92-PS.04

Pennsylvania Coastal Zone Management Program

1993 Presque Isle Exotic Plant Species Control Project: Restoration of Lithospermum caroliniense and Scirpus smithii

December, 1993

SPC # 226290
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ACKNOWLEDGEMENTS

Special acknowledgement goes to Kathleen McKenna, Bureau of Forestry for helping to develop the plan for the 1993 phase of the Lithospermum caroliniense restoration project and Scirpus smithii project. She also worked to secure funding for the project. Funding for this project was received from the Wild Resources Conservation Fund and Pennsylvania Coastal Zone Mnagement Program, Division of Coastal Zone Management, Pennsylvania Department of Environmental Resources.

Thanks go to Adjunct Curator of Botany Beverly Danielson who volunteered seven days of work on the project and Norma Kline who volunteered two days of work.

Thanks go to Cleveland Heights High School teacher Blair Chirdon and seven of his students who helped pull out a 20 by 15 foot meadow of Phragmites australis and Typha glauca on March 26.

Thanks go to Mercyhurst College Professor Michael Campbell and his students Katy Covin and Akrom Alzught who helped to establish and collect base line data from ten 10 by 10 foot plots at the Lithospermum caroliniense site.

Special thanks are given to Museum Botany Department Interns Heather Chirdon, Matthew Collier and Steven Meiers who set up the Scirpus smithii belt transect and pulled Lythrum salicaria and Epilobium hirsutum from a 25 by 35 meter area adjacent to the Scirpus smithii control plot. They also collected baseline data from the only park location of Geranium bicknellii. Removal of exotics and common weedy plants from the site is planned for 1994. Geranium bicknellii has not been seen at the site since 1986 but seeds are presumed to be present in the soil. Removal of vegetation at the site in 1994 may trigger release of the rare geranium from the seed bank.

Thanks are given to Park Superintendent Harry Leslie and Assistent Superintendents Obediah Derr and Peter Houghton for giving advice and assistance throughout the study and special thanks go to Superintendent Leslie go giving permission to begin the Geranium bicknellii restoration project.

QK183. P74. pd 1993

METHODS

In consultation with Kathleen McKenna, Professor Michael Campbell of Mercyhurst College and Adjunct Curator of Botany Beverly Danielson, plans were developed for renewal and exansion of two of the 1991 exotic control projects. One of the projects entailed the removal of Lythrum salicaria, Epilobium hirsutum, Typha X glauca, Phragmites and Phalaris arundinacea from the 1991 Scirpus smithii site. The other project involved the collecting data from two Lonicera morrowi removal areas within the Lithospermum caroliniense dry sand plain along the south side of PA Rt. 832 east of the Light House. Park Maintenance staff removed the Lonnicera morrowi from the two areas in 1991. A second phase of the puccoon study involved establishing five sets of 10 foot by 10 foot plots within the dry sand plain south of PA Rt. 832 and east of the Light House. Each of the five sets included one plot that was mowed regularly from mid to late summer and one plot where the soil was turned over in mid-summer.

On March 26, seven students from an environmental club at Cleveland Heights High School assisted with removal of hairy hillow herb (Epilobium hirsutum) and purple loosestrife (Lythrum salicaria from the 1991 Scirpus smithii study area. The students, Adjunct Curator Beverly Danielson and Curator James Bissell also removed a 20 by 15 foot meadow of Phragmites australis and Typha x glauca that establish within the northeast corner of the 1991 study area during the 1992 field season. On April 24, permanent 3 foot by 3 foot sample plots were established within the 1991 study area and percentage cover was recorded by the permanent plots. The numbered plots within the 1991 study area (#1 through #5) are shown on Appendix 2. The plots within the 1991 study area were sampled again on September 27.

On May 15, an expansion of the 1991 study area was made by removing sandbar willow (Salix exigua) along with a relatively solid cover of purple loosestrife and hairy willow herb. This expansion is called the Scirpus smithii control plot expansion and is shown on Appendix 2 as the area to the south of the belt transect bounded by sample plots numbered 6 through 10. Prior to removal of the exotics, percentage cover quadrat analyses was collected from each of the five sample plots and these plots were sampled again on September 27..

On May 15, a different method of palustrine sand plain restoration was also initiated. A 10 by 10 foot section of wet flats, heavily vegetated with purple loosestrife, hairy willow herb and blue joint reed-grass (Calamagrostis canadensis) was turned over. The northern edge of the turnover plot is 40 feet south of the southern edge of the Scirpus smithii plot. Percentage cover data was taken from five sample plots within the turned over area. The turned over area was clipped to within

four inches of the ground at three week intervals and sampled on September 27.

All percentage cover data collected, both prior and after to removal of exotics and is included within the appendix of this report. In addition, the location of all POSCIP plants within the 100 by 35 foot Scirpus smithii exotic control plot is shown by a series of maps within the Appendix.

On June 14, a census of the hairy puccoon was taken within the sand plain habitat along the south side of PA Rt. 832 to the east of the Presque Isle Light House. In addition to counting the puccoons, the two areas where Lonicera morrowi were removed in 1991 were examined to determine whether any Plants of Special Concern in Pennsylvani have estalbished since removal of the exotic shrubs.

On June 29, five sets of two 10 by 10 foot quadrats were established within the hairy puccoon sand plain east of the Light House and south of PA Rt. 832. At each of the five treatment sites the eastern plot was designated as an area to be rototilled and the western plot was designated as an area to be mowed. Percentage cover data within all the plots was collected on June 29. Volunteers Katy Covin and Akrom Alzught mowed all ten plots on July 15 and Akrom Alzught rototilled and again on September 8.

FIELD SCHEDULE
for
1993 PRESQUE ISLE STATE PARK
EXOTIC SPECIES MANAGEMENT PROJECT
CONTRACT NUMBER SP 101727

March 26	Exotic species removal from ***Scirpus smithii*** site.
April 24	Continue removal from Smiths's bulrush site.
May 15	Extend exotic species removal area at Smith's bulrush site and collect percentage cover data.
June 14	Census Lithospermum caroliniense population and inventory for POSCIP species at areas where Lonicera morrowi was removed in 1991.
June 23	Inventory for POSCIP species at both management areas and removal from exotic species from both areas.
June 29	Establish sites for quadrats where soil will be turned over and regular mowing will be done.
July 9	All puccoon 10 ft. test plots were mowed by volunteers Katy Covin and Akrom Alzught.
July 15	Volunteer Akrom Alzught rototilled five of the puccoon test plots.
July 24	Lythrum salicaria seedlings were weeded from Smith's bulrush site.
July 26	Remove Lonicera morrowi seedlings from puccoon quadrats.
August 6	Establish site for belt transect across the Smith's bulrush exotic control plot.
August 16	Museum interns Matthew Collier, Heather Chirdon and Steve Meiers set up Smith's bulrush belt transect.
August 17	Interns work on belt transect.
August 18	Interns work on belt transect.
August 19	Interns finish belt transect.
August 30	Hand pulling of Phalaris arundinacea and

1993 Field Schedule (continued)

	Lythrum salicaria seedlings from Smith's bulrush control plot.
September 8	Collection of percentage cover from soil turnover plots at puccoon site and collection of puccoon seed.
September 27	Collection of percentage cover data from quadrats in Smith's bulrush control plot and interior soil turnover plot; mapping of POSCIP species in Smith's bulrush control plot.

RESULTS

Scirpus smithii Exotic Control Project and Inerior Soil Turnover Project.

Three Scirpus smithii and several other POSCIP plants responded positively to the succession release conditions within the 100 by 35 foot area cleared of exotic species. The relatively high levels of Lake Erie during the study probably account for the low numbers of some of the POSCIP species found within the control plot. The lake remained at relatively high levels until middle summer and did not undergo a signficant decrease during May to July. Stable lake levels during the first half of the summer were observed in 1989 to inhibit germination of many rare plants that inhabitat the palustrine sand plain community and this same paucity of germination was observed throughout palustrine sand plains at Presque Isle during 1993. Plants of Special Concern in PA, in addition to Scirpus smithii, that resonded favorably to removal of exotics within the 35 by 100 foot control plot include:

Carex aquatilis
Carex bebbii
Cyperus diandrus
Cyperus odoratus
Eleocharis olivacea
Juncus balticus
Panicum tuckermanii
Potentilla anserina

As in 1991, with the exception of Potentilla anserina, all of the above POSCIP plants were rare or absent within the unweeded areas along the belt transect east and west of the control area. Two POSCIP species not observed in the study area in 1991 were found within the Scirpus smithii Control Plot Expansion following the removal of exotics:

Carex bebbii
Cyperus diandrus

The following typical members of the palustrine sand plain community also responded positively to succession release within the Scirpus smithii control plot:

Cyperus bipartitus
Cyperus flavescens
Cyperus odoratus
Cyperus strigosus
Juncus nodosus
Polygonum punctatum
Scirpus americanus

Interior Soil Turnover Plot:

Within the soil turnover area located 40 feet south of the Scirpus smithii Control Plot, only three POSCIP species responded to the succession release that resulted from turning over the soil and none of these POSCIP plants were present in the dense meadows adjacent to the turnover plot:

Carex bebbii (single plant in north central section of plot and not located in sample quadrats)
Cyperus odoratus (found in sample quadrats)
Polygonum amphibium var. stipulaceum (found in sample quadrats)

Several plants in addition to the POSCIP species listed above reponded to release from the seed bank as a result of turning over the soil. The realeased plants listed below were either rare or not found in the dense vegetation adjacent to the turnover plot:

Alisma subcordatum
Bidens cernua
Cyperus poeformis
Cyperus strigosus
Eupatorium perfoliatum
Lindernia dubia
Ludwigia palustris
Polygonum punctatum
Ranunculus scleratus
Rorippa islandica
Verbena hastata

Lithospermum caroliniense Restoration Project:

A total of 45 Lithospermum caroliniense plants were counted within the dry sand plain along the south side of PA Rt. 832 east of the Light House.

Several Plants of Special Concern in PA responded positively to mowing and/or rototilling within the 10 by 10 foot plots. Three POSCIP species showed great reponse to both treatments within more than one of the plots:

Cyperus schweinitzii
Schizachyrium scoparium var. littorale
Sporobolus cryptandrus

An additional POSCIP plant, Panicum commonsianum, was found to be present within mowed plot number 4a and was not observed there prior to the mowing.

