BEST MANAGEMENT PRACTICES FOR

Spurge Laurel

in the Metro Vancouver Region

metrovancouver
SERVICES AND SOLUTIONS FOR A LIVABLE REGION

ISCMV
INVASIVE SPECIES COUNCIL OF METRO VANCOUVER

Disclaimer

This publication is not intended to endorse or recommend any particular product material or service provider, nor is it intended as a substitute for engineering, legal, or other professional advice. Such advice should be sought from qualified professionals.

While the information in this publication is believed to be accurate, this publication and all of the information contained in it are provided "as is" without warranty of any kind, whether express or implied. All implied warranties, including, without limitation, implied warranties of merchantability and fitness for a particular purpose, are expressly disclaimed by Metro Vancouver. The material provided in this publication is intended for educational and informational purposes only.

Created by: Metro Vancouver, City of Surrey, and the Invasive Species Council of Metro Vancouver

In partnership with: Diamond Head Consulting

Requested by: The Regional Invasive Species Working Group for the Metro Vancouver region and the City of Surrey

Metrotower III, 4515 Central Boulevard, Burnaby, BC, V5H 0C6
metrovancouver.org

June 2022

Contents

CREDIT: ISCMV

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 Spurge Laurel 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.

Spurge laurel[1] is a perennial evergreen shrub native to Eurasia, northern Africa and the Mediterranean region that was introduced to North American as an ornamental plant (Strelau, Clements, Webb, & Prasad, 2018). Caution must be exercised when managing this species due to toxins that can cause health impacts in human and animals, including death if ingested.

Once established, spurge laurel can form a dense shrub layer and outcompete native plants in coastal BC forests, especially in vulnerable ecosystems. Although slow-growing, spurge laurel is long-lived and has the ability to disperse quickly and over long distances by birds and rodents spreading seeds (Canadian Forest Service Natural Resources, 2003). Strelau et al (2018) note that "widespread planting combined with a lack of public knowledge regarding the species' invasiveness has created great concern over its potential to spread".

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 spurge laurel, it is anticipated that the recommended best management practices will change. This document will be updated to reflect these changes as the information becomes available. Please check metrovancouver.org regularly to obtain the most recent version of these best management practices.

1 Spurge laurel (***Daphne laureola***) is also known by the common names spurge-laurel, Daphne, Daphne laurel, Daphne-laurel, Daphne spurge, wood laurel, dwarf spurge laurel and false laurel (Washington State Noxious Weed Control Board, 2021) **(Sargent, et al., 2003)**. It is referred to as spurge laurel in this document.

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 spurge laurel within the terrestrial vascular plants list.

IMPACTS

Indigenous Peoples have an intrinsic relationship with the natural world, built on reciprocity and stewardship. Many native plants and animals have cultural and spiritual significance for Indigenous Peoples, in addition to being important food and medicine sources. Indigenous communities in British Columbia have collectively called for invasive species prevention, management, and control due to their impact on infrastructure, the economy, human health, ecosystems, and cultural practices. Further collaboration with Indigenous Peoples will deepen our understanding about the impacts of invasive species, such as spurge laurel, on Indigenous ways of life and our shared environment.

All spurge laurel plant parts contain poisonous compounds including daphnetoxin, mezerein, and dihydroxycoumarin, which can be harmful to both animals and humans if ingested in sufficient quantities (Strelau, Clements, Webb, & Prasad, 2018) (Moshiashvili, Tabatadze, & Mshvildadze, 2020). Ingestion causes the following symptoms: burning in the mouth, swelling of the tongue and lips, followed by thirst, difficulty swallowing, nausea, vomiting, diarrhea, weakness, coma and possibly death in rare circumstances (WorkSafe BC, 2006). As few as 2-3 berries can fatally poison a child (Strelau, Clements, Webb, & Prasad, 2018). Poisoning can also occur through skin contact with the sap and leaves – these symptoms manifest as an itchy rash to severe irritation, usually disappearing after a few days (Mayne Island Conservancy, 2020; WorkSafe BC, 2006). Airborne droplets of sap can cause eye and throat irritation (WorkSafe BC, 2006).

Although spurge laurel is fairly slow to establish, it can expand into and inhabit areas where few other invasive plants survive (Mayne Island Conservancy, 2020). It is shade tolerant and spreads in shady woodland sites, reducing the amount of sunlight reaching the ground, inhibiting the growth of native plants and often leaving the forest floor unoccupied because of lack of sunlight (Strelau, Clements, Webb, & Prasad, 2018). Although details are unknown, spurge laurel is thought to alter soil chemistry (Webb, 2006), further hindering native plant growth (Strelau, Clements, Webb, & Prasad, 2018).

REPRODUCTION AND SPREAD

Despite its toxicity, many species of birds (e.g., American robin and cedar waxwing) and small mammals can tolerate eating spurge laurel berries and readily disperse the seeds in urban natural areas (4-County Cooperative Weed Management Area, 2018; Strelau, Clements, Wedd, & Prasad, 2018). Spurge laurel will not re-sprout from roots, but will readily re-sprout from the stem tissue at or below the soil (Mayne Island Conservancy, 2020).

