



BEST MANAGEMENT PRACTICES FOR
Bamboo
in the Metro Vancouver Region



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

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June 2024



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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 Bamboo 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.

Bamboos¹ comprise a large group of fast-growing, perennial, woody-stemmed evergreen grasses that grow worldwide. There are over 1450 species of bamboo documented worldwide exhibiting great diversity in size and characteristic (Buziquia, Freitas Lopes, Almeida, & de Almeida, 2019). Bamboos are native to tropical and warm temperate regions in the world and belong to the grass family (*Poaceae*), subfamily *Bambusoidea* (UBC Botanical Garden, 2023). Most bamboo species in Metro Vancouver originated from China and Japan (UBC Botanical Garden, 2023).

Bamboos are heavily promoted as ornamental plants, with some retailers specializing in their sale, distribution, and maintenance. Gardeners and homeowners are often drawn to bamboo as an exotic garden feature or privacy screen. Local gardening experts agree that some forms of bamboo are invasive, but still promote the planting of non-invasive varieties and the containment of more aggressive varieties (Minter, 2019). Bamboos are rarely identified by species in

retail centres, and consumers may not be aware of the risks of spread and damage to infrastructure associated with planting bamboo on their property. Seeking information online can be confusing as most websites that feature bamboo focus on maintenance and propagation, rather than control.

In recent years, bamboo has been used as a fast-growing, sustainable crop (compared to traditional evergreen tree plantations) for use as furniture, flooring, plywood, fabric, baskets, paper pulp, biofuel and food (Coyle, et al., 2019). The annual market value of bamboo products world-wide is estimated at \$60 billion (Coyle, et al., 2019). However, even resources promoting the commercial use of bamboo acknowledge the investment required to contain and manage running bamboo species on farms (Coyle, et al., 2019). As bamboos become more widely used, the extent and impact of invasions is expected to increase (Buziquia, Freitas Lopes, Almeida, & de Almeida, 2019).

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 bamboo, 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 metrovancover.org regularly to obtain the most recent version of these best management practices.

¹ Since bamboos rarely flower, naming and classification of unique species is difficult as the taxonomy of flowering plants is usually based on flower structures (UBC Botanical Garden, 2023). Further complicating the status of bamboo, other plants around the world that are not members of the *Poaceae* family (and are not true bamboos) have "bamboo" in the common name. This guide covers bamboos that are invasive and spreading in Metro Vancouver.

REGULATORY STATUS

Although invasive bamboos are plants of concern in the Metro Vancouver region, they are not currently regulated anywhere in British Columbia.

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 bamboo, on Indigenous ways of life and our shared environment.

Bamboos are notorious for escaping gardens, invading neighbouring properties and spreading to unwanted areas (UBC Botanical Garden, 2023). People often regret planting bamboo as over time it invades beyond garden beds, breaking through pots or containment barriers. Once established, bamboo is difficult to control.

Bamboo can encroach on and outcompete native vegetation (Buziquia, Freitas Lopes, Almeida, & de Almeida, 2019), resulting in the complete conversion of natural areas to bamboo monocultures (Coyle, et al., 2019). It impedes succession in native forests by blocking sunlight to understory vegetation, limiting seed dispersion, and causing seedling death in other species due to root competition and crushing (Buziquia, Freitas Lopes, Almeida, & de Almeida, 2019; Griscom & Ashton, 2003).

Bamboo-infested areas and dense commercial stands of bamboo provide very little habitat for native wildlife (Coyle, et al., 2019). In riparian areas, bamboo leaf litter can alter streamflow and water quality, and negatively impact invertebrate communities that depend on leaf litter diversity (O'Connor, Covich, Scatena, & Loope, 2000).

The synchronous seed production of bamboo species (described below in the Reproduction and Spread section) has human health and economic impacts. During rare large seed releases, rodent populations may increase. After exhausting the bamboo seed supply, the animals disperse in search of food, often damaging crops and invading human dwellings, increasing the risk of rodent-borne disease transmission (Smith, Gomulkiewicz, & Mack, 2015). In their 2015 modelling work, Smith, Gomulkiewicz & Mack suggested that this scenario is possible in North America due to the rapid expansion of invasive bamboos, and that high deer mice populations would likely persist for multiple generations afterwards.

