

**ACADIA NATIONAL PARK
PURPLE LOOSESTRIFE CONTROL PROGRAM
1991 SUMMARY REPORT**

by

Karen B. Anderson

and

Judith Hazen Connery

1992

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INTRODUCTION

Purple loosestrife (Lythrum salicaria) is an herbaceous perennial, introduced from Eurasia before 1814 (Louis-Marie, 1944). While its striking displays of color have made it a favorite of gardeners, its highly invasive nature has seriously impacted wetland communities throughout the United States. Fernald (1940) first noted that purple loosestrife was displacing native vegetation, which later caused concern that important wildlife food plants such as cattail would decline (McKeon, 1959; Smith, 1959; Smith, 1964; Novak, 1968). Loosestrife encroachment has now been recognized as a cause for decline in wetland quality (Malecki and Rawinski, 1979; U.S. Fish and Wildlife Service, 1979; Rawinski and Malecki, 1984; Thompson et al, 1987).

Rawinski and Malecki (1984) have noted that serious ecological consequences appear to result from purple loosestrife invasion in marshes. In their study, loss of open water and mudflats reduced feeding areas for shorebirds and waterfowl. Muskrats and long-billed marsh wrens used cattail stands rather than loosestrife, although red-winged blackbirds appeared to prefer loosestrife for nesting sites.

While some native animals have been shown to benefit from loosestrife, these are primarily species with broad niches that can exist in a variety of communities. Animals that lose their habitat to loosestrife invasion are species with narrow niches that rely on cattails and other outcompeted graminoid plants.

The National Park Service has been directed by Congress to maintain native functioning ecosystems. National Park Service Management Policies (1988) specifically addresses the issue of management of exotic species already present in the park:

"Management of populations of exotic plant and animal species, up to and including eradication, will be undertaken wherever such species threaten park resources or public health and when control is prudent and feasible."

As a result, a purple loosestrife management program was developed and implemented at Acadia National Park (ACAD) in 1988. Its primary components include:

- A. Survey of wetlands for the presence of purple loosestrife
- B. Quantitative monitoring of existing populations
- C. Chemical suppression of known populations
- D. Public education
 1. Local media
 2. Park employees and visitors
 3. Local nursery owners and managers

SUMMARY OF HISTORICAL MANAGEMENT AT ACADIA

The first record we have found of Lythrum salicaria on Mount Desert Island is in a 1928 list of plants of Mount Desert Island (Wherry, 1928). However, populations remained at relatively low levels in a handful of wetlands since that time, perhaps due to a lack of disturbance coupled with heavy competition from native vegetation. Mechanical removal of beaver dams and lodges in the Bear Brook watershed in the late 1970's and early 1980's seems to have resulted in proliferation of purple loosestrife in this location.

In 1984, Biological Technician Norman Fletcher established six permanent, one square meter (1 m²) plots in the Bear Brook Pond watershed to monitor changes in the population of purple loosestrife. Unfortunately, the location of these plots was poorly documented and water levels changed due to beaver activity, submerging some plots. In 1987, only two plots could be relocated.

From 1984 to 1987 flowering stems in the Bear Brook and other watersheds were either pulled or cut, collected, and burned to prevent additional seed production.

McInnes (1986) identified two locations with purple loosestrife within the Park (Bear Brook and Visitor Center/Hulls Cove House wetland) and listed loosestrife as one of twelve exotic species of management concern (McInnes, 1986). An even more thorough survey for exotic plants was completed the following year and identified four additional sites (Compass Harbor, the south end of the Tarn, Breakneck Brook/Paradise Hill carriage road access beaver pond, pond south of Old Farm Road) containing purple loosestrife within Park boundaries (Smith, 1987).

In 1989, seven permanent study grids were set up to monitor changes in purple loosestrife populations and a sampling protocol was established (Hazen and Anderson, 1990).

Purple loosestrife is currently found in six wetlands within the Park (see Appendix A). Additionally, loosestrife is located on private lands adjacent to park wetlands. The most notable of these populations exist on property adjacent to Bear Brook.

1991 MONITORING EFFORT

Methodology

We counted stems in the seven permanent study grids established in 1989. Methodology is given in the 1989 Purple Loosestrife Report (Hazen and Anderson, 1990). For locations of the grids see Appendix B.

Transect Monitoring Results

Stem counts were made at all seven grids this year between July 15 and July 19. Results are listed in Appendix C. Fifty (50) personnel hours were spent counting stems in the monitoring grids this year.

Kruskall-Wallis Tests were performed on the data by transect and between years 1989, 1990, and 1991 to determine if the spray program was having a significant effect on purple loosestrife stem counts. We used $p < 0.1$ as our level of significance because the stem counts could only change in one direction due to our spraying (ie. decrease). For the transects which showed significance, we then applied the Mann-Whitney U Tests pairwise between years to determine where the significance lay (see table below).

TABLE 1. Probability values for statistical tests performed on purple loosestrife transect monitoring data 1989-1991 (only transects with significant differences are shown). "----" means that p value was not significant; "*" means that p was also significant at the < 0.05 level.

Grid	Transect	Description	3-Year Kruskal Wallace	Pairwise Mann-Whitney U Tests		
				1989&90	1990&91	1989&91
1	3	Non-reproductive	---	0.073	---	---
5	5	Non-reproductive	0.082	0.078	0.071	---
5	5	Total stems	---	0.096	---	---
6	2	Total stems	0.045 *	---	0.039 *	0.008 *
6	3	Total stems	0.092 *	---	---	0.024 *
6	4	Reproductive	0.001 *	0.008 *	---	0.008 *
6	4	Non-reproductive	0.060	---	0.039 *	0.017 *
6	4	Total stems	0.006 *	---	0.039 *	0.002 *
6	5	Non-reproductive	0.062	---	0.014 *	0.071
6	5	Total stems	0.062	---	0.014 *	0.071
7	2	Non-reproductive	---	0.078	---	---

Other Wetland Areas Surveyed

Visual inspections were made at several other wetland areas in addition to the areas that were treated. Thirty-eight (38) personnel hours were spent checking MDI wetlands for purple loosestrife in 1991. The following is a list of the wetlands checked this year:

- Upper Breakneck Pond (southernmost pond)
- Lower Breakneck Pond (northernmost pond)
- wetlands/ditches along the Witch Hole Pond Carriage Trail loop, and Carriage Road access from Eagle Lake Parking Area including Halfmoon Pond.
- The Bowl and halfway down the outflow toward Otter Creek.
- north end of the Tarn
- Canon Brook--from just south of the Tarn south to Route 3.
- Old Farm Road--small pond south of road
- Kent Field/Precipice Marsh
- watershed north of Sand Beach
- beaver impoundments east and west of Rt.3 south of Blackwoods Campground
- Long Pond outflow on Ripple Pond
- part of the west shore of Round Pond
- Echo Lake inflow (south of and adjacent to beach)
- The Reservoir (on Western Mountain Road)
- Marshall Brook at Seal Cove Road
- Heath Brook from Seal Cove Road to the top (west end) of the beaver-impounded swamp
- Hodgden Pond outflow to Seal Cove Pond and a portion of the eastern shore of Hodgden Pond
- Duck Pond on the Long Pond Fire Road

Purple loosestrife was not found at any of these sites except one, so no loosestrife suppression was done. While loosestrife was present at the pond south of the Old Farm Road, no control was instituted because the wetland involved is small, most of the area infested is outside Park boundaries, and the area does not drain into any other wetlands. Systematic inspections should continue to ensure that new infestations of loosestrife do not go untreated.

1991 SUPPRESSION EFFORT

While developing a management strategy we considered treating some areas and leaving other populations untreated as an experimental control, with monitoring to occur in both. However botanists we consulted (C. Greene, Rawinski, pers. comm.) strongly recommended that control in all watersheds be initiated as soon as possible. They felt that the invasive nature of purple loosestrife has already been well established in nearby areas. It was therefore determined that the threshold for initiation of control was the presence of one purple loosestrife plant. The following is a description of our activities this year.

