Controlling Knotweed
(Polygonum cuspidatum Sieb. & Zucc.)

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Background

Knotweed Distribution:

Japanese knotweed and other closely related species have been found in almost every county in Washington State. Japanese knotweed is designated as a Class 'C' Noxious weed in Washington State. It ranges from Alaska to California east through most of the upper Midwest, and has heavily infested the northeast region of the United States and areas of the south and southeast. Japanese knotweed is found in natural areas, parks, gravel bars and along riverbeds and stream banks, rights-of-way, and roadsides. It is also found in riparian areas, and upland sites. Japanese knotweed thrives in moist soils, or where roots are able to grow into moist soils. Plants often become established after being discarded from cultivated gardens, or as escapes from abandoned home sites. When a Japanese knotweed stem segments with viable nodal buds, and the buds come into contact with moist soils, buds will sprout and send roots into the soil and become quickly established. The movement of Japanese knotweed along waterways and natural areas occurs from plants being broken-off during high water or flooding events, and from animals cutting plants for nesting or lodge building purposes, and viable buds becoming established downstream. The spread of Japanese knotweed also occurs from mechanical mowing and the unintentional transport of cut rhizome segments into neighboring landscapes.

KNOTWEED BIOLOGY:

Japanese knotweed, a member of the buckwheat family (Polygonaceae), it is an upright, herbaceous, shrub-like perennial that often grows to heights in excess of 10 feet. As with all members of this family, the base of the stem above each joint is surrounded by a membranous sheath. Stems of Japanese knotweed are smooth (bamboo-like), stout, and are swollen at the joints where the leaf joins the stem. Although leaf size varies depending upon environment conditions, age, and other factors, they are normally about 6 inches long, and 3 to 4 inches wide, broadly oval to somewhat triangular, and mostly pointed at the tip, and are alternate on the stems. The stems are hollow, but may be water-filled depending upon soil moisture levels, time of year, and area it is growing. The lowest one to two nodes may often be full of water. Seed may not be borne under all growing situations, and normally not under conditions found outside the native range of Asia. Small, pale greenish-white flowers occur in attractive, branched sprays in summer, and are followed shiny, very small about 1/10 inches long. Plants

grow quickly and often form large thickets or patches. The roots of Japanese knotweed are rhizomes that may extend 30 feet in length. Buds along the length of rhizomes may develop into new stems depending upon environmental and cultural conditions. Digging around the base of established plants, or severing roots encourages new vegetative buds to develop along the plant's rhizome system. Nodes around the root crown and shoots along the rhizomes appear in early spring around March. Above ground plants are usually killed by the first frost in fall.

Note: Care must be taken during Japanese knotweed control operations to prevent placing viable plant material, or disposing of cut Japanese knotweed stems, in areas that may lead to further infestations. Use of bio-barriers such as thick cardboard, tarps, or other non-permeable materials would be preferred materials to prevent wider spread of Japanese knotweed. Once plants have completely become devitalized, the barrier can be removed.

JAPANESE KNOTWEED CONTROL STRATEGIES:

The following information is designed to provide control options depending upon:

1. **The type of infested site**
2. **Level of infestation**
3. **Equipment available**

Herbicide choices and rates vary depending upon **SPECIFIC SITE** and **APPLICATION METHOD**.
Note: Manual methods such as grubbing, cutting, and removal of top growth have not been successful for long-term control and may actually exacerbate the problem further by encouraging new growth from rhizome segments.

Vinegar (5% acetic acid), and salt applications to cut surfaces of the cane have been completely ineffective in providing long-term control.

CONTROL STRATEGIES AND RECOMMENDATIONS

DISCLAIMER:

The following information is provided from summaries of data and observations from numerous experimental studies and commercial operations carried out over the past several years in southwestern Washington State, and northwestern Oregon. Consult the labels of products listed within the recommendations for specific restrictions and use guidelines, as well as contacting local or state regulatory officials regarding any labeling; licensing and permitting that may be needed by the applicator for specific Japanese knotweed control applications.

The intent of this work was to focus on riparian areas, where Japanese knotweed seems to propagate more rapidly. Recommended methods resulted from proven results and factors surrounding ESA issues, environmental and total program costs.

APPLICATION METHODS:

I. FOLIAR APPLICATION

Foliar Applications are those applications made with spray equipment designed to apply small droplets over the entire plant (stems and leaves). These may be made with backpack applicators or hose-end sprayers. Applicators should use care to treat only the target species, and not desirable neighboring vegetation.
Herbicides available depending upon the sites identified include the following.

Herbicide Rates and Uses:

Aquamaster®	All Sites	Rate: 8 % v/v*****

Note: Depending upon site infestation, foliar applications may require re-treatment during the growing season and possible follow-up treatment in successive years.

***** = volume to volume (herbicide:water)

Aquamaster + Habitat® ****** (aquatic approved product containing 2#/gallon imazapyr)

Aquamaster 5-8 % v/v plus Habitat 0.5-1% v/v

****** Note. Habitat has both post-emergence foliar plus soil activity. Use of this product may impact follow-up planting options. Read all products labeling for Habitat prior to use.

This use may not be labeled in all states.

II. Cut Stem Application

Cut stem applications are made by cutting the Japanese knotweed stem between the first and second internode, and delivering the herbicide into the "well'" created by cutting the internode in half. Approximately 20-40 mls are delivered into the well using this method. Depending upon the site, several herbicide options (listed below) exist for this application method.

