



PROGRESS OF THE 2004 SOUTHWEST WASHINGTON KNOTWEED CONTROL PILOT PROGRAM

January 2005



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AGR PUB 805-129 (N/1/05)

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EXECUTIVE SUMMARY

2004 Progress Report of the Southwest Washington Knotweed Control Pilot Program

Japanese knotweed is an aggressive noxious weed that spreads quickly, shades out other native plants and destroys habitat. It thrives in any moist soil or river cobble, in full or partial sunlight and is most common in the flood zone along rivers and creeks, roadside ditches, and beaches. Knotweed forms massive and deep root clusters, some as deep as nine feet, and grows in dense stands up to 12 feet tall.

In recent years, hundreds of patches of knotweed have appeared along Washington rivers. If unchecked, knotweed will steadily take over riverbanks and beaches.

In 2004, the Washington State Department of Agriculture was appropriated \$500,000 for the control of Japanese knotweed in southwest Washington during the year starting July 1, 2004. WSDA has used the funds to establish a knotweed control program and has contracted with county weed boards, another state agency, and a non-profit group to carry out control projects in selected watersheds in the 10-county region. WSDA has also contracted with WSU to evaluate the various integrated weed management strategies used during the 2004 control season.

Control activities took place in summer and early fall 2004. In most cases, a spray or injection system using herbicides, such as glyphosate or imazapyr, has been used. Approximately 325.6 acres of infestation was treated in the project area during the 2004 control season. Most sites slated for control received initial treatment with plans to re-survey and re-treat, if necessary, next spring.

This report details the implementation and the first six months of progress of this project.

Figure 1. Map of Watersheds and Parks Treated



KNOTWEED CONTROL PILOT PROGRAM

Overview

Knotweed is an aggressive noxious weed that spreads quickly, shades out other native plants and destroys habitat. It thrives in any moist soil or river cobble, in full or partial sunlight and is most common in the flood zone along rivers and creeks, roadside ditches, and beaches. Knotweed forms massive and deep root clusters, some as deep as nine feet, and grows in dense stands up to 12 feet tall.

In the northwest, knotweed usually spreads when roots and stems are moved by waterways, by floods or in contaminated soil. Root and stem fragments as small as one-inch can produce a new plant. As a result, even one patch can produce dozens of new populations. It poses a significant threat to riparian areas, where it can survive severe floods and is able to rapidly colonize scoured shores and islands.

In recent years, hundreds of patches of knotweed have appeared along Washington rivers. If unchecked, knotweed will steadily take over riverbanks and beaches, as it has in the eastern United States and Europe.

The knotweed infestations in Washington are relatively recent and may be controllable by aggressive, well-coordinated survey and eradication efforts.

Effects of Knotweed

Knotweed species were originally introduced as garden ornamentals for their attractive cascading blooms and large leaves. The plants were able to thrive with surprisingly little care. This ability to thrive allowed for rapid spread after escape from gardens.

The plant's native habitat is the harsh environment on the slopes of volcanoes. This environment's very poor soil characteristics are reproduced in the sand and gravel environments of Pacific Northwest streams. In many of these areas, knotweed is able to grow without competition because other plants are unable to grow in such harsh conditions.

Knotweed's success as a colonizer also gives the species a competitive edge over natives in less harsh areas of riparian zones. Knotweed emerges early in the season and quickly grows tall, shading out smaller plants with its large leaves. Even tree species such as willow and alder exhibit decreased populations when competing with knotweed.

By choking out and displacing native plants, knotweeds can decrease biodiversity and disrupt food chains by limiting habitat available for the large percentage of species that depend on riparian areas. Between 80 to 90 percent of Washington wildlife species use riparian areas during some life stage.

Perhaps more importantly, knotweed also affects aquatic species and the invertebrates that compose the basis of the aquatic food chain. The food chain is disrupted by an alteration to the quality and timing of the leaf litter regime. This alteration changes nutrient runoff, soil composition, and invertebrate food sources. Invertebrates are the basis of the aquatic food chain and are the main food source of anadromous fish smolts.

