KNOTWEED CONTROL ON THE HOH RIVER:

2010 SUMMARY REPORT

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Contents

Introduction

This report describes the objectives and results of work conducted in 2010 as part of the multi-year project to completely eradicate invasive knotweed (*Polygonum spp.*) species in 30 river miles of the active Hoh River channel migration zone and adjacent terraces.

Located on the west coast of the Olympic Peninsula in Washington State, the Hoh River is one of the few rivers in the lower 48 states maintaining five species of relatively healthy wild salmon and steelhead populations. Bull trout are listed as '*threatened*' under the Endangered Species Act. The riparian forest and floodplain is largely intact and undeveloped compared with most other rivers in the state – with relatively small populations of non-native invasive plants known to impact fish, wildlife, and native plant habitats (e.g. reed canarygrass, herb Robert, Scotch broom, and knotweeds).

Project History

In 1998, one clump of knotweed was observed at the edge of the river's channel migration zone (CMZ) at river mile (RM) 29.75. In the winter of 1999 or 2000, this single clump was transported downstream during one of several winter storm events, giving rise to a population of knotweed that rapidly became widely distributed within the Hoh River CMZ to the river's mouth, with over 18,000 canes counted between RM 30 and 15 by 2003.

Recognizing the potential threat to aquatic and riparian habitats posed by this aggressively invasive species, in 2002 the Hoh Tribe initiated a knotweed project, beginning the comprehensive river surveys, control, and effectiveness monitoring activities that continue today as a partnership between the non-profit 10,000 Years Institute, Hoh Tribe, Hoh River Trust, private landowners, the Department of Natural Resources, Olympic National Park, and the U.S. Forest Service. Over the years, direct funding has been provided by the Hoh Tribe through the Pacific Coast Salmon Recovery program, the National Fish and Wildlife Foundation, and the Washington Department of Natural Resources, with additional in-kind assistance from the Hoh Tribe, Hoh River Trust, the weed boards of Clallam and Jefferson counties, and 10,000 Years Institute.

Project objectives, methods, and results through 2009 are described in previous reports available from 10,000 Years Institute – **http://www.10000yearsinstitute.org/** :

Knotweed Control on the Hoh River: Summary Report – 2002-2004
Knotweed Control on the Hoh River: Summary Report – 2005
Knotweed Control on the Hoh River: Summary Report – 2006
Knotweed Control on the Hoh River: Summary Report – 2007
Knotweed Control on the Hoh River: Summary Report – 2008
Knotweed Control on the Hoh River: Summary Report - 2009

2010 Project Crew and Training

The 2010 project field crew consisted of 2 to 6 people working for 9 weeks under a new partnership developed with the local regional fisheries enhancement group Pacific Coast Salmon Coalition (PACSAC). This partnership enabled the Institute to train and employ a local field

crew; adding a new restoration component to the PACSAC toolbox, and enabling the project to expand access and outreach through local contacts. The Hoh River Trust provided an intern with previous knotweed survey experience for three weeks. The Institute trained and employed an intern for three weeks as well. The crew received instruction in survey and control methods and safe survey practices, as well as watershed and river ecology and geomorphology, native plant and bird identification, noxious weed identification, and pesticide application best management practices (BMPs). The project coordinator, field crew leader, and data manager was Jill Silver, who was also the only licensed pesticide applicator on the team. Eve Dixon, a licensed applicator and coordinator of the Jefferson County Noxious Weed Board assisted us in herbicide application on one site. In the future, PACSAC intends to have a least one licensed employee.

2010 Survey and Control Summary

Due to another wet, cold, and late spring and summer, and the fact that we're searching for increasingly fewer and smaller plants each year, we started surveys in mid-August to ensure the greatest degree of plant growth possible through winter flood deposits and dense native vegetation. The project surveyed approximately 1,900 acres in priority reaches between river miles (RM) 30 to RM 1. We surveyed and treated plants on state, federal, and private lands – of which the latter included Hoh River Trust (HRT), and nine others. Fieldwork ended in early October as the rains started and the river rose.

In order to cover a very large area with a small crew, strategy and local knowledge were helpful in prioritizing areas for surveys. We focused on priority areas with significant channel changes, bank erosion, over-bank flooding, areas of deep flood deposits with few plants, or areas where many plants were found the previous year. With this small crew, we were spaced farther apart in our survey lines, and thus were not able to cover the ground as intensively as in previous years.

As in previous years, the surveys covered mature coniferous forested terraces, alder forested floodplains and willow stands, and many miles of mainstem river cobble and gravel bars with shrubby thickets and extensive log jams, within the river's channel migration zone (CMZ) and 100 year floodplain where winter floods can deposit plant material. The CMZ is almost a mile wide in some areas (Elk Creek – RM 19.5, Schmidt Bar – RM 20, Peterson – RM 21, Lindner Bar – RM 23), and constricted within bedrock canyons in others (Spruce Canyon – RM 26 and the Hoh Oxbow – RM 17). Olympic National Park (ONP) conducted repeat surveys at the mouth of the river on the north side, and staff from the Hoh Tribe conducted spot surveys over the season in the lower river below the Oxbow at RM 17 during the conduct of other responsibilities.

