

KNOTWEED CONTROL ON THE HOH RIVER: 2009 SUMMARY REPORT



photo credit: Matthew Sciacca

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Introduction

This report describes the objectives and results of work conducted in 2009 as part of the multi-year project to completely eradicate invasive knotweed (*Polygonum spp.*) species in 29.75 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. The riparian forest and floodplain is largely native compared with most other rivers in the state – with relatively small populations of non-native invasive plants (e.g. reed canarygrass, Scotch broom, and knotweeds) known to impact fish, wildlife, and native plant habitats.

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 in the upper 15 miles of river by 2003.

Recognizing the potential threat to critical aquatic and riverine 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.

Project objectives, methods, and results through 2008 are described in previous reports available from 10,000 Years Institute – www.10000yearsinstitute.org or info@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

2009 Project Staff and Training

The 2009 field crew leader, project coordinator, and data manager was Jill Silver. A new field crew was hired through WSU Jefferson County Extension as a partner under contract. The crew was trained in survey and control methods during mid-August at Fletcher Creek and Spruce Creek. Even though none of the crew had prior experience with knotweed, and two were new to fieldwork altogether, all proved exceptional at finding plants in the most challenging of conditions. Training also included watershed and river ecology and geomorphology, native plant and bird identification, noxious weed identification and control best management practices (BMPs), and general training in safe survey practices and herbicide application.

2009 Survey and Control Summary

Surveys are starting later in the season to ensure the greatest degree of plant growth possible through deep winter flood deposits. This year, we started in mid-August, and found several new sprouts in mid-October! Combined with the challenge of working with a much smaller crew, strategy and local knowledge were critical in prioritizing areas for evaluation. Priority areas are those with significant channel changes, bank erosion, over-bank flooding, and where deep deposits and few plants were found the year before.

We surveyed approximately 1,000 acres between river miles (RM) 29.5 to RM 17, covering the priority areas with one exception – a small (approximately 3 acre) island created and isolated by river migration at Clear Creek between RM 23 and 24 on the south side of the river. We did not get to the large Alder Creek floodplain below RM 17 on the right bank, but there was no evidence of erosion or channel cutting, and similar reaches upriver did not have any plants. In the lower river, below the Hoh Oxbow (RM 16), we surveyed Cottonwood (RM 11 on the north side).

The surveyed areas included 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. The river migration zone 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 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.

As is typical on the Hoh River, a number of floodplain complexes experienced significant channel changes or bank erosion since the fall of 2008, including Cottonwood, Elk, Schmidt, Clear, Lindner, Spruce, Canyon, Fletcher Island, Richmond, Brandeberry. Deposition and scour were significant in a number of locations – more than six feet of fine sediment deposited in some areas, new areas of cobble and gravel, and in others, deep scour. In the case of Clear Creek, the river moved most of the main channel from the north side (Canyon) to the south (side channel behind the Clear Creek floodplain complex), and isolated a small island that we were not able to access. Spruce Creek had significant flow across the high spruce terrace and widening of side channels, a new tributary mouth, and lost more riverbank along the mainstem. In parts of the terrace flats where shrubs not dominant, all the downed small wood on the forest floor was ‘swept’ into neat piles against standing tree trunks – and several knotweed plants were observed growing from these piles. Linder Bar gained open depositional bar at the east end, which is also now at the north edge of the Clear Creek floodplain complex, and at the west edge of Morgan’s. Morgan’s had few physical changes, but we found new knotweed distributed far north into mature forest along old channel swales where recent flow was not evident.

There was more variety and variability in plant height, leaf size, and leaf shape than previously observed. We’d find a plant in one type of habitat with a specific size and shape, and ‘calibrate’ our eyes to that specific shape, only to find the next plant completely different. Unless old canes or flagging was found, small plants on gravel bars, along river edges, and in low-lying alder

stands are assumed to be new sites - where root fragments had been deposited by floods or where buried rhizomes were excavated to a viable depth where they could sprout.

In spite of the challenges, the downward trend in size and distribution of the knotweed infestation continues (Appendix 1). A total of .025 acres (1,085 ft²) in the 1,000 surveyed acres (i.e. where plants located) were treated in 2009, down from 0.11 acres (4,733 ft²) in 2008.

We logged 295 plant sites in total – reduced from 383 in 2008 and 1464 in 2004; the number of stems logged in the ‘binned’ data category in the data dictionary was a maximum of 1,535 and a minimum of 905, reduced from 2,734 maximum and 2,036 minimum in 2008. The mean of the ‘binned’ count – 1203 - is shown in Appendix 1, compared to previous years. 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 ONE tiny plant where 4108 canes were treated in 2003 and 707 in 2004. ONP staff found and treated 6 stems less than one foot tall at the mouth of the river.