Eastern Loncera morrowi pull-out site:

Two POSCIP plants were found within the 35 by 25 foot area at the eastern edge of study area where a dense thicket of Lonicera morrowi was pulled out in 1991:

Cyperus schweinitzii
Sporobolus cryptandrus

Three POSCIP plants were found within the eastern 15 by 15 foot area where Lonicera morrowi was pulled by park staff in 1991:

Cyperus schweinitzii
Panicum commonsianum
Sporobolus cryptandrus

APPENDIX

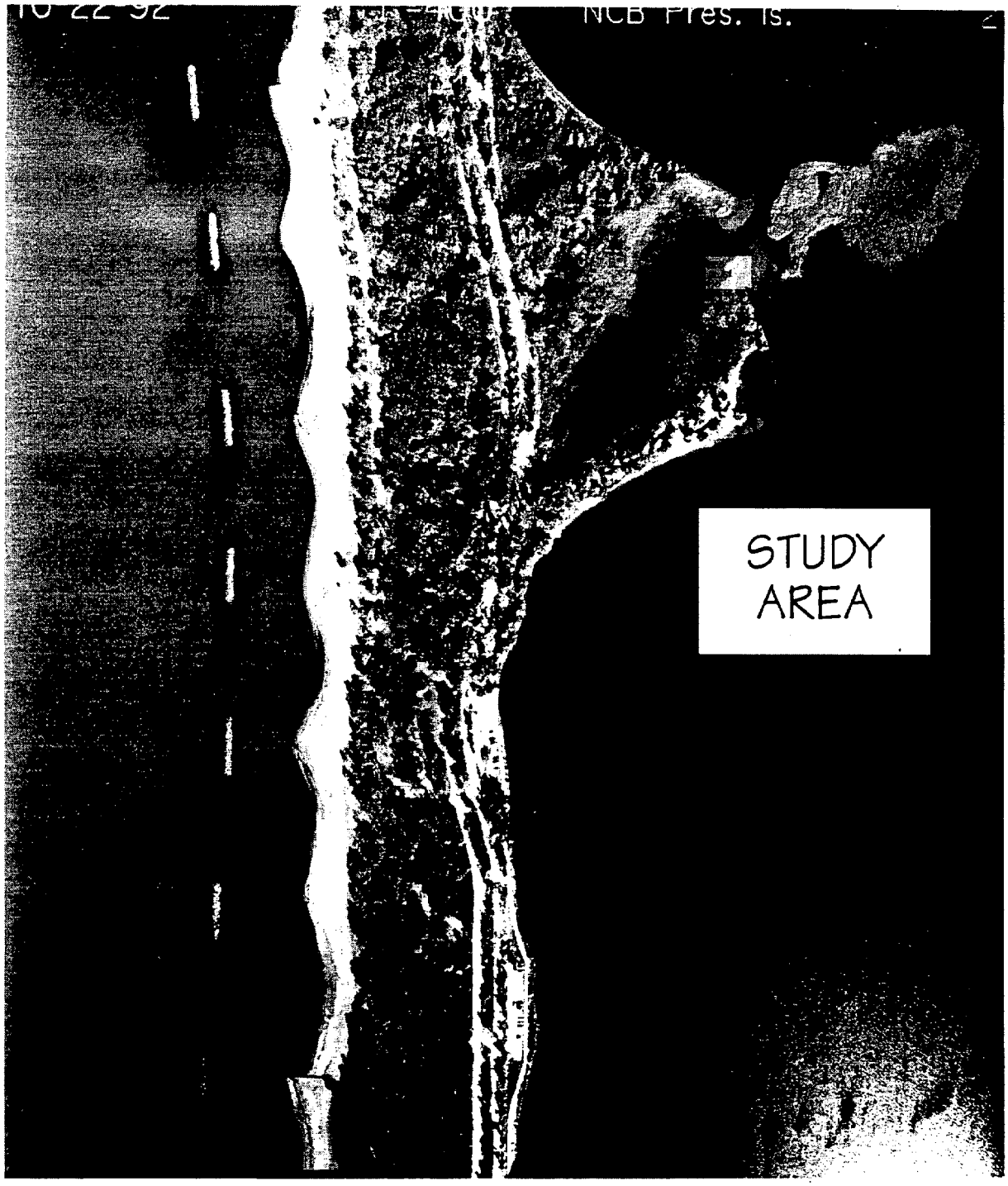
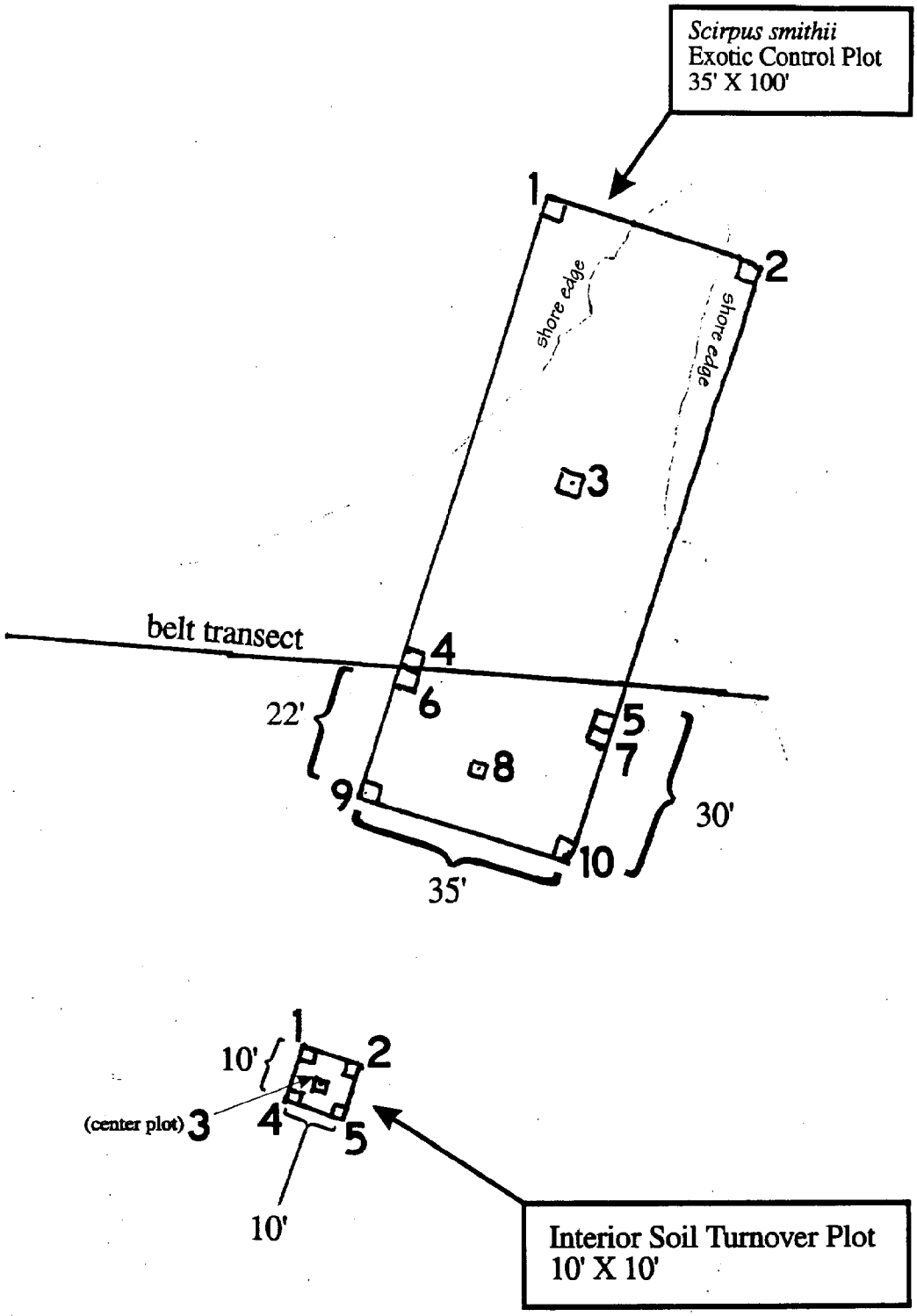


Figure 1

Scirpus smithii Exotic Control Study



N

1" = 26'

Figure #2

Mean Monthly Lake Erie Levels
1993

March .....572.67 feet

April .....573.16 feet

May .....573.16 feet

May .....573.06 feet

June .....573,06 feet

July .....573 feet

August .....572.64 feet

September .....572.28 feet

October .....571.92 feet

November .....571.72 feet

Percentage Cover
of
Five
3 by 3 foot quadrats
within
1991 Scirpus smithii exotic control area
April 24, 1993

	% cover
Plot #1 (Northwest corner of 1991 control plot)	
Open water	100%
Plot #2 (Northeast corner of 1991 control plot)	
Open water	100%
Plot #3 (Center of 78 by 35 foot plot)	
Phalaris arundinacea	10%
Typha X glauca	30%
Phragmites australis	60%
Plot #4 (Southwest corner of 78 by 35 foot plot)	
Bare sand	100%
Plot #5 (Southwest corner of 78 by 35 foot plot)	
Phalaris arundinacea	50%
Typha X glauca	40%
Bare sand	10%

PERCENTAGE COVER
of
Five
3 by 3 foot quadrats
within
1991 Scirpus smithii exotic control area
September 27, 1993

Plot #1 (Northwest corner of 1991 exotic control area)

Ceratophyllum demersum	3%
Nymphaea odorata	25%
Sagittaria rigida	3%
Vallisneria americana	10%
Bare sand (sumbmersed)	60%

Plot #2 (Northeast corner of 1991 exotic control area)

Potamogeton richardsonii	2%
Vallisneria americana	3%
Bare sand (submersed)	95%

Plot #3 (Center of 1991 exotic control area)

Scirpus americanus	5%
Bare sand	95%

Plot #4 (Southwest corner of 1991 exotic control area)

Cyperus bipartitus	3%
Cyperus odoratus	3%
Lythrum salicaria	3%
Myriophyllum spicatum	1%
Polygonum lapathifolium	2%
Ranunculus longirostris	2%
Scirpus americanus	4%
Scirpus fluviatilis (seedling)	1%
Sparganium eurycarpum	3%

Plot #5 (Southeast corner of 1991 exotic control area)

Phalaris arundinacea	2%
Scirpus americanus	3%
Bare sand	95%

PERCENTAGE COVER
of
Scirpus smithii CONTROL PLOT EXPANSION
14 May 1993

Plot #6 (Northwest corner of 22 feet by 35 feet expansion)
Note: All Quadrat sample plots are 3 X 3 feet.

