Hybrid Knotweed Control–Demonstration Project

Restoring Anadromous Fish Habitat in the Lapwai Creek Watershed

March 1, 2005 to February 28, 2006

Results Report

March 30, 2006

NEZ PERCE SOIL AND WATER CONSERVATION DISTRICT

Hybrid Knotweed Control – Demonstration Project

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Introduction

The Hybrid Knotweed Control Demonstration Project is a component of the *Restoring Anadromous Fish Habitat in the Lapwai Creek Watershed* project. This report summarizes the demonstration project results.

The *Restoring Anadromous Fish Habitat in the Lapwai Creek Watershed* is a Bonneville Power Administration (BPA) funded habitat restoration project located near Lapwai, Idaho. The Nez Perce Soil and Water Conservation District (District) (Figure 1) received BPA funds in 2002. The purpose of this project is to protect and restore steelhead habitat in the Lapwai Creek watershed. The project consists of three components: 1) collection of inventory data to determine location and type of habitat limitations, 2) selection and design of treatments to improve limitations, and 3) implementation of treatments.

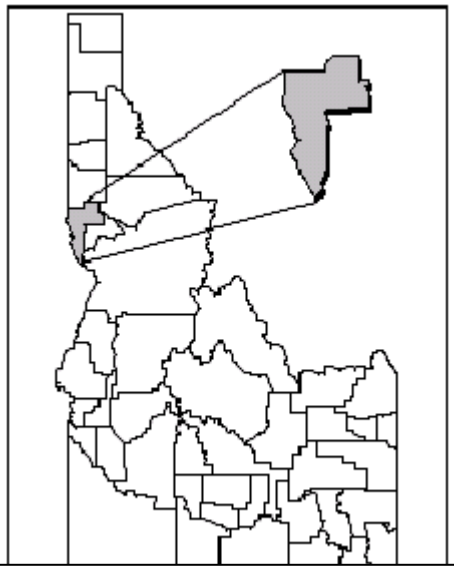

Figure 1. Nez Perce Soil and Water Conservation District Location Map

The Lapwai Creek watershed is located in Nez Perce and Lewis Counties, Idaho, and encompasses 175,000 acres. Elevations range from 1,100 to 4,500 feet with precipitation ranging from 14 to 24 inches per year. Lapwai Creek is located within the watershed, and is a steelhead spawning and rearing stream. Steelhead habitat in the watershed is limited by lack of instream structure, high water temperatures, low summer flows, and sediment.

A lack of riparian vegetation was identified as contributing to the habitat limitations. These limitations include: poor instream cover (from lack of woody debris), high water temperatures (lack of vegetation to provide shade), low summer flows (low organic matter in banks to store water) and sediment (lack of root mass in streambanks to prevent erosion). Weeds are a major concern in the ability to establish riparian vegetation. One of the weeds identified is hybrid knotweed (*Polygonum bohemicum*).

The 2003 stream inventory data indicated that hybrid knotweed was a concern in the Mission Creek tributary of Lapwai Creek (Figure 2). However, the 2004 data shows that the weed is more widespread than originally thought, with large populations in Tom Beall, Garden Gulch, and lower Mainstem Lapwai Creek. The control of this weed in potential restoration areas needs to occur prior to restoration activities.

The demonstration project was developed to identify treatment methods and educate landowners. The demonstration project results will be used to develop a watershed-wide hybrid knotweed treatment strategy.

