KNOTWEED CONTROL ON THE HOH RIVER:

2007 SUMMARY REPORT

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Introduction

This report describes the objectives and results of work conducted in 2007 as part of a multi-year project to completely eradicate invasive knotweed (*Polygonum*) 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 supporting relatively healthy wild salmon populations. Compared with most other rivers in the state, there is relatively little riparian area negatively impacted by non-native plants (e.g. reed canarygrass, Scotch broom, and knotweeds), although rapidly-expanding populations of non-native blackberry (*rubus spp*.) are of increasing concern within the riverine corridor – and knotweed would certainly be a significant problem without control.

In 1998, one clump of the invasive knotweed (*Polygonum cuspidatum s. lat*.) 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 one plant was transported downstream during a winter storm event, 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 habitats, the Hoh Tribe initiated a project in 2002, 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, the U.S. Forest Service and the Northwest Indian Fisheries Commission.

Project objectives, methods, and results through 2006 are described in three previous reports available from 10,000 Years Institute:

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

Project Staff and Training

We began the 2007 project with a new project field team supervisor, and a new field crew comprised of a supervised ten-man community service crew from Washington Department of Corrections. Training in survey and control methods took place in early July at the Lindner Creek bar (RM 23), and was conducted over a two week period, to carefully calibrate crew 'eyes' to find the well-hidden small plants that predominate after five years of control work in this river system.

Survey and Control Summary

River miles (RM) 27 to RM 17 were covered in the period from August to October (the 2007 effective field season). The river migration zone is almost a mile wide in some areas, and constricted within bedrock canyons in others. We covered 913 acres, from mature forested

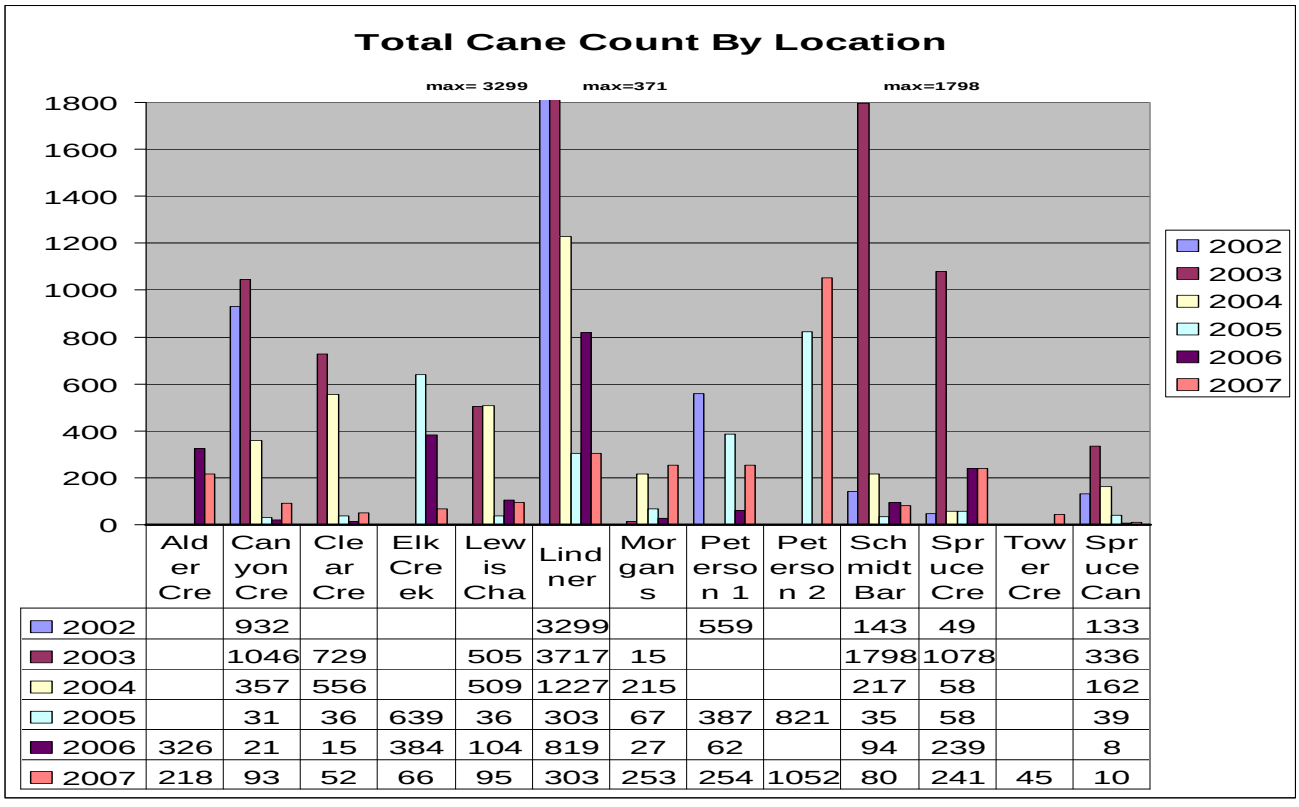
spruce terraces, across alder forested floodplains and willow thickets, and walking miles of cobble and gravel river bars, combing willow thickets and climbing over and through log jams.