Some bamboo species can take advantage of cracks in building foundations, enter dwellings (UBC Botanical Garden, 2023) and damage roads and sidewalks (Buziquia, Freitas Lopes, Almeida, & de Almeida, 2019). Bamboo may increase fire hazard (Coyle, et al., 2019).

Bamboo exhibits two distinct forms of growth: running and clumping (for more information refer to the Identification section below). Running bamboo species are considered a greater risk for invasion than clumping bamboo species (Lieurance, Cooper, Young, Gordon, & Flory, 2018). In their study of 47 species that are commonly cultivated in the horticultural, paper, construction, and biofuel industries, Lieurance et al (2018) identified all but one running bamboo species as a high invasion risk, and only one clumping species as high risk.

REPRODUCTION AND SPREAD

Bamboo spread is predominantly by vegetative growth through rhizomes, underground stems from which culms emerge (Coyle, et al., 2019). Dense rhizomes are found within the upper 30 centimetres of soil. Culms (stems) emerge from the rhizomes and elongate quickly (Alabama Cooperative Extension System, 2020). The Identification section below describes the two distinct growth forms of bamboo, and how they spread. Patches of bamboo are called groves and are genetically identical (Coyle, et al., 2019).

Rhizomes exposed to soil may resprout (Alabama Cooperative Extension System, 2020). Some running bamboo species can sprout or root from the nodes of culm cuttings (sections) that are buried in soil (Kigomo, 2007). This is more likely to occur from nodes in the lower part of the culm (Kigomo, 2007). Illegal dumping likely caused the establishment and spread of bamboo in City of Burnaby parks (Diamond Head Consulting, 2019).

Bamboo plants rarely flower, and not on a seasonal or annual basis like many plants. Bamboos of the same species across a wide area will flower at the same time (called synchronous flowering or masting) on a predictable cycle, every 3-120 years, depending on the species (Janzen, 1976). The timing of this process is determined by internal physiological characteristics rather than external cues such as weather (Janzen, 1976). The year before flowering occurs, some bamboo groves do not produce new culms (Janzen, 1976). During flowering, the plants produce large numbers of wind-pollinated flowers that set seed (Janzen, 1976). Flowering triggers slowed growth for the plant, and often plant death (UBC Botanical Garden, 2023). The new generation of seedlings then grows vegetatively for the same length of time as the parent generation and the process repeats. The flowering cycles of many bamboo species are known due to historic records (Janzen, 1976). There are some exceptions to the synchronous reproduction noted above and there are conflicting accounts of the timing and process of certain species, perhaps due to misidentification (Gucker, 2009).

HABITAT AND DISTRIBUTION

Bamboo has escaped cultivation and gardens, spreading into forests, roadsides, and riparian areas in the Metro Vancouver region (Butcher, 2024). Although bamboo prefers well-drained and rich organic soil, it can survive in a variety of soil conditions and habitats. Running bamboo grows larger in full sun, while clumping bamboo varieties prefer shade (Minter, 2019). Bamboos have been observed growing at sea level to 2,000 metres in elevation (Gucker, 2009).

Although some bamboo species cannot tolerate the winter in Canada, many cold hardy species can withstand freezing temperatures and snow. Approximately 50 species are thriving in the UBC Botanical Garden (UBC Botanical Garden, 2023). Bamboos are common in Metro Vancouver, the Fraser Valley, and on Vancouver and Gulf Islands where they are most often found in or adjacent to landscaped areas.



Bamboo encroaching on a waterway
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. 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. With a reduction in precipitation over the increasingly warm summer months, this region can also expect an increase in wildfire risk (Metro Vancouver, 2016). These changes will stress many sensitive ecosystems, increasing their vulnerability to competition from invasive species.

