Japanese knotweed – controlling the threat

Everyone loves beautiful plants. Flowers and shrubs adorn our gardens, homes, parks and public spaces. Some ornamental plants arrive in BC without the plant's natural pests and predators and are able to easily spread through their fruits, seeds or roots and end up dominating the landscape. These invasive plants are non-native species that have the potential to cause detrimental impacts on humans, animals and/or ecosystems.

One invasive posing a huge threat in the Sea to Sky corridor is Japanese knotweed (*Fallopia japonica*) – renowned as one of the "world's worst species". Japanese knotweed can be identified by its tall (>3 metres), bamboo-like stem structure, large leaves and small white flowers that bloom in late summer. It is a perennial plant that dies back every winter, so amazingly its height is achieved in just one growing season.

Knotweed was introduced to BC as a garden ornamental. In its native habitat of eastern Asia, knotweed lives in harsh volcanic slopes where it plays an important role as a colonizing species. But here in coastal BC, where there is an absence of its predators and diseases, combined with its incredible reproductive capabilities, it possesses the ability to thrive. From moist soil to river cobble and from full to partial sunlight, it can dominate rivers, creeks, roadside ditches, and beaches.

The highest concentration of this plant is in the southern part of the Sea to Sky Corridor. Squamish alone has over 100 infestations of this plant and examples can be seen along the south side of Finch drive across from the police station and across the street from the Brew Pub. Whistler and Pemberton have a few known infestations, all small and on private property. The most northern extent of knotweed (known) on crown land is along Highway 99 just north of the big orange bridge between Culliton Creek and Conroy Creek.

IMPACTS OF KNOTWEED

Invasive knotweed usually spreads when roots and stems are moved by waterways or human activities. These activities include soil movement containing knotweed plant material, the mowing or cutting of knotweed, or discarding knotweed plant materials in receptive habitats. In river corridors Japanese knotweed can reproduce from fragments that travel downstream during high-water events, affecting the gravel bars and riparian forests of entire river systems. As little as 0.6 of a gram of root material (from roots that have been known to extend up to 20 metres) and/or stem material can produce a new plant in as few as 6 days. As a result, one patch can be the source of many downstream infestations. The rate of spread of populations is exponential and the size of infestations will likely double every 5 years.

<u>Riparian Systems (streams and rivers)</u>

- Knotweed can tolerate long periods of submersion and colonize on nutrient poor soils, allowing it to establish and grow on the lower banks of rivers and creeks, where there is little competition.

- It displaces the lower, slower growing native plants beneath its extensive canopy through shading, competition for moisture and nutrients, and its densely matted litter.

- With only a limited amount of the sunlight available to drive freshwater food chains, many invertebrates, especially aquatic insects that prefer woody plant leaves (as opposed to knotweed leaves), move elsewhere. Further, the growth of smaller, younger trees along stream banks can be inhibited. Such trees would otherwise grow to overhang the water, providing a platform for insects to fall into the water and feed resident fish. Such trees also provide shade to cool water temperatures, as well as provide a continual source of coarse woody debris.

- Knotweed's extensive root system lacks the well-developed root hairs necessary to bind and hold in place stream bank soil, especially during peak winter rains. Further, each winter, the entire plant collapses on itself (and other surrounding plants) leaving a sparse vegetative and bare soil that is vulnerable to erosion. During

peak flow events, banks can erode resulting in sedimentation that can negatively impact human water quality and fish populations. Flood events are catalysts that spread knotweed stem and root material further downstream, where they eventually lodge, establish and perpetuate their aggressive growth cycle.

- It is believed to exacerbate flooding by clogging river and stream channels with its large stalks, thus changing natural erosion and deposition patterns.

Biodiversity & Wildlife

- Knotweed forms dense monocultures displacing native plant communities, as well as rare and endangered species.

- Although minor insect grazing has been observed on invasive knotweeds, no wildlife species here are known to feed on it.

Recreation, Safety, Infrastructure & Amenity Values

- It reduces sightlines due to rapid growth (road safety).

- Hydrological changes can lead to over widen stream channels, undercutting existing adjacent roads and highways.

- It can grow through small cracks in pavement, concrete or drainage structures, reducing structural integrity of public infrastructure – a *huge* potential burden to tax payers.