	% cover
Calamagrostis canadensis	30%
Epilobium hirsutum	4%
Lythrum salicaria	3%
Salix exigua	10%

Plot #7 (Northeast corner of 22 by 35 feet expansion)

Calamagrostis canadensis	45%
Epilobium hirsutum	15%
Lythrum salicaria	5%
Salix exigua	9%

Plot #8 (Center of 22 by 35 feet expansion)

Calamagrostis canadensis	40%
Epilobium hirsutum	10%
Lythrum salicaria	5%
Salix exigua	7%

Plot #9 (Southwest corner of 22 by 35 feet expansion)

Calamagrostis canadensis	50%
Epilobium hirsutum	2%
Lythrum salicaria	1%
Salix exigua	5%

Plot #10 (Southeast corner of 22 by 35 feet expansion)

Calamagrostis canadensis	45%
Epilobium hirsutum	5%
Lythrum salicaria	3%
Salix exigua	3%

Average Percentage Cover for four dominant species within plots 6 through 10:

Calamagrostis canadensis	42%
Epilobium hirsutum	7.2%
Lythrum salicaria	3.4%
Salix exigua	6.8%

Percentage Cover
of
Scirpus smithii CONTROL PLOT EXPANSION
27 September 1993

Plot #6 (Northwest corner of 22 by 35 foot expansion)

Butomus umbellatus	2%
Eleocharis smallii	3%
Leersia oryzoides	2%
Lythrum salicaria	3%
Ranunculus longirostis	2%
Sparganium eurycarpum	20%
Bare sand	60%

Plot #7 (Northest corner of 22 by 35 foot expansion)

Cyperus strigosus	2%
Epilobium hirsutum	3%
Lycopus americanus	3%
Lythrum salicaria	2%
Phalaris arundinacea	5%
Polygonum punctatum	2%
Scirpus americanus	8%
Bare sand	80%

Plot #8 (Center of 22 by 35 foot expansion)

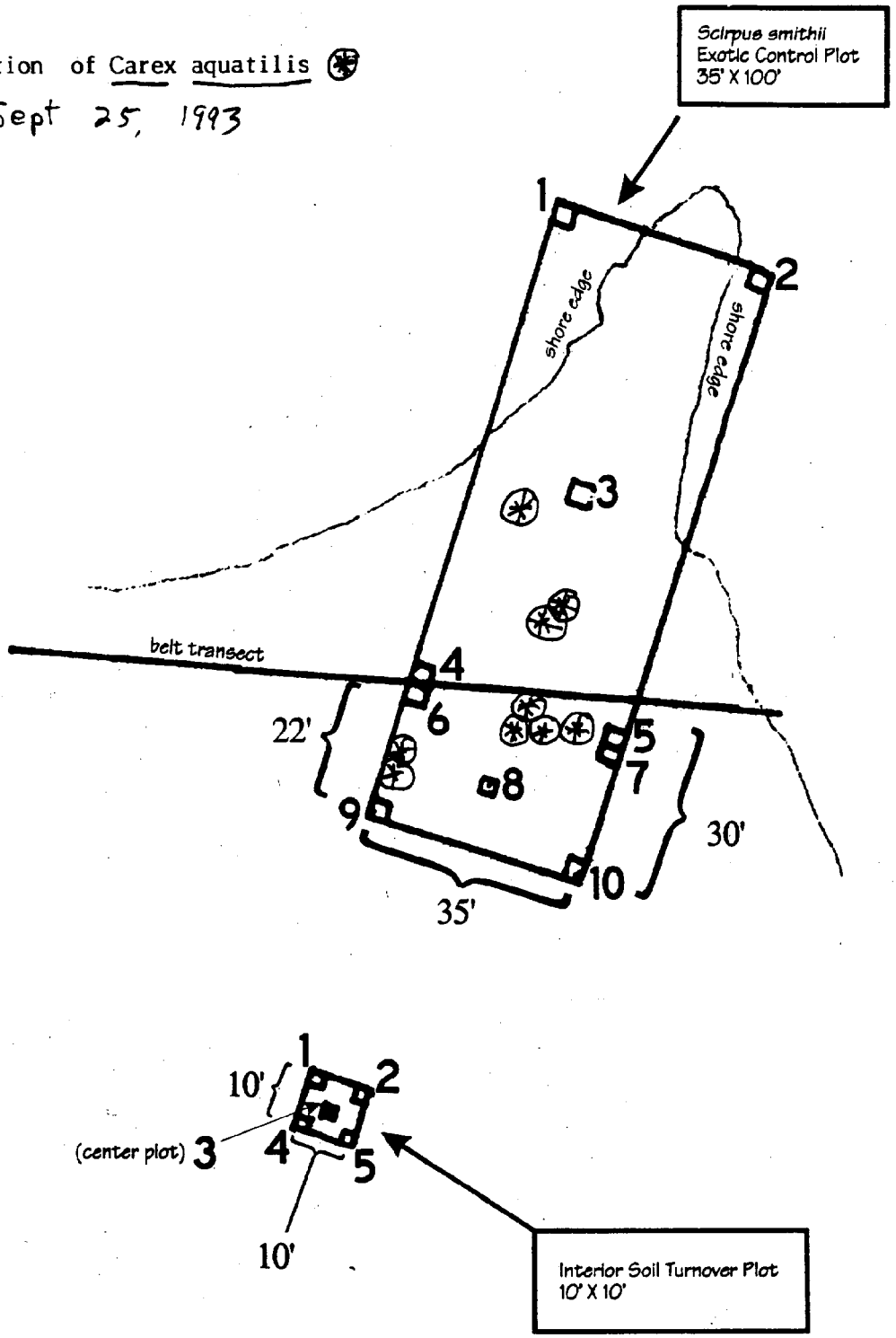
Calamagrostis canadensis	35%
Lythrum salicaria	2%
Sagittaria latifolia	2%
Salix exigua	2%
Scirpus americanus	12%
Sparganium eurycarpum	3%
Bare sand	50%

Plot #9 (Southwest corner of 22 by 35 foot expansion)

Eleocharis smallii	2%
Lythrum salicaria	2%
Pontederia cordata	1%
Sagittaria latifolia	1%
Scirpus americanus	3%
Sparganium eurycarpum	2%
Bare Sand	90%

Distribution of Carex aquatilis ⊛

Sept 25, 1993



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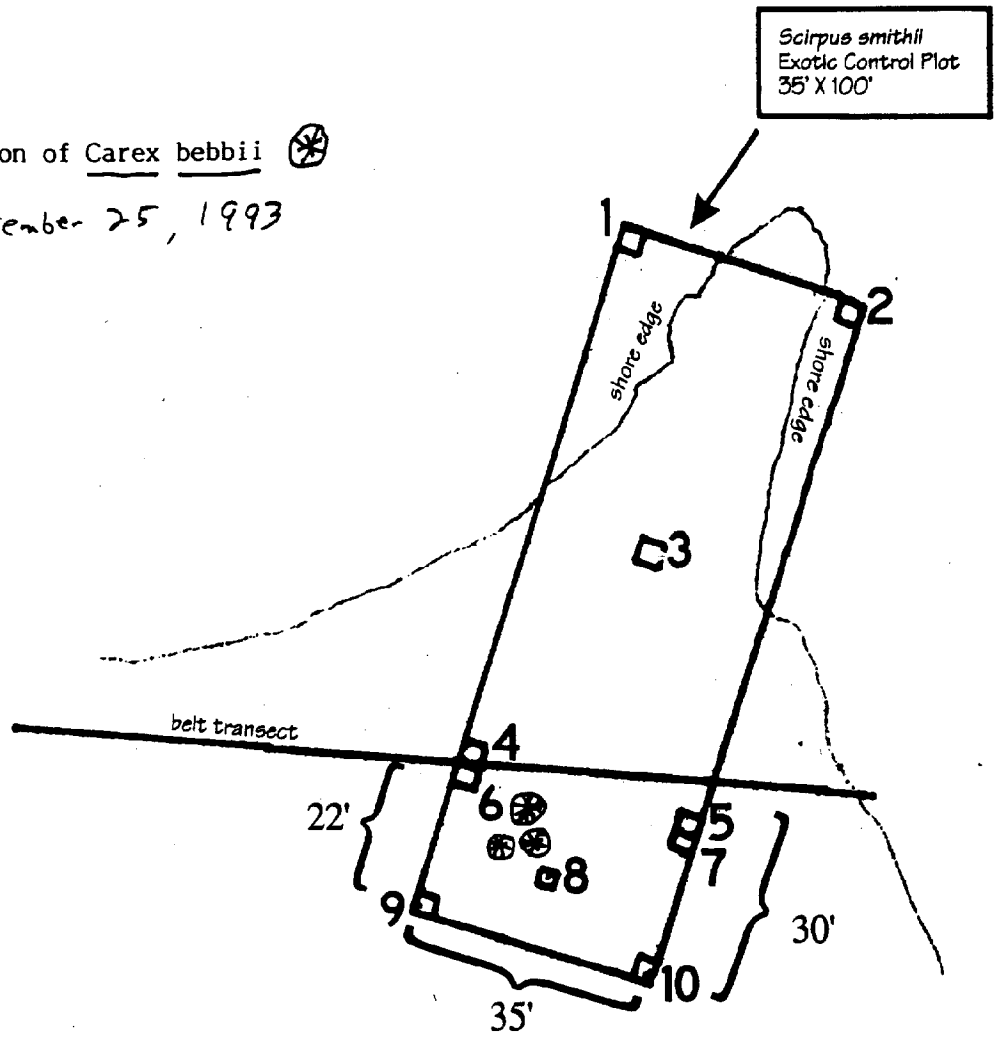
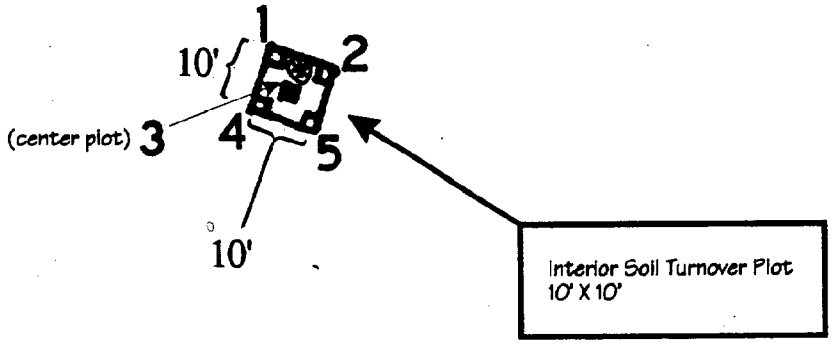
Distribution of Carex bebbii ⊛

