BEST MANAGEMENT PRACTICES FOR

Himalayan Blackberry

in the Metro Vancouver Region

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SERVICES AND SOLUTIONS FOR A LIVABLE REGION

ISCMV
INVASIVE SPECIES COUNCIL OF METRO VANCOUVER

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Introduction

The impacts of invasive species on ecological, human, and economic health are of concern in the Metro Vancouver region. Successful control of invasive species requires concerted and targeted efforts by many players. This document - "**Best Management Practices for Himalayan Blackberry in the Metro Vancouver Region**" - is one of a series of species-specific guides developed for use by practitioners (e.g., local government staff, crews, project managers, contractors, consultants, developers, stewardship groups, and others who have a role in invasive species management) in the region. Together, these best practices provide a compendium of guidance that has been tested locally by many researchers and operational experts.

Himalayan blackberry[1] was first introduced in British Columbia in the nineteenth century as a berry crop, but has more recently been recognized as an invasive species. Academic institutions, government, and non-government organizations continue to study this species in British Columbia. As researchers and practitioners learn more about the biology and control of Himalayan blackberry, it is anticipated that the recommended best management practices will change over time and this document will be updated. Please check metrovancouver.org often to ensure you have the most recent version of these best management practices.

REGULATORY STATUS

Section 2 (1) (b) (iii) of the *Community Charter*, Spheres of Concurrent Jurisdiction – Environment and Wildlife Regulation, states that "municipalities may regulate, prohibit and impose requirements in relation to control and eradication of alien invasive species", which includes Himalayan blackberry.

1 Nomenclature of this species is complicated and genetic analysis of Canadian samples is likely required for taxonomists to agree on a scientific name (Gaire et al 2015). The scientific name *Rubus bifrons* is supported by Flora North America and other sources; this species is also known as R. armeniacus and was previously known as *R. discolor, R. fruticosus* and *R. procerus* (Gaire et al 2015).

IMPACTS

Himalayan blackberry forms thick, impenetrable thickets of live and dead canes, which degrade the quality of riparian habitats as well as forest edges, transportation and utility corridors, and fence lines. It can obstruct roads, walkways and signage, making it difficult to access or inspect structures or other assets. Dense blackberry patches can prevent the establishment of native vegetation, limit the movement of people and large animals, and obstruct sight lines (ISCBC 2014). Contact with Himalayan blackberry thorns can also cause skin irritation, scratches and small wounds.

Although blackberry shrubs offer limited food, nesting sites, and wildlife cover, it is poorer quality habitat than native shrub species and results in decreased biodiversity (Bennett 2007). When Himalayan blackberry is the dominant understorey shrub in a forested setting in Metro Vancouver, it is often associated with a statistically significant reduction in bird species richness and evenness (Astley 2010). Typically, more bird species are noted in habitats with greater diversity of native vegetation (Astley 2010).

Though Himalayan blackberry provides nectar and pollen for bees, the bloom period does not overlap with the foraging periods of all pollinators. Restored areas in Metro Vancouver Regional Parks had 26% more pollinator species, and pollinators were 30% more abundant, compared to non-restored areas mostly dominated by Himalayan blackberry (Wray 2015).

When Himalayan blackberry out competes native vegetation in riparian areas, flooding and erosion potential often increases because of the lack of deep-rooted native shrubs. Himalayan blackberry cannot provide the necessary shade for stream water, or contribute large woody debris compared to stream sides with diverse native vegetation (Bennett 2007).

All levels of government, non-profit organizations and private property owners spend significant resources managing Himalayan blackberry in the Metro Vancouver region every year. In 2016, local/provincial governments and several right-of-way partners on Metro Vancouver's Regional Planning Advisory Committee - Invasive Species Subcommittee spent nearly $350,000 on Himalayan blackberry control efforts. This figure does not include control costs for private landowners across the region, volunteer 'weed pull' hours, or costs associated with education and awareness activities.

REPRODUCTION AND SPREAD

Himalayan blackberry is primarily a biennial plant that reproduces both vegetatively and sexually. It propagates via root pieces and forms daughter plants where the tips of first year canes touch the ground. Shoots can arise from underground runners that persist up to a meter deep and over 10 meters long (Soll 2004). Blackberry flowers are pollinated primarily by bumblebees and honey bees. The flowers can be self-pollinated, but cross pollination increases fruit set (LEPS, Graham and Clements n.d.). Typical thickets of blackberries can produce 7,000 to 13,000 seeds/m2 that remain viable in the soil for several years (ISCBC 2014). Fruiting stems generally die back at the end of the season, but non-fruiting stems may persist for several years before producing fruit (ISCBC 2014).

Although Himalayan blackberry allocates more resources directly to flowers and fruit than the native trailing blackberry (*Rubus ursinus*), the invasive blackberry has significantly lower reproductive effort (i.e., fewer resources diverted from vegetative activity to reproduction) (McDowell and Turner 2002). This likely contributes to its success in the Pacific Northwest, as it minimizes the trade-offs often inherent in reproduction (McDowell and Turner 2002).

