)
22	11 (57), 12 (33), 6 (5), 10 (4), 22 (1), 7 (< 1)	48	28 (86), 29 (14)
23	12 (71), 11 (26), 13 (3)	49	29 (100)
24	11 (65), 10 (16), 13 (14), 12 (4)	50	26 (100)
25	13 (35), 12 (29), 11 (19), 22 (9), 10 (7), 17 (1)		
26	6 (40), 10 (34), 11 (12), 7 (11), 2 (3), 3 (1)		

[1]Cover types are listed in decreasing order of prevalence; the percentage of the ecosystem type occupied by each cover type is given in parentheses.

Appendix F. Correspondence of the cover types with their constituent landscape ecosystem types.[1]

Cover Type	Ecosystem Types and Their Percentage (%) Occurrence in the Cover Type	Cover Type	Ecosystem Types and Their Percentage (%) Occurrence in the Cover Type
1	2 (100)	17	12 (48), 15 (26), 21 (6), 18 (6), 27 (5), 11 (5), 35 (2), 30 (1), 7 (1), 25 (1)
2	2 (44), 19 (19), 26 (14), 38 (12), 37 (5), 29 (5), etc.	18	35 (100)
3	2 (51), 3 (13), 38 (12), 13 (9), 32 (4), 33 (4), 30 (3), 26 (3), 6 (1)	19	17 (100)
4	28 (99), 19 (1)	20	34 (100)
5	29 (95), 3 (4), 2 (<1), 30 (<1)	21	7 (100)
6	30 (76), 26 (8), 22 (4), 8 (4), 38 (3), 5 (2), 4 (1), 7 (1), 32 (1), 36 (1), 21 (<1), 11 (<1), 20 (<1), 33 (<1), 35 (<1), 34 (<1)	22	21 (45), 8 (15), 12 (14), 35 (11), 25 (8), 22 (6), 9 (2)
7	38 (58), 26 (10), 30 (8), 32 (7), 29 (6), 39 (4), 20 (3), 22 (1), 13 (1), 36 (1), 19 (1)	23	41 (72), 42 (28)
8	38 (100)	24	43 (100)
9	7 (100)	25	44 (100)
10	26 (17), 7 (15), 21 (12), 38 (11), 11 (9), 36 (8), 22 (7), 20 (6), 8 (4), 27 (3), 5 (3), 24 (2), 25 (2), 30 (1), 31 (<1), 35 (<1)	26	50 (98), 42 (2)
11	21 (25), 22 (24), 7 (12), 8 (10), 26 (7), 27 (3), 35 (3), 11 (2), 12 (2), 23 (2), 24 (2), 31 (2), 4 (1), 26 (1), 25 (1), 38 (1), 36 (1), 5 (1), 32 (<1), 9 (<1), 15 (<1), 14 (<1), 30 (<1), 34 (<1), 39 (<1)	27	45 (100)
12	21 (22), 22 (19), 7 (12), 8 (11), 23 (8), 31 (5), 35 (4), 20 (4), 10 (4), 11 (3), 25 (3), 32 (2), 27 (1), 14 (1), 15 (<1), 9 (<1), 33 (<1), 16 (<1), 24 (<1), 36 (<1), 38 (<1)	28	47 (80), 48 (9), 18 (8), 46 (2)
13	21 (28), 25 (21), 35 (16), 8 (12), 16 (5), 24 (4), 32 (4), 23 (2), 14 (2), 7 (2), 15 (2), 31 (1)	29	49 (88), 48 (12)
14	30 (93), 21 (4), 39 (2)	plantations and developed land	2 (50), 7 (50)
15	18 (100)		
16	7 (44), 20 (28), 38 (22), 12 (6)		

[1]Ecosystems types are listed in decreasing order of prevalence; the percentage of the cover type occupied by each ecosystem type is given in parentheses.