Bamboo's rapid and aggressive growth, ability to survive in a variety of conditions and habitats, widespread distribution, and vast number of species worldwide will likely influence its ability to adapt to future climate changes. It is speculated that bamboos may benefit from our future climate in several ways:

- **Higher temperatures:** Bamboo grows best in temperatures between 20 and 33°C (Kigomo, 2007). With an 82% increase in the growing degree days² predicted by the year 2080 in this region (Metro Vancouver, 2016), bamboo plants will likely thrive and spread further.

- **Increased precipitation and flooding:** Prolonged or early flooding decreases the number of culms produced but does not impact long-term plant survival (Franklin, Prior, Hogarth, & McMahon, 2010). The development of aerial roots at the nodes on the lower part of the culms helps the plant to tolerate water inundation (Franklin, Prior, Hogarth, & McMahon, 2010). High precipitation and disturbance events are thought to support bamboo spread along streams (O'Connor, Covich, Scatena, & Loope, 2000).
- **Fire resistance:** The wax coating on the surface of culms appears to provide protection against fire (Franklin, Prior, Hogarth, & McMahon, 2010). Bamboo groves can withstand low-intensity fires; in high-intensity fires, culms suffer little damage although survival (especially of small culms) is impacted in the months and years following (Franklin, Prior, Hogarth, & McMahon, 2010).

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

² Growing degree days are a measure of heat accumulation that is useful for agriculture and horticulture. It is calculated by how warm daily temperatures are compared to a base temperature of 5°C (although different base temperatures may be useful for different plants). For example, if a day had an average temperature of 11°C, that day would have a value of 6 growing degree days. Annual growing degree days are accumulated this way for each day of the year and then summed. This measure is a useful indicator of opportunities for agriculture, as well as the potential for invasive species to thrive (Metro Vancouver, 2016).

Identification

Unless otherwise noted, the following identification information was collected from Gucker (2009). Although bamboos vary greatly in height, they look very similar (Diamond Head Consulting, 2019).

Stem: Segmented, straight, woody stems called culms emerge from rhizomes (horizontal underground stems) during the growing season; most culms are hollow between the nodes, but some are solid (UBC Botanical Garden, 2023). Culms lack bark. New culms and branches are green but may turn a different colour with maturity (for example golden yellow or black, depending on the species). Branch and leaf growth occurs every year (University of Maryland Extension, 2022). Bamboos range in height from short ground covers to timber bamboos over 20 metres tall (Alabama Cooperative Extension System, 2020).

Culms remain the same diameter from emergence to maturity, and do not increase in height after the first season (Coyle, et al., 2019). Culms emerging in subsequent years may grow larger in diameter and in height (Alabama Cooperative Extension System, 2020). Therefore, the shortest and thinnest culms in a grove are the oldest.

Growth Forms: Bamboo is categorized into two groups based on the growth habit of the rhizomes (Whatcom County Noxious Weed Board, 2023; UBC Botanical Garden, 2023). The genera known to exist in the Metro Vancouver region are listed for each type.

- **Clumping bamboo** (pachymorph/sympodial rhizomes) grows as dense, distinct clumps. Rhizomes are thick with short internodes and multiple branching tips. New rhizomes form adjacent to existing rhizomes, with slow outward growth. Genera found in Metro Vancouver: *Bambusa*, *Borinda*, *Chimonobambusa*, *Chusquea*, *Drepanostachyum*, *Fargesia*, *Hibanobambusa*, *Himalayacalamus*, *Thamnocalamus*, *Yushania* (UBC Botanical Garden, 2023).

- **Running bamboo** (leptomorph/monopodial rhizomes) spreads laterally, forming multiple culms along the length of the rhizome at nodes (Lieurance, Cooper, Young, Gordon, & Flory, 2018). Some running bamboos can spread up to 4.5 metres per year (Coyle, et al., 2019). This is the most invasive type of bamboo. Rhizomes have long internodes do not branch freely. Genera found in Metro Vancouver: *Arundinaria*, *Phyllostachys* (*Phyllostachys aurea*, golden bamboo, is considered the most abundant invasive bamboo in natural areas in North America), *Pleioblastus*, *Pseudosasa*, *Sasa*, *Semiarundinaria*, *Shibataea* (UBC Botanical Garden, 2023).

