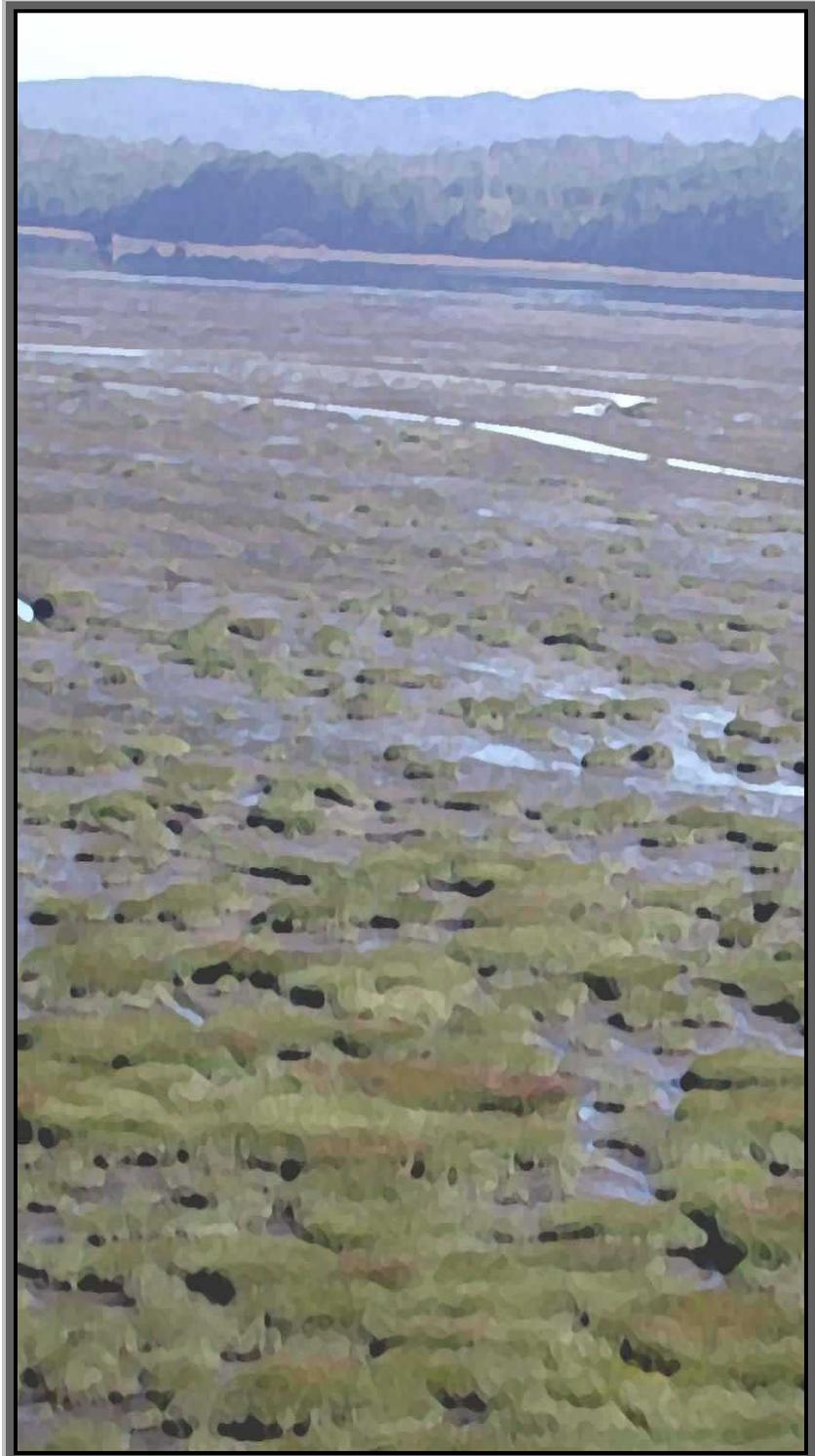




Spartina Eradication Program

2003 Report





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REPORT TO THE LEGISLATURE
PROGRESS OF THE 2003 *SPARTINA* ERADICATION
PROGRAM

December 15, 2003

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EXECUTIVE SUMMARY

2003 Progress Report of the *Spartina* Eradication Program

Spartina, commonly known as cordgrass, is an aggressive noxious weed that severely disrupts the ecosystems of native saltwater estuaries in Washington state. It outcompetes native vegetation, converts mudflats into monotypic *Spartina* meadows and robs waterfowl and shorebirds of highly important habitat. *Spartina* spreads by both seed production and below ground root growth. Since the initial introduction into our state, *Spartina* has grown to an infestation of more than 8,500 acres, spread out across 20,000 acres in marine intertidal areas of ten counties in western Washington, especially in Pacific County's Willapa Bay. *Spartina* is crowding out beneficial native vegetation, destroying important migratory shorebird and waterfowl habitat, increasing the threat of flooding and severely impacting the state's shellfish industry.

Since 1995, the Washington State Department of Agriculture (WSDA) has served as the lead state agency for the eradication of *Spartina*. This report details the progress of the eradication program in 2003.

2003 *Spartina* Eradication Season Accomplishments

An unprecedented amount of control work was carried out in 2003. An estimated 6,000 solid acres of *Spartina*, approximately 70% of the infestation, was treated in Willapa Bay. More acreage was treated during the 2003 season than the previous six years combined. In Puget Sound, an estimated 694 solid acres of *Spartina*, approximately 90% of the infestation, was treated.

This tremendous effort was a result of the increased level of funding provided to WSDA for the 01-03 biennium and increased cooperation of WSDA, other state agencies, universities, the U.S. Fish & Wildlife Service, counties, tribes, private organizations and private landowners. Also important were the continuing efforts to investigate new tools and improve the effectiveness of current tools to eradicate *Spartina*.

Enhanced Funding

WSDA utilized \$1.5 million of its \$2,166,260 *Spartina* appropriation in the second year of the biennium. Most of this funding was applied to control work during the 2003 season.

WSDA had originally allocated \$600,000 of its 01-03 budget for large-scale mechanical eradication of *Spartina* in Willapa Bay. After two field trials with a possible contractor, WSDA determined that large-scale mechanical control would not be feasible at this time. WSDA then initiated a cooperative effort with representatives from the Washington Department of Fish and Wildlife (WDFW), Washington State Department of Natural Resources (DNR), and the U.S. Fish and Wildlife Service (USFWS) during the fall of 2002 and winter of 2003 to formulate an agency work plan for utilizing the state funding for the remainder of the biennium. The group

worked cooperatively for several months to formalize a work plan for control in Willapa Bay, Grays Harbor, and Puget Sound.

Under the plan, WSDA provided more than \$700,000 worth of herbicide and equipment to state and federal agencies and counties for eradication activities in Willapa Bay and Puget Sound. This resulted in the control of over 6,700 solid acres of *Spartina* statewide, following an integrated approach that utilized mechanical, biological, physical and herbicide control options.

WSDA's *Spartina* budget for the 03-05 biennium is \$1.76 million, \$400,000 less than the amount in the previous biennium.

Cooperation and Coordination Activities

Continued cooperation in Grays Harbor and Puget Sound and enhanced cooperation in Willapa Bay with partner agencies and private groups and individuals were key success factors in 2003.

Willapa Bay *Spartina* Advisory Committee

As the 2003 treatment season grew closer and plans for the 2003 season were completed, WSDA worked with several entities to form the Willapa Bay *Spartina* Advisory Committee. The members of the committee represented WSDA, WDFW, DNR, USFWS, Willapa Bay/Grays Harbor Oyster Growers Association (WBOGA), The Nature Conservancy (TNC), Shoalwater Bay Indian Tribe, University of Washington-Olympic Natural Resource Center (UW-ONRC), Washington State University (WSU), Pacific County Weed Board, and Columbia Resources Alliance (CRA). The purpose of bringing this diverse group together was to foster better communication and cooperation and ultimately ensure that a successful approach towards eradication is achieved.

The advisory committee, chaired by WSDA, also established a Technical Committee. The Technical Committee, made up of program coordinators and field personnel from WSDA, WDFW, DNR, USFWS, and WBOGA, was tasked with ensuring all on-the-ground field operations were conducted smoothly as well as working on issues important for the success of *Spartina* eradication. At the September 2003 Advisory Committee meeting, a Planning Committee was formed to develop an agency work plan for the 2004 treatment season. The Planning Committee is also made up of program coordinators from WSDA, DNR, WDFW and USFWS as well as representatives of the WBOGA. The Planning Committee will begin developing plans in December 2003, which will build on the successful activities conducted during the 2003 treatment season.

Shellfish Industry Participation To Eradicate *Spartina*

As part of the cooperative effort in Willapa Bay, WSDA worked with the Willapa Bay/Grays Harbor Oyster Growers Association and USFWS to conduct a cost share effort of unprecedented size in the Nemah area of Willapa Bay.

The mudflats in the Nemah area are some of the most productive oyster beds in all of Willapa Bay. The area is infested with a meadow of approximately 900 solid acres and over 1,000 acres in clone fields. The effort, conducted jointly by WSDA and the oyster industry, involved numerous oyster growers contributing their labor, experience, money and resources to conduct

the treatments to the clone fields, while WSDA provided herbicide application equipment, herbicide and funding for a field coordinator. WSDA also conducted an aerial application to the entire meadow adjacent to the clone fields.

Continued Efforts to Improve Control Tools

The Spartina Eradication Program uses Integrated Pest Management (IPM), a coordinated decision-making and action process that uses the most appropriate pest control methods and strategy in an environmentally and economically sound manner to meet pest management objectives. Entities involved in Spartina eradication use a wide range of control tools, including ground and aerial herbicide applications, various mechanical tools, biological control using the insect *Prokelisia marginata*, and manual control, involving seedling digs in areas where an infestation has not taken hold.

There were several significant activities in this area in 2003.

- WSDA completed the task of developing an Ecological Risk Assessment (ERA) for the use of imazapyr on *Spartina*. Imazapyr, which has gone through several years of testing on both has been shown to have high potential as an extremely effective herbicide for control of *Spartina* while having far lower toxicity than the currently used herbicide, glyphosate. The completion of the ERA in conjunction with the issuance of a federal use label, as well as the completion of the SEPA review process by the Department of Ecology, will add a much needed new tool to the *Spartina* control tool box.
- WDFW conducted the first aerial application at new higher broadcast application rates, treating 200 solid acres. WSDA later conducted an aerial application on 900 acres of solid meadow.
- Washington State University's continued search for more effective herbicide application techniques.
- UW-ONRC and CRA continued to provide dry time maps to increase effectiveness of herbicide applications. (Dry time is the amount of time the plants are above water after being treated with herbicide.)
- WDFW contracted with a Kansas company for \$5,000 to test new mechanical control tool. It was determined to be not feasible at this time.

Other Noteworthy 2003 *Spartina* Eradication Program Activities

NPDES Water Quality Sampling Conducted

WSDA provided permit coverage for aquatic noxious weed control to numerous federal, state and local governmental agencies and private entities for herbicide applications to both marine and freshwater environments, including applications to eradicate *Spartina*.

The National Pollution Discharge Elimination System Permit (NPDES) for control of Aquatic Noxious Weeds, issued in 2002, required WSDA to conduct water quality sampling for concentrations of glyphosate in *Spartina* treatment areas. WSDA developed a monitoring plan during the winter and spring of 2003 in which a range of treatment sites were chosen. The

selected sites addressed the differing application methods planned throughout the season on different infestation types located in Willapa Bay, Grays Harbor and Puget Sound.

All of the post-treatment sampling was completed by October 24, 2003. The quantities of glyphosate detected in all post-treatment samples were within expected levels. A monitoring report will be submitted to Ecology by February 2004 to fulfill the monitoring requirements detailed in the NPDES permit.

Extent of the Infestation Revised

More accurate field surveys and aerial photos, coupled with better data from treatment activity, led WSDA and its partner agencies to revise the estimates of total solid acreage of *Spartina* at the beginning of the 2003 treatment season as well as the total affected acreage in Willapa Bay. As a result, the estimate of solid acres of *Spartina* in Puget Sound at the beginning of the 2003 season was revised to 760 solid acres, 30 acres more than the previous estimate. WSDA now estimates the acreage affected by *Spartina* in Willapa Bay at over 18,000 acres, with over 8,000 solid acres infested.

This is over 1,000-acre increase of the solid acres estimate for Willapa Bay provided in last year's report. Although a more accurate survey is likely responsible for much of the increase, there also appears to have been an overall increase of the entire infestation from last year, even when considering the amount of control conducted during the 2002 season.

In almost every area of the Bay during the 2003 season, a larger than normal amount of seedlings were observed. Although no scientific explanation has been found, the mild winter and spring of 2003 followed by a record-breaking hot, dry summer may have provided the perfect conditions for *Spartina* to produce more seeds and have more of those seeds germinate throughout the spring and summer. This observation of increased seedlings was also seen in Grays Harbor and Puget Sound, including sites that exhibited no *Spartina* during the 2002 season. This suggests similar factors affected all the water bodies.

Summary of 2003 Statewide *Spartina* Eradication Activities

Spartina Eradication in Willapa Bay

In 2003, the cooperative *Spartina* eradication effort resulted in treatment of an unprecedented 6,000 solid acres, or about 65 to 70% of the overall solid infestation.

WSDA anticipates the 2003 treatment efforts will result in a substantial decrease in the overall infestation. If so, this will be the first ever decline of the Willapa Bay *Spartina* infestation. This success was made possible through cooperative work by all entities involved in Willapa Bay *Spartina* control.

Spartina Eradication in Grays Harbor

Surveys conducted during the spring of 2003 turned up very little infestation in Grays Harbor. Surprisingly, however, during the summer of 2003 as WDFW crews were conducting treatments on pre-identified infestations, numerous new infestations were discovered. These infestations

were all less than 5 feet in diameter. All infestations, totaling 2.86 solid acres, were treated entirely.

New infestations are found in the bay every year, suggesting that seed is being transported to Grays Harbor from Willapa Bay. This demonstrates the importance of continued survey and control work in Grays Harbor, as well as future reductions in the Willapa Bay infestation.

Spartina Eradication in Puget Sound and Hood Canal

An estimated 694 solid acres of *Spartina* were treated in 2003. This is a 50% increase over the estimated 455 solid acres treated in 2002 and well above the 182 solid acres treated in 2001. The Puget Sound infestation, estimated at 1,000 solid acres in 1997, has been reduced by 24%. With continued success in Puget Sound, the yearly treatment figures should begin to decline in the next few years, due to the overall decrease in the solid acreage present in Puget Sound.

➤ Snohomish County

In total, 340 solid acres of *Spartina* were treated in Snohomish County in 2003 compared to 238 in 2002. For the first time in program history, all meadows in Southeast Skagit Bay, Leque Island and Mystery Island were treated entirely. These sites are home to three of the largest infestations in Puget Sound. The treatments were made possible through the successful cooperative efforts of WSDA, WDFW and Snohomish County. The combined size of these three infestations is approximately 300 solid acres. This constitutes about 90% of the overall infestation in Snohomish County. The treatments to a majority of these meadows were done using a combined mechanical/herbicide approach.

➤ Island County

In total, 323 solid acres of *Spartina* were treated in Island County in 2003 compared to 181 in 2002. The past focus of the eradication work in Island County was on reducing and removing the small outliers and working towards the large seed-producing meadows east of English Boom and Triangle Cove. During the 2003 treatment season, the focus shifted to include attacking the large meadows as well as the small outliers.

The entire Livingston Bay infestation was again treated in 2003. After five successful years of treatment, including the 2001 season in which herbicide was not allowed for use, the overall infestation has decreased from approximately 100 solid acres to an estimated 35 solid acres, a decrease of 65%. Only six known infestations in Island County did not receive some level of treatment.

➤ Skagit County

In total, 26 solid acres of *Spartina* were treated in Skagit County in 2003 compared to 36 in 2002. This reduction in the total amount treated is due to the overall reduction in the infestation in Skagit County. All known *Spartina* infestations were treated with the exception of one infestation on Swinomish tribal land, which is being tested as a biological control release site. The overall infestation, estimated at 100 solid acres in 1997, has been reduced in Skagit County by about 65%, to 35 solid acres in 2003.

➤ **San Juan, Clallam, Jefferson, Kitsap, King Counties**

WSDA crews have substantially reduced all known infestations in Clallam, Jefferson, Kitsap and King counties during the past five years. With the exception of one site in Kitsap County, all sites were treated entirely at least twice and are nearing eradication. WSDA will continue to progress towards that end with yearly surveying and control. Infestations on San Juan County continue to be controlled and surveyed by the San Juan County Noxious Weed Control Board.

Table 1 illustrates the total solid acres and estimated solid acres treated by county from 1997 through 2003.