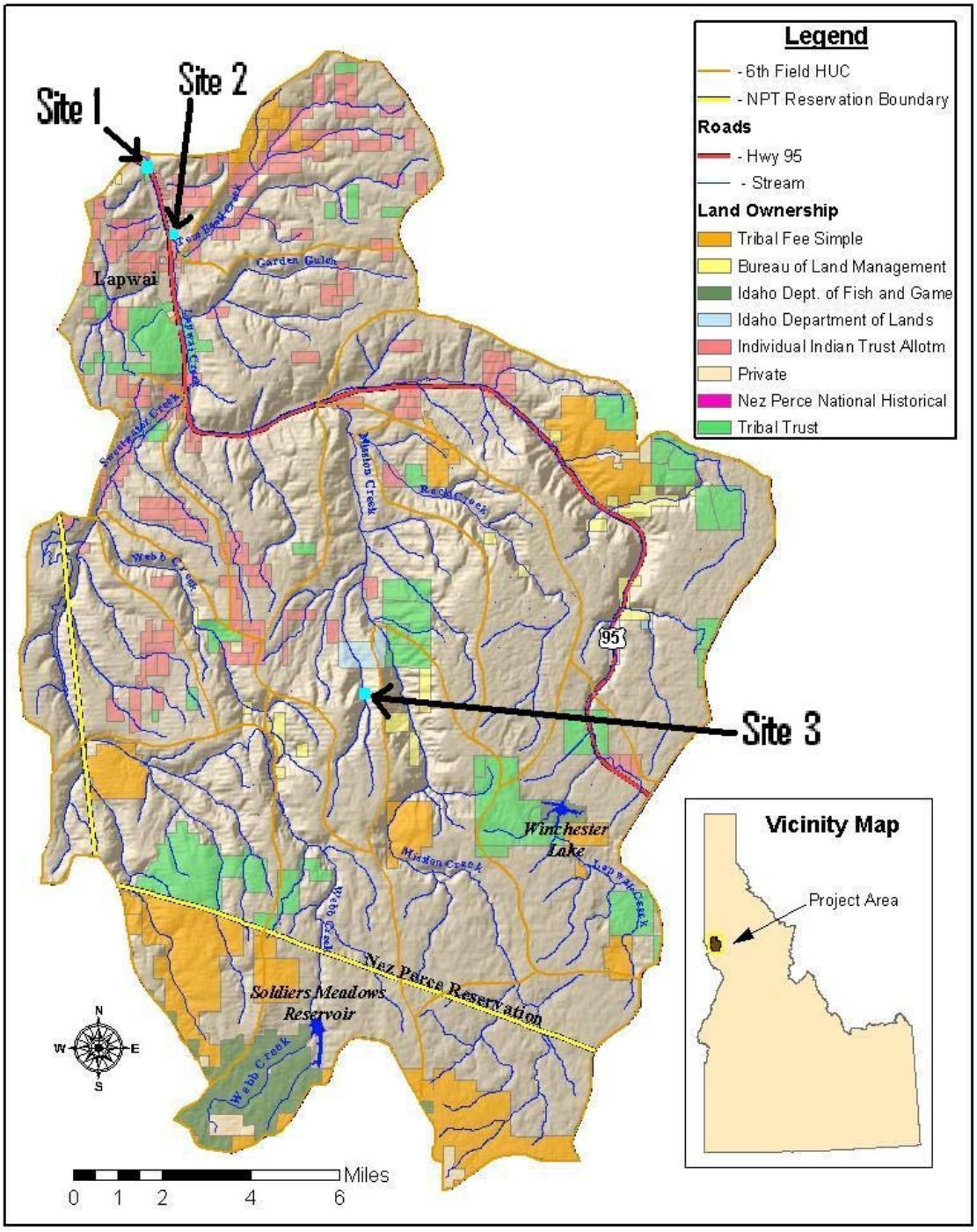

Figure 2. Demonstration Project General Location Map

Project Objectives

1. Evaluate chemical and mechanical control methods for hybrid knotweed, *Polygonum bohemicum*.
2. Demonstrate potential methods for control.
3. Educate watershed landowners about hybrid knotweed.

Hybrid Knotweed Review

Biology

Figure 3. Hybrid Knotweed Infestation

Hybrid knotweed, *Polygonum bohemicum,* also known as Bohemium knotweed, is a hybrid cross between Japanese knotweed, *P. cuspidatum,* and giant knotweed, *P. sachalinense*. It is a tall, shrub-like perennial herbaceous plant in the buckwheat family Polygonaceae. Invasive knotweeds, such as Japanese knotweed, giant knotweed, and hybrid knotweed, are similar in appearance. The basal root crown of hybrid knotweed in particular will produce 30-50 stout 4-12 foot bamboo-like shoots forming dense thickets. The hollow reddish-brown canes are about one inch in diameter with swollen nodes three to five inches apart, and the stems have a thin, papery sheath. The lower two segments may be water-filled, depending upon soil moisture levels. Although the leaves vary, they are normally six inches long, three to four inches wide, and broadly oval to somewhat triangular. They are mostly pointed at the tip, and are alternate on the stems.