Probably the greatest change to riparian habitats by knotweed is its comparative inability to control erosion. Despite having an extensive root system, knotweeds do not hold soil in place during flood events. This is thought to be an adaptation of the plant that helps it spread. Rather than holding soil, sections of the infestation wash downstream where rhizome and stem pieces can set roots and create a new infestation.

The consequence of this allowed runoff is an increase in siltation of streams. Increased siltation is a major factor in the loss of productive viability of native salmonids. Silt fills in the spaces between riverbed gravels that salmon utilize for egg laying. Siltation is also known to smother viable salmon eggs that have already been buried in gravel beds.

Knotweed infestations can block river views and limit river access, which can affect recreational opportunities and property values.

Knotweeds Present in Washington

There are four genetically interrelated species of knotweed in Washington state. All are listed as Class-B noxious weeds on Washington State's Noxious Weed list. The four species are commonly designated as Japanese, Giant, Bohemian, and Himalayan. The extent of the different species throughout the state is currently unknown though the levels of infestation in eastern Washington is known to be significantly less than in western Washington. Listing as a Class-B weed generally means that infestations can be controlled.

- Japanese knotweed (*Polygonum cuspidatum*) is the variety most commonly associated with knotweed problems. This species spreads vegetatively.
- Giant knotweed (*Polygonum sachalinense*) spreads vegetatively, but it does produce some viable pollen and hybridizes with Japanese knotweed.
- Bohemian knotweed (*Polygonum bohemicum*) is the hybrid produced by the Giant and Japanese strains. It is thought to produce greater amounts of viable pollen and may back cross with both parent species. This species can spread by seed or vegetatively.
- Himalayan knotweed (*Polygonum polystachyum*) also spreads mainly through vegetative means. The lance-shaped leaves of this species makes it readily identifiable when compared to the other species.

Treatment Techniques

Knotweed spreads quickly along riparian corridors in a general downstream direction. To successfully treat an entire watershed the following steps need to be taken:

- Survey for and treat all infestations with best available IPM technology starting at the top of a watershed and moving in a downstream direction. This includes a survey of all tributaries.
- Re-survey the watershed for several years and re-treat any new growth.
- Continue to survey the watershed and conduct public education activities. Follow up on any sightings that occur as a result of the public education campaign.

A fully implemented IPM program consistently looks to maximize efficacy while minimizing ecological and economic effects.

WSDA Knotweed Program

The WSDA Knotweed Control Program facilitated the formation of control programs by participating cooperators. Work included producing required environmental review, reporting forms, public notification materials, field data capture system, and publishing required notices.

WSDA continued to work cooperatively with Ecology to administer the National Pollutant Discharge Elimination System (NPDES) permit for aquatic noxious weed control. This included providing coverage in compliance with the permit to its contractors.

WSDA provided funding through interagency agreements and contracts for work to control knotweed conducted on selected watersheds by the noxious weed control boards of Clark, Skamania, Pacific, and Lewis Counties, the Washington State Parks and Recreation Commission, and The Nature Conservancy. WSDA provided the cooperators with public information materials and the herbicide used for control treatments. WSDA also entered into an interagency agreement with WSU Mount Vernon Research and Extension Unit to evaluate the efficacy of the differing treatment strategies used by the cooperators.

Knotweed Program Budget

WSDA received an appropriation of \$500,000 from the State General Fund to control knotweed in FY 2005. WSDA allocated \$290,196 of the appropriation for contracted knotweed control. Approximately \$11,300 was allocated for contracted evaluation of the efficacy of treatments. Other expenditures were for activities that directly supported the survey and control work of cooperators and some one-time start-up equipment. Table 1 details the estimated expenditures for this year's program.