Table 1. Acres of *Spartina* Treated in Washington State – 1997 through 2003

County	<i>Spartina</i> Present in 2003	<i>Spartina</i> Treated, 1997 - 2003		2003 Treatment Methods
Pacific (Willapa Bay)	Over 8,000 solid acres spread over > 18,000 acres	'97 - approx. 742 solid acres '98 - approx. 450 solid acres '99 - approx. 600 solid acres	'00 - approx. 800 solid acres '01 - approx. 900 solid acres '02 - approx. 1804 solid acres	Mow/herbicide, herbicide, seedling removal, various mechanical control.
		'03 – approx. 6,000 solid acres		
Snohomish	Approx. 370 solid acres spread over > 4,500 acres	'97 - approx. 89 solid acres '98 - approx. 126 solid acres '99 - approx. 90 solid acres	'00 - approx. 158 solid acres '01 - approx. 75 solid acres '02 - approx. 238 solid acres	Mow/herbicide, herbicide, seedling removal, dig, mechanically crush, mow
		'03 – approx. 343 solid acres		
Island	Approx. 350 solid acres spread over >1,000 acres	'97 - approx. 250 solid acres '98 - approx. 160 solid acres '99 - approx. 155 solid acres	'00 - approx. 130 solid acres '01 - approx. 72 solid acres '02 - approx. 300 solid acres	Mow/herbicide, herbicide, seedling removal, mechanically crush, mow
		'03 – approx. 325 solid acres		
Skagit	Approx. 35 solid acres spread over > 2,000 acres	'97 - approx. 91 solid acres '98 - approx. 57 solid acres '99 - all treated	'00 - approx. 60 solid acres '01 - approx. 33 solid acres '02 - approx. 37 solid acres	Mow/herbicide, herbicide, seedling removal, dig, mow
		'03 – approx. 26 solid acres		
Grays Harbor	Scattered clones and seedlings 2.8 acres in size	'97 - all treated '98 - all treated '99 - all treated	'00 - all treated '01 - all treated '02 - all treated	Herbicide, seedling removal, mow
		'03 – all treated		
Kitsap	8 infestations - approx. 1 solid acre total	'97 - all but 2 tribal sites '98 - all treated '99 - all treated twice	'00 - all treated '01 - all treated '02 - all treated twice	Mow mow/herbicide, dig, seedling removal
		'03 – all treated twice		
Jefferson	14 infestations – approx. 0.01 solid acres total	'97 - all treated '98 - all treated twice '99 - all treated twice	'00 - all treated three times '01 - all treated three times '02 - all treated three times	Mow, mow/herbicide, dig, seedling removal
		'03 – all treated twice		
Clallam	1 infestation < 0.001 acres in size	'97 - treated twice '98 - treated three times '99 - treated twice	'00 - treated four times '01 - treated four times '02 - treated four times	Dig
		'03 – treated three times		
King	2 infestations – single clones and a few seedlings	'97 – monitored '98 - all treated '99 - all treated	'00 - all treated twice '01 - all treated twice '02 - all treated twice	Dig
		'03 – all treated twice		
San Juan	Re-growth found at one site. 2 other sites clean for four consecutive years	'97 - all treated '98 - all treated '99 - monitored	'00 - all treated '01 - all treated '02 - all treated	Survey, dig
		'03 – all treated		

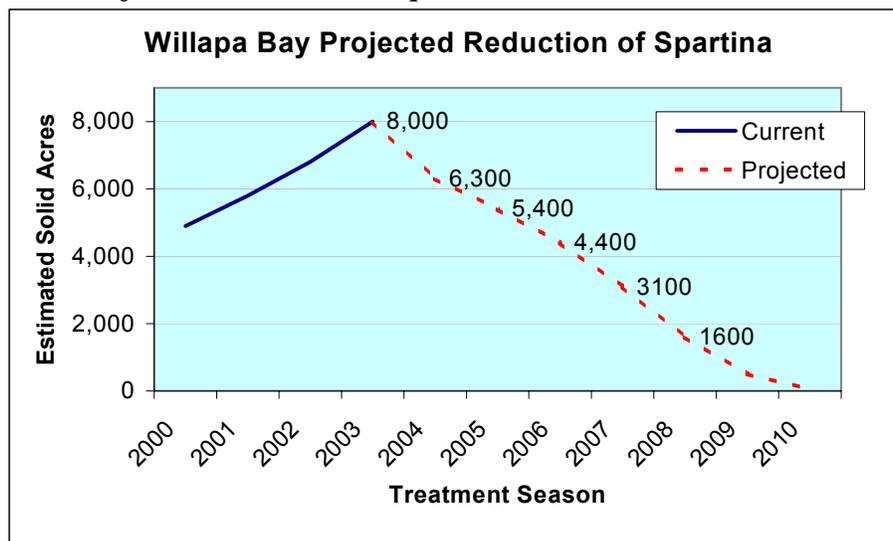
Recommendations for the Future

With the huge amount of acreage treated during 2003, the effort has shown that eradication is a greater possibility than ever before. The effort has proven that the amount of acreage needed to be treated every year, to progress towards eradication, is feasible with the current treatment approach. As large areas are treated for the first time, follow-up treatments will be necessary every year to ensure success. In many cases the follow-up treatments may be more costly and more time consuming than the initial treatments. Also, with the registration of imazapyr nearing completion, the effort will have an additional tool in the 2004 treatment season that will aid in the eradication program.

The activities of the 2003 treatment season illustrate the importance of continued funding at current levels for at least the next several years. Graph 1 illustrates the projected overall decrease in total solid acres in Willapa Bay over seven years. This projection assumes that:

- At least a 50% efficacy of the 6,000 acres treated during the 2003 treatment season (Based on efficacy data from previous years, at least 50% efficacy is achievable overall).
- WSDA continues to receive funding at the same levels as the 2003-2005 biennium.
- WDFW and DNR continue to receive funding at the same levels as the 2003-2005 biennium.
- USFWS continues to receive \$1,000,000 per year in federal funding for *Spartina* control.
- Through continued large-scale IPM, the effort will eradicate 2,000 solid acres per year in future years.
- A 17% growth rate will continue each year, regardless of when and where treatments occur (Growth rates were calculated from 1994-1997 DNR aerial infrared photos).

Graph 1. Projected solid acres of *Spartina* with continued same level funding



In Grays Harbor, extensive surveys are required to ensure all infestations are identified and treated. If the current level of activity continues in Grays Harbor and in Willapa Bay, Grays Harbor can continue to be protected from a major infestation.

Experience in central and southern Puget Sound shows that continuous control and monitoring of infestations, coupled with the elimination of nearby seed-producing meadows, can eradicate infestations and limit re-infestation. Substantial control took place in 2003 for the first time ever at the three largest infestations in Puget Sound. These infestations are much closer towards eradication. Continued funding and support is needed to keep up this successful effort in Puget Sound.

***SPARTINA* ERADICATION PROGRAM**

INTRODUCTION

Why is *Spartina* a problem?

The invasive noxious weed *Spartina* is found in the marine intertidal areas of Washington state. *Spartina* out competes and displaces beneficial native vegetation. It destroys extremely important migratory shorebird and waterfowl habitat in Willapa Bay, one of the most important estuaries on the West Coast migratory route. It also threatens to severely impact a huge shellfish industry that is extremely important to the economy of Washington state.

What species of *Spartina* occur in Washington State?

There are currently four species of non-native *Spartina* known to occur in Washington state. *Spartina alterniflora* is most widely found in Willapa Bay with over 8,000 solid acres currently infesting the Bay. *Spartina alterniflora* is also known to occur in Skagit County within Padilla Bay, Clallam County within Sequim Bay, Jefferson County within Thorndyke Bay and at several sites within Grays Harbor. Figure 12 (see pg. 52) shows *Spartina alterniflora* invading a mudflat in Willapa Bay.

Spartina patens is known to occur at only one location, Dosewallips State Park in Jefferson County. This infestation is controlled with yearly surveys, digging and herbicide applications as needed. Figure 13 (see pg. 52) shows the largest of the *Spartina patens* clumps found in 2001.

Spartina anglica is present in Skagit, Snohomish and Island counties. It has also been found in San Juan, King, Kitsap and Jefferson counties. Figure 14 (see pg. 53) shows a *Spartina anglica* clone at an undisclosed site in Puget Sound. It currently infests approximately 780 acres in Puget Sound and Hood Canal.

Spartina densiflora is a South American species that was discovered in 2001 in the northwest portion of Grays Harbor and within Race Lagoon in Island County. Figure 15 (see pg. 53) shows *Spartina densiflora* as it was discovered in northwest Grays Harbor.

How was *Spartina* introduced into Washington state?

Spartina alterniflora was unintentionally introduced to Willapa Bay as packing material for east coast oysters that were dumped into the bay during the late 1800's. In Puget Sound, various landowners intentionally introduced *Spartina alterniflora*, planting it to stabilize shorelines. *Spartina anglica* was also intentionally introduced. It was planted at a farm located in Port Susan in the early 1960's to serve as bank stabilization and potential feed for cattle. The modes of introduction for both *Spartina patens* and *Spartina densiflora* are unknown at this time.

In all, there are ten counties in western Washington with one or more infestations of *Spartina alterniflora*, *Spartina anglica*, *Spartina patens* or *Spartina densiflora*. These include Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Pacific, San Juan, Skagit and Snohomish counties.

Spartina infestations range from one infestation in Clallam County measuring only a few square feet to more than 7,800 solid acres (if contiguous) spread throughout Willapa Bay in Pacific County. All totaled, *Spartina* infests over 8,500 solid acres spread over more than 20,000 total acres.

How do we eradicate *Spartina*?

Spartina spreads quickly and is extremely difficult to eradicate. A successful eradication program involves four steps:

- 1) Preventing an existing infestation from producing seed;
- 2) Treating an existing infestation for several consecutive years using IPM (methods include mechanical, chemical or manual control, or a combination of these methods);
- 3) After eradication is achieved, monitoring the area and removing new seedlings to ensure no re-establishment occurs; and
- 4) Continuing to survey shorelines, educate the public and follow-up on possible sightings of new infestations.

WSDA *SPARTINA* PROGRAM

In 2003, the WSDA *Spartina* Eradication Program worked collaboratively with partner agencies to continue *Spartina* control; hired, equipped and coordinated a crew to treat all infestations in Clallam, Jefferson, Kitsap and King counties; assisted the Swinomish and Suquamish tribal communities with control work on their property; and worked cooperatively with the WDFW, DNR, USFWS and the aquaculture industry on infestations in Willapa Bay.

WSDA continued to work cooperatively with Ecology to administer the NPDES permit for aquatic noxious weed control, providing NPDES coverage to numerous federal, state and local governmental agencies and private entities for herbicide applications to both marine and freshwater environments.

WSDA provided funding through interagency agreements, personal services contracts and direct cost-share to state and local government agencies and private landowners. WSDA also provided over \$850,000 in equipment and herbicide to WDFW, DNR, USFWS, Skagit, Island and Snohomish counties and the Willapa Bay/Grays Harbor Oyster Growers Association for work in both Willapa Bay and Puget Sound. WSDA organized and facilitated the exchange of *Spartina* eradication information through regional planning and informational meetings; and continued to explore with partner agencies more efficient and cost-effective ways to eradicate *Spartina*.

Spartina Budget

WSDA allocated \$2,168,006 of its appropriation from the Aquatic Lands Enhancement Account (ALEA) for *Spartina* activities during the 01-03 biennium. Table 2 shows estimated expenditures for each fiscal year. Actual expenditures were slightly less as no funds were spent on attorney costs, less money was spent on salaries and benefits due to unexpected gaps in

employment for several seasonal and permanent positions, and the ecological risk assessment for imazapyr was conducted for less than allowed for in the contract.

Table 2. Budget Activity by Area – FY02 and FY03

Activity	Puget Sound/Oly. Peninsula		Willapa Bay		Total	
	FY02	FY03	FY02	FY03	FY02	FY03
¹ WSDA coordination and control activities	\$201,565	\$201,565	\$206,565	\$206,565	\$408,130	\$408,130
² Imazapyr Evaluation	0	\$50,000	0	\$50,000	0	\$100,000
³ Large-scale IPM	0	0	\$190,000	\$600,000	\$190,000	\$600,000
⁴ Purchased Services					\$220,000	\$220,000
Skagit Co.	\$40,000	\$40,000				
Island Co.	\$50,000	\$50,000				
Snohomish Co.	\$50,000	\$50,000				
Swinomish Tribe	\$10,000	\$10,000				
WDFW			\$60,000	\$60,000		
Other	\$5,000	\$5,000	\$5,000	\$5,000		
⁵ Direct Cost Share	\$5,000	\$5,000	\$5,000	\$5,000	\$10,000	\$10,000
Total WSDA Budget	\$361,565	\$411,565	\$466,565	\$926,565	\$828,130	\$1,428,130
⁶ Other State Agency Operational Budgets						
WDFW	\$117,475	\$270,181	\$149,700	\$202,760	\$267,175	\$472,947
WDNR			\$300,000	\$300,000	\$300,000	\$300,000
TOTAL State Agency Budgets	\$479,040	\$681,746	\$916,265	\$1,429,325	\$1,395,305	\$2,201,077

Notes for Table 2:

1. WSDA Coordination and Control Activities: These expenses include agency administrative expenses, salaries and benefits, travel, attorney fees, public notification expenses and other goods and services.
2. Funding for developing the necessary environmental review to allow the use of the herbicide imazapyr.
3. WSDA provided substantial funding, resources and equipment to all entities conducting on the ground control operations in 2003 to support a large-scale integrated pest management approach to eradicating Spartina. All funds reported in large-scale IPM were spent during the 2003 fiscal year.
4. Purchased Services: WSDA wrote two-year Interagency Agreements with Skagit, Island and Snohomish counties, an Interagency Agreement with WDFW to conduct work in Pacific County, and an Intergovernmental Agreement with the Swinomish Tribal Community to conduct work on its property in Skagit County.
5. Direct Cost Share: These amounts only include payments to landowners as reimbursement for equipment/supplies.
6. These figures represent the Spartina-eradication operational funds normally available to the Washington Department of Fish & Wildlife and the Washington Department of Natural Resources. This funding is separate from WSDA's Spartina funding. Updated from 2001 progress report.

WSDA received an appropriation of \$1,763,231 of ALEA funding for the FY03-05 biennium. Table 3 illustrates how WSDA has budgeted this appropriation. This is approximately \$400,000 less than was appropriated for the 01-03 biennium. This reduction should not substantially impact the amount of on-the-ground control that is achieved throughout the state next season. Approximately \$100,000 from the last biennium was a one-time expenditure dedicated to conducting an ecological risk assessment for imazapyr. Also, due to remaining amounts of herbicide purchased in FY03 and funding received by USFWS, WSDA will not need to provide as much herbicide to the effort in 2004 to achieve the same level of control. WSDA will also be cutting back on temporary staff time as a result of the reduction.

Table 3. Budget Activity by Area – FY04 and FY05

Activity	Puget Sound/Oly. Peninsula		Willapa Bay		Total	
	FY04	FY05	FY04	FY05	FY04	FY05
¹ WSDA Coordination and control activities	\$181,517	\$181,518	\$181,518	\$181,518	\$363,035	\$363,036
² Large-scale cost share	0	0	\$150,000	\$221,980	\$150,000	\$221,980
³ Large-scale IPM	0	\$33,000	\$30,774	\$161,406	\$30,774	\$194,406
⁴ Purchased Services					\$220,000	\$220,000
Skagit Co.	\$40,000	\$40,000				
Island Co.	\$50,000	\$50,000				
Snohomish Co.	\$50,000	\$50,000				
Swinomish Tribe	\$10,000	\$10,000				
WDFW			\$60,000	\$60,000		
Other	\$5,000	\$5,000	\$5,000	\$5,000		
Total WSDA Budget	\$336,517	\$369,518	\$427,292	\$629,904	\$763,809	\$999,422
⁵ Other State Agency Operational Budgets						
WDFW	\$113,284	\$84,915	\$172,755	\$141,425	\$286,039	\$226,340
WDNR			\$291,000	\$291,000	\$291,000	\$291,000
TOTAL State Agency Budgets	\$449,801	\$454,443	\$891,047	\$ 1,062,329	\$1,304,848	\$1,516,762

Notes for Table 3:

1. WSDA Coordination and Control Activities: These expenses include agency administrative and control costs including salaries and benefits, travel, attorney fees, public notification expenses and other goods and services.
2. WSDA will continue to support the Willapa Bay oyster industry and USFWS effort on economically important shellfish beds.
3. WSDA will continue to support large-scale IPM in Willapa Bay and Puget Sound by providing additional funding and resources to the effort in FY04 and FY05.
4. Purchased Services: WSDA has written two-year Interagency Agreements with Skagit, Island and Snohomish counties, an Interagency Agreement with WDFW to conduct work in Pacific County, and an Intergovernmental Agreement with the Swinomish Tribal Community to conduct work on its property in Skagit County.
5. These figures represent the Spartina eradication operational funds available to the Washington Department of Fish & Wildlife and the Washington Department of Natural Resources. This funding is separate from WSDA's Spartina funding.

The budget tables do not indicate the amount of funding provided by the USFWS for eradication activities. However, the USFWS did receive substantial funding for the 2003 season of \$956,713. It is presumed that a similar amount will be appropriated to the USFWS for the 2004 control season as well.

County Activities

In 2003, WSDA continued to allocate funding for labor and equipment for *Spartina* work crews in those counties with the majority of the infestations. WSDA allocated these resources by way of interagency agreements with the Skagit, Island and Snohomish County Noxious Weed Control Boards and WDFW in Pacific County. WSDA also provided all necessary herbicide and additional equipment to the above-mentioned entities. WSDA staff conducted field audits throughout the control season and facilitated coordination meetings to ensure contract priorities were adequately addressed.

Cost Share Program

As directed by RCW 17.26.007, WSDA offered financial assistance to private landowners for *Spartina* control and eradication in 2003. With the issuance of NPDES permits for herbicide applications, WSDA was able to provide cost share assistance in the form of purchasing herbicide for licensed private applicators as well as providing control for private landowners through county and state crews.

Table 4. WSDA Cost Share Options

Eradication/Control Method	WSDA Contribution	Landowner Contribution
County or state work crews mow and/or apply herbicide	WSDA grants county funds to treat priority areas	Must treat once during the season or agree to pay herbicide expenses
Direct cost share - Landowner applies herbicide	100% of herbicide costs	100% labor & equipment
Direct cost share - Landowner covers or digs up infestation	100% of pre-approved materials	100% labor
Direct cost share - Landowner uses WSDA pre-approved contractor	50% of contractor cost	50% of contractor cost

Because private landowners most often request the services of the state or county work crews, WSDA allocates the majority of cost share funding for this option (through interagency agreements). However, during the 2003 season, WSDA provided over \$10,000 in direct cost share to landowners in Willapa Bay. The 03-05 biennial budget table (Table 3) does not contain a line item specifically for cost share as in years past. This is because WSDA plans to use all available cost share funds to continue efforts with the oyster industry. Work will continue on the various properties treated under cost share agreements in years past, however, funding for these efforts will come from the WSDA coordination and control line item as well as the large-scale IPM line item.

WSDA also conducted a large cost share project with the Willapa/Grays Harbor Oyster Growers Association, resulting in treatment of several thousand acres of infestation. WSDA provided

over \$45,000 in herbicide, equipment and resources directly to the association for this effort as well as coordinating and conducting an aerial application to the identified cost share site.

Management Plans

As a requirement of the NPDES permit, WSDA developed a Statewide IPM Plan for the 2003 season. The Statewide IPM plan was a compilation of the five regional IPM work plans.

WSDA has been developing regional management plans since 1998. Copies of the 2003 statewide management plan as well as the 2003 regional plans are available by contacting the WSDA Statewide *Spartina* Eradication Program Coordinator. WSDA will update all IPM work plans prior to the 2004 control season.

2003 HIGHLIGHTS

In 2003, WSDA, state and federal partner agencies, local governments, tribal entities, and commercial and private landowners treated an unprecedented 6,700 solid acres of *Spartina* throughout Puget Sound, Grays Harbor and Willapa Bay. There are many positive highlights in 2003, such as the extremely successful year in Willapa Bay, which resulted from improved cooperation by all the entities involved, and approximately 6,000 solid acres being treated. WSDA also completed a crucial step in the process towards the potential approval of a new herbicide for use in aquatic environments. Several of the highlights are discussed below.