Appendix G. List of Scientific and Common Names.[1]

Herbaceous Plants, Lichens, Shrubs, and Woody Vines

Actaea pachypoda Ell.	white baneberry
Adenocaulon bicolor Hooker	trail-plant
Agropyron trachycaulum (Link) Malte	wheatgrass
Agrostis gigantea Roth	redtop
A. hyemalis (Walter) BSP.	ticklegrass
Allium tricoccum Aiton	wild leek
Alnus rugosa (Duroi) Sprengel	speckled alder
Amelanchier interior Nielsen	serviceberry
Ammophila breviligulata Fern.	beach grass
Andromeda glaucophylla Link.	bog-rosemary
Anemone canadensis L.	Canada anemone
Antennaria neglecta Greene	field pussytoes
A. plantaginifolia (L.) Richards	plantain-leaved pussytoes
Aquilegia canadensis L.	wild columbine
Aralia hispida Vent.	bristly sarsaparilla
A. nudicaulis L.	wild sarsaparilla
A. racemosa L.	spikenard
Arctostaphylos uva-ursi (L.) Sprengel	bearberry
Arisaema triphyllum (L.) Schott	jack-in-the-pulpit
Asplenium trichomanes L.	maidenhair spleenwort
Aster macrophyllus L.	large-leaved aster
Athyrium filix-femina subsp. *angustum* (Willd.) Clausen	lady fern
Botrychium virginianum (L.) Swartz	rattlesnake fern
Brachyelytrum erectum (Roth) Beauv.	grass
Bromus inermis Leysser	smooth brome
Cakile edentula (Bigelow) Hooker	sea-rocket
Caltha palustris L.	marsh-marigold
Campanula rotundifolia L.	harebell
Cardamine parviflora L.	bitter cress
C. pensylvanica Willd.	bitter cress
Carex arctata Boott	sedge
C. crinita Lam.	sedge
C. hystericina Willd.	sedge
C. lasiocarpa Ehrh.	sedge
C. oligosperma Michaux	sedge
C. pensylvanica Lam.	sedge
C. rostrata Stokes	sedge
C. stipata Willd.	sedge
C. trisperma Dewey	sedge
C. vesicaria L.	sedge
Caulophyllum thalictroides (L.) Michaux	blue cohosh

[1]Species nomenclature is based on the following sources: lichens (Hale 1969), ferns (Lellinger 1985), monocots (Voss 1972), dicots, Saururaceae-Cornaceae (Voss 1985), dicots, Ericaceae-Asteraceae (Gleason and Cronquist 1963).

Celastrus scandens L.	American bittersweet
Chamaedaphne calyculata (L.) Moench.	leatherleaf
Chimaphila umbellata (L.) Bart.	pipsissewa
Chrysosplenium americanum Hooker	golden saxifrage
Circaea alpina L.	enchanter's-nightshade
Circaea lutetiana L.	enchanter's-nightshade
Cirsium arvense (L.) Scop.	Canada thistle
Cladonia rangiferina (L.) Wigg.	reindeer moss
C. arbuscula (Wallr.) Rabenh.	lichen
C. mitis Sandst.	lichen
Claytonia caroliniana Michaux	spring-beauty
Clintonia borealis (Aiton) Raf.	bluebead-lily
Comandra umbellata (L.) Nutt.	bastard-toadflax
Coptis trifolia (L.) Salisb.	goldthread
Corallorhiza maculata Raf.	spotted coralroot
Corallorhiza striata Lindley	striped coralroot
Cornus canadensis L.	bunchberry
C. stolonifera Michaux	red-osier dogwood
Corydalis sempervirens (L.) Pers.	pale corydalis
Corylus cornuta Marsh.	beaked hazelnut
Cypripedium acaule Aiton	pink moccasin flower
Cystopteris fragilis (L.) Bernh.	brittle fern
Dactylis glomerata L.	orchard grass
Danthonia spicata (L.) R. & S.	poverty grass
Dentaria diphylla Michaux	two-leaved toothwort
Deschampsia cespitosa (L.) Beauv.	hair grass
D. flexulosa (L.) Beauv.	hair grass
Dicentra cucullaria (L.) Bernh.	Dutchman's breeches
Diervilla lonicera Miller	bush-honeysuckle
Dirca palustris L.	leatherwood
Drosera rotundifolia L.	round-leaved sundew
Dryopteris carthusiana (Villars) H.P. Fuchs	spinulous shield-fern
D. intermedia (Muhl.) A. Gray	glandular wood-fern
D. marginalis (L.) A. Gray	marginal shield fern
Dulichium arundinaceum (L.) Britton	three-way sedge
Eleocharis spp. R. Br.	spike-rushes
Epigaea repens L.	trailing arbutus
Equisetum fluviatile L.	water horsetail
E. pratense Ehrh.	meadow horsetail
Eupatorium maculatum L.	spotted joe-pye-weed
Festuca occidentalis Hooker	western fescue
Galium trifidum L.	bedstraw
G. triflorum Michaux	fragrant bedstraw
Gaultheria hispidula (L.) Muhl.	creeping snowberry
G. procumbens L.	wintergreen
Gaylussacia baccata (Wang.) K. Koch	black huckleberry
Glyceria canadensis (Michaux) Trin.	rattlesnake grass
G. striata (Lam.) Hitchc.	fowl manna grass
Goodyera repens (L.) R. Br.	dwarf rattlesnake-plantain
G. tesselata Lodd.	checkered rattlesnake-plantain

