# *Spartina* Eradication Program 2011 Progress Report

**Washington State Department of Agriculture**

*For more information or additional copies of this report, please contact:*

**Washington State Department of Agriculture**
*Spartina* Program
P.O. Box 42560
Olympia, WA 98504-2560

This report is available on the WSDA Web site at: http://agr.wa.gov

*Inquiries regarding the availability of this publication in an alternate format should be directed to the WSDA Receptionist at (360) 902-1976 or TTY (800) 833-6388.*

**Cover photo provided by Jonathan Still (WSDA),**
**Other photos provided by Dave Heimer, Les Holcomb (WDFW).**

Cover Photo: Digging of *Spartina alterniflora* in Willapa Bay during November. The large reduction in affected acres treated has made it possible for effective manual removal beyond the traditional end of the treatment season.

**AGR PUB 818-355 (N/2/12)**

# PROGRESS OF THE 2011 *SPARTINA* ERADICATION PROGRAM

February 2012

Washington State Department of Agriculture
Dan Newhouse, Director

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**Acronyms used in this report:**

| | |
|---|---|
| ALEA | Aquatic Lands Enhancement Account |
| ATV | All Terrain Vehicle |
| DNR | Department of Natural Resources, Washington State |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| IWM | Integrated Weed Management |
| NAP | Natural Area Preserve |
| NPDES | National Pollutant Discharge Elimination System |
| PSP | Puget Sound Partnership |
| TNC | The Nature Conservancy |
| USFWS | U.S. Fish and Wildlife Service |
| WSDA | Washington State Department of Agriculture |
| WDFW | Washington State Department of Fish and Wildlife |
| WSU | Washington State University |

**Concepts or Definitions used in this report:**

Solid Acres — A measure of how many acres a dispersed population would occupy if all *Spartina* plants were grouped together.

Affected Acres Treated — A measure of how many acres had one or more *Spartina* plants treated during a given year.

Surveyed Acres — A measure of how many acres were surveyed for *Spartina*, a minimum of once, during a given year.

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# Executive Summary

The Washington State Department of Agriculture (WSDA) has served as the lead state agency for the eradication of invasive *Spartina* since 1995. WSDA facilitates the cooperation of local, state, federal, and tribal governments; universities; interested groups; and private landowners responsible for the tremendous success of the program. From a statewide high of 9,000 solid acres infested in 2003, the program has reduced *Spartina* to a projected 7 solid acres in 2012. These final, 7 solid acres are a collection of individual plants and small clumps spread along thousands of miles of shoreline in the Puget Sound, Willapa Bay, and Grays Harbor.

*Spartina*, commonly known as cordgrass, is an aggressive noxious weed that has severely disrupted the ecosystems of native saltwater estuaries in Washington State. Left unchecked, *Spartina* out competes native vegetation and converts mudflats and estuaries into monotypic *Spartina* meadows. As a result, important migratory shorebird and waterfowl habitat are lost, the threat of flooding is increased, and the state's shellfish industry is severely impacted.

The next three years will be pivotal as the cooperators work throughout the intertidal waters of Washington State to find and eradicate the remaining infestations. WSDA remains confident that with continued funding the goal of eradication can be reached. Figure 1 is a projection of *Spartina* reduction within Washington State over the next three years assuming continued funding.

Specific knowledge regarding the distribution and extent of invasive *Spartina* within Washington State is fundamental to a successful eradication program. In 2011, as part of an increasingly detailed survey effort, project partners inspected over 80,000 acres of saltwater estuaries and more than a thousand miles of shoreline in 14 counties for evidence of *Spartina*. All infestations located were treated and location data was recorded, documenting the extent of the known infestation.

This eradication program is an unprecedented success story; however, the last few acres of *Spartina* will by far be the most difficult to find and eradicate.

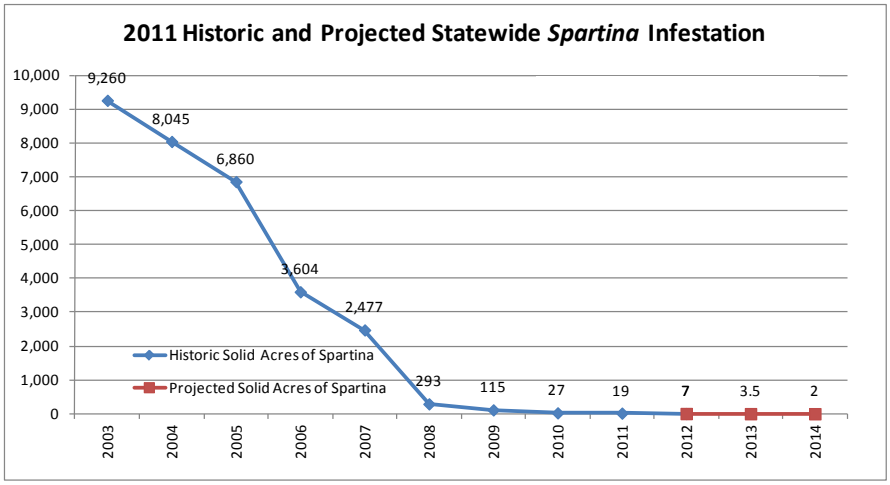


**Figure 1: Solid acres of *Spartina* by year statewide based on WSDA estimates. The blue line represents historic *Spartina* infestation since 2003. The red line indicates the projected *Spartina* infestation level through 2014. Projection assumes continued funding.**

**Willapa Bay**

The 2011 Willapa Bay treatment program was a success with all known infestations treated. The cooperators' combined 2011 Willapa Bay effort located and treated less than 2.5 solid acres of *Spartina*, which is an 86% reduction from approximately 18 solid acres treated in Willapa Bay during the 2010 season. In 2011, the program continued to eradicate the scattered infestations and individual plants remaining throughout the bay. WSDA estimates less than 1 solid acre of *Spartina* will remain in Willapa Bay during the 2012 treatment season.

**Grays Harbor**

2011 was a productive year for *Spartina* survey and eradication in Grays Harbor. WSDA, Washington Department of Fish and Wildlife (WDFW), and the United States Fish and Wildlife Service (USFWS) continued to work together to treat all known infestations. The potential habitat in Grays Harbor was surveyed three times during the 2011 season, with a total of 0.008 solid acres of *Spartina* found and treated. Of the 0.008 solid acres treated in Grays Harbor, 0.005 solid acres were *S. alterniflora* and 0.003 solid acres were *S. densiflora*. This is a 92% reduction from the approximate 0.11 solid acres treated in Grays Harbor during the 2010 season. WSDA estimates that fewer than 0.004 solid acres of *Spartina* will remain in Grays Harbor during the 2012 treatment season.

**Puget Sound**

In 2011, more than 16 solid acres of *Spartina* was found and treated in Puget Sound, the Strait of Juan de Fuca, and Hood Canal. This is a significant increase from the 8.5 solid acres located in 2010. A number of factors contributed to the increase in *Spartina* found, including: the most detailed survey to date, increased access to infested lands, and a long *Spartina* growing season. Continuing emphasis on detailed surveys will ensure the success of the Puget Sound *Spartina* program. WSDA estimates that fewer than 6 solid acres of *Spartina* will remain in Puget Sound in 2012.

**2011 Trends**

Key to the ongoing success of this project is the continued level of state funding provided to WSDA, WDFW, and the Department of Natural Resources (DNR), as well as federal funding provided by USFWS. Central to this success is continued cooperation of WSDA, WDFW, DNR, other state agencies, universities, USFWS, counties, tribes, private organizations, and private landowners.

With the largest infestations controlled, program efforts have evolved into a 'survey and eradicate' model focused on finding and treating the remaining individual plants and scattered infestations that exist along the Washington coast. The cooperators continue to evaluate and refine this survey effort. An encouraging development for 2011 is displayed in Figure 2 where nine sites (black dots) that represent previous *Spartina anglica* infestations were declared eradicated after the 2011 survey season. For an explanation of the survey criteria used to declare eradication please see page 20 of this report.

The next three years will be pivotal as the cooperators work throughout the vast intertidal waters of Washington State to find and eradicate the remaining infestations. Continued funding is imperative during the coming years to meet the program's goal of eradicating *Spartina*.

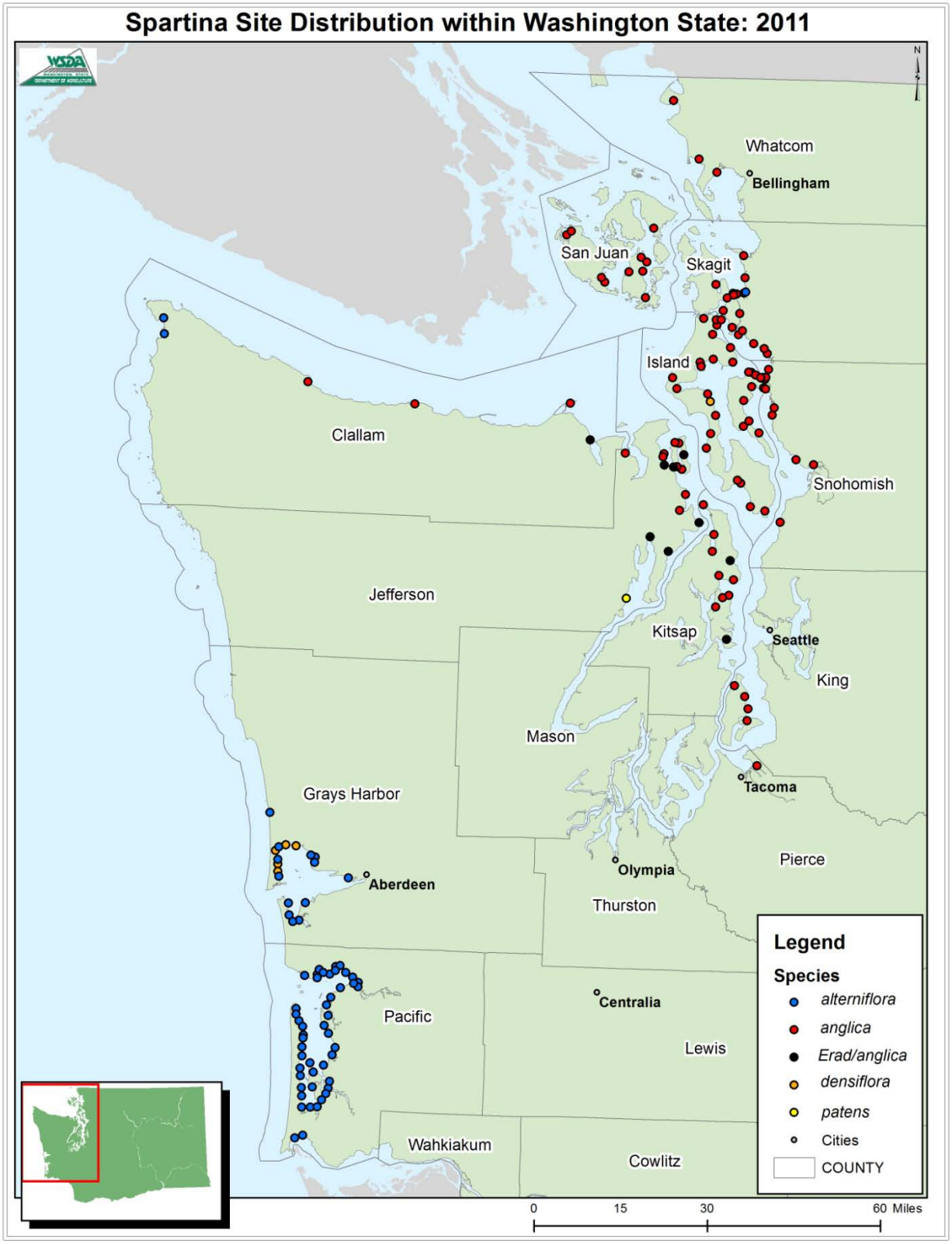


**Figure 2: Distribution of invasive *Spartina* sites in Washington State 2011.**

# *Spartina* Eradication Program

## WSDA *Spartina* Program

In 2011, the WSDA *Spartina* Eradication Program worked collaboratively with partner agencies to continue *Spartina* eradication.

