REPORT TO THE LEGISLATURE

PROGRESS OF THE *SPARTINA* AND PURPLE LOOSESTRIFE ERADICATION AND CONTROL PROGRAMS

(as required by RCW 17.26.015)

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EXECUTIVE SUMMARY

Chapter 255, Laws of 1995 designated the Washington State Department of Agriculture (WSDA) as the lead state agency for the eradication of *Spartina* and the control of purple loosestrife. The 1999 Legislature appropriated $818,000 from the Aquatic Lands Enhancement Account (ALEA) to WSDA for these activities in the 2000-01 biennium. As lead agency, WSDA is required to report to the Legislature annually on the progress of these programs. This report fulfills that requirement for 1999.

***Spartina* Eradication Program**

Funding the Spartina Program

WSDA allocated $718,000 from the appropriated ALEA funding this biennium for *Spartina* eradication statewide.

WSDA Activities

In 1999, the WSDA *Spartina* Eradication Program activities included the following:

- Working collaboratively with stakeholders to update and distribute six regional *Spartina* Management Plans
- Obtaining, providing coverage and meeting public notification requirements of six regional water quality permits
- Providing funding through interagency agreements, direct cost-share and other in-kind resource support to state and local government and private landowners
- Hiring and equipping a small crew to treat all infestations in Clallam, Jefferson, Kitsap and King counties
- Organizing and facilitating the exchange of *Spartina* eradication information through many regional planning meetings including a final all-day statewide conference held at the Natural Resource Building in Olympia on October 29, 1999
- Continuing to explore with stakeholders more efficient and cost-effective ways to eradicate *Spartina*

Summary of 1999 Statewide *Spartina* Eradication Activities

There are ten counties in western Washington with one or more infestation of *Spartina alterniflora*, *Spartina anglica*, or *Spartina patens*. This includes Clallam, Grays Harbor, Island,

Jefferson, King, Kitsap, Pacific, San Juan, Skagit and Snohomish counties. These infestations amount to approximately 4,500 to 5,000 solid acres of *Spartina* (if all populations were one contiguous meadow) spread over more than 20,000 acres of intertidal mudflats. All but approximately 10 solid acres are located in Pacific, Snohomish, Island and Skagit counties. In 1999, WSDA, partner state and federal agencies, local governments, tribal entities, commercial landowners and private landowners treated approximately 850 solid acres of *Spartina*.

Table 1. Acres of *Spartina* Treated in Washington State – 1997 through 1999

County	*Spartina* Present beginning of 1999 Control Season	*Spartina* Treated, 1997 - 1999	Treatment Method
Pacific	Approx. 3,600 solid acres spread over > 15,000 acres	'97 - approx. 742 solid acres '98 - approx. 450 solid acres '99 – approx. 600 solid acres	Mow, mow/herbicide, herbicide, seedling removal
Grays Harbor	Scattered clones and seedlings 0.52 acres in size	'97 – all treated '98 - all treated '99 – all treated	Mow, mow/herbicide, herbicide, seedling removal
Clallam	1 infestation < 0.5 acres in size	'97 - treated twice '98 - treated three times '99 – treated twice	Mow/herbicide (herbicide used for the first time at sight in 1999)
Jefferson	13 infestations – approx. 1.7 solid acres total	'97 - all treated '98 - all treated twice '99 – all treated twice	Mow, mow/herbicide, dig, seedling removal
Kitsap	7 infestations - approx. 2.5 solid acres total	'97 - all but 2 tribal sites '98 - all treated '99 – all treated twice	Mow, dig, seedling removal
King	2 infestations – single clones and a few seedlings	'97 - monitored '98 – all treated '99 – all treated	Dig
Snohomish	Approx. 485 solid acres spread over > 4,500 acres	'97 - approx. 89 solid acres '98 - approx. 126 solid acres '99 – approx. 90 solid acres	mow, mow/herbicide, herbicide, seedling removal, dig
Island	Approx. 308 solid acres spread over >1,000 acres	'97 - approx. 250 solid acres '98 - approx. 160 solid acres '99 - approx. 155 solid acres	Mow, mow/herbicide, herbicide, seedling removal
Skagit	Approx. 57 solid acres spread over > 1,900 acres	'97 - approx. 91 solid acres '98 - approx. 57 solid acres '99 – all treated	Mow, mow/herbicide, herbicide, seedling removal
San Juan	Nothing found - 3 previously infested sites monitored	'97 - all treated '98 - all treated '99 - monitored	Survey

Table 1, summarizes the statewide control effort by county and year for the past three years. In some counties, fewer acres were treated in 1999 than in previous years. For instance, in Pacific County more than 700 solid acres were treated in 1997 compared to approximately 600 solid acres in 1999. More than 400 solid acres treated in Pacific County in 1997 were treated by aerial

herbicide applications that are much less effective than ground applications because of the difference in amount of herbicide allowed by the label. Therefore, the 1999 treatments in Pacific County were substantially more effective than those done in 1997.

Puget Sound and Hood Canal Status

The estimated area of *Spartina* within Puget Sound and Hood Canal in 1997 was approximately 1,000 solid acres spread over more than 8,150 acres. Estimates compiled at the beginning of the 1999 control season by participating agencies and landowners indicated that the solid acres of *Spartina* had been reduced to approximately 900 or by 10%. The participating agencies and landowners made significant progress to reduce this acreage further in 1999.

- WSDA and partners treated all known infestations in Skagit, Clallam, Jefferson, King and Kitsap counties, and found no *Spartina* in San Juan County.

- The Island County Noxious Weed Board Coordinator, in cooperation with their board's private contractor, the US Navy and WSDA, prevented seed production on Whidbey Island and many infestations, including Deer Lagoon and Cultus Bay, are getting close to being eradicated.

- The Snohomish County Noxious Weed Board, in cooperation with WSDA and the Tulalip Tribe, treated all *Spartina* populations from the King County border north to Leque Island, including for the first time, all populations within Port Susan.

Willapa Bay Status

Using infrared photos taken in 1994 and 1997, a calculated expansion rate of 20% per year and a conservative estimate of acres killed by eradication efforts, DNR calculated that there were approximately 3,600 solid acres of *Spartina* spread over more than 15,000 acres at the beginning of the 1999 season.

The participating state and federal agencies, commercial and private landowners and the Shoalwater Bay Tribe treated approximately 600 solid acres of *Spartina* in 1999. Efficacy varies by control technique but the participating agencies conservatively estimated kill at approximately 275 solid acres based on expert observation. With 1999 eradication efforts, the expansion rate was reduced to approximately 8%.

The participating agencies made the most significant progress of the past four years in the areas they treated. In 1999 DNR, WSDA, the Washington State Department of Fish and Wildlife (WDFW) and the United States Department of Fish and Wildlife Service (USFWS) pooled their resources and focussed on a finite number of geographical areas. An Interagency Memorandum of Understanding (MOU) that allowed the participating agencies to share resources and work cooperatively regardless of property ownership solidified this partnership. The participating

agencies tailored their roles and responsibilities to the unique resources and expertise they possess, allowing them to maximize their productivity and reduce redundancy and inefficiency. Collaboratively, the agencies drafted a 1999 Willapa Bay *Spartina* Management Plan that defined where treatment would occur. The agencies targeted specific geographical areas for treatment for a variety of reasons including ecological and financial value.

Coordinating *Spartina* management efforts on a regional basis in Willapa Bay allowed the participating agencies to achieve more effective *Spartina* control than the individual entities could have accomplished alone. The agencies will use the efficacy and cost information to hone and develop the 2000 Willapa Bay *Spartina* Management Plan next spring. They also anticipate using this information produce a realistic cost-estimate of what it will take to eradicate *Spartina* from Willapa Bay using current techniques. The 2000 WSDA Report to the Legislature on the Progress of *Spartina* and purple loosestrife will include this information.

Grays Harbor Status

Grays Harbor landowners and managers have been concerned about the potential invasion of *Spartina* due to the magnitude of the problem in Willapa Bay. WDFW treated all known *Spartina* infestations early in the 1999 control season. However, an aerial survey done by WDFW, DNR and WSDA in October turned up several new infestations of *Spartina*. These findings further validated the threat of a large scale *Spartina* invasion into Grays Harbor. As a result, the agencies plan to conduct extensive aerial surveys in this region next year in an attempt to prevent *Spartina* from becoming established.

Spartina Eradication New Developments and Challenges

Biological Control of *Spartina*

A research team, funded primarily through grants obtained by the University of Washington Olympic Natural Resources Center (ONRC), focused most of its efforts on investigating the risks associated with potential introduction of *Prokelisia marginata* into Willapa Bay in 1999. *The Prokelisia marginata*, a planthopper native to California, has been shown by researchers to have an unusually devastating effect on *Spartina alterniflora* and *Spartina anglica* from Washington State. In all tests completed to date, results indicate definitively the insect does not act as a vector for disease and is extremely host-specific to *Spartina*.

ONRC hired an experienced research scientist in 1999 to design and implement the release strategy and pre- and post- release monitoring programs. A release could take place as early as next summer into Willapa Bay provided all required permits are in place. The state and federal agencies involved with *Spartina* eradication are monitoring activities closely in order to utilize any window of opportunity the planthopper provides. All parties involved postulate that the introduction of *Prokelesia marginata* would place selective pressure on *Spartina* infestations as the more resistant plants survive and propagate and the less resistant plants are eradicated. To achieve the overall goal of complete eradication, surviving resistant clones would have to be

eradicated within a limited number of growing seasons after the introduction of *Prokelisia marginata* populations using other tools in the integrated pest management tool kit.

USFWS Quality Amphibious Mower

The USFWS Willapa National Wildlife Refuge took delivery of an amphibious mower on August 3, 1999. The delivery was more than two months after the expected delivery date and cut the control season in half for the project. Mowing operations started immediately upon delivery and continued until early November. During this time (275 hours of actual machine run time) approximately 90 acres were mowed at one Willapa Refuge site, with 40 of these acres mowed twice. In addition, approximately 150 acres were mowed at another Willapa Refuge site. The machine performed well throughout the season, but did encounter some unexpected mechanical problems that had to be corrected. USFWS is currently investigating the possibility of attaching a ripper or harrow-type device on the back of the machine. If a viable option becomes available, they will run the machine this winter and into spring in an attempt to trample, disc or harrow the *Spartina* meadows prior to the next growing season.

