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Changes in Abundance of Vascular Plants under Varying Silvicultural Systems at the Forest Ecosystem Research and Demonstration Area, Paul Smiths, New York

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ABSTRACT

The Forest Ecosystem Research and Demonstration Area (FERDA) was established in 1998 adjacent to the Visitor Interpretive Center (VIC) for the Adirondack Park in Paul Smiths, NY, to provide visitors with first-hand exposure to forest management activities and to provide research opportunities for scientists and students at Paul Smith's College. This research note is designed to provide an introduction to the plants found on the FERDA. It is primarily a list of what is where, but it includes an introduction that helps visitors to the area consider how and why different species of plants are found in different parts of the forest. The table of species can be used as a checklist by amateur botanists to keep track of the plants they find or as an aid to identifying plants by limiting the likely species to those listed in this paper.

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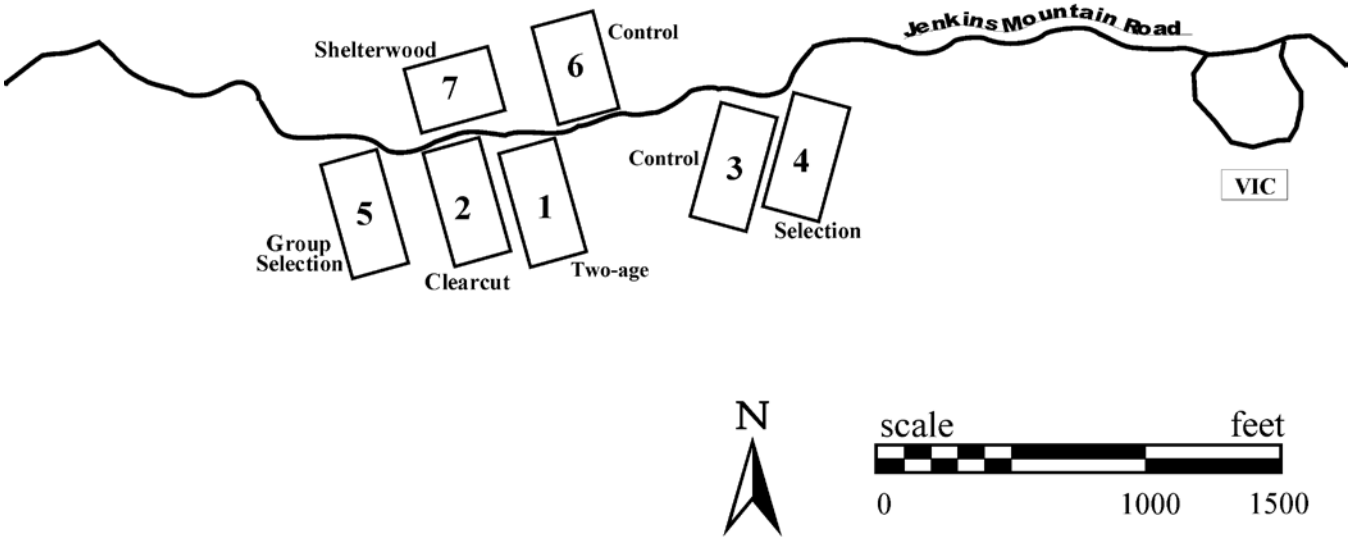

Figure 1.—Forest Ecosystem Research and Demonstration Area (FERDA) at the Paul Smith's College Visitor Interpretive Center (VIC) in Paul Smiths, NY showing the configuration of treatment blocks.

BACKGROUND

The interactions between forest management activities and the numbers and kinds of plants in a forest are complex. Forest management is conducted in many ways for many reasons. The primary activities that directly affect forest flora and fauna are operations that remove trees or other vegetation (Smith 1986). While timber harvested from a forest may be a primary source of revenue for a landowner, harvesting often yields additional benefits such as improved wildlife habitat and an increase in wildflower diversity.

Six silvicultural systems are demonstrated on 5-acre (2 ha) blocks near the Adirondack Park Visitor Interpretation Center (VIC) in Paul Smiths, NY (Fig. 1). The blocks are part of the Forest Ecosystem Research and Demonstration Area (FERDA). The primary goal of this demonstration project is to show visitors the conditions that result from a variety of silvicultural treatments, including changes to the plant species composition and wildlife habitat over time. A secondary goal of the FERDA is to document the effects of those treatments. Visitors can obtain a trail map at the VIC which includes illustrations of the five harvested and two unharvested (control) forest blocks. Interpretive signs along Jenkins Mountain Road briefly describe the silvicultural systems and depict projected forest development under each system.