WSDA hired, equipped, and managed personnel to survey and treat infestations in Whatcom, San Juan, Clallam, Jefferson, King, Pierce and Kitsap counties; assisted the Swinomish, Suquamish, Makah, Puyallup, and Tulalip tribal communities and the noxious weed control boards in Skagit, Snohomish, and Island counties with eradication work; worked cooperatively with Washington Department of Fish and Wildlife (WDFW), Washington Department of Ecology (DOE), and the U.S. Fish and Wildlife Service (USFWS) in Puget Sound and Grays Harbor; worked cooperatively with the Department of Natural Resources (DNR), WDFW, USFWS, The Nature Conservancy (TNC), the Shoalwater Tribe, Pacific County, the aquaculture industry, University of Washington, and Washington State University on infestations in Willapa Bay.

WSDA continued to administer the Department of Ecology National Pollutant Discharge Elimination System (NPDES) general permit required for *Spartina* eradication activities.

WSDA provided resources through interagency agreements, contracts, and cost-share to state and local government agencies and private landowners. WSDA organized and facilitated the exchange of *Spartina* eradication information through regional planning and informational meetings, and continued to explore more efficient and cost-effective ways to eradicate *Spartina* with partner agencies.

In 2011, WSDA continued to allocate funding for resources and *Spartina* work crews in counties with the majority of the infestations. In Willapa Bay, $165,000 was designated for Pacific County to continue the transition toward greater county involvement. In the Puget Sound, WSDA provided resources totaling $156,000 by entering into agreements with the noxious weed control boards in Skagit, Island, and Snohomish counties, the Swinomish Tribe, and WDFW. WSDA staff participated in field activities throughout the control season and facilitated coordination meetings to ensure contract priorities were adequately addressed. WSDA continued working with WDFW, DNR, WSU, and USFWS to explore the potential for restoration of once-infested tidelands to functioning shorebird and waterfowl habitat.

During 2011 WSDA participated in ongoing efforts related to the West Coast Governors' Agreement on Ocean Health. In this agreement the Governors of Washington, California, and Oregon committed to eradicate all non-native *Spartina* on the western U.S. coast by 2018. As part of this agreement an Action Coordination Team shares knowledge and developments with representatives from the three states, federal government, tribal governments, non-governmental organizations, and the Province of British Columbia. This continued high level intergovernmental cooperation will aid ongoing eradication programs and enhance future efforts.

## Budget

WSDA allotted $1.8 million of an appropriation from the Aquatic Lands Enhancement Account (ALEA) for statewide *Spartina* activities during the 2011-2013 biennium. Table 1 describes how WSDA allocated funds to conduct *Spartina* survey and eradication activities throughout Western Washington.

**Table 1: WSDA *Spartina* Budget Activity by Area – FY12 and FY13**

| Activity | Puget Sound/ Olympic Peninsula | | Willapa Bay | | Grays Harbor | | Total |
|---|---|---|---|---|---|---|---|
| | *FY12* | *FY13* | *FY12* | *FY13* | *FY12* | *FY13* | *FY12&13* |
| [1]**WSDA Eradication & Coordination Activities** | $275,000 | $275,000 | $140,000 | $120,000 | $65,000 | $60,000 | $935,000 |
| [2]**Purchased Services** | | | | | | | |
| Pacific Co. | | | $165,000 | $185,000 | | | $350,000 |
| Skagit Co. | $25,000 | $25,000 | | | | | $50,000 |
| Island Co. | $50,000 | $50,000 | | | | | $100,000 |
| Snohomish Co. | $50,000 | $50,000 | | | | | $100,000 |
| Swinomish Tribe | $6,000 | $6,000 | | | | | $12,000 |
| WDFW | $25,000 | $35,000 | $60,000 | $60,000 | $35,000 | $40,000 | $255,000 |
| **Total** | **$431,000** | **$441,000** | **$365,000** | **$365,000** | **$100,000** | **$100,000** | |
| **Biennial Total** | | **$872,000** | | **$730,000** | | **$200,000** | **$1,800,000** |

**Notes for Table 1:**

1. WSDA Eradication and Coordination Activities: Expenses include WSDA eradication, survey, restoration activities, salaries and benefits, herbicide, equipment, travel, legal fees, public notification expenses, and other goods and services.
2. Purchased Services: WSDA interagency agreements and intergovernmental agreements to accomplish *Spartina* eradication goals.

Other agencies received additional funding for *Spartina* activities during the 2012-2013 biennium. This funding is provided from ALEA, federal agreements, grants, and other sources. Table 2 describes where these funds were allocated.

**Table 2: Other Agencies *Spartina* Budget Activity by Area – FY12 and FY13**

| Agency | Puget Sound/ Olympic Peninsula | | Willapa Bay | | Grays Harbor | | Total |
|---|---|---|---|---|---|---|---|
| | *FY12* | *FY13* | *FY12* | *FY13* | *FY12* | *FY13* | *FY12&13* |
| **WDFW** | $106,000 | $118,000 | $136,000 | $108,000 | | | $468,000 |
| **DNR** | | | $230,000 | $230,000 | | | $460,000 |
| [1]**USFWS** | | | $200,000 | [2]$200,000 | $100,000 | $90,000 | $590,000 |
| **TOTAL** | $106,000 | $118,000 | **$566,000** | **$538,000** | $100,000 | $90,000 | |
| **Biennial Total** | | **$224,000** | | **$1,104,000** | | **$190,000** | **$1,518,000** |

**Notes for Table 2:**

1. USFWS funds in Willapa are expended by the Willapa National Wildlife Refuge for eradication efforts on Refuge lands. USFWS funds in Grays Harbor are contracted to WSDA and WDFW to support eradication efforts throughout the harbor.
2. Estimate based on carry forward funding.

For programmatic purposes, this geographic region includes Willapa Bay and all intertidal areas on the Washington side of the Columbia River.

## Extent of the Infestation in Willapa Bay

*Spartina alterniflora* is the only species of invasive *Spartina* infesting Willapa Bay. All infestations within Willapa Bay were treated during the 2011 season, and most were treated two or more times. This season the program continued efforts aimed at eradicating the scattered infestations and individual plants remaining throughout the Bay.

WSDA estimates that, during the 2011 season, approximately 2.25 solid acres of *Spartina* were treated in Willapa Bay. This estimate is based on the treatment data reported by the cooperators. Table 3 identifies areas of the Bay treated and the cooperators conducting the treatments.

The affected acres treated reached a high of 25,430 in 2009 due to the addition of small recently discovered infestations while many areas of the bay continued to required small-scale treatments to scattered plants. In 2011 the affected acres treated declined to 2,587. This is a positive indication that the program is not only proving to be effective at reducing overall solid acres of *Spartina* but trending toward eradication in some areas of the bay. With the large reduction in affected acres manual removal of *Spartina* has become cost effective in some areas. This has allowed the cooperators to augment the eradication effort and extend the treatment season. In 2011 approximately 450 square feet (.01 solid acres) of *Spartina* was dug and removed from the bay by the cooperators.

The decline in affected acres treated does not reduce the need to have a detailed monitoring program in place throughout the bay. In 2011 the cooperators surveyed over 30,000 acres of potential *Spartina* habitat, most of it two or more times during the course of the season. The cooperators collected GPS data for all known *Spartina* occurrence points in the bay. In 2011, a *Spartina* occurrence point was roughly defined as ‘any *Spartina* identified within approximately one square meter.’ With the continued decline in solid acres, the cooperators will transition this definition to ‘one GPS data point per plant’ for the 2012 treatment season. This level of vigilance will be necessary during the coming years in order to achieve eradication.

WSDA estimates fewer than 2.5 solid acres of *Spartina* were present in Willapa Bay over the course of the 2011 treatment season. This estimate is derived from treatment acreages reported by the cooperators (2.25 acres) and includes an additional 5% to compensate for late season emergence, survey, or application misses and other contributing factors.

Over the past nine years, the combined effort in Willapa Bay has been extremely effective and has reduced the overall infestation from a high of 8,500 solid acres in 2003 to fewer than 2.5 solid acres in 2011. This is an overall reduction of 99.9% achieved in eight treatment seasons. If the 2011 treatment season meets expectations and achieves an overall efficacy of 60% or greater, WSDA estimates that less than 1 solid acre of *Spartina* will be present in Willapa Bay during the 2012 treatment season.

Figures 3 and 4 are maps of North Willapa Bay and South Willapa Bay including treatment sites.

Table 3: Summary of 2011 Willapa Bay *Spartina* Eradication Effort

| ***Site*** | ***Estimated Acres Surveyed*** | ***Estimated Affected Acres Treated*** | ***Estimated Solid Acres Treated*** | ***Entity Conducting Treatment*** |
|---|---|---|---|---|
| **North Willapa Area** | | | | |
| North Cove / Toke Point | 1030 | 254 | .3902 | ST/PC/WDFW |
| Toke Point / Cedar River | 750 | 31 | .0425 | WDFW |
| Cedar River / Smith Creek | 612 | 41 | .0825 | WDFW |
| Smith Creek / Willapa Meadow | 3986 | 357 | .59 | WDFW |
| Mailboat Slough | 265 | 117 | .152 | PC |
| South Bend / Raymond | 368 | 49 | .0585 | PC |
| S. Willapa River / Rose Ranch | 412 | 24 | .0028 | DNR |
| Rose Ranch / Stony Point | 465 | 31 | .0125 | DNR |
| Ellan Sands | 1172 | 13 | .015 | PC |
| Bone River / South Stony Point | 758 | 33 | .0096 | DNR |
| Wilson Point/Niawiakum River | 729 | 52 | .0138 | DNR |
| Bay Center / Palix / Nemah Beach | 2456 | 215 | .1896 | DNR/PC |
| **South Willapa Area** | | | | |
| North & South Nemah / Seal Slough | 4119 | 118 | .1382 | PC |
| Naselle | 1695 | 136 | .0364 | DNR/TNC |
| Willapa National Wildlife Refuge | 6748 | 492 | .25 | USFWS |
| Long Beach Peninsula | 4476 | 622 | .2508 | DNR/WSDA/PC |
| Columbia River / Baker Bay | 80 | 2 | .0008 | WSDA |
| **Total** | **30,121** | **2,587** | **2.2352** | |

WSDA = Department of Agriculture, WDFW = Department of Fish and Wildlife, DNR = Department of Natural Resources, USFWS = U.S. Fish and Wildlife Service, TNC = The Nature Conservancy, ST = Shoalwater Tribe, PC = Pacific County