This species has been sold as an ornamental plant and can be found in gardens (4-County Cooperative Weed Management Area, 2018) and maintained on residential properties.

HABITAT AND DISTRIBUTION

Spurge laurel thrives in gardens, along roadsides, at waste sites, and as an understory shrub in forests, especially near residential and urban areas. It is often found growing in isolated clusters, but can also form large, dense, dominant stands. It is commonly associated with other similar invasive plants such as English and Irish ivies (*Hedera helix and H. Hibernica*), English holly (*Ilex aquifolium*) and Himalayan blackberry (*Rubus bifrons*), and native plants such as salal (*Gaultheria shallon*) and Oregon-grape (*Mahonia spp.*) (Strelau, Clements, Webb, & Prasad, 2018) (Lei, 2014). Spurge laurel has a competitive advantage in areas with high deer populations as the animals do not browse it (Underhill, Management of Daphne laureola presentation, 2020).

Spurge laurel can tolerate partial to full shade, although higher densities are found in forests with moderate shade levels compared to high (open canopy) and low (closed canopy) levels of sunlight (Lei, 2014). Plants growing in low sunlight tend to have thinner, darker green, healthier looking leaves whereas plants in high sunlight have thicker, slightly curled, yellowing leaves (Strelau, Clements, Webb, & Prasad, 2018). Spurge laurel can grow in a variety of soil conditions and soil moisture is rarely a limiting factor (Lei, 2014).

Spurge laurel is found in all provinces in Canada and the Yukon Territory (North Carolina State University Extension, 2020). It is common in southwestern coastal BC, including southern Vancouver Island, Gulf Islands, Sunshine Coast, Fraser Valley and Metro Vancouver (Strelau, Clements, Webb, & Prasad, 2018). Lei (2014) predicts that this species has potential to spread further across western Canada.

Many people and agencies have put forth considerable effort managing this species on Vancouver Island and the Southern Gulf Islands (Underhill, 2021), which has informed much of the local research and knowledge about this species.

Spurge laurel seedlings arising from a seed bank now dominate this forest understory

CREDIT: ISCMV

CLIMATE CHANGE ADAPTATION

Climate models 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. At 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 competition from invasive species.

Spurge laurel may be able to adapt to our future climate in several ways:

- **Extended growing season:** Spurge laurel is able to photosynthesize throughout the entire year, even during the winter months, increasing its survivability (Strelau, Clements, Webb, & Prasad, 2018). In a study of temperature and first flowering date in central England, spurge laurel was among a minority of plants that exhibited earlier first flowering dates with higher autumn temperatures (whereas most plants responded by delaying or retarding flowering) (Fitter, Fitter, Harris, & Williamson, 1995).
- **Longer summer drought periods:** Although spurge laurel thrives in shady habitats, it can survive in full sun (Canadian Forest Service Natural Resources, 2003). It is able to take advantage of high light situations (for example, during a summer drought), producing more fruits and enhancing seedling survival with sunnier conditions (Strelau, Clements, Webb, & Prasad, 2018). Further, the plant is efficient at conserving water (Strelau, Clements, Webb, & Prasad, 2018) and during summer drought conditions, produces berries with a higher water content compared to other berry-producing plants, which may preferentially attract animals that disperse the berries (Lei, 2014).

With these kinds of competitive advantages, this species is more adaptable than native species in a variety of ecosystems. Its ability to survive in variable conditions and spread quickly suggests that it will be able to withstand, and possibly thrive, with changing climate conditions.

Identification

Unless otherwise noted, the following identification information was collected from Strelau et al (2018).

Lifecycle: Evergreen shrub that lives longer than 40 years (Canadian Forest Service Natural Resources, 2003).

Stem: Thin, green when immature, greyish-brown once mature; 0.4 – 1.5 metres tall, resembling small trees; flexible; stems can grow upright, or prostrate (lying on the ground for a portion) (Washington State Noxious Weed Control Board, 2021); plants can have up to 100 stems per metre squared branching from the base (Lei, 2014).

Leaves: Evergreen, thick, waxy, smooth, shiny on top; yellow-green, older leaves dark green; oval to oblong, often tapered at the base; 4 – 13 centimetres long and 1 – 3 centimetres wide; grow in dense whorls at the ends stems; new leaves form a few weeks after flowering, in late January.

Flowers: Small, sweetly scented, tubular shaped splitting into 4 lobes (petals) at the end; pale yellow-green; 6 – 12 millimetres long, in clusters of 5-20 found at the base of the leaves at the tops of the stems from January to April; plants begin flowering in their second to fourth year of growth (Webb, 2006), typically when they are 25 centimetres or taller (Underhill, 2020).

Flowers and fruits persist for short periods and are often inconspicuous or not visible during most of the year.

Fruits: Small, round to egg-shaped berries with a single seed, 8 – 22 millimetres long; turning from green to purple-black as they ripen in early June (Lei, 2014); berries fall off in July-August or are eaten by birds or rodents (Mayne Island Conservancy, 2020). The bitter taste of the berries likely discourages consumption and limits poisoning of other animals (Washington State Noxious Weed Control Board, 2006). Seed viability is thought to decrease substantially after two years (Webb, 2006).