Upper River:

In the upper river, we added two priority areas – Lewis and Upper Brandeberry – both resulting from the new 'local' connection to the landowner, and information from the landowner that the infestation had spread to new sites in the middle of the river. The original infestation at the property spread from an ornamental planting, and had been treated by injection in 2008 but not visited since, and had since had some re-growth.

The other new infestation was located on State land on a large floodplain island now lying in the middle of two wide and deep braids of the Hoh River, and accessible only by wading hip deep

across river braids in very low flow conditions. We ferried equipment and herbicide to the island, and hiked in to the infestation, which lies between the original 2008 Lewis site and the original plant site at Brandeberry (RM 29.75), and appears to be moving slightly upriver from each – which may be a function of the plant rhizomes moving up the infested side channel that bisects the island in a SE to NW direction (see the Upper Brandeberry site in the map in Appendix 2). Next year we will survey farther into upriver in Olympic National Park to ensure that there's no other site above these. Based on early project surveys there's always been the assumption that the infestation originated at RM 29.75, but this needs to be reviewed.

Upper Brandeberry channel, bisecting the mid-channel island; knotweed on either side, only about 5 feet tall.

In the upper river above the Hoh Oxbow at RM 16, we did not reach several areas: 1) the Tower Creek floodplain at RM 25 on the south side of the river, 2) the approximately 3 acre island created and isolated by river migration at Clear Creek at RM 23, and 3) Spruce Canyon on the south side of the river below Owl Creek at RM 26, or east Peterson's Bar at RM 21.5.

Lower River:

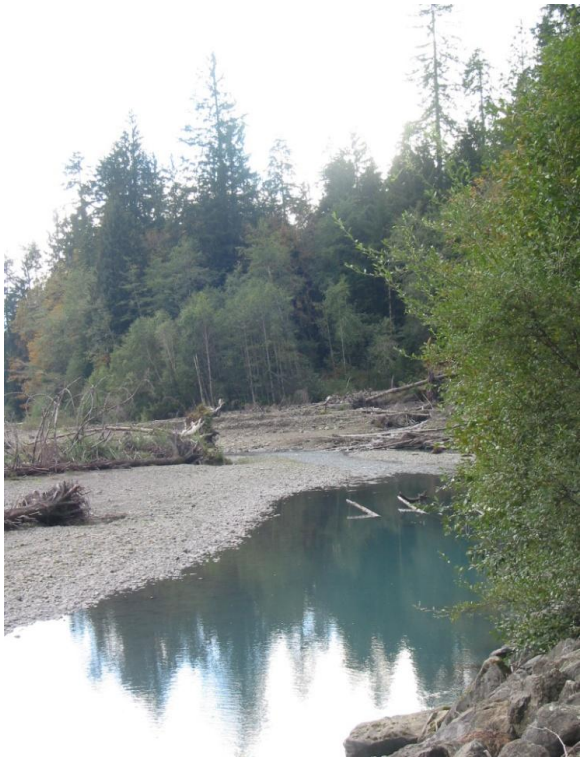
In the lower river, below the Hoh Oxbow, we added several survey areas that were not surveyed prior or have not been surveyed since 2004 – Old Joe's Slough at RM 14, Baker Bar at RM 13, Hoh Humm Ranch at RM 10 on the left bank, G & L at RM 6, and Lower Hoh at RM 1 on the right bank. We found large clumps and a number of scattered individual plants at the Old Joe's Slough, Baker Bar, and Hoh Humm Ranch. We did not treat plants on agricultural lands at G & L and Lower Hoh due to concerns over organic certification of beef cattle that might come into

contact with the herbicide. In the lower river, we did not survey Nolan Bar at RM 8, where we found no plants last year, and only one sprout in 2008.

General trends:

There were not as many channel changes in the winter floods of 2009-10 as occurred in 2008-9. The gravel bar at Lewis Channel (RM 28 on the north side of the river) continues to expand to the south, while across the river, Richmond Island (RM 28.5) continues to be eroded on the northeast, as well as the south side as the south river side-channel widens; reducing the size of the island considerably. Lindner Bar at RM 23 has grown in width and length as the river moves to the south. The largest area of change was in RM 19-21, including Schmidt Bar, Elk Creek, and Peterson's West – the river moving to the north side, and exposing a very wide gravel bar with alder islands. Hoh River Trust lost an old homestead site at Schmidt Bar where we'd surveyed in previous years, and they'd treated large infestations of non-native blackberry. Deposition and scour were still significant in a number of locations – deep fine sediment deposited in some areas, new areas of cobble and gravel, and in others, deep scour. Spruce Creek again had significant flows across the high spruce terrace, bank erosion along the mainstem, widening of interior side channels, and widening of the new Dismal Creek tributary mouth.