Spraying Preparation

As required by NPS management policies, the North Atlantic Regional Office, Washington Office, and U.S. Department of Agriculture approval was obtained for the use of RODEO herbicide and surfactant prior to application. Jackson Lab again granted permission for us to conduct control measures on the property they own adjacent to Bear Brook.

A memo was sent to park staff in all visitor contact stations to inform them about the purple loosestrife suppression program and to enable them to answer visitor's questions about our activities (see Appendix D).

Personnel involved in 1991 purple loosestrife work were natural resource specialist/integrated pest manager Judy Hazen Connery, seasonal biological technicians Karen Anderson, Bruce Connery, Nancy Howard, and Linda Gregory, V.I.P. Angie Del Vecchio, and Y.C.C. crew members Eden Abbott, Adrianna Bobinchock, Jennifer Dodge, and Loren Hubbard.

All personnel to be involved in field work were given training in the history of the project, rationale for control, identification of purple loosestrife, safety and health issues related to the chemicals used, and proper operation of pressure sprayers prior to initiating survey and suppression efforts. All applications of herbicide were supervised by a Maine Master Pesticide Applicator (J. Hazen Connery) or a Certified Pesticide Applicator (K. Anderson).

A solution of 1% RODEO herbicide (Monsanto Co., St. Louis, MO 63167) and 1/2% aquatic surfactant (Arborchem Products Co., Fort Washington, PA 19034) was mixed in pressure sprayers of 2 gallon capacity that were cleaned and inspected before being filled or re-filled with herbicide. All sprayers were tested prior to each day's spraying. An effort was made to only mix the amount of herbicide necessary for the day's planned spraying. 2 1/2 T RODEO and 1 1/4 T surfactant were mixed per gallon of water.

Spraying Technique

To allow time for the transport of herbicide from leaf surface to plant tissue, no spraying was done if measurable precipitation was expected within 24 hours. Also, to minimize spray drift and further protect non-target plants, no spraying was done when wind speeds exceeded 10 MPH.

RODEO is most effectively applied when the loosestrife plant is putting the maximum amount of energy into growth and flowering, and has not yet begun to senesce. This year spraying was conducted from July 22 through August 30 including some re-spraying. This was within the time frame we had set, but we began all of our efforts this year a bit earlier since dry, warm weather conditions promoted early growth and flowering. Some plants were in flower during counting and control, but they were generally not as mature this year as last year.

We carried sprayers in backpacks, and carefully applied the RODEO mixture to individual loosestrife plants until the leaves of the plants were wet but not dripping. By carefully adjusting the nozzle spray pattern and by physically isolating the individual loosestrife plants as much as possible, nearby non-target plants were protected from inadvertent spraying without the use of a spray shield. Complete coverage of treatment areas was ensured by dividing large areas into smaller, easily demarcated units and by using flagging to mark spray lines. If more than one person was present, generally all parties walked abreast and then turned as a unit at the end of the line. When time allowed, the effectiveness of the spraying was checked; in cases where spraying had not been effective or in cases where plants were missed, areas were re-sprayed.

Public Education

A memo from the Integrated Pest Manager was sent to the staff of all public contact stations in the Park giving details of the loosestrife control program so that Park personnel could provide information and answer questions (see Appendix D).

Reporting

Total herbicide use was reported to the NPS North Atlantic Regional Office and to the Maine State Board of Pesticide Control as required.

OTHER OBSERVATIONS

During control efforts in 1990 we noticed a caterpillar eating purple loosestrife leaves. We observed these caterpillars on 6-7 different plants, and the plants each had lost at least one leaf. We collected one caterpillar which entered its pupal stage before it was identified. The pupal case and the resulting moth were sent to the Entomology Lab of the Maine Forest Service, who forwarded the specimen to Tony Roberts, a lepidopterist (RFD 1, Box 71A, Steuben, ME). Mr. Roberts identified it as Acronicta obliqua (Noctuidae:Aconictinae), and sent us a food list of this organism which made it clear that it was a generalist in its feeding habits, partial to Polygonum. (see N50 Pest and Weed Control 1991 file for more complete information). We did not observe these caterpillars in 1991.

The dry weather conditions this summer were favorable to aphids. In the Visitor's Center/Hulls Cove House wetland we noticed heavy infestations on two or three mature loosestrife plants that were severe enough to inhibit flowering or cause severe wilting.

SUMMARY OF CONTROL EFFORT BY AREA

BEAR BROOK WATERSHED

Treatment Dates: Around Pond -July 25
August 13 (re-spray)

North of Park Loop Road -August 1
August 7
August 8 (re-spray)
August 13 (re-spray)

Date Re-Checked: August 7

Approximate Personnel Hours: 102.3

Gallons of RODEO Mixture Applied: 11.25

Acreage Treated:	Pond(south of PLR)	19.13 acres (7.73 ha)
	North of PLR	10.48 acres (4.23 ha)

		29.61 acres (11.96 ha)

Loosestrife Population:

-around Pond--only a few plants except for localized dense populations to the west and southwest in and around small beaver impoundments along inlet streams.

-north of Park Loop Road--many plants in wetland finger which runs west parallel to the Park Loop Road and in lightly forested area behind that. A lot of loosestrife was found west of the brook on Jackson Lab's property. Many plants in "tree-kill" area just south of Schooner Head Road.

Effect of Treatment: There was a light rain in the evening of our first day of control at Bear Brook, and many of the plants sprayed that day were unaffected, necessitating re-spraying. As usual, generally older plants were affected more than younger. Of note: despite an increase in the number of personnel hours expended, we used less herbicide this year at Bear Brook.

Prospects for Control: Permission was again granted this year to control on Jackson Lab's part of the wetland. Because we can treat the whole affected, we have a better chance of reducing the impact of the loosestrife population. However, due to the large area involved and the amount of disturbance still occurring due to beaver, it is unlikely that we could ever eradicate this population.

BEAR BROOK WATERSHED SUMMARY

Location	1988 ¹	1989 ²	1990 ³	1991
Personnel Hours	N/A	67.5	68.75	102.3
Gallons Applied	34.5	18.9375	24.4	11.25
Population	Upper drainage: dense population of small & large plants. Lower drainage: less dense population of mostly small plants.	well established throughout; few flowering stems around the Pond.	well established throughout.	well established throughout
Effect of Treatment	large plants and half of the small plants withered; plants sprayed 9/22 appear unaffected.	older plants succumbed more readily than young; many plants missed the first time; one plant may have resprouted after foliage killed by herbicide.	older plants succumbed more readily than young; effectiveness may be variable on the same plant.	older plants succumbed more readily than young.

¹Willey, 1988

²Hazen and Anderson, 1990

³Connery and Anderson, 1991

THE TARN

Treatment Dates: August 2

Date Re-Checked: not rechecked

Approximate Personnel Hours: 18.0

Gallons of RODEO Mixture Applied: 1.25

Acreage Treated: 2.96 acres (1.20 ha)

Loosestrife Population: The wetland south of and immediately adjacent to the Tarn contains a scattered population of both young and old plants. There is an small muddy area near the east side of the monitoring transects which had a large number of seedling plants this year (as well as last), perhaps due to a slight shift in water levels.

Effect of Treatment: Flower heads were removed from plants near the edge of the pond to reduce the chance of water-spread propagules.

Prospects for Control: Continued control effort in this area might eventually lead to eradication. Control at the Tarn should remain a priority due to the extensive wetlands, both north and south, to which it is hydrologically connected.