North Puget Sound Permit Appealed

The North Puget Sound permit was appealed on July 23, 1999 by several groups opposed to herbicide use. Grounds cited in the appeal include procedural matters and concerns over adherence to federal statutes, particularly the Clean Water Act. A stay was also requested. The Pollution Control Hearings Board denied the petition for stay on October 7, 1999. A hearing on the appeal itself is scheduled for January 2000.

Purple Loosestrife Control Program

Funding the Purple Loosestrife Program

WSDA allocated $100,000 from the appropriated ALEA funding this biennium for purple loosestrife control statewide.

Status of Purple Loosestrife Control in Washington State

Purple loosestrife is semi-aquatic weed that is found in virtually every county in Washington State and every state in the United States except for Florida. Purple loosestrife infests environmentally sensitive habitats such as meadows, marshes, stream and river-banks, and lake shores as well as irrigation ditches, drainage ditches, and storm-water retention basins. Loosestrife harms wetlands by crowding out native wetland plants and by eliminating nutritional food sources and shelter for wetland wildlife that has adapted to specific plant communities. Loosestrife also chokes out both natural and artificial waterways, slowing natural flows and promoting deposit of silt. This process causes long-term water quality degradation and requires costly maintenance including dredging and cleaning of drainage and irrigation ditches.

Purple loosestrife flourishes in many parts of our state due in part to the relative lack of natural enemies. Loosestrife is also a prolific seed producer as individual plants are capable of producing over a million seeds. The seeds are very small, about the size of ground pepper, and are easily transported by water, wind, wildlife, boats, boat trailers and vehicles. When conditions are right, a small isolated cluster of loosestrife plants can spread and cover a marsh in one growing season, spelling a quiet death for wetlands as a natural ecosystem.

Complete eradication of purple loosestrife from Washington State is not possible at this time due largely to the extent of the infestation and the limited control options currently available. The availability of a selective herbicide approved for use in wetland areas would facilitate control efforts. Currently herbicide control options are limited to Rodeo®, which is relatively non-selective, and 2,4-D which is selective but only approved by the Department of Ecology for use in very limited instances.

WSDA Activities

WSDA loosestrife activities for 1999 included obtaining a statewide water quality permit to allow herbicide treatment throughout the state. WSDA issued coverage under this permit to 38 individuals and agencies in 1999. More than 3,500 acres were treated for purple loosestrife infestations this year under the WSDA permit.

WSDA facilitated the control of purple loosestrife on Federal Bureau of Land Management (BLM) lands in Skagit County, and issued eight permits for manual control projects to allow movement of plants to disposal sites. WSDA continued to enhance county noxious weed control board activities by purchasing equipment and allowing use of equipment, such as small boats and canoes, to survey and control purple loosestrife infestations and to distribute biological control organisms.

WSDA contracted with Washington State University to raise, collect and release biological control agents for purple loosestrife in Washington State. Several thousand insects were raised and released on purple loosestrife infestations in 1999. These biological control agents had a significant impact on the purple loosestrife in many areas including the Winchester Wasteway area in Grant County. The impact in this area is especially visible as hundreds of acres of loosestrife plants show significant feeding damage from the beetles.

SPARTINA ERADICATION PROGRAM

Introduction

Spartina, commonly known as cordgrass, is a noxious weed that severely disrupts native saltwater ecosystems, alters fish, shellfish and bird habitat and increases the threat of floods. Three species of *Spartina* have been introduced to western Washington.

Spartina alterniflora is a species native to the East Coast of North America. It was introduced to Willapa Bay in the early 1900's when it was used as packing material for the shipment of east-coast oysters to the Bay. According to DNR estimates, there were approximately 3,600 solid acres of *Spartina* spread over more than 15,000 total acres of mudflats in Willapa Bay at the beginning of the 1999 control season. In Puget Sound, *Spartina alterniflora* is known to exist in Skagit County within Padilla Bay, Clallam County within Sequim Bay and Jefferson County within Bywater Bay. It was introduced by private landowners in Puget Sound sometime in the 1960's in an attempt to stabilize their shorelines. *Spartina alterniflora* has also been discovered at several locations within Grays Harbor and along the lower reaches of the Copalis River. Less than 20 solid acres of *Spartina alterniflora* are present in Skagit, Clallam, Jefferson and Grays Harbor counties combined.

Figure 1. *Spartina alterniflora* in Willapa Bay, Pacific County, Washington State

Spartina patens is present at only one known location in Washington State, at Dosewalips State Park in Jefferson County. It was first discovered at this site in the early 1990's and its method of introduction is not known. At the beginning of the 1999 control season, WSDA staff found approximately 15 scattered clumps of *Spartina* patens within the park boundary.

Figure 2. *Spartina patens* at Dosewalips State Park, Jefferson County, Washington State

Figure 3. *Spartina anglica* on Suquamish Reservation, Kitsap County, Washington State

Spartina anglica is present in Skagit, Snohomish and Island counties. It has also been found in San Juan, King, Kitsap and Jefferson counties. *Spartina anglica* originated in England from a cross of the American *Spartina alterniflora* and the European *Spartina maritima*. The result of this cross was a sterile hybrid named *Spartina X townsendii*. This sterile hybrid then underwent a genetic process termed "allopolyploidy" resulting in a fertile new species, *Spartina anglica*, with double the chromosome numbers of either of its parents. It was introduced into Puget Sound by a private landowner in an attempt to stabilize their shorelines. The hybrid vigor of *Spartina anglica* is amazing. The former Washington State Department of Game first observed *Spartina anglica* in Port Susan prior to 1979. At that time its estimated total area was less than 15 acres. At the beginning of the 1999 control season, there was approximately 900 solid acres spread over more than 8,000 acres throughout Puget Sound and Hood Canal.

In all, there are ten counties in western Washington with one or more infestations of either *Spartina alterniflora, Spartina anglica or Spartina patens*. These include Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Pacific, San Juan, Skagit and Snohomish counties. *Spartina* infestations range from one *Spartina* colony (or clone) measuring approximately 50 feet in diameter in Clallam County to more than 3,600 acres spread throughout Willapa Bay in Pacific County. All totaled, *Spartina* infests approximately 4,500 to 5,000 solid acres spread over more than 20,000 acres.

Spartina spreads quickly and is extremely difficult to eradicate. Successful eradication involves essentially four steps. Those steps are:

1) Preventing an existing infestation from producing seed;

2) containing an existing infestation to a site (particularly important given *Spartina's* high rate of vegetative spread);

3) treating for several consecutive years with a variety of treatment methods including mowing, applying herbicides, and hand pulling or a combination of these methods; and

4) after successful eradication is achieved, monitoring the area and removing new seedlings to assure no re-establishment occurs.

Basic Program Components

Chapter 255, Laws of 1995 designated WSDA as the lead state agency for the eradication of *Spartina*. As lead agency, WSDA has coordinated the development of strategies and management plans for eradicating *Spartina*, streamlined regulatory process requirements by obtaining "umbrella" water quality permits, provided moneys to state and local government and private landowners, and explored with its partners more efficient and cost-effective ways to eradicate *Spartina*.

The WSDA *Spartina* program has several basic components including budget, county activities, cost share activities, water quality permits and management plans. These components are detailed in this section of the report.

Budget

WSDA allocated $718,000 of its appropriation from the Aquatic Lands Enhancement Account (ALEA) for *Spartina* activities this biennium. Table 2, illustrates how WSDA intends to use the funds. The table shows projected expenditures for FY00 and FY01.

Table 2. Budget Activity by Area – FY00 and FY01
($718,000 total - $ in thousands)

	Puget Sound/Oly. Peninsula		**Willapa Bay**		**Total**	
Activity	*FY00*	*FY01*	*FY00*	*FY01*	*FY00*	*FY01*
WSDA Coordination and control activities	$91.5	$94	$91.5	$94	$183	$188
Survey (Adopt-A-Beach)	$20	$20	0	0	$20	$20
Purchased Services					$139	$136
- Skagit	$20	$20				
- Island	$25	$25				
- Snohomish	$25	$25				
-WDFW (Pacific County)			$30	$30		
- Residue Study			$30			
- Risk Assessment				$30		
- Aerial Applications			$7	$4		
- Equipment	$1	$1	$1	$1		
Landowner Cost Share	$2	$1	$14	$15	$16	$16
TOTAL	$184.5	$186	$173.5	$174	**$358**	**$360**

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 such as rent, insurance, supplies, communication, bond fees and training.
2. Survey (Adopt-A-Beach): WSDA wrote a two-year contract this biennium for Adopt-A-Beach to continue to coordinate volunteer Spartina surveys throughout Puget Sound and Hood Canal.
3. Purchased Services: WSDA wrote two-year contracts this biennium for county work crews in Skagit, Island and Snohomish counties. WSDA also wrote a two-year contract for the WDFW to conduct work in Pacific County. The Residue Study and Risk Assessment reflect money allocated to support anticipated research relevant to Rodeo®.
4. Landowner Cost Share: Due to increased private landowner interest in Willapa Bay, WSDA allocated more funding for this region than Puget Sound.

County Activities

In 1999, WSDA continued to allocate funding for *Spartina* work crews in those counties with the majority of the infestations. WSDA allocated this funding by way of contracts in which it and the Skagit, Island and Snohomish county noxious weed control boards, and WDFW in Pacific County, agreed on designated priority areas. The highest priority infestations were those on private property where landowners requested work crew assistance from WSDA. WSDA staff

conducted field audits throughout the control season and facilitated coordination meetings periodically to assure priorities were being adequately addressed. As previously mentioned, WSDA wrote these contracts for two years or through the end of the biennium.

Cost Share Program

As directed by RCW 17.26.007, WSDA offered financial assistance to private landowners for *Spartina* control and eradication in 1999. Table 3, describes how WSDA provided this assistance.

Table 3. 1999 WSDA Cost Share Options

Eradication/Control Method	WSDA Contribution	Landowner Contribution
County work crews mow and/or apply herbicide	WSDA grants county funds to treat priority areas in '99 control season	Must treat once in '99 season or agree to pay herbicide expenses
Direct cost share - Landowner applies herbicide	100% of herbicide and adjuvant	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

Since private landowners overwhelmingly requested the services of the county work crews, WSDA allocated the majority of cost share funding for this option. However, WSDA provided approximately $16,000 in direct cost share during the 1999 season. Some landowners and county coordinators still feel strongly that the state should pay more than 50%. Due to several factors including funding, this is not possible.