Gymnocarpium dryopteris (L.) Newm.	oak fern
Hepatica americana (DC.) Ker	round-lobed hepatica
Heracleum maximum Bartram	cow-parsnip
Hieracium spp. L.	hawkweeds
Hystrix patula Moench	bottlebrush grass
Ilex verticillata (L.) A. Gray	winterberry
Impatiens capensis Meerb.	spotted touch-me-not
Iris versicolor L.	larger blue flag
Isoetes spp. L.	quillworts
Juniperus communis var. *depressa* Pursh	ground juniper
Kalmia polifolia Wang.	pale-laurel
Laportea canadensis (L.) Wedd.	wood nettle
Lathyrus japonicus Willd.	beach pea
Lechea intermedia Britton	pinweed
Ledum groenlandicum Oeder.	Labrador-tea
Lemna minor L.	duckweed
Listera convallarioides (Sw.) Torrey	twayblade
Lobelia dortmanna L.	water lobelia
Lonicera canadensis Marsh.	American fly honeysuckle
L. dioica L.	limber honeysuckle
Lycopodium lucidulum Michaux	shining clubmoss
Lycopus americanus Muhl.	cut-leaved water-horehound
L. uniflorus Michaux	bugle-weed
Lysimachia terrestris (L.) BSP.	yellow loosestrife
L. thysiflora L.	yellow loosestrife
Maianthemum canadense Desf.	Canada mayflower
Matteuccia struthiopteris (L.) Todaro	ostrich fern
Melampyrum lineare Desr.	cow-wheat
Melica smithii (Gray) Vasey	melicgrass
Mentha arvensis L.	wild mint
Mitchella repens L.	partridge-berry
Mitella nuda L.	naked miterwort
Moneses uniflora (L.) A. Gray	one-flowered wintergreen
Monotropa hypopithys L.	pinesap
M. uniflora L.	Indian pipe
Myrica gale L.	sweet gale
Myriophyllum spp. L.	water milfoils
Nemopanthus mucronatus (L.) Loes.	mountain-holly
Nymphaea odorata Aiton	fragrant water-lily
Oenothera biennis L.	evening primrose
Onoclea sensibilis L.	sensitive fern
Opuntia fragilis (Nutt.) Haw.	prickly-pear
Oryzopsis asperifolia Michaux	rice-grass
Osmorhiza chilensis Hooker & Arn.	sweet-cicely
O. claytonii (Michaux) C.B. Clarke	sweet-cicely
Osmunda cinnamomea L.	cinnamon fern
O. regalis L.	royal fern
Oxalis acetosella L.	common wood sorrel
Panax trifolius L.	dwarf ginseng
Phleum pratense L.	timothy