Hybrid knotweed plants arise from fibrous roots and produce a spreading rhizome system, possibly from each major shoot, that may extend 25-40 feet or more and penetrate more than seven feet into the soil. The plant can also vegetatively propagate with as little as a one half inch piece of stem or rhizome. Plant fragments that wash downstream or are moved in contaminated soil can readily lead to new infestations. Hybrid knotweed grows to form large, dense thickets in almost any environment with at least temporary damp soil, such as riparian zones along rivers and streams, disturbed uplands, crop field edges, city lots, and forest edges. This non-native plant prefers sunny locations, but it can exist in nearly complete shade with reduced growth.

The plants produce tiny greenish white flowers in late July through August. The flowers are found in branched clusters from leaf axils near the ends of the stems. They are showy, plume-like inflorescences in open sprays that produce small, winged fruit. Seeds are transported by water, short distances by wind, and in attached mud. Seeds of Japanese knotweed are not fertile in the United States; however, the seeds of hybrid knotweed are fertile. After flowering, plants die back in the fall following a hard frost, but bare stalks often remain through the winter.

Impacts

Due to early emergence in spring and a rapid growth rate, knotweeds out-compete native plants by competing for light, moisture, and nutrients. The plants can completely clog small waterways, displace native vegetation due to its aggressive growth, reduce stream shade by prohibiting tree growth, and create bank erosion problems, thus warranting it as a flood hazard. The ecological impacts of this plant lead to a decrease in riparian habitat for salmon and other fish, wildlife, and river systems.

Control

Eradication attempts vary in success and usually require several years of treatment. A literature review was completed prior to selecting the methods for the demonstration. Three treatment methods were found in the review: biological, mechanical, and chemical.

Biological treatments are in the testing phase and no biological control agents are available at this time.

Mechanical treatments include hand pulling, digging, cutting, tilling, shading, and burning. Hand pulling new growth is available if the soil is soft. Pulling reduces the plant root mass; however, this method requires weekly monitoring and removal of new sprouts. When digging with hand tools and mechanized equipment, care needs to be taken as rhizome fragments can be spread while the soil disturbance will allow new plants to establish.

Using equipment to dig out rhizomes in combination with an herbicide treatment may be effective because the digging will stimulate rhizomes to produce a higher density of stems and make the plant more vulnerable to chemical treatment. The rhizomes should be dug in the dormant season and herbicides used in the growing season.

The cutting method involves manually cutting the vegetative portion of the plant; however, this method is labor intensive and plant parts are easily spread. Three cuttings are needed each year during the growing season and senescence or just after flowering for up to three years. Cutting may stimulate new growth, but it results in a reduction in rhizomatous reserves.

Tilling physically disturbs the root system, but leads to many resprouts. Tilling may be effective as part of an integrated pest management program in combination with other treatments.

To shade the plants, cut them to the ground and shade them with plastic or cardboard. Studies have shown that high light environments promote knotweed growth; however, no long-term reports are available on the success of this method.

Finally, a controlled burn of the stem and crown material will reduce the viability and volume of material. Burning concerns include air quality pollution and safety concerns. Scorching is similar, but a propane burner is used to heat the stems.

Chemical treatments include foliar spray and wiping herbicide applications and injection methods. Foliar method applications spray herbicide on the foliage of the plant. Herbicides used include glyphosate or triclopyr at a 2% solution with a 0.5% solution of non-ionic surfactant. Foliar sprays should be applied when air temperatures are greater than 65°F. Foliar applications of glyphosate at 4 pounds of active ingredient per acre should be applied three times: once in June, once in August, and once in August of the following year. Wiping involves cutting the stems 2 inches above the

ground surface and then brushing the chemical on the cut surface of the stem. Glyphosate and triclopyr are used at rates from 25-50% concentration. Finally, injection of herbicides into the plant can be made. Injections of 5 ml of 100% glyphosate are usually used.

Methods

Site Selection – Three sites were selected. Site selection was based on ease of access to site, sufficient stand size to demonstrate all treatments, and a representative portion of the watershed. Figures 4, 5 and 6 illustrate the treatment areas along Mission Creek and Lapwai Creek.

Site inventory - Inventory data collected at each site includes physical site data such as soil type, existing vegetation, and plant density. Density is designated as the number of stems per square foot. Table 1 lists the physical site data for each location.