Since blackberry reproduction can happen both vegetatively and sexually, dispersal also can take place through both methods. It reproduces primarily through the movement of stem and root fragments and berries, which are consumed by birds and omnivorous mammals, such as foxes, bears, and coyotes, thereby moving seeds (ISCBC 2014). Humans also contribute to the spread by purposefully planting or maintaining canes for their fruit (ISCBC 2014), and unintentionally moving seed or infested substrates during roadside mowing, landscaping or other activities.

HABITAT AND DISTRIBUTION

Himalayan blackberry can grow on a variety of barren, infertile soil types, and a range of soil pH and textures, but prefers rich, well-drained soils (ISCBC 2014) with higher concentrations of sand, and less silt and clay (Caplan and Yeakley 2006). It is tolerant of periodic flooding by brackish or fresh water (ISCBC 2014), and is able to withstand soils with low water content and low nutrient availability with only a small reduction in growth (Caplan and Yeakley 2006).

Himalayan blackberry stand height is correlated to canopy cover; the higher the concentration of light, the higher the concentration of blackberry plants (Caplan and Yeakley 2006). It can, however, survive in varied light conditions (ISCBC 2014). Shade has been found to be the primary environmental deterrent of blackberry occurrence and growth (Caplan and Yeakley 2006). As such, it is widely naturalized, often found on disturbed sites and streamside areas (Pojar and MacKinnon 2004) at low elevations under 700 metres (UBC 2017) with lots of sun exposure. This includes areas such as: transportation and utility corridors, parks, trail sides, backyards, abandoned properties, pastures, riparian areas, freshwater wetlands, forest edges, and wooden ravines (ISCBC 2014).

Within British Columbia, Himalayan blackberry is currently found in the Lower Mainland, Sunshine Coast, Fraser Valley, Gulf Islands, central to southern Vancouver Island, Queen Charlotte Islands, the Okanagan, and the West Kootenay areas (ISCBC 2014). It is one of the most widespread invasive plants in Metro Vancouver and is common in many habitats throughout the region.

CLIMATE ADAPTATION

Climate modellers predict that the Metro Vancouver region will experience warmer temperatures; a decrease in snowpack; longer dry spells in summer months; more precipitation in autumn, winter and spring; more intense extreme events; and an extended growing season. In the past, our region had an average of 252 days in the growing season. In lower elevations 45 days will be added to the growing season by the 2050s, and 56 days by the 2080s, resulting in nearly a year-round growing season of 357 days on average. In higher elevation ecosystems the growing season length will increase by 50% to 325 days by the 2080s (Metro Vancouver 2016). These changes will stress many sensitive ecosystems, increasing their vulnerability to invasive species.

Himalayan blackberry may be able to adapt to our future climate in several ways:

- **Warmer temperatures:** An increase in carbon dioxide associated with higher temperatures may favor Himalayan blackberry regeneration and spread over native plants which are less efficient in acquiring carbon and other nutrients (USDA 2020).
- **Longer summer drought periods:** Himalayan blackberry growth is highly correlated with sun exposure (Caplan and Yeakley 2006) and presumably more access to sun, for longer periods, may encourage its growth.
- **Increased precipitation and flooding:** Himalayan blackberry is tolerant to flooding (ISCBC 2014).

Based on climate change models, the Center for Invasive Species and Ecosystem Health predicts that Himalayan blackberry will expand in the United States (USDA, 2020). Himalayan blackberry can thrive in a variety of habitats and is already very widespread in the region. With these kinds of competitive advantages, this species is more adaptable than native species in a variety of ecosystems and suggest that it will be able to withstand, and possibly thrive, with changing climate conditions.

Identification

The following identification information was collated from the Invasive Species Council of BC (2014), Plants of Coastal British Columbia (2004) and E-Flora (2017).

Life cycle: Perennial, thicket-forming shrub, erect to trailing along the ground.

Stems: Stems range from erect to sprawling. Stout stems are erect, then arch and trail along the ground up to 10-12 m long, and up to 3 m high (even higher if aided by trees or other structures). It has robust, stiff, 4 to 5 angled stems (canes) that support large, flattened, and hooked or straight prickles. These prickles or barbs will point back to the root end, helping to distinguish the root from the tip. First year canes produce leaves only and can root at the tips, producing daughter plants.

Second year canes grow from the axils of first year canes and produce flowers and fruits. Canes have been known to grow up to 7 m in a single season (LEPS, Graham and Clements n.d.). Stems vary from pale green (young) to red to brown (old).

Leaves: Leaves are alternate, and mostly evergreen, 12-25 cm wide. They have predominantly large, oval or oblong, toothed leaflets that radiate from the end of the leaf stem that are a smooth green on top, with white hairs below. Leaflets are generally grouped in fives on first-year canes and threes on flowering (second-year) canes.

Flowers: Small (2-3 cm diameter), white to light pink, stalked, 5-petalled, arranged in clusters of 5-20, blooms from April to August, flower stalks are woolly and prickly, many stamens.

Fruits: Fruits (drupelets) are usually 1-1.5 cm long, and up to 2 cm in diameter. The blackberries are oblong to spherical, black and shiny, hairless, and edible. They form on second year canes and ripen from mid-summer to fall.

Each berry produces numerous seeds that have a hard, impermeable coat. Seeds remain viable for a period of several years; however the specific length of viability has not been documented.

The following photos show blackberry plant parts.