Table 1. Estimated Budget Activity, FY 2005

Activity	Budgeted Expenditure
¹Purchased Services	\$301,496
Clark County	\$94,173
Skamania County	\$56,843
Lewis County	\$22,335
Pacific County	\$43,917
The Nature Conservancy	\$65,308
WA State Parks & Recreation Commission	\$7,600
Washington State University Extension	\$11,303
²Herbicide Purchases	\$55,000
³Public Information Materials	\$6,000
⁴NPDES Water Quality Monitoring	\$2,000
⁵Electronic Field Data Capture	\$5,000
⁶WSDA Coordination	\$130,504
Total	\$500,000

Notes for Table 1:

1. Contracts and agreements with county weed boards, a state agency, and a non-profit group to carry out control projects in selected watersheds and with WSU to evaluate efficacy of various control treatments.
2. WSDA provides all herbicide used in the projects. Herbicide is purchased through Dept. of General Administration to utilize economies of scale to obtain the lowest cost.
3. WSDA printed information flyers and the letters to landowners for all projects.
4. Laboratory analysis of water samples for water quality monitoring required by the NPDES permit.
5. Equipment purchased for use by cooperators to test collecting field data electronically.
6. WSDA coordination expenses include agency administration costs, salaries and benefits for a full-time coordinator and part-time clerical support, travel, attorney costs, one-time vehicle and equipment costs, and other goods and services.

Survey and Treatment

More than 311 river miles were surveyed and approximately 325.6 acres of infestation were treated in the project area during the 2004 control season.

Most cooperators surveyed the streams by either walking creek beds or boating the larger streams. GPS points were taken of located infestations, and these points were used to obtain information on the ownership of the parcels. Landowners were then contacted and asked to sign a permission/waiver form before any treatment was conducted. Most landowners were familiar with the program because of a mass-mailed letter from WSDA that explained the details of the program.

The treatments used were determined on a site-by-site basis according to integrated pest management (IPM) principles. IPM is a pest management concept that uses the most

appropriate pest control method and strategy to meet pest management objectives in an environmentally and economically sound manner.

An important IPM consideration of the program was to treat each river system, when possible, starting in the headwaters and working in a downstream direction. This strategy prevents re-infestation of treated areas during high-water events of the winter and fall.

Treatments consisted of herbicide applications and manual control. The preferred manual control technique was stem bending which best retarded plant growth with only one site visit. Other manual controls, including digging and hand pulling, require return site visits and are not ecologically sensible in riparian habitats. With stem bending, the stems dry out after bending and can't re-sprout when washed downstream during a high-water event. Digging and hand pulling are known to encourage sprouting, but were also tried as a treatment technique. We expect there will be a need for follow-up treatments at sites where these techniques were used.

Four types of herbicide applications were used during the 2004 control season. These included injection of glyphosate, and foliar applications of glyphosate, a glyphosate/imazapyr mix, and triclopyr. These three herbicides are registered for use in aquatic environments. Injection of glyphosate is a treatment system for applying herbicide that is specific to knotweed control that was first approved for use in 2004. The technique consists of injecting undiluted glyphosate directly into the hollow stem of the plant. An applicator gun developed specifically for this technique injects a fixed amount of herbicide through a hollow needle. This technique showed an efficacy of 90 to 100% during trial use and minimizes the possibility of herbicide drift. However, injection is labor intensive and inappropriate for large scale treatments and for situations when small stem size does not support the application, such as found in early infestations.

WSDA contracted with WSU to conduct an efficacy study on the differing treatment schemes used by the project cooperators. Different survey methods are also being evaluated. The results of these evaluations, together with a review of the ecological impacts, costs and time constraints of each treatment strategy, will be used to develop the integrated pest management system for future control seasons and to help determine the best use of funding.

Public Outreach Activities

WSDA produced a letter to landowners explaining the overall program and provided informational flyers for cooperators to provide to landowners and other interested parties. Several of the cooperators worked with local media to provide information to the public through news stories and notices. The county programs displayed exhibits explaining the local knotweed program at their county fairs. Washington State Parks and Recreation Commission plans to install interpretive signs explaining the control project at Cape Disappointment State Park. These signs will reach a wide audience as large numbers of visitors are expected at the park for the Lewis and Clark Bicentennial.

Plans for 2005

With continued funding at \$500,000 annually, WSDA's knotweed program will continue to work with cooperators in southwest Washington to survey and successfully treat infested watersheds. WSDA will work with cooperators to complete current contracts and will accept proposals for funding for the 2005 control season starting in April.