Water Quality Permits

Prior to the 1997 control season, WSDA applied for and negotiated the terms of six area-wide three-year water quality permits. These permits allow the use of the herbicide Rodeo® and surfactants (R-11, X-77, LI-700) in the waters of Willapa Bay, Grays Harbor, the Straits of Juan de Fuca/Pacific Ocean, Hood Canal, southern Puget Sound and northern Puget Sound from June 1 through October 31 for *Spartina* control. The Department of Ecology (DOE) issued five of the permits for three years, or through the 2000 control season. Due to typographical errors and other misunderstandings, the other permit, for North Puget Sound, was issued for one year, expiring after the 1998 control season. DOE issued WSDA a new North Puget Sound permit for the 1999/2000 control seasons, terms of which are somewhat different from the permits for other areas. This permit is the subject of an ongoing appeal. (These events are discussed in more detail in the *Spartina Program New Developments and Challenges* section.)

WSDA granted coverage under the permits to qualified applicants. In 1999, 29 applicants requested coverage under one or more of the WSDA permits. These applicants included federal,

state and county agencies, commercial applicators and private landowners. Applicants who met the permit terms received a packet containing a *Spartina*-specific Pesticide Application Record form, a WSDA flier on Herbicide Application Recommendations, the applicable permit(s) and a general flier on *Spartina*. Table 4, summarizes the permit coverage WSDA granted in 1999.

Table 4. 1999 Permit Coverage by Waterbody

Waterbody	1999 Permitted Applicators
Willapa Bay	20
Grays Harbor	9
Northern Puget Sound	18
Hood Canal	9
Straits of Juan de Fuca	9
Southern Puget Sound	9

The water quality permits required WSDA to notify all residents potentially affected by herbicide applications. WSDA accomplished this notification by conducting a mass mailing to more than 46,000 residents in western Washington in May 1999. WSDA staff, in conjunction with the county noxious weed board coordinators, also posted all public access points along selected shorelines prior to any herbicide applications and published legal notices in relevant county newspapers each month during the control season.

Management Plans

In the winter and spring of 1999, WSDA staff worked with the county noxious weed control board coordinators, staff from the WDFW, DNR, USFWS, tribal communities, and private landowners, to prepare six *Spartina* management plans. These management plans correspond to the areas covered under the six permits issued by Ecology. The management plans provide information on the affects of *Spartina* to the intertidal ecology of these areas, describe previous control efforts/results, and outline the control strategy for the coming year. Copies of 1999 plans are available by contacting the WSDA Statewide *Spartina* Control Coordinator. WSDA will update all management plans prior to the 2000 control season.

Program Results by Geographic Area

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 and King counties (Refer to Figure 4).

Funding Spartina Eradication Work in Puget Sound and Hood Canal

WSDA contributed a significant amount of funding for *Spartina* eradication projects in Puget Sound and Hood Canal during the 1999 control season. WSDA provided a total of $85,000, through contracts with the noxious weed control boards, to Skagit, Island and Snohomish counties and an additional $28,000 worth of herbicide and new equipment. WSDA also provided $3,000 to the Swinomish Tribal Community for equipment rental and purchase and $20,000 to Adopt-A-Beach for volunteer survey/removal projects and public education/outreach. In addition, WSDA hired, equipped and ran a small *Spartina* crew to work on the infestations in Clallam, Jefferson and Kitsap counties for six months, amounting to approximately $25,000 in additional funding. WSDA provided $2,000 to private property owners in the form of direct cost-share. Excluding general program costs, WSDA contributed approximately $164,000 specifically for *Spartina* eradication projects during the 1999 control season in Puget Sound and Hood Canal.

WDFW also contributed a significant amount of funding and other resources towards *Spartina* eradication projects in Puget Sound during the 1999 control season. Their contribution amounted to approximately $125,000. WDFW obtained approximately $25,000 of the $125,000 through a matching grant with USFWS for mowing projects and had approximately $30,000 remaining from a 1997 Coastal Protection Fund award by the Natural Resource Damage Assessment (NRDA) committee. The balance of their contribution to the *Spartina* eradication effort came from WDFW's Noxious Weed Program budget.

The Island, Skagit and Snohomish county noxious weed control boards provided some funding and other resources to *Spartina* eradication projects in 1999 as well. In addition to contributing general weed board resources, the Skagit County Noxious Weed Control Board Coordinator applied for and was awarded approximately $20,000 from the Skagit Fisheries Enhancement Group for *Spartina* eradication projects in 1999.

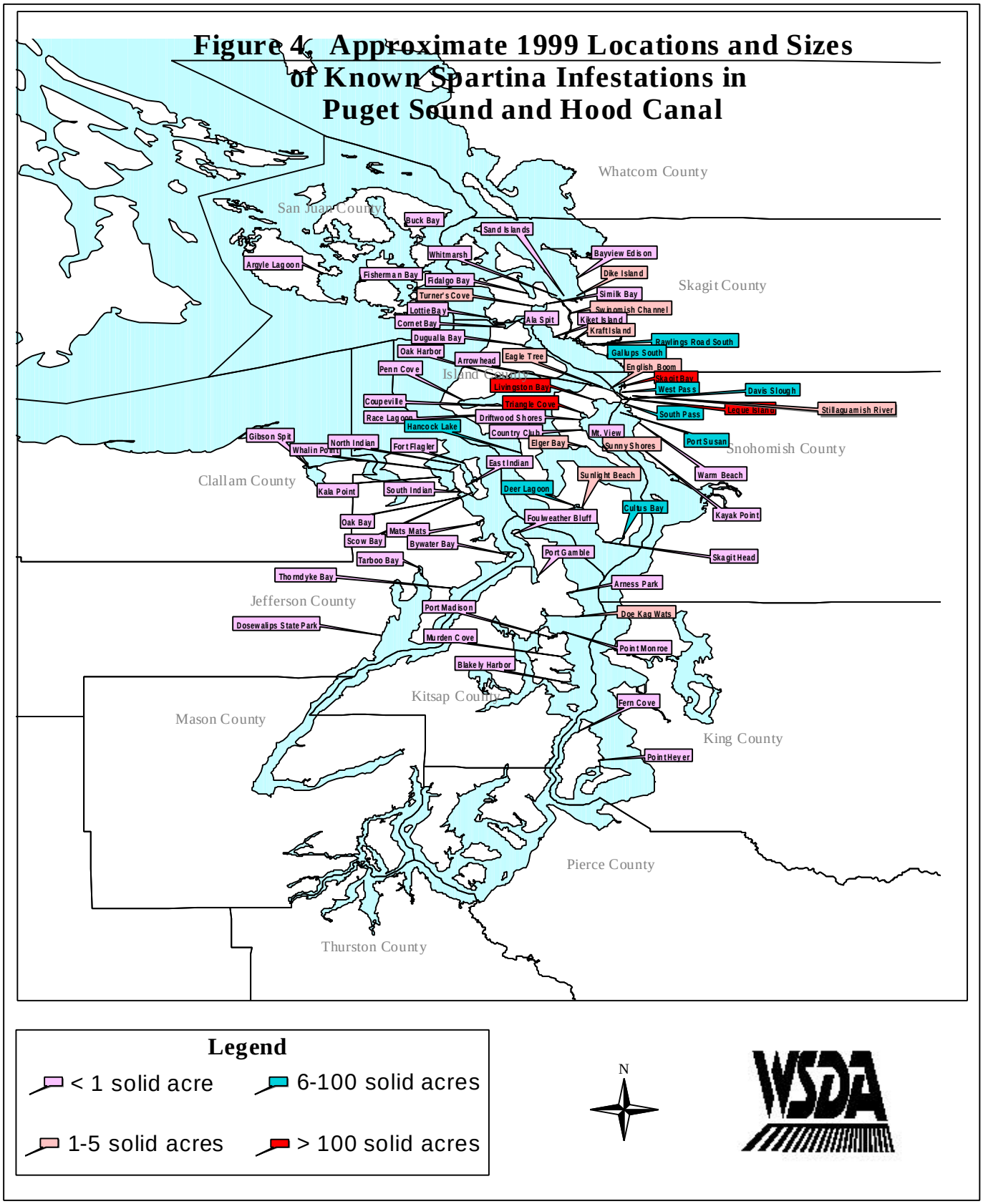


Figure 4. Approximate 1999 Locations and Sizes of Known Spartina Infestations in Puget Sound and Hood Canal

Extent of the Infestation in Puget Sound and Hood Canal

In understanding the extent of the *Spartina* infestation, it is important to know that there are different ways to measure and quantify acreage. Likewise, there are different uses for each type of acreage measurement. For instance when reporting the amount of *Spartina* treated with herbicide it is best to think in terms of solid acres of plant material. WSDA defines solid acres as the actual amount of *Spartina*, as if the separate infestations were consolidated into one large area. In management terms and in looking at the "big picture" it makes more sense to think of infested acres or affected acres. Affected acres are the overall number of acres affected by *Spartina* including the space between infestations. For example, we could look at ten acres of mud flat with many *Spartina* clones spread across it; this would be ten infested acres, but the solid acreage would perhaps be only one or two acres. It is important to note the affected acreage has the potential and is at risk of becoming solid acres if no treatment is implemented.

The estimated area of *Spartina* within Puget Sound and Hood Canal in 1997 was approximately 1,000 solid acres, spread over approximately 8,150 acres. At the beginning of the 1999 control season, there were an estimated 900 solid acres present within Puget Sound and Hood Canal. This amounts to a 10% decrease in the overall *Spartina* population in Puget Sound and Hood Canal from 1997 to 1999. Tables 5, 6, 7 and 8 show the acreage figures on a site-by-site basis. The sites in these tables correspond with those highlighted in Figure 4.