Piles of woody debris against tree boles and deep silt deposits from previous winter flood flows. An old red flag indicates a prior plant site.



The mouth of Tower Creek is along the tree line in the background. This site experienced up to 8 feet of scour, and was the prior treated site of many small red sprouts spreading from a large stand behind downed wood at the edge of the stream and river confluence.

There continue to be wide variability in plant height, leaf size, color, and leaf shape than making it difficult to 'calibrate' our eyes for surveys. Unless old canes or flagging was found, or a site was visible on the GPS unit matching the location, small plants on gravel bars, along river edges, and in low-lying alder stands are assumed to be new sites, where root fragments were deposited by floods or buried rhizomes were excavated to a viable depth where they could sprout.

In the photo above, small yellow and yellowish-green plants lie hidden under other plants. The following photo shows larger leaves and darker green color. A slug had munched on the leaves.

The downward trend in size and distribution of the knotweed infestation continues (see Appendix 1). A total of 0.0070 acres (304 ft^2) in the 1,900 surveyed acres (i.e. where plants located) were treated in 2010, down from .025 acres (1,085 ft^2) in approximately 1,000 surveyed acres in 2009.

Even with additional acres surveyed, we logged 108 plant sites in total – reduced from 295 in 2009, 383 in 2008, and 1464 in 2004. The mean number of stems logged in the 'binned' data category in the GPS data dictionary was 1775, shown compared with previous years in Appendix 1. These reductions translate to less biomass (stem and root fragments) available to spread to new locations during river migration. The most exciting results were from the area where the infestation originated in 1999 – we found only two small plants where 4108 canes were treated in 2003 and 707 in 2004.

Can you find the knotweed? It's hidden in the middle of the downed wood, in a windthrow impacted section of floodplain – with alder and salmonberry.

ONP staff appears to have eradicated the Giant knotweed population at the mouth of the river, although there remain untreated knotweed plants upstream of the ONP boundary in RM 1 due to the concern with organic certification of beef.

Other than the patch at the river's mouth, all plants found up to 2008 have been Bohemian knotweed (*Polygonum bohemicum)*. In 2008, giant knotweed was believed to be documented far upriver for the first time at two locations - Brandeberry and Peterson's Bar West. We did not know how to interpret this finding, and in 2009, we observed what we believe is Giant knotweed at a number of new locations from Owl Creek to Lindner Bar. We are tracking species in the GIS as we are able to make a clear determination. There may be varying forms of hybridization occurring.

We relocated one large root crown observed in years prior to 2010 at the egress of a river side channel at Elk Creek. These are named the '*chia pet syndrome*' by members of the OKWG, and are considered a significant problem because spraying the sprouts or stems doesn't move enough herbicide into the rhizome to kill it, and they continue to sprout small plants, while being in position to move downstream in pieces.

Elk Creek rhizome continues to sprout new leaves – in October.

Rain was a challenge as always, impacting our visual abilities in dark shady floodplains, interfering with GPS use, and making it impossible to spray plants. Another continuing challenge was the apparent interference with GIS satellites from frequent military overflights in the valley.

Mapping Discussion

We updated our Thale's MobileMapper CX GPS unit with 2009 orthophotos covering the entire river floodplain and channel migration zone from the initial infestation to the mouth. Prior orthophotos were from 2006, and channel changes have been significant since then.

Clipped raster data was loaded onto to the GPS unit, and managed on the unit using Arc Pad (a smaller version of Arc View). In lay terms, we were able to view aerial photos and parcel data, as well as past year's knotweed site data, which was useful in identifying old plant sites with our location super-imposed on the view.

The unit performed better than in 2009 – we had fewer power and software failures, but we still struggled with the technology at times. Our 2010 maps were also plotted on these updated 2009 aerials. Maps are available for download from the 10,000 Years Institute website at http://www.10000yearsinstitute.org - they are large files.

From the beginning of the project, we'd divided the river into areas based on contiguous floodplain complexes or river bars or river reaches, and this year, we created shape files in GIS around the reach area so as to maintain consistency as the river migrates and bars change. As listed in Appendix 1, these reaches are named after adjacent tributaries, campgrounds, and historic or current landowners, and are used to track plant sites by river mile and landowner throughout the life of this project. The reach areas are shown in color on the map in Appendix 2. A Data Dictionary loaded on the GPS unit contains a complete list of mapping attributes, and variants of this dictionary are used by all cooperators on the Olympic Peninsula, presented in Appendix 3.