In addition to WSDA's program, various efforts are underway to control knotweed in a number of the state's watersheds. Those involved include the state departments of Fish & Wildlife, Natural Resources and Transportation; public utility districts; US Forest Service; county noxious weed boards; several tribes; The Nature Conservancy; 10,000 Years Institute; Native Plant Society; private landowners and others. WSDA is working with many of the same partners in southwest Washington. Several county weed boards and local conservation and salmon enhancement groups are working to assemble control programs and have expressed interest on working with WSDA on these efforts.

WSDA has requested that a proviso be added to 2005 supplemental budget to allow the program to work outside southwest Washington. Expansion of the area where WSDA funding can be used will help increase the productivity of ongoing control programs in other parts of the state and will help establish control programs on the east side of the Cascades. Knotweed is not as well established in eastern Washington and can be economically eradicated before the problem becomes as extensive as it is in western Washington.

PROGRAM RESULTS BY GEOGRAPHIC AREA

WSDA defined southwest Washington using the regional classification of the State Noxious Weed Control Board. Counties in the area include Pacific, Clark, Skamania, Lewis, Grays Harbor, Thurston, Pierce, and Mason. Six proposals for funding were submitted; all were funded to varying extents as listed below.

All projects, except for the Cape Disappointment project, concentrated treatment in the riparian areas of the project streams. Upland sites were also treated if the infestations were deemed to pose the danger of spreading into the adjacent riparian areas.

The projects included a mix of treatment options that concentrated on differing methods of herbicide-based control methods. Other treatment alternatives were reserved as secondary options because mechanical removal would create unwanted substrate disturbance in the sensitive riparian areas and other physical treatments, to be effective, would require re-treatment every few weeks.

The program results are discussed in more detail by area with associated maps in the following section.

Table 2. Project Activity

Cooperator	Watersheds To Be Treated	Funds Awarded	River Miles Surveyed	Acreage Treated
Clark Co. Noxious Weed Control Board	North & East Fork of the Lewis River, Cedar Creek, Cougar Creek, including Abernathy Creek in Cowlitz County	\$94,733	53	125.0
Skamania Co. Noxious Weed Control Board	Little White Salmon River, Wind River, Washougal River	\$56,843	44	31.9
Lewis Co. Noxious Weed Control Board	Upper Cowlitz River	\$22,335	28	7.2
Pacific Co. Noxious Weed Control Board	Willapa River watershed	\$43,917	30	158.1
State Parks and Recreation Commission	Little Creek at Beacon Rock State Park (Skamania Co.) Cape Disappointment State Park (Pacific Co.)	\$7,060	na	2.3
The Nature Conservancy	Wishkah River, Black River, Elk River (Thurston and Grays Harbor Co.)	\$65,308	156	1.1
Total			311	325.6

Clark County

The Clark County Noxious Weed Board crew surveyed and treated all infestations along the entire length of the East Fork Lewis River, west of Angel Falls on the border with Skamania County. No knotweed was discovered until well downstream of the county line. The work was completed with county personnel, Conservation Corps crews, and landowner volunteers.

The treatments consisted of both injection of glyphosate and foliar applications of a glyphosate/imazapyr mix. Approximately 125 acres of infestation were treated on 53 river miles. The surveyed river miles include 31 miles on the main stem and 22 miles of tributaries.

Of the 247 infestations treated, 229 were located on the main stem East Fork. Of these, 174 were located in the riparian area. The others were upland areas that were likely to infest nearby riparian areas if left untreated. Much of the treated area was also seeded with a rye grass mixture to prevent erosion of the stream banks.

The North Fork of the Lewis River is slated for treatment in 2005, with landowner permission being gained during the off-season. The entire length of the East Fork will be re-surveyed and re-treated as needed next season.