Sites were logged with a Thales GPS unit. Small plants found on gravel bars, along river edges, and in low-lying alder stands were assumed to be new sites unless old canes or flagging was found. Old root crowns were observed at Lindner Bar and Peterson 1 with re-sprouting and physiological signs of glyphosate showing in the roots and stem.

Data collected in 2007 supports the observation that the downward trend in size and distribution of the knotweed infestation continues. Lindner Bar shows a 91% decrease from the original infestation, with 3299 stems in 2002 to 303 stems in 2007. Lewis Channel populations are reduced 82% from 505 stems in 2002 to 95 stems in 2007. The table below illustrates this trend.

Spruce Creek, a mature spruce forest located on a rarely flooded high terrace, showed no significant decrease in stem count in the previous two years but stems have been reduced 80% since 2003 and are much smaller - 1-5 stems and less than 3 feet tall; representing less biomass to spread to new locations during river migration. According to the 2006 GIS data, the 2007 site locations within Spruce Creek are located farther inland on the terrace this year; evidence that winter floods deposited knotweed plant material out to the outer edges of the floodplain. This site is a prime example of the highly unstable and dynamic characteristics of this river, and demonstrates that new infestations can be found in originally knotweed-free areas.

The increase in plant numbers from 2005-2007 in some sections of the watershed can also be attributed to plants missed the previous season, expanded survey areas, and new gravel bars formed by winter river migration.



	Alder Cre	Canyon Cre	Clear Cre	Elk Creek	Lewis Cha	Lindner	Morgans	Peterson 1	Peterson 2	Schmidt Bar	Spruce Cre	Tower Cre	Spruce Can
2002		932				3299		559		143	49		133
2003		1046	729		505	3717	15			1798	1078		336
2004		357	556		509	1227	215			217	58		162
2005		31	36	639	36	303	67	387	821	35	58		39
2006	326	21	15	384	104	819	27	62		94	239		8
2007	218	93	52	66	95	303	253	254	1052	80	241	45	10

Mapping

We use the most recent aerial photos available provided by the Hoh Indian Tribe and Olympic National Park; covering the entire river floodplain and channel migration zone, from the initial infestation to the mouth. 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 incoming tributaries, campgrounds, and historic or current landowners. These names were used to map each site where plants were found 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.

As in previous years, river migration in the winter of 2006 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 portions of the infestation are now gone, swept downstream. Section names previously applied to these locations refer to the named area previously treated and are not an exact location. Site specifics will corrected through a GIS analysis based on UTMs, but continue to be the basis of plant population comparisons from the previous seasons.