Large-Scale Integrated Pest Management of *Spartina*

After investigating the possibility of large-scale mechanical eradication of *Spartina* with a company out of Lawrence Kansas during the summer and fall of 2002, WSDA concluded that, at that time, a contract with the Kansas-based company would not be feasible. WSDA had set aside over \$600,000 for a potential contract for large-scale mechanical control. With the decision to no longer pursue such a contract, WSDA was able to take the lead in providing substantial funding for a cooperative effort to continue to eradicate *Spartina* from Willapa Bay, Puget Sound and Grays Harbor.

After the decision not to proceed with a contract was made, WSDA along with representatives from WDFW, DNR and USFWS cooperatively formulated a plan for using the funding that had been intended for the large-scale mechanical contract. Together, over several months, the agencies developed a work plan for the 2003 treatment season, which followed an integrated pest management approach using mechanical, biological, and herbicide control tools. The plan allowed WSDA to provide substantial resources for control in Willapa Bay, Grays Harbor and Puget Sound. Concurrent to the development of the work plan formulated by the agencies, a local group based in Pacific County developed a plan to address treatment of *Spartina* mainly in the southern portion of Willapa Bay. This plan was presented to WSDA and many aspects were incorporated into the overall work plan for 2003.

In Willapa Bay, as directed by the agency developed work plan, WSDA provided over \$700,000 in equipment and herbicide to WDFW, DNR and USFWS. WSDA was able to provide the agencies with their herbicide needs for the entire season. This allowed the other agencies to utilize their entire budgets on all remaining equipment and personnel needs. The other benefit of

this approach was that WSDA was able to entice several companies to competitively bid on the contract for the herbicide, resulting in a nearly 40% lower price for glyphosate than the price agencies paid at the beginning of the 2002 treatment season. The overall result of the effort made possible by the development of the agency work plan, was an extremely significant portion of the entire infestation being treated through the use of both herbicide and mechanical control tools. The result will likely be a substantial and measurable reduction in the overall infestation.

In Puget Sound, WSDA was also able to provide all the necessary herbicide needs to WDFW, Snohomish, Island and Skagit Counties. WSDA also provided key pieces of equipment to WDFW and Snohomish County. The result of this work plan in Puget Sound was an estimated 90% of all infestations being treated, including initially treating all meadows in South Skagit Bay. This area represents the most heavily infested area of Puget Sound, and the source of much of the seeds infesting other areas of Puget Sound. This effort, coupled with the past successful effort towards eradication in Puget Sound will continue to reduce the infestation and continue to bring the North Puget Sound effort closer to the goal of eradication.

Willapa Bay *Spartina* Advisory Committee Formed

As the 2003 field season drew near, and the successful development of the agency work plan was completed, WSDA worked with a diverse group of individuals representing a wide range of interests to form the Willapa Bay *Spartina* Advisory Committee. The committee was formed with representatives from WSDA, WDFW, DNR, USFWS, UW, ONRC, WSU, PCSGA, WBOGA, CRA, Pacific County Weed Board, Shoalwater Tribe, and The Nature Conservancy. The committee, chaired by WSDA, was created to help improve the cooperation and communication necessary for the successful control of *Spartina* in Willapa Bay. The Advisory Committee assisted the entities conducting control work to formulate an overall plan for 2003 and beyond.

At the committee's first meeting in March 2003, WSDA received support for the agency work plan that had been developed during the previous fall and winter. Because the work plan only addressed funding available through June 30, 2003, the end of the 2001-2003 biennium, the committee also began discussing additional control to be done during the 2003 treatment season with funding from the 03-05 biennium. The Advisory Committee also worked closely to ensure that a large cost share effort between WSDA and the WBOGA was successful.

WSDA also asked for the formation of a Willapa Bay Technical Committee, which would be made up of representatives from each of the entities conducting on-the-ground control work. The Technical Committee would be tasked with further developing work plans for the current season, as well as ensuring cooperation and communication between the individuals responsible for the on the ground operations. The Technical Committee, which was also chaired by WSDA and comprised of the program coordinators and field personnel from WDFW, DNR, USFWS and the WBOGA, met frequently throughout the season. At the end of the 2003 treatment season, the Advisory Committee formed a planning committee to develop work plans for the upcoming treatment season.

WSDA and Oyster Industry Work to Eradicate Spartina

As part of the combined effort to eradicate *Spartina* from Willapa Bay in 2003, WSDA worked cooperatively with the Willapa Bay/Grays Harbor Oyster Growers Association and USFWS to conduct a cost share effort of unprecedented size in the Nemah area of Willapa Bay.

The mudflats in the Nemah area are some of the most productive oyster beds in all of Willapa Bay. The *Spartina* infestation in the Nemah area includes a meadow of approximately 900 solid acres, and over 1,000 acres in infested clone fields. The effort involved numerous private oyster growers contributing their labor, expertise, money and resources to conduct the treatments to the clone fields, while WSDA provided herbicide application equipment, herbicide and funding for a field coordinator who ensured proper herbicide applications were conducted and all applicable laws and permits were complied with. The USFWS provided on the ground assistance and support to the growers and WSDA. WSDA also conducted the aerial application to the 900-acre meadow adjacent to the clone fields.

With funding awarded for the 2003-05 biennium, WSDA was able to contribute over \$140,000 in equipment, resources, herbicide and on-the-ground control towards this cost share effort. The WBOGA also provided substantial amounts of resources towards the effort. Many individual growers supplied additional equipment, the personnel, boats, barges, skiffs and dredges that were needed to make this huge effort successful. All told, the growers contributed approximately 1,260 man-hours towards the effort. They spent an estimated 9 days conducting the treatments to the clone field in the Seal Slough/Nemah treatment site. However, the largest contribution made by the growers came in the form of lost production time. The growers did not hire separate crews to treat *Spartina* but rather utilized employees that would have otherwise been working on shellfish production operations. The growers estimate that 90% of all clones in this area were treated.

WSDA will continue to work with the WBOGA and USFWS to ensure that the necessary follow-up treatments to the cost share site are conducted and, if time and resources allow, additional areas for this type of cost share work will be treated.

Registration Process Nearing Completion For New Herbicide Imazapyr[®]

For the past 10 years researchers at WSU have been continuously looking for new tools to add to the *Spartina* control toolbox. From the inception of the program, managers have had to rely on only one herbicide, glyphosate. While the use of new mechanical control tools has continued to evolve over the years, the use of new herbicides has not. WSU research identified one herbicide, imazapyr, which showed potential as an effective *Spartina* control tool. However, in order for the herbicide to be allowed for use in aquatic environments it had to go through a lengthy registration process. As part of that registration and approval process, the WSDA *Spartina* program was required to complete an ecological risk assessment of the herbicide.

WSDA staff worked with an environmental consulting firm during the 2003 season to complete the environmental review necessary to evaluate the use of the herbicide for *Spartina* control. The U.S. Environmental Protection Agency (EPA) also completed the necessary federal registration process at the end of 2003. WSDA *Spartina* program staff is now working closely

with the Department of Ecology to ensure the necessary SEPA process is completed and the new herbicide is allowed for use under the NPDES permit.

With the successful registration and complete environmental review, the cooperative control effort will add another tool to the *Spartina* control toolbox. This tool, used in conjunction with the existing herbicide, mechanical and biological control tools, will allow the cooperating entities to more successfully control invasive *Spartina* in both Puget Sound and Willapa Bay.

NPDES Water Quality Monitoring Conducted

In 2003 the use of herbicides for *Spartina* control with the active ingredient glyphosate was permitted under the National Pollution Discharge Elimination System (NPDES) permit for control of aquatic noxious weeds. The permit requires water quality monitoring for the detection of glyphosate in tidal water. Prior to the control season a monitoring plan was created by WSDA, which outlined the water quality sampling protocol.

The plan was designed to monitor glyphosate levels at a variety of sites. The sites were selected to be representative of both infestation and application types throughout the state. Sampling locations were selected for infestation types where certain application types were anticipated. The application/infestation relationships were ground broadcast/meadow, hand held/scattered regrowth, high volume/clone field, precision spray/meadow, and backpack/seedlings. Both pre-treatment and post-treatment samples were collected at each monitoring site.

Pre-treatment samples were collected to address any sources of glyphosate in the water column that may be unrelated to *Spartina* control. This was achieved by taking all pre-treatment samples at least 12 hours before any glyphosate treatment occurred within the water body. To verify the source of any detection, pre-treatment sample stations were selected at or near sites where post-treatment sampling would occur.

Post-treatment samples were collected at the first tidal event to completely inundate the sample site after the entire site was treated. Thus, the post-treatment sampling schedule was dependent on both completion of treatments and tidal regimes. Sampling required coordination between WSDA, Island County Noxious Weed Board, WDFW and USFWS. All sampling was completed by October 24.

The sampling procedures conformed to general United States Geologic Service (USGS) guidelines. Field quality procedures included the submission of equipment blanks and replicate samples. After collection, the samples were sent to Environmental Health Labs in South Bend, Indiana, which is accredited with the Department of Ecology.

All samples were reported to contain glyphosate concentrations within expected levels. A monitoring report will be submitted to Ecology by February 1, 2004. The monitoring program will continue next season, however, the plan will be modified to look at different factors, such as off-site transport and concentrations through time.

Program Results by Geographic Area

SPARTINA ERADICATION EFFORTS IN WILLAPA BAY

This water body includes the mouth of Willapa Bay, Willapa Bay, and all the rivers, streams and creeks that feed into the Bay.

Extent of the Infestation in Willapa Bay

During the 2002 control season, a combined survey was conducted by WSDA, WDFW, DNR, USFWS and UW-ONRC. The survey used Global Positioning System (GPS) units from both ground-based and air-based platforms. The GPS-based survey was compared to aerial infrared photos taken of the entire infestation during the 2000 season, as well as the Geographical Information System (GIS) layer of *Spartina* that was created from the 2000 aerial photo set. This method of quantifying acreage, while still not completely accurate, proved to be far more accurate than the previous method of relying on projected growth rates. This method was improved even further during the 2003 treatment season. Coupled with the treatment figures from the various agencies and including the areas that were not treated during the 2003 season, a fairly accurate estimate of total acreage, both solid and affected has been determined. WSDA now estimates the acreage affected by *Spartina* in Willapa Bay at over 18,000 acres, with over 8,000 solid acres infested.

This is a 1,000-acre increase of the solid acres estimate provided in last year's report. Although a more accurate survey is likely responsible for much of that increase, another factor involved may be the large numbers of seedlings observed in the Bay this season, possibly pointing to an overall increase of the entire infestation from last year, even when considering the amount of control conducted during the 2002 season.

In almost every area of the Bay during the 2003 season, a larger than normal amount of seedlings were observed. Although no scientific explanation has been found, the mild winter and spring of 2003 followed by a record breaking hot and dry summer could have provided the perfect conditions for *Spartina* to produce more seeds and have more of those seeds germinate throughout the spring and summer. This observation of increased seedlings was also seen in Grays Harbor and Puget Sound, suggesting it was similar factors affecting all the water bodies.

Roles and Responsibilities of Participating State and Federal Agencies in 2003

In 2003, the participating agencies pursued the use of various herbicide application systems, and mechanical control tools to combat the spread of *Spartina*. The following list outlines the role each agency assumed in Willapa Bay during the 2003 control season.

- **WSDA** – Continued to work with Ecology to ensure NPDES coverage was issued to all necessary applicators. WSDA provided resources, equipment and herbicide to WDFW, DNR, USFWS and the oyster industry. Worked cooperatively with WDFW to control entire North Willapa Bay meadow, conducted cost share control activities with WDFW and DNR on

private land on the Long Beach Peninsula, continued to operate mechanical control tools on North Long Beach Peninsula.

- **DNR** – Conducted control work in Pot Shot, Stanley Point and Naselle River as well as Natural Area Preserves. Managed the infrared aerial photography and mapping program. Developed and implemented a *Spartina* control monitoring program in cooperation with WSU. Provided staff time and airboat assistance for UW-ONRC biocontrol program.
- **WDFW** – Conducted control operations in cooperation with WSDA in North Bay priority area, conducted control work with WSDA on private property on the Long Beach Peninsula and assisted UC-Davis in collecting data for research that may help to improve *Spartina* control. Collected data for control monitoring program. Conducted early season aerial broadcast application.
- **USFWS** – Operated ground broadcast application equipment, conducted control work in South Bay, Long Island Slough, North Long Island and Naselle areas. Provided airboat support for *Spartina* researchers.
- **UW – ONRC** – Continued to manage the biological control release program and provided mapping and Geographic Information System (GIS) support.
- **WSU** – Worked with DNR, WSDA, and WDFW to develop a standard monitoring protocol and conducted monitoring at various sites. Continued research to improve effectiveness of control program.

Highlights of the 2003 Season in Willapa Bay

In 2003, the cooperative *Spartina* eradication effort resulted in treatment of an unprecedented 6,000 solid acres, or about 65 - 70% of the overall solid infestation. Figure 1 shows the approximate location of all treatment sites. Table 5 identifies the areas of the bay treated, who conducted treatment and what kind of treatment was done. Figures 2 and 3 are maps of North Willapa Bay and South Willapa Bay treatment areas, respectively.

WSDA anticipates that the estimated 6,000 solid acres treated during the 2003 season will result in substantial decrease in the overall infestation. If true, this will be the first ever decline of the Willapa Bay *Spartina* infestation. This success was made possible through cooperative work by all entities involved in Willapa Bay *Spartina* control. With the proven ability to treat such a large amount of acreage during a single control season, continued funding is essential to ensure that follow up treatments can be conducted while continuing to attack untreated infestation sites.

Great progress was made in several areas of the Bay during the 2003 season by the agencies involved. The USFWS focused its efforts on the meadows found at Porters Point, Tarlatt Slough, O'Meara Cove, East Long Island, North Pot Shot and Kaffee Lewis Slough. USFWS crews also treated substantial amounts of clone fields adjacent to these meadows. In all, the USFWS treated approximately 3,400 solid acres of clones and meadows in South Willapa Bay. The majority of the acreage treated by USFWS was done through the use of sophisticated ground broadcast application equipment that allowed treatments to occur in both previously treated areas

where scattered re-growth was found as well as in previously untreated meadows. This equipment was utilized in areas of infestation where the maximum amount of dry time was possible, thus improving efficacy. Figure 16 (*see pg. 54*) shows one of the tracked amphibious vehicles conducting spray operations. Figure 17 (*see pg.54*) shows an aerial view of the Porters Point treatment area. Much of this site has now received two consecutive years of treatments. Figure 18 (*see pg. 55*) is an aerial infrared photo of the Porters Point site taken in September 2003 after treatments to site were conducted.

WDFW and WSDA treated all meadows on both the north and south side of the Willapa River as well as all adjacent clone fields. All together WDFW and WSDA treated over 900 solid acres in North Willapa Bay. WDFW also took the first steps at testing new higher label application rates for aerial applications. In early June WDFW contracted for an aerial application of approximately 200 acres of the Willapa River meadow. Early indications were favorable enough to allow WSDA to conduct an aerial application of approximately 900 acres in the Seal Slough/Nemah area later in the season. This application is discussed in greater detail below.

WSDA and WDFW conducted extensive mechanical control treatments in the North Willapa area. All told, over 400 solid acres of the Willapa River meadow were treated mechanically as well as the entire Rose Ranch meadow. In combination with the early June aerial application, the majority of the meadow on the north side of the Willapa River was treated before any seed was produced. This should greatly reduce the amount of re-growth and new growth next season. This should also reduce the amount of re-treatment needed in this area during the next treatment season. However, as with all sites treated during the 2003 season, many years of follow up treatment will be required to bring this site to full eradication. Figure 19 (*see pg. 55*) shows an amphibious Marsh Master mechanically crushing a site in the North Willapa treatment area. Figure 20 and 21 (*see pg. 56*) are aerial infrared photos of the North Willapa meadow in 2000 and 2003.

DNR focused the majority of its control work in the Long Island Slough and Naselle River areas, treating more than 350 solid acres utilizing integrated pest management principles. DNR retreated through herbicide applications, a large area of the Naselle River that was previously treated through mechanical crushing. DNR also continued to treat Pot Shot slough. This is a site that has been the focus of treatments by all entities involved since 1997. During the 2003 treatment season DNR treated all remaining infestations at this site. USFWS also contributed to the 2003 treatment of this site by tilling paths into the more heavily infested areas to allow for airboat access. Figure 22 and figure 23 (*see pg. 57*) show the 1997 and 2003 aerial infrared photos of Pot Shot.

The Willapa Bay/Grays Harbor Oyster Growers Association became a major on-the-ground partner in the fight against *Spartina* during the 2003 season. While the Association has always supported the successful eradication of *Spartina* and many growers have conducted treatment programs on their oyster beds, the Association has never had the opportunity to coordinate a large crew to treat a vast tract of clone fields. This work was made possible through a large-scale cooperative cost share effort conducted by WSDA and the Association. WSDA was able to provide the necessary application equipment and herbicide to the Association, as well as funding to hire an on-the-ground coordinator for the Association. This made it feasible for the

Association to use the combined efforts and resources of many individual growers and growers' crews to treat over 1,000 affected acres of clone fields in the Nemah area. WSDA further contributed to this effort by contracting for an aerial herbicide application to the large meadow adjacent to the clone fields treated by the Association.