Note: Follow recommendations noted above under Biology, for care of cut plant material to avoid further spread of the weed.

Roundup Pro®	Upland & Riparian Sites	Rate: 50% + 50% water
Aquamaster	Upland & Riparian Areas	Rate: 50% + 50% water
Roundup Pro + Arsenal® (Growing Season only)	Upland Sites Only	Rate: 50% + 25% + 25% water
Roundup Pro +Garlon 3A™	Upland Sites	Rate: 50% +25% + 25% water (Growing Season only)

Note:

Cut stem applications have proven to be about 95% effective on mature plants. Applications made during early season growth often results in partial control. For regrowth applications, allow plants to reach at least four (4') feet in height, before making the second cut stem or stem injection application. Waiting for this height, insures the second treatment will be effective.

III. Stem Injection

Stem injection applications are those applications made in the lower portion of the Japanese knotweed plant in the first few internodes above the ground level. In 2004, the J. K. injection tool™ was commercially introduced following several years of testing and has been found to be a very effective tool for the individual stem injections using Aquamaster herbicide that meters the labeled 5cc/mls of product per injection. The needle is inserted perpendicular to the stem, and midway between lower nodes. The applicator squeezes the trigger and the pre-set amount of Aquamaster is delivered into the stem cavity. Consult the Aquamaster herbicide product labeling to determine specific use recommendations and specific use guidelines.
Note: For information on the JK injection tool visit: ***JKinjectiontools.com*** on the internet. Check the Aquamaster label to determine the maximum number of stems that are treatable per acre using the JK injection tool.

Supplemental labels have been approved for several states; please check with your state pesticide registration division for current approvals.

The injection process in riparian areas has been the most effective against plant regrowth, as well as selective to the Japanese Knotweed and poses limited threats to neighboring vegetation. The use of Aquamaster injected into each stem/cane gave total control with no regrowth occurring following treatment for 36 months. With this method there is no need to cut canes, or handle viable plant material for disposal. Simply inject them and walk away. If 40 of 50 canes in an area are injected, expect that the 10 canes NOT injected/treated to survive and spread. Each cane develops its own rhizome system. The injection process is more cost effective compared to making several trips to sites to re-spray foliar applications. Injections can be made anytime during the growing season with good success, with early June being the preferred timing as most canes have developed. The injection method relies less upon weather factors than other control options, and the herbicide is contained in the plant.

Stem injection applications are those applications made just below the first or second node above the ground. In addition to the JK injector tool, a simple probe can be used to create a small opening in the stem on either side just below the node. This allows pressurized water to escape while the syringe metered to inject 5 cc/mls of Aquamaster, delivers the treatment dose on a downward diagonal through one of the two holes closest to the applicator. The second hole will then allow the pressurized water to escape if the node is full of water. Plants will normally take up the herbicide within 20 minutes of the injection.

Herbicide Rates and Uses for stem injection include the following:

Aquamaster®	Riparian Sites	Rate 100% (5cc/mls)

Field Observations:

During recent test trial periods on Japanese knotweed, evaluators noted that when plants were injected above the third internode or segment, that only the upper portion of the cane was affected. The day after application, the area above the injection site had wilted and collapsed. On applications made at the same location within the first two segments, above the J. Knotweed root crown, no herbicide symptoms were observed during the first week. After that period, plants showed herbicide symptomology of leaf curling and yellowing. This may suggest that injection applications made above the second internode region are unable to completely translocate the herbicide to the roots prior to disruption or collapse of the conductive tissue. This phenomenon occurred in the spring time when most photosynthate is moving up in the plant as opposed to later in the year as photosynthate is being sent to the roots and rhizome structures. In those situations, aggressive regrowth occurs later in the same growing season of treatment. For best results, use the stem injection system described earlier, especially during late spring and early summer applications.

Update:

Observations made from commercial applications in 2003 and 2004 indicated that under some unusually heavy winter rainfall conditions, non-target plants developed herbicide symptomology. Understanding the conditions where these limited events occurred is critical for making successful applications in the future. In the situations where injury resulted, large numbers of plants had been treated, and soils became saturated with winter rain events. It is likely that glyphosate was released from treated root systems ('leaked-out' of roots that were breaking-down) and became available to neighboring plant roots sharing the same space in the water saturated soil solution. In soils that are light in texture, such as sands, where fewer herbicide-binding sites exist to tie-up or bind the glyphosate to mineral soils making it herbicidal inactive; it is likely that these non-target plants accumulated enough glyphosate to show herbicide injury symptoms into the following year. These symptoms included, late leaf emergence and small misshaped leaves. While rarely seen with foliar applications, these events are known to occur, and would be predicted to occur in low organic matter soils, or in mineral soils with fewer binding sites.

Secondly, in 2004 applicators using rates less than 5cc's per injection achieved 75% control. Where application rates were maintained at the recommended 5 cc's per injection, a control rating project-wide was 85% control. This difference in control amounts to an additional 10,000 stems project-wide requiring treatment in 2005 as a result of the diminished control from using the lower 3cc application rate. In the course of making applications, occasionally stems will be overlooked and not treated, but the use of lower rates will require additional significant human and financial resources to be used to obtain satisfactory results. Once again, follow-up is a key element of successful removal of J. knotweed. Using the recommended rate plus careful application techniques will produce the best results and opportunities for control of this aggressive invasive species.