Highlights of the 1999 Season in Puget Sound and Hood Canal

- **Skagit County**

Table 5. 1997 and 1999 Estimated *Spartina* Populations - Skagit County

Site Name	Affected Acres	1997 Solid Acres at Beginning of Season	1999 Solid Acres at Beginning of Season	% Change in Solid Acres 1997-1999
Bayview Edison	1350	0.2	0.1	-50%
Dike Island	20	17	3.6	-79%
Sand Islands	50	4.2	0.25	-94%
Whitmarsh	2	0.1	0.02	-80%
Swinomish Channel	192	1.4	1.2	-14%
Similk Bay	65	0.1	0.1	0%
Turner's Cove	50	4.5	4	-11%
Kraft Island	30	15	10	-33%
Rawlins Road S.	105	30	15	-30%
Gallup's South	86	25	21	-16%
Lottie Bay	0	0	0.2	new
Kiket Island	0	0	1	new
Fidalgo Bay	0	0	0.1	new
Total	**1,950**	**97.5**	**57**	**-42%**

The Skagit County Noxious Weed Board *Spartina* crew, in cooperation with WSDA, DOE, and the Swinomish Tribal Community, treated all known *Spartina* populations in 1999. Treatment by the county and DOE crews included mowing, mow/herbicide and digging while treatment by the Swinomish Tribal Community crew consisted of mowing and digging. The approximate solid acreage of *Spartina* present at all known sites in Skagit County declined from approximately 97.5 acres at the start of the 1997 control season to 57 acres at the start of 1999, a 42% decline. Table 5, indicates the percent change from 1997 to 1999 at each site in Skagit County.

- **Snohomish County**

The Snohomish County Noxious Weed Board *Spartina* crew, in cooperation with WSDA and the Tulalip Tribal Community crew, treated all *Spartina* populations from the King County boarder north to Leque Island. The county crew treated by mowing, mow/herbicide application and/or digging. The Tulalip Tribe crew conducted digs on tribal property. For the first time ever, the county crew treated all known infestations within Port Susan. The county crew also began treating the Skagit Bay infestation for the first time in 1999. This area encompasses part of Island and Snohomish counties and is owned or managed by numerous private owners and organizations. Skagit Bay contains the largest *Spartina* infestation in Puget Sound and has increased substantially from the beginning of the 1997 control season to the beginning of the 1999 control season.

Table 6. 1997 and 1999 Estimated *Spartina* Populations - Snohomish County

Site Name	Affected Acres	1997 Solid Acres at Beginning of Season	1999 Solid Acres at Beginning of Season	% Change in Solid Acres 1997-1999
Skagit Bay	1000	175	200	+13%
South Pass	45	10	4	-60%
North Leque / West Pass	550	260	255	-2%
South Leque / Davis Slough	430	11	6	-45%
Stillaguamish	20	8	5	-38%
Port Susan	2,500	20	10	-50%
Warm Beach	50	2	0.1	-95%
Kayak Point to Warm Beach	25	0.1	0	-100%
Total	**4,620**	**486**	**480**	**-1%**

Much of Snohomish County Noxious Weed Board *Spartina* crew work was accomplished using WSDA's hovercraft, recently purchased by the Snohomish County Noxious Weed Control Board to transport equipment and personnel. The approximate solid acreage of *Spartina* present at all known sites in Snohomish County declined at seven of eight sites between 1997 and 1999, however, the increase in the Skagit Bay infestation resulted in only a 1% decline in total solid acres during the period. Table 6, indicates the percent change from 1997 to 1999 at each site in Snohomish County.

- **Island County**

The Island County Noxious Weed Control Board, in cooperation with WSDA and their private contractor, made significant progress to eradicate *Spartina* from the county during the 1999 control season. The Island County Noxious Weed Control Board contractor and its' crews, working much of the time in cooperation with WDFW crews, successfully treated and suppressed seed production for the second year in a row on nearly all of Whidbey Island. The U.S. Navy used a private contractor for *Spartina* eradication work on their property and the Island County Noxious Weed Board Coordinator conducted work on several sites on northern Whidbey Island.

Perhaps two of the biggest success stories to date in the *Spartina* battle have occurred on southern Whidbey Island in Island County. The Island County Noxious Weed Control Board private contractor, working in cooperation with WDFW crews, treated and reduced Cultus Bay and Deer Lagoon *Spartina* infestations to under 15 solid acres at each site from 1997 to the beginning of 1999. Both sites were over 40 solid acre *Spartina* infestations in 1996. All infestations at Deer Lagoon and Cultus Bay received the mow/herbicide treatment in 1999. Depending on the efficacy of the 1999 treatment, there could be only scattered single or small plants growing at these sites next year.

Spartina infestations on Camano Island continued to be a lower priority for the Island County Noxious Weed Control Board and WSDA than those on Whidbey Island. However, WDFW crews made significant progress on Camano Island during the 1999 control season. The treatment of the *Spartina* infestation at Livingston Bay is an example of this progress. This site consisted of nearly 100 contiguous acres of *Spartina* at the beginning of the 1999 season and had not been treated prior to this year. The WDFW crew treated approximately half of the total populations, utilizing the mow/herbicide treatment method.

Additionally, WDFW mowed approximately 50 acres in Skagit Bay, allowed it to re-grow approximately 10 to 15 inches, then partnered with WSDA to conduct an aerial herbicide application on it. This method proved successful in preventing seed production and efficacy of the treatment method will be evaluated next spring.

The Triangle Cove *Spartina* Task Force continued to play an active role in the *Spartina* fight on Camano Island during 1999 as well. WSDA provided direct cost-share funding that allowed them to continue to chip away at the more than 100 solid acres of *Spartina* present in Triangle Cove. As additional *Spartina* populations on Whidbey Island are brought to eradication, the Island County Noxious Weed Control Board and WSDA will shift their focus and funding to infestations on Camano Island.

Table 7. 1997 and 1999 Estimated *Spartina* Populations - Island County

Site Name	Affected Acres	1997 Solid Acres at Beginning of Season	1999 Solid Acres at Beginning of Season	% Change in Solid Acres 1997-1999
Whidbey Island				
Ala Spit	5	0.5	0.01	-98%
Cornet Bay	10	0.5	0.4	-20%
Coupeville	1	0.2	0	-100%
Cultus Bay	300	40	12	-70%
Deer Lagoon	150	60	14	-77%
Dugualla Bay	20	1	0.5	-50%
US Navy Property	300	40	35	-20%
Skagit Head	5	0.1	0	-100%
Oak Harbor	5	0.1	0.1	0%
Penn Cove	10	1	0.1	-90%
Race Lagoon	5	0.1	0	-100%
Snakelum	5	0.2	0	-100%
Sunlight Beach	25	8	5	-38%
Camano Island				
Arrowhead	10	2	1	-50%
Country Club	2	0.1	0	-100%
Driftwood Shores	0.5	0.1	0	-100%
Eagle Tree	6	3.5	2	-43%
Elger Bay	30	5	5	0%
English Boom	30	12	10	-17%
Livingston Bay	200	63	100	+37%
Mt. View	5	1	1	0%
Sunny Shores	5	2	2	0%
Triangle Cove	250	170	170	0%
Total	**1,380**	**410**	**358**	**-13%**

As shown in Table 7, the approximate solid acreage of *Spartina* present declined at 17 of 23 sites between the start of the 1997 season and the start of the 1999 season, however, the increase in the Livingston Bay infestation and the large infestation in Triangle Cove made for an overall decline of just 13% for the county during the period.

➢ Other Puget Sound Counties

The WSDA crew made significant progress toward eradicating *Spartina* from San Juan, Clallam, Jefferson, Kitsap and King counties in 1999. The total amount of *Spartina* in these counties at the beginning of the 1999 season would be less than five solid acres if it was contiguous.

For the most part, eradication activities consisted of mowing and digging in these counties during the 1999 season. However, the WSDA crew treated populations in Clallam and Jefferson counties with herbicide in 1999 for the first time ever. The herbicide-treated sites had been mowed out repeatedly with little effect in past years. In addition, WSDA worked cooperatively with the U.S. Navy on Indian Island in Jefferson County to treat infestations on its property with

herbicide for the first time in 1999. As a result, a long-term partnership has been solidified for the management of *Spartina* on this Navy property.

Table 8. 1997 and 1999 Estimated *Spartina* Populations – San Juan, Clallam, Jefferson, Kitsap and King Counties

Site Name	Affected Acres	1997 Solid Acres at Beginning of Season	1999 Solid Acres at Beginning of Season	% Change in Solid Acres 1997-1999
San Juan County				
Argyle Lagoon	0.5	0.01	0	-100%
Fisherman Bay	0.5	0.01	0	-100%
Buck Bay	0.5	0.01	0	-100%
Clallam County				
Gibson Spit	5	1	0.5	-50%
Jefferson County				
Dosewalips Park	20	0.5	0.2	-60%
Thorndyke Bay	10	2	0.2	-90%
Tarboo Bay	2	0.1	0.05	-50%
Oak Bay	8	0.5	0.1	-80%
Mats Mats	1	0.1	0.02	-80%
Scow Bay	10	0.1	0.02	-80%
Whalin Point	20	0.1	0.02	-80%
Kala Point	5	0.5	0.4	-20%
Bywater Bay	20	0.1	0.02	-80%
South Indian Island	20	0.1	0.02	-80%
North Indian Island	10	0	0.5	New
East Indian Island	5	0	0.1	New
Fort Flagler	1	0	0.02	New
Kitsap County				
Murden Cove	1	0.1	0.02	-80%
Blakely Harbor	1	0.02	0	-100%
Point Monroe	3	0.5	0.02	-96%
Foulweather Bluff	20	0.75	0.25	-67%
Port Gamble	5	0.1	0.02	-80%
Doe-Kag-Wats	25	2.0	2.0	0%
Arness Park	3	0.1	0.02	-80%
King County				
Fern Cove	0.5	0.01	0	-100%
Point Heyer	2	0.25	0.1	-60%
Total	**199**	**8.96**	**4.6**	**-49%**

Table 8, shows the approximate solid acreage of *Spartina* present at all 26 known infestation sites in San Juan, Clallam, Jefferson, Kitsap and King counties at the start of the 1997 and 1999 control seasons, with an overall decline of 49% between the two years.