THE TARN SUMMARY

Location	1988 ¹	1989 ²	1990 ³	1991
Personnel Hours	N/A	5.0	17.0	18.0
Gallons Applied	N/A	1.75	1.8	1.25
Population	South shore: scattered pop'n of small & large plants. North shore: no loosestrife	South shore: scattered pop'n of small & large plants. North shore: no loosestrife	South shore: scattered pop'n of small & large plants, but one concentration of seedlings on east side. North shore: no plants.	South shore: scattered pop'n of small & large plants, but one concentration of seedlings on east side. North shore: no plants.
Effect of Treatment	N/A	older plants succumbed more readily; most seedlings seemed unaffected; a few plants may have resprouted after herbicide killed foliage.	older plants succumbed more readily; a few immature plants missed or unaffected.	N/A

¹Willey, 1988

²Hazen and Anderson, 1990

³Connery and Anderson, 1991

COMPASS HARBOR

Treatment Dates: July 25
August 13 (re-spray)

Date Re-Checked: August 13

Approximate Personnel Hours: 1.1

Gallons of RODEO Mixture Applied: 0.1

Acreage Treated: N/A

Loosestrife Population: This population of small plants is in an unlikely spot along the east shore of Dorr Point which is not a wetland. Most of the plants are young, but one had a flower head which was removed. There was a light rain the night of 7/25, so this population was re-sprayed.

Prospects for Control: Due to the isolated nature of this small population, prospects appear good that with continued treatment it can be eradicated.

COMPASS HARBOR SUMMARY

Location	1988 ¹	1989 ²	1990 ³	1991
Personnel Hours	N/A	0.5	0.75	1.1
Gallons Applied	<0.1	0.1875	0.1	0.1
Population	scattered pop'n of mostly small plants	small pop'n of mostly small plants	small pop'n of mostly small plants	small pop'n of mostly small plants
Effect of Treatment	plants initially hand-pulled; some later resprouted. After spraying large plants withered while small plants were mostly unaffected.	not re-checked	all were dead except two tiny seedlings and one young plant.	some plants affected. Not checked after re-spray.

¹Willey, 1988

²Hazen and Anderson, 1990

³Connery and Anderson, 1991

VISITOR CENTER/HULLS COVE HOUSE

Treatment Date: July 25
August 29 (re-spray)

Date Re-Checked: August 29

Approximate Personnel Hours: 6.75

Gallons of RODEO Mixture Applied: 2.75

Acreage Treated: 3.26 acres (1.32 ha)

Loosestrife Population: In the open area of this wetland there are very few plants, but an extremely large infestation of tiny seedlings (where the stand of mature, tall, flowering plants was last year) exists back toward the V.C. parking lot (where culvert comes out from under parking lot is one edge of it) in a stand of alders and cattails.

Effect of Treatment: The re-spraying last year really did a good job at eradicating the thick stand of mature plants. This year, however, that area is a carpet of seedlings! There was light rain the night of 7/25, so we re-sprayed this wetland this year, too. The seedlings were showing no ill effect whatsoever.

Prospects for Control: It will take a long time to control the population of plants in this wetland. While most of the mature plants in the alders were killed, the seeds (evidenced by massive seedling growth this year) that must be in this wetland from other years will provide plants for years to come. Luckily, this wetland is not hydrologically connected to any wetlands of significance, and hopefully, the infestation will not spread.

VISITOR CENTER/HULLS COVE HOUSE SUMMARY

Location	1988¹	1989²	1990³	1991
Personnel Hours	N/A	N/A	12.5	6.75
Gallons Applied	1.0	N/A	3.9	2.75
Population	dense population of small & large plants	N/A	in open area, very few plants. Dense pop'n of mostly large plants in alder stand.	in open area, very few plants. Dense pop'n of seedlings in alder stand.
Effect of Treatment	plants initially hand-pulled later resprouted; after spraying, larger plants withered, small plants mostly unaffected.	N/A	mixed results- some live, some die; respraying seems to have helped effectiveness.	most mature plants from last year died. Seedlings appeared unaffected

¹Willey, 1988

²Hazen and Anderson, 1990

³Connery and Anderson, 1991

EAST OF DUCK BROOK ROAD

Treatment Date: N/A

Date Re-Checked: June 27
July 10

Approximate Personnel Hours: 0.30

Gallons of RODEO Mixture Applied: None

Acreage Treated: N/A

Loosestrife Population: None found this year. In the past, two flowering clusters on the outflow dam of this impoundment.

Effect of Treatment: No treatment in 1991.

Prospects for Control: There were no plants found at this location in 1991, but this is perhaps a result of drought conditions this summer. This area should continue to be checked for several years.

EAST OF DUCK BROOK ROAD

Location	1988 ¹	1989 ²	1990 ³	1991
Personnel Hours	N/A	N/A	0.75	N/A
Gallons Applied	N/A	N/A	0.1	N/A
Population	N/A	N/A	two mature plants on the outflow dam of this beaver impoundment	none found
Effect of Treatment	N/A	N/A	flowering heads removed; little effect from the spraying.	N/A

¹Willey, 1988

²Hazen and Anderson, 1990

³Connery and Anderson, 1991

WITCH HOLE POND OUTFLOW

Treatment Date: N/A

Date Re-Checked: July 10

Approximate Personnel Hours: 0.75

Gallons of RODEO Mixture Applied: None

Acreage Treated: N/A

Loosestrife Population: No plant found in 1991, perhaps due to extreme drought conditions. Previously, about 2/3 of the way down the wetland area from the beaver fooler on an old beaver structure was one large loosestrife plant.

Effect of Treatment: No treatment in 1991. Treatment last year seemed to have been effective, but there was evidence of spray drip (some plants around old loosestrife stalk appeared damaged).

Prospects for Control: This year, the population appears controlled, but that may be due to drought conditions. The area should continue to be checked for the next couple of years.

WITCH HOLE POND OUTFLOW SUMMARY

Location	1988 ¹	1989 ²	1990 ³	1991
Personnel Hours	N/A	N/A	1.75	0.75
Gallons Applied	N/A	N/A	0.1	N/A
Population	N/A	N/A	one large plant	none found
Effect of Treatment	N/A	N/A	In 1991, appeared to have been effective.	N/A

¹Willey, 1988

²Hazen and Anderson, 1990

³Connery and Anderson, 1991

BREAKNECK BROOK/PARADISE HILL C.R. ACCESS BEAVER POND

Treatment Date: August 30

Date Re-Checked: N/A

Approximate Personnel Hours: 0.5

Gallons of RODEO Mixture Applied: <0.1

Acreage Treated: N/A

Loosestrife Population: one stem (non-reproductive) was found below the main dam near a fallen log.

Effect of Treatment: not rechecked

Prospects for Control: Good, if there is no seed source upstream.

BREAKNECK BROOK BEAVER POND

Location	1988 ¹	1989 ²	1990 ³	1991
Personnel Hours	N/A	N/A	0.75	0.5
Gallons Used	<0.1	N/A	0.1	<0.1
Population	one large plant	N/A	one non-reproductive plant (two stems)	one non-reproductive plant
Effect of Treatment	plant withered	N/A	not rechecked	N/A

¹Willey, 1988

²Hazen and Anderson, 1990

³Connery and Anderson, 1991

SUMMARY OF 1991 SUPPRESSION EFFORT

Location	Personnel Hours	Gallons Applied	Population	Effect of Treatment
Bear Brook	102.3	11.25	well established	older plants succumbed more readily than young.
The Tarn	18.0	1.25	scattered, both young and old plants	older plants succumbed more readily; most seedlings seemed unaffected.
Compass Harbor	1.1	0.1	small population of mostly young plants	some plants affected. Not re-checked after re-spraying.
Visitors Center/ Hulls Cove House	6.75	2.75	open area w/ few plants; large infestation of seedlings in alder stand	seedlings appeared to be unaffected. Most plants in the open area showed some effect.
Witch Hole Pond Outflow	0.75	N/A	none found this year	N/A
East of Duck Brook Road	0.30	N/A	none found this year	N/A
Breakneck Brook Beaver Pond	0.5	<0.1	one non-reproducing plant below main dam near fallen log	not rechecked
TOTAL	129.7	15.45	-----	-----

DISCUSSION

The summer of 1991 was especially dry. During May to July, year-to-date precipitation totals lagged behind totals for both 1989 and 1990; water levels in all wetlands were low by mid-summer. August, however, was much wetter than average and the total rainfall for the year was on par with 1989 and 1990. Average monthly temperatures in 1991 were the highest for the three years (1989-91) from February to June. Low water levels which expose muddy substrate followed by re-flooding favor the spread of purple loosestrife. We should note any increase in loosestrife populations around edges of wetlands in 1992.