New Thales units, distributed by Magellan Navigation Systems, were used this year. We were able to download clipped raster data directly to the unit and then use the unit to manage the data using Arc Pad, a program installed directly on the unit (a smaller version of Arc View). This allowed us to make our data applicable and manageable right in the field without having to transfer the data to Arc View or a similar program later. In lay terms, we were able to view aerial photo images and parcel data, as well as past year's data on knotweed sites.

Olympic National Park was contracted to process the GPS data into GIS layers and maps. A series of maps from Lindner Bar are appended as an example of the project's results (please see Appendix 2).

Application Methodology and Discussion

Application of the herbicide glyphostate was accomplished largely by closely targeted foliar spray methods in 2007, 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.

The crew used occasionally used a low pressure Solo backpack sprayer or, more often, a hand-held one-liter spray bottle. We initially used a solution of 8% *Aquamaster* and 1.5% *Agri-dex* with *Blazon Blue* marker dye; but after concerns surrounding the strength of the solution and the inability of plants to translocate the high percentage solution to stems and roots, we changed to a solution of 6% *Aquamaster* and 1.5% *Agri-dex*.

Plants were so small and widely distributed that we used only 1.23 gallons of herbicide in the entire 2007 season.

Effectiveness Monitoring of 2007 Control Activities

Over 99% treatment effectiveness was documented in subsequent effectiveness surveys, except in the case of plants sprayed with an 8% solution of *Aquamaster* and 1.5% *Agri-dex*. In these few cases, the leaves were dead and brown, but the stems were still green. This implied the herbicide treatment was not reaching the stem or the rhizomes, only impacting the leaves themselves. The percentage of herbicide percentage must be low enough for the translocation process to take effect. There was also one incident of re-sprouting directly from the stem after the plant had been treated and the leaves had fallen off – this plant was retreated.

As previously noted, the solution was changed to 6% *Aquamaster* and 1.5% *Agri-dex*. Those plants spray- treated with the 6% solution demonstrated usual results; a slower and more consistent yellowing of the leaves and stem, resulting in plant death.

GIS Mapping and Database Update

The database has been updated with 2007 data and is available to researchers interested in the behavior of these species. GIS maps are available through the Institute, and examples are appended in this report (Appendix 2).

Presentations and Educational Outreach

Over the 2007 and early 2008 seasons, three presentations were made to the Olympic Knotweed Working Group, and one in Forks, Washington to the west end community including west Clallam and Jefferson counties. A copy of that presentation has been provided to NFWF and to the North Olympic Lead Entity Group.

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. Past reports, maps, and herbicide information was also provided over the course of the project. Project information was 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 three Olympic Knotweed Working Group meetings. Informative posters were posted at all Hoh River public boat launches and campgrounds.

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 – requiring repeat surveys in all locations each year. It would be helpful to double the size of the crew to 20 crew members as the knotweed becomes

smaller and more widely distributed, and therefore increasingly difficult to locate; requiring even more intensive and careful surveying.

A different herbicide could provide a better response with the problem of re-sprouting from underground rhizomes some distance from the treated plant. Knotweed rhizomes have been documented up to 50 feet from the plant. Experts surmise that in some cases the 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. Clallam County and Olympic National Park are both using the herbicide Imazapyr to treat knotweed, sometimes in a mix with *Aquamaster*. It is a soil-persistent herbicide that will move throughout the plant at a slower rate and will stay and attack the root structure and rhizomes of the knotweed plant longer, especially throughout the winter. Imazapyr is not known to have any effects on salmon populations, and is less toxic to plant species than is glyphosate, but further research into this topic is planned for the following season.

The cooperation of private landowners in the Hoh River valley is imperative to the success of this project. Suggestions for improving support of the project in lieu of concern over herbicide application include a series of continuing outreach and education projects within the local community including public and private meetings with landowners, question and answer sessions, and re-distribution of informative brochures and articles. This is an issue that impacts all of the river-adjacent landowners, the recreational public, and the Hoh Tribe – and we are working to communicate the importance of this project to the sustainability of Hoh River resources they enjoy.