Figure 2. Clark County Treatment Sites



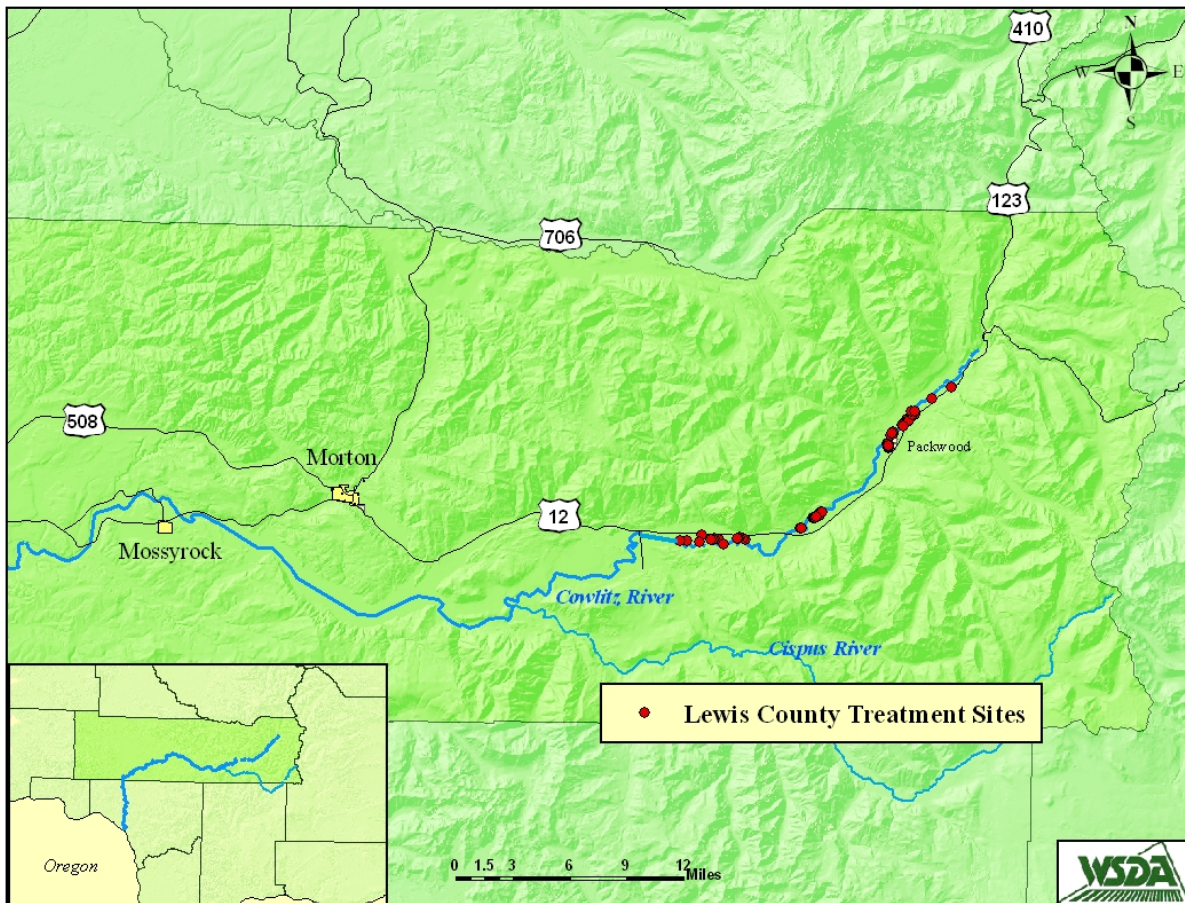
Lewis County

The Lewis County Noxious Weed Control Board crew surveyed and treated 28 miles of the upper reaches of the Cowlitz River to near the confluence with the Cispus River. Most of the infestations were treated with the exception of a few properties with absentee landowners where permission to treat could not be obtained.

Most of the treatments were conducted with a foliar application of a glyphosate/imazapyr mix. The injection of glyphosate was used when that option was preferred by the landowner. On some of the parcels, including National Forest Service property and a municipal well protection area, herbicide use was not allowed so stem bending and manual removal was used.

Approximately 7.2 acres of infestation were treated along the river and will be checked for regrowth in the spring. Work will continue to obtain permission to treat infestations from landowners where permission was not obtained this year.