This document lists the plant species present in the demonstration area and reports on resulting changes in species presence and abundance over the first 10 years since the initial treatments were applied.

FOREST MANAGEMENT ACTIVITIES

Different tree species require various light conditions for germination and growth. Some species, such as paper birch (see Table 1 for scientific names of species), are intolerant of shade and grow well in high light conditions but may not reproduce under the deep shade of a closed forest canopy. Certain sun-loving species store seed in forest soils for many years. For example, the seeds of pin cherry remain dormant in low light, but will germinate after the forest canopy has been removed. Still other species like sugar maple are shade tolerant, meaning they can survive and grow under very shady conditions, but may be outcompeted by faster-growing species in full sunlight.

The various silvicultural systems that have been established in the FERDA study cover the range of light conditions and extent of potential disturbances caused by forest management activities. This range of treatments gives visitors the opportunity to see which plants do well under the different conditions and allows forest managers to adapt their approaches to produce conditions that are likely to provide the benefits that a forest owner

wants. One basic premise is that trees in the northern hardwood forest, such as those found in the Adirondacks, can be managed to live 100 years on average. This life span, controlled by active forest management, generally produces a satisfactory balance of a variety of benefits from forests. Each forest management system simply varies the schedule and spacing within that 100-year cycle of the forest when trees are removed to make way for new growth (Smith 1986).

The silvicultural systems demonstrated on the FERDA are listed below in order of severity of disturbance and the amount of light that reaches the ground layer:

- No treatment (control). The forest was left alone to develop without direct intervention by forest activities. The control blocks allow for comparisons with more active management and demonstrate that things change even when people do nothing directly to the forest.
- Single-tree selection. About 30 percent of the tree volume was removed as single trees of varying sizes scattered throughout the block. Openings in the canopy were the size of individual trees. This system involves creating room for new trees to establish after each treatment and ensures that trees of many sizes and ages are present through the life of the forest. Treatments are applied about every 20 years or as needed to minimize overcrowding. Young trees and understory species that grow well in shade have the advantage.
- Group selection. About 30 percent of the tree volume was harvested. Trees were removed in clusters, forming openings of 0.10 to 0.25 acres in the forest canopy. This system creates space for new trees with each treatment and aims to ensure that trees of a variety of sizes and ages are always present. Under this plan, the decision to remove more trees occurs about every 20 years. Shade tolerant tree seedlings and understory plant species still have a competitive advantage but less so than under single tree selection.
- Two-aged. This system requires conversion to a forest with two distinct age classes. Most of the trees larger than 10 inches in diameter at breast height were removed to simulate a stand dominated by half-mature trees. The conditions created by this treatment are intended to produce more light on the forest floor and encourage new trees that need extra light to establish. This block will be ready for another treatment 50 years after the first one, when the forest will be composed of trees in two size classes of approximately 50 and 100 years old.
- Shelterwood. This system aims to establish a full cohort of new trees of about the same age and encourages trees that need a lot of light to grow. About 70 percent of the overall shade was removed in the initial treatment, leaving a partial canopy over most of the area. After sufficient numbers of new trees are established as saplings, the remaining canopy trees will be removed, likely 10 to 20 years after the initial treatment. The newly established trees will be ready for harvest approximately 100 years after the first treatment.
- Clearcut. This system creates an area favorable to sun-loving plants and animals, with particular focus on trees that do not establish or thrive in shady conditions. All canopy trees and smaller trees were cut, resulting in an even-aged forest that will be harvested again when the trees are mature, in about 100 years.

INVENTORY

A detailed inventory of all vascular plants was completed in each forest block prior to the initial harvest (during the summer of 1998 and spring of 1999) and again in 2009. Because this study aimed to identify all vascular plants present on the site, the inventory procedure was to walk multiple line transects across each block parallel to one boundary, close enough to each other (about 6 meters apart) to increase the likelihood that all plants within the block were seen and identified. Each species found was assigned an abundance category after the block was completed. Sample plots were not used because although they provide good quantitative information, they typically do not sample a large proportion of the less abundant species. Inventories were also conducted in

many of the intervening years but are not reported here. For details of the procedures, see Palmer et al. (1995) and Myers (2001). All plants within each block were identified and assigned an abundance class within each block for each inventory year:

5: Abundant (an important dominant or co-dominant species),

4: Frequent (easily seen or found),

3: Occasional (scattered widely but easy to find),

2: Infrequent (few individuals or colonies in a number of locations and difficult to find), and

1: Rare (limited to one or several locations and observed rarely).