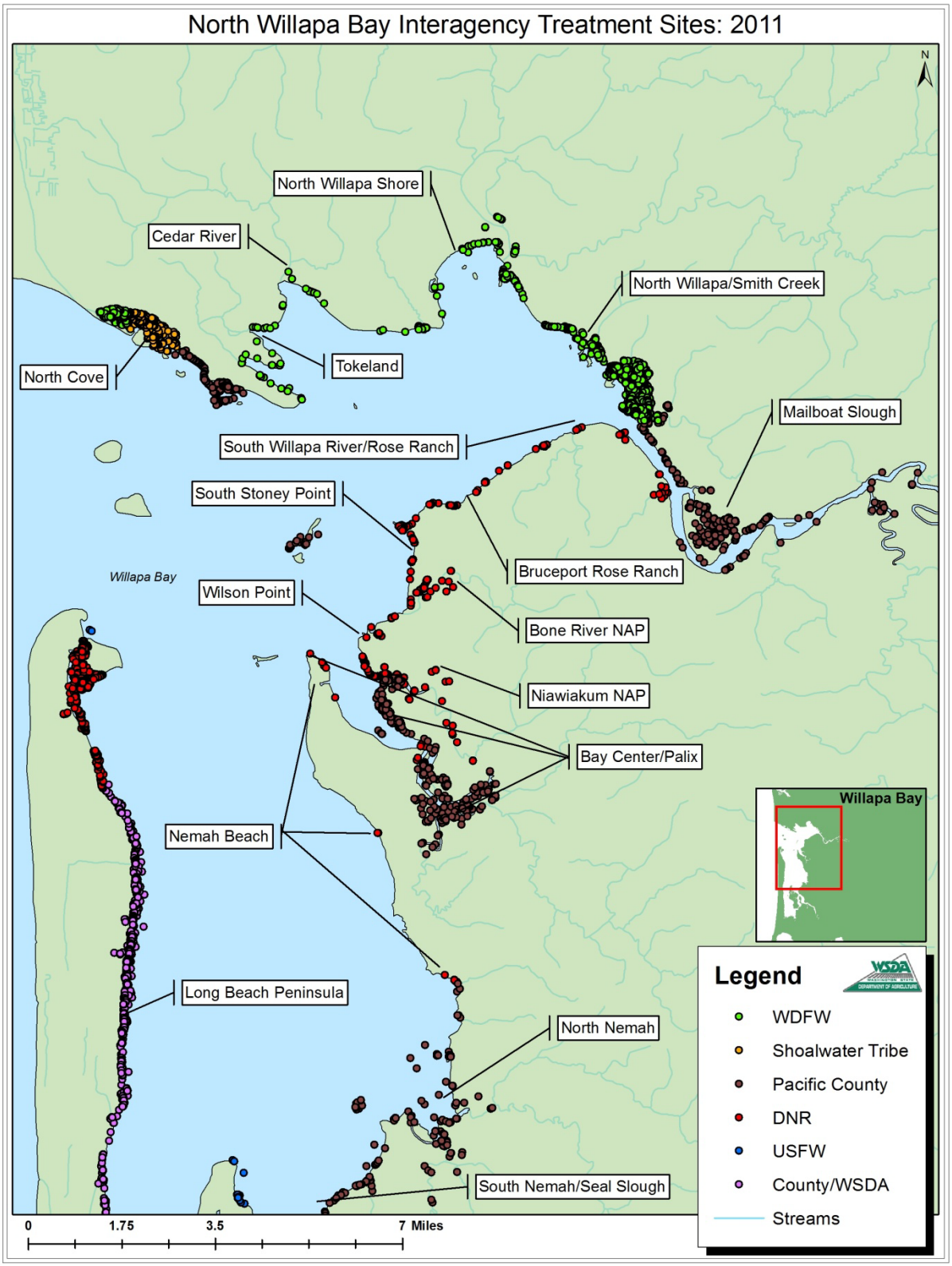


**Figure 3: 2011 North Willapa Bay interagency *Spartina* treatment sites.**

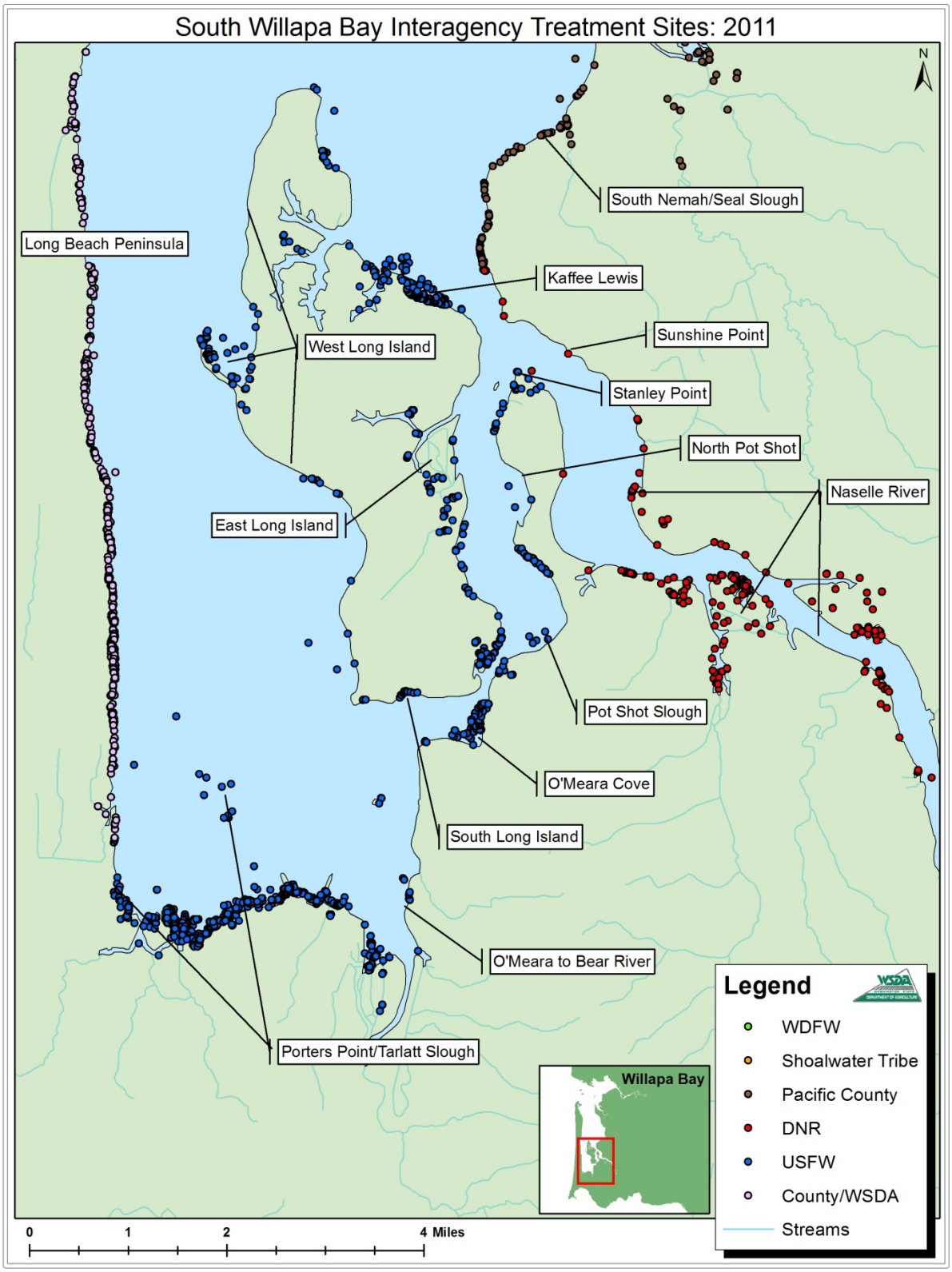


**Figure 4: 2011 South Willapa Bay interagency *Spartina* treatment sites.**

## Roles of Willapa Bay Cooperators in 2011

- **WSDA** – Continued cooperation with the Department of Ecology to ensure NPDES coverage was available to qualified applicators. Provided resources, equipment, and herbicide to WDFW, DNR, Pacific County, and private property owners to ensure proper treatment of all sites. Conducted eradication activities on the Long Beach Peninsula and Columbia River in cooperation with Pacific County and DNR.

- **DNR** – Conducted eradication activities in Palix River, Nemah Beach, Wilson Point, Naselle River, Rose Ranch, Stony Point, South Willapa River, and the Natural Area Preserves. DNR also cooperatively treated the Long Beach Peninsula with Pacific County and WSDA.

- **WDFW** – Conducted eradication activities from Toke Point to the Willapa River Meadow.

- **USFWS** – Conducted eradication activities on Long Island and from the Stanley Point area south to the northern boundary of the Tarlatt Slough treatment area.

- **Pacific County –** Conducted eradication activities on the Long Beach Peninsula in cooperation with DNR and WSDA. Treated Ellan Sands, North Nemah, South Nemah and Seal Slough. Conducted treatments between North Cove and Toke Point in cooperation with the Shoalwater Tribe. Pacific County also cooperatively treated the Palix River and Bay Center areas with DNR. Provided staff time to conduct Class A Noxious Weed compliance activities for *Spartina alterniflora*.

- **Shoalwater Tribe –** Worked closely with state and federal partners. Provided staff time to evaluate previous treatments and consult regarding 2011 activities. Conducted eradication activities on tribal-owned lands between North Cove and Toke Point in cooperation with Pacific County.

- **University of Washington Olympic Natural Resources Center (UW-ONRC) –** Continued to develop tidal elevation maps of various treatment sites to predict the dry time that plants receive on specific days.

- **Washington State University (WSU**) – Continued research to improve efficacy of control tools**.** Continued research on impacts of *Spartina* to shorebirds and waterfowl.

- **The Nature Conservancy (TNC) –** Worked closely with the cooperators in the Technical Committee. Cooperated with DNR to treat Ellsworth Slough in the Naselle River.

## Recommendations for the Future

With the successes of the past nine years and the massive reductions of *Spartina* in Willapa Bay, continued support and funding are more important than ever. In 2011, the Willapa Bay *Spartina* Eradication Program continued to focus on small-scale treatments of scattered infestations and individual plants found throughout the bay. The transition from the large-scale treatments of meadows has required an increase in the numbers of personnel on the ground to give individual attention to areas that helicopters or large machines were previously able to cover in a relatively short amount of time. As the large meadows have broken up into small, scattered plants under the pressure of eradication, the amount of herbicide needed to treat the infestation has declined. Manual removal of *Spartina* has become cost effective, in some areas, and provides for a longer treatment season. This programmatic shift has resulted in lowered herbicide costs and increased labor costs. Under this regime, WSDA anticipates the overall cost of re-treating scattered infestations in 2012 will not differ significantly from the cost of conducting the previous large-scale applications. Furthermore, it is anticipated that with continued programmatic success the cost of conducting the Willapa Bay *Spartina* eradication program in 2013 and beyond will begin to decrease.

WSDA estimates less than 1 solid acre of *Spartina* will be present in Willapa Bay during the 2012 treatment season. With the successful eradication of over 8,000 solid acres of *Spartina* in Willapa Bay over the past eight years, it is critical that program continuity is maintained. Figure 6 is a projection of *Spartina* reduction within Willapa Bay over the next three years with continued funding.