Figure 1. Approximate Location of 2003 Interagency Willapa Bay Treatment Sites

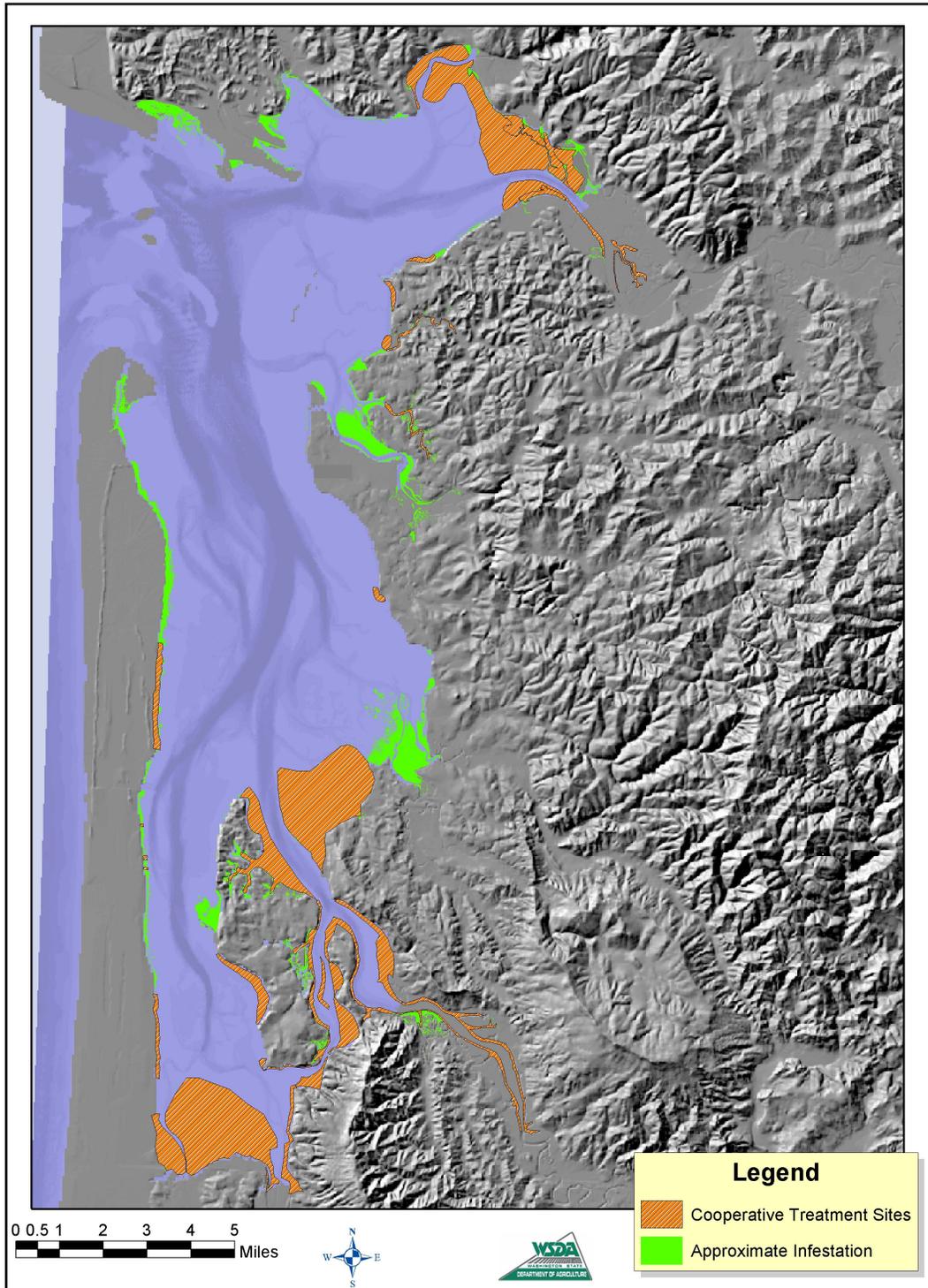


Table 5. Summary of 2003 Willapa Bay *Spartina* Eradication Effort

Site	Estimated Solid Acreage Treated	Approximate Affected Acres Treated	Entity Conducting Treatment	Treatment Method Used
North Willapa Area				
North River/Smith Creek/Willapa River Meadow	925	2500	WDFW, WSDA	Herbicide, Crush
North Stoney Point	22	22	WDFW	Crush
Oysterville - Nahcotta	90	187	WSDA, DNR	Crush, Herbicide
South Willapa River/Rose Ranch/Mailboat Slough	177.88	470	WDFW, WSDA	Herbicide, Crush
Niawiakum NAP	14	70	DNR	Herbicide
Bone River NAP	9	93	DNR	Herbicide
South Stoney Point	25	40	WDFW	Herbicide
Ramsey Point	1	34	DNR	Seedling Herbicide
South Willapa Area				
North Pot Shot	83.3	83.3	USFWS	Herbicide
O'Meara Pt. – Bear R.	10	177	USFWS	Herbicide
O'Meara Point	75	103	USFWS	Herbicide
Pot Shot	137	223	DNR	Herbicide
South Long Island	10	36		
Smokey Hollow	1	20	WSDA	Seedling Dig
East Long Island/Middle Island Reserve	175	260	USFWS	Herbicide
Ellsworth/Naselle/Chetlo Harbor	200.06	803	DNR, USFWS	Herbicide
Porters Point/ Tarlatt Slough	2425.30	2700	USFWS	Rototill, Herbicide
Stanley Point	114	114	DNR	Herbicide
Kaffee Lewis Slough	518.04	650	USFWS	Herbicide
Nemah/Seal Slough	1000	2100	WSDA/WBOGA	Herbicide
Long Beach Cost Share	10	110	WSDA, DNR, WDFW	Herbicide
Total	6,022.58	10,795.3		

Figure 2. 2003 North Willapa Bay Interagency Treatment Sites.

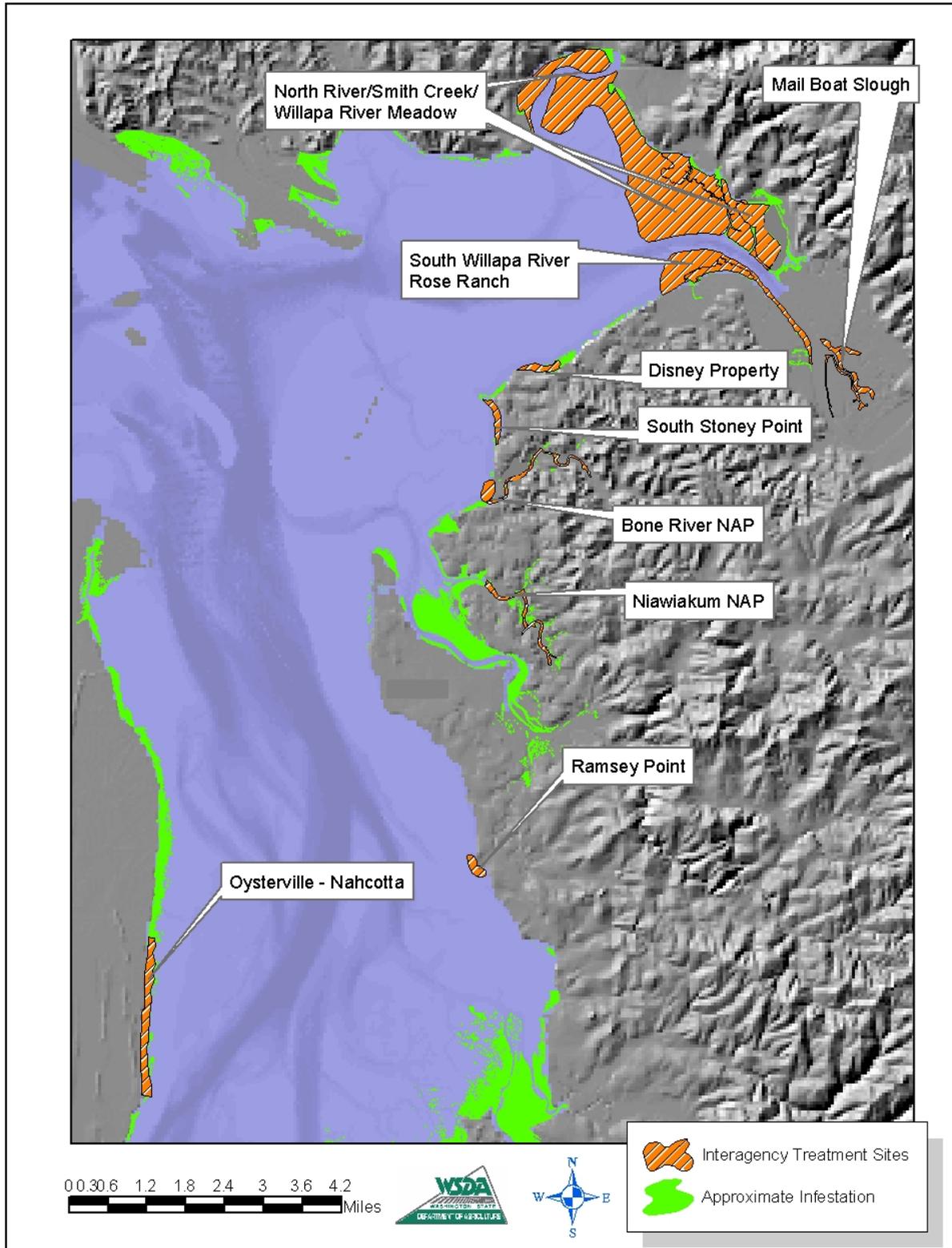
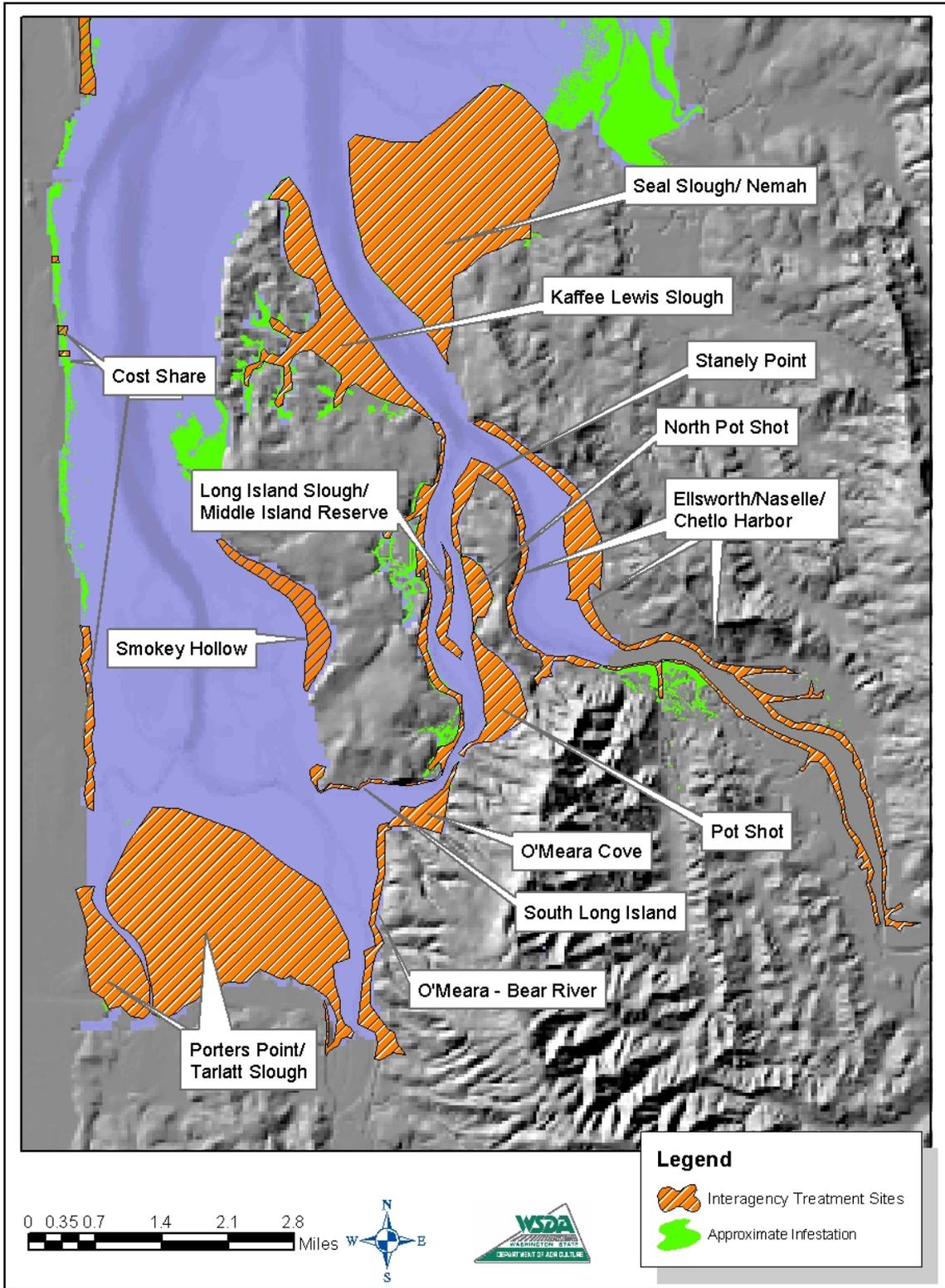


Figure 3. 2003 South Willapa Bay Interagency Treatment Sites



2003 *Spartina* Eradication Monitoring Program, Willapa Bay

Prior to the 2003 field season, the protocol used for monitoring the control work was refined. DNR, WDFW, WSDA, and WSU worked together to develop a standard approach to measure the effectiveness of treatment activities, which integrated different methods used over the past several years. The protocol incorporated aspects of two different sampling methods that had been implemented in 2002, resulting in one standard set of procedures that was followed by all. This new protocol was implemented during the 2003 season by the entities listed above, with the data being comparable across sites.

The monitoring program allows managers to understand the effectiveness of treatment methods in different sites and then to use that information, along with acres treated, to determine how much *Spartina* was killed each year. It also provides information about how effective the overall control approach is, as well as effectiveness of individual treatments. Data generated from the program are also used for adaptive management purposes—to improve and make future adjustments to the control strategy.

Monitoring sites were selected in areas where chemical and mechanical control have been previously conducted, as well as at untreated sites. The treated sites vary in substrate type, method and timing of treatment. Untreated sites will serve as a reference for comparison to the sites where control has taken place. To date, the treated sites sampled in the monitoring program and the treatments conducted before sampling occurred include the following:

Stanley Point	Crushed winter - spring 2003
Willapa River	Crushed summer 2001 *
North Chetlo Harbor (Naselle River)	Crushed winter 2001 and fall 2002
South Chetlo Harbor (Naselle River)	Crushed winter 2001 and fall 2002
Outer Chetlo Harbor (Naselle River)	Crushed fall and summer 2002
Stony Point	Crushed fall 2002
Disney Property	Crushed fall 2002
Rose Ranch	Crushed winter 2002 and spring 2003
Nahcotta	Crushed summer 2002
Patten Site	Hand held spray, summer 2002
Oysterville	Hand held spray, summer 2002
Naselle Bridge	Hand held spray, summer 2002
Leadbetter	Hand held spray, summer 2002
Porters Point 8 – 14 hrs dry time	Ground broadcast, summer 2002
Porters Point 24 hrs dry time	Ground broadcast, summer 2002

*Data for the Willapa River site was collected in July 2002. The data reflect only the 2001 treatment

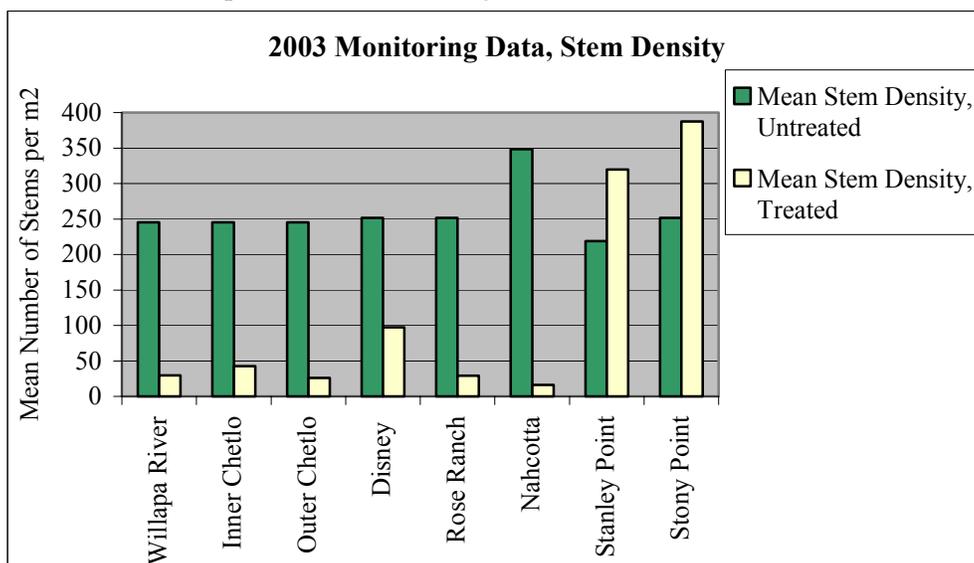
Sampling occurred in the summer of 2003 by WDNR, WDFW, WSU and WSDA staff before any summer treatments were conducted, except for the Rose Ranch site, which was sampled approximately three months after the 2003 treatment. Therefore, the results of this year's monitoring reflect only those treatment activities conducted prior to the 2003 summer field season, with the exception of the Rose Ranch site.

At most treatment sites, at least 100 samples were collected; in untreated, or reference sites, 25 samples were collected. The samples were collected along randomly located transects at one-meter intervals. A 0.5 x 0.5 m² sampling unit, or quadrat, was placed along the transects and the number of stems, number of flowering stems, and percent native vegetation cover were recorded.

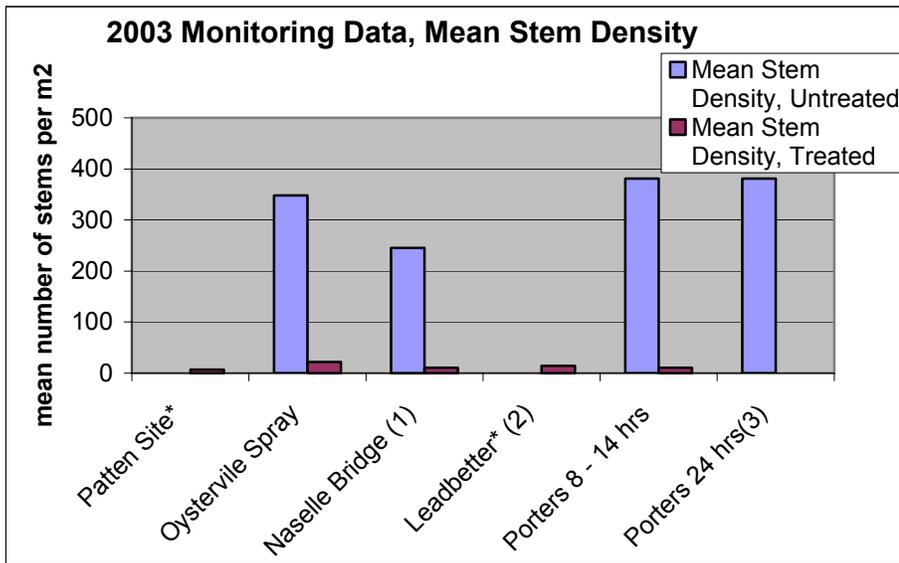
The results of the monitoring work show significant reductions in average stem density in all but 2 sites (Graph 2 and 3). These reductions range from a 95% drop in stem density at the Naselle Bridge site to a 61% decline in stem density at the Disney Property. It is important to note that at this time pretreatment data for the several sites that received herbicide applications is not available at this time. It is highly likely that these sites may result in a greater reduction in stem density than the 95% seen at the Naselle Bridge site. Two sites show an increase in the average number of stems present (Stanley Point and Stony Point). One factor that may be related to the increase in stem density at these sites is substrate type. The sediment at each of the two sites is sandier, and thus firmer, than at the other sites. Without substantial pressure and compression on the root mass of the plants when mechanically crushing, which is reduced on firm ground, there was not enough damage to kill the plant. It was also observed that the stems growing back after these treatments were narrower in diameter than at nearby reference sites, resulting in a greater number of thinner stems.