Willapa Bay

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

Funding Spartina Eradication Work in Willapa Bay

WSDA provided $30,000 through an interagency agreement to WDFW for *Spartina* eradication work in Willapa Bay in 1999. WSDA also contributed approximately $25,000 of herbicide to the cooperative Willapa Bay control effort, contributed $6,000 towards the aerial herbicide program, and provided more than $14,000 to private landowners in direct cost-share. The WSDA *Spartina* crew worked in Willapa Bay several days in 1999 as well and provided mowing equipment to the Shoalwater Tribal Community when needed and available. Additionally, DNR, WDFW and USFWS all contributed significant funding and other support towards the cooperative Willapa Bay control effort in 1999.

Extent of the Infestation in Willapa Bay

Like Puget Sound and Hood Canal, there are different ways to measure and quantify acreage, and different uses for each of the numbers. The first step in analyzing the extent of infestation in Willapa Bay is to calculate the solid acres of *Spartina*. DNR created Geographical Information System (GIS) layers for these calculations using color infrared aerial photography. This mapping method accounts for *Spartina* patches larger than three feet in diameter. Seedlings and one-to two-year-old clones are not included in these numbers. Using these maps, DNR determined that in 1994 there were approximately 2,025 acres of solid *Spartina* spread throughout Willapa Bay and 3,250 solid acres in 1997. This indicates a 60% increase in solid *Spartina* throughout Willapa Bay over those three years, or approximately 20% per year. Using this calculated expansion rate and conservative estimates of acres killed by the eradication effort, DNR estimates there were more than 3,600 solid acres of *Spartina* present in the Bay at the beginning of the 1999 season.

The next step is to calculate the affected acres of *Spartina*. Ongoing analysis is being conducted by DNR to arrive at this figure. This will be accomplished by taking the solid acreage figures and essentially adding the space between those infestations. Field observations will also be used in this analysis to help compensate for the undetectable (smaller than three feet in diameter) patches of *Spartina*. Past inventory efforts and expert estimations indicate that the affected acres for the 1997 *Spartina* infestation is thought to be on the order of 12,000 to 15,000 acres. Willapa Bay contains approximately 47,000 acres of intertidal mud flats. Using the numbers for 1997, an estimated 25%-32% of the intertidal area was infested with some level of *Spartina* and 6% of the 47,000 total acres was covered by solid plant material.

Highlights of the 1999 Season in Willapa Bay

In 1999, the cooperative control effort in Willapa Bay resulted in treatment of approximately 600 solid acres of *Spartina*, or 17% of the overall infestation. Further growth projections calculated by DNR indicate that despite the cooperative treatment effort, there was an 8% increase in *Spartina* in Willapa Bay by the end of the control season. The agencies are continuing to loose ground bay-wide with current amount of funding allocated for *Spartina* eradication in Willapa Bay.

Despite the overall loss in ground, the agencies are making progress and killing *Spartina* on the areas they are treating. USFWS, WDFW and DNR have generally focused their resources on their own property in past years. These properties, in many cases, are spread throughout the Bay, resulting in a dilution of acreage treated in relation to the Bay's overall infestation. To remedy this situation, these agencies pooled their resources with WSDA in 1999 and focussed eradication efforts on specific geographic areas in an attempt to control the infestations one site at a time. To facilitate this effort USFWS staff, in cooperation with WSDA, DNR and WDFW, implemented an interagency memorandum of understanding that allowed the agencies to share resources and work cooperatively regardless of property ownership.

In 1999, the participating agencies tailored their roles and responsibilities to the unique resources and expertise they possessed, allowing them to maximize productivity while reducing redundancy and inefficiency. The following list outlines the role each agency played in Willapa Bay during the 1999 control season:

- **USFWS –** Operated the Quality amphibious flail mower, provided a base of operations for participating agencies, provided an airboat to DNR and experimented with an airboat-mounted herbicide wiper apparatus.

- **WSDA –** Provided permitting and public notification support, coordinated and contributed funding towards the aerial spraying program, provided funding to WDFW through an interagency agreement, provided herbicide for cooperative effort, provided cost-share assistance to private landowners and conducted eradication activities periodically when the WSDA crew was available.

- **DNR –** Coordinated the ground control and crew operations in south Bay, conducted control work on Natural Area Preserves and Maintenance Sites, managed the infrared aerial photography and mapping program, contributed funding and support for aerial herbicide application program and provided support for biological control research.

- **WDFW –** Coordinated the ground control and crew operations in north Bay, participated in control operations in south Bay and at Maintenance Sites, conducted ground control and crew operations with WSDA staff on private property as part of the WSDA Cost-Share Program and operated and improved the Hockney underwater mower.

In 1999, the agencies prioritized and treated specific geographic areas as follows (refer to Figure 5, for general locations of sites):

Maintenance Sites: Control work at these sites was done to maintain the relatively "*Spartina*-free" integrity of the sites. This was either in an area where past control work reduced the infestation down to low levels or in regions where new infestations were just establishing. These sites generally consisted of scattered clones and seedlings over a wide geographic area. Eradication activities typically included seedling removal and spot herbicide treatments. The 1999 Maintenance Sites and Project Unit Numbers (PUN's) were:

a) Rhodesia – PUN 11 / Nemah Beach – PUN 12 / Pickernill – PUN 12
b) Ellan Sands – PUN 29
c) Smith Creek – PUN 3
d) Teal Slough – PUN 17
e) Southwest Long Island – PUN's 34 and 35

Primary Sites: At primary sites, 100% of the *Spartina* populations received treatment and, in most cases, follow-up treatment. The primary sites were kept to a number and acreage that made it possible for cooperating agencies to achieve their goals in respect to their budget, time and prevailing permit restrictions. Herbicide applications, mowing and physical removals were all done extensively at these sites. The 1999 Primary Sites and PUN's were:

a) Potshot Slough – PUN 19
b) Toke Point/North Bay – PUN's 1, 2 and 3
c) Bear River – Omeara Point to Greenhead Slough – PUN's 21 and 22
d) Bone River Natural Area Preserve – PUN 9

Secondary Sites: Secondary sites were designated for control of seed set and included measures to reduce and contain growth such as aerial herbicide applications and large-scale mowing with the USFWS Quality amphibious mower. The locations of these sites were typically near and of direct impact to the primary sites and/or maintenance sites. The goal for secondary sites was to suppress seed set in order to avoid re-infestation of adjacent sites. This work was also done to prepare these areas for future upgrade to primary site status. The 1999 Secondary Sites and PUN's were:

a) North and South of Potshot (Linked to Potshot) – PUN's 18 and 20
b) Southeast Long Island (Linked to Potshot) – PUN's 33 and 34
c) Porter's Point (Linked to Bear River) – PUN 23
d) Niawakum River (Linked to Bone River) – PUN 9

Tertiary Sites: These sites were located in places where control had been conducted in the past and where continued control was warranted because of ecological significance, financial investment, public support or other justifiable and important reasons. Work was done at these sites in an attempt to maintain their current integrity. However, financial investment was minimized so that the agencies were not spread too thin. The 1999 Tertiary sites and PUN's were:

a) Leadbetter Point – PUN 28
b) Kafee/Lewis Slough's – PUN's 33 and 37

Coordinating *Spartina* management efforts on a regional basis in Willapa Bay allowed the participating agencies to achieve more effective *Spartina* control than individual entities could have accomplished alone. Of the total 600 acres treated in 1999, the state and federal agencies and commercial and private landowners conducted approximately 40% of this treatment by ground-applied herbicide, 45% by mowing and 15% by aerial-applied herbicide. Treatment efficacy varies by the method but the agencies conservatively estimate that approximately 275 solid acres of *Spartina* were killed in Willapa Bay during the 1999 season.

The agencies will continue to conduct control work in this manner in 2000. This will allow them to produce realistic acreage and cost figures. After the agencies evaluate efficacy in spring 2000, they will use the information to develop the 2000 Willapa Bay *Spartina* Management Plan.

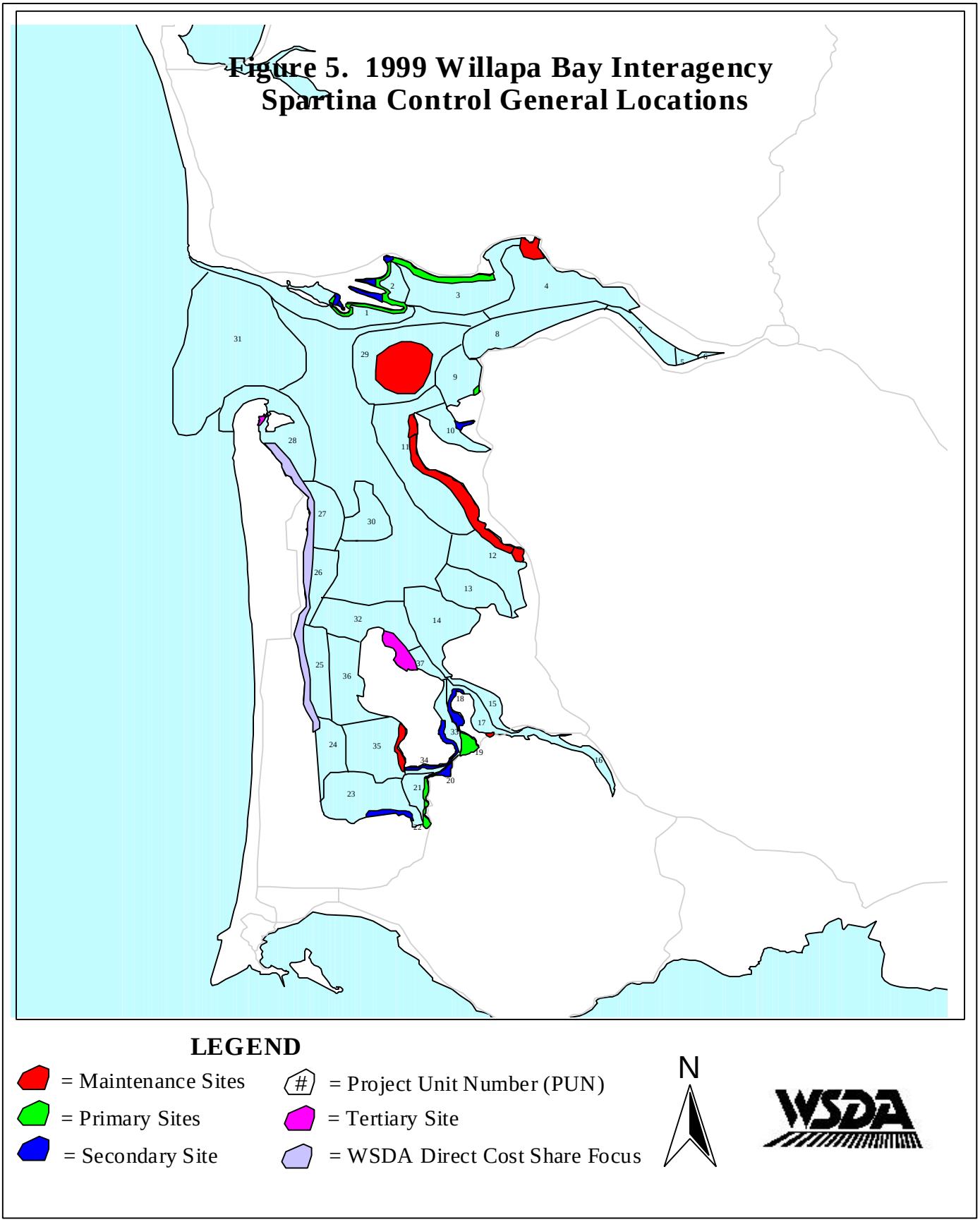


Figure 5. 1999 Willapa Bay Interagency
Spartina Control General Locations
LEGEND
= Maintenance Sites
= Primary Sites
= Secondary Site
= Project Unit Number (PUN)
= Tertiary Site
= WSDA Direct Cost Share Focus
N
WSDA