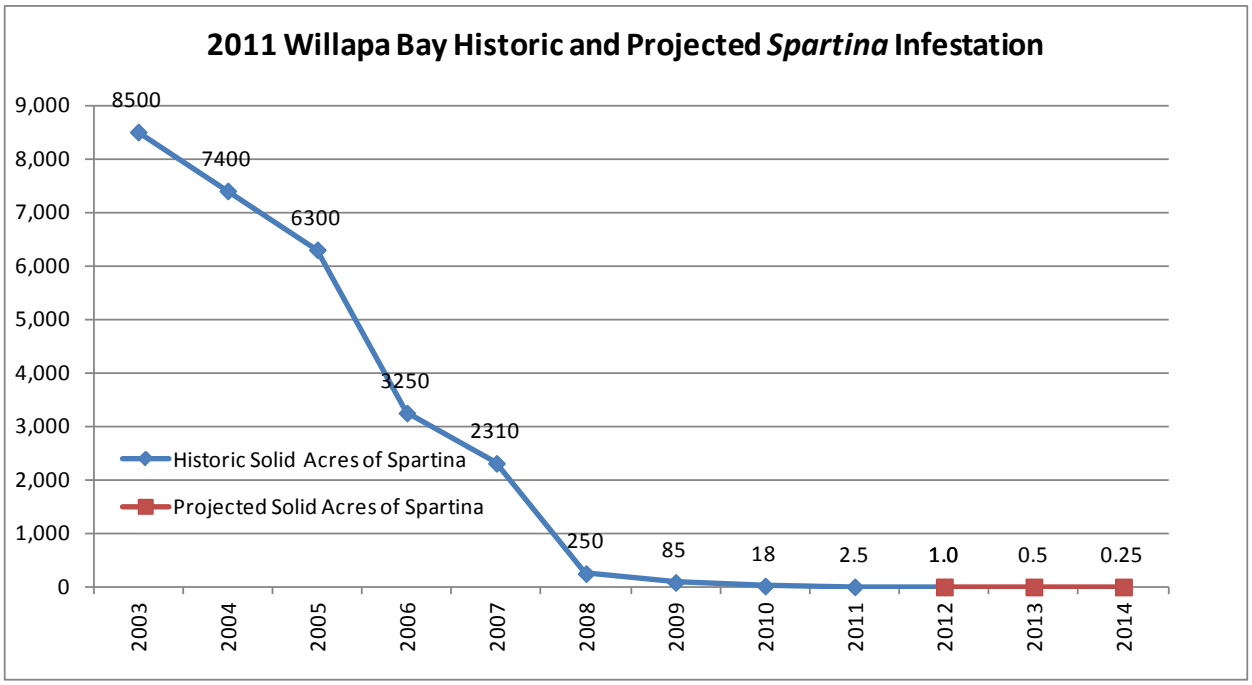


**Figure 5: Solid acres of *Spartina* in Willapa Bay by year, based on WSDA estimates. The blue line represents the historic area of *Spartina* since 2003. The red line represents the projected *Spartina* area through 2014. Projection assumes continued funding.**

# *Spartina* Eradication Effort in Grays Harbor

For programmatic purposes this geographic area includes Grays Harbor, its surrounding tributaries, and the coast from Cape Shoalwater to Cape Flattery (Figure 6.)

Two species of *Spartina* infest Grays Harbor. The most prevalent species in Grays Harbor during the 2011 season was *Spartina alterniflor*a which totaled roughly 55% of the infestation. *Spartina densiflora,* discovered in 2001, is a South American cordgrass species that tends to grow higher in the intertidal zone and blends in well with native grasses, totaled approximately 45% of the infestation.


**Figure 6. Grays Harbor *Spartina* project area.**

## Historical Overview of the Grays Harbor Infestation

Survey and control work started in Grays Harbor in 1995. However, due to the overwhelming size of the *Spartina* infestation in Willapa Bay, resources to conduct a comprehensive survey in Grays Harbor were not available until 2005. An aerial survey in late summer of 2005 located an estimated 10 solid acres of *Spartina* and spurred an effort to undertake a more thorough survey and treatment program.

Of the 10 solid acres located through the aerial survey, WDFW treated 6.5 solid acres during the remainder of the 2005 season. WDFW also treated 3.5 solid acres, including all known infestations, during the 2006 season. The experience gained during the 2005 and 2006 treatment seasons led the project partners to conclude that a more aggressive effort was needed to achieve eradication in Grays Harbor.

As a result, in 2007 staff from WSDA, U.S. Fish and Wildlife Service and WDFW combined forces to achieve the most thorough survey and treatment regime in the Harbor to that point. Approximately 25,000 acres of intertidal lands in Grays Harbor and its tributaries with the potential for *Spartina* infestations were surveyed. Additionally, a coastal aerial survey revealed a 0.7 acre infestation in Grass Creek and also a relatively large infestation just south of Cape Flattery. Both infestations were *S. alterniflora*, and treated in the 2007 and 2008 seasons. The 2007 season yielded a total of 2.51 solid acres of *Spartina* treated in Grays Harbor and the Copalis River drainage.

While conducting three whole harbor survey circuits in 2008, Grays Harbor crews found and treated 0.445 solid acres of *Spartina*. Of the 0.445 acres treated in Grays Harbor, 0.279 solid acres were *S. alterniflora* and 0.166 solid acres were *S. densiflora*. A positive sign in 2008 was that half-gallon low-pressure sprayers were adequate to treat the reduced numbers of plants in Grays Harbor.

In 2009, two circuits of the entire harbor were completed, treating an estimated 0.54 solid acres of *Spartina.* Crews treated approximately 0.26 solid acres of *S. alterniflora* and 0.28 solid acres of *S. densiflora.* In the Bills Spit area of Grays Harbor a dense population of *S. densiflora* exists, therefore a transect or grid system methodology was used to maximize detection of *S. densiflora* plants hidden among other native vegetation. Transect system methods are discussed in the 2009 and 2010 WSDA *Spartina* reports. Within the transect area, 0.19 solid acres of *S. densiflora* was treated. An additional 0.09 solid acres were treated outside of the transect boundaries. Crews continued to use half-gallon low pressure sprayers with excellent results.

Two circuits, including *S. densiflora* transects, were completed in the 2010 season. Treatments totaled an estimated 0.11 solid acres of *Spartina* (0.046 *S. alterniflora* and 0.064 *S. densiflora*). The *S. densiflora* transect area yielded 0.044 solid acres. In addition, 0.02 solid acres were treated outside of the transect area. Survey and treatment crews used a combination of chemical and mechanical (digging) methods to remove *Spartina* in 2011. Because of the significant reductions of *Spartina* infesting the Harbor, digging has become cost effective in some areas and was the primary means of control in 2011. However, in some heavily infested areas herbicide was used.

## 2011 Survey and Treatment Season in Grays Harbor

With the opportunity furnished by continued federal funding from the USFWS Nisqually National Wildlife Complex and approximately $100,000 in dedicated state funds, the cooperators developed three major goals for the 2011 treatment season:

1) Achieve at least two comprehensive rounds of survey and treatment throughout Grays Harbor, treating all known infestations with emphasis on high salt marsh areas.
2) Survey coastal sites that may harbor undetected *Spartina* infestations.
3) Continue to incorporate *S. densiflora* transect methods in the Bills Spit area. Transect methodology is a systematic survey technique to maximize detection of a target species. (Refer to the 2009 and 2010 WSDA *Spartina* reports for detailed descriptions of transect methods)

Grays Harbor surveys continued during the 2011 season. Some amount of either *S. densiflora* or *S. alterniflora* was found within most of the historically infested areas, although populations of both species were significantly reduced (92%) in solid acreage from the 2010 season. *S. alterniflora* comprised 55% of the infestation and continues to be more widespread in terms of total area present. *S. densiflora* occurred in a more limited area, yet it comprised 45% of the infestation (Figure 7).

During the 2008 and 2009 surveys, crews observed *S. densiflora* continuing to spread northerly from Bills Spit to North Bay. Although crews continue to find *S. densiflora* in North Bay the associated solid acreages and plant numbers continue to decline. These reductions were facilitated by increased survey and treatment efforts during the spring and late fall months of 2010 and 2011.

Unlike the other invasive *Spartina* species in Washington State *S. densiflora* remains green year round. The project partners have determined that this trait makes it more effective to survey for *S. densiflora* in the late fall to early spring when the surrounding native species are senesced. These 'winter surveys,' have resulted in an increased rate of *S. densiflora* detection.

Figure 8 depicts the 2011 distribution of *S. densiflora* in Grays Harbor.