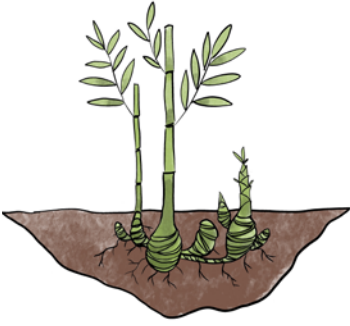
Leaves: Narrow and pointed at the tip, 5-15 centimetres long and up to 2 centimetres wide, arranged in a fan-like pattern on branches. Leaves are mostly evergreen and are continually replaced (timing of leaf shedding varies by species) (University of Maryland Extension, 2022).

Flowers: Bamboos do not produce flowers and seeds annually, but sexually reproduce synchronously with members of the same species at the same time; the length of flowering cycles depends on the species, every 3-120 years (see Reproduction and Spread section for more detail). For some species of bamboo introduced in North America, flowers have never been observed. 8-12 flowers grow in spikes, up to 5 centimetres long.

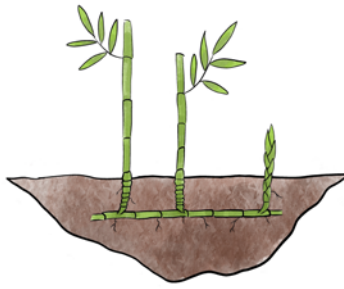
Fruits: Branched flower clusters (panicles) containing seeds are long and straw coloured when mature. Once released, seeds germinate quickly and are thought to have short viability (Gucker, 2009).

Roots: Stems emerge from a dense rhizome system, which is usually located in the top 30 centimetres of soil. Many bamboo species produce aerial roots from nodes on the lowest sections of the culms (Franklin, Prior, Hogarth, & McMahon, 2010).

The following photos show bamboo plant parts.



Cross section of clumping bamboo, with minimal horizontal spread and slow growth
CREDIT: I. GASIOR



Cross section of running bamboo, with multiple stems arising from horizontal rhizomes
CREDIT: I. GASIOR



Clumping bamboo grove
CREDIT: ISCMV



At this site, running bamboo has escaped from a residential property and is spreading down the fence line
CREDIT: ISCMV



Mature, woody bamboo stems with nodes
CREDIT: ISCMV



Cut bamboo culms with hollow interior and woody exterior
CREDIT: ISCMV



Leaves
CREDIT: ISCMV



Bamboo shoots emerging next to mature culms
CREDIT: MATHATELLE, FLICKR



Flowers
CREDIT: F. & K. STARR, FLICKR



Seeds from golden bamboo (*Phyllostachys aurea*)
CREDIT: S. HURST, USDA NRCS PLANTS DATABASE, BUGWOOD.ORG



This running bamboo has exposed rhizomes (arrows) with roots growing from the rhizome nodes. One vertical culm is also visible on the right.
CREDIT: N. LIND, FLICKR

SIMILAR SPECIES

The species most commonly mistaken for bamboo are listed below. Note that the word bamboo is used in the common name for many plant species worldwide.

NATIVE SPECIES

- **Horsetail (*Equisetum* species)**, especially the fertile stems without branches, resemble small bamboo culms. *Equisetum* species also spread by underground rhizomes, but the stems are usually less than 70 metres tall (Proudfoot, Fretwell, & Starzomski, 2016) and the leaves are inconspicuous and adhere tightly to the stems and branches at nodes. *Equisetum* species are common in a variety of environments in the Metro Vancouver region. Although some gardeners find horsetail a nuisance, they are not considered invasive.