Grays Harbor

This waterbody includes the mouth of Grays Harbor, Grays Harbor, all the rivers, creeks and streams that run into Grays Harbor and the Copalis River drainage.

Funding Spartina Eradication Work in Grays Harbor

WDFW conducted all *Spartina* eradication work within Grays Harbor during the 1999 control season. However, DNR, WSDA and WDFW all contributed funding towards helicopter services to survey the entire region in late October 1999.

Extent of the Infestation in Grays Harbor

Property managers and landowners in Grays Harbor have been concerned about the potential invasion of *Spartina* due to the magnitude of the problem in neighboring Willapa Bay. This threat was originally validated when one large *Spartina* clone was discovered in Grays Harbor in 1992 by DNR staff. This was the only known infestation at the time in Grays Harbor and DNR mowed it repeatedly throughout the growing season.

In 1995, WDFW initiated surveys in response to concerns and reports of further *Spartina* invasion into Grays Harbor. WDFW performed a survey from both the ground and air and found no *Spartina*.

In 1996, WDFW staff surveyed the entire bay including the lower Chehalis River drainage either by boat or by fixed wing aircraft. They found and treated 10 clones with herbicide. WDFW observed no seedlings in Grays Harbor in 1996.

In 1997, WDFW revisited all sites treated the previous year and treated four of the 10 sites again with herbicide.

In June 1998, WDFW found five clones ranging in size from five feet to 20 feet in diameter. They treated these clones with herbicide. Late in the control season WDFW returned to evaluate treatment efficacy and found approximately 300 seedlings growing in the area where they had discovered the largest clone. They treated all seedlings with herbicide.

Highlights of the 1999 Season in Grays Harbor

WDFW staff found and treated a small clone in Grays Harbor in June 1999. At another previously infested site, WDFW found and treated several new scattered seedlings. They also found and treated an infestation along the lower Copalis River.

WDFW found and treated *Spartina* infestations at several new sites within Grays Harbor in October 1999. WDFW, DNR and WSDA conducted a survey by helicopter on October 25, in an

attempt to try to locate *Spartina* populations missed by ground survey. Weather was poor in the region but they discovered and mapped approximately six new *Spartina* clones.

WDFW, DNR and WSDA plan to conduct an extensive aerial survey of all tributaries, rivers and creeks that feed into Grays Harbor in June or July of 2000. This appears to be the best way to locate all the *Spartina* infestations because of the difficulty in accessing many of the remote sites by boat. WSDA will continue to work closely with WDFW to assure adequate funding is available for *Spartina* eradication work in this region.

***Spartina* Program New Developments and Challenges**

Progress of the Development of a Biological Control for *Spartina*

Biological control is considered one of the more promising potential new tools for *Spartina* control. Several organisms have been evaluated. The farthest advanced in testing is the planthopper *Prokelisia marginata*. Dr. Donald Strong, of the University of California at Davis, has spent over a decade studying *Spartina* and its associated insect communities. The results of several separate trials conducted from 1993 to 1997 revealed that *Prokelisia marginata*, which is native to California, had an unusual devastating effect on *Spartina alterniflora* and *Spartina anglica* from Washington State. In the first and second trials, *Spartina* clones taken from Willapa Bay were killed or severely stressed by moderate populations of *Prokelisia*. Native *Spartina* stocks from Maryland and California were completely unaffected. In later trials, *Spartina anglica* from Puget Sound also displayed an extremely high level of vulnerability to the insects. In follow-up trials conducted in 1998, this effect of *Prokelisia* on Willapa Bay *Spartina* was again replicated.

The state and federal agencies involved with *Spartina* eradication are monitoring the biological control research closely in order to utilize any window of opportunity the planthopper provides. All parties involved postulate that the introduction of *Prokelesia marginata* would place selective pressure on *Spartina* infestations as the more-resistant plants survive and propagate and the less-resistant plants are eradicated. To achieve the overall goal of complete eradication, surviving resistant clones would have to be eradicated within a limited number of growing seasons after the introduction of *Prokelisia marginata* populations using other tools in the integrated pest management tool kit.

Release Strategy

With the completion of risk studies on the horizon, a research team is preparing a strategy for releasing *Prokelisia marginata* into Washington State. The University of Washington's Olympic Natural Resources Center (UW-ONRC) secured federal funding to hire an experienced research scientist to design and implement the release strategy and pre- and post release monitoring programs. ONRC expects to release *Prokelisia marginata* into Willapa Bay as early as the summer of 2000. However, the research team must secure a federal/state permit to release prior to importation of the starter culture from California. The Columbia Pacific Resources Center

(CPRC), a local non-profit, built a greenhouse in 1999 to receive the initial population and mass rear additional insects in Long Beach. WDFW provided the funding for the greenhouse.

Pre- and Post- Release Baseline Studies

The information gathered through extensive monitoring will allow professionals to adjust the release strategy to optimize chances for success. The CPRC was awarded a Coastal Zone Management (CZM) grant to support the costs of involving citizen monitors in the monitoring activities. The CPRC secured additional support from WDFW. The CPRC and ONRC are also developing a web-site to disseminate information collected during the monitoring program and to provide the public with easy access to general information on invasive *Spartina* and its control.

Completion of Risk Analysis

During the past year, the research team focused most of its efforts on investigating the possible role of pathogenic agents in the observed mortality in Willapa *Spartina* caused by the insect. The team used sophisticated DNA screening techniques to detect what was thought to be the presence of a type of bacteria called phytoplasmas. To precisely identify the bacteria, the team carried out the most precise methods of DNA sequencing. The results indicated definitively that the bacteria present were not phytoplasmas. Other tests completed indicate the insect does not act as a vector for disease. The team consulted with senior plant pathologists following completion of the studies and the results were confirmed.

The research team initiated further host range tests in 1999 to screen additional potential non-target hosts. These tests were recommended after they circulated the 1998 report on host testing for peer review. The new tests will screen several commercial crops including corn, barley, wheat, and oats. Another addition will be *Leymus hirsutus* (European dune grass) which occurs in upland areas west of the cascades in British Columbia, Washington and northern Oregon. *Lolium perenne* (perennial ryegrass), *Poa annua (*annual bluegrass) a dominant grass in golf courses and lawns in Northwest, and two eastern Washington *Spartina* species will also be screened. The team expects to complete this final set of host range tests by February 2000. This work is expected to bring to a conclusion the assessment of risks. The team will prepare and submit a petition to the United States Department of Agriculture (USDA) Technical Advisory Group (TAG) proposing use of *Prokelisia marginata* for *Spartina* control. The TAG provides the highest level of peer review available. The research team will then turn its full attention to the release program and the exploration of other *Spartina*-specific insects.

Research into the Causes of Vulnerability

With federal funds, the research team continues to explore why Willapa Bay *Spartina* is affected by the presence of *Prokelisia marginata*. It is expected that better understanding will allow agencies to exploit *Spartina's* vulnerabilities. The team has begun looking into genetic sources of sensitivity as well as structural causes. Suppression of seed production is one of the key goals of this work. The other central goal is to discover how to more effectively target the various methods to capitalize on the plant's different vulnerabilities.

Develop Models to Track and Strategically Integrate Into the Washington State IPM Program

The team is beginning to develop sophisticated GIS-based models of *Spartina* infestation dynamics so that the impacts of the insect release can be tracked and the integration of control tools can be planned. The ONRC is beginning to develop a series of animated scenarios depicting various approaches to control and related futures in GIS-based graphics. These tools will help make the statewide IPM program more cost effective.

Public Outreach and Agency Coordination

The CPRC has sponsored a series of presentations and public meetings to transfer scientific information generated through this project to the public and to state and federal officials involved in the *Spartina* management program. A quarterly newsletter has been published for a wider audience.

The USFWS Amphibious Mowing Machine

The USFWS Willapa National Wildlife Refuge took delivery of an amphibious mower (Figure 6) on August 3, 1999. The delivery was more than two months after the expected delivery date and cut use during the control season in half for the project. Mowing operations started immediately upon delivery and continued until early November.

Figure 6. USFWS Quality Amphibious Mowing Machine in Willapa Bay

In 1999 (275 hours of actual machine run time) approximately 90 acres were mowed one time on the Willapa Refuge, of which 40 acres were re-mowed at a later date. In addition, approximately 150 acres were mowed at another Willapa Refuge site. The machine performed well throughout the season, but did encounter some unexpected mechanical problems that had to be corrected. USFWS is currently investigating the possibility of attaching a ripper or harrow-type device on the back of the machine. If a viable option becomes available, they will run the machine this winter and into spring in an attempt to trample, disc and harrow the *Spartina* meadows prior to the next growing season.