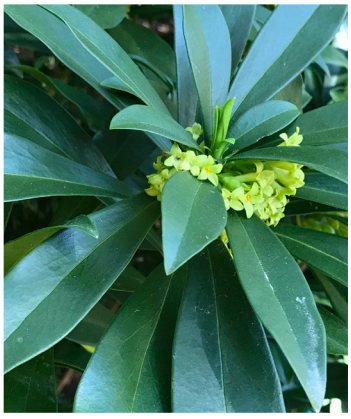
Roots: There are many woody roots; there is a colour change from the brown stem to orange roots at the root collar, the place where the stem becomes root (Nature Conservancy of Canada, 2007), although it is often subtle (Underhill, 2021).

Other characteristics: Plants have a strong, unpleasant odour when cut.

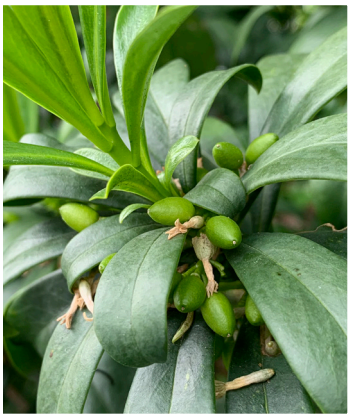
The following photos show spurge laurel plant parts.

Bark of a mature, multi-stemmed plant with visible leaf scars
CREDIT: ISCMV

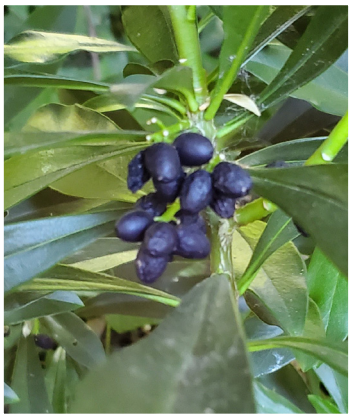
Leaves
CREDIT: ISCMV



Flowers
CREDIT: CITY OF SURREY



Immature berries and new leaves at the top of a stem
CREDIT: ISCMV



Mature berries
CREDIT: CITY OF SURREY

Seedling
CREDIT: ISCMV

Orange roots
CREDIT: ISCMV

SIMILAR SPECIES

NATIVE SPECIES

The species most commonly mistaken for spurge laurel are listed below.

- **Pacific rhododendron** (*Rhododendron macrophyllum*) 1 – 8 metres tall with evergreen, leathery, oblong-elliptic, 8 – 20 centimetre long leaves and many bright pink to purple flowers up to 5 centimetres wide in terminal clusters (Klinkenberg, 2020). People often mistake spurge laurel for a small rhododendrons (Mayne Island Conservancy, 2020). There are also horticultural varieties of rhododendron (see non native species below).

NON NATIVE SPECIES

- **Rhododendrons** (*Rhododendron species*) are variable in height, leaf size and flower colour, but are usually much larger than spurge laurel, reaching heights of 5 metres tall/wide (City of Victoria, 2021). Rhododendron flowers are showy, colourful (ranging from white, yellow to pink, purple and red), and larger than spurge laurel flowers. See the native Pacific rhododendron photo for a representation of the general look of rhododendrons.
- **February daphne** (*Daphne mezereum*) is a woody, deciduous shrub with purple, pink or white flowers in clusters (Strelau, Clements, Webb, & Prasad, 2018) that emerge prior to the leaves in early spring and become bright red berries (Missouri Botanical Garden, 2021). Like spurge laurel, February daphne is highly toxic (Missouri Botanical Garden, 2021).
- **Winter Daphne** (*Daphne odora*) is very similar in habit to spurge laurel and can be planted as an ornamental alternative (Evergreen, 2021). Winter Daphne has highly fragrant cream to purple flowers that bloom in winter (Invasive Species Council of BC, 2021). It is small, with thick, lance-shaped leaves that are often variegated. The berries of this plant are also poisonous (Invasive Species Council of BC, 2021).

Pacific rhododendron

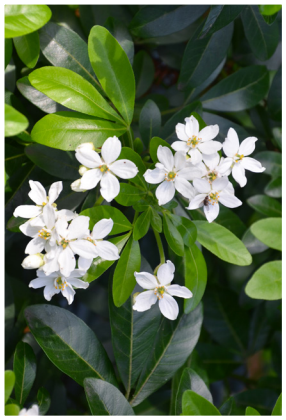
CREDIT: R. DROKER VIA FLICKR

- **Choisya or Mexican mock orange** (*Choisya ternata*) is a compact, rounded, evergreen shrub that produces plentiful clusters of fragrant while flowers that broom in the spring and again in late summer (City of Victoria, 2021); glossy leaves have three leaflets (Gardenworks, 2021). This plant is a suitable alternative for spurge laurel in a number of landscape settings.
- **Cherry laurel/English laurel** (*Prunus laurocerasus*) is a tall evergreen shrub or tree with alternate, thick, waxy, fine-toothed, oblong, 7-20 centimeters long leaves. It has tall cylindrical clusters of white flowers in the spring that become fleshy purplish-black berries 10 – 15 millimetres long with a large stone (Klinkenberg, 2020). Although it is considered invasive, it has been widely used as a hedge plant in the Metro Vancouver region. Like spurge laurel, the berries, leaves and bark of cherry laurel are all poisonous.