- Land values will be negatively impacted if a given area becomes knotweed infested. There is significant cost associated with treatment and disposal of knotweed. *Experts predict that the removal of knotweed associated with the London 2012 Olympics will exceed $100 million dollars.*

CONTROL OPTIONS

There is no "silver bullet" or single best control strategy for knotweed – each site is different. It will likely take 3-5 years to be successful using integrated approaches. Due to its dispersal method, control projects require coordination with multiple land owners and across jurisdictions.

Mechanical control

Options for mechanical removal of knotweed are prohibitively costly on large infestations due to its tremendous regeneration capabilities, estimated at a minimum of $250,000 per hectare. If you were to dig up the plant, you would have to make sure all the roots are collected. This means digging a pit up to 5 m deep and at least 5 m beyond the infestation. In some cases this could not be accomplished without dismantling existing infrastructure. Another option is to constantly cut the plant every 2-3 weeks, which could potentially exhaust the underground rhizome if continued diligently for 3-5 years. A final mechanical option is cutting and smothering the plant initially and then cutting all surrounding re-growth for 3-5 years as in the cutting option. Digging was successfully used to treat the Whistler knotweed sites and a small site in Alice Lake Park. Long term monitoring will determine the efficacy of this approach for small infestations (up to 15 stems).

Chemical control

When does the risk of losing a riparian or natural area to destruction from knotweed outweigh the risk from potential herbicide contamination? As a society, we need to weigh *all* the risks and develop best management practices. Like a doctor prescribing medical drugs to heal a patient when "plenty of rest and fluids" aren't enough, the selective use of herbicide has been one of the crucial tools used in other parts of the world when controlling knotweed.

In considering the potential direct effects of any chemical on any biological organism, it is necessary to take into account two fundamental principles of toxicology:

1) All chemicals are toxic (e.g. caffeine, alcohol, nicotine, glyphosate, sodium chloride [table salt]), but some are more toxic than others;
2) The degree to which a toxicological effect is expressed depends on exposure or dose, both in terms of the actual amount and the time frame over which it occurs (as an analogy, think of the difference in effect resulting from consuming several glasses of alcohol in say an hour, versus the same amount over an entire day)

The herbicide being proposed to control Japanese knotweed in the Sea to Sky Corridor is glyphosate, the same herbicide found in Roundup®. This is a *non-selective* herbicide, which means it will target all plants, native and invasive. Also importantly, it is *non-residual*, which means it will rapidly degrade, principally by micro-organisms, and therefore is non-persistent in soil and water. The time required for the chemical to dissipate by half ranges from days to a few weeks depending on edaphic (soil characteristics) and climatic conditions.

There are three key reasons why this herbicide is being considered: i) its excellent record of efficacy and reliability in controlling knotweed; ii) its relatively favourable environmental behaviour profile (e.g. non-persistent in soils, vegetation and water, non-bioaccumulatory, very low leaching potential) and; iii) its relatively low innate toxicity to humans and wildlife.

Options for targeted application are as follows:

a) Stem injection: herbicide is injected directly into each hollow stem cavity (3-5 ml of a 48% glyphosate solution; suggested for populations up to 300 stems in high use areas);
b) Cut and fill: herbicide is injected directly into the hollow stem cavity after the above ground plant material has been cut down (3-5 ml of a 24% glyphosate solution; suggested for populations up to 300 stems in lower use areas); and
c) Foliar spray: herbicide is selectively sprayed from a backpack tank on the surface area of the plant (an 8% glyphosate solution; suggested for populations over 300 stems)

The Sea to Sky Corridor is part of an area that has a Pest Management Plan (PMP), which outlines an integrated pest management approach to managing invasive species on crown land. At municipal and private levels, integrated pest management approaches are decided locally.

If you're interested in researching this topic further, there are many sources of factual, accurate and peer-reviewed scientific information on the internet. Unfortunately, there is even more unsubstantiated personal opinion, myth and outright inaccuracies or misrepresentations circulating through that medium. Please always be cautious in accepting any singular piece of information as fact (including this article), and require presentation of solid data to substantiate a viewpoint. Good science and derivative policies are founded on replication, peer review and the weight of scientific evidence principle.

For more information on herbicide as a tool for invasive plant control, please contact your local municipality or the Sea to Sky Invasive Species Council at ssinvasives@gmail.com or 604-698-8334. The Sea to Sky Invasive Species Council (www.ssisc.info) is a non-profit society dedicated to minimizing the threat of invasive species in the corridor.