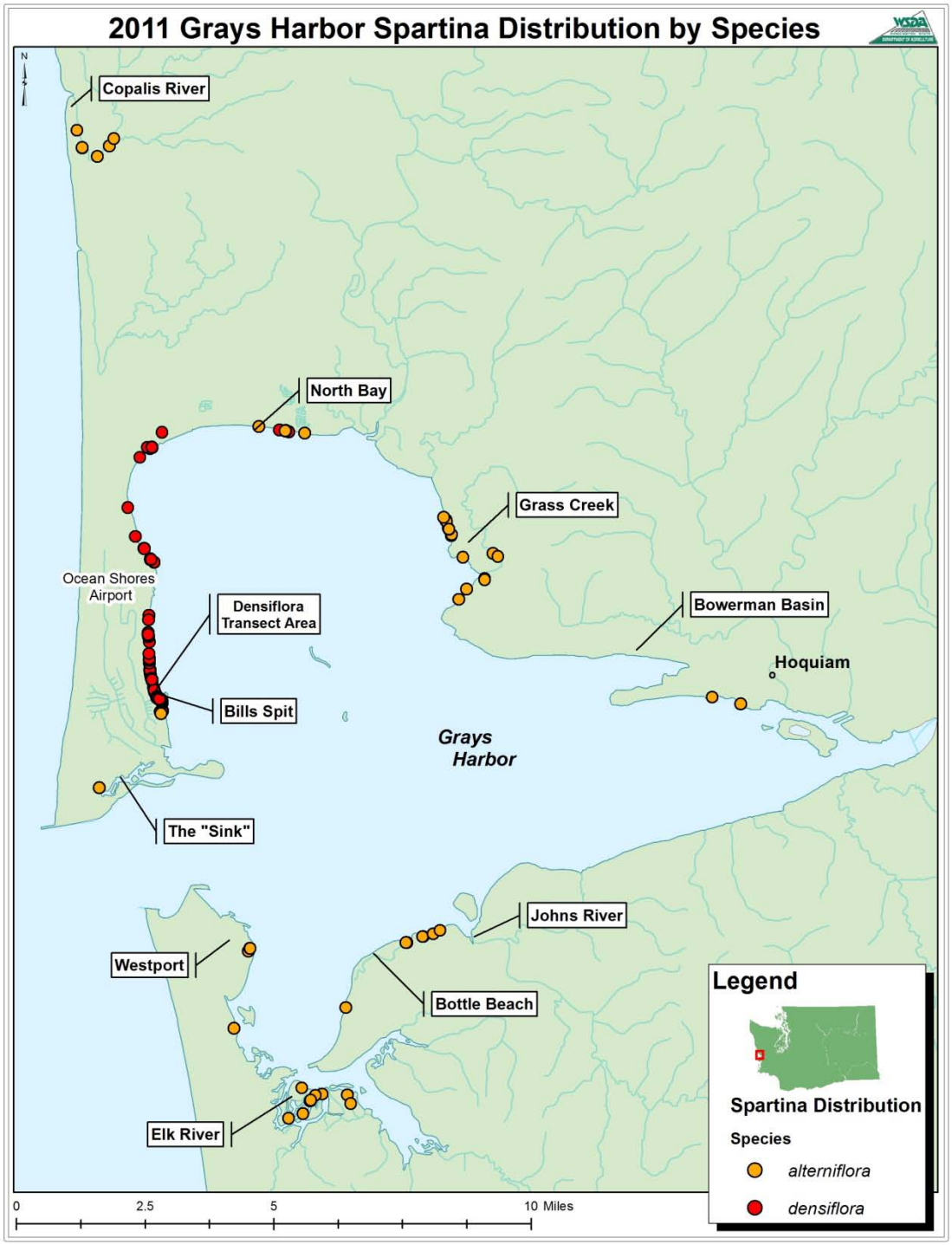


**Figure 7. *Spartina* distribution *S. alterniflora* (yellow) and *S. densiflora* (red), Grays Harbor, 2011.**

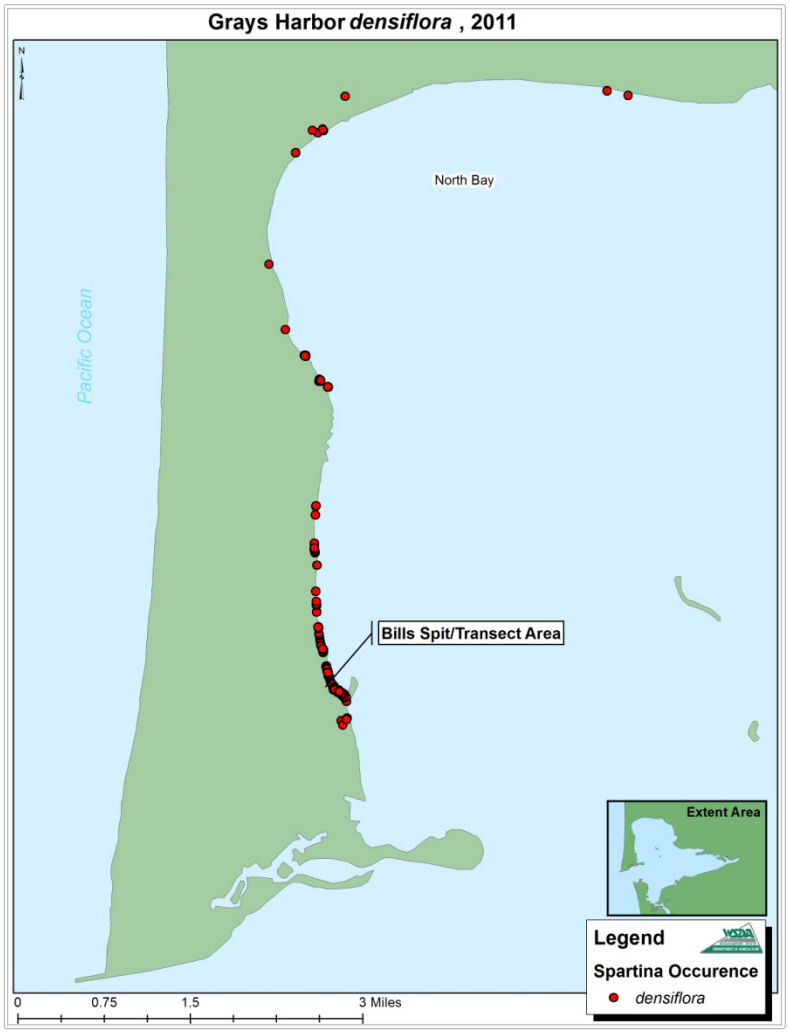


**Figure 8. Grays Harbor *S. densiflora* infestation points, 2011.**

Consistent with recommendations provided in the 2009-2010 *Spartina* reports, WDFW hired the Grays Harbor crew in mid-April of 2011 to conduct *S. densiflora* surveys in the Bills Spit and North Bay areas. Spring surveys for *S. densiflora* are highly effective, because the green *S. densiflora* plants are visible among the senesced native vegetation, maximizing its detection. During these spring surveys *S. densiflora* was flagged within the transect area and dug outside of the transect area. During April and May, approximately 245 plants (0.0013 solid acres) were dug outside of the transect area. These areas extended from Damen Point north beyond the transect area to the Ocean Shores airport.

In addition, two rounds of transects were completed at Bills Spit (Fig. 9) yielding approximately 324 (0.0017 solid acres) *S. densiflora* plants. The second round of transects was completed in early December 2011. During this second round 65 *S. densiflora* plants were dug. Winter survey and treatment proved highly beneficial due to the senesced surrounding vegetation. Overall, from 2009 to 2011, a 97% decrease in plant numbers was achieved using the transect methodology at Bills Spit (Figure 9).


**Figure 9: 2009-2011 Grays Harbor transect grid system layout and corresponding plant numbers within cells. Darker shaded areas indicate larger numbers of *S. densiflora* plants.**

Staff from WSDA and WDFW continued to work in joint crews throughout the June 1 to October 31 treatment season, achieving three harbor survey circuits and two *densiflora* transect laps, treating an estimated 0.005 solid acres (1,041 plants) of *alterniflora* and 0.003 solid acres (569 plants) of *densiflora* for a total of .008 solid acres of *Spartina*. This is a 92% reduction from the 0.11 solid acres that existed in 2010. Because of the reduced amount of *Spartina*, crews used mechanical treatment (digging) as the primary IWM tool(s).

Along with three survey and treatment circuits in the main Grays Harbor water body and surrounding tributaries and two *densiflora* transect laps performed in Bills Spit, the Grays Harbor crew also surveyed 38 miles of the outer coastline. This survey was conducted by foot and all-terrain vehicles, extending from Cape Shoalwater to Westport and continuing north to Ocean Shores and the Moclips River. A helicopter survey flight was also conducted in August extending

from Elk River to Cape Flattery. These combined 2011 coastal surveys yielded no new *Spartina* infestations.

Table 4 identifies the areas in which either *S. alterniflora* or *S. densiflora* occurs and compares the percentage reduction/increase in square feet treated between the 2010 and 2011 seasons. The data shows that meticulous survey efforts in Grays Harbor and the use of transect methodology in Bills Spit have resulted in large reductions of *Spartina*. The reductions may also be influenced by a reduced seed bank within the harbor.

Table 4. Sites and areas of *Spartina* treated (square feet) in 2010 and 2011 with corresponding percent reduction/increase between the two years.

| *Site* | *Square Feet Treated in 2010* | *Square Feet Treated in 2011* | *Percent Reduction* | *Spartina Species* |
|---|---|---|---|---|
| Bills Spit | 1917 | 74 | 96% | *S. densiflora* |
| Bottle Beach | 113 | 9 | 92% | *S. alterniflora* |
| Bowerman Basin | 4 | 10 | -151% | *S. alterniflora* |
| Chenois Creek | 0 | 17 | | *S. alterniflora* |
| Copalis River | 261 | 87 | 67% | *S. alterniflora* |
| Damen Point | 9 | 0 | 100% | *S. alterniflora/densiflora* |
| Elk River | 1176 | 35 | 97% | *S. alterniflora* |
| Grass Creek | 322 | 26 | 92% | *S. alterniflora* |
| Humptulips River | 35 | 35 | 0% | *S. alterniflora* |
| Johns River | 52 | 2 | 96% | *S. alterniflora* |
| North Bay | 30 | 78 | -157% | *S. alterniflora/densiflora* |
| Ocean Shores | 871 | 0 | 100% | *S. densiflora* |
| Point Brown | 0 | 0 | | *S. alterniflora* |
| Rennie Island | 0 | 0 | | *S. alterniflora* |
| Westport (Fire Cr. Pt.) | 17 | 5 | 72% | *S. alterniflora* |
| **Total Square Feet** | **4807** | **378** | **92%** | |
| **Total Solid Acres** | **.11** | **.008** | | |

## Recommendations for the Future

The 2011 survey and treatment season in Grays Harbor was successful. Continued cooperation between partner agencies provided the resources needed to achieve detailed surveys and treatments during the 2011 season. Three Harbor survey circuits and two *S. densiflora* transect laps were completed, with all known *Spartina* infestations treated.

After the success of the 2011 season, WSDA expects that less than 0.004 solid acres of *Spartina* will be present in Grays Harbor during the 2012 treatment season (Figure 10). Since 2005, the Grays Harbor effort has achieved over a 99% reduction in *Spartina.*

Specific recommendations for the 2012 Grays Harbor survey and treatment season include:

1) Conduct a minimum of two comprehensive rounds of survey and treatment throughout Grays Harbor with emphasis on high salt marsh areas.
2) Hire Grays Harbor crews in early spring to conduct transect surveys and treat *S. densiflora* located outside the Bills Spit transect area before the competing vegetation becomes too high.
3) Conduct transect methodology utilizing advanced GPS technology. Conduct winter *S. densiflora* transect methods in Bills Spit and perform surveys in North Bay.
4) Continue to perform coastal surveys and extend the Grays Harbor survey well inland of the salt marsh to insure that no outlying infestations are missed.

Figure 10 is a projection of *Spartina* reduction within Grays Harbor over the next four years with continued funding.

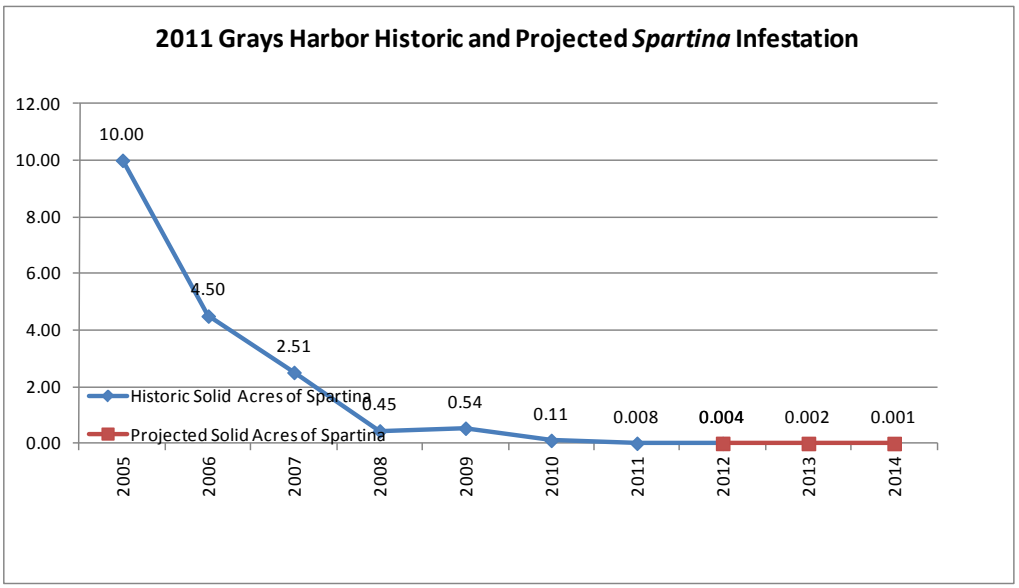


**Figure 10: Solid acres of *Spartina* in Grays Harbor by year, based on WSDA estimates. The blue line represents the historic area of *Spartina* since 2005. The red line represents the projected *Spartina* area through 2014. Projection assumes continued funding.**

# *Spartina* Eradication Effort in Puget Sound, Hood Canal, and the Strait of Juan de Fuca

## Overview

For programmatic purposes, this geographic region ranges west to Cape Flattery, north to Whatcom County and south to south Puget Sound including Hood Canal. This region includes all waters in the Puget Sound basin. There are more than 2,400 miles of shoreline in these waters. Along the shores of Puget Sound, four species of *Spartina* are found: *Spartina anglica, Spartina alterniflora, Spartina densiflora, and Spartina patens*. Of these four species, *S. anglica* is the most abundant and accounts for more than 99% of the infestation. *S. anglica* was introduced to Snohomish County in 1961 and the infestation increased to a peak of more than 1,000 acres by 1997. *S. alterniflora, S. densiflora* and *S. patens* are limited in distribution and extent; combined, these three species account for less than 0.1 solid acres throughout Puget Sound. Figure 11 shows the current distribution of *Spartina* sites in the Puget Sound region.

An encouraging development for 2011 can be seen in Figure 11, where the nine black dots represent *Spartina anglica* sites which have met the criteria for eradication. Eradication criteria have been developed in collaboration with the members of the West Coast Governors' Agreement on Ocean Health. The proposed criterion requires that six consecutive negative survey events occur over the course of three or more seasons and that a maximum of two survey events can occur in any season. As the program moves towards eradication the need to evaluate if sites meet this criterion has necessitated that the cooperators track the distribution and extent of the known infestation in increasing detail.

The 2011 control season was successful; below are some highlights of the 2011 treatment season. Following these brief highlights are more detailed reports on a regional basis.

- Nine *Spartina anglica* sites were declared eradicated.
- Less than 16.33 solid acres of *Spartina* were located and treated during 2011.
- The Puget Sound survey was the most detailed to date. The cooperators continue to evaluate and refine the survey effort. In 2011 all infestations located were treated and location data was recorded, documenting the extent of the known infestation.
- The Puget Sound program has achieved a 98% reduction in *Spartina* from the peak infestation of more than 1,000 solid acres in 1997.