Sites were logged with the GPS unit when there were satellites available, or when there was no satellite coverage, we either plotted a point on the unit using the ArcPad function, or hand-applied it to a paper copy map and later plotted it into the corresponding GIS map.

Comparative maps for three reaches (Elk/Schmidt, Lindner, and Owl/Lewis/Brandeberry were produced by Luke C. Cherney in Port Townsend, and are available in digital format through the Institute. An example comparing years 2008, 2009, and 2010 is appended to this report (Appendix 2).

The database has been updated with 2010 data, given to WSDA, and is available to researchers interested in the behavior of these species.

We upgraded our GPS capabilities in a training workshop coordinated through the Olympic Knotweed Working Group (OKWG), with assistance from other professionals, and have begun to increase in-house GIS capabilities in order to better manage data and communicate results.

Herbicide Application – Permitting, Methodology, Totals, and Discussion

A National Pollution Discharge Elimination Permit (NPDES) is required for herbicide application in natural areas. This project is covered through joint permitting with Clallam and Jefferson counties. Herbicide records for each site and application are maintained by the Institute, and reported through the Clallam County noxious weed board to WSDA.

We used the products ***Aquaneat*** (containing 48% *glyphosate* and 52% water), ***Habitat*** or ***Polaris AQ***, (containing the active ingredient *imazapyr*), in a mix of 93% water, ***Competitor*** surfactant, and ***BlazeonBlue*** marker dye. All of these products have been carefully vetted through the OKWG and with the Department of Agriculture to assure the least toxicity to the surrounding aquatic and terrestrial environment, animals, and people. *Glyphosate* acts by attacking three of the 'essential' amino acids made by plants, disrupting the plant's ability to grow. *Imazapyr* also acts by affecting essential amino acids in plants, but is a longer-lasting herbicide intended to provide a better response with the problem of re-sprouting from underground rhizomes some distance from the treated plant. Knotweed rhizomes have been documented 50 feet from the parent plant. Experts surmise that in some cases herbicide cannot travel that distance, depending on a number of factors including the amount of above-ground biomass available to translocate a sufficient amount of herbicide, time of treatment, and plant physiology. *Glyphosate* seems to 'leak' out of the rhizomes, while *imazapyr* is a soil-persistent herbicide that moves throughout the plant at a slower rate, and attacks the root structure and rhizomes of the knotweed plant over a longer period, especially throughout the winter. *Imazapyr* is not reported to have any direct effects on fish, and is less harmful to a range of plant species than is *glyphosate* – but we continue to advocate using as little as possible, as carefully as possible, so as not to impact other plants or water.

As in previous years, the application of the herbicide was accomplished largely by carefully-targeted foliar spray methods, in contrast to earlier years when plants were large, and the injection method was the primary method of treatment. Most canes are now too small to inject. Injection was used only on canes larger than 0.5 inches, and we found only five plant sites with canes this size, including Lewis, Lindner, Old Joe's Slough, Baker Bar, and HRT. At Lewis, the plant sites injected in 2008 had re-grown near a well where there are restrictions for the use of *imazapyr*, so they were again injected with ***Aquaneat*** (i.e. *glyphosate*) at 5 ml. per cane. Two additional small clumps were found to the south on the alder/willow dominated river floodplain and bar – and these were sprayed, but only with ***Aquaneat*** – no ***Polaris*** (i.e. *imazapyr*) was used at the request of the landowner. Retreatment in 2011 will be necessary.

A hand-held one-liter spray bottle was employed to spray the herbicide directly on plant leaves and stems of small plants, although we used a backpack sprayer on the larger stands we found at Old Joe's Slough, Baker Bar, and Upper Brandeberry.

On 1,900 total acres surveyed and 304 ft^2 treated in 2010, we used 2.8 pints of herbicide concentrate in 8.6 gallons of spray mix containing 3% ***Aquaneat***, 1% ***Habitat***, 1.5% surfactant, and 1% marker dye. We injected a total of 4.83 ounces or 0.6 pints of ***Aquaneat*** in stems larger than ½". The amount of spray is twice what we used last year, and the amount of injection is half of what we used last year.

We had good results using our sprayers this season – no accidental spillage occurred from the nozzles or pumps malfunctioning. Each evening, the sprayers were completely emptied and triple rinsed in order to avoid gumming up of the unit, and allow for smooth operation.

Finally, as last year, we noted poor vegetative regrowth of native plants at several sites where foliar spray had occurred in 2009 (Lindner, Richmond Island). These sites were on fine-grained soils, and appear to have been sprayed with a backpack sprayer using *imazapyr* in the mix. We are concerned about the impacts, and are tracking the response to the use of the more persistent herbicide, but believe we must balance its effectiveness on knotweed with short-term localized impacts. In general, we are pleased to see a good response by native shrubs and forbs.