September 25, 1993





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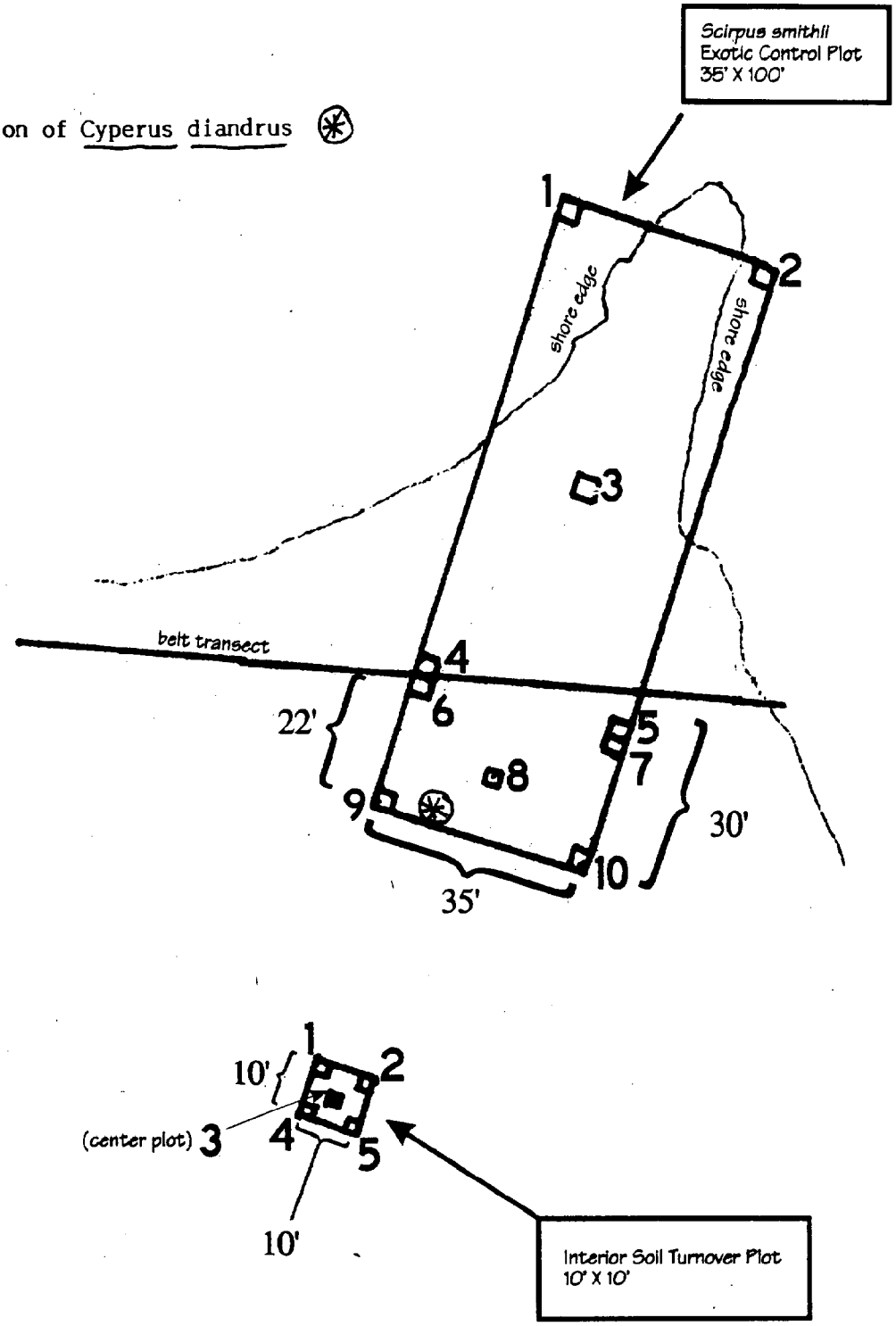
Distribution of Cyperus diandrus ⊛



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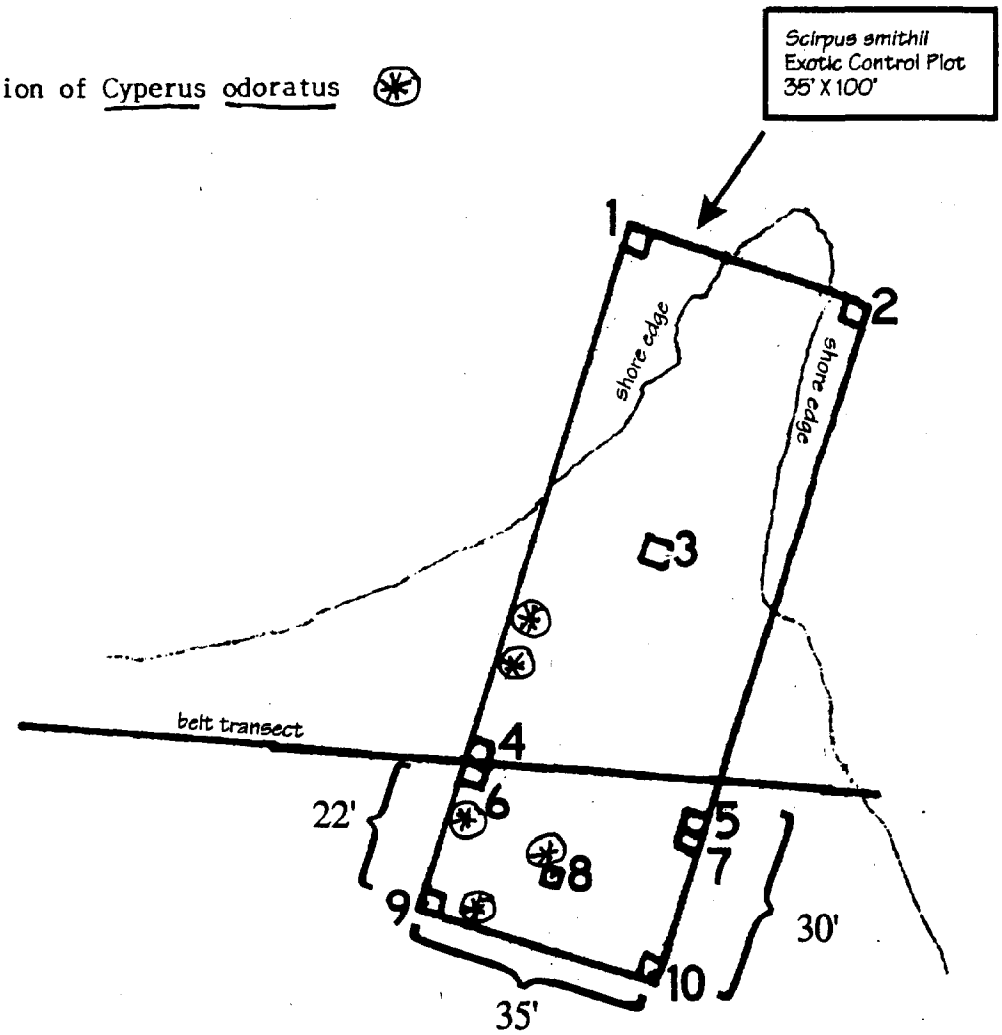
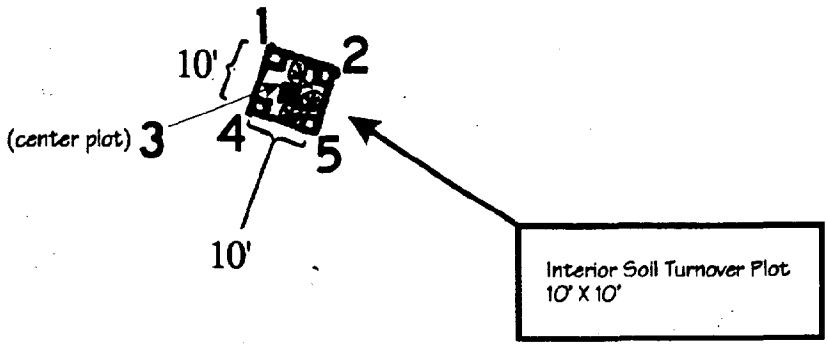
Distribution of Cyperus odoratus ⊛





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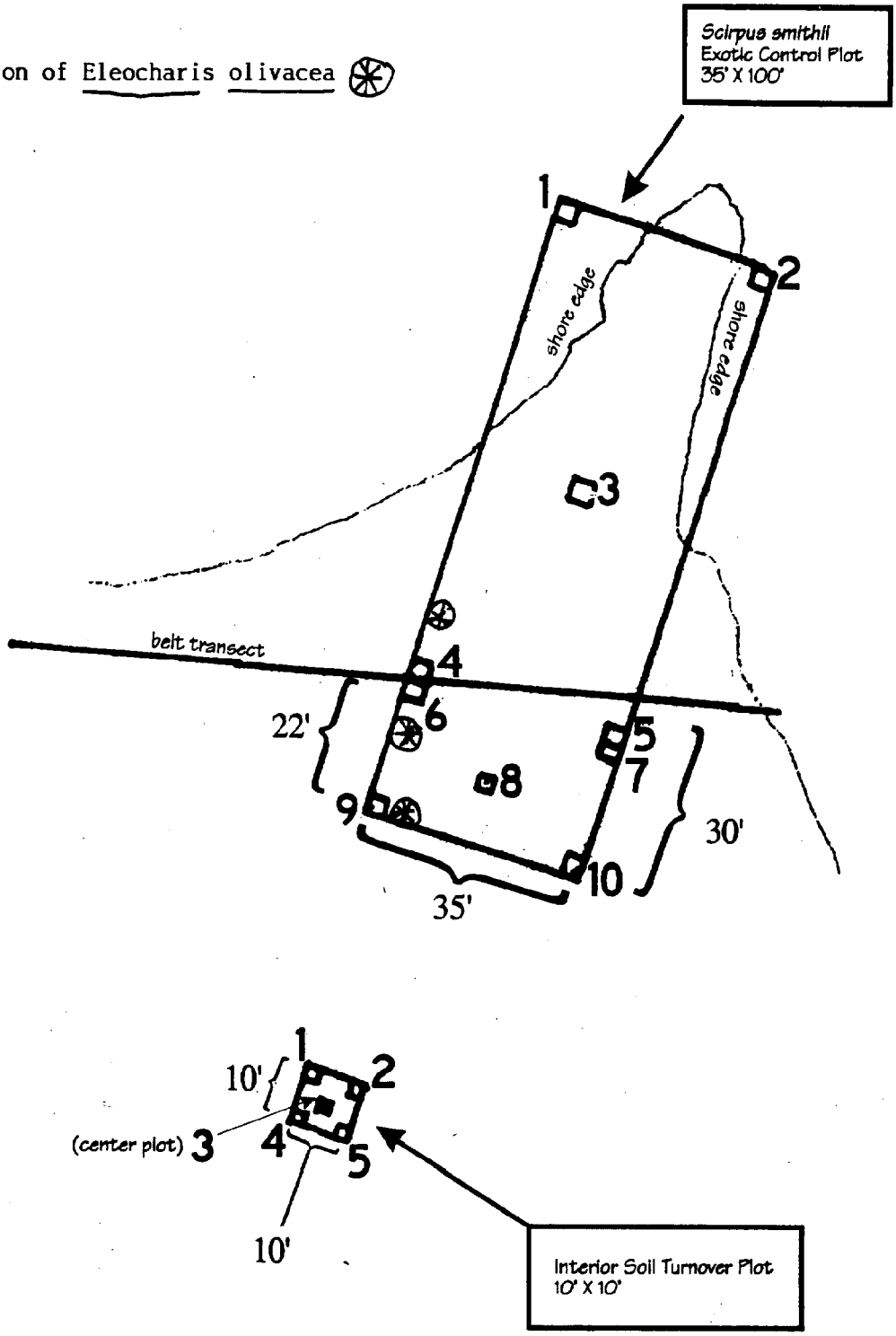
Distribution of Eleocharis olivacea ⊛