Data also indicates a low number of flowering stems at all mechanical treatment sites. The average number of flowering stems per quadrat ranged from 0 (Stanley Point, Willapa River, North Chetlo Harbor, South Chetlo Harbor, Outer Chetlo Harbor, and Rose Ranch) to 14 (Stony Point). The other sites, Disney Property and Nahcotta, both had an average of about 2 flowering stems. Not having any spray-only sites to use as a comparison, it is difficult to conclude from the data alone if crushing specifically is causing the reduction in flowering. It may be, in fact, that all types of treatment reduce flowering. However, this unambiguous result of exceptionally low flowering at the treatment sites suggests that mechanical control is a useful tool not only for reducing the overall infestation, but also in stopping the production of *Spartina* seeds.

Graph 2. 2003 monitoring data. Mechanical Control.



Graph 3. 2003 monitoring data. Herbicide applications



* Pretreatment data for Patten site, Leadbetter, and Porters sites not available at this time.

(1) Only 42 samples collected or reported for Naselle Bridge site

(2) Only 80 samples collected or reported for Leadbetter site.

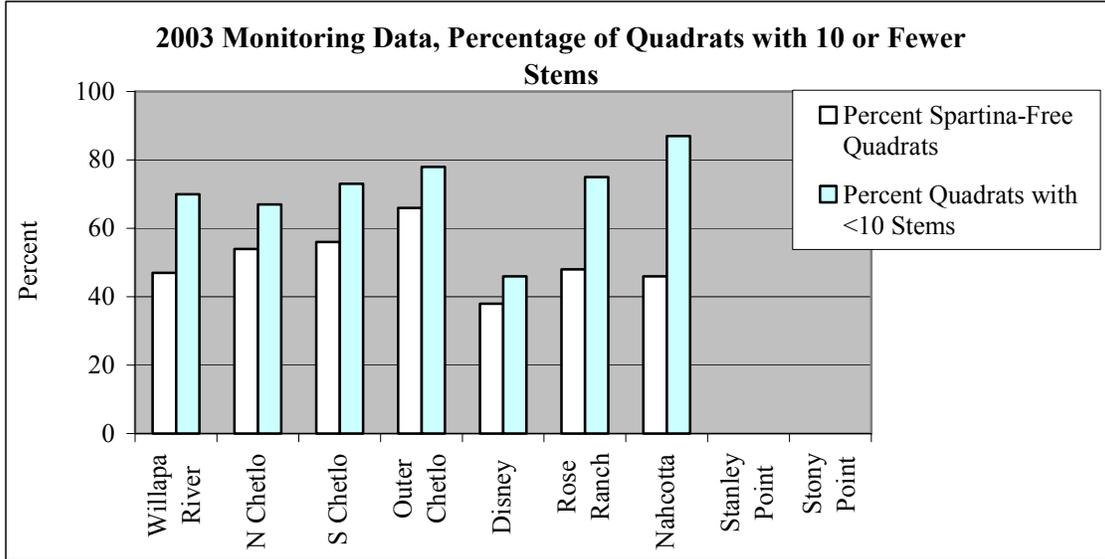
(3) Only 30 samples collected or reported for Porters 24hrs site

In addition to evaluating the reduction in stem density at treatment sites, the proportion of sample quadrats that contain no or very few stems of *Spartina* was also examined. Consideration of both metrics provides a complete look at how much *Spartina* remains following treatment. For example, knowing that a site contains 66% *Spartina*-free quadrats doesn't indicate how much *Spartina* is contained in the 34% of remaining quadrats. By offering both sets of data, one is able to better understand both the distribution of *Spartina* at a given site, as well as the overall quantity of live stems.

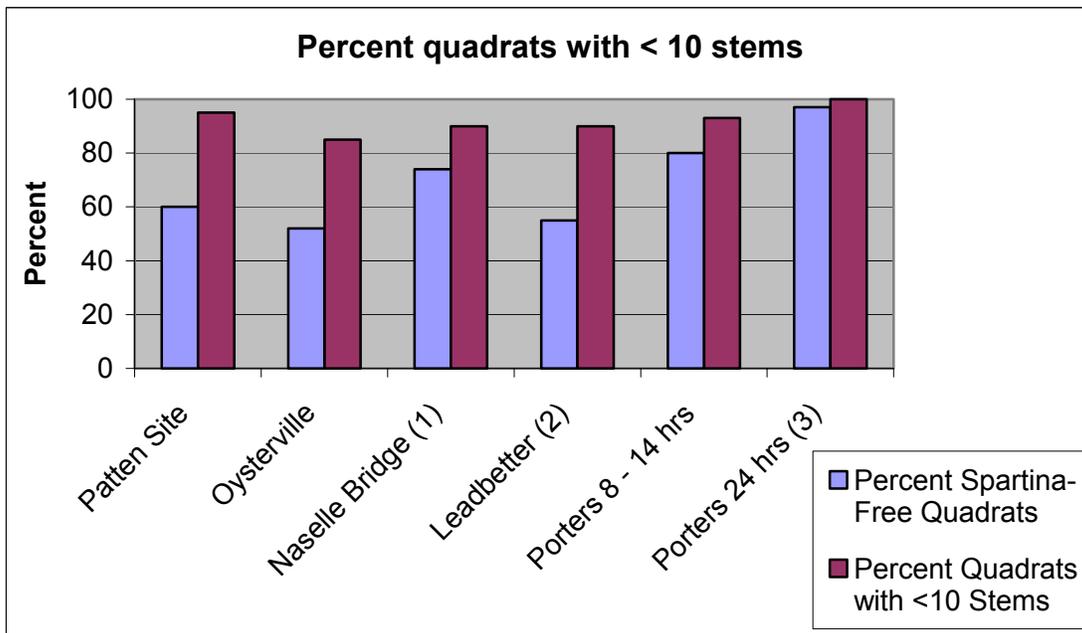
Graphs 4 and 5 show both the percent of sample quadrats having 0 stems and those having 10 or fewer stems. Ten or fewer stems was chosen based on observations in the field that quadrats containing as many as 10 stems were still about 90 to 95 percent free of *Spartina*. It provides a measure of being "almost there" in terms of *Spartina* eradication and gives another sense of how much *Spartina* remains at a given site. To help visualize this concept, Figure 24 (see pg. 58) shows a quadrat containing 10 stems.

The *Spartina*-free figures range from 0% at two sites (Stanley Point, Stony Point), meaning all of the sample quadrats had live *Spartina* stems, to 97% at Porters Point 24hrs, meaning only 3% of the quadrats contained live *Spartina* stems. Similarly, those same two sites contained 0% quadrats with 10 or fewer stems, while 12 sites (Willapa River, N. Chetlo Harbor, S. Chetlo Harbor, Outer Chetlo Harbor, Rose Ranch, Nahcotta, Patten site, Oysterville, Naselle Bridge, Leadbetter, Porters 8 – 12 hrs, and Porters 24 hrs) had 67% or more quadrats with 10 or fewer stems. For the sites with all quadrats containing *Spartina* stems, the reason for this outcome may be explained by substrate type, as mentioned above.

Graph 4. Percent of Quadrats with 10 or fewer stems. Mechanical Control



Graph 5. Percent of Quadrats with 10 or fewer stems. Herbicide Applications



- (1) Only 42 samples collected or reported at Naselle Bridge site
- (2) Only 80 samples collected or reported at Leadbetter site
- (3) Only 30 samples collected or reported at Porters 24 hrs site

When looking at the data for herbicide applications, in particular the two Porters Point sites, it is important to describe the reference to dry time. Dry time is describe as the amount of time the portion of the plant that was sprayed remains above water. In the case of the Porters Point 8 –14 hrs site, this refers to the portions of the plants sprayed at this site were above water for at least 8 hours and up to 12 hours before the tide inundated the plants. When comparing this site to the Porters Point 24 hr site (24 hours dry time) it becomes apparent that the greater the dry time,

especially with aerial or ground broadcast applications, the greater the efficacy.

In general, the *Spartina* free quadrat data, along with those for stem density, indicate that not only is *Spartina* at most of the sites substantially reduced, but also that much of those sites contain no live stems at all. With continued treatment in these areas, both mechanical and chemical, it is predicted that *Spartina* will be nearly eradicated there in two or three more years.

Monitoring at all sites will continue in 2004 to assess the amount of *Spartina* growing back after herbicide applications and additional mechanical control. As stated above, the expectation is to see continued declines in the stem density of *Spartina*, as well as increases in the number of sample units containing few to no live stems. This information will continue to be used to adjust the existing management approach and plan for future control work. For example, based on the data collected at Stanley Point and Stony Point, which indicated poor mechanical control efficacy, DNR and WDFW treated the entire sites with herbicide during the 2003 season.

All the data collected and reviewed for this report suggests that the control tools, both herbicide and mechanical, when used in the right environmental conditions, will be effective. These options allow managers to choose from a wide range of treatment combinations when treating *Spartina*, and, therefore, conduct a more successful integrated pest management program.

Biological Control

The biological control program continued to make progress in 2003. The biocontrol agent, *Prokelisia marginata*, has shown potential for controlling *Spartina*, but its populations have not grown to high densities over large areas. Scientists from the University of Washington's Olympic Natural Resources Center (UW-ONRC) have determined some of the reasons why populations of the planthopper have not increased from year to year. The current strategy involves improvements in three areas that are expected to lead to a greater impact on *Spartina*.

The first improvement has come with a better understanding of what kinds of sites are most suitable to *P. marginata* reproduction and survival. In 2002, habitat characteristics at 12 release sites were quantified. Three factors were found to significantly improve *P. marginata* performance. These include a high level of nitrogen in *Spartina* leaves, low spider abundance, and stems that remained intact throughout the winter. In the summer of 2003, releases were made only into sites with these desirable characteristics. Three of the release sites, Middle Tarlatt, Upper Palix, and North Cove (2), were new this year. Insects were also re-released at three sites where *P. marginata* survived the winter of 2002 to give those populations a boost. No release was made at the South Tarlatt Slough site, where winter survival in 2002 was highest. This population appears to be growing without supplemental releases.

The second improvement for the biocontrol program involves using the best adapted source population of *P. marginata*. So far, the insects used in the biocontrol program have come from California. In Willapa Bay, these insects appear to emerge from dormancy too early in the spring, before the temperature has risen sufficiently and before *Spartina* spring growth. As a result, a large proportion of the over-wintering nymphs die off during the spring months and few develop into reproductive adults. To remedy this problem, *P. marginata* has now been imported from the East Coast (Rhode Island and Virginia) after receiving permits from the USDA-APHIS

and WSDA. It is expected that these cold-adapted populations will emerge from dormancy in late April, which is more appropriate timing for the Willapa Bay climate.

Table 6. Numbers of *P. marginata* released and sampled in 2003.

Site	Number released in Summer 2003	Sampled Density* Adults/m² October	Sampled Density* Nymphs/m² October
Tarlatt South	0	27	483
Tarlatt Middle	2,400	246	349
Leadbetter North	30,400	867	831
Parpala Road	17,600	1,631	3,257
Upper Palix	18,900	256	1,122
North Cove (1)	11,800	262	601
North Cove (2)	23,800	166	556
U.C. Davis Experiment sites			
Tarlatt North	4,800		
Chetlo Harbor	4,800		
Wilson Point West	4,800		
Puget Sound sites		Nymphs and adults per stem in October	
Turner's cove (west)	14,000	7.1	
Turner's Cove (east)	12,000	12.1	

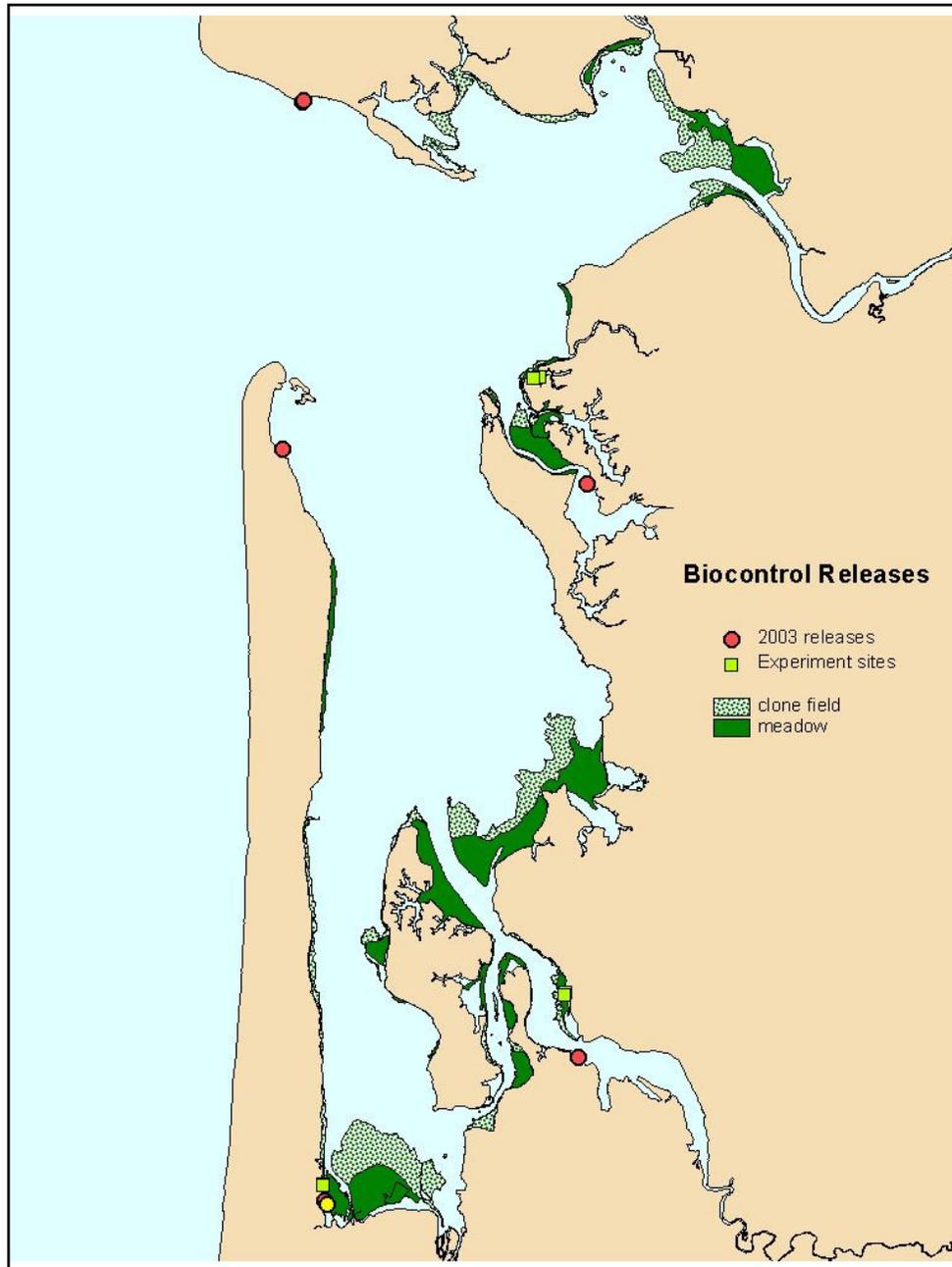
*Actual field densities are approximately twice the sampled density based on a tested vacuum efficiency of ~50%. A total of 119,300 insects were released in Willapa Bay and 26,000 in Puget Sound.

The third way the biocontrol program could be enhanced in the future is through the screening and introduction of new biocontrol agent species. Even though *P. marginata* is a promising biocontrol agent, it is often more effective to have multiple biocontrol agent species contributing stress to the plants. Initial survey work in the native range of *Spartina* was completed in 2002. More than two-dozen herbivorous insects were found that appear to be specialized on *Spartina*. About ten of these have good potential for impacting invasive *Spartina* if introduced on the West Coast. Host specificity testing and risk assessment of these agents is needed to determine whether they would be safe to introduce into the new environment. This could be accomplished in two to three years if sufficient funding can be found.

This year, as in previous years, some browning of *Spartina* due to *P. marginata* feeding was observed. A 50% reduction in the mass of seed heads was measured in areas where *P. marginata* was abundant. This is a result of *P. marginata* feeding at the base of the inflorescence during seed development. Also, large amounts of honeydew excreted by the insects resulted in the growth of fungus on the inflorescences, which might have inhibited seed development. The collected seeds are currently being germinated to determine *P. marginata*'s effect on seed viability.

For the first time, releases of *P. marginata* were made into Puget Sound for biological control of *S. anglica*. Releases were made on August 11 (~14,000 insects) and October 1 (~12,000 insects) in two different areas of a meadow located in Turner's Cove on Swinomish Tribe property.