Alex spraying Giant knotweed at Upper Brandeberry.

Effectiveness Monitoring of 2009 Control Activities

Spot effectiveness surveys were conducted prior to and during training at Fletcher Island, Lindner Bar, Spruce Creek, Spruce Canyon, and Lewis Channel. Old flagging was found in approximately 11% of sites – approximately 3% of these sites had a re-sprouting stem, often some feet from the original infestation.

Presentations and Educational Outreach

In 2010, we made several presentations summarizing results and challenges to the Olympic Knotweed Working Group, and the Jefferson County Noxious Weed Board. 10,000 Years Institute also responded to calls from individuals and groups interested in controlling knotweed or developing other control projects, and provided information and training. We have offered

presentations to the Hoh Tribe, Hoh River Trust, DNR Olympic Region, and the Pacific Coast Salmon Coalition.

Landowner and Partner Outreach

Calls were made in July to six key landowners in the upper river, above the Hoh Oxbow Bridge on Highway 101. Pacific Coast Salmon Coalition called and visited other landowners, and obtained several new access agreements in key sites in both the upper and lower river.

Past reports, maps, and herbicide information are provided over the course of the project. Summaries and maps for activities on specific parcels are being developed for each landowner who provided access. Project information is being shared with staff from the Department of Natural Resources, the Department of Fish and Wildlife, the US Forest Service, Hoh River Trust, Hoh Tribe, Olympic National Park, the Northwest Indian Fisheries Commission, the Clallam and Jefferson County Noxious Weed Board staff, Jefferson County Commissioners, and during discussion at OKWG meetings. Informative posters are located at all Hoh River public boat launches and campgrounds. New posters will be created and posted next year to show the range of plant size and growing sites.

Ideas for Improvement

The current management strategies have proven highly successful; but annual winter floods in the Hoh river watershed continue to pose challenges to the project as they move buried rhizomes and plant parts to new, unknown locations, and bury other areas with deep deposits that may take some time (***how many years????***) for knotweed to push up through – requiring repeat surveys in all river floodplain and terrace locations that receive flood waters each year.

We've had to balance the need to cover a lot of difficult terrain with a low budget – which in the past has necessitated using relatively inexpensive but inexperienced correctional crews, followed in 2009 by a more professional but much smaller crew. It would be helpful to increase the size of the crew as the knotweed becomes increasingly smaller and more widely distributed, and therefore more difficult to locate; requiring even more intensive and careful surveying – but this requires more funding – and budget predictions are poor.

Conclusions and Future Plans

Our control methods have proven to be highly effective – we can see from field surveys and data analysis that a huge proportion of living knotweed plants on the Hoh River has been successfully eradicated over the past seven years. Unlike the huge stands one is accustomed to seeing along many rivers and roads, it has become nearly impossible to find knotweed on the Hoh River!

The remaining population is largely made up of small single-stemmed plants, significantly reducing the biomass available to start new plants – which is a really important factor in terms of the project's long term planning. The challenge remains to locate widely spaced, very small plants on a wide and complex river floodplain over a distance of 30 miles in length, and since a single missed plant is capable of spreading to many new locations when eroded during a flood event, annual surveys of the entire river and floodplain continue to be required in order to locate translocated fragments that may have produced new plants. Large rhizomes buried deeply in flood deposits may express only one small stem in a season, which after herbicide application

that kills the single stem, often retains the ability to resprout. Some of these large rhizomes are found at edge of the river, and a strategy for removing or treating these masses without breaking off rootlets and increasing new plant growth, or causing impact to the water through herbicide application, is needed. We continue to work on a solution for this phenomenon with the OKWG, and see evidence that the addition of *imazapyr* to the herbicide application is helping.

A crew of at least ten well-trained and motivated workers is necessary to adequately cover the entire floodplain, all the vegetated bars, and the upland terrace forests. A local crew familiar with the terrain and ecosystem is a key ingredient to success. The cooperation of private landowners in the Hoh River valley is also imperative to the success of this project. Support of the project was strong the past two years, and we will continue the outreach and positive results that encourage this cooperation.

We are planning for next year's surveys depending on funding availability, and will revisit all previous plant locations, and expand our focus upstream of Upper Brandeberry in ONP and in the lower river. We will continue to actively participate in the OKWG, and to share project results with interested parties and in appropriate forums.