February daphne with flowers
CREDIT: FRUPUS
VIA FLICKR

February daphne with berries
CREDIT:
H. HILLEWAERTVIA
VIA FLICKR

Winter daphne
CREDIT: A. DAVEY
VIA FLICKR



Choisya
CREDIT: VLAD PROKLOV
VIA FLICKR

Cherry laurel
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 2021), which houses information about 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 carrying out a spurge laurel inventory it is useful to record the following information as it will later inform treatment plans:

- Size and density of infestation;
- Location in relation to the 10-metre Pesticide-Free Zone adjacent to water courses;
- Location in relation to other water sources, such as wells;
- Public access (whether there is risk of public contact with the plant).

Reporting

Please report spurge laurel occurrences to:

- The Provincial Report Invasive Species program (via smart phone app www.gov.bc.ca/invasive-species).
- The Invasive Species Council of Metro Vancouver: 604-880-8358 or www.iscmv.ca.
- The municipality where the spurge laurel was found.
- The landowner directly – If the landowner is unknown, the Invasive Species Council of Metro Vancouver can provide support to identify the appropriate authority.

Reports submitted through these channels are reviewed by invasive species specialists who coordinate follow-up activities when necessary with the appropriate local authorities. However, some people may be hesitant to report infestations as their presence may affect property values.

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.

HANDLING SPURGE LAUREL SAFELY

Since spurge laurel is toxic to touch, inhale and ingest, personal protective equipment (PPE) should be used to reduce the risk of harm to workers. To ensure the necessary precautions are taken, it is best to hire a professional to handle spurge laurel infestations.

WHEN HANDLING SPURGE LAUREL PLANTS, THE FOLLOWING PPE SHOULD BE WORN:

- Waterproof gloves;
- Goggles or face shield, as droplets of sap may be released into the air upon disturbance;
- Long sleeved shirt and pants or waterproof coveralls or rain gear (pants and jacket with hood) (WorkSafe BC, 2006);
- A HEPA filter face mask (Underhill, 2021) or respirator when cutting or manually controlling plants for extended periods (Strelau, Clements, Webb, & Prasad, 2018).

Personal protective equipment used to manage spurge laurel

CREDIT: SEA TO SKY INVASIVE SPECIES COUNCIL

Wash hands thoroughly after management activities and before eating. After use, gloves and clothing should be disposed or laundered to prevent a buildup of sap (WorkSafe BC, 2006).

BE SURE TO HAVE THE FOLLOWING ON HAND:

- Access to water or portable water source for cleaning gloves and clothes;
- Hand soap;
- A portable eyewash station; and
- A first aid kit.

When possible, avoid direct skin contact with the plant (e.g., when using a machine or tool). Be sure that others without PPE are not in the area where management activities will take place. Mechanical methods (weed-eating, etc.) produce more toxic vapours than manual control methods (Nature Conservancy of Canada, 2007).

If skin comes in contact with sap, flush with copious amounts of water and consult a physician if a rash develops (WorkSafe BC, 2006). If sap gets into the eyes, flush with copious amounts of water, then consult a physician (WorkSafe BC, 2006). For additional first aid advice, consult WorkSafe BC.

For the reasons noted above, this plant may not be a suitable candidate for community weed pull activities for the general public or school/youth groups. However, experienced volunteers could undertake this work if they have received training on the safety hazards of the plant, have access to appropriate PPE, and are directly supervised by an expert who can advise on best practices and disposal.

Prioritize management at sites where people or animals may easily come in contact with the plants. For large sites or dense patches of spurge laurel, it is also recommended to manage isolated individuals first (Mayne Island Conservancy, 2020).

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 spurge laurel over the long term.

Prior to any work around spurge laurel, follow the protocols for PPE outlined above. When working in or adjacent to spurge laurel, it is best to 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 spurge laurel before leaving an infested area. Plants, plant parts, and seeds should be tarped or bagged before transport to an appropriate disposal site with extreme caution as airborne sap droplets can cause respiratory irritation (see Disposal section).

When selecting plants for a site, do not purchase, trade, or transplant spurge laurel. The Invasive Species Council of BC's 'Grow Me Instead' Program or Metro Vancouver's Grow Green website provide recommendations for non-invasive, drought-tolerant plants, and garden design ideas. All materials (e.g., topsoil, gravel, mulch, compost, wood chips, plant stock) should be weed-free. Spurge laurel could be unintentionally introduced via these materials and sites where they are used should be monitored carefully for any growth (Crosby, 2018).

Healthy green spaces are more resistant to invasion by invasive plants, so it is also important to maintain or establish healthy plant communities.

MANUAL/MECHANICAL: RECOMMENDED

While wearing appropriate PPE, the following methods can be used to control spurge laurel:

- **Cutting the plant below the root collar** with hand pruners or loppers is the most effective method for any size plant of any size infestation (Nature Conservancy of Canada, 2007) and is an appropriate method for initial removal of dense spurge laurel cover (Webb, 2006). Spurge laurel can re-sprout from the stem, but will not re-sprout from the roots or below the root collar. The root collar is where the stem becomes root (Mayne Island Conservancy, 2020). To be sure that the plant is cut at the right place, cut below the uppermost lateral root (Mayne Island Conservancy, 2020). Cutting at this part of the plant may require putting the cutting tool into the ground at the base of the plant, then cutting it underground. Stems lying on the ground need to be pulled up before cutting, to help determine the location of the root collar (Webb, 2006).