**Table 5: Estimated solid acres of *Spartina* in 2011 by county as reported by WSDA and records from *Spartina* cooperators**

| *County* | *Estimated Solid Acres of Spartina* |
|---|---|
| **Island** | **8.38** |
| **Snohomish** | **7.42** |
| **Skagit** | **0.45** |
| **Clallam** | **0.0028** |
| **San Juan** | **0.0105** |
| **Kitsap** | **0.0432** |
| **Jefferson** | **0.0169** |
| **Pierce** | **0.0004** |
| **Whatcom** | **0.0023** |
| **King** | **0.00** |
| **Total** | **16.33** |

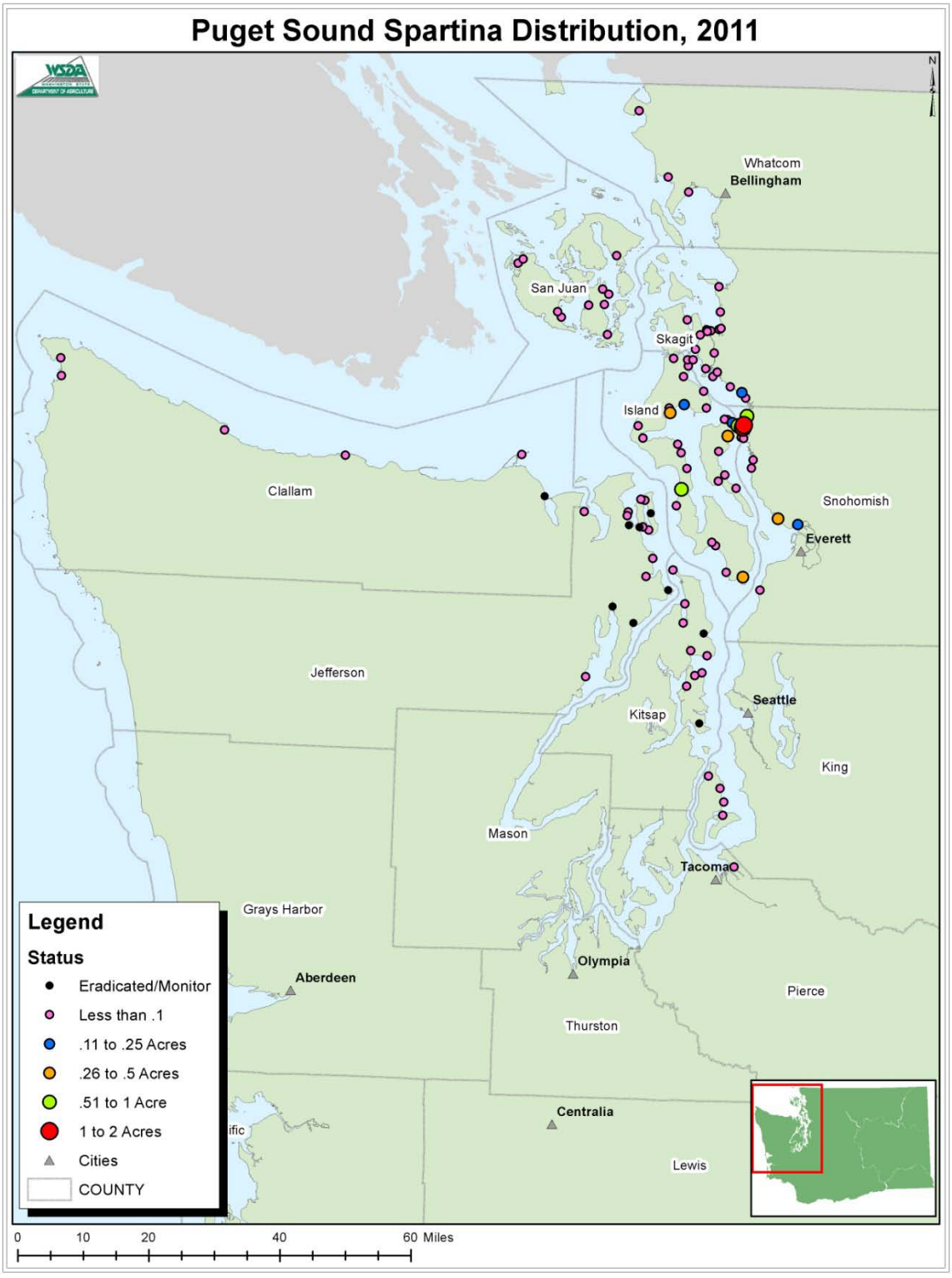


**Figure 11: Extent and distribution of *Spartina* sites in Puget Sound. For clarity on the map, some smaller infestations have been combined. The largest infestations remain near the original introduction site of *S. anglica* in Snohomish County.**

## Island County

In 2011, Island County had the largest infestation of *Spartina* in Puget Sound. The Island County Noxious Weed Control Board and Washington State Department of Fish and Wildlife conducted the *Spartina* eradication work in Island County. A total of 8.38 solid acres of *Spartina* were found and treated in Island County this season. Washington State Department of Agriculture provided Island County $50,000 for *Spartina* eradication activities in 2011.

Island County Noxious Weed Control Board and its contractor Wildlands Management controlled the major *Spartina* infestations and seed sources on Whidbey Island in 2011. 3.7 solid acres of *Spartina* were treated by Wildlands Management throughout Island County in 2011. Cultus Bay, Crescent Harbor, and Maylors Marsh contained the majority of solid acreage treated in 2011.

Wildlands Management mechanically removed Puget Sound's only known infestation of *Spartina densiflora* in Race Lagoon located on Whidbey Island. Less than 8 individual plants were located and removed at this site in 2011. Continued survey and treatment efforts aimed at eradication of this infestation will remain a high priority. Due to *S. densiflora's* cryptic nature within the native salt marsh survey and treatment (mechanical) efforts will be conducted during the early spring and winter months of 2012.

Washington State Department of Fish and Wildlife treated a total of 4.68 solid acres in Island County in 2011. Triangle Cove continues to show high levels of reduction with only 0.11 solid acres treated in 2011. In one treatment lap, 0.75 solid acres were treated as part of a County, WDFW, and WSDA cooperative effort at Hancock Lake this season.

**Table 6: Depicts the past and present solid acres of *Spartina* treated, as well as percent reductions in Island County.**

| Year | *Spartina* treated (solid acres) | % Reduction from previous year |
|---|---|---|
| 2002 | 300 | |
| 2003 | 325 | -8% (net increase) |
| 2004 | 164 | 49% |
| 2005 | 134 | 18% |
| 2006 | 99 | 26% |
| 2007 | 97 | 2% |
| 2008 | 15.4 | 84% |
| 2009 | 10.6 | 31% |
| 2010 | 2.6 | 76% |
| **2011** | **8.38** | -69% (net increase) |
| | | **97% reduction from peak acreage** |

## Snohomish County

The second largest *Spartina* infestation in Puget Sound is in Snohomish County. The Snohomish County Noxious Weed Control Board, Washington State Department of Fish and Wildlife, The Nature Conservancy and the Tulalip Tribal Nation found and treated 7.42 solid acres of *Spartina* in 2011. This is a 45% increase from the 4.1 solid acres present in 2010. A number of factors contributed to the increased amount of *Spartina* found in 2011 including: the most detailed survey to date, increased access to infested tribal lands, and late season *Spartina* emergence. Washington State Department of Agriculture provided Snohomish County $50,000 for *Spartina* eradication activities in 2011.

The Snohomish County Noxious Weed Control Board (SCNWCB) treated 2 solid acres of *Spartina*. Their main focus was in Southeast Skagit Bay, where just over 1 solid acre was treated.

Washington State Department of Fish and Wildlife (WDFW) focused their efforts on WDFW owned and managed lands in Snohomish County. In 2011WDFW efforts located and treated approximately 5.42 solid acres in Snohomish County.

One significant event was that the Tulalip Tribes approved herbicide applications on all tribal lands for 2011. This allowed SCNWCB to lead a cooperative treatment of Tulalip Bay for the first time. Among the reasons for the tribal approval were that cooperative digs over the past few years had proved ineffective and the holes left behind after dig events were not naturally filling in the low energy areas of Tulalip Bay. Approximately 0.25 acres of previously untreated *Spartina* was treated as part of this effort.

**Table 7: Depicts the past and present solid acres of *Spartina* treated as well as percent reductions in Snohomish County.**

| Year | *Spartina* treated (solid acres) | % Reduction from previous year |
|---|---|---|
| 2002 | 238 | |
| 2003 | 343 | -44% (net increase) |
| 2004 | 350 | -2% (net increase) |
| 2005 | 375 | -7% (net increase) |
| 2006 | 215 | 43% |
| 2007 | 60 | 72% |
| 2008 | 21.3 | 65% |
| 2009 | 13.5 | 37% |
| 2010 | 4.1 | 69% |
| **2011** | **7.42** | **-45% (net increase)** |
| | | **96% reduction from peak acreage** |

## Skagit County

In 2011, Skagit County had the third largest infestation of *Spartina* in Puget Sound. Approximately 0.45 solid acres of *Spartina* were found and treated in 2011 by Skagit County Noxious Weed Control Board, Department of Ecology, Washington State Department of Fish and Wildlife, WSDA, the Swinomish Tribal Nation, and The Nature Conservancy. This is a 75% reduction from 1.84 solid acres treated in 2010. WSDA provided $25,000 to Skagit County Noxious Weed Control Board and $6,000 to the Swinomish Tribal Nation for *Spartina* eradication activities in 2011.

The Skagit County Noxious Weed Control Board treated a total of 0.26 solid acres of *Spartina* in 2011.

The Swinomish Tribal Nation engaged in *Spartina* control on their lands. Two rounds of treatment were completed by the Swinomish Tribe throughout their land. A total of 0.18 solid acres of *Spartina anglica* was treated. Turner's Cove was the most heavily infested area with .05 acres treated in 2011. In 2010, 0.105 solid acres of *Spartina* were treated in Turner's Cove. This is a 52% reduction from 2010. The Swinomish Tribal Nation's continued cooperation is essential to eliminate *Spartina* from Skagit County.

The Department of Ecology (DOE) has controlled *Spartina* on their Padilla Bay Estuarine Research Reserve since 1996. Prior to 2011 two species of *Spartina* existed in Padilla Bay, *Spartina anglica* and *Spartina alterniflora*. This is the first year that no *S. alterniflora* plants were located. DOE expects to declare eradication of this species from Padilla Bay in the next few years. In the 2011 treatment season, DOE treated/dug 0.0006 solid acres (26 square feet) of *Spartina anglica.*

**Table 8: Depicts the past and present solid acres of *Spartina* treated as well as percent reductions in Skagit County.**

| Year | *Spartina* treated (solid acres) | % Reduction from previous year |
|---|---|---|
| 2002 | 37 | |
| 2003 | 26 | 30% |
| 2004 | 13.5 | 48% |
| 2005 | 10 | 26% |
| 2006 | 10 | 0% |
| 2007 | 6 | 40% |
| 2008 | 6.2 | -3% (net increase) |
| 2009 | 4.6 | 26% |
| 2010 | 1.8 | 60% |
| **2011** | **0.45** | **75%** |
| | | **98% reduction from peak acreage** |

## Clallam, Jefferson, Kitsap, King, San Juan, Pierce, and Whatcom Counties

In 2011, WSDA continued to work with the Noxious Weed Control Boards of Clallam, Jefferson, Kitsap, King, San Juan, Pierce, and Whatcom Counties as well as the U.S. Navy, State Parks, Merrill Ring, Vashon Maury Land Trust, Suquamish Tribe, Puyallup Tribe, Makah Tribe, and U.S. Fish and Wildlife Service (USFWS) to conduct surveys and control *Spartina*. These cooperators played an important role in all aspects of integrated weed management from consent to control work in the 2011 season.