Other Species of Concern

A number of other species of concern were noted during our knotweed surveys, and we roughly estimate that by pulling and cutting some of these plants in passing, the distribution of ***billions*** of seeds did not occur. The plants discussed below are listed by the Center for Invasive Plant Management as some of the worst weeds in the west, and are all interfere with native riparian succession necessary to achieve and sustain a healthy native riparian forest. Among those, Scotch broom (C*ytisus scoparius*), non-native blackberry (Himalayan and Evergreen - *Rubus spp*.), reed canarygrass (*Phalaris arundinacea*), Herb Robert (*Geranium robertianum*), and Canada thistle (C*irsium arvense*) are of increasing concern within the Hoh river corridor where they had previously not been widely distributed. Butterfly bush (*buddleja davidii Franch.)* is planted on the north side of the river on private property within the channel migration zone, and as has been shown on the Dungeness River, poses a threat comparable to knotweed. Each of these species has competitive advantages over native plants, and when not managed, easily become monocultures in nutrient-poor and highly disturbed environments such as river bars. They are joined by numerous other non-native species, also distributed by wind or water, including smartweed (*Polygonum spp.)* and common burdock (*Arctium minus*).

Scotch broom is well-established in areas with high human use - Lindner, Morgan's, Clear Creek, Owl Creek, and Brandeberry - and is often associated with the use of seed-contaminated gravel in construction, roads, or riverbank protection such as at Baker Bar, where there is a solid five acre patch resulting from river construction of an engineered log jam project. It grows over ten feet in height in patches at Lindner Bar. Spreading from Baker Bar and Old Joe's Slough where river stabilization projects were constructed, it is observed to be spreading quickly on other gravel bars in the lower river below RM 15. This species is exhibiting an effect on native forest succession where it is established – at Lindner Bar, there are patches that have not been replaced by native tree succession in the past decade, and at Baker Bar, there are no other plants growing in a solid stand of over two acres that is more than 6 feet in height. According to weed literature, a mature Scotch broom plant can produce 6,000 seeds that remain viable in soil for 60

or more years. In the Hoh River's active channel and floodplain, new plants are becoming widely distributed as floodwaters deposit seeds. Scotch broom sequesters nutrients such as nitrogen, and with a deep tap root, is able to survive drought and flood conditions that kill or excavate alder and willow, which are critical to beginning the successional process that establishes conifer in riparian forests.

Herb Robert (*Geranium robertianum*), an understory competitor with allelopathic properties, was found spreading in size and distribution in a number of locations. The source location is reported to be a maintenance yard at Snider Creek in Olympic National Park. Expanding populations have been observed at Brandeberry, Lewis Channel, Morgan's, Lindner, Elk Creek, Schmidt Bar, and Cottonwood.

Foxglove (*Digitalis purpurea*) is exploding in density across wind-exposed bars and along banks and in depositional zones along large wood jams. This species is considered naturalized, but as with the other species listed here, has not been observed as widely in prior years in the Hoh River floodplain. As all parts of the plant are poisonous including the seeds, and each plant can produce 200,000 seeds, and we observed some patches solidly covering hundreds of square feet, we are advocating the pulling of these plants - particularly before they bloom.

Tansy ragwort (*Senecio jacobaea*) was found in many different types of habitats – mostly those with some disturbance - and we pulled every plant we found (approximately 45). We found and pulled one small patch of Common Tansy (*Tanacetum vulgare*).

Bull thistle (*Cirsium vulgare*) was also widely distributed in disturbed sites and we pulled, buried, and kicked down many stalks. Sites where we pulled thistle in previous years were mostly free of plants.

Outside of the knotweed project, we are working with WSU to distribute biocontrols for certain species (Tansy ragwort, Canada thistle and Scotch broom). Hoh River Trust and Pacific Coast Salmon Coalition both provided funding and supervision for a crew from Olympic Corrections Camp to pull Scotch broom – which was greatly appreciated.

Knotweed and other invasive plants impact all of the river-adjacent landowners, the recreational public, and the Hoh Tribe – and while knotweed requires the use of herbicide in complex habitats like the Hoh River – the others do not. We encourage each person to '*pull that ONE plant – before it goes to seed'* (and report the knotweed when seen)! We hope to expand the knotweed project with funding from additional sources and address these other invasive plants which in combination, pose as much of a threat to fish and wildlife habitat as does knotweed.