Leaf (with 5 leaflets), stem and thorns
CREDIT: ISCMV

Flowers
CREDIT: ISCMV

Fruit
CREDIT: D. HANNA

SIMILAR SPECIES

Several similar berry species can grow in similar habitats as Himalayan blackberry and it is not uncommon to see more than one blackberry species growing at sites in British Columbia. However, Himalayan blackberry is typically the most dominant species, especially in disturbed areas.

Species present in British Columbia that could be confused with Himalayan blackberry include:

NATIVE SPECIES

- Trailing blackberry (*Rubus ursinus*) is a smaller and far less robust plant than Himalayan blackberry with deciduous leaves in groups of three (not five) and smaller stems (0.5 cm diameter) with a white waxy stem coating (sometimes appearing bluish) that tend to hug the ground. Blooming April to August, it has large white flowers in flat-topped clusters that stand more upright that the vines.
- Black raspberry (*Rubus leucodermis)* has smaller stems and small, black or purple-colored hairy berries that are hollow in the center like raspberries, while blackberries are shiny and the berry's core detaches when picked.
- Salmonberry (*Rubus spectabilis*) has smaller, upright, zigzagged stems, smaller prickles, red-pink flowers (not white), and dark reddish to yellowish (not black) edible berries.

Trailing blackberry
CREDIT: ISCMV

Black raspberry

Salmonberry
CREDIT: ISCMV

NON-NATIVE SPECIES

- Cut-leaf or evergreen blackberry *(Rubus laciniatus)* is primarily differentiated from Himalayan blackberry by leaf characteristics. Evergreen blackberry has more deeply incised and jaggedly toothed leaflets, and is greenish on the under surface (rather than whitish). *R. laciniatus* canes are usually thinner and less robust than *R. armeniacus*. In Metro Vancouver, *R. laciniatus* is far less common than *R. armeniacus*. However, it is also considered invasive with similar impacts, and can be controlled using the same methods.

Cut-leaf blackberry

CREDIT: ISCMV

Tracking

The provincial government maintains the Invasive Alien Plant Program (IAPP) application (BC Ministry of Forests, Lands and Natural Resource Operations and Rural Development 2017), which houses information pertaining to invasive plant surveys, treatments, and monitoring. Many agencies, including local governments, have their own internal invasive species inventory and mapping protocols that are used by staff, contractors and, in some cases, the public. For example, the City of North Vancouver has its own system called AlienMap. Agencies in British Columbia that do not enter data into IAPP are encouraged to check it regularly because it contains public reports and data from other agencies and it is important to consider as much data as possible when making management decisions. The Map Display module of IAPP is publicly accessible.

When conducting a Himalayan blackberry inventory, the following information should be recorded as it will later help inform treatment plans:

- Size and density of infestation;
- Location in relation to the high water mark of water courses; and
- Location in relation to other water sources, such as wells.

Reporting

Since Himalayan blackberry is widespread throughout the Metro Vancouver region and does not pose an imminent health or safety risk, there is generally little value in reporting individual occurrences.

Prevention and Control Strategies

Effective invasive plant management may include a variety of control techniques ranging from prevention, chemical, manual, mechanical, biological and/or cultural methods. Each method is described below in order of effectiveness.

Himalayan blackberry can be effectively controlled through both manual/mechanical and chemical treatment techniques. The technique used is dependent on the age and size of the infestation, and site characteristics. Chemical treatment is most effective and efficient; however it is not necessarily suited to all sites. Manual/mechanical treatment can also be effective, but will generally be more time consuming and may promote seedling germination through soil disturbance. Follow-up monitoring and treatment will be required for several years regardless of the treatment technique.

Wear gloves, eye protection, long pants, long sleeves and sturdy footwear to avoid injuries from thorns when working around Himalayan blackberry.

STRATEGY COLOUR LEGEND

GREEN: RECOMMENDED

ORANGE: CAUTION

RED: NOT RECOMMENDED OR NOT AVAILABLE

PREVENTION: IMPERATIVE

Prevention is the most economical and effective way to reduce the spread of Himalayan blackberry over the long term.

When working in or adjacent to Himalayan blackberry, inspect and remove plants, plant parts, and seeds from personal gear, clothing, pets, vehicles, and equipment and ensure soil, gravel, and other fill materials are not contaminated with blackberry plant parts before leaving the infested area.

Do not purchase, trade, or grow Himalayan blackberry. Instead, grow regional native plants that are naturally adapted to the local environment and non-invasive. Consult the Invasive Species Council of BC's Grow Me Instead Program or Metro Vancouver's Grow Green website for non-invasive and drought-tolerant plants, and garden design ideas. It is also important to maintain or establish healthy plant communities that are resistant to invasion by invasive plants.