In Kitsap County, a total of 0.043 solid acres of *Spartina* were treated or removed in 2011. WSDA and the Suquamish Tribe worked together to treat the largest known infestation in the central Puget Sound at Doe-Kag-Wats. This site has significant challenges with continually shifting driftwood that litters the cove and makes surveying difficult and dangerous. 0.04 solid acres of *Spartina* were treated using herbicide at Doe-Kag-Wats in 2011 which is a 43% decrease from the 0.07 solid acres treated in 2010. Eradication at this site will require repeated visits in the coming years.

Approximately 0.0105 solid acres of *Spartina anglica* was dug or treated using herbicide in San Juan County in 2011. Low Point, which is located on southeast San Juan Island, was the most heavily infested area with 0.0075 acres found and treated in 2011, a 50% decrease from the 0.015 solid acres treated using herbicide in 2010. In total 0.01 solid acres of *Spartina anglica* were located and treated by digging or herbicide in 2011. One new site 'Baker View' was located on the Eastern side of Lopez Island bringing the total number of infested sites in San Juan County to ten.

Approximately 0.0028 solid acres of *Spartina alterniflora/anglica* were treated or removed from Clallam County in 2011. With help from the Clallam County Noxious Weed Control Board, United States Department of Fish and Wildlife, Merrill Ring, and the Makah Tribal Nation, two survey circuits were completed and all known infestations were treated in 2011.

The combined 2011 infestation in Jefferson County was 738 square feet or 0.017 solid acres. Of this, 8 square feet were *Spartina anglica* and 730 were *Spartina patens*. Historically, Jefferson County has contained the only known infestation of *Spartina patens* in Washington State at Dosewallips State Park on Hood Canal. The WSDA crew surveyed the site during the 2011 season and found and treated approximately 730 square feet. Due to the elusive/cryptic nature of this species WSDA expects that frequent and detailed surveys will be required before it can be successfully eradicated.

*Spartina anglica* was discovered for the first time in Pierce County in 2010. The infestation is located at Squally Beach/Commencement Bay along the Hylebos Waterway in the Port of Tacoma. WSDA crews conducted three rounds of survey and digging at the site in 2011, finding and removing 18 square feet of *Spartina*. This is a 70% decrease from the 60 square feet first found and treated in 2010.

In Whatcom County, a few small *Spartina anglica* clones were discovered on the Nooksack Delta within the Lummi Reservation in 2010. These clones were not treated but were designated as a high priority for the 2011 treatment season. In 2011, a collaborative effort with the Lummi Nation, the Whatcom County Weed Board and WSDA located and dug approximately 100 square

feet or 0.0023 solid acres of *S. anglica* in this area. With the continued cooperation of the Lummi Tribe this area will remain a high priority in 2012.

Multiple survey laps were conducted in King County in 2011. No *Spartina* was present.

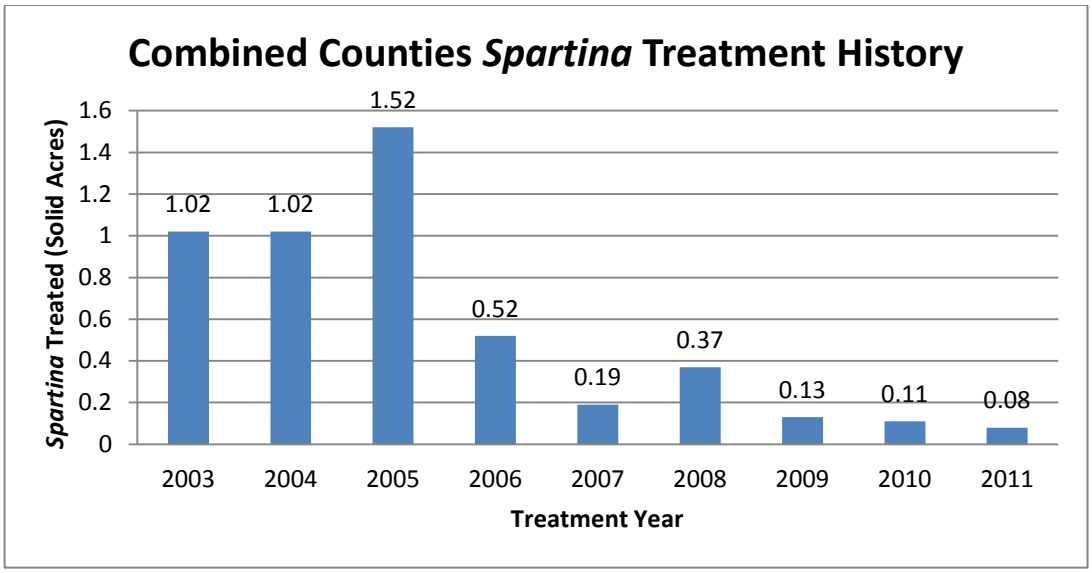


**Figure 12: Depicts the past and present solid acres of *Spartina* treated in Clallam, Jefferson, Kitsap, King, San Juan, Pierce and Whatcom Counties.**

## Recommendations for the Future

Continuous control and the elimination of major seed producing populations of *Spartina* in Puget Sound have resulted in significant decreases in remaining acreage. Less than 16.33 solid acres of *Spartina* were found and treated in 2011 throughout Puget Sound, Hood Canal, and the Straits of Juan de Fuca. This is a 98% reduction from the height of the infestation in 1997 at 1,000 solid acres. The *Spartina* management paradigm in Puget Sound has shifted from aerial treatments, boom sprayers and large scale mechanical control, towards a more labor intensive effort that uses fewer material resources and less herbicide. In order to find the remaining scattered plants, personnel needs on the ground have expanded. Figure 13 is a projection of *Spartina* reduction within Puget Sound over the next three years with sustained funding.

Once again the 2011 field season confirmed that cooperation and coordination is essential to the success of the *Spartina* Eradication Program in Puget Sound. Increased survey and pooled resources will be important for eradicating remaining infestations. With continued collaboration between cooperators in the region and sustained funding, the future success of the Puget Sound *Spartina* program looks bright.

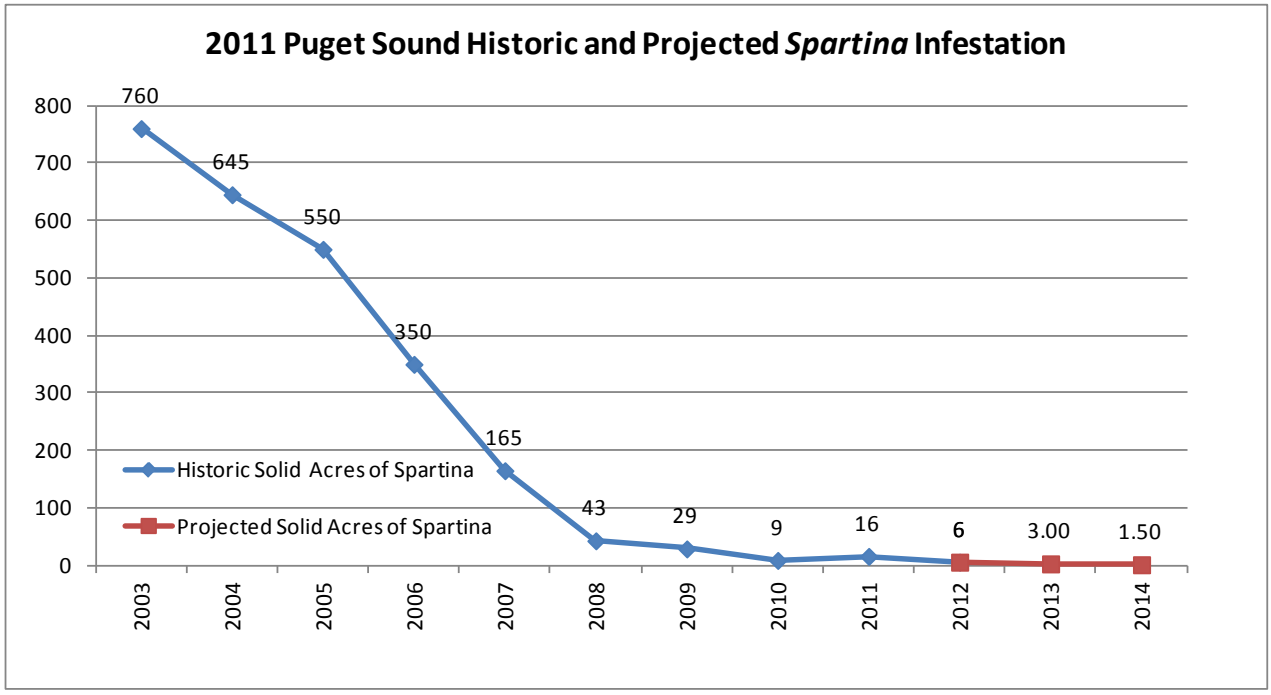


**Figure 13: Area (acres) of *Spartina* in Puget Sound based on WSDA estimates. The blue line represents the historic area of *Spartina* and the red line represents the projected area of *Spartina*. Projected area assumes sustained funding. All areas are in solid acres.**

# Appendices

## Appendix 1 - *Spartina* in Washington State

**Why is *Spartina* a problem?**

The invasive noxious weed *Spartina* is found in various intertidal areas of Washington State. *Spartina* can modify the hydrology of estuaries, causing increased flooding. It out competes native vegetation, forming monotypic meadows that accumulate sediment. This disturbance can lead to reduced plant diversity, elevated intertidal areas and displacement of invertebrates, which are a major food source for shorebirds and juvenile salmon. *Spartina* can destroy valuable shorebird, waterfowl and salmon habitat. *Spartina* also has the ability to threaten both the natural and commercial shellfish beds that are important to the economy of Washington State.

**Which species of *Spartina* occur in Washington State?**

There are currently four species of non-native *Spartina* known to occur in Washington. *Spartina alterniflora* is most widely found in Willapa Bay, with fewer than 1 solid acre estimated to be currently infesting the Bay. *Spartina alterniflora* is also known to occur in Skagit, Clallam, and Grays Harbor counties.

*Spartina anglica* is present in Skagit, Snohomish and Island counties. It has also been found in San Juan, Whatcom, King, Pierce, Kitsap, Clallam and Jefferson counties in small infestations. It currently infests approximately 16 solid acres in the Puget Sound region.

*Spartina patens* is known to occur at only one location in the state: Dosewallips State Park in Jefferson County. This infestation receives annual surveys and is controlled by digging, covering and herbicide applications as needed. The current infestation size is approximately 730 square feet (.017 acres).

*Spartina densiflora* is a South American species that was discovered in 2001 in both Grays Harbor and Island counties. The species currently infests approximately 130 square feet (.003 acres) in Grays Harbor and a few square feet in Island County.

Figure 15 shows each of the four species.

**How was *Spartina* introduced into Washington State?**

*Spartina alterniflora* was unintentionally introduced to Willapa Bay along with oysters shipped from the east coast during the late 1800's. In Puget Sound, landowners introduced *Spartina alterniflora* in an effort to stabilize shorelines. *Spartina anglica* was similarly introduced into Puget Sound at a farm located in Port Susan in the early 1960's to serve as bank stabilization and as a potential source of feed for cattle. The modes of introduction for both *Spartina patens* and *Spartina densiflora* are unknown.