Presumably due to the warmer weather conditions, purple loosestrife began flowering earlier than usual (first flowers noted as early as June 24 in a ditch along Rt.3 in Bar Harbor), and we began control efforts earlier in response. Almost all spraying and re-spraying was completed this year before the date spraying commenced in 1989 and 1990. With additional staff to help us, transect counts were done in record time. The Y.C.C. crew was trained and assisted us in our initial spraying efforts at the Tarn and Bear Brook. This accounted for us finishing Bear Brook in two full working days. Unfortunately, despite predictions of clear weather, a light rain fell the evening of July 25th, one of our most intensive spraying days. All re-spraying was done by a 2-3 person crew, and took a longer period to complete than the initial spraying.

The four member Y.C.C. crew contributed 60 personnel hours of work, 10 hours of which were training. It took 5 hours of Resource Management personnel time to train the Y.C.C. crew.

The documented amount of time dedicated to purple loosestrife control in 1991 totalled 240 personnel hours (including Y.C.C. hours) broken down by task as follows:

Checking wetlands for infestations	38 hours
Transect counts	50 hours
Training (YCC and ResMgt personnel)	22.5 hours
Spraying	112 hours
Re-spraying	17.5 hours.

In addition, K. Anderson spent time studying and taking the exam to become a Maine Certified Pesticide Applicator this year.

We were interested to note that although we used less herbicide at Bear Brook, we used more personnel time spraying here this year. Some possible explanations are (a) there was less purple loosestrife (b) our less experienced crews took longer to coordinate and had to work more slowly to ensure coverage (c) less experienced crews may have missed some plants (d) a larger area needed re-spraying this year, or (e) a combination of these factors.

While statistical analysis was performed on the monitoring data and there appear to be some significant changes, closer inspection of the data reveals that in many cases stem counts

increased. This invalidates our initial assumption. This indicated that there are factors other than our spraying which are affecting purple loosestrife numbers. A better way of displaying data trends might be to use bar graphs showing stem counts per year for either each grid, each transect, or even each plot. For instance, what the statistical analysis doesn't show is that the total number of loosestrife stems counted overall has decreased from 1989 to 1991. See Figure 1.

TRANSECT MONITORING DATA

Number of stems counted for all grids

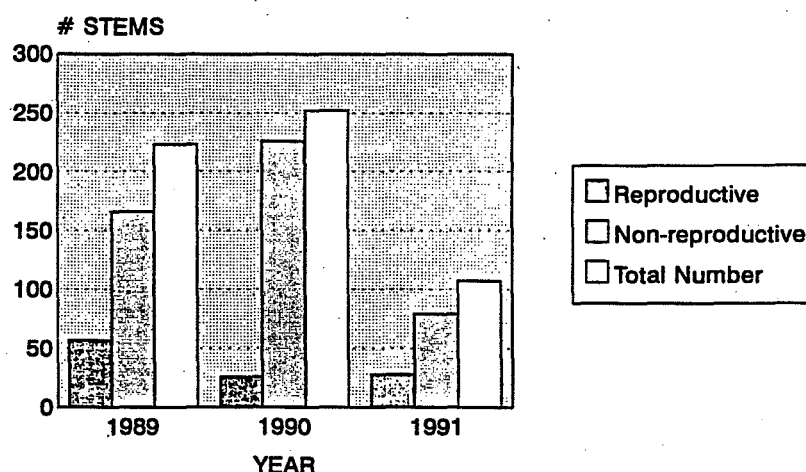


FIGURE 1. Number of stems of purple loosestrife counted on all seven monitoring grids for 1989, 1990, and 1991.

According to Thompson (1987), early foliage of purple loosestrife is palatable to white-tailed deer (*Odocoileus virginianus*), but mature plants are much less frequently browsed. However, especially in 1990, most plants that we noticed browsed were mature plants. In 1991, to try to quantify this, we counted the number of browsed stems that fell within our monitoring transects, divided as usual into reproductive stems vs. non-reproductive stems (based on a judgement of maturity, since flowers were often browsed). Of the reproductive stems we counted in our monitoring grids, 71% were browsed (N=28); of the non-reproductive stems counted, only 14% (N=79) were browsed. This appears to contradict Thompson's (1987) assertion. Whether or not browsing has any effect on the viability of the plants is, of course, another question. According to Rawinski and Malecki (1979), deer browsing was not enough to stop loosestrife plants from increasing in size. So while deer may act to slow the growth of purple loosestrife, they will not prevent its growth and spread.

If we note trends from year to year for early flowering at certain wetlands, we should make an effort to spray these wetlands first. This year, unlike other years, we got most of our spraying done before loosestrife flowers were mature and plants had reached maximum growth. In 1989, only the Tarn (sprayed 8/17) was noted as having flowers already mature. In 1990, the following areas' flowers were mature when they were sprayed: Witch Hole Pond outflow (sprayed 8/22); some plants at the Hulls Cove House/Visitor Center wetland (sprayed 8/20). This year we began control early and no notes were made about plants being overmature during control; some plants were flowering, but were early in their flowering period. No trends seem to have occurred between years.

In 1990 we began removing flowering heads from plants in small populations (this year: Compass Harbor). The extra time involved is minimal, and the removal of the year's seed source could, in the long run, greatly increase chances of eradicating these populations. Due to the extensive wetlands downstream, seed heads were also removed from flowering purple loosestrife along the edge of the Tarn, both in 1990 and 1991.

We need to continue checking other wetlands in the Park for the presence/absence of loosestrife. We did a good job this year and got many things checked, including most areas that had also been checked last year. In particular, we need to keep an eye on the two areas which had loosestrife in 1990 and didn't have it this year to be sure that the problem has been eradicated. It could be that the odd weather conditions this year made it too dry for those plants to sprout, though the roots may still be alive.

We continue to wonder if the trampling caused by our sampling technique cause problems by reducing shading, impacting competing, beneficial plants, or disturbing the substrate, since purple loosestrife is known to respond to disturbance. However, we cannot come up with a strategy for testing this that would also allow us to adequately monitor and control the population. We hope that, in time, monitoring can be conducted every other or every third year. This would reduce disturbance and lower program costs. However, a longer interval between monitoring might cause loss of continuity due to reprogramming or to personnel changes.

During the winter of 1991/1992, heavy rains in January caused two of the beaver dams north of the Park Loop Road at Bear Brook to wash out (on either side of monitoring grid #7). The beaver were not in winter residence in this section of stream, and it remains to be seen whether or not they will re-build this dam. If not, there will be a large amount of substrate available for loosestrife seedlings. We need to check this area carefully in 1992.

MANAGEMENT RECOMMENDATIONS

The Park should place a high priority on maintaining undisturbed wetlands. The use of heavy equipment in wet areas should be avoided whenever possible, even during beaver control efforts. The broadcast use of broad spectrum herbicides should also be avoided.

As noted in the Integrated Pest Management Plan, successful purple loosestrife management involves addressing populations adjacent to the Park on private property. Park resource managers should work with abutting landowners and local nurseries to reduce infestation sources from nearby lands.

An integrated approach of loosestrife management will be most effective. However, until tests of biological control agents can be completed, and both risks and costs evaluated, biological control is not a viable control strategy. Because of its rapid spread and difficulty to control, the importance of early detection has been stressed in instituting control measures (Thompson et al, 1987).

New low cost monitoring techniques may be available with the cooperation of U.S. Agricultural Stabilization and Conservation Services (ASCS). Balogh and Bookhout (1989) had good success in monitoring large areas for loosestrife invasion by using true-color aerial photographs. These photographs are usually taken in July or August which coincides with the bloom period of loosestrife. However, this technique may not be effective at Acadia now that the number of mature flowering plants seems to be reduced.