MANUAL/MECHANICAL: RECOMMENDED

The success of manual/mechanical methods is contingent on removal of all plant parts: canes, roots and root crowns to prevent re-sprouting (DiTomaso et al. 2013). The following manual/mechanical methods can be used to control Himalayan blackberry:

- **Hand Pulling:** Small seedlings or young plants can be hand pulled to uproot the root crown. This method works best after rain or when soils are soft, and with shade suppressed canes in forest understories. Pulling should be done as soon as canes are large enough to grasp but have not produced seed (Soll 2004).
- **Digging/Grubbing:** Dig up root crowns and lateral roots. Work must be as thorough as possible because any remaining root fragments may sprout a new plant (Soll 2004). Claw mattocks or pulaskis are effective (King County 2014).
- **Cutting*:** Manually cutting the above ground growth using any number of hand tools (e.g., brush cutter, loppers, machete, etc.) is not an effective control method on its own unless it is repeated multiple times over multiple years to exhaust the plants stored reserves. However, cutting prior to digging/grubbing is critical in thickets to enable access to the roots and root crowns. If roots are being removed after cutting, cut the canes at 30 cm in height so roots can be easily located.

- **Mowing*:** Mowing can be very effective, but can also harm desirable species (ISCBC 2014). If roots are not manually removed, mowing several times per year, particularly during the flowering period, over several years is necessary to exhaust root reserves (DiTomaso et al. 2013). Do not mow where soil is highly susceptible to compaction or erosion, where soil is very wet or on steep slopes (Soll 2004). If follow-up treatment is not undertaken, plants will regrow in greater density (Soll 2004). If roots are being removed after mowing, allow stems to regrow to 30 cm in height so roots can be easily located.
- **Tilling*:** Repeated tillage (cultivation) in combination with mowing will stimulate regrowth. However, this strategy can be very effective when followed-up with spot application of herbicide or hand-digging to remove roots (ISCBC 2014). Tilling causes significant soil disturbance and is therefore unsuitable in riparian areas (DiTomaso et al. 2013). During tillage care should be taken to ensure that root pieces/crowns are not spread or dragged beyond the infested area as they could re-sprout. These parts should be collected by hand for disposal.
- **Vegetation Release:** Natural regeneration of other desirable plants can often be encouraged through persistent control of blackberry. Cutting back blackberry two or more times per year can encourage growth of existing native plants, create layering and sprouting of species such as willow and black cottonwood, and stimulate germination or rapid early growth of native species from seed (Bennett 2007). This method works best where there is already scattered existing native vegetation, not where blackberry is a monoculture.

* Methods that rely solely on repeated cutting or mowing may reduce blackberry cover in the long run; however this result is difficult to achieve in most cases. Less intensive treatments of one or two mowings or cuttings a year are likely to fail (Bennett 2007).

If volunteers will be removing large berms of blackberry plants, it is recommenced to pre-cut stems (or flail mow berm and let regrow to 30 cm). Volunteers can then dig out the root crowns more easily.

Note that manual/mechanical application methods can also be used in combination with the chemical control methods outlined below.

MANUAL/MECHANICAL CONTROL TIMING

It is best to delay removal if the blackberry patch is used as a nesting site for native passerine birds; removal should take place after the nesting season, from September to mid-March (Garry Oak Ecosystem Recovery Team 2002). Thickets can be flail mowed during the winter or early spring, allowed to regrow to 30 cm and then the root crowns can be removed. If canes can only be removed once in a season, the best time for manual or mechanical control is when the plant starts to flower, since much of the root reserves have gone into flowering (Whatcom County Noxious Weed Control Board n.d.).

Although invasive species can be problematic, removal efforts should consider the availability of all floral resources in an area (Elle 2012). If there is little other vegetation nearby for the birds and other pollinators, consider removing only one quarter of the blackberry infestation each year (King County 2014) and establishing a pollinator-friendly native plant community. Slow removal of invasive species and establishing plants that bloom throughout the growing season, may be essential to ensure pollinators have a food supply throughout their life cycle.

APPLYING MANUAL/MECHANICAL CONTROL METHODS IN RIPARIAN AREAS

Himalayan blackberry often grows along water courses. Consider the impact of control techniques and the resulting bare soil on the adjacent aquatic environment. Schedule removal works during a period of least risk to fish species, outside of the fish window. Adhere to Provincial and Federal riparian regulations. It is recommended to consult with a qualified environmental professional when working around water bodies.

CHEMICAL: RECOMMENDED

When alternative methods to prevent or control invasive plants are unsuccessful, professionals often turn to herbicides. With the exception of substances listed on Schedule 2 of the BC Integrated Pest Management Regulation, the use of herbicides is highly regulated in British Columbia. Site characteristics must be considered with herbicide prescribed, based on site goals and objectives and in accordance with legal requirements. This summary of BC's *Integrated Pest Management Act* provides an overview of the provincial legislation.

Chemical control can be an effective and relatively inexpensive method to treat blackberry; however, this method should be used with caution for three reasons (Soll 2004):

1. Blackberry often grows in riparian areas where pesticide use is restricted
2. Some herbicides promote vegetative growth from lateral roots
3. When used incorrectly, herbicide will only top-kill blackberry

PESTICIDE LICENCE AND CERTIFICATION

A valid pesticide licence is required to:

- offer a service to apply most pesticides;
- apply most pesticides on public land including local government lands[2]; and
- apply pesticides to landscaped areas on private land, including outside office buildings and other facilities.

Pesticides (e.g., herbicides, insecticides, fungicides) are regulated by the federal and provincial government, and municipal governments often have pesticide bylaws.