  Roots can be left in the ground. While not a viable method on its own, applying mulch to sites where spurge laurel has been cut can eliminate or reduce re-sprouting (Prasad, 2005). Due to the cost and logistics of mulch application, it may only be feasible at small sites (Prasad, 2005).

- **Cutting the tops off plants < 2-3 years old** can be effective as young plants do not have enough energy to grow new branches (Strelau, Clements, Webb, & Prasad, 2018). Cutting the top whorl of leaves with hand pruners or loppers may also deter flower and seed production if timed before those reproductive stages.

- **Pulling or digging**

  - **Plants < 15 centimetres tall** can be pulled by hand (Underhill, Management of Daphne laureola presentation, 2020), which is easiest during rainy periods when the soil is moist. Pulling slowly and steadily will allow removal of most of the roots (Thurston County Noxious Weed Control Board, 2017). Some plants may be difficult to pull and should be removed using another method to avoid injury. Soil disturbance should be minimized when using this technique.

The root collar (indicated by the arrow) is located on the stem where the roots begin to flare out

CREDIT: ISCMV

  - **Plants > 15 centimetres tall** can be pulled, dug out, or excavated using a manually-operated tool (e.g., Weed Wrench©, Extractigator©, and others) that removes entire plants via a base with powerful jaws and a handle that uses leverage to pry the roots from the ground (Nature Conservancy of Canada, 2007). A shovel can also be used to dislodge the plant and roots (4-County Cooperative Weed Management Area, 2018). However, digging may increase worker exposure to the plant's toxic vapours, so cutting below the root collar (described above) is generally the preferred method for plants > 15 centimetres tall (Underhill, 2020).

If the stems break when pulling or digging, and the plant cannot be fully removed, cut the stump below the root collar using the method described above, in order to avoid re-sprouting (Nature Conservancy of Canada, 2007).

- **Cutting with a brush cutter, weed eater, etc.** can be used for large patches of seedlings (Nature Conservancy of Canada, 2007), as plants younger than 2-3 years old have less survival capacity than mature plants when the above-ground portion of the plants are cut (Washington State Noxious Weed Control Board, 2006). Cut the plants as close to the ground as possible (King County, 2021). This method is less labour intensive than manual control methods described above and less disturbing to the soil, however, non-target plants can easily be damaged. This method may also cause plant sap to more easily volatilize, which poses a greater risk to workers (Nature Conservancy of Canada, 2007). If using a brush cutter or weed eater, it is extremely important that workers wear appropriate safety gear, including a respirator.
- **Burning** is nis not a safe management technique as it releases toxic substances (Strelau, Clements, Webb, & Prasad, 2018).

REMOVAL TIMING

Although removal is possible year-round, it is best to prioritize manual/mechanical removal before berries ripen to prevent seed production and when the ground is wet (late winter/early spring) (4-County Cooperative Weed Management Area, 2018).

APPLYING MANUAL/MECHANICAL CONTROL METHODS IN RIPARIAN AREAS

Spurge laurel often grows in large contiguous patches right up to the edge of 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.

Spurge laurel invading a roadside and forest edge

CREDIT: ISCMV

CHEMICAL: CAUTION

When alternative methods to prevent or control invasive plants are unsuccessful, professionals often turn to herbicides. Herbicide application on spurge laurel is less effective due to its thick, waxy leaves, although it is sometimes successful (Strelau, Clements, Webb, & Prasad, 2018).

This method should be used with caution for the following reasons (Crosby, 2018):

1. Weather conditions greatly influence treatment efficacy;
2. Spurge laurel often grows in riparian areas where pesticide use is restricted; and
3. Since spurge laurel growth is closely associated with other plants, chemical control can easily damage non-target species (Province of BC, 2002).

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.

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 governments, 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 that 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 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. However, since spurge laurel is not a regulated noxious weed in the Metro Vancouver region, the 'Landscape' certification category is needed for herbicide use on public and private lands. 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, create poor control results, or pose a 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

Although not specifically listed on the labels for the following herbicides, spurge laurel may be treated under the general application provision for woody plants. The following information is from Prasad et al. (2005) and Strelau et al. (2018).

ACTIVE INGREDIENT (EXAMPLE BRAND NAMES)+	APPLICATION	PERSISTENCE	GROWTH STAGE++	TYPE+++
Triclopyr (e.g., GarlonTM)	foliar application, cut stump	residual	actively growing	selective, no effect on grasses
Glyphosate (many products)§	foliar application, cut stump	non-residual*	actively growing	non-selective

+ 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.

++ Active growing periods vary from year to year depending on weather and other factors. There may be more than one active growing period for a plant in a year.

+++ 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.

§ Glyphosate can impact trees with roots within or adjacent to the treatment area.