Polygala paucifolia Willd.	fringed polygala
Polygonatum pubescens (Willd.) Pursh	hairy Solomon's-seal
Polypodium virginianum L.	common polypody
Polystichum braunii (Spenner) Fee	Braun's holly-fern
Potamogeton spp. L.	pondweeds
Potentilla palustris (L.) Scop.	marsh cinquefoil
P. tridentata Aiton	three-toothed cinquefoil
Prunus virginiana L.	choke cherry
Pteridium aquilinum (L.) Kuhn	bracken
Pyrola elliptica Nutt.	shinleaf
Ranunculus acris L.	common buttercup
Rhus glabra L.	smooth sumac
Ribes cynosbati L.	prickly gooseberry
R. oxyacanthoides L.	northern gooseberry
Rosa acicularis Lindley	wild rose
Rubus parviflorus Nutt.	thimbleberry
R. pubescens Raf.	dwarf raspberry
R. setosus Bigelow	blackberry
R. strigosus Michaux	red raspberry
Salix humilis Marsh.	upland willow
Sambucus pubens Michaux	red-berried elder
Sanguinaria canadensis L.	bloodroot
Sarracenia purpurea L.	pitcher-plant
Satureja vulgaris (L.) Fritsch.	wild basil
Saxifraga virginiensis Michaux	early saxifrage
Scirpus spp. L.	bulrushes
Scutellaria lateriflora L.	skullcap
Selaginella rupestris (L.) Spring	rock spikemoss
Smilacina racemosa (L.) Desf.	false Solomon's-seal
S. trifolia (L.) Desf.	three-leaved false Solomon's seal
Smilax ecirrata (Kunth) S. Watson	carrion-flower
Solanum dulcamara L.	nightshade
Solidago nemoralis Aiton	gray goldenrod
Sparganium spp. L.	bur-reeds
Sphagnum spp. L.	sphagnum (moss)
Spiraea alba Duroi	meadowsweet
Streptopus roseus Michaux	rose twisted-stalk
Symphoricarpos albus (L.) Blake	snowberry
Thalictrum dasycarpum Fisch. & Ave-Lall.	purple meadow-rue
Thelypteris phegopteris (L.) Slosson	narrow beech fern
Thelypteris palustris Schott	marsh fern
Tragopogon pratensis L.	goat's beard
Triadenum fraseri (Spach) Gl.	marsh St. John's-wort
Trientalis borealis Raf.	starflower
Trillium cernuum L.	nodding trillium
Typha spp. L.	cattails
Urtica dioica L.	stinging nettle
Uvularia grandiflora Sm.	large-flowered bellwort
Vaccinium angustifolium Aiton	low sweet blueberry
V. macrocarpon Aiton	large cranberry

V. membranaceum Dougl.	bilberry
V. myrtilloides Michaux	velvetleaf blueberry
V. oxycoccus L.	small cranberry
Viola pubescens Aiton	Canada violet
Woodsia ilvensis (L.) R. Br.	rusty woodsia

Trees

Abies balsamea (L.) Miller	balsam fir
Acer pensylvanicum L.	striped maple
A. rubrum L.	red maple
A. saccharum Marsh.	sugar maple
A. spicatum Lam.	mountain maple
Betula alleghaniensis Britton	yellow birch
B. papyrifera Marsh.	white birch
Fraxinus americana L.	white ash
F. nigra Marsh.	black ash
F. pennsylvanica Marsh.	red ash
Larix laricina (DuRoi) K. Koch	tamarack
Ostrya virginiana (Miller) K. Koch	hop-hornbeam
Picea glauca (Moench) A. Voss	white spruce
P. mariana (Miller) BSP.	black spruce
Pinus banksiana Lamb.	jack pine
P. resinosa Aiton	red pine
P. strobus L.	white pine
Populus balsamifera L.	balsam poplar
P. grandidentata Michaux	bigtooth aspen
P. tremuloides Michaux	trembling aspen
Prunus serotina Ehrh.	black cherry
Quercus rubra L.	red oak
Sorbus decora (Sarg.) Schneider	showy mountain-ash
Thuja occidentalis L.	northern white-cedar
Tilia americana L.	basswood
Tsuga canadensis (L.) Carriere	hemlock
Ulmus americana L.	American elm

Appendix H. Glossary

Acidophilic. Thriving on highly acidic soils.

Aeolian. Picked up, carried, and deposited by wind.

Alluvium. Sediment deposited by moving water. Found in or adjacent to intermittent or perennial stream courses.

Areal Coverage. The area encompassed by the vertical projection of the above-ground parts of a plant or group of plants onto the ground. When expressed as a percentage value, it refers to the proportion of the horizontal surface area of a specified unit of ground that is occupied by the vertical projections of all plants within the population of interest.

Aspect. The direction a slope faces. The down-slope azimuth.

Azimuth. The horizontal direction, measured in degrees clockwise from true north.

Basal Area. The cross-sectional area of the stem of a tree at breast height. Also Basal Area per Hectare (BA/ha): the sum of the cross-sectional areas of all members of a species expressed on a per-hectare basis.

Biomass. The total mass of living organisms per unit area or volume.

Canopy. The uppermost vegetative layer of a forest, formed by the adjoining and overlapping upper crowns of the larger overstory trees.