- Health Canada evaluates and approves chemical pest control products as per the *Pest Control Products Act.*
- The *BC Integrated Pest Management Act* sets out the requirements for the use and sale of pesticides in British Columbia. This Act is administered by the Ministry of Environment and Climate Change Strategy.
- Several municipalities have adopted bylaws which prohibit the use of certain pesticides.

Everyone who uses pesticides must be familiar with all relevant laws.

2 on up to 50 ha/year by a single organization. Organizations looking to treat over 50 hectares of land per year are also required to submit a Pest Management Plan and obtain a Pesticide Use Notice confirmation.

ONLY companies or practitioners with a valid Pesticide Licence and staff who are certified applicators (or trained assistant applicators working under a certified applicator) may apply herbicide on invasive plants located on public lands in British Columbia. Applicators must be either the land manager/owner or have permission from the land manager/owner prior to herbicide application.

On private property the owner may obtain a Residential Applicators Certificate (for Domestic class products only) or use a qualified company. Residents do not require a Residential Applicator Certificate for certain uses of domestic class glyphosate including treatment of plants that are poisonous for people to touch, invasive plants and noxious weeds listed in legislation, and weeds growing through cracks in hard surfaces such as asphalt or concrete. Refer to the 'Pesticides & Pest Management' and 'Home Pesticide Use' webpages listed in the Additional Resources Section for more information.

Questions? Contact the BC Integrated Pest Management Program:

Telephone: (250) 387-9537
Email: bc.ipm@gov.bc.ca

Pesticide applicator certificates can be obtained under the category 'Industrial Vegetation Management' to manage weeds on industrial land, roads, power lines, railways, and pipeline rights-of-way for control of noxious weeds on private or public land. Assistant applicator training is also available and the online course and exam are free.

It is best practice for personnel supervising or monitoring pesticide contracts to also maintain a pesticide applicator licence so they are familiar with certification requirements.

For more information on how to obtain a licence and the requirements when working under the provincial *Integrated Pest Management Act and Regulation*, please review the Noxious Weed & Vegetation Management section on this webpage: gov.bc.ca/PestManagement.

HERBICIDE LABELS

Individual herbicide labels must always be reviewed thoroughly prior to use to ensure precautions, application rates, and all use directions, specific site and application directions are strictly followed. Under the federal *Pest Control Products Act* and the BC Integrated Pest Management Regulation, **persons are legally required to use pesticides (including herbicides) only for the use described on the label and in accordance with the instructions on that label**. Failure to follow label directions could cause damage to the environment, poor control results, or danger to health. Contravention of laws and regulations may lead to cancellation or suspension of a licence or certification, requirement to obtain a qualified monitor to assess work, additional reporting requirements, a stop work order, or prohibition from acquiring authorization in the future. A conviction of an offence under legislation may also carry a fine or imprisonment.

Herbicide labels include information on both the front and back. The front typically includes trade or product name, formulation, class, purpose, registration number, and precautionary symbols. Instructions on how to use the pesticide and what to do in order to protect the health and safety of both the applicator and public are provided on the back (BC Ministry of Environment 2011).

Labels are also available from the Pest Management Regulatory Agency's online pesticide label search or mobile application as a separate document. These label documents may include booklets or material safety data sheets (MSDS) that provide additional information about a pesticide product. Restrictions on site conditions, soil types, and proximity to water may be listed. If the herbicide label is more restrictive than provincial legislation, the label must be followed.

HERBICIDE OPTIONS

The following herbicides can be used on Himalayan blackberry:

ACTIVE INGREDIENT (EXAMPLE BRAND NAMES)+	APPLICATION	PERSISTENCE	GROWTH STAGE	TYPE ++	COMMENT
Glyphosate (many products)	foliar application	non-residual	September to October; ineffective when applied earlier	non-selective	can impact trees with roots within or adjacent to the treatment area; sometimes combined with triclopyr for improved efficacy
Imazapyr (e.g. Arsenal™)	foliar application	residual	post-emergence, actively growing**	non-selective	
Triclopyr (e.g. Garlon™)	foliar application or basal bark spray	residual	foliar application: mid-summer and early fall after flowering and start of fruit set; basal bark spray: applied any time of year	selective, no effect on grasses	
2,4-D mixed with triclopyr*	foliar application	residual	actively growing	selective, no effect on most grasses	2,4-D products not currently permitted on BC Ministry of Transportation and Infrastructure jurisdiction
Metsulfuron (e.g. Escort™*)	foliar application	residual	fully leaved-out; before fall discoloration	selective, no effect on grasses	may affect shrub species

* Blackberry is not specifically listed on the 2,4-D or Escort™ labels; however they can be used under the general application provision for woody species.

** Active growth occurs in the spring and fall (i.e., not during cold months and not during summer bloom/fruiting periods).

+ The mention of a specific product or brand name of pesticide in this document is not, and should not be construed as an endorsement or recommendation for the use of that product.

++ Herbicides that control all vegetation are non-selective, while those that control certain types of vegetation (e.g. only grasses or only broadleaf plants) are termed selective.

Picloram is sometimes used to treat blackberry, but it is not recommended for use in coastal areas or the Lower Fraser Valley west of Hope because it is very persistent (4 to 7 years) and mobile in high water tables or regions with high rainfall.

Note that keeping the herbicide application rate low for control of deep-rooted perennials is generally better so the above ground plant tissue does not die before herbicide is translocated into the roots (Soll 2004).