* Non-residual herbicides are active only on growing plant tissue have little or no persistence in the soil whereas residual herbicides persist in the soil, remaining effective over an extended period.

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 need to be followed (which means for glyphosate products treatment can happen up to the water's edge) and other restrictions may apply (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)[3] in British Columbia in accordance with the I*ntegrated Pest Management Act* and Regulation and all public land Pesticide Management Plans (PMPs). A plant must be either a listed Noxious Weed (under the Weed Control Act) or appear in the *Forest and Range Practices Act* Invasive Plants Regulation to be treated within the 10 metre PFZ. S**purge laurel is not listed and therefore glyphosate and other herbicides can only be applied on spurge laurel up to 10 metres away from the high water mark (HWM)** [4]. 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 will not enter the intake or well.

When managing spurge laurel with herbicide in riparian areas:

- Observe and mark all PFZs while on site.
- The high water mark (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, 2011).

APPLICATION METHODS

Even plants that are treated are toxic, so appropriate PPE is required at all times and during all stages of control.

- **Foliar application** can be undertaken by hand sprayer or backpack sprayer. Leaves and stems should be sprayed until they are wet but not dripping (Island County Noxious Weed Control Board, 2015). To prevent seed spread, herbicide can be applied from the start of the growing season until the late blooming stage (Thurston County Noxious Weed Control Board, 2017). If application is planned for later in the year after berries have formed, stems with berries should be first cut and removed to prevent seeds from ripening or spreading (Thurston County Noxious Weed Control Board, 2017).
- **Cut stump application** can be used to prevent re-growth from cut stems (King County, 2021). After cutting the stems as close to the ground as possible, the cut stems should be immediately painted with herbicide (Island County Noxious Weed Control Board, 2015).

CULTURAL: NOT AVAILABLE

There are no documented cultural control methods for spurge laurel. Due to the toxicity of spurge laurel, targeted grazing is not a suitable management option for this species.

BIOLOGICAL: NOT AVAILABLE

There are no biological control agents currently available in BC for spurge laurel. Preliminary studies of the native fungus *Phomopsis* as a biocontrol agent for spurge laurel showed promise (Prasad, 2005), but research was abandoned due to lack of funding (Washington State Noxious Weed Control Board, 2006). The Provincial biocontrol program is not currently studying this potential biocontrol agent.

Large, multi-stemmed spurge laurel

CREDIT: ISCMV

CONTROL SUMMARY

The following table provides a summary and comparison of control methods for spurge laurel. The use of personal protective gear is advised.

CONTROL STRATEGY	TECHNIQUES	APPLICABLE SITE TYPE	PROS	CONS
Manual	**Cutting the plant below the root collar**	Plants and sites of any size	If plants are removed offsite the safety hazard is immediately eliminated, selective, non-chemical	Labour intensive, plants can resprout from the stems if cut above the root collar
	Cutting the tops off plants < 2-3 years old	Seedlings or young plants	If plants are removed offsite the safety hazard is immediately eliminated, selective, non-chemical, prevents flower/seed production if timed appropriately	Labour intensive, re-growth is possible
	Pulling or digging plants < 15 centimetres tall	Seedlings or young plants	If plants are removed offsite the safety hazard is immediately eliminated, selective, non-chemical	Labour intensive, may create soil disturbance, higher risk to workers compared to cutting
	Pulling or digging plants > 15 centimetres tall	Mature plants		Not as effective as cutting below the root collar, labour intensive, may create soil disturbance, greater risk to workers compared to cutting
Mechanical	**Cutting with a brush cutter, weed eater, etc.**	Large sites with seedlings	Less labour intensive than manual control methods, less disturbing to soil, non-chemical	Can increase risk of injury to workers, contaminates equipment, risk of non-target damage
Chemical	**Foliar application**	Sites that cannot be managed in other ways, sites with minimal integration of native plants, sites with high exposure risk for staff	Selective with appropriate herbicide and application, less labour intensive	After treatment safety hazard still present, unintended environmental/health impacts, high public concern, weather dependent, requires trained staff, does not address seed bank
	Cut stump application	Plants that have been previously cut	Selective with appropriate herbicide and application, may prevent re-growth of cut plants	Unintended environmental/health impacts, high public concern, weather dependent, requires trained staff, does not address seed bank
Manual	**Burning**	None		Not effective, not safe
Cultural	**Grazing**	None		Not a suitable management option for this species, potential toxicity
Biological	**No biological control agents are currently available for distribution in British Columbia**			

CONTROL SUMMARY COLOUR LEGEND

GREEN: RECOMMENDED

ORANGE: CAUTION

RED: NOT RECOMMENDED OR NOT AVAILABLE

Disposal

Disposal options for spurge laurel are dependent on site specifics and volumes and are best determined on a site-by-site basis (Underhill, 2021).

ON SITE DISPOSAL

Spurge laurel decomposes significantly within two years (Underhill, 2021) but on site disposal is not recommended unless the material can be piled on the soil surface, and left where no people or animals will encounter it (4-County Cooperative Weed Management Area, 2018). If there is risk to other site users, due to the toxicity of the plant material, it should be removed offsite (Nature Conservancy of Canada, 2007)

Home composting is not recommended (4-County Cooperative Weed Management Area, 2018). Home compost that contains spurge laurel should never be used on edible plant gardens.