Scouring rush (*Equisetum hyemale*) stems

CREDIT: F. & K. STARR, FLICKR

NON NATIVE SPECIES

- **Knotweed species** are commonly mistaken for bamboo and vice versa. All knotweeds have hollow, segmented stems. The three knotweed species most often mistaken for bamboo are Japanese knotweed (*Reynoutria japonica*), Bohemian knotweed (*Reynoutria x bohemica*), and Giant knotweed (*Reynoutria sachalinensis*). Knotweeds are often called 'false bamboo'. Unlike bamboo, knotweed stems die back completely every winter. Knotweed leaves are larger and more conspicuous, heart to triangular shaped, 8-10 centimetres wide and 15-40 centimetres long. Knotweeds are an invasive species of concern in southwestern BC. More information on these invasive species can be found in the [Best Management Practices for Knotweed Species in the Metro Vancouver Region](#).
- **Giant reed (*Arundo donax*)** is an invasive grass native to temperate Asia that can reach heights of over 10 metres (Brown, 2020). Like bamboo it has rhizomes and hollow culms (1-4 centimetres in diameter with nodes 12-30 centimetres apart) (Brown, 2020). The pale green leaves are 70 centimetres long and clasp the stems. Flowerheads grow in plumes at the top of stems. Although giant reed is thought to have potential to spread in coastal areas in BC, it has only been found at one retail location in the Fraser Valley and is not known to occur outside of cultivation in Canada (Brown, 2020). It is a regulated pest plant under the Canada [Plant Protection Act](#), which prohibits its importation and movement (Government of Canada, 2024).
- **Reed canary grass (*Phalaris arundinacea*)** is a fast-growing perennial invasive grass that can thrive in a variety of conditions. It is common throughout wetlands in Metro Vancouver. Its maximum height is 2 metres. In the winter, the above-ground portions of the grass die back, laying flat on the ground, and the leaves turn from green to a straw-colour. More information on this invasive species can be found in the [Best Management Practices for Reed Canarygrass in the Metro Vancouver Region](#).

- **Lucky bamboo (*Dracaena sanderiana*)** is a houseplant available in single stems that are often braided together or twisted into shapes (GardenWorks, 2021). Although it has similar looking stems and leaves as the bamboos covered in this document, it is not a true bamboo. Lucky bamboo only survives indoors in the Metro Vancouver region and is not considered to be invasive.

- **Heavenly bamboo/sacred bamboo (*Nandina domestica*)** is an evergreen shrub grown for its showy white flowers and bright red berries; its blue-green leaves have a burgundy tint when they first emerge (GardenWorks, 2024). The leaves have a similar shape to bamboo but are shorter and rounder in the centre. The branches are spreading, not upright like bamboo.



Bohemian knotweed stems and leaves
CREDIT: ISCMV



Giant reed
CREDIT: L. J. MEHRHOFF, UNIVERSITY OF CONNECTICUT, BUGWOOD.ORG



Reed canarygrass
CREDIT: ISCMV



Lucky bamboo
CREDIT: H. DE VRIES, FLICKR



Heavenly bamboo
CREDIT: F. & K. STARR, FLICKR

Tracking

The provincial government maintains [InvasivesBC](#), an invasive species database, map and mobile data collection application available for use by all land managers, contractors, government agencies and non-profit organizations completing surveys and/or management activities on invasive species in BC. 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 bamboo 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;
- Whether it is growing around desired vegetation or structures.

Reporting

Since bamboo 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. Much of the research on bamboo management has been conducted on golden bamboo, although the information is likely useful for many bamboo species.

Control or eradication of established bamboo groves requires extensive effort, and likely many years of repeated treatment and follow-up (Coyle, et al., 2019; Lieurance, Cooper, Young, Gordon, & Flory, 2018). Since bamboos spread vegetatively, the whole rhizome system must be removed or destroyed for complete control (Lieurance, Cooper, Young, Gordon, & Flory, 2018). The large height of many bamboo species can complicate control (Alabama Cooperative Extension System, 2020). The management of infestations that are encroaching or adjacent to natural areas should be prioritized.

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 bamboo over the long term.

When working in or adjacent to bamboo, it is best to inspect and remove plants and plant parts from personal gear, clothing, pets, vehicles, and equipment and ensure soil, gravel, and other fill materials are not contaminated with bamboo before leaving an infested area.