APPLYING PESTICIDE IN RIPARIAN AREAS

Provincial legislation prohibits the use of herbicides within 10 metres of natural water courses and 30 metres of domestic or agricultural water sources on public lands. On private lands herbicide labels must be followed (which means for glyphosate products treatment can happen up to the water's edge), and additional restrictions may apply for some private lands (e.g., industrial sites, forestry sites, golf courses, etc.). On public lands, glyphosate is the only active ingredient that can be applied within the 10 metre Pesticide-Free Zone (PFZ)[2] in British Columbia in accordance with the BC *Integrated Pest Management Act* and Regulation and all public land Pesticide Management Plans (PMPs). A plant must be either a listed Noxious Weed (under the BC *Weed Control Act*) or appear in the *Forest and Range Practices Act* Invasive Plants Regulation to be treated within the 10 metre PFZ. **Himalayan blackberry is not listed and therefore glyphosate and other herbicides can only be applied on blackberry up to 10 metres away from the high water mark (HWM)[3].** The 30 metre no-treatment zone around a water supply intake or well used for domestic or agricultural purposes may be reduced if the licencee or PMP holder is "reasonably satisfied" that a smaller no-treatment zone is sufficient to ensure that pesticide from the use will not enter the intake or well.

When managing Himalayan blackberry with herbicide in riparian areas:

- Observe and mark all PFZs while on site.
- The HWM should be determined by careful evaluation by the applicator.
- Distances in PFZs should be measured as horizontal distance.
- Herbicides restricted in a PFZ must not enter these zones by leaching (lateral mobility) through soil or by drift of spray mist or droplets.
- Treatments should be conducted when water levels are low (e.g. summer months) to reduce risk.
- Note that efficacy may be dependent on site conditions, including moisture in the soil.

3 The Pesticide-Free Zone (PFZ) is an area of land that must not be treated with pesticide and must be protected from pesticide moving into it, under the *Integrated Pest Management Act* and Regulation.

4 The High Water Mark (HWM) is defined as the visible high water mark of any lake, stream, wetland or other body of water where the presence and action of the water are so common and usual and so long continued in all ordinary years as to mark upon the soil of the bed of the lake, river stream, or other body of water a character distinct from that of the banks, both in vegetation and in the nature of the soil itself. Typical features may include, a natural line or "mark" impressed on the bank or shore, indicated by erosion, shelving, changes in soil characteristics, destruction of terrestrial vegetation, or other distinctive physical characteristics. The area below the high water mark includes the active floodplain (BC Ministry of Environment and Climate Change Strategy 2018).

APPLICATION METHODS

The preferred application methods to minimize non-target damage and applicator exposure are as follows:

- **Foliar application** uses a backpack or handheld sprayer to completely cover the actively growing plant parts with herbicide, including suckers growing away from the main bush (Soll 2004).
- **Basal bark spray** involves high concentrations of herbicide in oil, applied to the basal portion of stem using backpack sprayers. This method effectively kills roots, particularly in the fall (Soll 2004).
- **Cut stump** involves cuttings the stems near the ground followed by painting the cut portion of the stem with herbicide (Soll 2004). Painting must occur within 10 minutes of the cut to ensure effectiveness (San Juan County Noxious Weed Control Program 2014). This method is likely best applied in the late summer or fall, although more research is needed to confirm optimal timing.

Note these application methods can also be used in combination with manual/mechanical methods outlined above. For example, regrowth of patches that were cut/mowed can be spot sprayed. One challenge with only using herbicide treatment of blackberry is that the roots are still present in the soil. If restoration activities are planned for the site, the dead canes and root crowns may require manual removal prior to planting.

TREATMENT TIMING

Generally, herbicides should be applied when blackberry is in full leaf; results are poor when plants are sprayed prior to this stage (Soll 2004). Blackberry is best sprayed in late summer or fall, particularly if glyphosate is used. Drought or dry conditions will significantly reduce efficacy (Soll 2004). In areas where people pick berries, timing should be carefully considered to avoid contamination of the fruit. If treatment is necessary between March and September, nesting activity searches should also be conducted and mitigation measures should be implemented.

CULTURAL: PARTIALLY RECOMMENDED

- Growing **a closed canopy with deep shade** can be used to suppress Himalayan blackberry. The plants will need to be continually removed or cut back around seedlings or planted trees until they grow to a height well above the blackberry. The utility of this method is restricted to sites where a tree canopy is desired and/or appropriate. In practice, many blackberry patches in Metro Vancouver grow along narrow natural area corridors where the edges will always receive adequate light no matter how closed the tree canopy may be.
- **Targeted grazing** will not be effective on its own, but may be used as a complementary method as part of a larger integrated pest management plan to suppress blackberry spread and/or regrowth (Miller, Tarasoff & Salmon, 2021). Goats and pigs prefer young canes (1-4 years old); on mature stands they tend to only eat the leaves (King County 2014). Grazing by horses, cattle and sheep dramatically reduces the number of daughter plants (i.e., new plants produced by tip rooting) (Soll 2004). Grazing must be continuous for 3-5 years to prevent re-growth, and complete eradication is unlikely (Miller, Tarasoff & Salmon, 2021).