Plot Layout - Site location was based on density of plants and a weed population sufficient to complete all treatments. Plots are 100 square feet, although the foliar application plots were larger.

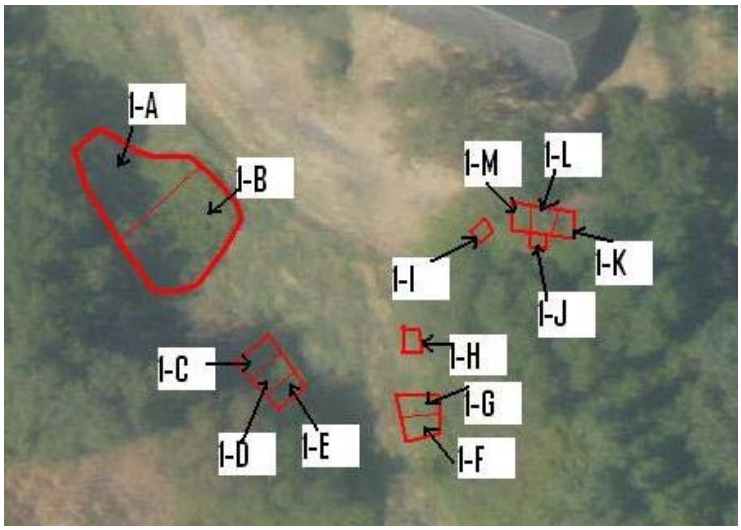

Figure 4. Site 1 Plot Location Map

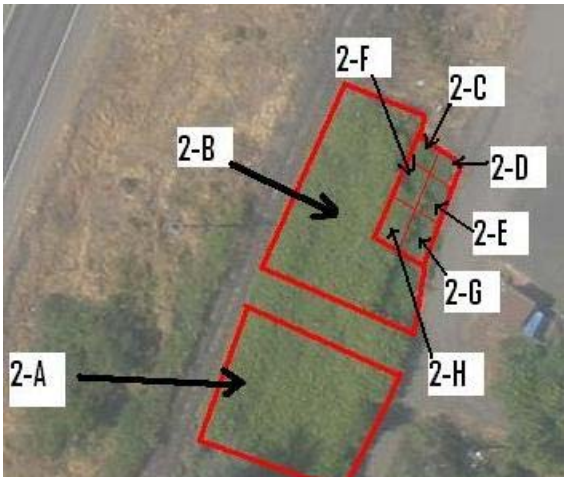

Figure 5. Site 2 Plot Map

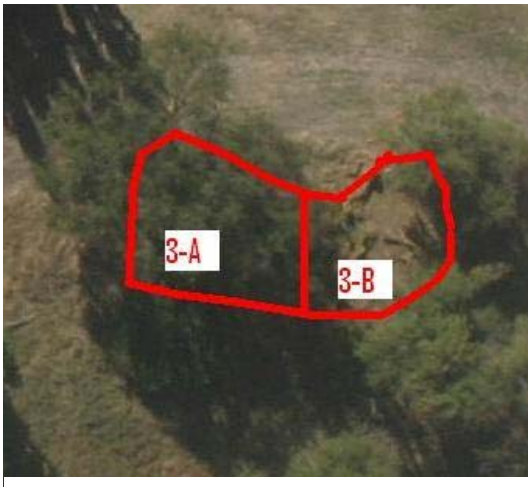

Figure 6. Site 3 Plot Map

Materials - Materials needed include 6 mm black plastic, air temperature gauges, loppers, string, stakes, survey paint, tarps, and railroad ties.

Data Collection – Data collection consists of photographs, air temperature measurements, soil type, precipitation data, growth measurements, and stem counts (Table 1). Photo

documentation is completed pre- and post-treatment. Knotweed plants were harvested during June 2005. The plots were bundled and dried to weigh for treatment comparisons. Climate data is obtained from the Lewiston climate station. Air temperature is measured by using ONSET corporation Hobo temperature gauges set to record on hourly intervals.

Table 1. Physical Site Data

Site Number	Soil Type	Precipitation from 7/1/04 to 12/31/04 (inches)	Precipitation from 7/1/04 to 6/30/05 (inches	Elevation (feet)
1	Lapwai- Bridgewater Complex (silt loam)	5.71	13.31	800
2	Tom Beall Silt Loam	5.71	13.31	880
3	Linville-Waha Complex (silt loam)	5.71	13.31	2,080

Treatments - Fifteen treatments applied in 2004 were selected based upon available literature. The treatments are described in Table 2.