Sale of purple loosestrife has been banned in Indiana, Minnesota, Wisconsin, Illinois, and Ohio. Park managers should contact State and other land management agencies (The Nature Conservancy, Audubon, etc.) to discuss this possibility for Maine.

We need to be careful about thoroughly covering treatment areas when spraying. This means not making assumptions regarding "appropriate loosestrife habitat". The loosestrife population at the Hulls Cove House/Visitor Center wetland was overlooked in 1989 because it was in an alder stand and the investigators did not think purple loosestrife would grow there. Also, in the Bear Brook watershed, we found many young plants in the woods west of the stream (behind Morrill Park and Jackson Lab) where we might have assumed that it would not grow due to shading. If pockets of the population remain untreated they will eventually reach the age to be a seed source to the wetland, further hampering control efforts.

Care must be taken to wash footwear when moving from one wetland to another to prevent spreading seeds from wetlands with loosestrife populations to uninfested wetlands.

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APPENDIX A
LOCATIONS OF PURPLE LOOSESTRIPE
1991

WITHIN PARK BOUNDARIES:

- Bear Brook Pond (Beaver Dam Pond)
- Bear Brook Drainage below pond
- Compass Harbor
- Old Farm Road - small pond, south side of road
- The Tarn, south end only
- Visitor Center/Hulls Cove House wetland
- Breakneck Brook/Paradise Hill C.R. access beaver pond

OUTSIDE PARK BOUNDARIES:

- Bear Brook Drainage
- Old Farm Road pond
- Drainage ditch or small stream southwest of Rt.3,
across from the Bayview, between the Bar
Harbor Motel and the Seaview Restaurant.
- Garden in front of The Burning Tree restaurant
in Otter Creek.

FORMER AREAS OF INFESTATION:

- beaver impoundment east of where culvert crosses east
to west under Duck Brook Road (New Eagle Lake
Road)
- beaver impoundment on Witch Hole Pond outflow, within
and adjacent to C.R. loop (northeast section)

APPENDIX B
DIAGRAMS/DESCRIPTIONS OF TRANSECTS

- GRID 1: Located on the northeast side of the Bear Brook Beaver Pond, southeast of the main dam near the Park Loop Road, near a clump of three oaks (cut by beaver in 1990, resprouting). Transects run at a bearing of 226.5 degrees true north from the grid baseline.
- GRID 2: Located about halfway along the east side of the Bear Brook Beaver Pond, steeper gradient than Grid 1. Transects run at a bearing of 254.5 degrees true north from the grid baseline.
- GRID 3: Located to the east of the south side of the Bear Brook Beaver Pond, beginning just north of trees in thick alder and grasses/sedges. Transect 1 begins near the base of hemlock tree with grid to left--bearing from beginning of transect 1 to the beginning of transect 5 is 302.5 degrees true north. Transect 5 begins near the base of the largest diameter snag in the vicinity, just east of a very large, deep beaver canal--bearing from the beginning of transect 5 to culvert at road is 10.5 degrees true north. Transects run at a bearing of 12.5 degrees true north from the grid baseline.
- GRID 4: Located to the west of the Bear Brook Beaver Pond north of the northernmost feeder stream that has been dammed by beaver. On the Park Loop Road, east of the entrance to the Bear Brook Picnic Area, a cement culvert goes under the road--bearing from the south end of that culvert to transect 5 is 149.5 true north. Transects run at a bearing of 96.5 degrees true north from the grid baseline.
- GRID 5: Located on the east of the wetland south of and adjacent to the Tarn, west of Route 3, approximately 15 feet from the iron guard rail, 22 posts north of the south end. Transects run at a bearing of 264.5 degrees true north from the grid baseline.
- GRID 6: Located north of the Park Loop Road on the Bear Brook outlet stream, west of the stream, high and dry near stone ledge, north of the stone walkway which crosses the footpath. Transect 2 runs along a small dam. Transects run at a bearing of 100.5 degrees true north from the grid baseline.
- GRID 7: Located north of the Park Loop Road on the Bear Brook outlet stream, east of the stream, downstream from Grid 6, below a major dam (dam washed out winter 91/92) where the stream makes an almost 90 degree turn to the east. Transects run at a bearing of 320.5 degrees true north from the grid baseline.

APPENDIX C
GRID SURVEY RESULTS 1991

GRID 1

Record#	R1	NR1	R2	NR2	R3	NR3	R4	NR4	R5	NR5
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	2	0	0
3	0	0	0	0	0	0	0	0	0	0
4	0	0	0	1	0	1	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
8			0	0	0	0	0	0		
9			0	0	0	0				
10					0	0				
11					0	0				

GRID 2

Record#	R1	NR1	R2	NR2	R3	NR3	R4	NR4	R5	NR5
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0					0	0	0	0

GRID 4

Record#	R1	NR1	R2	NR2	R3	NR3	R4	NR4	R5	NR5
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0
9							0	0	0	0

GRID 5

Record#	R1	NR1	R2	NR2	R3	NR3	R4	NR4	R5	NR5
1	0	0	0	0	0	0	0	0	0	0
2	0	1	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	2	0	0	0	0
8	0	0	0	1	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0
10	1	0	0	0	0	0	1	2	0	0
11	0	0	0	0	0	0	0	2	0	0
12	0	2	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	2	1	0	0
15	0	0	0	0	0	0	0	0	0	5
16	0	0	0	0	0	0	0	0	3	5
17	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	2	0
19	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	2	0	0	0	0
21	0	0	0	2	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	1	1
27	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	1	0
29	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0
49	0	0								
50	0	0								

GRID 6

Record#	R1	NR1	R2	NR2	R3	NR3	R4	NR4	R5	NR5
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
8	2	3	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	2	1	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	1
20	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0
26					0	0				

GRID 7

[illegible]

APPENDIX D
MEMOS RELATING TO PURPLE LOOSESTRIFE
1991

NATIONAL PARK SERVICE COMMON DATA BASE
IPM FORM 10-21A

PROJECT ID NO: ACAD005
NORTH ATLANTIC REGION
ACADIA NATIONAL PARK
PROJECT YEAR: 1991
PROJECT PEST(S): Purple loosestrife (Lythrum salicaria)
PROJECT PURPOSE: To control invasive non-native plants and
restore ecosystem.

PRODUCT NAME: RODEO

EPA REG NUMBER: 524-343

PRODUCT/DILUENT MIXTURE: 1% solution

USAGE RATE: Spray to wet as needed.

AMOUNT USED PER APPLICATION: As needed.

ACTIVE INGREDIENT(S)	% AI	LBS/GAL AI
GLYPHOSATE	53.500	5.400

TREATMENT METHOD: Hand spraying.

FORM APPLIED: Liquid

AREA OR UNITS TO BE TREATED: Purple loosestrife in wetlands.

DESCRIPTION OF SITES: Wetlands

OF SITES: Unknown

OF APPLICATIONS: As needed

AMT PRODUCT USED TOT: Unknown

SEASON OR PERIOD OF APPLICATION: July-August

AREAS TO BE AVOIDED: Avoid spraying native plants. Avoid drift
to non-target plants.

AREAS TO BE TREATED WITH CAUTION: None

PRECAUTIONS: Avoid contact with skin, eyes, or clothing. Use
low pressure spray.

USE OF CERTIFIED OR TRAINED PERSONNEL: Application supervised
by Maine Certified Pesticide Applicator.

MONITORING: Pre- and post-treatment monitoring will be conducted
to assess success.

CONTACT: Judy Hazen Connery, Biologist 207-288-5463

PARK APPROVAL NAME: Len Bobinchock, Act'g Superintendent 3/26/91

REGION APPROVAL NAME:

DATE:

WASO APPROVAL NAME:

DATE:

WASO DECISION:

REMARKS: Not to be applied when rain is predicted within 24
hours. Maximum application rate 7 1/2 pints per acre. Do not
mix, store, or apply in galvanized steel or unlined steel (except
stainless steel) containers or spray tanks. May also be applied
to surface of carriage road bridges to control vegetation as
needed. Department of Interior Form attached. Areas where
applications will be made are not drinking water supplies. Rare
and endangered species check made by Dr. Craig Greene, 1988.