We relocated two large root crowns observed in years prior to 2008, considered a significant problem because we can’t get enough herbicide in them to kill them, and which are continuing to sprout small plants. The one at the egress of a side channel at Elk Creek appears to have sent underground rhizomes 60 feet away into an island where a large clump has developed on the island’s terrace – 15 feet up!

Other than the remains of the small stand of Giant knotweed (*Polygonum sachalinense*) at the mouth of the river that has since been largely eradicated by ONP staff, all plants found up to 2008 have been Bohemian knotweed (*Polygonum bohemicum*). Giant knotweed was documented far upriver for the first time in 2008 at two locations - Brandeberry and Peterson’s Bar West. We did not know how to interpret this finding last year, and this year, we observed what we believe is Giant knotweed at a number of new locations from Owl Creek to Lindner Bar. A private landowner reported a Giant knotweed stand at Old Joe’s Slough (RM 13.25) in November; unfortunately too late to survey or treat. It may be migrating from a site on the north side of the river at RM 30 where access is not allowed by the landowner. We hope to be able to access this property in the future, and risk a new infestation of the entire river if this is not achieved.

Rain was a problem this past season, impacting our visual abilities in dark shady floodplains, and making it impossible to treat plants with herbicide. The crew did not survey during the week of September 28th, due to predicted poor weather. Another challenge was the apparent interference with GIS satellites from daily military overflights in the valley.

Mapping Discussion

We’re using 2007 orthophotos from Hoh River Trust covering the entire river floodplain and channel migration zone from the initial infestation to the mouth as our base maps. We’ve divided the river into sections based on contiguous floodplain complexes or river bars or river reaches. As shown in Appendix 1, these sections are named for adjacent tributaries, campgrounds, and historic or current landowners. These names are used to locate each plant site in order to distinguish section characteristics such as river mile and landowner throughout the

life of this project. A Data Dictionary contains a complete list of mapping attributes, and variants of this dictionary are used by all cooperators on the Olympic Peninsula.

Sites were logged with a Thales (Magellan MobileMapper CX) GPS unit when there were satellites available, or hand-applied to a map and later digitized into the GIS. Clipped raster data was loaded onto 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. We experienced a significant amount of problems with the unit this year, which more training may correct.

As in previous years, river migration in the winter of 2008 caused significant changes to the floodplain and upper terraces. River bars that were once accessible from one side of the river are now only accessible by the other. Gravel bars that once made up large areas of the infestation are now gone, swept downstream, and in other sections, new bars with new plants are easily accessible. Section names previously applied to these locations refer to the named area previously treated and are not an exact location. Site specifics can be corrected through a GIS analysis based on UTM's, but continue to be the basis of plant population comparisons from the previous seasons.

GIS maps were produced with assistance from ISE Consultants in Port Townsend, and are available in digital format through the Institute. An example comparing years 2008 and 2009 is appended to this report (Appendix 3). The database has been updated with 2009 data and is available to researchers interested in the behavior of these species.

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 are maintained and reported.

As in 2008, in 2009, the application of the herbicide was accomplished largely by carefully-targeted foliar spray methods, in contrast to earlier years where the injection method was the primary method of treatment. This change is due to the reduction in size of the plants – most canes are now too small to inject. Injection was used only on canes larger than .5 inches, and we found only five plant sites with canes this size. A hand-held one-liter spray bottle was employed to spray the herbicide directly on plant leaves and stems of small plants.

We used the products *Aquaneat* (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 in the Olympic Knotweed Working Group and with the Department of Agriculture to assure the least toxicity to the surrounding aquatic and terrestrial environment, animals, and people.

On 1,000 total acres surveyed and treated in 2009, we used only 1.4 pints of herbicide concentrate in 34.67 pints (4.3375 gallons) of spray mix containing 3% *Aquaneat*, 1% *Habitat*, 1.5% surfactant, and 1% marker dye. This equals 1.04 pints of *Aquaneat*, 0.3467 pints of

Habitat, 0.52 pints of *Competitor*, and 0.3467 pints of *BlazeonBlue*. We injected a total of 715.15 ml of *Aquaneat* in stems larger than ½” which equals 24 ounces or 1.5 pints.

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 known to have any effects on salmon populations – but we continue to advocate using as little as possible, in as safe a manner as possible.