Appendix 1: Project Results - 2002-2010

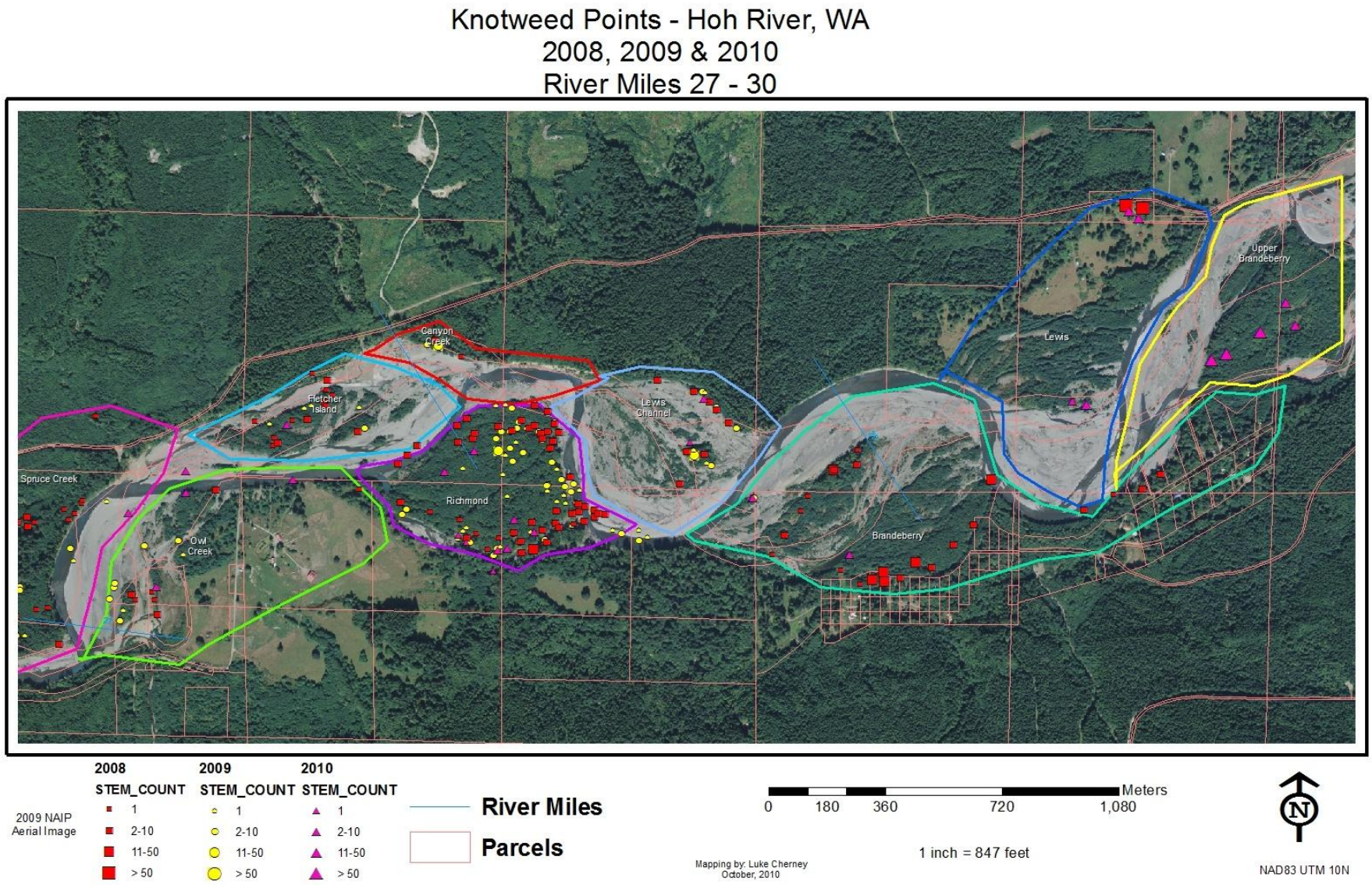
River Bar	RM	Total # Canes	2002	2003	2004	2005	2006	2007	2008	2009	2010
Upper Brandeberry	30	789	-	-	-	-	-	-	-	-	**789**
Brandeberry	29.75	5280	ns	4108	707	69	135	ns	256	1	**4**
Richmond[a]	28.5	410	a	a	a	a	ns	ns	216	170	**24**
Lewis	28.5	231	ns	ns	ns	ns	ns	-	150	ns	**81**
Canyon Creek	28	2555	932	1046	357	31	21	92	55	21	**0**
Lewis Channel	28	1239	ns	505	509	36	104	ns	45	35	**5**
Owl Creek	27	6857	869	4517	1053	238	117	ns	24	28	**11**
Fletcher Island	27	240	ns	ns	ns	ns	158	ns	55	8	**19**
Spruce Creek	27	1807	49	ns	1078	58	239	220	115	41	**7**
Spruce Canyon	26	1027	133	336	162	39	8	3	0	346	**0**
Tower Creek[b]	25	385	326	ns	ns	48	ns	ns	ns	11	**ns**
Coontz' Bar[c]	25	30	7	ns	ns	ns	23	ns	ns	c	**c**
Coontz' Bar LB[c]	25	2155	1925	136	47	ns	47	ns	ns	c	**c**
Morgan's	24	649	ns	15	215	67	15	191	80	58	**8**
Clear Creek	23	1542	ns	729	556	36	15	52	110	19	**25**
Lindner	23	10350	3299	3717	1227	303	819	303	394	109	**179**
Peterson's Bar	21.5	1511	ns	559	206	387	62	191	99	7	**0**
Peterson's Bar West	21	2039	ns	ns	821	ns	35	1052	18	91	**22**
Willoughby	20	2	ns	ns	ns	ns	ns	1	0	1	**0**
Schmidt Bar	20	3662	1437	1798	217	35	94	80	1	0	**0**
Elk Creek	19.5	1939	ns	ns	ns	639	384	66	580	250	**20**
Alder	19	544	ns	ns	ns	ns	326	218	0	0	**0**
Hell Roaring	15.5	572	ns	ns	ns	ns	572	ns	ns	ns	**ns**
Allen's Bar	15	25	ns	ns	ns	ns	25	ns	ns	ns	**ns**
Allen's Bar II	15	60	ns	ns	ns	ns	60	ns	ns	ns	**ns**
Old Joe's Slough	14	447	ns	181	ns	14	43	ns	ns	ns	**209**
Baker	13	1626	319	ns	857	224	124	ns	ns	ns	**102**
Dengate Island[d]	12	465	ns	125	31	50	11	ns	ns	ns	**248**
Cottonwood	10.5	1628	326	813	318	119	35	ns	15	1	**1**