United States Department of the Interior

NATIONAL PARK SERVICE

Acadia National Park

P.O. Box 177

Bar Harbor, Maine 04609

207-288-3338

IN REPLY REFER TO:

May 1, 1991

N50(ACAD)

COPIES FOR YOUR INFORMATION

Memorandum

To: Files

From: Acting Superintendent

Subject: Purple Loosestrife Management Program, Environmental
Impact Evaluation

Purple loosestrife (Lythrum salicaria) is a highly invasive nonnative plant which colonizes disturbed wet environments, displacing indigenous wetland vegetation. Purple loosestrife has virtually wiped out native wetland communities by establishing mono-specific stands in many areas of the Northeast.

In order to fulfill National Park Service Management Policies (1978) to protect native systems, efforts to prevent further spread of purple loosestrife were initiated by Acadia's Resource Management staff in 1983. This program consisted of identifying wetlands invaded by purple loosestrife, setting up a limited number of monitoring plots, and trying to prevent any expansion of loosestrife populations by cutting and burning flower heads. Simultaneously, more extensive literature searches were conducted to determine the feasibility of loosestrife eradication, and to devise a more effective management strategy.

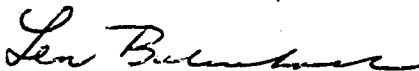
After thorough literature review and consultation with ecologists familiar with the issue, it was determined that eradication was not likely, but reducing and then maintaining the purple loosestrife populations at very low numbers was both feasible and desirable. Although many treatment alternatives were considered, including pulling and cutting plants, alteration of water levels, and burning, herbicide treatments were deemed essential in order to achieve the target level of suppression.

A Purple Loosestrife Action Plan was developed in 1988 and included in the Integrated Pest Management Plan which was finalized and approved by the Regional Director in April 1991. Management efforts include the following:

1. Prevention of infestation by eliminating human caused disturbance in wetlands.
2. Identification of areas populated by purple loosestrife
3. Public education targeted to staff, visitors, local gardeners, and nursery managers
4. Survey of treatment areas for rare and endangered plants, and other species of special concern
5. Inspections and coordination with local water companies adjacent to human water supplies
6. Quantitative monitoring each year prior to herbicide treatments to measure the effectiveness of management actions
7. Treatment of individual purple loosestrife plants using an approved herbicide applied by trained and licensed staff

Implementation of the Purple Loosestrife Action Plan began in 1988. An article appeared in the Bar Harbor Times (August 25, 1988) as part of an effort to educate the public. Only one letter to the editor expressed concern about the elimination of this plant from Park wetlands.

Careful implementation of the Purple Loosestrife Action Plan has no known potential for significant adverse impact and there are no known unresolved controversies over the alternative uses of available resources. Therefore, this action can be considered a categorical exclusion from the National Environmental Policy Act procedures. Program implementation is a day-to-day resource management activity (516DM 6, Appendix 7.4 E.2) involving the restoration of noncontroversial native species into suitable habitats within their historic range, and the elimination of exotic species (516 DM 6, Appendix 7.4 E.6).



Len Bobinchock

cc: Sydoriak, NARO
DiSalvo, NARO
Clark, NARO

May 30, 1991

N50(ACAD)

Maine Board of Pesticide Control
State House Station #28
Augusta, Maine 04333

Dear Board Members:

We request approval to apply a 1% solution of Rodeo (glyphosate) by hand sprayer to individual purple loosestrife plants along stream and pond banks within the boundaries of Acadia National Park. Purple loosestrife is an invasive non-native plant of little value to wildlife which has been listed as a noxious weed in many northern states. Although approximately 25% of the Park's plant species are non-native, this species has been targeted for control due to its highly invasive nature and current low population levels which make management feasible.

According to local town managers, none of the watersheds involved in this project are used as water supplies for public or private use. A monitoring program to assess management success has been established. Pesticide applications will be directly supervised by a certified master pesticide applicator, and all necessary safety precautions will be used. Care will be taken to avoid drift to non-target plants. A map showing treatment areas is attached.

This project will also be reviewed by the Director of the National Park Service as well as by the U.S. Department of Agriculture.

As in 1990, we plan to initiate management actions in July. If you have any questions or need further information, please contact me at 288-5463, Monday through Friday, 8 AM to 4:30 PM. Thank you very much for reviewing this proposal.

Sincerely,

Judith Hazen Connery
Biologist

Enclosure
JHCONNERY:tjg:5/30/91

Known Purple Loosestrife treatment areas
FRENCHMAN
1991



THE JACKSON LABORATORY

Bar Harbor, Maine 04609

July 1, 1991

Judith Hazen Connery, Biologist
Acadia National Park
P.O. Box 177
Bar Harbor, ME 04609

Dear Mrs. Connery:

This is sent to confirm your plans to spray the purple loosestrife (*Lythrum salicaria*) found in the Bear Brook watershed.

It is my understanding from our conversation of July 1, 1991, that the spraying will begin the week of July 25, 1991, during the regular daytime hours of 8:30 to 3:30 p.m. Access to the area will be done from the Park Loop Road and the Schooner Head Road. No parking of vehicles will occur on Laboratory property unless previously arranged.

As in the past three years, permission is granted to continue your control efforts on Jackson Laboratory property in the Bear Brook watershed.

Good luck on managing this highly invasive, non-native plant.

Sincerely,



Oral L. Applegate, Jr.
Manager, Environmental & Safety Engineering

OLA:sep



IN REPLY REFER TO:

United States Department of the Interior

NATIONAL PARK SERVICE

Acadia National Park

P.O. Box 177

Bar Harbor, Maine 04609

207-288-3338

Please circulate
RM staff
RB
KBA
NH
R

July 18, 1991

N50(ACAD)
IN HOUSE

Memorandum

To: Staff

From: Biologist

Subject: Purple Loosestrife Control

Purple loosestrife (Lythrum salicaria) control work will begin soon. The resource management staff will be hand spraying the herbicide Rodeo in several wetland areas in an effort to control this invasive plant. The Beaver Dam Pond/Bear Brook watershed is a top priority for control and will be an area of high visibility to visitors. Please assist us by patiently answering visitor questions about this effort. Here are some pointers:

What is purple loosestrife and why are we concerned about it?

Purple loosestrife is an invasive plant which quickly dominates wetland ecosystems. It displaces native plants which are important food sources for wildlife. If caught early enough, control is possible. Purple loosestrife was imported from Europe.

What chemical are we applying and why?

The herbicide Rodeo is being used because it is biodegradable, does not harm animal life, and is not persistent. It is also safe to applicators, relatively inexpensive, and has been proven to be effective in purple loosestrife control.

It is NPS policy not to use any herbicide unless absolutely necessary. However, it was determined that the potential effects of uncontrolled loosestrife expansion would be much worse than any side effects of herbicide application. Hand pulling of loosestrife is ineffective.

Does Rodeo kill other plants?

Yes. It is a broad spectrum, contact herbicide which will kill whatever vegetation it contacts. Care will be taken to protect non-target plants from exposure.

How did purple loosestrife get here?

No one knows for sure. Seed could have spread from neighboring gardens, on car tires, or from birds. One of the important aspects of our control program will be to educate visitors and park neighbors about the problem. We hope that they might be convinced to avoid planting purple loosestrife so that garden plants will not serve as a seed source. We plan to contact local nurseries and seed suppliers and ask them to voluntarily stop the sale of purple loosestrife.

We would appreciate your assistance in locating purple loosestrife on Park lands. A non-native plant identification guide is attached. If you see purple loosestrife growing in other than the locations listed below, please contact a member of the resource management staff.

Known purple loosestrife populations in the Park:

Bear Brook watershed
The Tarn
Compass Harbor
Hulls Cove House wetland

Thank you for your help. If you have any questions or would like to review the purple loosestrife action plan, please call me at extension 162 or stop by my office.