SPECIES TABLE

Table 1 presents the abundance classes of all plants found in the study area. Species within the table are grouped by growth form (tree, shrub, herb, etc.) and are listed alphabetically by scientific name within each group. Species names use conventions from the PLANTS database (USDA, NRCS 2012).

A list of species abundances before treatments were implemented can be found in Wade et al (2003). The 2009 abundance classes are listed in the species table (Table 1) for each block individually. If the abundance of a species within a block increased from 1999 to 2009, it is represented in **boldface type**. If the abundance decreased, it is represented in *italics*. If the abundance remained the same, it is presented in normal type. If the species was not recorded in the initial 1999 inventory, it is underlined. If a species was recorded in the 1999 survey but was not found in a block in 2009, it is recorded with a zero in italics ("*0*"). In this way, a quick scan of the rows and columns of the table can provide an impression of which species increased or decreased their abundance under the various treatments, and which treatments affected the abundances of large numbers of species. Some species may not have been recorded in the 1999 inventory due to differences in data collectors.

Each column in the table reports abundances for an individual block. The column headings correspond to the treatments as follows:

CL1 = Control (Block 3)
CL2 = Control (Block 6)
ST = Single-tree selection (Block 4)
GS = Group Selection (Block 5)
TA = Two-age (Block 1)
SW = Shelterwood (Block 7)
CC = Clearcut (Block 2)

FINDINGS

Plant species abundances changed from year to year under all conditions, even when there was no human-caused disturbance, as was demonstrated in the two control blocks, each of which differed substantially from the other (Table 2). The number of species that did not change abundances during the first 10 years of the experiment was relatively small (13 percent in the clearcut to 29 percent in the single-tree selection) and was lowest among the blocks disturbed the most by harvesting and higher in the blocks with less disturbance. The block with the greatest number of species that decreased in abundance was Control Block 2, demonstrating that natural rises and falls in populations occur even without human activity. The block that showed the most new species arriving after the treatment was the clearcut, where many of the new species were those that typically germinate from dormant seed in the forest soil after disturbance occurs. While many species also decreased in abundance, the clearcut had the fewest number of species that completely disappeared over the 10 years after treatment, indicating that such treatments create a variety of habitat conditions in which many species can find a niche. In total, 33 species were found on every block both before and after the study (the "core flora" for the area), including 9 trees, 2 shrubs, 13 herbs, 4 ferns, 2 fern allies, 1 grass, and 2 sedges.

ACKNOWLEDGMENTS

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Table 1.—Forest Ecosystem Research and Demonstration Area 2009 species list and vascular plant species abundances