Figure 4. Map of biological control sites, including release sites, monitoring sites, and experiment sites

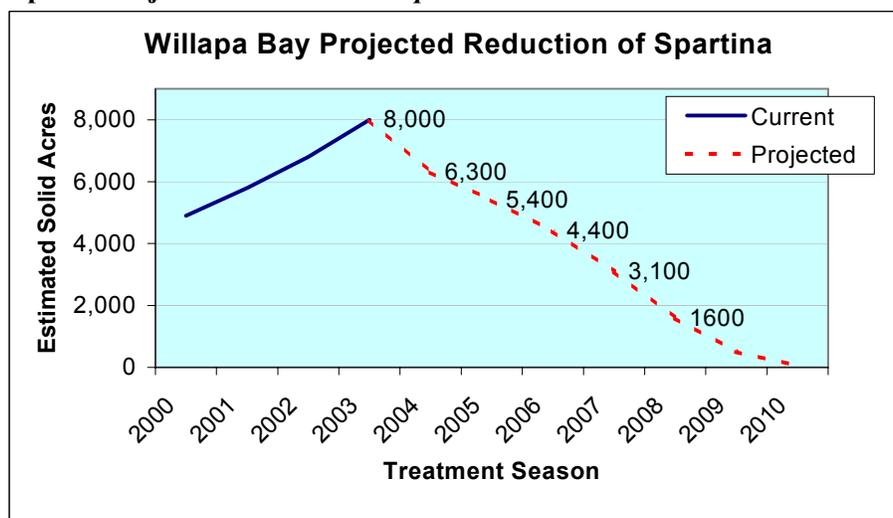


Recommendations for the Future

With the huge amount of acreage treated during 2003, the effort has shown that eradication is a greater possibility than ever before. The effort has proven that the amount of acreage needed to be treated every year, to progress towards eradication, is feasible with the current treatment approach. As large areas are treated for the first time, follow up treatments will be necessary every year for several years to ensure success. In many cases the follow up treatments may be more costly and more time consuming than the initial treatments. Also, with the registration of imazapyr nearing completion, the effort will have an additional tool in the 2004 treatment season that will aid in the eradication program. This illustrates the importance of continued funding at current levels for at least the next several years. Graph 5 illustrates the projected overall decrease in total solid acres over 7 years. This projection assumes that:

- At least a 50% efficacy of the 6,000 acres treated during the 2003 treatment season. (Based on efficacy data from previous years, at least 50% efficacy is achievable overall.)
- WSDA continues to receive funding at the same levels as the 2003-05 biennium
- WDFW and DNR continue to receive funding at the same levels as the 2003-05 biennium.
- USFWS continues to receive \$1,000,000 per year in federal funding for *Spartina* control.
- Through continued large-scale IPM, the effort will eradicate 2,000 solid acres per year in future years.
- A 17% growth rate will continue each year, regardless of when and where treatments occur. (Growth rate calculated from 1994-1997 DNR aerial infrared photos.)

Graph 5. Projected solid acres of *Spartina* with continued same level funding



***SPARTINA* ERADICATION EFFORT IN GRAYS HARBOR**

This waterbody includes the mouth of Grays Harbor, Grays Harbor, and all the rivers, creeks and streams that run into Grays Harbor and the Copalis River drainage. Figure 5 shows the approximate locations of the 2003 treatment sites in Grays Harbor.

Extent of the Infestation in Grays Harbor

Due to the magnitude of the problem in neighboring Willapa Bay, property managers and landowners in Grays Harbor have long been concerned about the potential for invasion of *Spartina*. This threat was validated in 1992 with the discovery of one large *Spartina* clone in Grays Harbor by DNR staff. This was the only known infestation in Grays Harbor at the time, and the DNR crew mowed it repeatedly throughout the growing season.

In 1995, WDFW began conducting yearly surveys and control work in Grays Harbor. At the beginning of the 1995 season there were approximately 2 solid acres of known *Spartina* within the Grays Harbor management area.

Between 1995 and 2002 WDFW and Grays Harbor County Noxious Weed Board conducted regular surveys of the harbor. WDFW would conduct yearly control work to any infestations found during the surveys.

In 2002, WDFW, WSDA and DNR continued to put strong emphasis on preventing *Spartina* establishment in Grays Harbor. Specifically, all known infestations were treated by the end of the 2002 season, including the newly discovered *Spartina densiflora*.

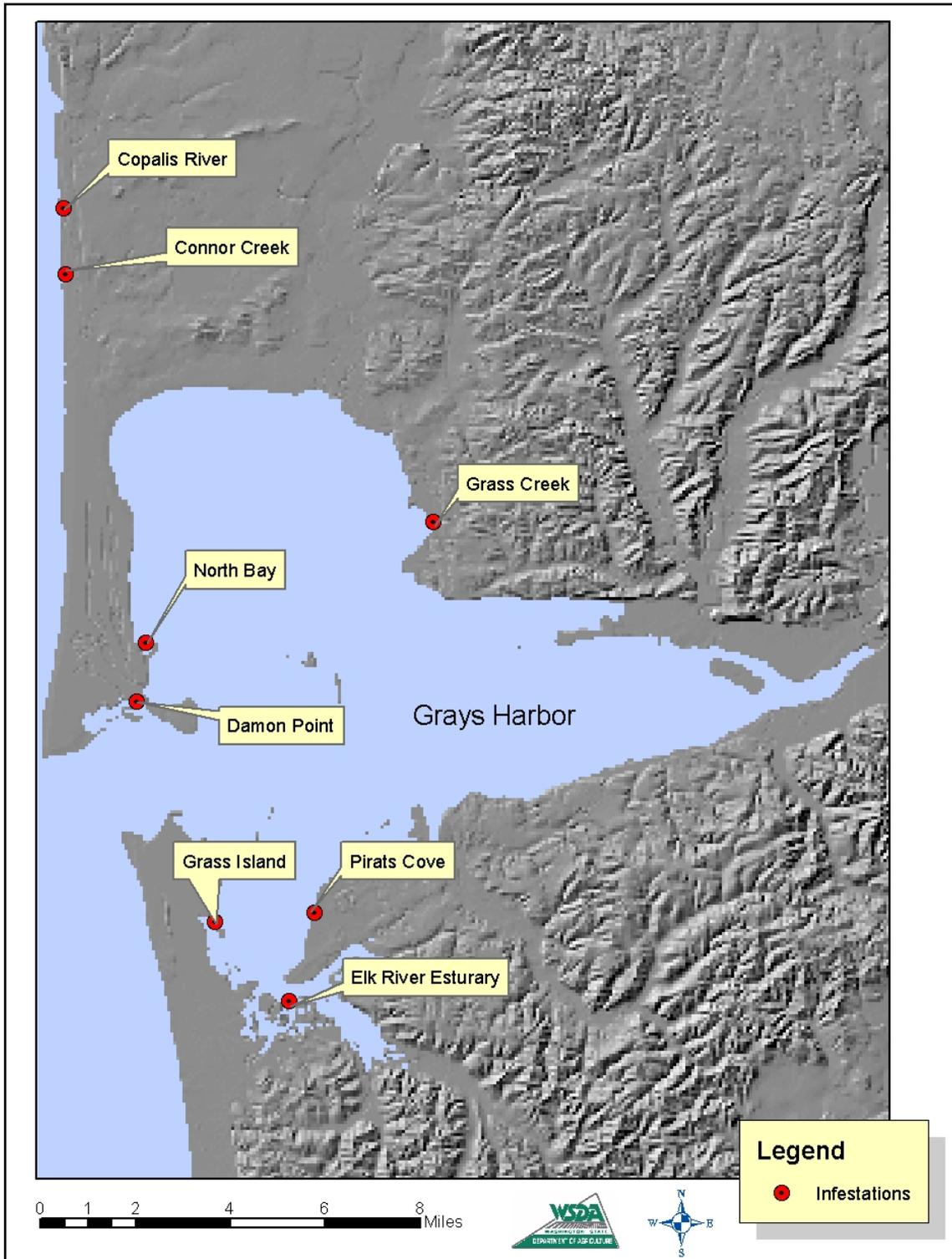
Surveys conducted during the spring of 2003 turned up very little infestation in Grays Harbor. Surprisingly, however during the summer of 2003 as WDFW crews were conducting treatments on pre-identified infestations, numerous new infestations were discovered. These infestations were all less than 5 feet in diameter. This leads to the conclusion that the mild winter, combined with the long hot summer, resulted in a large number of seedlings that grew very rapidly. All of the new infestations that were identified were treated entirely.

Recommendations for the Future

The size of the Grays Harbor treatments has fluctuated since 1992 from as much as the 2.86 solid acres controlled this season to as little as 0.25 acres controlled during the 2001 season. Every year new infestations are found throughout the bay, suggesting that seed is being transported from Willapa Bay and deposited in various areas of Grays Harbor. This demonstrates the importance of continued funding not only to conduct surveys and control work in Grays Harbor, as well as for future reductions in the Willapa Bay infestation.

If the current level of activity continues in Willapa Bay, Grays Harbor can continue to be protected from a major infestation. Extensive surveys in Grays Harbor are required to ensure all infestations are identified and treated.

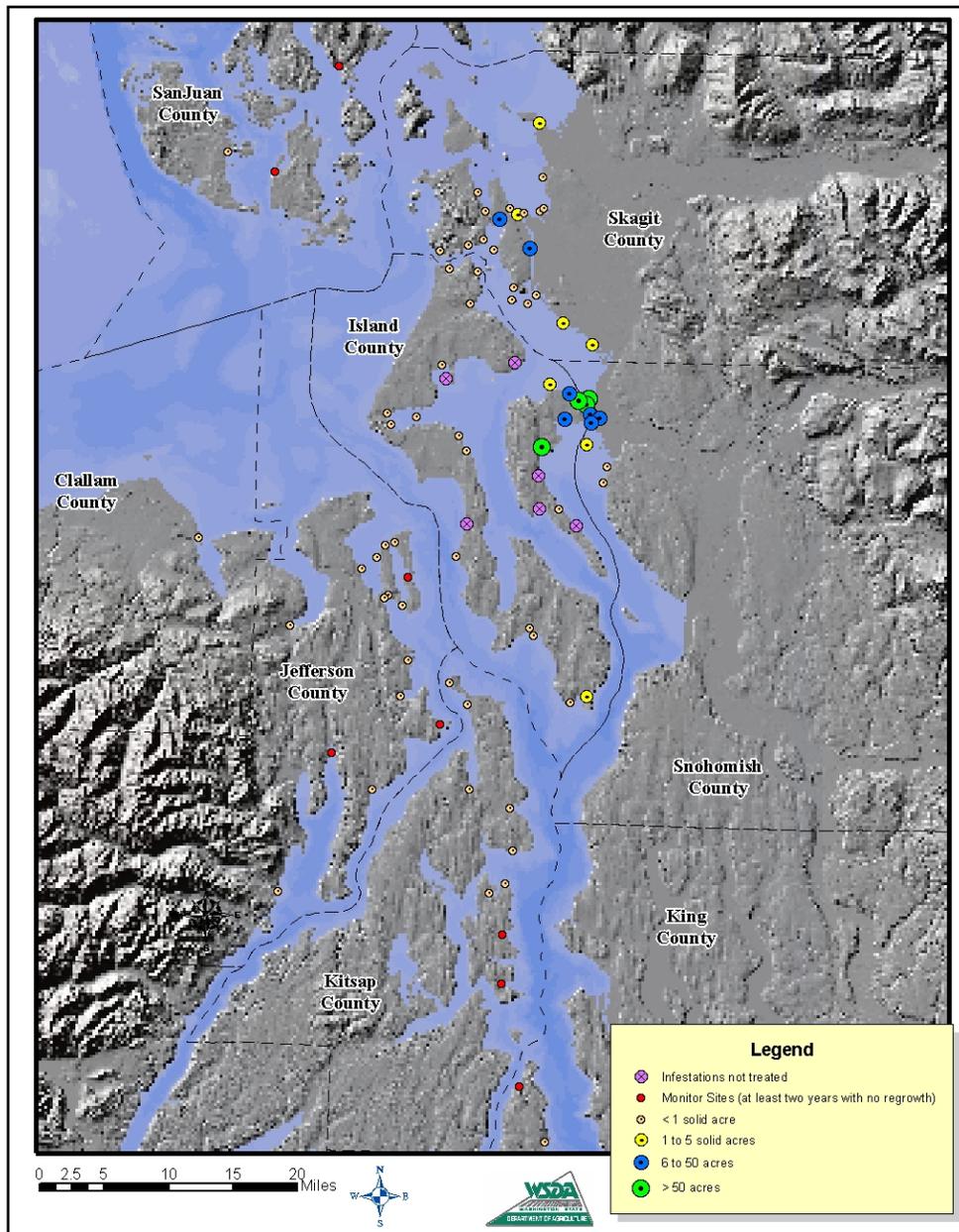
Figure 5. Approximate Locations of WDFW Grays Harbor Treatment Sites in 2003



SPARTINA ERADICATION EFFORT IN PUGET SOUND AND HOOD CANAL

For purposes of the WSDA *Spartina* Program, Puget Sound and Hood Canal refers to San Juan, Skagit, Island, Snohomish, Clallam, Jefferson, Kitsap and King counties. Figure 6 shows approximate locations and sizes of all known *Spartina* infestations in Puget Sound and Hood Canal. Figure 6 also shows locations of monitor sites, which are defined as sites of previous infestation with at least two consecutive years of no regrowth. During the 2003 treatment season, an estimated 694 solid acres were treated compared to approximately 455 solid acres in 2002 and only 182 solid acres treated in 2001.

Figure 6. Locations and Sizes of All Known Puget Sound and Hood Canal *Spartina* Infestations



Extent of the Infestation in Puget Sound and Hood Canal

Much more accurate field surveys, coupled with better data from treatment activity, have led program coordinators in North Puget Sound to re-evaluate the total solid acreage of *Spartina* at the beginning of the 2003 treatment season as well as the total solid acreage present in 1997 at the onset of major coordinated *Spartina* control in Puget Sound.

The use of accurately calibrated ground broadcast application equipment on all major infestations in South Skagit Bay resulted in more accurate acreage figures than in years past. The equipment, which is calibrated to deliver a specified amount of herbicide per acre, allows managers to more precisely calculate treated acreage and therefore determine infestation size by looking at the amount of herbicide used for one treatment of the entire area. This method was verified in several locations in South Skagit Bay through GPS ground surveys and shown to be accurate.

As a result, the estimate of solid acres of *Spartina* in Puget Sound at the beginning of the 2003 season was revised to 760 solid acres, 30 acres more than the previous estimate. Based on this figure, the Puget Sound infestation, estimated at 1,000 solid acres in 1997, has been reduced by 24%.

Snohomish County

WSDA provided \$50,000 to the Snohomish County Noxious Weed Control Board for *Spartina* eradication activities in 2003. In addition, Snohomish County had \$15,000 for start up in May and June from the previous biennium. On top of this funding, WSDA provided all the necessary herbicide to the county. WDFW and Wildlands Management also conducted a substantial amount of control work in Snohomish County during the 2003 season. This work was focused mainly on WDFW-managed lands on Leque Island. The herbicide for these treatments was also provided by WSDA.

In total, 340 solid acres of *Spartina* were treated in Snohomish County in 2003 compared to 238 in 2002. Table 6 shows the solid acres treated, who did the treatment, and the treatment methods used on every site in Snohomish County. Figure 7 identifies the approximate location of the infestations.

For the first time in program history, all meadows in Southeast Skagit Bay, Leque Island and Mystery Island were treated entirely. These sites are home to three of the largest infestations in Puget Sound. The treatments were made possible through the successful cooperative efforts of WSDA, WDFW and Snohomish County. The combined size of these three infestations is approximately 300 solid acres. This constitutes about 90% of the overall infestation in Snohomish County.

The treatments to a majority of these meadows were done using a combined mechanical/herbicide approach. A substantial portion of the Southeast Skagit Bay meadow was mechanically crushed by Snohomish County during the 2002 season. After the entire site was treated with herbicide, the site was crushed again. This mechanical effort accounted for over 90 solid acres crushed. All of which was also treated with herbicide. WDFW also treated much of

the Leque Island site mechanically during the 2002 season, prior to any herbicide applications. This approach, used in previous years on a smaller scale, proved to be highly effective at reducing infestations.

These treatments should substantially reduce the amount of seed produced and distributed by these infestations, as well as reduce their overall size. The suppression of seeds should greatly decrease the amount of re-growth and new growth needing to be treated during 2004.

Table 6. Summary of 2003 *Spartina* Eradication Effort in Snohomish County

Site	Estimated Solid Acreage treated	Entity Conducting Treatment	Treatment Method used
Port Susan	2	WM	Dig, Mow
South East Skagit Bay	173.27	SC, WDFW	Herbicide, Crush
Davis Slough	7.5	WDFW	Herbicide
Mystery Island	50.5*	WDFW	Herbicide
Leque Island	67.95*	WDFW	Herbicide, Crush
South Leque	20.5	WDFW, WM	Herbicide
Warm Beach	0.018*	SC	Herbicide
West Pass	15.56	SC, WDFW	Herbicide
Kayak Point to Warm Beach	0.0001*	PFPS	Mow, Dig
South Pass	5.8	SC, WDFW	Herbicide
Total Solid Acres Treated	343.09		

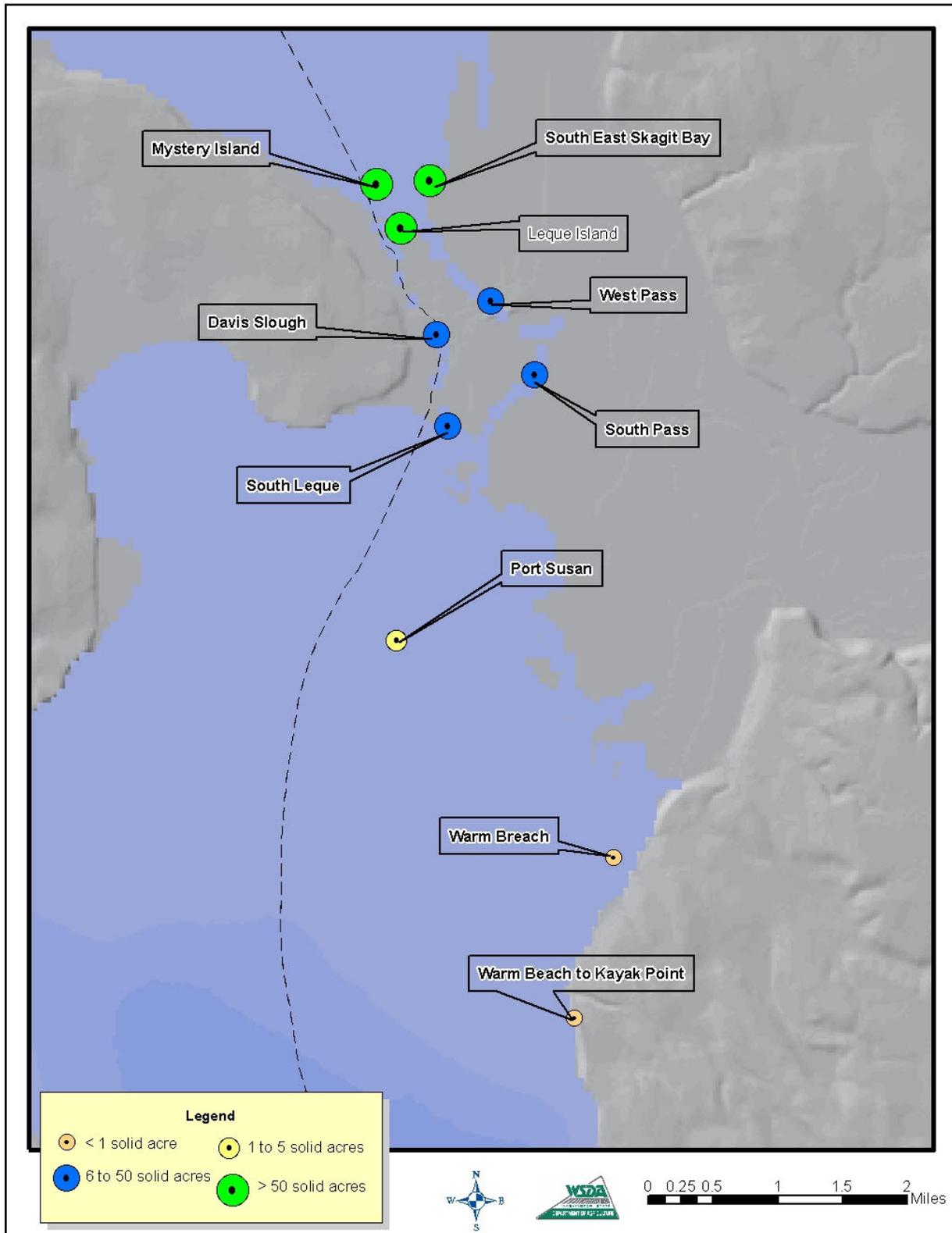
*Denotes entire site treated

SC = Snohomish County, WDFW = Department of Fish and Wildlife, WM = Wildlands Management

Both Snohomish County and WDFW conducted much of their herbicide applications using ground broadcast application equipment mounted on small tracked utility vehicles. The application equipment was purchased by WSDA as part of the North Puget Sound IPM effort. The decision to move forward with this application method was based on the apparent success with ground broadcast applications demonstrated by the USFWS in Willapa Bay during the 2002 season. This method, newly employed by both WDFW and Snohomish County, allowed both entities to treat far more acreage than in any other year. Figure 25 (*see pg. 58*) shows WDFW conducting ground broadcast applications at Leque Island.