Figure 3. Lewis County Treatment Sites



Pacific County

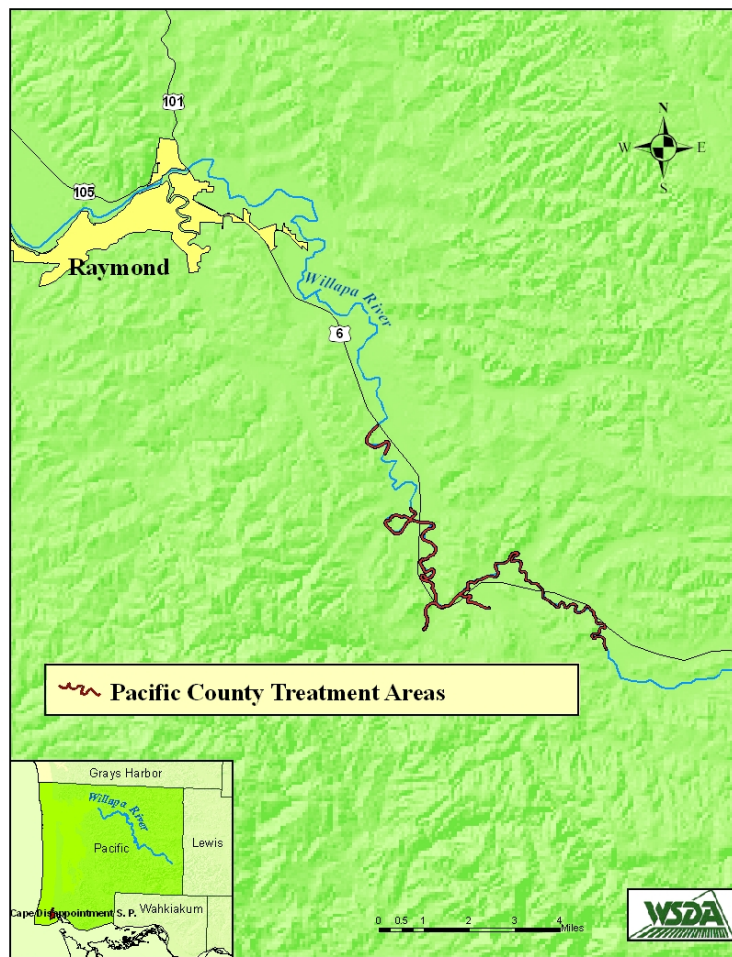
The Pacific County Noxious Weed Board surveyed and treated the Willapa River in conjunction with its project partner, the Pacific Conservation District. All knotweed located during the surveys of the upper watershed were treated. This area covered approximately 16.1 river miles of the main stem.

The tributaries surveyed included Fern Creek, Half Moon Creek, Forks Creek, Ellis Creek, Trap Creek, and Green Creek. Infestations were located and treated on Forks Creek and Trap Creek for approximately one mile from the confluences with the main stem.

Approximately 11.25 miles of the main stem of the Willapa River before reaching tidal influence remain to be surveyed and treated. The saltwater area of the tidally influenced river has shown to prevent the growth of knotweed on this particular river.

Treatments consisted exclusively of foliar applications of a glyphosate/imazapyr mix. The total acreage treated is approximately 158.09 acres. The treated area will be re-surveyed in the spring.

Figure 4. Pacific County Treatment Sites



Skamania County

The Skamania County Noxious Weed Control Board surveyed and treated infestations on the Wind, Washougal, and Little White Salmon rivers. The work was completed with some assistance from another county crew that was operating under federal funding to complete a variety of projects of local concern.

Each river was treated from the closest infestation to the headwaters in a downstream direction to the confluence with the Columbia River. All known infestations were treated twice during the season, with a small number receiving three treatments.

All infestations were treated by injection of glyphosate with a foliar application of glyphosate to stems that were too small for injection. Approximately 31.9 acres of knotweed were treated. Each site will be re-treated in the spring.

Figure 5. Skamania County Treatment Sites



The Nature Conservancy

The Nature Conservancy crew worked in conjunction with state and county agencies to survey extensive areas of lightly infested watersheds to prevent large-scale invasion of the riparian areas of the Elk and Black Rivers and to survey and begin treatments on the heavily infested Wishkah River.

The crew surveyed and treated all known infestations on the entire length of the Black River and its tributaries in Thurston County. Approximately 0.2 acres of knotweed were located and treated in the watershed. The crew worked with Department of Natural Resources personnel to locate and treat all infestations on the Elk River in Grays Harbor County. Some of the treated area includes the Elk River Natural Resource Conservation Area. The area treated equaled approximately 0.5 acres. The work on these two rivers protected large ecologically sensitive areas from the threat of extensive infestations of knotweed.