OFF SITE DISPOSAL

When disposed off site, since airborne sap droplets can cause respiratory irritation, all plant parts should be tarped or placed in thick plastic bags before transporting to an appropriate disposal facility. Never transport spurge laurel plants inside an enclosed vehicle (Nature Conservancy of Canada, 2007). Spurge laurel plants should not be burned, as this releases a toxic vapour.

In the Metro Vancouver region, few facilities accept spurge laurel plants and/or infested soil since it is considered a 'toxic plant' under local waste disposal legislation. Please consult this disposal facility list for current details.

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

CLEANING AND DISINFECTION[5]

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

- Wash with 180°F (82°C) 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 (149°C).
- Fully rinse detergent residue from equipment before leaving the facility.

* Appropriate self-serve and mobile hot power-wash companies in the Metro Vancouver area include: 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 spurge laurel growth.

Follow-up Monitoring

Whatever control method is used, follow-up monitoring and maintenance treatments are components of an integrated management plan or approach. Large infestations will result in dense germination from the seed bank usually within two to three years (Nature Conservancy of Canada, 2007). Monitor spurge laurel sites at least once annually (Thurston County Noxious Weed Control Board, 2017) and continue to manage any seedlings that germinate at the site (Mayne Island Conservancy, 2020).

Spurge laurel seedlings arising from a seed bank now dominate this forest understory

CREDIT: ISCMV

5 Adapted from Metro Vancouver 2017 Water Services Equipment Cleaning Procedures and Inspection Protocols.

Restoration

After manually controlling spurge laurel, mulching can be effective to discourage re-growth and seedling growth (Prasad, 2005). It is best not to attempt restoration until after an initial germination of spurge laurel seedlings post- first treatment (Nature Conservancy of Canada, 2007).

Examples of common competitive native species prescribed in 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
	Indian plum	Oceanspray
TREES		
Western red cedar	Western red cedar	Douglas-fir
Red alder	Red alder	Red alder

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. There are several science-based resources available to guide restoration efforts, such as the South Coast Conservation Program's Diversity by Design restoration planning toolkit.

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 spurge laurel re-invasion.

Spurge laurel 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 (e.g., tree wrapping, exclusion caging/fencing, vole guards, etc.).

References

4-County Cooperative Weed Management Area. (2018). *Spurge Laurel (Daphen laureola)*. Retrieved from 4-County Cooperative Weed Management Area: https://4ccwma.files.wordpress.com/2018/10/ipm_18_spurgelaurel_2.pdf

BC Ministry of Environment. (2011). *Canadian Pesticide Education Program: Applicator Core Manual. Federal, Provincial, Territorial Working Group on Pesticide Education, Training and Certification*.

Canadian Forest Service Natural Resources. (2003). *Natural Resources Notes, Number 1: Daphne laureola. Natural Resources Canada-Canadian Forest Service & Department of National Defense*.

City of Victoria. (2021). *Invasive Aliens from the Garden: Spurge Daphne and Tree Lupine*. Retrieved from https://www.victoria.ca/assets/Departments/Parks~Rec~Culture/Parks/Documents/invasive-species-spurge-daphne.pdf

Crosby, K. (2018, December). Natural Areas Coordinator, City of Surrey. (F. Steele, Interviewer)

Evergreen. (2021). *Invasive Plant Profile - Spurge Laurel*. Vancouver.

Fitter, A., Fitter, R., Harris, I., & Williamson, M. (1995). *Relationships between first flowering date and temperature in the flora of a locality in central England. Functional Ecology*, 55-60.

Gardenworks. (2021). *Mexican Mock Orange*. Retrieved from Plant Database: https://plants.gardenworks.ca/11190002/Plant/8952/Mexican_Mock_Orange/

Government of Canada. (2018, July 5). *Daphne luareola*. Retrieved from Canadian Poisonous Plants Information System: https://www.cbif.gc.ca/eng/species-bank/canadian-poisonous-plants-information-system/all-plants-scientific-name/daphne-laureola/?id=1370403266826

Invasive Species Council of BC. (2021). *Grow Me Instead* Brochure. Retrieved from https://bcinvasives.ca/wp-content/uploads/2021/01/ISCBC-GMI-Brochure-180425-WEB-1.pdf

Island County Noxious Weed Control Board. (2015, January). *Spurge Laurel*. Retrieved from Island County Noxious Weed Program Weed Alert: https://www.islandcountywa.gov/Health/DNR/Noxious-Weed/Documents/Spurge-Laurel.pdf

King County. (2021). *Spurge laurel identification and control*. Retrieved from Noxious Weed Identification: https://kingcounty.gov/services/environment/animals-and-plants/noxious-weeds/weed-identification/spurge-laurel.aspx

Klinkenberg, B. (2020). *Prunus laurocerasus L*. Retrieved from E-Flora BC: Electronic Atlas of the Plants of British Columbia: https://linnet.geog.ubc.ca/Atlas/Atlas.aspx?sciname=Prunus%20laurocerasus

Klinkenberg, B. (2020). *Rhododendron macrophyllum*. Retrieved from E-Flora BC: Electronic Atlas of the Plants of British Columbia: https://linnet.geog.ubc.ca/Atlas/Atlas.aspx?sciname=Rhododendron%20macrophyllum&redblue=Both&lifeform=3

Lei, T. (2014). *Environmental Preferences and Constraints of Daphne laureola, an Invasive Shrub in Western Canada*. Canadian Journal of Forest Research, 1462-1467.