Scientific name[a]	Common name	Abundance[b]						
		CL1[c]	CL2	ST	GS	TA	SW	CC
Trees, needle-leaf								
Abies balsamea (L.) P. Mill.	balsam fir	*2*	2	*3*	*2*	*2*	3	3
Larix laricina (Du Roi) K. Koch	tamarack							1
Picea rubens Sarg.	red spruce	3	*2*	*3*	*3*	2	*3*	*3*
Pinus resinosa Aiton	red pine						1	2
Pinus strobus L.	eastern white pine	1		2	1	1	1	1
Pinus sylvestris L.	Scots pine[d]							1
Tsuga canadensis (L.) Carr.	eastern hemlock	*2*	*1*	2	*3*	*1*	*2*	*1*
Trees, broad-leaf								
Acer pensylvanicum L.	striped maple	4	*3*	4	4	4	*4*	4
Acer rubrum L.	red maple	3	2	3	**4**	**4**	**4**	**5**
Acer saccharum Marsh.	sugar maple	*4*	*3*	*4*	*4*	*4*	*3*	*3*
Acer spicatum Lam.	mountain maple	1	1	1	1	1	1	
Amelanchier spp. Medik.	serviceberry	1		1	1	1	1	
Betula alleghaniensis Britt.	yellow birch	*3*	*3*	*3*	*4*	**4**	**4**	**4**
Betula papyrifera Marsh.	paper birch		*0*				1	2
Betula populifolia Marsh.	gray birch							1
Fagus grandifolia Ehrh.	American beech	5	5	5	5	5	*4*	5
Populus grandidentata Michx.	bigtooth aspen							1
Populus tremuloides Michx.	quaking aspen							2
Prunus pensylvanica L. f.	pin cherry	1	1	1		2	2	4
Prunus serotina Ehrh.	black cherry	**2**	1	3	*1*	**3**	2	**3**
Prunus virginiana L.	chokecherry	1		1	1			1
Salix bebbiana Sarg.	Bebb willow							1
Salix spp. L.	willow					1		2
Sambucus racemosa L.	red elderberry	*2*	*1*	*2*	*1*	*2*	*2*	*2*
Sorbus americana Marsh.	American mountain ash	1		*1*			1	1
Shrubs								
Cornus alternifolia L. f.	alternateleaf dogwood			*0*				
Diervilla lonicera P. Mill.	northern bush honeysuckle						1	1
Ilex mucronata (L.) Powell, Savolainen & Andrews	catberry/mountain holly			1	1			1
Ilex verticillata (L.) Gray	common winterberry			1				
Ledum groenlandicum Oeder	Labrador tea			1				
Lonicera canadensis Bartr. ex Marsh.	American fly honeysuckle	3	1	3	*1*	*0*	*1*	*1*
Ribes cynosbati L.	eastern prickly gooseberry	*0*		*0*				
Ribes glandulosum Grauer	skunk currant	1		1		1	1	
Rubus allegheniensis Porter	Allegheny blackberry	1		**3**	2	4	4	**5**
Rubus idaeus L.	American red raspberry	2	*1*	**4**	**4**	**5**	**5**	**5**
Spiraea alba Du Roi var. *latifolia* (Ait.) Dippel	white meadowsweet					1		1
Spiraea tomentosa L.	steeplebush			1				

Scientific names and common names from PLANTS Database (USDA NRCS 2012). **continued**

[b] **Bold** = ↑; *italics* = ↓; underline = new 2009; *Italic"0"* = found 1999 but not 2009.

[c] CL=control; ST=single tree; GS=group selection; TA=Two-age; SW=shelterwood; CC=Clearcut

[d] Introduced species according to PLANTS data base (USDA NRCS 2012).

Table 1.—continued

Scientific name[a]	Common name	Abundance[b]						
		CL1[c]	CL2	ST	GS	TA	SW	CC
Vaccinium angustifolium Ait.	lowbush blueberry			*1*		1		1
Vaccinium myrtilloides Michx.	velvetleaf blueberry			2			1	
Viburnum lantanoides Michx.	hobblebush	4	*3*	5	*3*	*3*	*4*	3
Viburnum nudum L. var. *cassinoides* (L.) Torr. & A. Gray	withe-rod	1		1		1	1	1
Herbs & Sub-shrubs								
Anaphalis margaritacea (L.) Benth.	pearly everlasting							1
Aralia hispida Vent.	bristly sarsaparilla				1		2	3
Aralia nudicaulis L.	wild sarsaparilla	3	*1*	3	*3*	*2*	*2*	*2*
Arisaema triphyllum (L.) Schott	Jack in the pulpit	3	*2*	*1*	2	*2*	*1*	2
Circaea alpina L.	small enchanter's nightshade	1	1	1				1
Claytonia caroliniana Michx.	Carolina spring beauty	**2**	1	1	1	1		
Clintonia borealis (Ait.) Raf.	bluebead lily	3	**2**	3	2	*2*	*2*	*2*
Coptis trifolia (L.) Salisb.	threeleaf goldthread	*2*	1	*3*	*2*	*1*	*2*	2
Cornus canadensis L.	bunchberry dogwood	**2**	*1*	*1*			1	*1*
Cypripedium acaule Ait.	pink lady's slipper		*0*	*0*	1		1	
Dalibarda repens L.	robin runaway/dewberry	1	1	2	2	1	*1*	*1*
Doellingeria umbellata (P. Mill.) Nees	parasol whitetop	*1*	*0*	2		*0*		*2*
Epifagus virginiana (L.) W. Bartram	beechdrops	*1*	*2*	*0*	*1*	**2**	*0*	*0*
Epilobium coloratum Biehler	purpleleaf willowherb							2
Epipactis helleborine (L.) Crantz	broadleaf helleborine[d]	1						
Erythronium americanum Ker Gawl.	dogtooth violet	**2**	**2**	*0*	**3**	**2**	**2**	1
Euthamia graminifolia (L.) Nutt.	flat-top goldentop			1	1	1	1	3
Fragaria vesca L.	woodland strawberry	1			1	1		
Galeopsis tetrahit L.	brittlestem hempnettle	**2**	*0*		*1*	2	2	2
Galium triflorum Michx.	fragrant bedstraw	*1*	1	*2*	1	2	1	*1*
Hieracium aurantiacum L.	orange hawkweed[d]			1				1
Hieracium scabrum Michx.	rough hawkweed							1
Hieracium spp. L.	hawkweed			1			1	
Hypericum perforatum L.	common St. Johnswort[d]						1	
Impatiens capensis Meerb.	jewelweed		*1*					2
Laportea canadensis (L.) Weddell	Canadian woodnettle						*0*	
Lactuca biennis (Moench) Fernald	tall blue lettuce							1
Lactuca canadensis L.	Canada lettuce					2	1	
Lobelia inflata L.	Indian-tobacco							1
Lycopus uniflorus Michx.	northern bugleweed	1	*1*		*1*	1		*2*
Maianthemum canadense Desf.	Canada mayflower	**4**	**4**	**4**	*3*	*3*	3	*3*
Maianthemum racemosum (L.) Link	false Solomon's-seal	2	*2*	*0*	*1*	2	*1*	*1*
Medeola virginiana L.	Indian cucumber	3	3	3	3	3	*2*	*2*
Mitchella repens L.	partridgeberry	2	1	**3**	1	2	1	1
Monotropa uniflora L.	Indianpipe	*2*	*2*	2	*2*	2	*1*	*1*
Oclemena acuminata (Michx.) Greene	whorled wood aster	2	*1*	1	1	1	1	1