Table 2. Demonstration Project Treatments

Treatment Number	Treatment Name	Description
1-A	Foliar – 2.22% 2,4-D	Treatment was completed on 10/8/04 after plant flowering. A 48 ft x 20 ft plot was sprayed with Crossbow - recommended label rate 192 ounces per acre or 2.22% mixture of 4.24 oz on the plot with an additional 0.32 oz of surfactant. Air temperature was 72°F with a 2 mph breeze from the west. Application used a hand pump to thoroughly wet all foliage. Approximately 1-2% of the plants were yellowing.
2-A	Foliar – 48 oz/Ac glyphosate	Treatment date was 10/18/04. Air temperature was 64°F with a 10 mph breeze from the southwest. A 40 ft X 40 ft plot was sprayed with Credit Extra - recommended label rate for non-cropland habitat management rate 48 oz per acre or 1.8 oz on the plot with an additional 0.32 oz of surfactant.
3-A	Foliar – 48 oz/Ac glyphosate	A 40 ft X 40 ft plot was sprayed with Credit Extra - recommended label rate for non-cropland habitat management rate 48 oz per acre or 1.8 oz on the plot with an additional 0.32 oz of surfactant. Plot sprayed on 10/8/04 with an air temperature of 68°F and a slight south breeze. Approximately 1-2% of the plants were yellowing.

Treatment Number	Treatment Name	Description
1-B	Foliar – 48 oz/Ac glyphosate	Treatment was completed on 10/8/04 after plant flowering. A 40 ft x 40 ft plot was sprayed with Credit Extra - recommended label rate 48 oz per acre or 1.1 oz on the plot with an additional 0.32 oz of surfactant. Air temperature was 72°F with a 2 mph breeze from the west. Application used a hand pump to fully wet all foliage. Approximately 1-2% of the plants were yellowing.
2-B	Foliar – 3.7% 2,4-D	Air temperature on treatment day was 64°F with a 10 mph breeze from the southwest. Treatment date was 10/18/04. Plot sprayed with Crossbow (spraying full sized plants), recommended label rate was 192 oz per acre – equating to a 3.7% mixture of 7.1 oz on the plot with an additional 0.32 oz of surfactant.
3-B	Foliar – 3.7% 2,4-D	A 40 ft X 40 ft plot sprayed with Crossbow (spraying full sized plants), recommended label rate was 192 oz per acre – equating to a 3.7% mixture of 7.1 oz on the plot with an additional 0.32 oz of surfactant. Air temperature at time of treatment was 68°F with a slight south breeze. Approximately 1-2% of plants were turning yellow at the time of application. Application date 10/8/04.
1-C	Cut to 6" post-flowering	Treatment was completed on 10/8/04 after plant flowering prior to dormancy. A 10 ft x 10 ft plot was treated by cutting the stems 6 in above ground surface using loppers. Cut materials were dried on tarps and then composted.
2-C	Cut to 12" and wiped stem with 16% 2,4-D	A 10 ft x 10 ft plot was treated. Stems were cut after flowering to 12 in above ground surface and wipe with Crossbow. Label recommends diesel fuel as a carrier to be brushed on. This method was not used, instead 66% water, 16% surfactant, and 16% full rate of Crossbow was mixed and then wiped across 100% of the cut stem surfactant. Air temperature on treatment day was 64°F with a 10 mph breeze from the southwest. Treatment date was 10/18/04.
1-D	Cut to 6" and covered post-flowering 2' beyond edge	Treatment was completed on 10/8/04 after plant flowering prior to dormancy. A 10 ft x 10 ft plot was treated by cutting plant stems 6 in above ground surface with loppers. The plot was then covered with 6 mm black plastic sheeting secured with railroad ties. Sheeting extended 2 ft from treatment area edges.
2-D, 2E, 2G	Cut to 10-12" post-flowering	Three 10 ft x 10 ft control plots were measured. All knotweed was cut off to a height of 10 to 12 in. Plants were cut on 10/17/04.
1-E	Cover post-flowering	Treatment was completed on 10/8/04 after plant flowering prior to dormancy. A 10 ft x 10 ft plot was treated by covering entire plants with 6 mm black plastic sheeting secured with railroad ties.