Circumneutral. Neither strongly acid or basic; refers to soil or water that is approximately neutral.

Coarse Fragments, Soil. Refers to soil particles greater than 2 mm in diameter. Coarse fragments are divided into classes according to their size and shape. The classes are:

	Equidimensional	Flattened
2 mm to 75 mm	Gravel	Channers
75 mm to 250 mm	Cobbles	Flags
greater than 250 mm	Stones	Stones

Channer. See *Coarse Fragments, Soil.*

Climax. The position of relative stability; the mature late-successional, self-

maintaining, and self-reproducing state of vegetational development that culminates plant succession on a given site.

Clone. The aggregate of stems descended asexually from one sexually produced individual.

Colloid, Soil. Organic and inorganic matter of very small particle size and correspondingly large surface area per unit mass.

Colluvium. Sediment derived from unconfined slope wash or from gravitational movement of material. Found near the base of slopes, or on benches along the slope.

Community. An assemblage of plants and animals living together in a common area.

Coverage. See *Areal Coverage.*

Crown Fire. A fire that travels through the crowns of trees in a forest, killing most or all vegetation in its path.

Crystalline. Rock that solidified from the molten or near-molten state, composed of interlocking mineral crystals. Includes most igneous and metamorphic rock. Examples: granite, gneiss. See also Sedimentary and Metamorphic Rock.

DBH. Diameter at breast height, i.e., the average stem diameter, outside bark, at a point 1.30 m (4.5 ft) above the ground.

Development, Soil. The change in soil properties through time. A soil may be seen to be arranged in bands or layers roughly parallel to the soil surface. These layers are called horizons and they form as a result of soil development. All of the horizons of a soil taken together are referred to as its profile. From the surface down the horizons of soil are named:

Oi Undecomposed organic material deposited at the surface.

Oe Partially-decomposed organic material such that source material can still be recognized

Oa Well-decomposed amorphous organic matter.

A A dark-colored horizon at the mineral surface of the soil; it is the zone of mixing of organic matter with mineral soil. Organic matter of the O horizon decays and is mixed with the mineral soil by soil animals, particularly earthworms. A horizons are generally absent in very acid soils (see pH below).

E A light-colored horizon below an A horizon, or immediately below the O horizon in very acid soil. The E is the zone of removal of dissolved and suspended substances from the soil by the downward movement of water. Organic matter, clay particles, and iron compounds are removed from this horizon leaving it lighter in color and generally more acid than other soil horizons.

B Usually a red-orange, orange, or yellow zone in the soil always located below an A or E horizon. In this horizon suspended and dissolved materials, removed from the upper horizons, are deposited. The B horizons of most soils in the Huron Mountains are characterized by accumulations of iron and aluminum compounds (Bs horizon; the "s" for sesquioxide, i.e., iron and aluminum oxides). B horizons with an accumulation of organic material are darker in color and are designated Bh ("h" for humus). The B horizon is the zone in which hardpans are usually found.

C The C horizon is the zone of material located low enough in the profile to be relatively unaffected by the soil-forming processes discussed above. It is generally lighter in color than the B horizon. It is often referred to as parent material because it usually is the original state of the material that now forms the A, E, and B horizons.

Dike. A tabular body of rock held within a rock matrix of different origin. Dikes originate by the intrusion of molten rock or sediment into cracks in the country rock.

Drainage, Soil. The rate of gravitational water movement through the soil. This downward movement of water may be slowed by such conditions as: (1) Clay and silt-rich layers: smaller particles leave smaller spaces for water to move through, hence the water moves more slowly, (2) Hardpans: a product of soil development; hardpans are very dense compact layers in the soil, (3) Bedrock: impermeable to water unless cracked, or (4) High water table: water fills all available pore spaces.

Soil drainage classes used in the descriptions, from best drained (driest) to most poorly drained (wettest), are: excessively well drained, somewhat excessively well drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained.

Drift. Any material transported and deposited by glacial action.

Dry-mesic. Intermediate between mesic and dry in moisture conditions.

Ericaceous. A member of the heath family (Ericaceae).

Establishment. The process whereby a germinated seed extends roots, stems, and

leaves and gains a physiologically viable foothold in the ecosystem. This is the single most critical stage in the life history of an individual. The process may take several years.