Judy Hazen Connery
Enclosure

LYTHRUM SALICIFOLIUM

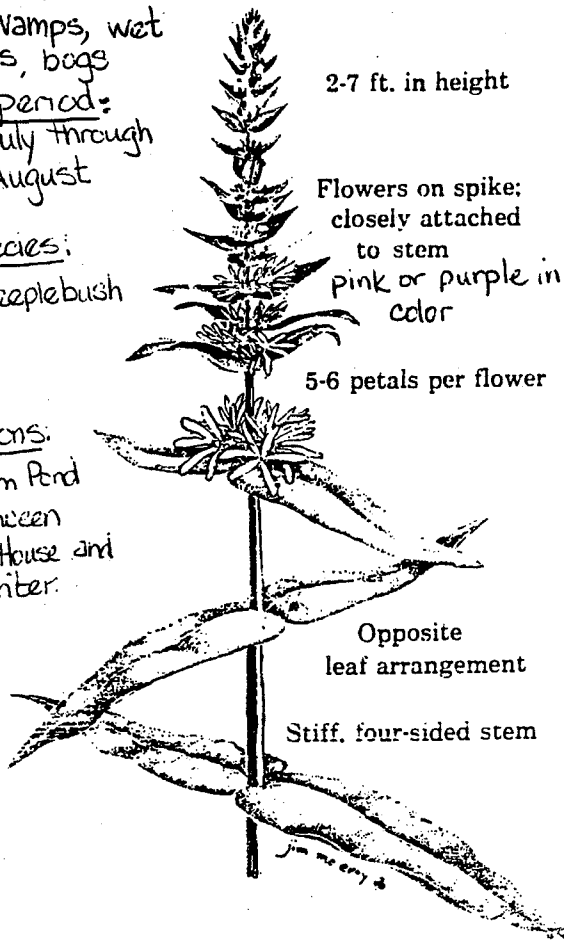
Habitat: swamps, wet marshes, bogs
Blooming period: late July through mid-August

Similar species:

native steeplesbush
 fireweed

Known locations:

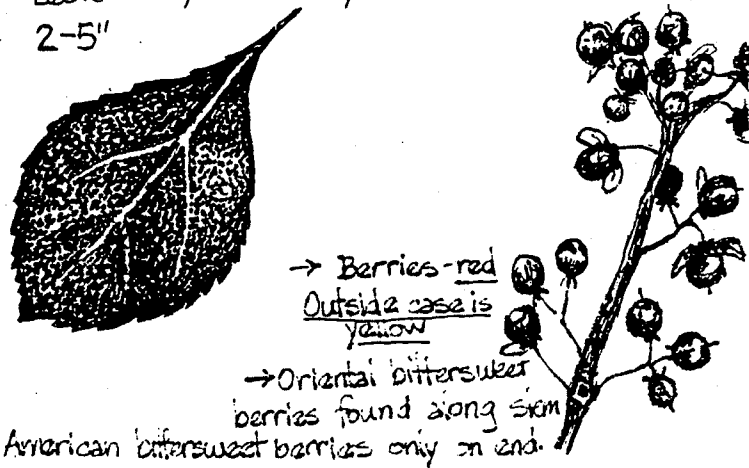
→ Beaver dam Pond
 → Wetland between Hulls Cove House and Visitor Center.



ORIENTAL BITTERSWEET STREPTOCARPUS ORBICULATA

- Tangled, high climbing vine.
- Flowers small, green. Appear late May-June
- Found near old foundations where it was planted as an ornamental.
- Buds small, pointed, sharply set nearly at right angles to stems.
- Berries distinctive and ornamental.

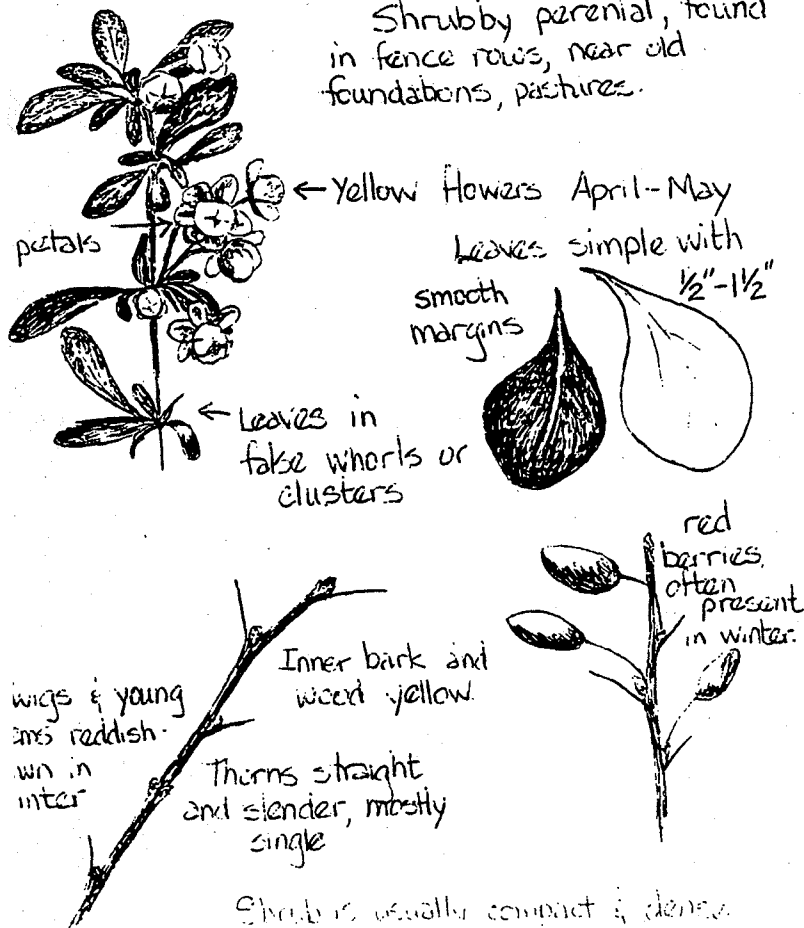
Leaves may be nearly circular, 2-5"



JAPANESE BARBERRY

Barberis thunbergii

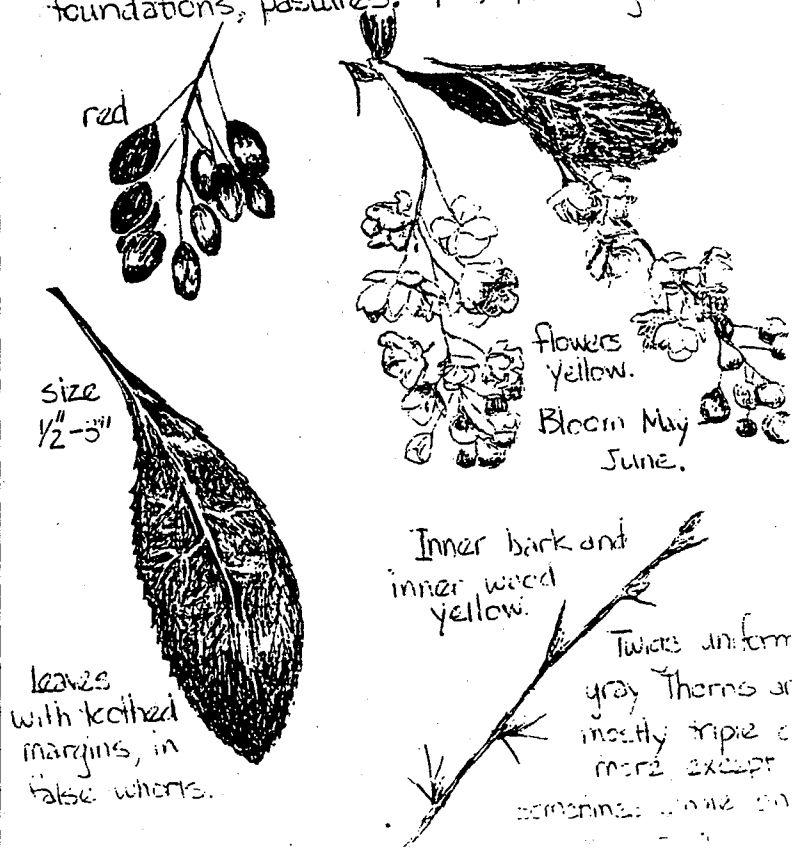
Shrubby perennial, found in fence rows, near old foundations, pastures.