Scientific names and common names from PLANTS Database (USDA NRCS 2012). **continued**

[b] **Bold** = ↑; *italics* = ↓; underline = new 2009; *Italic"0"* = found 1999 but not 2009.

[c] CL=control; ST=single tree; GS=group selection; TA=Two-age; SW=shelterwood; CC=Clearcut

[d] Introduced species according to PLANTS data base (USDA NRCS 2012).

Table 1.—continued

Scientific name[a]	Common name	Abundance[b]						
		CL1[c]	CL2	ST	GS	TA	SW	CC
Oxalis montana Raf.	mountain woodsorrel	*3*	3	3	*3*	*3*	*2*	*2*
Oxalis stricta L.	common yellow oxalis	1				1	1	
Panax trifolius L.	dwarf ginseng	**3**	**2**	**2**		1		
Polygonatum pubescens (Willd.) Pursh	hairy Solomon's seal	*0*	*2*	*2*	2	*2*	*2*	*1*
Polygonum cilinode Michx.	fringed black bindweed	1	*1*	**3**	1	**3**	**3**	**3**
Potentilla norvegica L.	Norwegian cinquefoil							1
Prenanthes altissima L.	tall rattlesnakeroot		1					
Prenanthes cf. *altissima* L.	tall rattlesnakeroot	2		1				
Pyrola elliptica Nutt.	waxflower shinleaf		1			1		*1*
Ranunculus recurvatus Poir.	blisterwort		1					*1*
Rubus flagellaris Willd.	northern dewberry				1	1	1	1
Rubus hispidus L.	bristly dewberry	*0*	*0*	*0*	*0*	1	1	*1*
Rubus pubescens Raf.	dwarf red blackberry	2	1	1	*1*			*1*
Scutellaria lateriflora L.	blue skullcap		1					
Solidago caesia L.	wreath goldenrod	1						
Solidago canadensis L.	Canada goldenrod							1
Solidago rugosa P. Mill.	wrinkleleaf goldenrod	*1*	*0*	*1*	*1*	1	2	**3**
Streptopus lanceolatus (Aiton) Reveal	twistedstalk	**2**	*1*	2	1	1	1	*1*
Symphyotrichum lanceolatum (Willd.) G.L. Nesom	white panicle aster							1
Symphyotrichum lateriflorum (L.) A.& D. Löve	calico aster							1
Taraxacum officinale G.H. Weber ex Wiggers	common dandelion[d]				1	1	1	1
Tiarella cordifolia L.	heartleaf foamflower	*2*	*2*	*2*	1	*1*	*1*	*2*
Trientalis borealis Raf.	starflower	3	*2*	**4**	*2*	*2*	*2*	*2*
Trillium erectum L.	red trillium	3	3	3	3	3	3	3
Trillium undulatum Willd.	painted trillium	3	**3**	3	3	3	3	3
Typha latifolia L.	broadleaf cattail							1
Uvularia sessilifolia L.	sessileleaf bellwort	1						
Veronica officinalis L.	common speedwell[d]					1		1
Viola cucullata Aiton	marsh blue violet		*0*	*0*		*0*		
Viola spp. L.	violet	3	*2*	*3*	3	3	*1*	*2*
Ferns								
Athyrium filix-femina (L.) Roth ssp. *angustum* (Willd.) Clausen	common ladyfern	3	1	1	1	1	1	1
Botrychium dissectum Spreng.	cutleaf grapefern	1			1			
Dennstaedtia punctilobula (Michx.) T. Moore	eastern hayscented fern	*4*	*3*	**4**	*3*	*4*	**4**	5
Deparia acrostichoides (Sw.) M. Kato	silver false spleenwort			1				
Dryopteris intermedia (Muhl. ex Willd.) Gray	intermediate woodfern	4	**5**	**4**	4	4	4	*3*
Dryopteris marginalis (L.) Gray	marginal woodfern	1						