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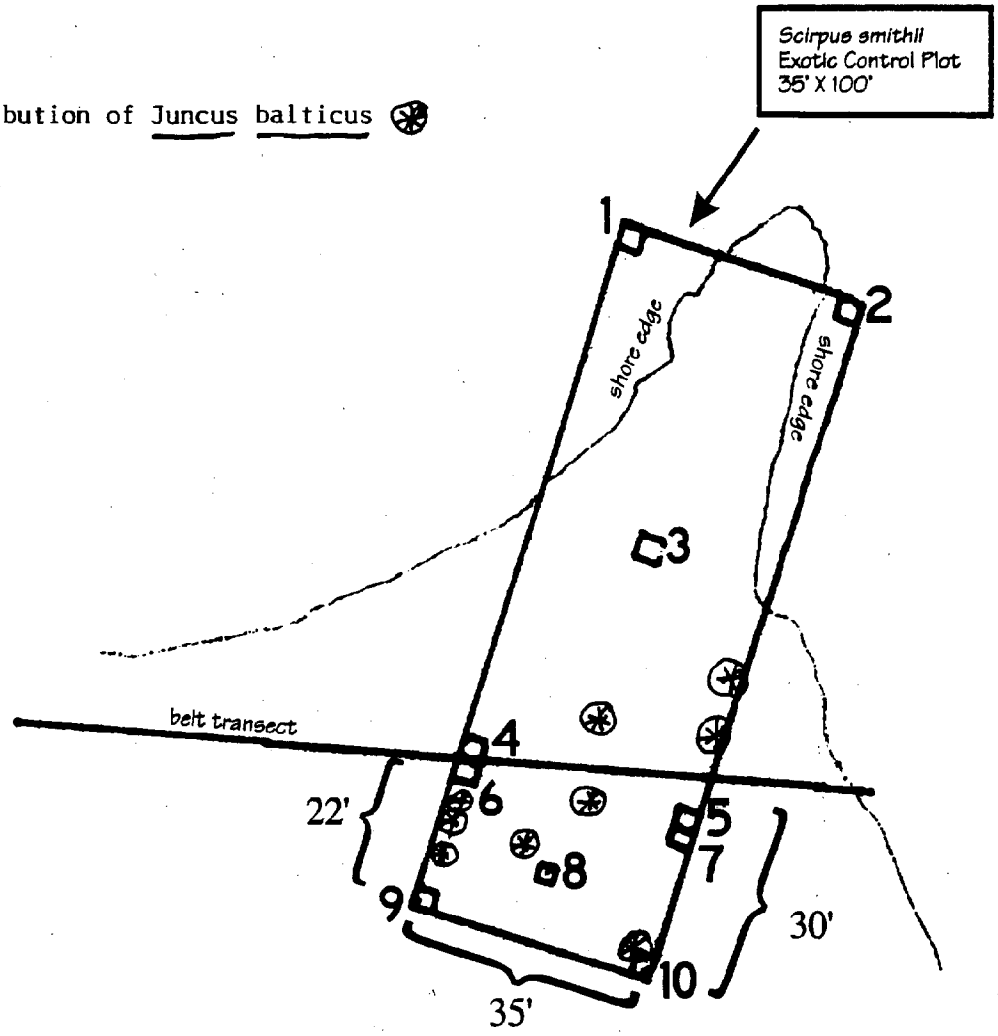
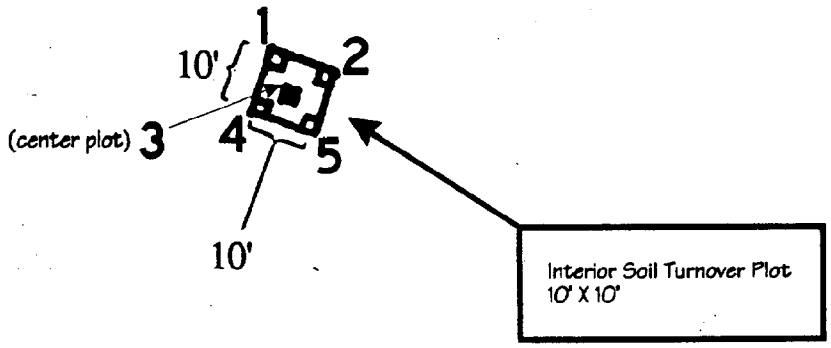
Distribution of Juncus balticus ⊛





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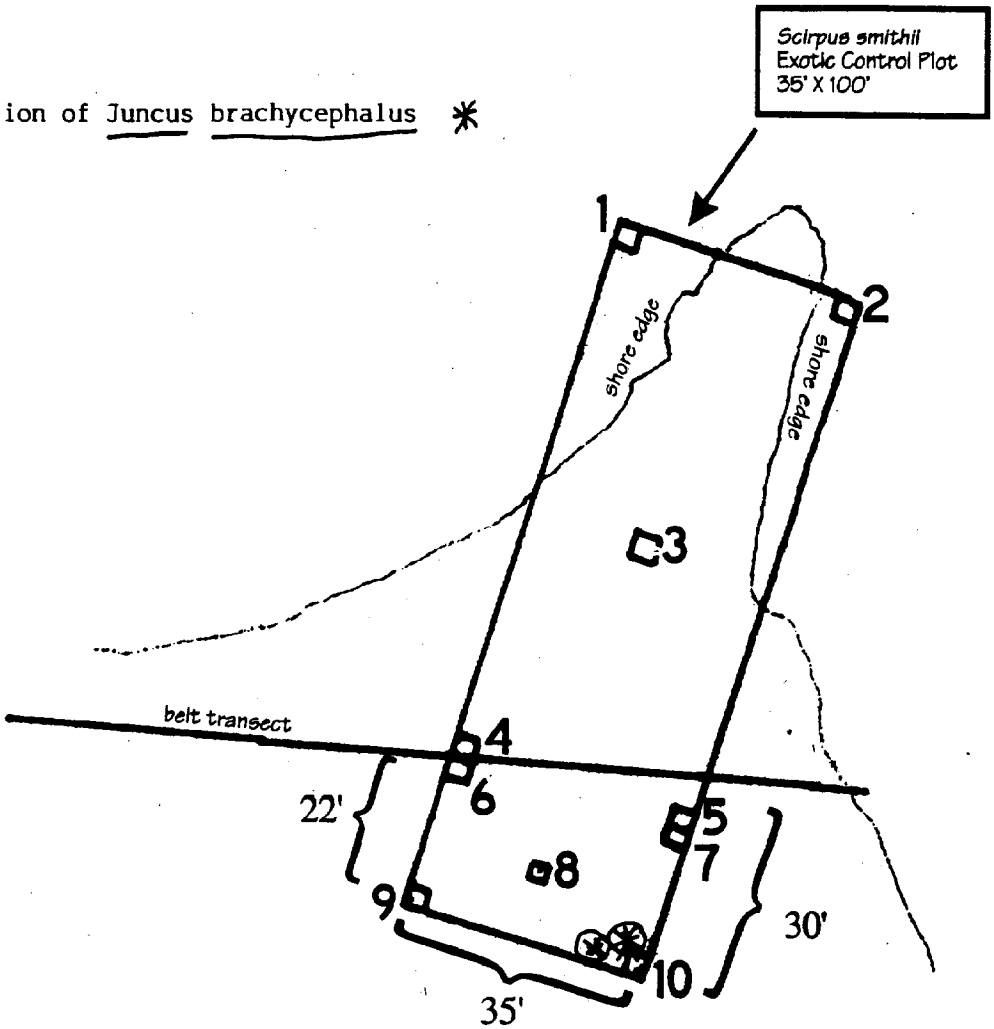
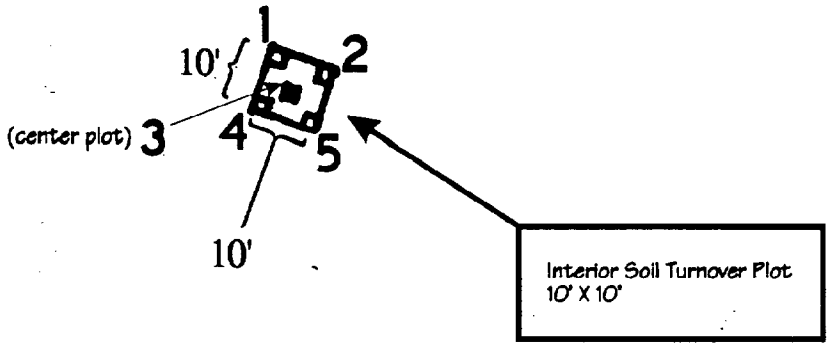
Distribution of Juncus brachycephalus *