Conclusions and Future Plans

Our control methods used have proven highly effective and a huge proportion of living knotweed plants on the Hoh River have been successfully eradicated, shifting the remaining population from large many-stemmed clumps to small single-stemmed plants. While significantly reducing the biomass available to start new plants, this creates another challenge - that of locating widely spaced, very small plants on a wide river floodplain over a distance of 30 miles in length.

A single missed plant is capable of spreading to many new locations when eroded during a flood event, requiring an entire river and floodplain survey to find the new locations where these fragments have produced new plants. Large rhizomes hidden in substrates may express only one small stem in a season, which retains the ability to resprout after that single stem has been treated and killed. We also need to develop a strategy for treating or removing the few large rhizomes found at water's edge, and are collaborating with the Knotweed Working Group on this issue.

Based upon new information about the ecology and persistence of plant fragment 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 to ten years, 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 members is necessary to adequately cover the entire floodplain, all the vegetated bars, and the upland terrace forests.

Funding will be sought in 2008 to implement another complete river survey and control effort, engaging partners and additional crew where possible. With funding, we'll be back surveying and controlling plants, starting upstream and moving down. We plan to begin fieldwork in mid to late July 2008. We will continue to participate in the Olympic Knotweed Working Group, and to share project results with interested parties and in appropriate forums.

Tiny knotweed plant hidden in a log jam

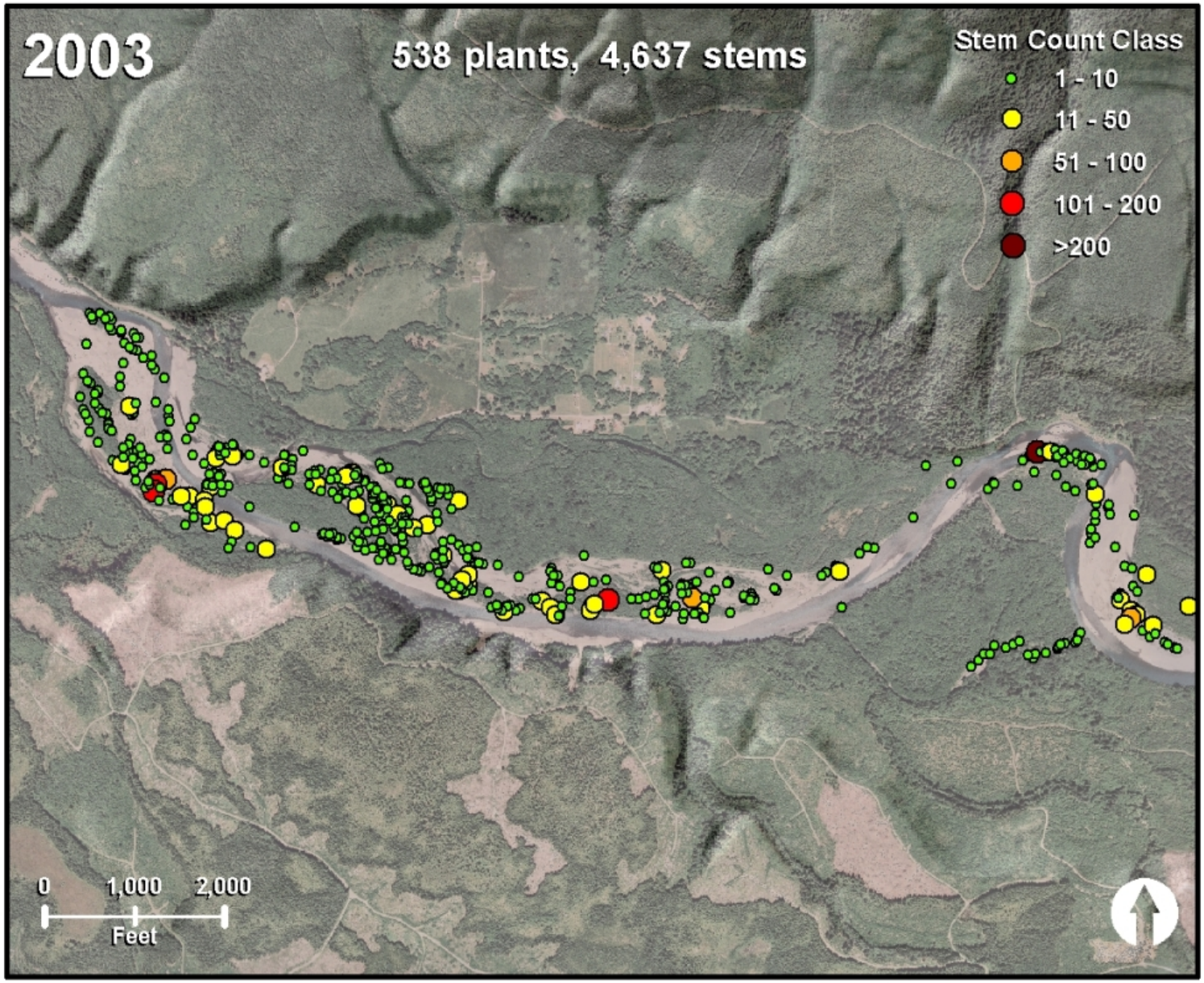
Knotweed plant, less than 2 feet in height, in native plants