Scientific names and common names from PLANTS Database (USDA NRCS 2012). **continued**

[b] **Bold** = ↑; *italics* = ↓; underline = new 2009; *Italic"0"* = found 1999 but not 2009.

[c] CL=control; ST=single tree; GS=group selection; TA=Two-age; SW=shelterwood; CC=Clearcut

[d] Introduced species according to PLANTS data base (USDA NRCS 2012).

Table 1.—continued

Scientific name[a]	Common name	Abundance[b]						
		CL1[c]	CL2	ST	GS	TA	SW	CC
Dryopteris X *boottii* (Tuckerman) Underwood (pro sp.)	Boott's woodfern			1				
Gymnocarpium dryopteris (L.) Newman	western oakfern	**2**	*1*				1	
Onoclea sensibilis L.	sensitive fern	1	1	*0*	1	**1**	*1*	2
Osmunda cinnamomea L.	cinnamon fern	*0*	1	*1*	*1*		1	*1*
Osmunda claytoniana L.	interrupted fern	1		*2*	**2**	1	*2*	**2**
Osmunda regalis L.	royal fern				1		1	1
Phegopteris connectilis (Michx.) Watt	beech fern	2	1	*1*	1	1	*1*	1
Polypodium virginianum L.	rock polypody	1	1	1		*0*		
Pteridium aquilinum (L.) Kuhn	western brackenfern	*0*		*0*				1
Thelypteris noveboracensis (L.) Nieuwl.	New York fern	**3**	2	2	*2*	**3**	*2*	*3*
Fern allies								
Equisetum arvense L.	field horsetail		1					
Equisetum sylvaticum L.	woodland horsetail		1					1
Huperzia lucidula (Michx.) Trevis.	shining clubmoss	4	5	4	4	*3*	*3*	*2*
Lycopodium annotinum L.	stiff clubmoss				2	3		1
Lycopodium clavatum L.	running clubmoss							1
Lycopodium digitatum Dill. ex A. Braun	fan clubmoss							1
Lycopodium obscurum L.	tree clubmoss/ground pine	3	1	4	2	*3*	2	*2*
Grasses								
Agrostis gigantea Roth	redtop						1	1
Agrostis hyemalis (Walter) Britton, Sterns & Poggenb.	winter bentgrass						1	2
Agrostis perennans (Walt.) Tuckerman	upland bentgrass			*0*			1	*1*
Brachyelytrum erectum (Schreb. ex Spreng.) Beauv.	bearded shorthusk	*1*	*0*	*1*	*0*	*1*	*1*	*1*
Calamagrostis canadensis (Michx.) Beauv.	bluejoint					1		1
Cinna latifolia (Trevis. ex Goepp.) Griseb.	drooping woodreed	3	*1*	3	*2*	**3**	**3**	*2*
Danthonia compressa Austin	flattened oatgrass			1	1		1	2
Danthonia spicata (L.) Beauv. ex Roemer & J.A. Schultes	poverty oatgrass					*0*	1	
Dichanthelium acuminatum (Sw.) Gould & C.A. Clark	tapered rosette grass							1
Glyceria canadensis (Michx.) Trin.	rattlesnake mannagrass						1	
Glyceria melicaria (Michx.) F.T. Hubbard	melic mannagrass	1	1		1			1
Glyceria striata (Lam.) Hitchc.	fowl mannagrass	1						
Oryzopsis asperifolia Michx.	roughleaf ricegrass	*0*		*1*		1		
Poa pratensis L.	Kentucky bluegrass[d]					1	1	
Poa saltuensis Fernald & Wiegand	oldpasture bluegrass	1		1				
Poa spp.		2						1
Rushes								
Juncus brevicaudatus (Engelm.) Fernald	narrowpanicle rush							1
Juncus effusus L.	common rush	1						2