Grazing opportunities are limited in urban areas due to municipal bylaws regulating animals, the need for specially trained herds, and damage animals may cause in sensitive ecosystems (e.g. off-target grazing, erosion). Grazing will be indiscriminate and therefore may result in the loss of desirable species (DiTomaso et al. 2013). This method is best suited for large, continuous patches with little other desired vegetation, not sensitive or riparian sites. Many Himalayan blackberry sites in the Metro Vancouver region would not be good candidates for targeted grazing.

BIOLOGICAL: NOT AVAILABLE

No biological control agents have been approved for use in British Columbia on Himalayan blackberry (ISCBC 2014).

A non-native species of rust fungus (*Phragmidium violaceum*) was found on Himalayan blackberry in Oregon in 2005 that is believed to have been accidentally introduced (Peters 2012). It partially to fully defoliates both Himalayan and evergreen blackberries (*Rubus laciniatus*) and reduces tip rooting (DiTomaso et al. 2013). This fungus has been successfully used in Chile, Australia, and New Zealand (Peters 2012) and testing in Oregon indicated that the rust had minimal to no impact on native blackberry populations, but impacted one commercial variety.

Himalayan blackberry in bloom

CREDIT: ISCMV

CONTROL SUMMARY

The following table provides a summary and comparison of control methods for Himalayan blackberry.

CONTROL STRATEGY	TECHNIQUES	APPLICABLE SITE TYPE	PROS	CONS
Manual	**Hand pulling**	Young individual plants that are large enough to grip	Selective, non-chemical, can be done by volunteers, inexpensive	Labour intensive
	Digging, grubbing	Individual plants, sites of all sizes	Selective, non-chemical, can be done by volunteers, inexpensive	Labour intensive, creates disturbance
	Cutting 30 centimetres above the ground	Use before pulling or digging to provide easy access to roots	Selective, non-chemical, can be done by volunteers, causes minimal harm to surrounding plants	Repeated cutting required, not an effective method on its own
	Vegetation release	Sites with existing native vegetation	Encourages growth of native plants	Long-term commitment
Mechanical	**Mowing, tilling to remove exposed roots**	Areas accessible by a machine	Less labour intensive, non-chemical	Requires trained staff, speciality equipment, creates disturbance, must be repeated multiple times each year
Chemical	**Foliar application, basal bark spray, cut stump**	High density sites, sites with minimal integration of native trees and shrubs, non-aquatic environments	Treatment method for plants that cannot be managed other ways, less labour intensive, treat large areas	Unintended environmental/ health impacts, high public concern, requires trained staff, weather dependent
Cultural	**Growing a closed tree canopy**	Where appropriate to install trees	Natural, can be used with other methods	Long-term commitment, labour intensive, not suitable for sites where tree canopy is not desired, blackberry will always persist on perimeters of shaded areas
	Targeted grazing	Large, continuous patches with little other desired vegetation, sites that meet infrastructure and logistical requirements of a grazing herd	Livestock can provide treatment on slopes and terrain inaccessible to humans or machinery	Complete eradication unlikely, environmental damage, long-term commitment
Biological	**No bioagents are currently available for distribution in British Columbia**			

CONTROL SUMMARY COLOUR LEGEND

GREEN: RECOMMENDED

ORANGE: CAUTION

RED: NOT RECOMMENDED OR NOT AVAILABLE

Disposal

Control methods for blackberry tend to generate a large volume of green waste. In most cases, it is desirable to dispose of blackberry off site to facilitate access for future monitoring, follow-up treatment and restoration planting.

OFF SITE DISPOSAL

When disposed off site, transport plant parts on tarps or in thick plastic bags to an appropriate disposal or compost facility (see below). Care should be taken to ensure that plant parts are not spread during transport (ISCBC 2014).

In the Metro Vancouver region, several facilities accept Himalayan blackberry plants and/or infested soil. This list provides addresses and website links for the disposal facilities. This list is updated periodically.

PLEASE CONTACT ALL FACILITIES BEFOREHAND TO CONFIRM THEY CAN PROPERLY HANDLE THE MATERIAL.

ON SITE DISPOSAL

When off site disposal is not practical, chipping the plant into small pieces and leaving the green waste on site as mulch is a viable option, provided the root crowns are removed from the site. Although blackberry can re-sprout from roots and root crowns, if all plant parts are fully removed from the soil they tend to dry out and die very quickly and are rarely observed re-sprouting in Metro Vancouver (MacKenzie 2017). Roots can also be suspended in the air on nearby trees to ensure they dry out and don not re-sprout (Pocock 2017).

Composting Himalayan blackberry foliage and berries at home or at municipal works yards is **not recommended** as the temperature will not reach high enough to kill the roots or seeds.

CLEANING AND DISINFECTION[5]

Before leaving a site, remove all visible plant parts and soil from vehicles, equipment, and gear, and if possible, rinse these items. When back at a works yard or wash station, vehicles should be cleaned and disinfected using the following steps:

- Wash with 180 °F water at 6 gpm, 2000 psi*, with a contact time of ≥ 10 seconds on all surfaces to remove dirt and organic matter such as vegetation parts or seeds. Pay special attention to undercarriages, chassis, wheel-wells, radiators, grills, tracks, buckets, chip-boxes, blades, and flail-mowing chains.
- Use compressed air to remove vegetation from grills and radiators.
- Sweep/vacuum interior of vehicles paying special attention to floor mats, pedals, and seats.
- Steam clean poor access areas (e.g., inside trailer tubes) – 200 psi @ 300 °F.
- Fully rinse detergent residue from equipment prior to leaving facility.