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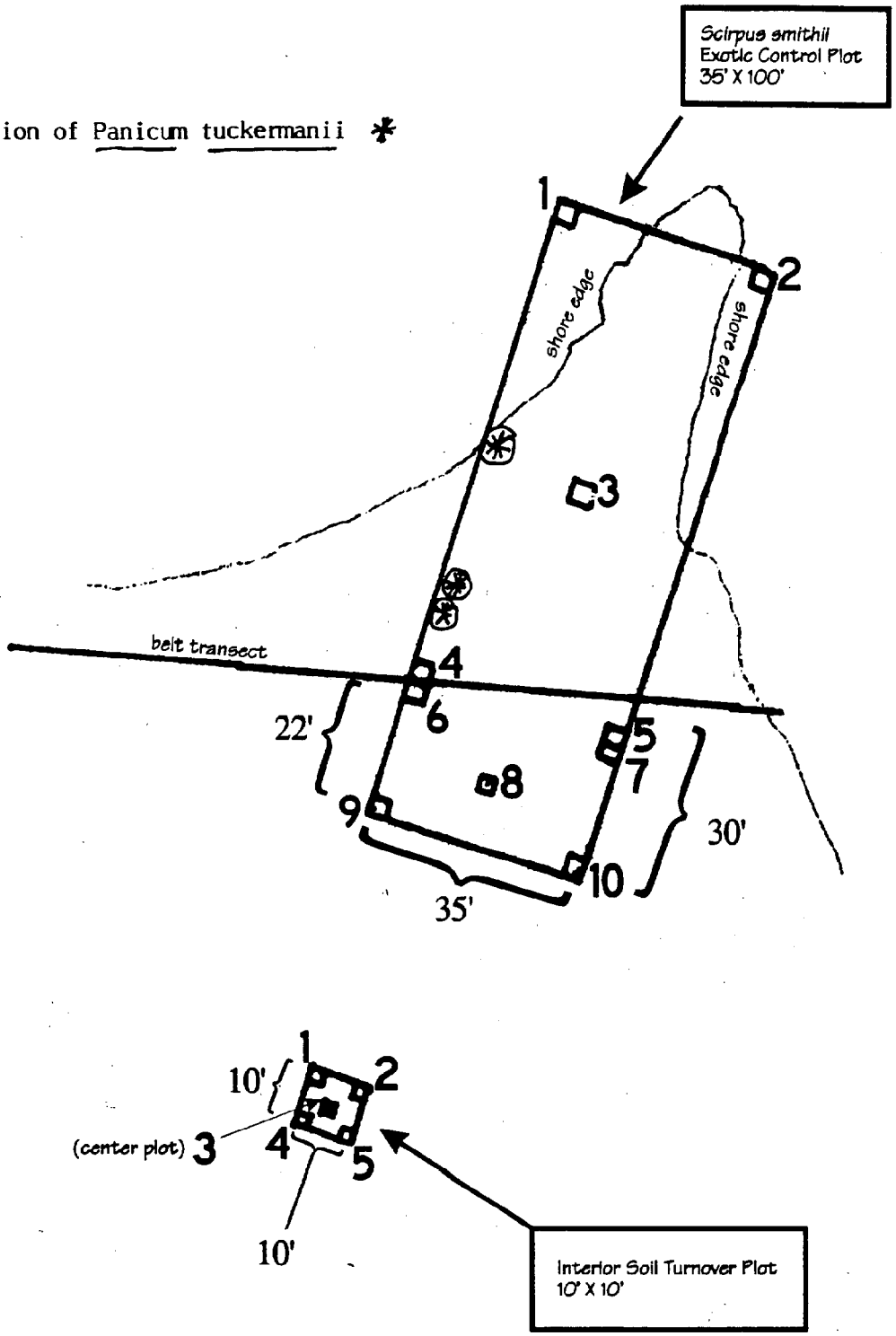
Distribution of Panicum tuckermanii *



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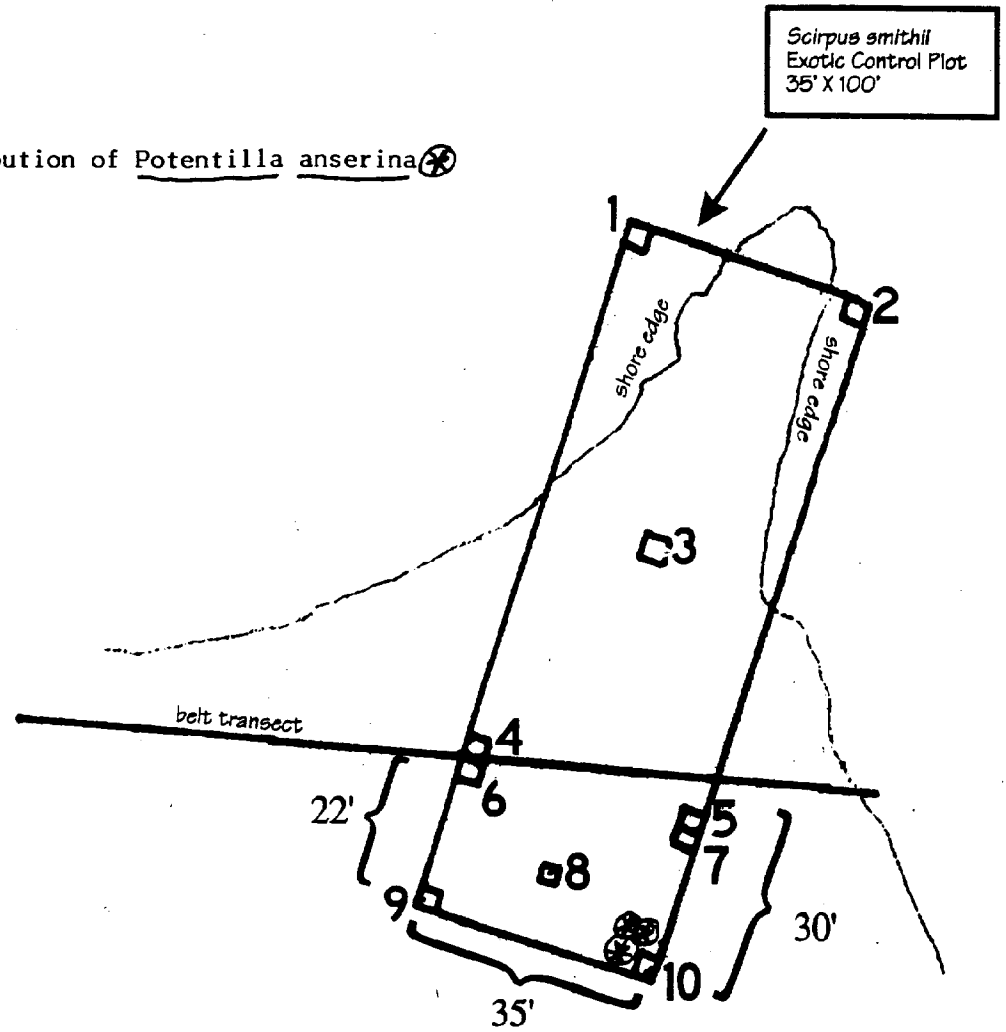
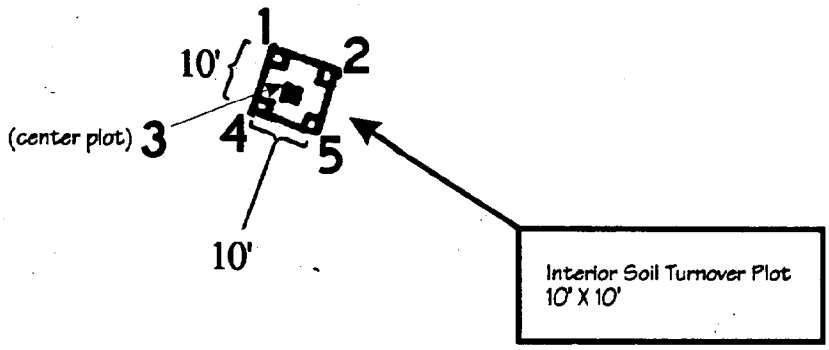
24.

Distribution of Potentilla anserina ⊛





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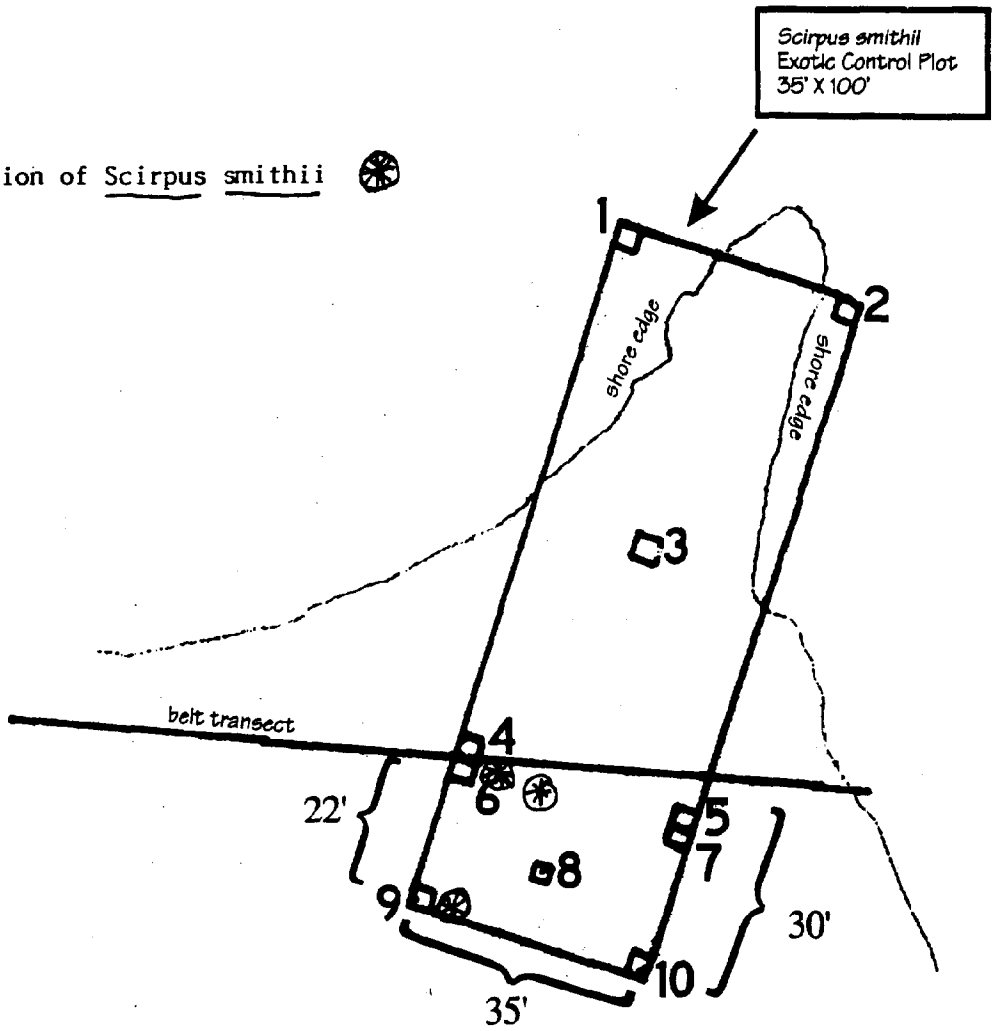
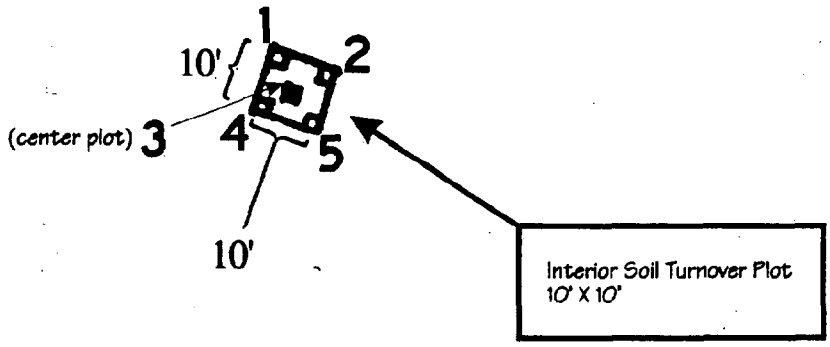
Distribution of Scirpus smithii ⊛