The crew also worked with the Grays Harbor County Noxious Weed Board to survey and treat infestations on the Wishkah River. Treatments on the Wishkah were conducted exclusively on county and Weyerhaeuser land because of the lateness in the season when work was begun. The crew wanted to treat the largest contiguous parcels before frost made the work untenable. In the off season, work will be done to obtain landowner permission for smaller tracts of land where infestations were identified during survey and all treated areas will be re-surveyed. All treatments consisted of glyphosate injections. The total treated acreage was approximately 0.4 acres.

Figure 6. The Nature Conservancy Treatment Sites



Washington State Parks and Recreation Commission

Washington State Parks contracted with the Pacific County Noxious Weed Control Board to foliarly apply triclopyr to an upland infestation in Cape Disappointment State Park that threatens two rare vegetation communities that are listed as globally imperiled.

Approximately 1 acre of infestation was treated.

The Parks staff also contracted with the Skamania County Noxious Weed Control Board to inject glyphosate into the infestations along Little Creek and Woodard Creek that flow through Beacon Rock State Park. Approximately 1.3 acres of infestation were treated. Park staff will re-survey all infestations next spring.

Figure 7. Washougal River Treatment - Before



Figure 8. Washougal River Treatment - After



Figure 9. Clark County Treatment - Before

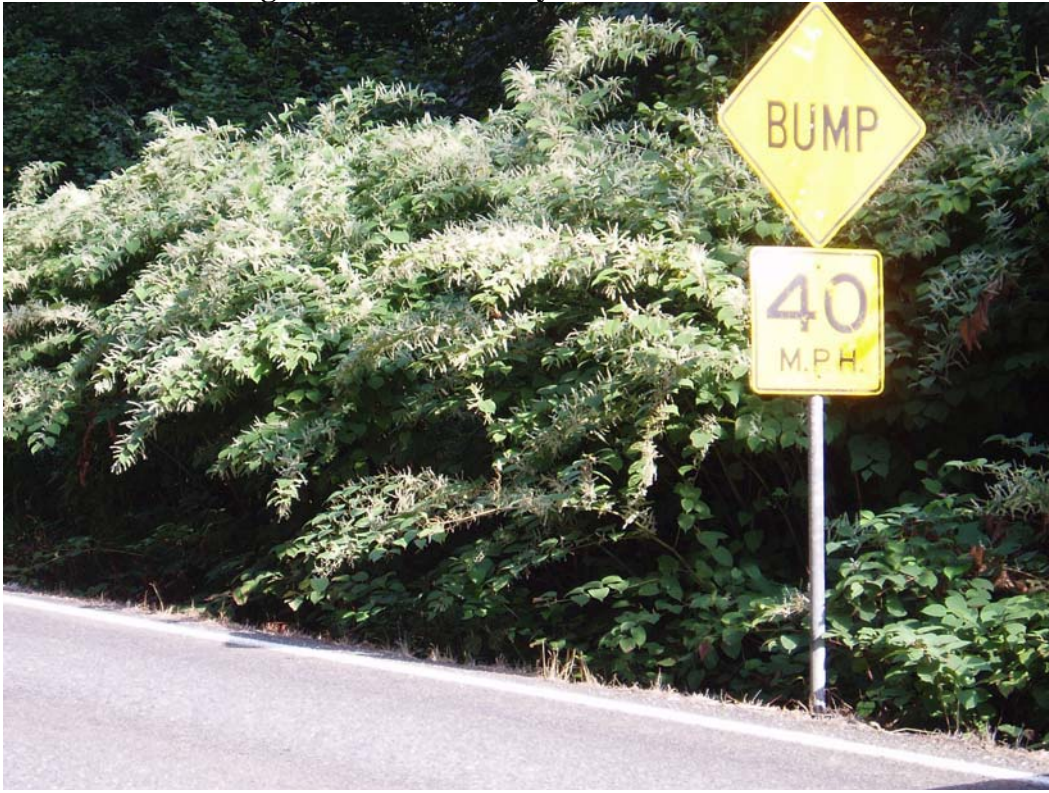


Figure 10. Clark County Treatment - After