Grid surveys in high terrace mature spruce forest

Appendix 1: Hoh River Knotweed Control Project Results – 2002 – 2007 (ns = no survey in that year)

Number of Canes by Year, River Bar, and River Mile								
River Bar	**River Mile**	**Total # Canes**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Brandeberry	29.75	5019	ns	4108	707	69	135	ns
Canyon Creek	28	2479	932	1046	357	31	21	92
Lewis Channel	28	1154	ns	505	509	36	104	ns
Owl Creek	27	6794	869	4517	1053	238	117	ns
Fletcher Island	27	158	ns	ns	ns	ns	158	ns
Spruce Creek	27	1644	49	ns	1078	58	239	220
Spruce Canyon	26	681	133	336	162	39	8	3
Spruce Canyon LB	26	374	326	ns	ns	48	ns	ns
Coontz' Bar	25	30	7	ns	ns	ns	23	ns
Coontz' LB	25	2155	1925	136	47	ns	47	ns
Morgans	24	503	ns	15	215	67	15	191
Clear Creek	23	1388	ns	729	556	36	15	52
Lindner	23	9668	3299	3717	1227	303	819	303
Peterson's Bar	21.5	1405	ns	559	206	387	62	191
Peterson's Bar West	21	1908	ns	ns	821	ns	35	1052
Schmidt Bar	20	3661	1437	1798	217	35	94	80
Elk Creek	19.5	1089	ns	ns	ns	639	384	66
Alder	19	544	ns	ns	ns	ns	326	218
Allen's Bar	15	25	ns	ns	ns	ns	25	ns
Allen's Bar II	15	60	ns	ns	ns	ns	60	ns
Hell's Roaring	15.5	572	ns	ns	ns	ns	572	ns
Old Joe's Slough	14	238	ns	181	ns	14	43	ns
Baker	13	1524	319	ns	857	224	124	ns
Dengate Island	12	217	ns	125	31	50	11	ns
Cottonwood	10.5	1611	326	813	318	119	35	ns
Nolan Creek	8	11	ns	ns	ns	11	ns	ns
Nolan Bar	8	286	ns	ns	ns	ns	286	ns
Rayonier Bar	7	275	ns	ns	ns	ns	275	ns
G & L	6	113	ns	ns	ns	113		ns
Lower G&L	5.5	132	ns	ns	ns	ns	132	ns
Fletcher Creek	2.5	151	ns	ns	102	ns	49	ns
Lower Hoh	1	731	ns	ns	ns	394	337	ns
		46600	**9622**	**18585**	**8463**	**2911**	**4551**	**2468**