The Nature Conservancy (TNC) and People for Puget Sound (PFPS) also became major on-the-ground contributors to the program in 2003. TNC received a substantial grant for *Spartina* control in Puget Sound for the 2003 season. They, in-turn, contracted with PFPS to conduct the control work. The focus of the PFPS effort was to manually control many of the remaining small infestations throughout the North Puget Sound. They also surveyed and prepared many of the sites not suitable for manual control for future herbicide applications. TNC also used a portion of their funding to contract with Wildlands Management to control much of the infestation in Port Susan, which is now owned by TNC.

Figure 7. Approximate Locations of all 2003 Snohomish County *Spartina* Treatment Sites



Island County

WSDA provided \$50,000 to the Island County Noxious Weed Control Board for *Spartina* eradication activities in 2003. As with Snohomish County, Island County had funds remaining for start up in May and June (approximately \$7,000) from the previous biennium. Island County sub-contracted the majority of its *Spartina* eradication work to a private company, Wildlands Management (WM). In addition, WDFW conducted a large amount of control work in Island County during the 2003 season. WSDA provided all necessary herbicide to both Island County and WDFW for the 2003 season. The People For Puget Sound *Spartina* Crew (PFPS), which was funded by The Nature Conservancy (TNC), also conducted substantial control work in Island County.

In total, 325 solid acres of *Spartina* were treated in Island County in 2003 compared to only 181 in 2002. Table 7 shows the solid acres treated, who did the treatment and the treatment methods used. Figure 8 shows the approximate locations of the treatment sites.

The past focus of the eradication work in Island County was on reducing and removing the small outliers and working towards the large seed-producing meadows east of English Boom and Triangle Cove. During the 2003 treatment season, the focus shifted to include attacking the large meadows as well as the small outliers. WDFW crews used the ground broadcast application equipment to treat the large meadow east of English Boom, know as the Emerick's/Price site, in its entirety. This site had never received any amount of treatment prior to the 2003 season. Figure 26 (*see pg. 59*) shows a portion of this site several weeks after the application was completed. WDFW and WSDA crews also treated a majority of the Triangle Cove meadow by way of mechanical crushing. The focus on this treatment was to reduce the seed set and cause mortality through continuous multiple year treatments.

Wildlands Management continued to attack the remaining infestation in Livingston Bay. This site is another great success story in North Puget Sound *Spartina* control. In 1999 the infestation in Livingston Bay was estimated at approximately 100 solid acres. WDFW and Wildlands Management began treating this infestation in 1999 using a combination of herbicide and mechanical control tools. After five successful years of treatment, including the 2001 season in which herbicide was not allowed for use; the overall infestation is now estimated at only 35 solid acres. This is an overall decrease of nearly 65%. The entire infestation was treated during the 2003 season.

The Nature Conservancy and People for Puget Sound were very active on-the-ground participants in the North Puget Sound eradication program during the 2003 treatment season. The People for Puget Sound effort, funded by a TNC grant, focused on the numerous small outliers in Island County. These small infestations, many of which were large infestations several years ago, are extremely important to control to ensure they do not return to large infestations. The PFPS effort worked closely with Island County and WDFW to ensure that infestations not suitable for the PFPS effort were addressed by WDFW or Island County.

Only six know infestations in Island County did not receive some level of treatment. Two of those infestations, Maylor Marsh and Hancock Lake, are both located within Whidbey Island Naval property. During the 2002 treatment season, WSDA, WDFW and Island County worked cooperatively with the Navy to ensure that these sites were treated. Although these sites are still a concern, busy schedules on the part of both the Navy Personnel and *Spartina* crews lead to these sites not being treated. WSDA, WDFW and Island County have committed to strengthening their efforts to arrange for control activities to be conducted at these sites during the 2004 season. The other 4 sites were surveyed by PFPS and WDFW and are scheduled for treatment during the 2004 season.

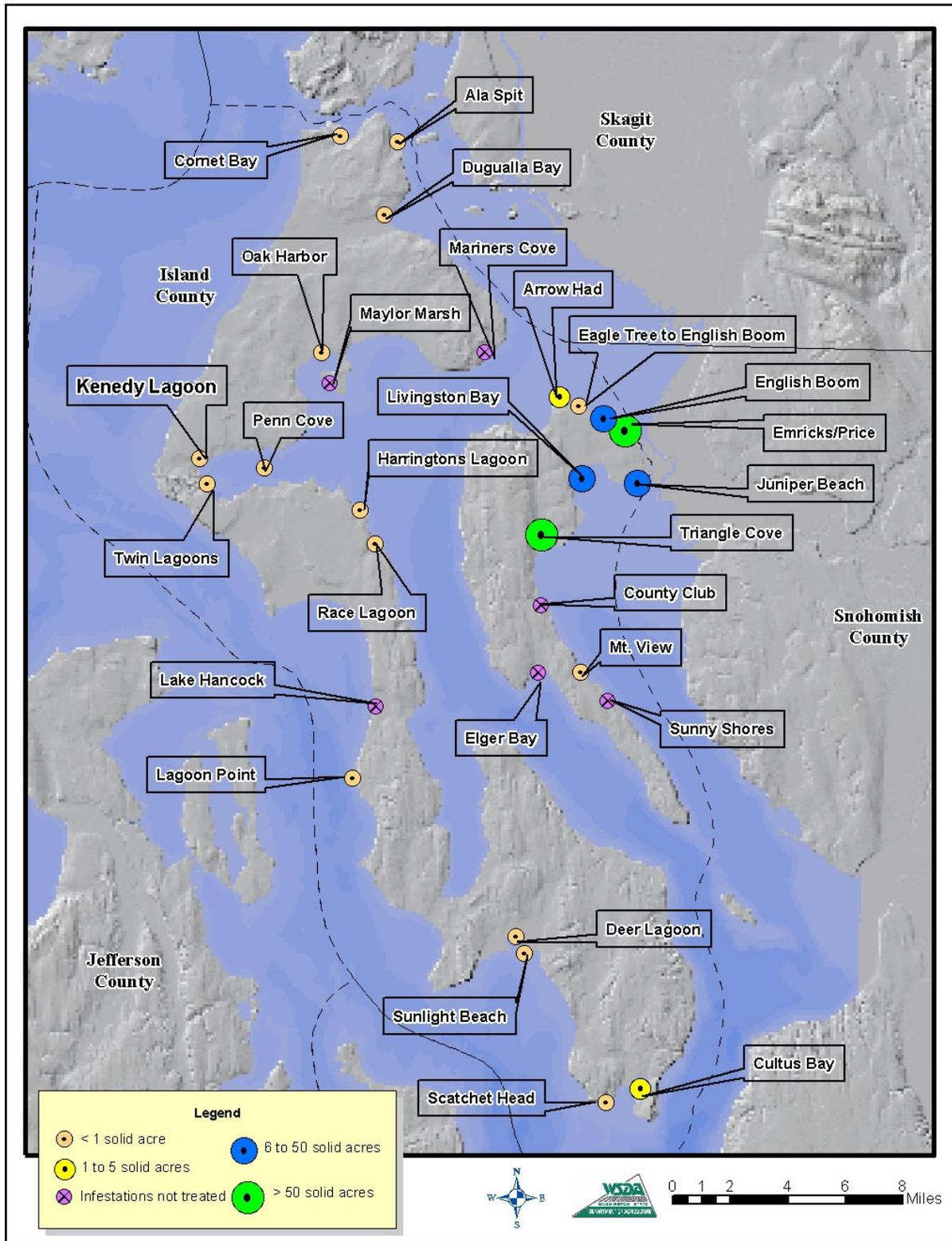
Table 7. Summary of 2003 *Spartina* Eradication Effort in Island County

Site	Estimated Solid Acreage Treated	Entity Conducting Treatment	Treatment Method
Ala Spit	0.25*	PFPS	Dig
Cornet Bay	0.1*	PFPS	Dig
Dugwalla Bay	2*	WM, PFPS	Dig, Herbicide
Race Lagoon	0.5*	PFPS	Dig, Seed Removal
Arrowhead Beach	3*	WM	Herbicide
Livingston Bay	34.5*	WM, PFPS	Herbicide, Dig
Emricks/Price	121.5*	WM, WDFW	Herbicide
Deer Lagoon	1.5	PFPS	Dig, Seed Removal
Cultus Bay	1.75	WSDA, PFPS	Dig
English Boom	15*	WM	Herbicide
Mt. View Lagoon	0.1*	PFPS, WDFW	Herbicide, Dig
County Club	0.25 *	WDFW, PFPS	Herbicide
Sunny Shores	2.5*	WDFW, PFPS	Herbicide
Eagle Tree	0.25	PFPS	Dig
Sunlight Beach	.8	PFPS	Dig
Juniper Beach	13.5*	WM	Herbicide
Triangle Cove	127.5	WDFW, WSDA	Crush
Penn Cove/Twin Lagoons, Kennedy Lagoon	0.1*	WSDA, PFPS, IC	Dig
Harringtons Lagoon	0.1*	PFPS	Dig, Seed Removal
Mariner's Cove	0	PFPS	Survey
Lagoon Point	0.25	PFPS	Dig
Total Solid Acres Treated	325.45		

*Denotes entire site treated

WM = Wildlands Management, WDFW = Department of Fish and Wildlife, IC = Island County
WSDA = Department of Agriculture, DNR = Department of Natural Resources.

Figure 8. Approximate Locations of all 2003 Island County *Spartina* Treatment Sites



Skagit County

WSDA provided \$40,000 to the Skagit County Noxious Weed Control Board and \$10,000 to the Swinomish Tribal Community during the 2003 control season. The Swinomish Tribe, WDFW and Washington Department of Ecology also allocated resources towards *Spartina* eradication activities in Skagit County. In addition, Skagit County had approximately \$33,000 remaining for start-up funding from FY 2003 funding provided by WSDA.

In total, 26 solid acres of *Spartina* were treated in Skagit County in 2003 compared to 36 in 2002. This reduction in the total amount treated is due to the overall reduction in the infestation in Skagit County. All known *Spartina* infestations were treated with exception of one infestation on Swinomish tribal land. Table 8 shows the solid acres treated, who did the treatment, and the treatment methods used on every site in Skagit County. Figure 9 shows the approximate locations of all Skagit County 2003 treatment sites.

The Swinomish Tribal Community continued to work cooperatively with WSDA, Skagit County and others to conduct *Spartina* eradication activities following an integrated pest management approach. WSDA, Skagit County, Ecology and the Swinomish Tribal Community conducted early-season mowing operations on infestations on tribal property. These mowing operations were followed up with mid-summer herbicide applications by Skagit County. Skagit County also worked directly with the tribal community to make herbicide applications to several other sites along the Swinomish Channel.

In addition to the mowing operations and herbicide applications, Swinomish Tribal crews conducted extensive manual removal operations throughout the reservation. The tribal community also worked with WDFW and UW to release an insect for biological control to the one site on tribal property that was not treated by either herbicide, mechanical or manual means. With the release of this biological control, the Swinomish Tribal Community is now using all available methods to eradicate *Spartina* from tribal lands. This biological control release, if successful, will serve as a nursery site, at which insects could be collected for distribution to other sites in the Puget Sound Region.

The overall effort in Skagit County continues to be extremely successful. The overall infestation, estimated at 100 solid acres in 1997, has been reduced in Skagit County by about 65% to 35 solid acres in 2003. With the recent movement towards an IPM approach for controlling infestations on Swinomish Tribal property, the effort in Skagit County will continue to result in more a successful eradication program.

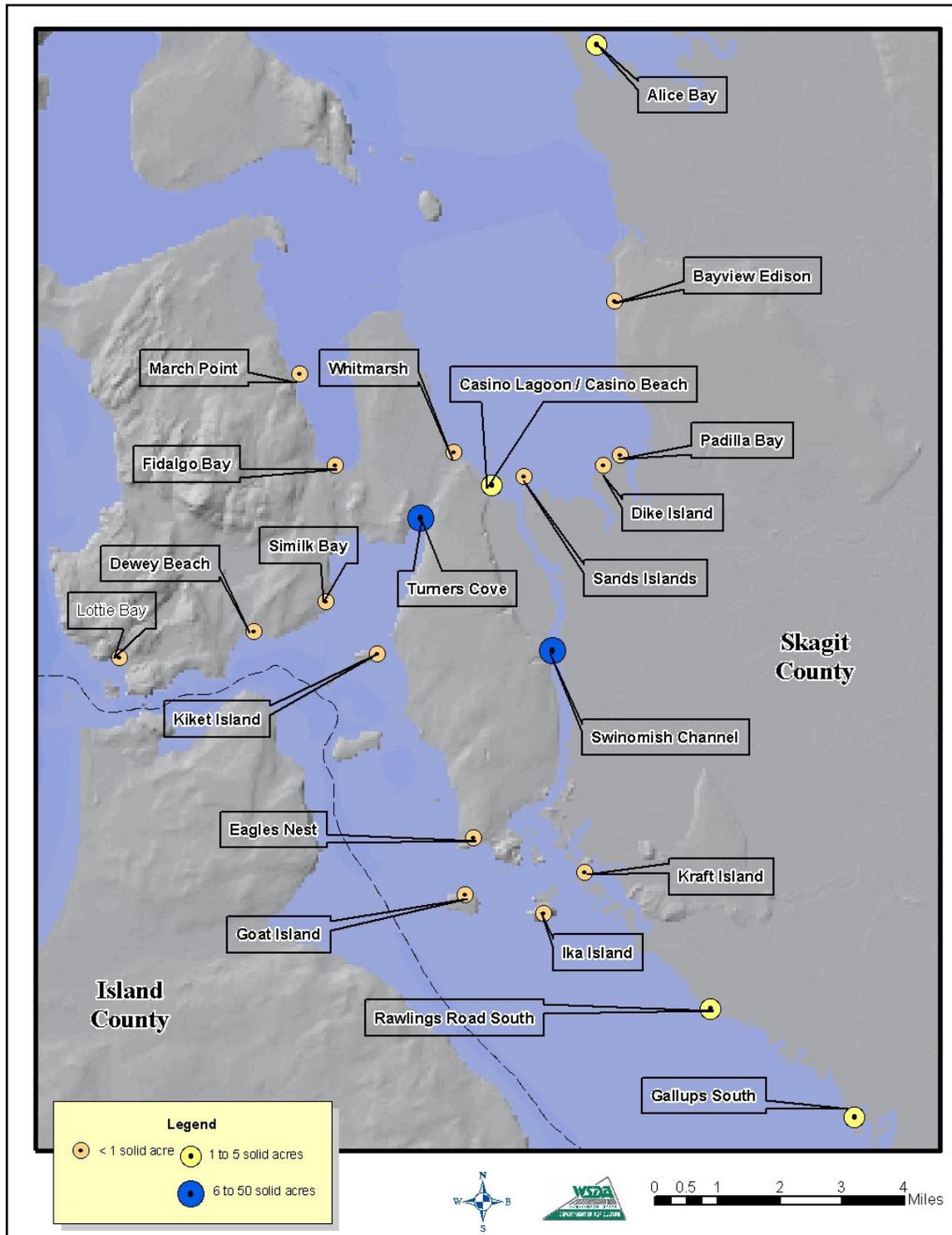
Table 8. Summary of 2003 *Spartina* Eradication Effort in Skagit County

Site	Estimated Solid Acreage Treated	Entity Conducting Treatment	Treatment Method
Gallups South	5*	SK	Dig, Herbicide
Rawlings Rd. South	4*	SK	Mow, Herbicide
Kiket Island	0	SK	Monitor
Sands Island	0.5*	SK	Herbicide
Kraft Island	3*	SK	Herbicide
Ika Island	0.001*	SK	Dig
Dike Island	0.75*	WM, WDFW	Herbicide
Padilla Bay	0.003*	DOE	Dig
Similk Bay	0.001*	SK	Dig
Bayview Edison	0.0001*	DOE	Dig
Eagle's Nest	0.1	SW, PFPS	Dig
Alice Bay (Samish Island)	0.03	WDFW, DOE	Herbicide
Turners Cove	1	SW	Mow, Dig, Biocontrol release
Lottie Bay	0.0001*	SK	Monitor, Dig
Goat Island	0.1*	SK	Herbicide
Dewey Beach	0.001*	SK	Monitor, Dig
Fidalgo Bay	0.01*	SK	Dig
March Point	0.01*	SK	Dig, Herbicide
Whitmarsh	0.01*	SK	Dig, Herbicide
Casino Lagoon/ Casino Beach	6*	WDFW, WSDA, SW, PFPS	Mow, Dig, Herbicide
Swinomish Channel	6*	SK, SW, WSDA, WDFW, PFPS	Dig, Herbicide
Total Solid Acres Treated	26.50		

*Denotes entire site treated

SK = Skagit County, WM = Wildlands Management, DOE = Department of Ecology, WSDA = Department of Agriculture, WDFW = Department of Fish and Wildlife, SW = Swinomish Tribal Community, PFPS = People for Puget Sound

Figure 9. Approximate Locations of all 2003 Skagit County *Spartina* Treatment Sites



San Juan, Clallam, Jefferson, Kitsap, King Counties

In 2003, WSDA continued to work with the San Juan County Noxious Weed Control Board Coordinator, as well as the U.S. Navy and State Parks, to conduct control work in San Juan, Clallam, Jefferson, Kitsap and King counties. San Juan County conducted surveys of all known sites and contacted the UW Research Station at Argyle Lagoon, notifying them that control of the infestation on their property was needed. Figure 10 shows where the surveys and control work took place. The U.S. Navy assisted the WSDA crew with control and surveys on Indian Island by providing access to sites on Naval property. WSDA also worked with State Parks to conduct control work at Dosewallips State Park in Jefferson County. Figure 11 shows the locations of all 2003 WSDA treatment sites. Table 9 shows the solid acres treated, who performed the treatment, and the treatment methods used at every site in San Juan, Clallam, Jefferson, Kitsap and King counties.