North Puget Sound Permit Appealed

On June 30, 1999, DOE issued a new, two-year water quality permit for use of Rodeo® for *Spartina* eradication in North Puget Sound. This permit is the first of the six regional permits to incorporate changes authorized by Senate Bill 5670, which had been enacted by the 1999 session of the Legislature. Among other provisions, Senate Bill 5670 establishes conditions for *Spartina* water quality permits, including a maximum wind speed of ten miles per hour and a minimum drying time of four hours between application and tidal inundation. Where appropriate, herbicide applications under this permit commenced in July 1999.

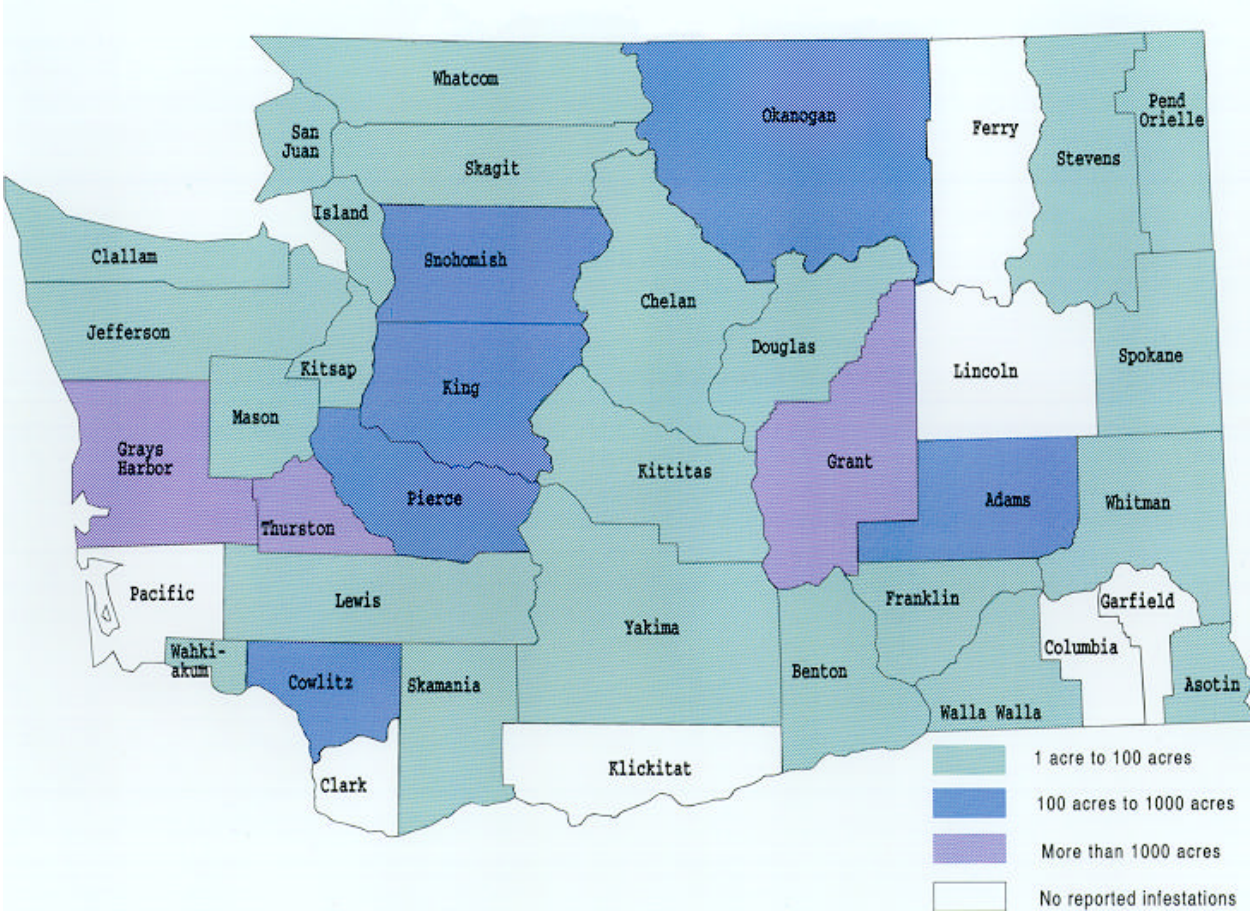
Several groups opposed to herbicide use appealed the permit on July 23, 1999. Grounds cited in the appeal include procedural matters and concerns over adherence to federal statutes, particularly the Clean Water Act. The appellants requested a stay. The Pollution Control Hearings Board denied the petition for stay on October 7, 1999. A hearing on the appeal itself is scheduled for the end of January 2000.

PURPLE LOOSESTRIFE CONTROL PROGRAM

Purple Loosestrife Control Program Status

Purple loosestrife infests several thousand acres of vital riparian habitat in Washington State and is known to occur in 32 of 39 counties (Figure 7). The largest infestations are found in Grant, Thurston and Grays Harbor counties. Actual infested acreage is difficult to estimate due to the large area involved and the remote locations of many sites.

Figure 7. Distribution of purple loosestrife in Washington State.



WSDA and partners have explored many control options including hand pulling, mechanical control (cutting and mowing), burning, water level manipulation, covering small infestations with black plastic, herbicides and biological control agents. The size and location of the infestation often dictates the most effective method of control. The areas that purple loosestrife inhabits are very sensitive to disturbance. Removing large plants usually opens up the area for a flush of seedling plants the following season that must be dealt with.

In Washington, small infestations of purple loosestrife are often controlled by hand pulling the entire plant or by removing the flower heads before viable seed have been produced. The latter method has the disadvantage of leaving the adult plant in place but does serve to eliminate the spread by seed. A permit from WSDA is required to transport and dispose of removed plants and plant parts. This is required to ensure that new infestations are not created from the removed plants. WSDA provides these permits to applicants at no cost. These sites are usually located in areas where large-scale colonization has not occurred or is not possible.

In areas where infestations are larger, hand pulling usually becomes too labor-intensive and costly to be feasible. Herbicides are used to treat areas that are too large to hand pull. Glyphosate is the herbicide most commonly used for the control of purple loosestrife. Glyphosate works well for controlling purple loosestrife plants but is a non-specific systemic and, when broadcast sprayed, can harm other vegetation in the area. 2,4-D is another approved herbicide in very limited areas. 2,4-D has the advantage of being selective for broadleaf plants, such as purple loosestrife, and does not harm monocot species that comprise many important aquatic perennial plants such as cattails. A widely available selective herbicide would be very helpful in the control of many of our purple loosestrife infestations. Very large infestations, where it is not financially or biologically feasible to treat with herbicides, are treated with biological control agents. In these areas there are simply too many plants to treat with other currently available control methods.

The overall purple loosestrife control program in Washington State is comprised of several parts including the following activities:

- Ongoing education of the public about the threat posed by purple loosestrife is the first step in reducing the spread in Washington State. Many federal, state and county agencies are involved in this continuing process.

- New introductions of purple loosestrife, which is sometimes sold as an ornamental, have been limited by the WSDA quarantine against the sale and transport of plants both into and within Washington State. WSDA Plant Services Specialists inspect nurseries to ensure that plants are not being sold.

- Small outlying infestations are being identified earlier and treated manually or with herbicides to eradicate and eliminate the spread of these populations.

- The large infestations, such as the Winchester Wasteway area in Grant County, are being treated with biological control agents to reduce the density and limit the spread of the infestations.

Basic Program Components

The WSDA Purple Loosestrife Control Program has several basic components including budget, water quality permits, cooperative projects, regulatory programs and biological control programs. These activities are detailed in this section of the report.

Budget

WSDA allocated $100,000 of its appropriation from the ALEA account for purple loosestrife control activities this biennium. Table 9, illustrates how WSDA intends to use the funds. The table shows projected expenditures for FY00 and FY01.

Table 9. Purple Loosestrife Anticipated Budget Activity for the 2000-01 Biennium

Activity	$ Allocated by WSDA for the 2000-01 Biennium
WSDA Coordination and control activities	$46,000
Biological Control Contract with WSU	$50,000
Equipment purchases	$4,000
TOTAL	**$100,000**

Figure 8. Purple loosestrife in Grant County

Water Quality Permit for Herbicide Control

Activities for 1999 included preparing the necessary documents for one statewide water quality permit. In 1999, the purple loosestrife permit covered not only purple loosestrife but six other species. WSDA is the lead agency for herbicide applications to control these noxious weed species in a manner similar to the *Spartina* program. This permit allows herbicide treatment (Rodeo® and in some instances 2-4,D) for purple loosestrife, wand loosestrife, garden loosestrife, saltcedar, indigobush, Japanese knotweed and reed canarygrass throughout the state. The biggest difference between this water quality permit and the *Spartina* permits is that applicants are charged with carrying out the public notification process. The scattered nature of the infestations of these noxious weed species, purple loosestrife and reed canarygrass in particular, makes public notification from WSDA very difficult.

WSDA issued coverage under the permit to 38 individuals and agencies in 1999. All geographic areas of the state were represented. In 1999 more than 3,500 affected acres were treated for purple loosestrife under the WSDA permit.

Figure 9. Treating purple loosestrife with glyphosate along the Yakima River.

Cooperative Projects

For the fourth consecutive year WSDA authored an interagency agreement with WDFW to control purple loosestrife and *Spartina* on approximately 50 acres of Bureau of Land

Management (BLM) lands in Skagit County. The BLM land is adjacent to WDFW land in a remote area of the Skagit River. WDFW staff conducted the control work and BLM funded it through its contract with WSDA. This cooperative effort saves time and money for both land managing agencies.

WSDA issued eight permits for manual control projects to allow movement of plants to disposal sites in 1999. WSDA issued two permits for research projects as well. These permits are required for compliance with the *Lythrum* (purple loosestrife) quarantine (WAC 16-752-400).

WSDA enhanced county noxious weed control board activities by purchasing equipment such as small boats and canoes. This equipment is used to survey and control purple loosestrife infestations as well as collect and re-distribute biological control organisms. The Washington State Noxious Weed Control Board suggested the purchase of this equipment. Small watercraft, including canoes and a 12-foot-boat with an outboard motor, were purchased in 1997 and are stored and maintained by the Skagit, Pend Oreille and Pierce County Noxious Weed Control Boards.