* Appropriate self-serve and mobile hot power-wash companies in the Metro Vancouver area include: Zolliker Fleet Cleaning, Omega Power Washing, Eco Klean Truck Wash, RG Truck Wash, Ravens Mobile Pressure Washing, Hydrotech Powerwashing, Platinum Pressure Washing Inc, and Alblaster Pressure Washing. Wash stations should be monitored regularly for Himalayan blackberry growth.

Follow-up Monitoring

Whatever control method is used, follow-up monitoring and maintenance treatments are important components of an integrated management plan or approach. Initial treatments are rarely successful in removing or killing all roots and root crowns. Resprouting and new germination from the seed bank are very likely. In addition, it is quite common for an effectively controlled blackberry patch to be re-invaded by surrounding patches (Bennett 2007), so it is critical to monitor for invasion from adjacent areas.

- Annual follow-up monitoring should take place following initial treatment for both chemically and manually treated sites. The number of years of monitoring required will vary depending on the control method(s) and site characteristics. In Metro Vancouver, sites controlled through manual digging and restored with native vegetation need a minimum of three years of follow-up treatments on average (MacKenzie 2017).
- When controlling blackberry through vegetation release (see MANUAL/MECHANICAL control section), control should be ongoing until native trees reach a height of 5 m (Soll 2004).

In the long-term, taking steps to encourage and support the growth of a coniferous tree canopy in riparian and forest areas will help keep blackberry levels low (Bennett 2007).

5 Adapted from Metro Vancouver 2018 Water Services Equipment Cleaning Procedures and Inspection Protocols.

Restoration

Restoration is recommended to create competition, control Himalayan blackberry regrowth, and replace lost food supply for pollinators. If only herbicide was used, manual/mechanical removal of the dead canes and root crowns may be necessary prior to planting.

Mulch can be used to avoid leaving bare soil and reduce colonization by other invasive plant species. The International Society of Arboriculture and relevant municipal parks or arboriculture departments offer guidelines for mulch application. Specific mulch depths can be used to control invasive weeds and encourage plant growth (International Society of Arboriculture 2011). If restoration and/or mulch application is not feasible at the time, installation of erosion and sediment control measures and/or a planting quick establishing native grass mix are recommended to avoid leaving bare soil exposed until restoration is feasible.

Replacement species should be chosen based on the ecology of the site by a qualified environmental professional. Local biologists, environmental professionals, agronomists, agrologists, native and domestic forage specialists, seed companies, and plant nurseries are all good sources for localized recommendations for regional native species and regionally adapted domestic species, based on site usage. Native grass seed mixes are also available. Several science-based resources are available to guide restoration efforts, such as the South Coast Conservation Program's Diversity by Design restoration planning toolkit.

Examples of common competitive native species prescribed for Metro Vancouver sites are summarized in the table below based on site moisture.

WET SITES	MOIST SITES	DRY SITES
SHRUBS		
Salmonberry	Salmonberry	Thimbleberry
Hardhack	Willow	Nootka rose
Willow	Red osier dogwood	Red flowering currant
Red osier dogwood	Red elderberry	Snowberry
Pacific ninebark	Vine maple	Tall Oregon grape
Black hawthorn	Indian plum	Oceanspray
TREES		
Western red cedar	Western red cedar	Douglas-fir
Red alder	Red alder	Red alder

Revegetation of the site to a domestic or cultured non-native plant species composition may be considered in some circumstances. Often domestic species establish faster and grow more prolifically, which aids in resisting invasive blackberry re-invasion.

Himalayan blackberry sites are often found in areas with existing, or potential, wildlife populations (e.g. deer, beaver, muskrat, vole, etc.) that can damage restoration plantings. Therefore, any revegetation plan must consider impacts from wildlife and utilize appropriate mitigation measures to protect the restoration and existing native plantings (tree wrapping, exclusion caging/fencing, vole guards, etc.).

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Additional Resources

For more information please refer to the following resources.

Invasive Species Council of British Columbia Himalayan blackberry Fact Sheet. https://bcinvasives.ca/wp-content/uploads/2021/01/Himalayan_Blackberry_Factsheet_20190220.pdf

British Columbia Ministry of Forests, Lands, Natural Resources Operations and Rural Development, Invasive Alien Plant Program (IAPP). http://www.gov.bc.ca/invasive-species

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King County Noxious Weed Control Program: *Best Management Practices for Himalayan Blackberry.* King County, Washington http://your.kingcounty.gov/dnrp/library/water-and-land/weeds/BMPs/blackberry-control.pdf

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E-Flora BC, an Electronic Atlas of the Plants of BC. http://www.eflora.bc.ca/

Grow Me Instead. https://bcinvasives.ca/play-your-part/plantwise/

Pesticides and Pest Management, Province of British Columbia https://www2.gov.bc.ca/gov/content/environment/pesticides-pest-management

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