Fibric. The least decomposed type of organic material. Fibric soils contain large amounts of fibers that are well preserved and identifiable as to botanical origin.

Footslope. The area at the base of a slope where slope gradients are small (relative to up-slope) and colluvial material may accumulate.

Forest Type. A characterization of a forest area on the basis of the predominant tree species.

Fragipans. A soil horizon usually located near the base of the B horizon. The formation of fragipans is poorly understood but the result is a very dense, compact layer, which restricts the downward movement of water and plant roots.

Gap. A hole in an otherwise unbroken forest canopy caused by the death of one or more trees.

Granitic. An igneous rock of similar crystal composition to granite, composed chiefly of quartz, orthoclase feldspar, sodium plagioclase feldspar, and micas.

Ground Cover. The collection of all herbaceous plants and low-growing (<1.5 cm dbh) shrubs in a community. The ground cover does not include tree seedlings and saplings.

Ground Fire. A fire that burns over the forest floor, consuming litter and low vegetation. The above-ground portion of small woody plants may be killed but larger trees usually survive.

Ground Flora. A list of all the species in the ground-cover layer.

Hardpan. A cemented or hardened layer in the soil. See also Fragipan and Ortstein.

Hemic. Organic soil material intermediate in properties between the less decomposed fibric and the more decomposed sapric materials.

Horizon, Soil. See *Development, Soil*.

Lacustrine. Formed or deposited in lakes.

Landform. A physiographic division of the landscape. A terrain feature with a definable shape and composition. See also Physiography.

Leaching. The suspension or dissolution of materials in the soil and their downward transport by the gravitational movement of water.

Litter. The organic remains of plants and animals that is found either on the soil surface or buried in the mineral soil itself. See Development, soil for a description of surface litter layers.

Mesic. Characterized by, relating to, or requiring a moderate amount of moisture. The soil of mesic sites is rarely saturated with water, but contains adequate moisture for the growth of most plants throughout the growing season.

Metamorphic Rock. Rock which has been altered in its mineral composition or mineral arrangement by the intense heat and pressure associated with burial deep beneath the earth's surface. Example: gneiss, slate. See also Crystalline and Sedimentary Rock.

Microclimate. The climate near the ground of a relatively small landscape feature.

Microtopography. The topographic form of the land on a scale of centimeters to several meters.

Mineral Soil. A soil that is dominantly composed of inorganic mineral particles, having less than 25-35% organic matter (plant and animal remains) by dry weight.

Mottling. Spots or blotches in the soil profile, of one or several colors, occurring within a contrasting background color. Usually used to refer to the bluish, grayish, or greenish dull colors (due to the color of reduced iron) frequently associated with wet, poorly-oxygenated conditions.

Muck. An organic soil that is normally saturated with water for long periods of time and whose constituent plant parts are markedly decomposed and no longer identifiable. Muck is usually darker in color, and has less fiber and more mineral material than peat.

Organic Soil. A soil that is greater than 25-35% organic matter (plant and animal remains) by dry weight.

Overstory. The collection of all woody stems in a forest that exceed 9.0 cm (3.6 in) dbh. The overstory includes all trees in the main canopy of the forest, along with the subdominant layer and much of the small tree layer underneath the canopy.

Ortstein. A volume of soil in the B horizon in which soil particles are cemented together by iron and aluminum compounds. Usually orange to orange-brown in color.

Outwash. Materials, mostly sands and gravels, deposited by meltwater streams flowing away from a glacier.

Peat. An organic soil that is normally saturated with water for prolonged periods of time. The constituent plant parts are slightly decayed or nondecayed and are recognizable as to botanical origin.

pH. The negative log of the hydrogen ion concentration of a solution (such as the water held in the soil). This value provides a measure of the acidity of the soil . A low pH (such as 4.0) corresponds to extremely acid conditions and high concentrations of hydrogen ions. Extremely acid soils are not capable of storing such plant nutrients as calcium, magnesium, and potassium in amounts sufficient for the vigorous growth of nutrient-demanding tree species like basswood and white ash or shrub species such as leatherwood. Higher pH, less acid soils are able to store larger quantities of these plant nutrients. The pH classes used in the ecosystem descriptions are:

extremely acid	< 4.5
very strongly acid	4.5 - 5.0
strongly acid	5.1 - 5.5
moderately acid	5.6 - 6.0
slightly acid	6.1 - 6.5
neutral	6.6 - 7.3

Physiography. An abbreviation of the term 'physical geography'. It refers to the surficial form, the material composition and structure of the land, and to its origin through the action of geologic processes. See also Landform.