Figure 9. Access to sites often requires the use of watercraft

In 1998, WSDA purchased an eighteen-foot boat capable of navigating on the Columbia River. The Cowlitz County Noxious Weed Control Board stored and maintained the boat in 1998. WSDA moved the boat to Thurston County in 1999 and it is being stored and maintained by the Thurston County Weed Board. WSDA plans to move the boat to eastern Washington in 2000 to

allow more counties to have access to it. All of the boats purchased by WSDA are available to weed control agencies by request. WSDA has also purchased other equipment including back-pack sprayers, weed wrenches and boat-mounted sprayers for use by weed control entities.

Figure 10. Treating an upland purple loosestrife plant with a backpack sprayer in Yakima County

In cooperation with county noxious weed control boards and the Washington State Noxious Weed Control Board, WSDA continues to develop and maintain a database and mapping system to assist in tracking purple loosestrife infestations, control efforts and biological control distribution. WSDA obtained funds for the mapping software through a grant from the United States Department of Agriculture - Cooperative Agricultural Pest Survey (CAPS) program. WSDA is currently in the process of mapping known purple loosestrife locations. Biological control agent release sites have been mapped since 1996. WSDA is currently mapping the 1999 sites. In 1998, WSDA purchased ArcView® Geographic Information System (GIS) for its Noxious Weed Program. WSDA plans to enter purple loosestrife data into GIS in 2000. This will facilitate the sharing of information between local, state and federal agencies, most of which are already using similar GIS technology. WSDA will map some of the more extensive purple loosestrife infestations using Global Positioning System (GPS) technology in 2000. WSDA purchased a Trimble GeoExplorer GPS unit in 1996 that is used by weed staff and is also available for counties to use.

WSDA participates in the Chehalis River Task Force, which is attempting to control noxious weeds, including purple loosestrife, in the Chehalis River Drainage. Approximately 100 acres on 51 different sites have been identified to date. These are under varying control programs depending on jurisdiction. WSDA also participates in the Yakima River Purple Loosestrife Task Force and the Mid Columbia Purple Loosestrife Management Project which is addressing the problem of purple loosestrife in the Yakima River Drainage and the Mid Columbia region. WSDA provided support and equipment to the project in 1999, as well as use of WSDA boats.

WSDA continues to work with weed control entities and private groups to control purple loosestrife using non-chemical methods. Instructional manuals, hand clippers, plastic bags and "weed wrenches" are available for use by community groups who are manually controlling infestations in sensitive areas. WSDA has paid for the proper disposal of purple loosestrife plants in some instances where the costs were prohibitive to the volunteer groups.

Regulatory Program

WSDA has regulatory authority for noxious weed control in counties that do not have activated noxious weed control boards. In 1999, WSDA staff conducted control work in Kitsap, Mason and Douglas counties. Mason and Kitsap counties are currently in the process of activating boards, while Douglas County has opted not to activate a board at this time. In the absence of a board, WSDA staff worked closely with Washington State University Cooperative Extension personnel in Douglas County on weed issues in that county.

Figure 11. Early purple loosestrife infestation in Douglas County

WSDA Plant Services Specialists routinely inspect nurseries and other retail outlets to help prevent the sale of purple loosestrife in Washington State. Nursery companies in other states are also notified that purple loosestrife plants cannot be sold into Washington State.

Biological Control Program

Given the extensive infestation of purple loosestrife in Washington State and the limited resources available to combat this invader, WSDA has chosen to place a strong emphasis on a biological control program. Two species of beetles, *Galerucella calmariensis* and *G. pusilla*, and two species of weevils, *Hylobius transversovittatus* and *Nanophyes marmoratus*, have been released in Washington State. These biological control agents undergo extensive testing before they are allowed into the United States to ensure that they will only feed on the target species.

Galerucella were first introduced to Washington State in 1992. This native of Europe feeds on the buds and leaves of the plant causing skeletonizing and defoliation of host plants to the extent that plants are often killed. Heavily defoliated plants may die or produce fewer shoots the following year. *Galerucella* moves fairly readily and quickly to neighboring infestations.

Figure 12. Early season *Galerucella* feeding damage in Grant County

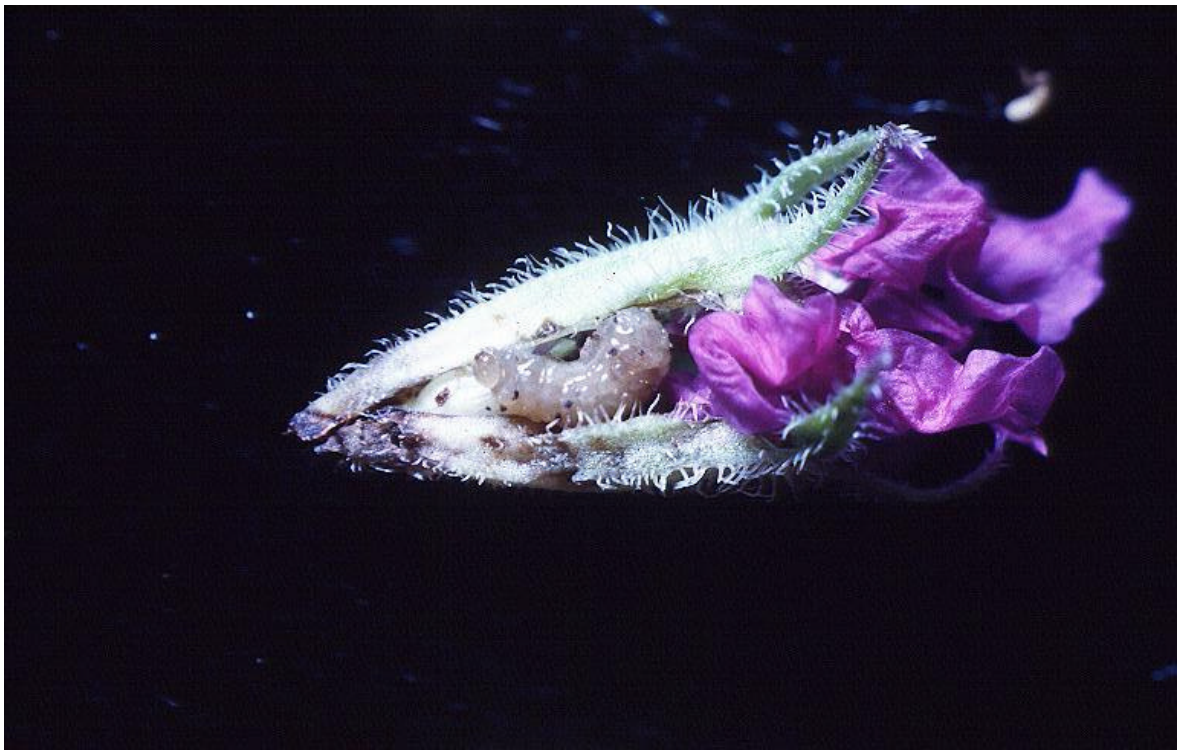
Hylobius transversovittatus is a native of Europe that was also introduced into Washington State in 1992. *Hylobius* larvae mine the roots of purple loosestrife while adults feed on the leaves. This species does not move far from its point of release necessitating manually transporting it from site to site.

Figure 13. Adult *Hylobius transversovittatus*

Nanophyes marmoratus was introduced to Washington State in 1996. The initial weevils were obtained from the Oregon Department of Agriculture as part of a biological control agent exchange program. Larvae consume the stamens, petals and ovaries of unopened floral buds. Infested buds fail to open and drop from the plant. Adults feed on young leaves near the shoot tips and on flower buds when they begin to form. Flower buds, which are fed upon by either larvae or adults, usually abort and fail to produce seeds. Another species of *Nanophyes*, *N. brevis* has not yet been approved for introduction into the United States.

Figure 14. Adult *Nanophyes marmoratus*

Figure 15. *Nanophyes marmoratus* larvae feeding in seed head



WSDA continued to contract with Dr. Gary Piper of Washington State University to raise, collect and release biological control agents for purple loosestrife in Washington State. In 1999, Dr. Piper shifted the emphasis of his work from *Galerucella* to *Hylobius* and *Nanophyes*. *Galerucella* is now well-established and is spreading on its own as well as by field collections conducted by other agencies. Since 1996, 24 county, state, federal and tribal agencies have been the recipients of purple loosestrife biological control agents propagated at Washington State University.

Table 10. Purple Loosestrife Biological Control Agent Releases by the Washington State University, 1999

Insect Released	Number Released	Number of Release Sites
Hylobius transversovittatus	6,225 egg/larval inoculations	12 sites in 3 counties
Nanophyes marmoratus	3,400 adults	11 sites in 2 counties

For 2000, WSDA plans to again contract with Dr. Piper for biological control work with the emphasis to again be placed on *Hylobius* and *Nanophyes* research, production and distribution. These two species are not as widely distributed in Washington State as the emphasis to date has been placed on *Galerucella*. *Nanophyes* shows great potential to further reduce purple loosestrife populations by feeding in the seed heads, reducing the tremendous amount of seeds produced by

individual plants. Since *Nanophyes* has only been released in the field in Washington State since 1998, much work remains to ensure its distribution throughout the state.

Figure 16. *Galerucella* damage at Winchester Wasteway in Grant County

WSDA again participated in a project initiated by the Washington State Noxious Weed Control Board to collect and redistribute *Galerucella* from the Winchester Wasteway area in Grant County to other areas of the state. This is the largest collection and redistribution of its kind in the United States. The *Galerucella* are having a significant impact on the purple loosestrife in the Winchester Wasteway area. WSDA purchased equipment for the project and made releases of these insects in Douglas and Yakima counties. A total of 41 county, state and federal agencies participated in the project in 1999.

Figure 17. *Galerucella* Collection in Grant County

Figure 18. Collected *Galerucella* to be redistributed to other areas of the state

In 1999, WSDA funded a pilot project in cooperation with the WDFW, the state Noxious Weed Control Board, the University of Washington and the King County Noxious Weed Control Board for the rearing of *Galerucella* beetles in a mesh enclosure at the Center for Urban Horticulture in Seattle. WSDA hopes that *Galerucella* raised in western Washington will be more suitably acclimated to the environment thereby increasing their tolerance and survivability in the moister climate. Additionally, it may be more cost-effective to raise certain biological control agents for release rather than to collect them in the field. WSDA anticipates continuing this project, with some slight modifications, in 2000.

Figure. 19 Purple loosestrife rearing pilot project enclosure on the University of Washington campus