WSDA crews have substantially reduced all known infestations in Clallam, Jefferson, Kitsap and King counties during the past five years. It is important to note that with the exception of the Doe-Kag-Wats site in Kitsap County, all sites were treated entirely at least twice. Again, with the exception of the Doe-Kag-Wats infestation located on the Suquamish Reservation in Kitsap County, all sites are nearing eradication and will continue to progress towards that end with yearly surveying and control. WSDA continues to work with the Suquamish Tribal Community to explore various options for eradicating the infestation.

One not so encouraging observation made during the 2003 treatment season was the large numbers of seedlings seen at many of the sites that exhibited no *Spartina* during the 2002 season. This observation was not only confined to the Willapa Bay and Hood Canal region but was also noted throughout the Sound. No explanation for this has been found, although, many IPM practitioners involved in *Spartina* control think that the relatively mild winter and spring of 2003 followed by a record breaking hot dry summer provided the plant with the conditions necessary to produce more seeds and have those seeds survive better through the course of the season.

Recommendations for the Future for Puget Sound

It is reasonable to assume that continuous control and monitoring of these sites, coupled with the elimination of major nearby seed producing meadows, is reflected in the small infestation size and the low re-infestation rate of central and southern Puget Sound infestations. With continued funding for all agencies involved, this same success will be achieved in the rest of Puget Sound. Substantial control took place for the first time ever at the three largest infestations in Puget Sound. Great progress was made this season and these infestations are much closer towards eradication. Continued funding and support is needed to keep up this successful effort in Puget Sound.

Figure 10. Approximate Locations of 2003 San Juan County *Spartina* Treatment/Survey Sites

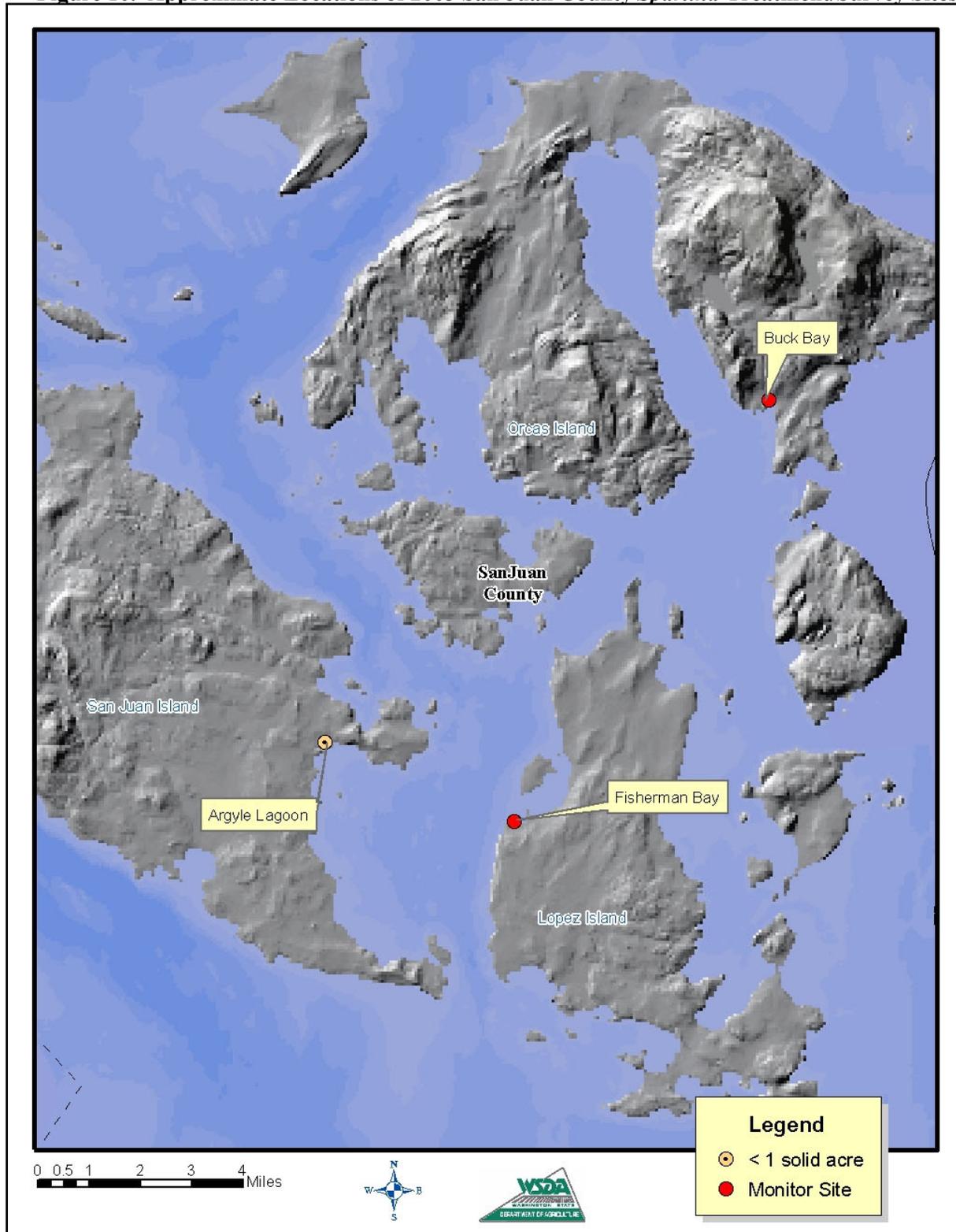


Figure 11. Approximate Locations of all 2003 Clallam, Jefferson, Kitsap and King county *Spartina* infestations

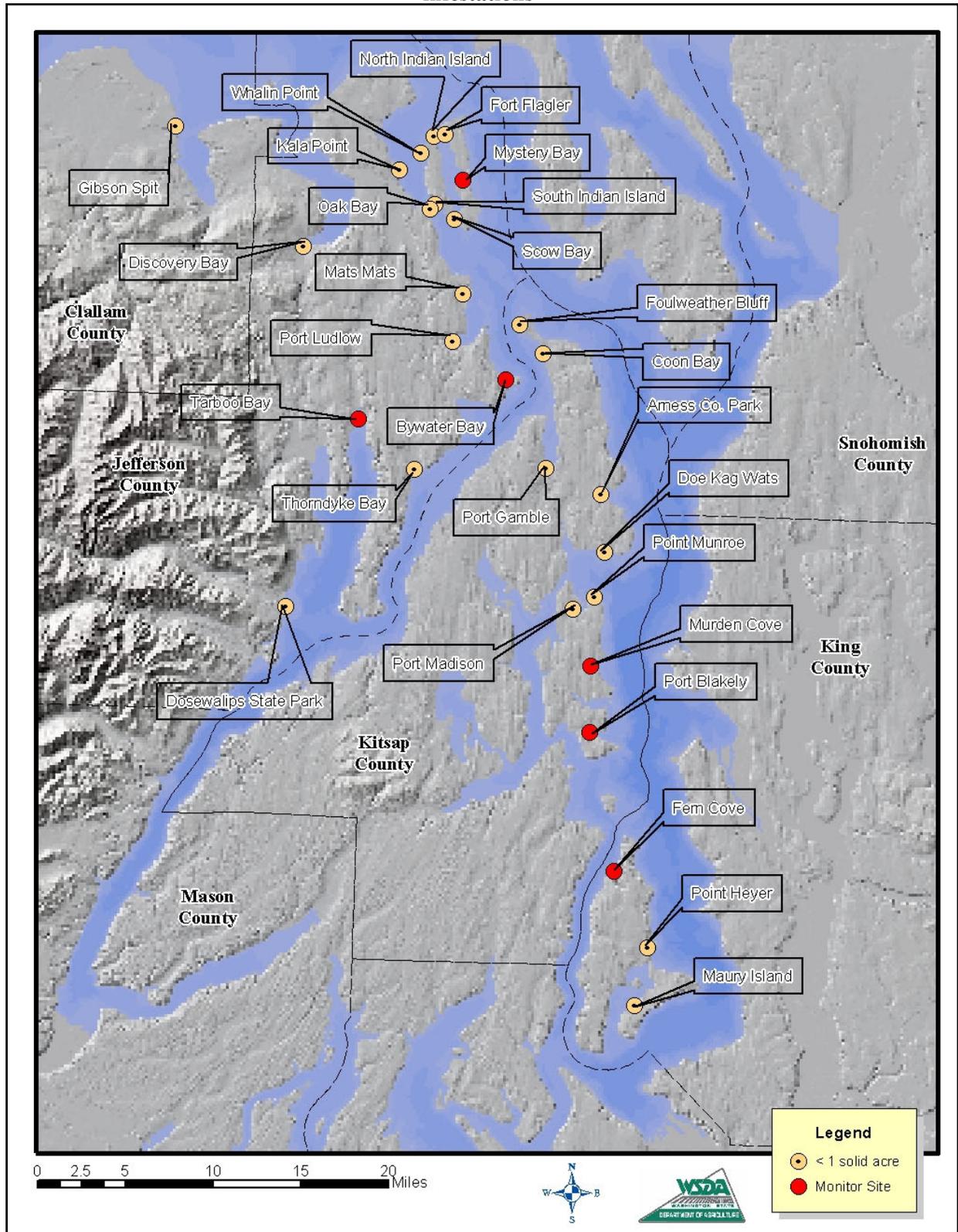


Table 9. Summary of 2003 *Spartina* Eradication Effort in San Juan, Clallam, Jefferson, Kitsap and King Counties

Site	Estimated Solid Acreage Treated	Entity Conducting Treatment	Treatment Method
San Juan County			
Argyle Lagoon	0.0009*	SJC	Dig
Fisherman Bay	0	SJC	Monitor
Buck Bay	0	SJC	Monitor
Clallam County			
Gibson Spit	0.0001*	WSDA	Dig
Jefferson County			
Dosewallips State Park	0.0001*	WSDA	Dig
Thorndyke Bay	0.0001*	WSDA	Dig
Tarboo Bay	0	WSDA	Monitor
Oak Bay	0.0001*	WSDA	Dig
Mats Mats	0.0001*	WSDA	Dig
Scow Bay	0.0001*	WSDA	Dig
Whalin Point	0.05*	WSDA/Navy	Herbicide
Kala Point	0.001*	WSDA	Dig
Bywater Bay	0	WSDA	Monitor
Discovery Bay#	0.003*	WSDA	Dig
South Indian Island	0.0001*	WSDA	Dig
North Indian Island	0.0006*	WSDA/Navy	Dig
Fort Flagler	0.0001*	WSDA	Dig
Port Ludlow	0.0001*	WSDA	Dig
Mystery Bay	0	WSDA	Monitor
Kitsap County			
Murden Cove	0	WSDA	Monitor
Port Blakely	0	WSDA	Monitor
Point Monroe	0.0001*	WSDA	Dig
Foulweather Bluff	0.001*	WSDA	Dig
Coon Bay#	0.008*	WSDA	Dig
Port Gamble	0.0001*	WSDA	Dig
Doe-Kag-Wats	1*	WSDA	Mow, Dig
Arness Park/Kingston Ferry	0.0001*	WSDA	Dig
Port Madison	0.0001*	WSDA	Dig
King County			
Fern Cove	0	WSDA	Monitor
Maury Island	0.0001*	WSDA	Dig
Point Heyer	0	WSDA	Monitor
Total Solid Acres Treated	1.0578*		

*Denotes entire site treated # Denotes newly discovered infestation
 SJC = San Juan County, WSDA = Department of Agriculture, Navy = U.S. Navy

Figure 12. *Spartina alterniflora* in Willapa Bay, Pacific County, Washington (2000)



Figure 13. *Spartina patens* at Dosewalips State Park, Jefferson County, Washington (2000)



Figure 14. *Spartina anglica* invading mudflat in Livingston Bay, Island County (1999)



Figure 15. *Spartina densiflora* located in Grays Harbor near Damon Point (2002)



Figure 16. USFWS amphibious ground broadcast application platform.



Figure 17. Porters Point area of South Willapa Bay several months after herbicide applications. In all USFWS treated over 2,400 solid acres in the Porters Point area.



Figure 18. 2003 aerial infrared photo of Porters Point Area. Photo taken September 2003.



Figure 19. WSDA Marsh Master mechanically crushing meadow in North Willapa Bay.



Figure 20. Infrared aerial photo of a section of the Willapa River meadow prior to treatment. Photo taken September 2000. Outline indicates boundary of meadow prior to 2003 treatment.



Figure 21. Infrared aerial photo of same section of Willapa River meadow after 2003 treatment. Photo taken September 2003.

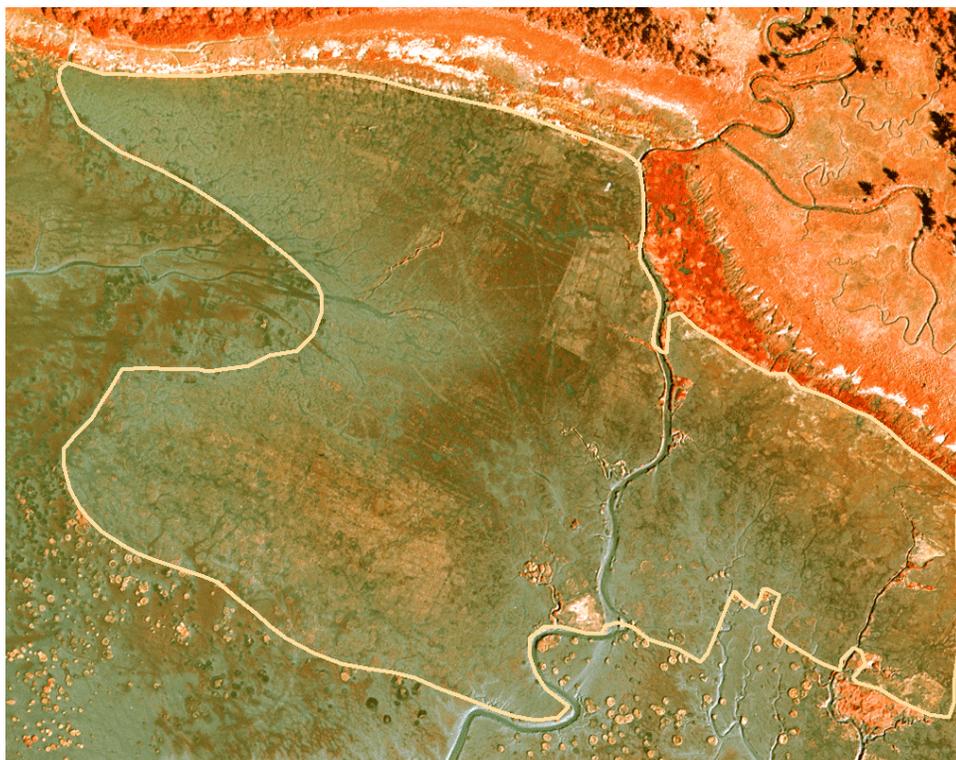


Figure 22. Aerial infrared photo of Pot Shot slough taken in 1997.



Figure 23. Aerial infrared photo of Pot Shot slough taken in 2003.

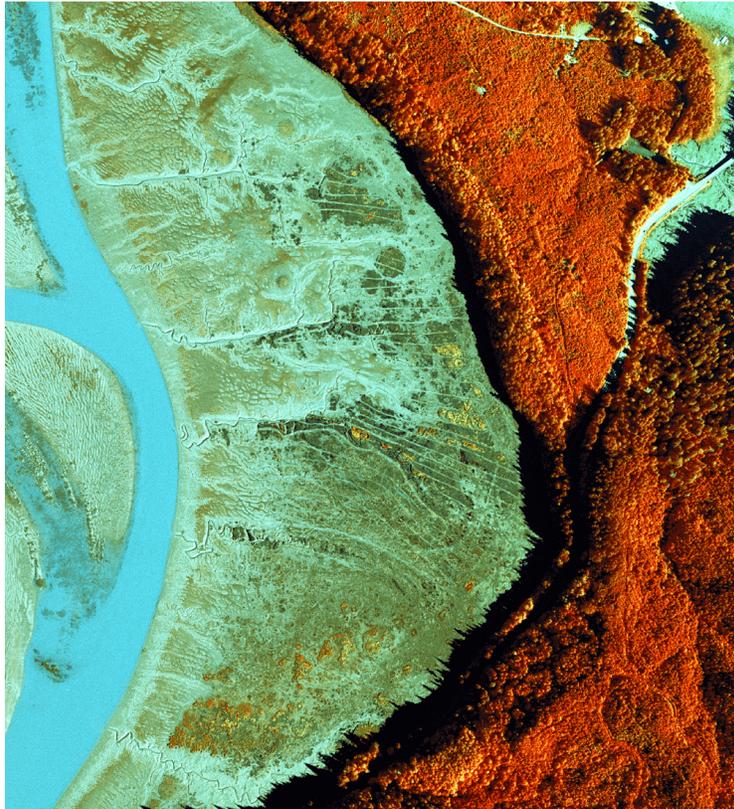


Figure 24. Photo of sampling quadrat containing 10 stems, taken July 28th 2003.



Figure 25. WDFW conducting ground broadcast applications to Leque Island, Snohomish County



Figure 26. Photo of Emericks/Price site several weeks after ground broadcast applications.