Treatment Number	Treatment Name	Description
1-F	Injection post-flowering	Treatment was completed on 10/18/04 after plant flowering prior to dormancy. A 10 ft x 10 ft plot was treated by cutting plant stems approximately 12 in above ground surface. Aquamaster (glyphosate) was injected in each stem below the second node using 5 ml per injection, injecting 88 total stems. Stems were cut on 10/6/04. Air temperature was 64°F with a 10 mph breeze from the southwest on the treatment date.
2-F	Injection – post-flowering	Treatment date was 10/18/04. Air temperature on treatment date was 64°F with a 10 mph breeze from the southwest. A 10 ft x 10 ft plot was treated by cutting knotweed stems to 12 in above the ground. An injection tool was used to inject Aquamaster into the stem below the second node. A rate of 5 ml per injection was used. 30 total stems were treated. Stems were cut on 10/12/04.
1-G	Cut to 12" and wiped stem with 25% glyphosate	Treatment was completed on 10/18/04 after plant flowering prior to plant dormancy. A 10 ft x 10 ft plot was treated by cutting stems to within 12 in of the ground surface. Cut stems were then treated using a wipe method with Aquamaster (glyphosate) at 25% strength and 75% water, adding one ounce of surfactant. 100% of the stems were wiped. Air temperature was 64°F with a 10 mph breeze from the southwest on the treatment date.
1-H	Cut to 12" and wiped stem with 16% 2,4-D	Treatment was completed on 10/18/04 after plant flowering prior to plant dormancy. A 10 ft x 10 ft plot was treated by cutting stems to within 12 in of the ground surface. Cut stems were then treated using a wipe method with Crossbow (2,4-D). The label recommends diesel fuel as a carrier to be brushed on, instead a 66% water, 16% surfactant, and 16% full rate Crossbow was used to wipe 100% of each stem. Air temperature was 64°F with a 10 mph breeze from the southwest on the treatment date.
2-H	Cut to 12" and wiped stem with 25% glyphosate	A 10 ft x 10 ft plot was treated by using 25% full strength Aquamaster and 75% water, adding 1 oz of surfactant. All stems were cut to 12 in high on 10/12/04. The Aquamaster solution was applied on 10/18/04 by wiping all stems. Air temperature on treatment day was 64°F with a 10 mph breeze from the southwest.
1-I	Control	The control plot was staked as a 10 ft x 10 ft plot and no treatment.

Treatment Number	Treatment Name	Description
1-J	Cover pre-flowering	Treatment was completed 7/6/04 prior to plant flowering. A 10 ft x 10 ft plot was covered with 6 mm black sheeting cover. Plastic sheet was secured with railroad ties.
1-K	Cut to 6" and cover pre-flowering to 2' beyond edge	Treatment was completed on 7/6/04 prior to plant flowering. Using loppers, knotweed stems were cut 6 in above ground surface. The 10 ft x 10 ft plot was covered with 6 mm black plastic sheeting secured with railroad ties. Sheeting extended 2 ft beyond plot edges. Cut materials were dried on tarps and composted.
1-L	Cut to 6" pre-flowering	Treatment was completed on 7/6/04 prior to plant flowering. Knotweed stems were cut 6 in above ground surface using loppers. Cut materials were dried on tarps and removed materials were burned.
1-M	Cut to 6" and covered pre-flowering to 4' beyond edge	Treatment was completed on 7/6/04 prior to plant flowering. Using loppers, stems were cut to 6 in above ground surface and covered with 6 mm black plastic sheeting. Sheeting was secured with railroad ties. Sheeting extended 4 ft from treatment area edges. Cover was left for 8 months.

Data Summary and Conclusions

Treatment effectiveness was monitored in 2004 and 2005. Knotweed plants were harvested from treatment plots in June 2005. Harvested plants were then bundled, dried, and weighed for treatment comparisons.

The injection treatment plots were the most effective with 97% mortality in the plots.

The cut and cover treatments were effective, with approximately 60% plant mortality. No difference was noted from the timing of covering.

The cut and wipe with chemical treatments resulted in approximately 80% plant mortality.

The foliar treatments resulted in approximately 23% plant mortality.

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