Scientific names and common names from PLANTS Database (USDA NRCS 2012).

continued

[b] **Bold** = ↑; *italics* = ↓; underline = new 2009; *Italic"0"* = found 1999 but not 2009.

[c] CL=control; ST=single tree; GS=group selection; TA=Two-age; SW=shelterwood; CC=Clearcut

[d] Introduced species according to PLANTS data base (USDA NRCS 2012).

Table 1.—continued

Scientific name[a]	Common name	Abundance[b]						
		CL1[c]	CL2	ST	GS	TA	SW	CC
Juncus tenuis Willd.	poverty rush						1	1
Sedges								
Carex arctata Boott ex Hook.	drooping woodland sedge	2	1	1	1	1	2	2
Carex blanda Dewey	eastern woodland sedge		1					
Carex brunnescens (Pers.) Poir.	brownish sedge	*2*	1	*2*	3	**3**	2	3
Carex canescens L.	silvery sedge							1
Carex communis L.H. Bailey	fibrousroot sedge	1	2	2	1	2	1	**2**
Carex crawfordii Fernald	Crawford's sedge					1		
Carex debilis Michx.	white edge sedge	**2**	*1*	**3**	**3**	**3**	**3**	3
Carex deweyana Schwein.	Dewey sedge	1				1	1	1
Carex disperma Dewey	softleaf sedge	1		1	1		1	
Carex echinata Murray	star sedge							1
Carex gynandra Schwein.	nodding sedge	*1*	*0*	*1*	*1*	**3**	**3**	**3**
Carex intumescens Rudge	greater bladder sedge	*2*	*2*	2	1	*2*	1	3
Carex laxiflora (Lam.)	broad looseflower sedge	*0*			*0*			
Carex leptonervia (Fernald) Fernald	nerveless woodland sedge	1	*1*	1	*1*	2	1	*1*
Carex novae-angliae Schwein.	New England sedge			1				
Carex pensylvanica Lam.	Pennsylvania sedge					1		1
Carex projecta Mackenzie	necklace sedge	1		1		2	1	
Carex scabrata Schwein.	eastern rough sedge		*1*					*1*
Carex scoparia Schkuhr ex Willd.	broom sedge							2
Carex stipata Muhl. vex Willd.	awlfruit sedge						1	1
Carex trisperma Dewey	threeseeded sedge	1	1	1			1	
Scirpus atrocinctus Fernald	blackgirdle bulrush						1	2
Scirpus atrovirens Willd.	green bulrush				*0*	*0*	*0*	2
Scirpus cyperinus (L.) Kunth	woolgrass							2

[a] Scientific names and common names from PLANTS Database (USDA NRCS 2012).
[b] **Bold** = ↑; *italics* = ↓; underline = new 2009; *Italic"0"* = found 1999 but not 2009.
[c] CL=control; ST=single tree; GS=group selection; TA=Two-age; SW=shelterwood; CC=Clearcut
[d] Introduced species according to PLANTS data base (USDA NRCS 2012).

Table 2.—Summary of species abundance changes by block within the Forest Ecosystem Research and Demonstartion Area (FERDA) at the Adirondack Park Visitor Interpretative Center (VIC) in Paul Smiths, NY

Block	CL1	CL2	ST	GS	TA	SW	CC
Number of species that were found in 1999 but not in 2009	7	9	11	4	6	3	1
Number of species that were found in 2009 but not in 1999	29	13	27	26	33	43	64
Number of species that increased abundance 1999-2009	11	6	10	5	13	9	10
Number of species that decreased abundance 1999-2009	18	30	22	27	19	27	36
Number of species that did not change abundance	32	24	28	19	20	16	17
Total species found by block	97	82	98	81	91	98	128
Grand total of species found in FERDA at the VIC	173						

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