We experienced several problems with the sprayers this season, and had spillage at four sites of between .10 and 1.0 pints. Fortunately, all the spills took place on silt soils with high organic matter, far away from water, and we buried any material that had herbicide contamination, including plant parts that we pulled away from their roots in order to keep the roots from exposure. Each evening, the sprayers were completely emptied and triple rinsed, in order to avoid gumming up the spray unit and allow for smooth operation, and while this was necessary and helpful, it was not always completely effective. We have not yet found equipment that both meets the challenges of difficult survey conditions and the very small volumes we use.

Finally, we noted poor vegetative regrowth of native plants at several sites where foliar spray had occurred in 2008 (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.

Effectiveness Monitoring of 2008 Control Activities

Effectiveness surveys were conducted at Fletcher Island, Lindner Bar, Spruce, Spruce Canyon, Lewis Channel, and Owl Creek separately from the 2009 control surveys. The data and notes from the effectiveness surveys show less than 3% live plants found. Old flagging was found in approximately 10% of sites – approximately 15% of these sites had a re-sprouting stem, usually some feet from the original infestation. Many of the small plants appear to be new sites.

Presentations and Educational Outreach

In 2009, a number of presentations summarizing results and challenges were made to the Olympic Knotweed Working Group, the Jefferson County Noxious Weed Board, and to the American Fisheries Society annual meeting at Squaxin Island titled *Challenges of Controlling Invasive Knotweed in the Hoh River and its Floodplain: Implications for Salmon Habitat Restoration*. 10,000 Years Institute also responded to calls from groups interested in developing other knotweed control projects, and provided information and training.

Landowner and Partner Outreach

Letters and brochures informing landowner participants of project plans were sent in July to twelve primary landowners in the upper river, above the Hoh Oxbow Bridge on Highway 101. Personal visits and calls were made to six of these landowners, and another six at Brandeberry Lots. We completed new access agreements with three landowners, bringing the number to eight.

Past reports, maps, and herbicide information were 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, Olympic National Park, the Northwest Indian Fisheries Commission, the Clallam and Jefferson County Noxious Weed Board staff, Jefferson County Commissioners, and during discussion at Olympic Knotweed Working Group 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 location.

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 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.

We're working to upgrade our GPS capabilities with a training workshop to be coordinated through the Olympic Knotweed Working Group, and will also be working to increase in-house GIS capabilities in order to better manage data and communicate results.

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's becoming very difficult 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. 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 plants, or causing impact to the water through herbicide application is needed (a photo of the rhizome at Elk Creek is appended). We continue to work on a solution for this phenomenon with the Olympic Knotweed Working Group, and see evidence that the addition of *imazapyr* to the herbicide application may be effective.

Based on evidence of the persistence of plant fragments in floodplain deposits and the ability of plants to maintain very slow growth in completely shaded areas, coupled with the difficulty of locating every plant on the expansive Hoh River channel migration zone (CMZ), knotweed plants are expected to be present in the river corridor for at least another eight years – requiring annual surveys - after which periodic surveys will be necessary to verify that the river remains free of knotweed. 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.

We are preparing for next year's surveys depending on funding availability, planning to begin fieldwork in mid to late July 2010, surveying and controlling plants, starting upstream and moving down. We will continue to actively participate in the OKWG, and to share project results with interested parties and in appropriate forums.

The cooperation of private landowners in the Hoh River valley is imperative to the success of this project. Support of the project was very high this year, and we will continue the outreach that engenders this responsiveness.

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 – all the others do not. We encourage each person to ‘pull that ONE plant’ – before it goes to seed (and report the knotweed when seen)!

Other Species of Concern

A number of other species of concern were noted during our surveys, and we roughly estimate that by pulling and cutting many of these plants, the distribution of billions of seeds did not occur. The plants outlined below are listed by the Center for Invasive Plant Management as some of the worst weeds in the west. Among those, Scotch broom (*Cytisus scoparius*), non-native blackberry (Himalayan and Evergreen - *Rubus spp.*), and Canada thistle (*Cirsium arvense*) are of increasing concern within the riverine 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 poses a threat comparable to knotweed. Each of these species has competitive advantages over native plants, and when not managed, easily become monocultures.

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. There are patches where it grows over ten feet in height (Lindner Bar). It is also observed to be spreading quickly on 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 achieved succession in the past decade. According to weed literature, a mature Scotch broom plant can produce 6,000 seeds which 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. They are joined by numerous other non-native species, also distributed by wind or water including smartweed (*Polygonum spp.*), common burdock (*Arctium minus*), and

Herb Robert (*Geranium robertianum*), an understory competitor with allelopathic properties, was found this year in a number of locations, and the source location may be a maintenance yard at Snider Creek in Olympic National Park. 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 so widely distributed 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.