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Scirpus Smithii Belt Transect

by Heather M. Chirdon, Matthew H. Collier,
Claudia Eggers and Stephen R. Meyers

August 1993

INTRODUCTION

Purple loosestrife (Lythrum salicaria) is an invasive plant that takes over wetlands, choking out all native vegetation. Though it has been present on Presque Isle for a number of years, until recently, its impact has been minimal. In the area studied the *Lythrum* is spreading and its detrimental effects are of concern to Presque Isle State Park and the Cleveland Museum of Natural History. The purpose of this study is to establish baseline data in an area containing the invasive *Lythrum*. It is hoped that this study will aid in understanding the effects of *Lythrum* upon native plant communities, both before and after its removal.

METHODS

A belt transect was used to sample an area which had been previously eradicated of *Lythrum*. The transect was 40 meters in length, beginning and ending in areas of open water. Wooden stakes were placed one meter apart at each end and two lengths of string, each 40 meters long, were tied to them. The transect was divided into forty 1 meter squares. All plants in each square meter were identified and "percent coverage" was estimated.

RESULTS

Table 1: Percent Coverage and Plant Species Found in Transect

	Species	% Cover
1.	*Scirpus tabernaemontani*	100%
2.	*Lythrum salicaria*	25%
	Typha x galuca	10%
	Scirpus americanus	2%
	Scripus tabernaemontani	63%
3.	*Scirpus tabernaemontani*	47%
	Lythrum salicaria	30%
	Typha x glauca	10%
	Solanum dulcamara	5%
	Scirpus americanus	5%
	Lycopus virginicus	2%
	Salix exigua var. interior	1%
4.	*Scirpus tabernaemontani*	7%
	Lythrum salicaria	30%
	Sailx exigua var. interior	1%
	Nymphaea odorata	1%
	Scirpus americanus	20%
	Typha x glauca	40%
	Calamagrostis spp.	1%
5.	*Lycopus virginicus*	40%
	Scirpus americanus	10%
	Epilobium hirsutum	10%
	Scirpus tabernaemontani	5%
	Calamagrostis spp.	5%
	Leersia oryzoides	5%
	Typha x glauca	5%
	Lythrum salicaria	20%
6.	*Scirpus americanus*	20%
	Lycopus virginicus	50%
	Lythrum salicaria	5%
	Calamagrostis spp.	20%
	Leersia oryzoides	5%
7.	*Scirpus americanus*	100%
8.	*Scirpus americanus*	92%
	Typha x glauca	4%
	Calamagrostis spp.	3%
	Lythrum salicaria	1%
	Juncus balticus	1%

9.	*Scirpus americanus*	20%
	Scirpus tabernaemontani	7%
	Typha x glauca	5%
	Carex aquatilis	30%
	Juncus balticus	3%
	Sparganium eurycarpum	35%
10.	*Sparganium eurycarpum*	30%
	Carex aquatilis	25%
	Scirpus tabernaemontani	5%
	Scirpus americanus	10%
	Juncus balticus	3%
	Juncus brachycephalus	5%
	Carex spp.	1%
	Sagittaria latifolia	5%
	Nymphaea odorata	1%
	Lythrum salicaria	15%
11.	*Scirpus americanus*	15%
	Scirpus tabernaemontani	3%
	Sparganium eurycarpum	50%
	Juncus balticus	10%
	Juncus brachycephalus	5%
	Juncus nodosus	1%
	Carex aquatilis	10%
	Lythrum salicaria	5%
	Eleocharis smallii	1%
12.	*Sagittaria latifolia*	10%
	Sparganium eurycarpum	75%
	Lythrum salicaria	5%
	Scirpus americanus	10%
13.	*Sparganium eurycarpum*	70%
	Scirpus americanus	20%
	Alisma triviale	10%
14.	*Sparganium eurycarpum*	75%
	Lythrum salicaria	5%
	Calamagrostis spp.	10%
	Eleocharis smallii	10%
15.	*Nymphaea odorata*	32%
	Scirpus americanus	5%
	Salix exigua var. interior	5%
	Sagittaria latifolia	5%
	Sparganium eurycarpum	43%
	Lythrum salicaria	5%
	Eleocharis smallii	5%

16.	*Sparganium eurycarpum*	20%
	Scirpus americanus	25%
	Pontederia cordata	30%
	Nymphaea odorata	15%
	Carex aquatilis	5%
	Sagittaria latifolia	5%
17.	*Butomus umbellatus*	5%
	Sagittaria latifolia	30%
	Pontederia cordata	35%
	Nymphaea odorata	2%
	Scirpus americanus	2%
	Sparganium eurycarpum	25%
	Lythrum salicaria	1%
18.	*Pontederia cordata*	70%
	Sparganium eurycarpum	24%
	Sagittaria latifolia	5%
	Scirpus americanus	1%
19.	*Sparganium eurycarpum*	35%
	Pontederia cordata	60%
	Sagittaria latifolia	5%
20.	*Pontederia cordata*	35%
	Sagittaria latifolia	5%
	Sparganium eurycarpum	35%
	Nymphaea odorata	25%
21.	*Pontederia cordata*	25%
	Sagittaria latifolia	5%
	Sparganium eurycarpum	65%
	Nymphaea odorata	5%
22.	*Pontederia cordata*	14%
	Sagittaria latifolia	25%
	Sparganium eurycarpum	60%
	Nymphaea odorata	1%
23.	*Sparganium eurycarpum*	75%
	Sagittaria latifolia	15%
	Pontederia cordata	10%
24.	*Scirpus taberneamontani*	10%
	Sparganium eurycarpum	70%
	Sagittaria latifolia	10%
	Nymphaea odorata	10%
25.	*Sparganium eurycarpum*	70%
	Scirpus tabernaemontani	15%
	Sagittaria latifolia	14%
	Pontederia cordata	1%

26.	*Sparganium eurycarpum*	60%
	Pontederia cordata	9%
	Sagittaria latifolia	20%
	Scirpus tabernaemontani	10%
	Nymphaea odorata	1%
27.	*Sagittaria latifolia*	10%
	Scirpus americanus	5%
	Sparganium eurycarpum	80%
	Scirpus tabernaemontani	5%
28.	*Sparganium eurycarpum*	70%
	Sagittaria latifolia	15%
	Scirpus tabernaemontani	15%
29.	*Sparganium eurycarpum*	70%
	Sagittaria latifolia	15%
	Scirpus taberneamontani	15%
30.	*Pontederia cordata*	10%
	Sagittaria latifolia	25%
	Sparganium eurycarpum	40%
	Scirpus taberneamontani	25%
31.	*Sparganium eurycarpum*	65%
	Sagittaria latifolia	7%
	Nymphaea ordorata	5%
	Pontederia cordata	3%
	Scirpus tabernaemontani	20%
32.	*Sparganium eurycarpum*	70%
	Pontederia cordata	20%
	Scirpus tabernaemontani	1%
	Scirpus americanus	8%
	Nymphaea odorata	1%
33.	*Sparganium eurycarpum*	85%
	Pontederia cordata	5%
	Sagittaria latifolia	10%
34.	*Pontederia cordata*	5%
	Sparganium eurycarpum	60%
	Sagittaria latifloia	15%
	Scirpus americanus	20%
35.	*Nymphaea odorata*	25%
	Pontederia cordata	50%
	Sparganium eurycarpum	25%
36.	*Nymphaea odorata*	70%
	Sagittaria latifolia	20%
	Sparganium eurycarpum	9%
	Scirpus americanus	1%

37.	*Sparganium eurycarpum*	*70%*
	Nymphaea odorata	*6%*
	Sagittaria latifolia	*4%*
	Scirpus americanus	*20%*
38.	*Pontederia cordata*	*1%*
	Sparganium eurycarpum	*99%*
39.	No vegetation	
40.	No vegetation	

DISCUSSION

After the data was collected, Lythrum salicaria was cleared from an area approximately 35 meters by 25 meters. Entire plants were removed, in an attempt to minimize possible resurgence of the loosestrife. This area will continue to be monitored to determine the success of this project.

ACKNOWLEDGMENTS

Special thanks to Jim Bissell for identifying unknown plants and getting us started on the project.