COMMON BARBERRY

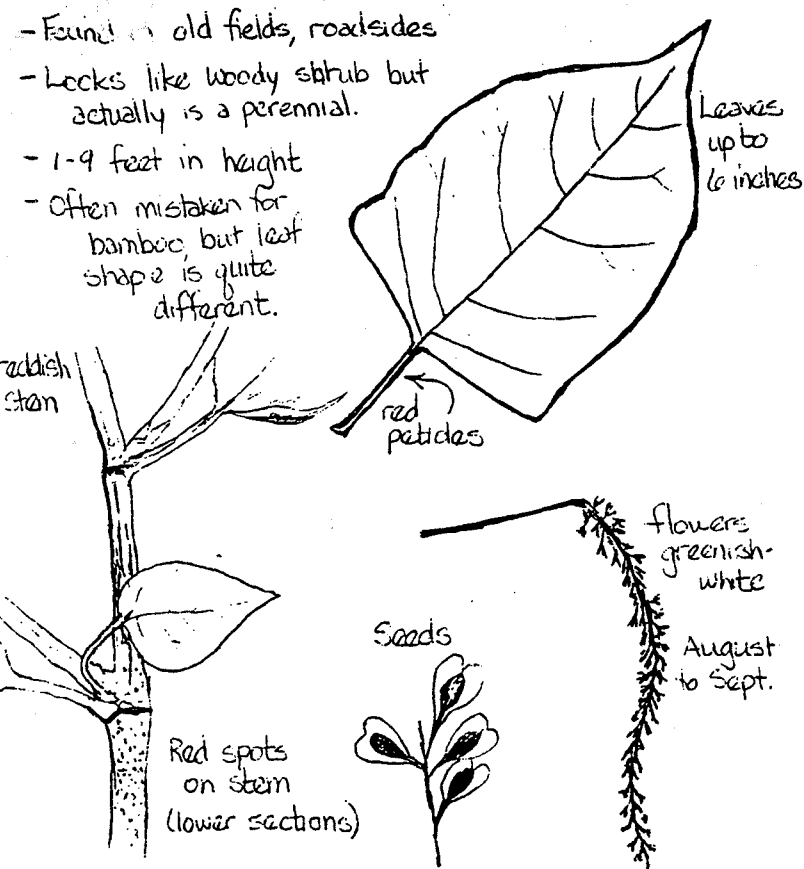
Barberis vulgaris

Shrubby perennial found in fence rows, near old foundations, pastures. 1-9 feet high.



JAPANESE KNOTWEED

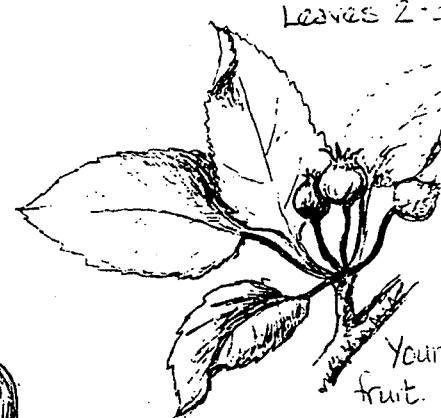
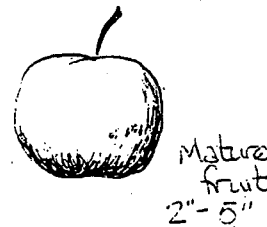
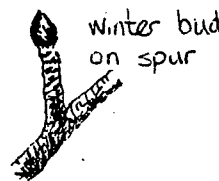
Polygonum cuspidatum



Known locations: Driveway Hills Cove House, Intersection Park Loop Road & Paradise Hill Rd.

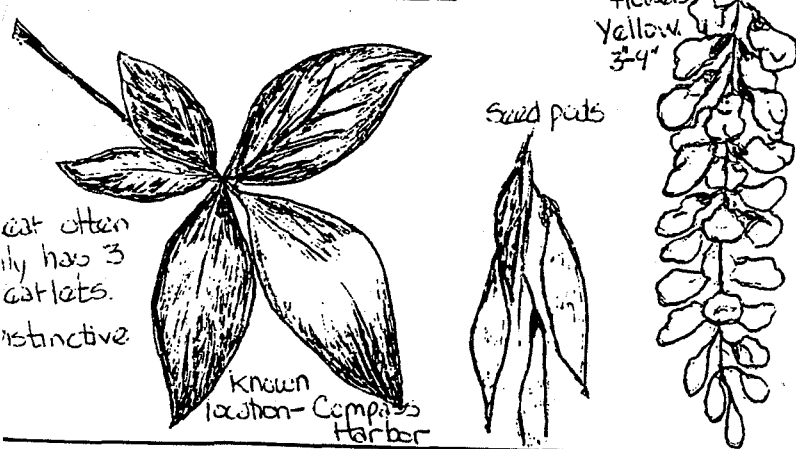
APPLE

Malus domestica



GOLDEN CHAIN TREE

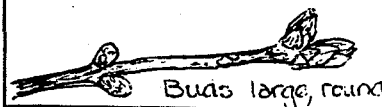
Laburnum x watereri



COMMON LILAC



Bush to 20'
Found near old foundations
Flowers in May, lavender or white



ACTINIDIA

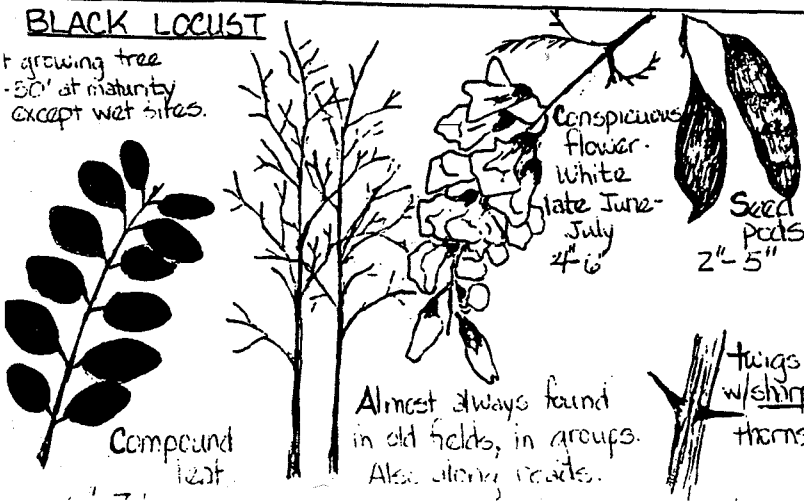
-Vine used in landscaping
-Similar to bitterweed but with fleshy green berries in August

-Control method - cut & remove roots

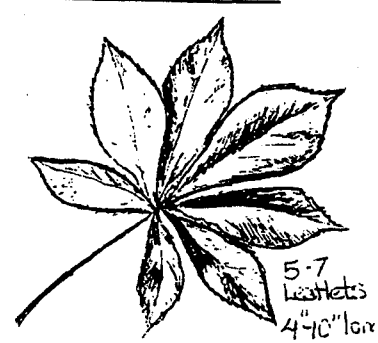
-Known location - north of Brown Mtn. Gate

BLACK LOCUST

Fast growing tree
-50' at maturity except wet sites.



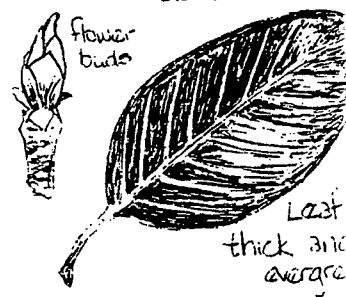
HORSE CHESTNUT



Medium-large tree, 25'-60' tall.

RHODODENDRON

Found near old foundations



Leaves rarely clustered at tips