Project Photos:



Chris, soaking wet, with one of the largest clumps of the season, and in bloom, which was rare.



Large clump from above viewed from Spruce Canyon across the river.



Re-sprouting clump in downed wood and scoured terrace deposits at Canyon Creek.



Single tiny plant at Brandeberry under a log in a log jam – down from 4108 in 2003.



Small plant (with red ribbon) in native forb layer with GPS unit and map for scale.



Plant in flood silt deposits along Spruce Creek bank.



Small plant at edge of side channel at Lewis Channel (follow red arrow).



Tiny plant with spots.



Examples of different survey challenges – Matt searching the edges and interiors of willow and alder thickets, open gravel bars, and log jams. Mature spruce forest patches are in the distance.



Michael seen from atop a log jam - searching through dense native shrubs is a challenge!



Chase in a salmonberry and alder flat with a new plant at an old plant site.



A treated site from 2008 with no re-sprouts and healthy native plants – as shown by old blue and yellow flagging on the spruce bole, third over from the left.



River disturbance zone at Tower Creek and east end of Morgans – new channels carved.



Scotch broom, Canada thistle, and knotweed established at Schmidt Bar.



Himalayan blackberry clump at Richmond Island – Michael is holding loppers as high as the canes in the alder trees. This species impacts our ability to control knotweed.



Possible giant knotweed between Owl and Maple Creeks.



Large rhizome resprouting at Elk Creek side channel confluence with the mainstem Hoh River.

Series – digging out the new sprouted plant found on October 14th:



Appendix 1: Project Results - 2002-2009

River Bar	River Mile	2002	2003	2004	2005	2006	2007	2008	2009
Brandeberry	29.75	ns	4108	707	69	135	ns	256	1
Richmond ^a	28.5	-	-	-	-	ns	ns	216	170
Canyon Creek	28	932	1046	357	31	21	92	55	21
Lewis Channel	28	ns	505	509	36	104	ns	45	35
Owl Creek	27	869	4517	1053	238	117	ns	24	28
Fletcher Island	27	ns	ns	ns	ns	158	ns	55	8
Spruce Creek	27	49	ns	1078	58	239	220	115	41
Spruce Canyon	26	133	336	162	39	8	3	0	346
Spruce Canyon LB ^b	26	326	ns	ns	48	ns	ns	ns	11
Coontz' Bar	25	7	ns	ns	ns	23	ns	ns	doesn't exist
Coontz' LB	25	1925	136	47	ns	47	ns	ns	ns
Morgans	24	ns	15	215	67	15	191	80	58
Clear Creek	23	ns	729	556	36	15	52	110	19
Lindner	23	3299	3717	1227	303	819	303	394	109
Peterson's Bar	21.5	ns	559	206	387	62	191	99	7
Peterson's Bar West	21	ns	ns	821	ns	35	1052	18	91
Schmidt Bar ^c	20	1437	1798	217	35	94	80	1	0
Elk Creek	19.5	ns	ns	ns	639	384	66	580	250
Alder	19	ns	ns	ns	ns	326	218	0	0
Allen's Bar	15	ns	ns	ns	ns	25	ns	ns	ns
Allen's Bar II	15	ns	ns	ns	ns	60	ns	ns	ns
Hell Roaring	15.5	ns	ns	ns	ns	572	ns	ns	ns
Old Joe's Slough	14	ns	181	ns	14	43	ns	ns	ns
Baker	13	319	ns	857	224	124	ns	ns	ns
Dengate Island	12	ns	125	31	50	11	ns	ns	ns
Cottonwood	10.5	326	813	318	119	35	ns	15	1
Nolan Creek	8	ns	ns	ns	11	ns	ns	ns	ns
Nolan Bar	8	ns	ns	ns	ns	286	ns	1	0
Rayonier Bar	7	ns	ns	ns	ns	275	ns	ns	ns
G & L	6	ns	ns	ns	113	ns	ns	ns	ns
Lower G&L	5.5	ns	ns	ns	ns	132	ns	ns	ns
Fletcher Creek	2.5	ns	ns	102	ns	49	ns	ns	ns
Lower Hoh	1	ns	ns	ns	394	337	ns	ns	ns
		9622	18585	8463	2911	4551	2468	2064	1203