Appendix 2 – GPS Maps: Lindner Bar Plant and Stem Count for Years 2003, 2004, and 2007



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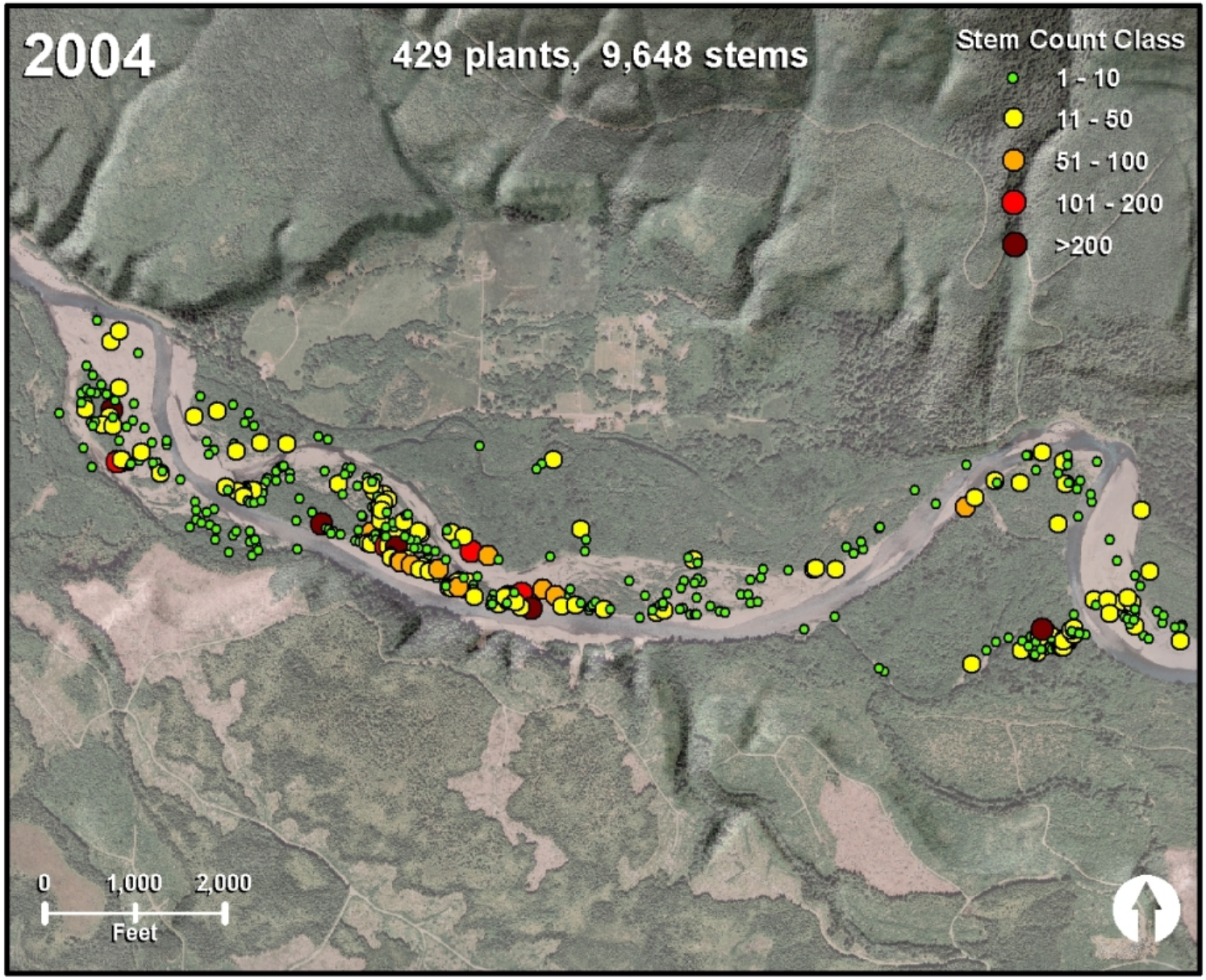

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