Percentage Cover
of
Five 3 by 3 foot Quadrats
within
Interior 10 by 10 foot
Soil Turnover Plot
14 May 1993

Plot #1 (Northwestern corner of turnover plot)

Calamagrostis canadensis	30%
Epilobium hirsutum	10%
Lythrum salicaria	30%

Plot #2 (Northeastern corner of turnover plot)

Calamagrostis canadensis	20%
Carex stricta	2%
Epilobium hirsutum	5%
Lythrum salicaria	25%

Plot #3 (Center of turnover plot)

Calamagrostis canadensis	60%
Epilobium hirsutum	5%
Lythrum salicaria	20%

Plot #4 (Southwest corner of turnover plot)

Calamagrostis canadensis	20%
Epilobium hirsutum	5%
Lythrum salicaria	30%

Plot #5 (Southeast corner of turnover plot)

Calamagrostis canadensis	25%
Carex stricta	3%
Lythrum salicaria	30%

PERCENTAGE COVER
of
FIVE
3 by 3 foot Quadrats
within
10 by 10 Foot
Interior Soil Turnover Plot
September 27, 1993

Plot #1 (Northwest corner of Turnover Plot)

Alisma subcordatum	2%
Bidens cernua	1%
Calamagrostis canadensis	6%
Convolvulus sepium	1%
Cyperus strigosus	3%
Lythrum salicaria	1%
Polygonum amphibium stipulaceum	2%
Polygonum punctatum	1%

Plot #2 (Northeast corner of Turnover Plot)

Calamagrostis canadensis	5%
Convolvulus sepium	3%
Cyperus poeformis	2%
Galium tinctorium	2%
Lythrum salicaria	3%
Ludwigia palustris	2%
Rorippa islandica	2%

Plot #3 (Center of Turnover Plot)

Cyperus odoratus	2%
Cyperus strigosus	3%
Galium tinctorium	2%
Juncus tenuis uniflorus	10%
Lindernia dubia	2%
Lythrum salicaria	2%
Mimulus alatus* (seedlings)	8%
Polygonum amphibium stipulaceum	2%
Ranunculus scleratus*	2%
Rorippa islandica	2%
Sparganium eurycarpum	2%
Verbena hastata*	2%

Plot #4 (Southwest corner of Turnover Plot)

Cardamine pennsylvanica	2%
Convolvulus sepium	3%
Cyperus odoratus*	2%
Eupatorium perfoliatum	10%
Lythrum salicaria	2%

Turnover Plot (continued)
September 27, 1993

Mimulus alatus*	3%
Ranunculus scleratus*	3%

Plot #5 (Southeast Corner of Turnover Plot)

Carex stricta	20%
Convolvulus sepium	2%
Cyperus odoratus*	2%
Eupatorium perfoliatum	2%
Leersia oryzoides	2%
Ludwigia palustris	10%
Mimulus alatus*	15%
Polygonum amphibium stipulaceum	1%
Polygonum punctatum	3%

Composition of ground-cover in 10' X 10' areas in the habitat of hairy puccoon on Presque Isle (S side of PA 832 east of the lighthouse) on 29 June 1993.

	Percentage of Total Ground-Cover									
Taxon	1	1a	2	2a	3	3a	4	4a	5	5a
Bryophyta - Musci					1	4				
Equisetaceae										
Equisetum laevigatum			1							
Graminae										
Agropyron repens										2
Bromus tectorum						1				
Calamagrostis canadensis	40	25					4			
Dactylis glomerata					30	15				
Panicum virgatum				3		<1				
Poa compressa					30	5	2	7	1	2
Poa pratensis	1		10	5		5	2	5	1	4
Sorghastrum natans			30	1	2		<1		1	3
Cyperaceae										
Carex Muhlenbergii			4							
Myricaceae										
Myrica pensylvanica		<1					<1	2	3	
Polygonaceae										
Rumex acetosella	20			35	40	5	4	3	<1	
Caryophyllaceae										
Lychnis alba	3									
Scleranthus annuus						1				
Saponaria officinalis		<1								
Stellaria media						<1				
Rosaceae										
Potentilla argentea					<1					
Potentilla recta					<1					
Rubus (flagellaris)?	90	90	80	50			85	95	65	60
Leguminosae										
Trifolium dubium					4					
Oxalidaceae										
Oxalis sp.					1					
Euphorbiaceae										
Euphorbia cyparissias									50	30
Anacardiaceae										
Toxicodendron radicans	1	10	20	10			1	2	7	6
Guttiferae										
Hypericum perforatum				2						
Asclepiadaceae										
Asclepias syriaca		1								<1
Convolvulaceae										
Convolvulus arvensis	1				<1					
Scrophulariaceae										
Verbascum thapsus	5									
Plantaginaceae										
Plantago lanceolata				5	30	15				
Caprifoliaceae										
Lonicera Morrowi	1	2	1	1			<1	1		
Compositae										
Achillea millefolium	5									
Centaurea maculosa				20		2				
Erigeron annuus					1	10				
Taraxacum officinale					<1	<1				
Tragopogon pratensis					<1					

Effects of mowing and soil turn-over on vegetation communities in the habitat of hairy puccoon (Lithospermum caroliniense) at Presque Isle.

Experimental Design

Five pairs of 10' X 10' squares of habitat (adjacent to living puccoon plants) were marked on 29 June 1993 and the composition of ground-cover plant communities was determined.

All ten squares were mowed to within 4" of the ground on 9 July 1993.

The eastern-most square of each pair was rototilled to turn over the soil to an average depth of 3" on 15 July 1993.

On the attached data table, the squares are numbered as they occurred from the east to west. Squares 1-5 were both mowed and rototilled. Squares 1a-5a were only mowed.

PRESQUE ISLE PUCCOON SITE SURVEY
September 8, 1993

Composition of ground cover in 10' x 10' areas in the habitat of hairy puccoon on Presque Isle (S side of PA 832 east of the lighthouse) on September 8, 1993. Squares are numbered from east to west. Squares 1-5 were both mowed and roto-tilled and squares 1a-5a were mowed only. Percentage data for areas where *Lonicera morrowi* was removed in 1991 follow the five sets of quadrat data.

SURVEY SITES:

#1 Turned-over

Bare ground	90%
Calamagrostis canadensis	10%
Saponaria officinalis	5%
Rubus flagellaris	4%
Rumex acetocella	4%
Achillea millefolia	2%
Setaria viridis	2%
Solanum carolinense	1%
Asclepias syriaca	1%
Digitaria sanguinalis	1%
Toxicodendron radicans	1%
Oxalis stricta	<1%
Rosa multiflora	<1%
Cyperus schweinitzii	<1%
Panicum capillare	<1%
Phytolacca americana	<1%

#1a Mowed

Bare ground	
Calamagrostis canadensis	10%
Rubus flagellaris	5%
Lonicera morrowi (seedlings)	5%
Sorghastrum natans	1%
Toxicodendron radicans	1%

#2 turned-over

Bare ground	70%
Panicum virgatum	4%
Rubus flagellaris	2%
Solanum carolinense	2%
Toxicodendron radicans	1%
Carex rugosperma	<1%
Equisetum laevigatum	<1%
Schizachyrium scoparium var. *littorale*	1 seedling in middle

#2a mowed

Bare ground	10%
Sporobolus cryptandrus	4%
Plantago lanceolata	2%
Sorghastrum nutans	2%
Panicum virgatum	2%
Rumex acetocella	(many seedlings)
Oxalis stricta	<1%
Rubus flabellaris	5%
Centaurea maculata	3%
Schizachyrium scoparium var. littoralis	1%
Oenothera biennis	1%
Poa compressa	4%

3 turned-over

Bare ground	45'
Carpetweed Mollugo verticillata	10%
Digitaria sanguinalis	3%
Dactylis glomerata	3%
Plantago lanceolata	3%
Taraxacum officinale	2%
Calamagrostis canadensis	1%
Sporobolus cryptandrus	1% (6 plants)
Oxalis stricta	<1%
Conyza canadensis	<1%
Panicum digitaria	?
Portulaca oleracea	?

#3a mowed

Bare ground	30%
Sporobolus cryptandrus	4%
Conyza canadensis	4%
Dactylis glomerata	3%
Panicum virgatum	2%
Plantago lanceolata	2%
Schizachyrium scoparium var. littorale	2%
Centaurea maculata	1%
Taraxacum officinale	1%
Rumex acetocella	1%
Digitaria sanguinalis	1%
Oxalis stricta	<1%
Euphorbia maculata	<1%

4 turned-over

Bare ground	50%
Rubus flagellaris	4%
Rumex acetosella	3%
Calamagrostis canadensis	2%
Cyperus filiculmis	<1%

4a mowed

Rubus flagellaris	80%
Lonicera morrowi	4%
Rumex acetosella	4%
Bare ground	2%
grass	2%
Panicum commonsianum	1% (2 plants)
Cyperus filiculmis	1%
Prunus serotina	<1%
Myrica pensylvanica	<1%

5 turned-over

Bare ground	90%
Rubus flagellaris	3%
Euphorbia cyparissias	2%
Digitaria sanguinalis	1%
Sporobolus cryptandrus	1%
Mollugo verticillata	1%
Panicum virgatum	<1%
Portulaca oleracea	<1%

5a mowed

Rubus flagellaris	25%
Panicum virgatum	10%
Euphorbia cyparissias	5%
Sporobolus cryptandrus	2.3?
Bare ground	<1%
Ambrosia ~~peilostachya~~ artemisiifolia	(one plant)
Cyperus schweinitzii	(one depauperate plant)

Eastern Lonicera morrowi "pull out site"

35 'E-W x 25' N-S area cleared by park in 1991. Exotic plants hand weeded out by JKB and volunteers in early 1993.

Bare ground	40%	
Calamagrostis canadensis	5%	
Cyperus schweinitzii	5%	50 - 100 plants
Rumex acetocella	4%	
Conyza canadensis	3-4%	
Sporobolus cryptandrus	3%	20 plants
Carex blanda	3%	
Rubus occidentalis	3%	
Plantago lanceolata	2%	
Euphorbia maculata	2%	
Ambrosia artemisiifolia	2%	
Oxalis stricta	2%	
Panicum virgatum	2%	
Poa compressa	2%	
Euphorbia maculata	2%	
Asclepias syriaca	1%	
Digitaria sanguinalis	1%	
Gnaphalium obtusifolium	1%	
Oenothera biennis	1%	
Setaria viridis	1%	
Solanum carolinense	1%	
Sorghastrum nutans	1%	
Rubus flagellaris	<1%	
Euphorbia cyparissias	<1%	
Physalis heterophylla	<1%	
Rhus typhina	<1%	
Verbena hastata	<1%	

15' X 15'

Western Lonicera morrowi pull-out (shaded) - located at western end of study area

Cyperus filiculmis	5%	
Rubus flagellaris	3%	
Poa compressa	3%	
Panicum commonsianum	2%	(4 plants)
Carex rugosperma	2%	
Cyperus schweinitzii	1%	(4 plants)
Lonicera morrowi	1%	(seedlings)
Carex blanda	1%	
Physalis heterophylla	<1%	
Sporobolus cryptandrus	<1%	(1 plant)
Verbascum thapsus	?%	

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