Mayne Island Conservancy. (2020). *Safe removal of Toxic Daphne*. Retrieved from https://mayneconservancy.ca/wp-content/uploads/2020/10/Safe-Removal-of-Toxic-Daphne.pdf

Metro Vancouver. (2016). *Climate Projections for Metro Vancouver.* Burnaby, BC.

Missouri Botanical Garden. (2021). *Daphne mezereum*. Retrieved from PlantFinder: https://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?taxonid=287356

Moshiashvili, G., Tabatadze, N., & Mshvildadze, V. (2020). *The genus Daphe: A review of its traditional uses, phytochemistry and pharmacology*. Fitoterapia.

Nature Conservancy of Canada. (2007). *Best Practices of Invasive Species Management in Garry Oak and Associated Ecosystems: Daphne (Daphne laureola)*. Retrieved from Garry Oak Ecosystems Recovery Team: https://goert.ca/wp/wp-content/uploads/IS-Best-Practices-Daphne-2007.pdf

Prasad, R. (2005, June). *Current Status and Management Options of Exotic and Invasive Weeds of Forestry in Coastal British Columbia, Canada*. Outlooks on Pest Management, pp. 225-229.

Province of BC. (2002). *A Guide to Weeds in British Columbia*.

Sargent, J., Webb, C., Robinson, A., Prasad, R., Benner, J., & Singh, S. (2003). *IRF Proejct #26: Project to Control Exotic Species in Garry Oak Ecosystems Occurring on Federal Lands. Natural Resources Canada*.

Strelau, M., Clements, D., Webb, C., & Prasad, R. (2018). *The Biology of Canadian Weeds: 156. Daphne laureola L. Canadian Journal of Plant Science*, 947-958.

Thurston County Noxious Weed Control Board. (2017). *Spurge Laurel. Retrieved from Thurston County Noxious Weed Fact Sheet:* https://www.co.thurston.wa.us/tcweeds/factsheets/Spurge%20Laurel_2017.pdf

Underhill, R. (2020). Management of Daphne laureola presentation. *ISCMV 2020 AGM & Fall Forum*.

Underhill, R. (2021, December). Biologist, Mayne Island Conservancy. (T. Murray, Interviewer)

Washington State Noxious Weed Control Board. (2006). *Written Findings of the Washington State Noxious Weed Control Board: Daphne laureola L.*

Washington State Noxious Weed Control Board. (2021). *Spurge Laurel*. Retrieved from https://www.nwcb.wa.gov/weeds/spurge-laurel

Webb, C. (2006, July 19). *Daphne laureola: Environmental Weed Control of Spurge-laurel*. Botanical Electronic News, No. 364.

WorkSafe BC. (2006). *Severe Skin Irritation from Spurge Laurel (Daphne laureola)*. Retrieved from Toxic Plant Warning: https://www.worksafebc.com/en/resources/health-safety/information-sheets/toxic-plant-warning/severe-skin-irritation-from-spurge-laurel-daphne-laureola?lang=en

Additional Resources

For more information please refer to the following resources.

- BC Ministry of Forests, Lands, and Natural Resource Operations, Invasive Alien Plant Program (IAPP). www.gov.bc.ca/invasive-species
- Grow Green Guide. www.growgreenguide.ca
- Grow Me Instead. http://bcinvasives.ca/resources/programs/plant-wise/
- Mayne Island Conservancy (2020). Safe Removal of Toxic Daphne. https://mayneconservancy.ca/wp-content/uploads/2020/10/Safe-Removal-of-Toxic-Daphne.pdf
- Pesticides and Pest Management. Province of British Columbia https://www2.gov.bc.ca/gov/content/environment/pesticides-pest-management
- Strelau, M., Clements, D.R., Webb, C. & Prasad, R. (2018). The Biology of Canadian Weeds: 156. *Daphne laureola* L. Canadian Journal of Plant Science, 947-958. https://cdnsciencepub.com/doi/full/10.1139/cjps-2017-0247
- WorkSafe BC Toxic Plant Warning: Severe Skin Irritation from Spurge Laurel *(Daphne laureola*) https://www.worksafebc.com/en/resources/health-safety/information-sheets/toxic-plant-warning/severe-skin-irritation-from-spurge-laurel-daphne-laureola?lang=en

Acknowledgments

The project team would like to thank the following individuals and groups for their contributions related to the development and review of this document:

Erin Galloway, Sea to Sky Invasive Species Council

Keith MacKenzie, Diamond Head Consulting Ltd.

Rob Underhill, Mayne Island Conservancy

The Regional Invasive Species Working Group

To submit edits or additions to this report, contact Laurie Bates-Frymel, Senior Planner at 604-436-6787 or laurie.bates-frymel@metrovancouver.org.


metrovancouver
SERVICES AND SOLUTIONS FOR A LIVABLE REGION