Pit and Mound Microtopography. Small-scale topographic features of the forest floor created by windthrown trees. Pits and mounds are spatially paired--the "mound" is created by overturned soil strata removed from the "pit" by the upturned root system of the tree.

Pleistocene. An epoch in the earth's history that began with the global cooling of 2-2.5 million years ago and ended with the disappearance of continental glaciers in North America and Eurasia between 10,000 and 15,000 years ago.

Precambrian. The geologic era comprising the time interval between the earth's origin (4.5 to 5 billion years ago) and the origin of complex, hard-bodied organisms (hence an identifiable time boundary in the fossil record) 570 million years ago.

Regeneration. The process whereby an individual tree, a population of trees, or an entire forest community reproduces itself on a site.

Relative Density. The density of a tree species (stems/hectare) divided by the sum of the densities of all species, expressed as a percentage.

Relative Dominance. The basal area coverage of a tree species (m^2/ha) divided by the sum of the basal area coverages for all species, expressed as a percentage.

Root Collar. The line of junction between the root system of a tree and its stem.

Sapric. The most highly decomposed type of organic soil material. Sapric soils contain only small amounts of plant fiber (see Muck).

Sedimentary Rock. Rock formed from materials (usually mineral grains) that have been transported, deposited, and cemented together Examples: sandstone, shale. See also Crystalline and Metamorphic Rock.

Species Diversity. A measure of both the number (species richness) and relative abundances of plant species in a specified area or biological community; the greater the number of species and the more nearly equal their proportions, the greater is the species diversity.

Serotinous Cones. Cones which open and release seeds only when subjected to the intense heat of fire.

Shade Tolerance. The relative ability of a plant species to survive and thrive in the shaded understory of the forest. Shade tolerant plants have a high capacity to survive in such situations and intolerant plants a low capacity to do so.

Soil. The biochemically altered surface of landforms that serves as a rooting medium for plants. Soil develops as part of landscape ecosystems, and the properties of soil are derived from the parent material, its position on the landscape, and from the interaction and co-development of the soil body and the vegetation community. See also Development, Soil.

Sorting. Refers to the degree of variability in the sizes of particles in a soil, sediment, or sedimentary rock. "Well sorted" implies that the particles are all of a similar size, while "poorly sorted" indicates a wide distribution of particle sizes.

Slope Percent. The inclination of the land surface measured as a ratio of vertical to horizontal change, expressed as a percent.

Succession. The change in composition of plants and animals of a given area over time. Following a disturbance such as fire or logging, a typical progression of species is usually observed over time until a position of relative stability, or steady state (climax) is reached. Thus, we can identify species appearing early (early-successional species) or late (late-successional species) in succession for a given ecosystem type.

Texture. The relative proportions of the soil mass in each of three particle size classes: sand (largest particles, 2 mm to .05 mm), silt (intermediate size particles, .05 mm to .002 mm), and clay (the smallest particle size, less than .002 mm). The sizes of soil particles are important because soil high in clay and silt content is capable of storing large amounts of water and nutrients for plant growth, whereas sand soil holds relatively less water. The common soil textural classes found in the Huron Mountains, in order of increasing clay + silt content, are: sand, loamy sand, sandy loam, loam, and clay loam.

Till. Unstratified glacial drift transported in or beneath the glacier and deposited without extensive reworking by water. Material deposited under the glacier as it moves is called lodgement till, whereas material released from the ice as it melts is termed ablation till.

Tip-up-mound. A mound of soil created by the upturned roots of a windthrown tree.

Topography. The three-dimensional shape of the earth's surface.

Tree seedlings. The collection of all young tree reproduction (seedlings and saplings) less than 1.5 cm (0.6 in) dbh.

Understory. The collection of all woody stems in a forest between 1.5 and 9.0 cm (0.6 and 3.5 in) dbh. The understory includes large shrubs and most tree saplings.

Wet-mesic. Intermediate between mesic and wet in moisture conditions.

Water Table. The level in soil or a permeable rock body separating saturated conditions (below) from unsaturated conditions (above).