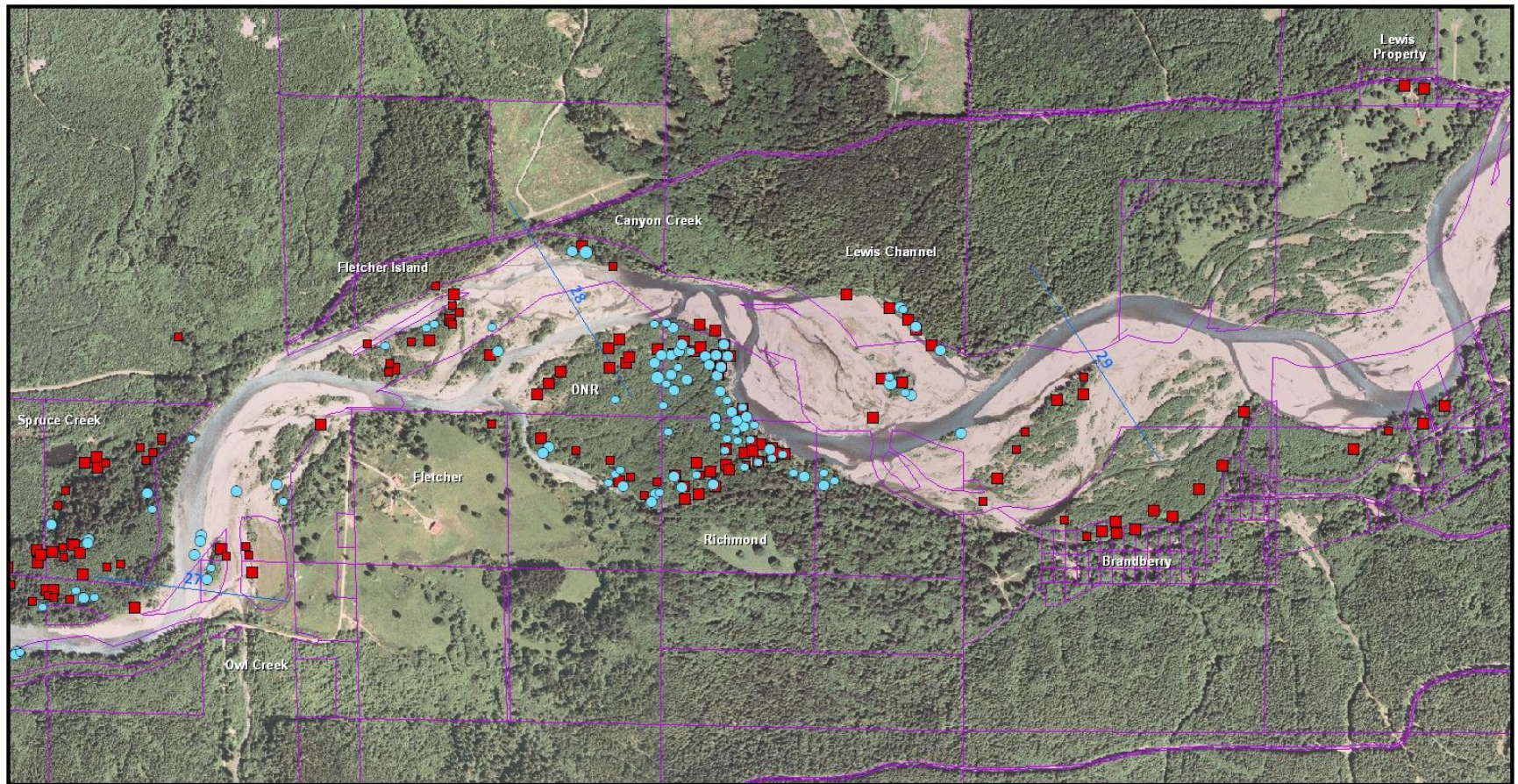
a This island and property were included in Brandeberry and/or Owl Creek from 2002 - 2005

b Spruce Canyon LB is Tower Creek from 2006 - 2009

c Schmidt Bar is greatly reduced in size due to channel migration

Appendix 2: GIS Map: RM 27 - 29 - Stem Count for Years 2008 and 2009

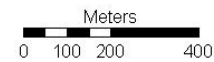
2008 & 2009 Knotweed Points Hoh River, Washington - Rivermiles 27-29



Knotweed Stem Counts

	2009	2008
●	1	■
●	2 - 10	■
●	11 - 50	■
●	> 50	■

— Rivermiles
 — Parcels



1 inch = 800 feet



NAD83 UTM 10N

2006 Digital Orthophoto

Appendix 3: 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>