Appendix 1, con't:

River Bar	RM	Total # Canes	2002	2003	2004	2005	2006	2007	2008	2009	2010
Nolan Creek	8	11	ns	ns	ns	11	ns	ns	ns	ns	**ns**
Nolan Bar	8	287	ns	ns	ns	ns	286	ns	1	0	**ns**
Rayonier Bar	7	275	ns	ns	ns	ns	275	ns	ns	ns	**ns**
G&L	6	113	ns	ns	ns	113	ns	ns	ns	ns	**ns**
Lower G&L	5.5	132	ns	ns	ns	ns	132	ns	ns	ns	**ns**
Fletcher Creek	2.5	151	ns	ns	102	ns	49	ns	ns	ns	**ns**
Lower Hoh	1	758	ns	ns	ns	394	337	ns	ns	6	**21**
		51793	**9622**	**18585**	**8463**	**2911**	**4551**	**2469**	**2214**	**1203**	**1775**

a This island and property were included in Brandeberry and/or Owl Creek from 2002 - 2005
b Spruce Canyon LB is Tower Creek from 2006 on
c Coontz Bar and Coontz Bar LB is included in Tower Creek from 2008 on
d Dengate Island is Hoh Humm and HRT in 2010

Appendix 2: Comparative 2008, '09 and '10 GIS Map – Stem Count for RMs 27 – 29



Appendix 3: Data Dictionary

KNOTWEED NUMBER (Automatically assigned)
LOCATION NAME
CLUSTER TYPE (REQUIRED)
- Individual
- Clump
- Group

CANE COUNT (REQUIRED)
- 1
- 2-5
- 6-10
- 11-25
- 26-50
- 51-100
- 101-200
- over 200

HEIGHT OF PLANT (REQUIRED)
- < 1 foot
- 1-3
- 3-6
- 6-10
- >10 feet

EROSION POTENTIAL (REQUIRED)
- High
- Moderate - High
- Moderate
- Low – Moderate
- Low

COVER {REQUIRED - canopy closure of shrubs and trees above knotweed}
- Open
- Partially open
- Mostly closed
- Closed

PRIMARY SUBSTRATE (REQUIRED)
- VDA Vegetated Debris Accumulation
- C Cobble
- G Gravel
- S Sand
- F Fines
- LWD Large Woody Debris

SECONDARY SUBSTRATE (OPTIONAL)
- VDA Vegetated Debris Accumulation
- C Cobble
- G Gravel
- S Sand
- F Fines
- LWD Large Woody Debris

TREATMENT (REQUIRED)
- Inject
- Spray
- Spray and Inject
- NONE

COMMENTS (OPTIONAL - Anything important to the data collected on the particular cluster)
OBSERVER (REQUIRED - initials of three mapping crew members)

Appendix 4: Invasives 101 and Species of Concern – Educational Links and Resources

The Global Invasive Species Team
http://www.invasive.org/gist/methods.html

Center for Invasive Plant Management – Worst Weeds of the West List
http://www.weedcenter.org/inv_plant_info/worst.html

Scotch broom
http://www.nwcb.wa.gov/weed_info/Cytisus_scoparius.html
http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/scotch-broom.aspx

Buddleia (Butterfly Bush)
http://www.nwcb.wa.gov/weed_info/buddleja_davidii.html
http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/butterfly-bush.aspx

Tansy Ragwort
http://www.nwcb.wa.gov/weed_info/Senecio_jacobaea.html
http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/tansy-ragwort.aspx

Canada thistle
http://www.nwcb.wa.gov/weed_info/Cirsium_arvense.html

Bull thistle
http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/bull-thistle.aspx

European blackberry
http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/blackberry.aspx

Herb Robert
http://kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/herb-robert.aspx