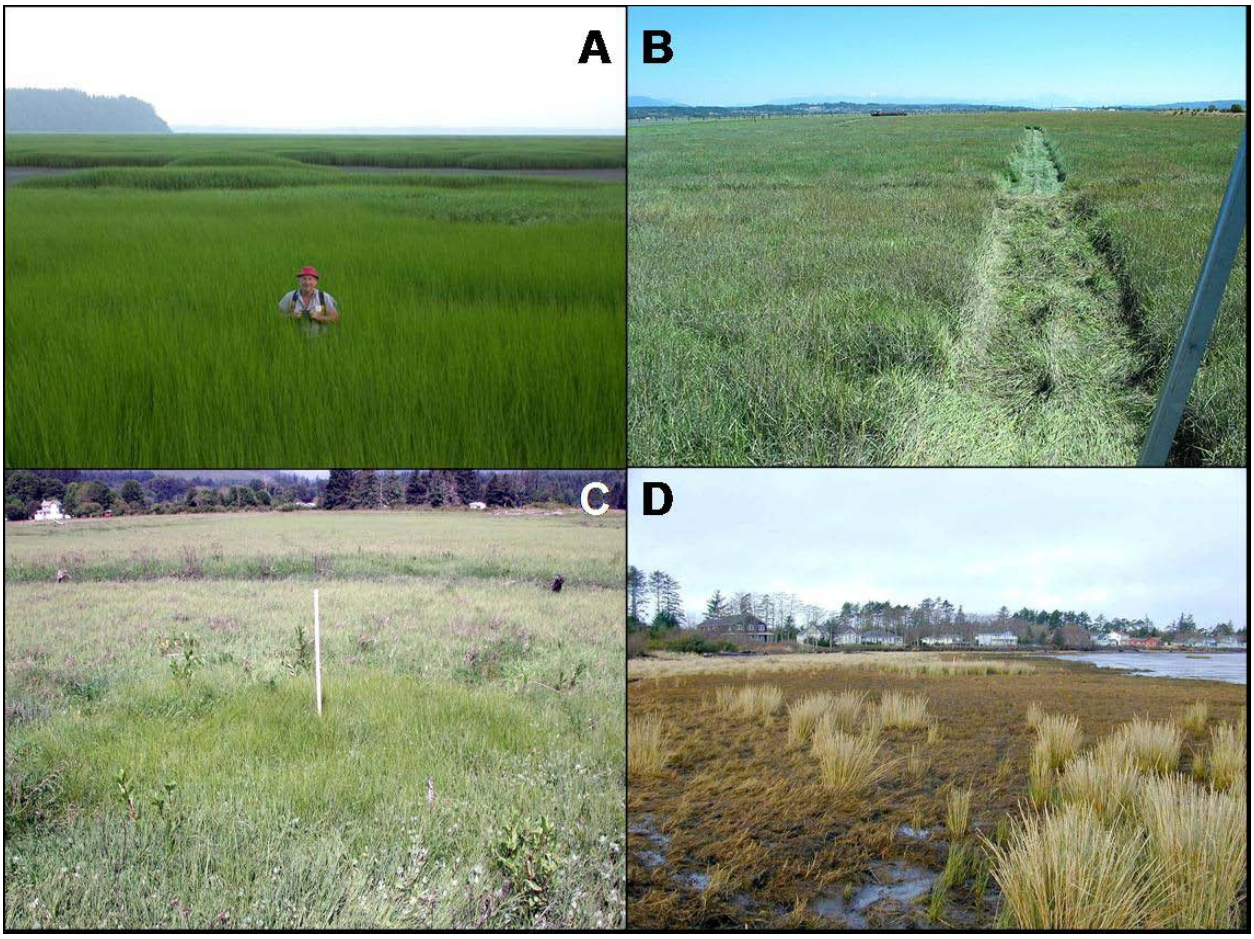


**Figure 1-1: The four species of *Spartina* present in Washington. A) A meadow of *S. alterniflora* in Willapa Bay, B) A meadow of *S. anglica* in Skagit Bay (2003), C) *S. patens* at Dosewallips (2001), and D) clones of *S. densiflora* in Grays Harbor County.**

## How do we eradicate *Spartina*?

*Spartina* spreads quickly and is 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 integrated pest management (IPM) techniques (including mechanical, chemical or manual control, or a combination of these methods);
3) After eradication is achieved, monitoring the area to ensure no re-establishment occurs;
4) Continuing to survey shorelines, educate the public, and follow-up on possible sightings of new infestations.

## Appendix 2 – Survey in Puget Sound, Hood Canal, and Strait of Juan de Fuca

*Contributed by Tanner Ketel, WSDA*

The goal of the state wide eradication program is the complete removal of all invasive *Spartina* species from Washington State. With significant decreases in solid acreage of *Spartina* achieved in the past eight years, an increase in shoreline survey is more important than ever. Accurate delimitation of known infestations and early detection of new populations are key to the success of any eradication program. Since 2007, WSDA and its cooperators have increasingly made survey a priority. The following details the increasing survey activities and new finds of the past five field seasons.

Throughout the course of the control seasons when time and tides permit, WSDA and cooperators participated in shoreline and estuarine surveys. In 2011, as part of an increasingly detailed survey effort, project partners inspected over 80,000 acres of saltwater estuaries and more than a thousand miles of shoreline in 14 counties for evidence of *Spartina*. This concerted effort utilized staff from WSDA, WDFW, county noxious weed boards, People for Puget Sound, and numerous private citizens volunteering their time. Surveys were conducted with watercraft, various types of rough/all terrain vehicles, and helicopter observation. Shoreline was identified in areas with potential *Spartina* habitat and surveyed.

During 2007, 373 miles of shoreline were surveyed statewide. A large portion (273 miles) consisted of helicopter surveys along the outer coast funded by USFWS. In addition, 40 miles of shoreline were surveyed in the Puget Sound region in 2007.

During 2008, survey activities increased in the Puget Sound region. A total of 364 miles of shoreline were surveyed in Puget Sound. Areas of Whatcom County, San Juan County, and portions of the south Puget Sound were surveyed by boat. People for Puget Sound (PPS) organized volunteer surveys in San Juan, Whatcom, Island, and Skagit Counties; with volunteers, PPS surveyed more than 53 miles of shoreline.

In 2009, in addition to the previously known survey/treatment areas in Puget Sound, 454 miles of shoreline were surveyed by foot and boat by WSDA. 93 of these miles were in Puget Sound predominantly around the northern end of the Kitsap Peninsula. 155 miles of Hood Canal were surveyed, focusing on the cryptic species *Spartina patens*. 161 new shoreline miles were surveyed in San Juan County. In addition, Parks Canada, Ducks Unlimited Canada, and a crew from WSDA worked together to conduct a survey of 46 miles of shoreline along the Canada-Washington border. Also, a total of 103 shoreline miles was surveyed by volunteer kayakers from People for Puget Sound.

In 2010, in addition to susceptible areas surveyed in past years, 470 never-before-explored shoreline miles were surveyed by WSDA. Of these, 390 miles are located in south Puget Sound, encompassing a large part of the Thurston, Pierce and King County shoreline.

Continued emphasis on survey and outreach resulted in 562 shoreline miles surveyed as part of the WSDA effort in 2011. Aerial surveys were conducted in Pacific County, Grays Harbor County,

Clallam County, and Jefferson County. No new infestations were found. Due to unexpected vessel breakdowns most boat surveys were postponed until 2012.

In 2011 volunteer surveys were conducted in Clallam, Island, Jefferson, Kitsap, Pierce, Skagit and Whatcom counties. These efforts were organized by People for Puget Sound. Volunteer hikers and kayakers surveyed prioritized shorelines and reported finds to the project partners. As part of this effort an additional 225 miles of shoreline in 7 counties was surveyed. Of particular note is the ongoing assistance of People for Puget Sound in the survey and control efforts underway in the Red River Delta on the Lummi Nation lands. Volunteers first located this infestation in 2008 and have continued to assist with both continued surveys and with the manual removal efforts.

On the eastern shore of Lopez Island in San Juan County a private citizen reported a new infestation of *S. anglica.* The clone, approximately 5ft in diameter, was later located and manually removed by WSDA crew members. This site now named 'Baker View' has been added to the annual survey site list.

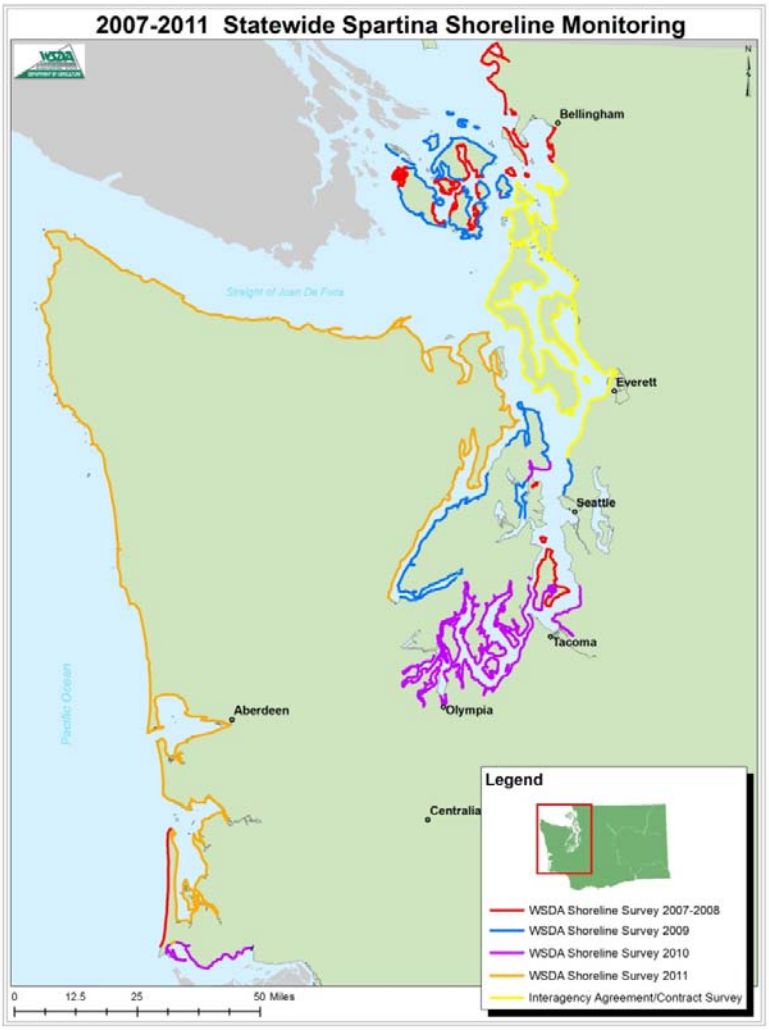


**Figure 1-2: WSDA performed surveys in Puget Sound, Grays Harbor and Willapa Bay.**

The past five years of survey yielded several previously unknown finds in the Strait of Juan de Fuca, Neah Bay area, Commencement Bay and throughout Puget Sound. An infestation of *S. alterniflora* was discovered by aerial survey in the Waatch and Sooes River estuaries on Makah Tribal lands. Ground based surveys detected *S. anglica* infestations in the Pysht River Estuary, at Salt Creek, and on Dungeness Spit in Clallam County. Boat surveys in San Juan County revealed new infestations of *S. anglica* on Low Point, White Point, and Swifts Bay located on San Juan and Lopez Islands. A volunteer survey lead by People for Puget Sound discovered infestations of *S. anglica* at the mouth of the Red River and Nooksack River Delta in Whatcom County as well as a *S. anglica* find on Dredge Islands at the north end of the Swinomish Channel in Skagit County. Increased outreach has led to discoveries in Commencement Bay in Pierce County, Hope Island in Skagit County, and Lopez Island in San Juan County.

Subsequent to discovery, all of these sites were the focus of targeted management efforts. The total area of these finds is less than one solid acre. Though these sites are relatively small, their discovery and management are important in preventing the renewed spread of *Spartina* within the region.