When selecting plants for a site, do not purchase, trade, or transplant bamboo. Avoid using running bamboos as a privacy screen, hedge, living fence or other ornamental planting (Coyle, et al., 2019). The Invasive Species Council of BC's 'Grow Me Instead' Program or Metro Vancouver's Grow Green 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. Bamboo can be 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.

Some of the running bamboos at highest risk for invasion are currently in use or proposed for use in the pulp and biofuel industries (Lieurance, Cooper, Young, Gordon, & Flory, 2018). It is imperative that these species be avoided for commercial production and horticulture use. At commercial bamboo operations, the spread of bamboo plant parts can be prevented using the following methods (Lieurance, Cooper, Young, Gordon, & Flory, 2018):

- Creating buffers around fields or installing below-ground physical barriers (see Cultural Control section below).
- Destroying viable rhizomes post-harvest.
- Securing loads of bamboo during transport.

- Decommissioning bamboo production facilities and monitoring those properties for growth areas (see Disposal section below). In Japan, bamboo invasions in natural areas are highly correlated with the abandonment of production facilities and the subsequent spread by rhizomes to adjacent.

MANUAL/MECHANICAL: RECOMMENDED

- **Digging** with a shovel or pickaxe can be effective for small stands of clumping and running bamboo. All rhizomes must be removed, as any left in the soil may resprout (Alabama Cooperative Extension System, 2020). For larger sites, excavation can be considered (see below).
- **Excavation** using a backhoe, root rake or other heavy machine may be required to remove large patches of bamboo that have been left to spread for a long period of time (Minter, 2019). All rhizomes must be removed, as any left in the soil may resprout (Alabama Cooperative Extension System, 2020). This method is only possible in areas accessible by heavy equipment and where complete soil disturbance can be tolerated (Alabama Cooperative Extension System, 2020). Care should be taken to reduce impacts to non-target species (Diamond Head Consulting, 2019). Trials in the City of Burnaby experienced periodic regrowth for 2 years after initial bamboo excavation (Butcher, 2024).
- **Repeated cutting or mowing** with during the growing season and for several years can be an effective control measure (Whatcom County Noxious Weed Board, 2023). Following the cutting of mature culms, repeated cutting or mowing of regrowth close to the ground gradually exhausts the energy reserves in the rhizomes (Coyle, et al., 2019; Alabama Cooperative Extension System, 2020). Tender new culms emerging in the spring may only require being kicked or knocked over (University of Maryland Extension, 2022). Trials in the City of Burnaby have employed monthly mowing, increasing to every two weeks during July and August (Butcher, 2024).

The length of time required to achieve control has not been well studied and may depend on the size, age and health of the infestation (Alabama Cooperative Extension System, 2020), but it is likely that this method will take a minimum of three years to achieve control (Butcher, 2024). Local trials have encountered a dramatic increase in rhizome and culm production during treatment, but a reduced culm size (for example, new culms 1-2 millimetres in diameter versus over 30 millimetres in the largest culms in the grove) (Butcher, 2024). Re-growth after this technique also tends to be outward from the initial grove, up to several metres (Butcher, 2024).

- **One-time cutting stems** can be used for sites that require immediate removal of stems for safety or other timely purpose but will not alone eradicate the plants. Cutting is often recommended before applying some herbicides (see Chemical Control section for additional information).
- **Root pruning** can be used as a method for controlling running bamboo, but it will not eradicate the plants. In August and again in November, a pruning saw or crowbar can be used to expose the underground rhizomes and roots and then cut the rhizomes (Minter, 2019). This method can be used in combination with trenching (see Cultural Control section).
- **Burning** bamboo has not been well studied (Alabama Cooperative Extension System, 2020). Rapid regeneration of new shoots after burning has been observed (Coyle, et al., 2019) and therefore burning is not recommended. Further, prescribed burning is not selective and may require a permit from the local fire department.

REMOVAL TIMING

APPLYING MANUAL/MECHANICAL CONTROL METHODS IN RIPARIAN AREAS

Bamboo 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.

CULTURAL: CAUTION

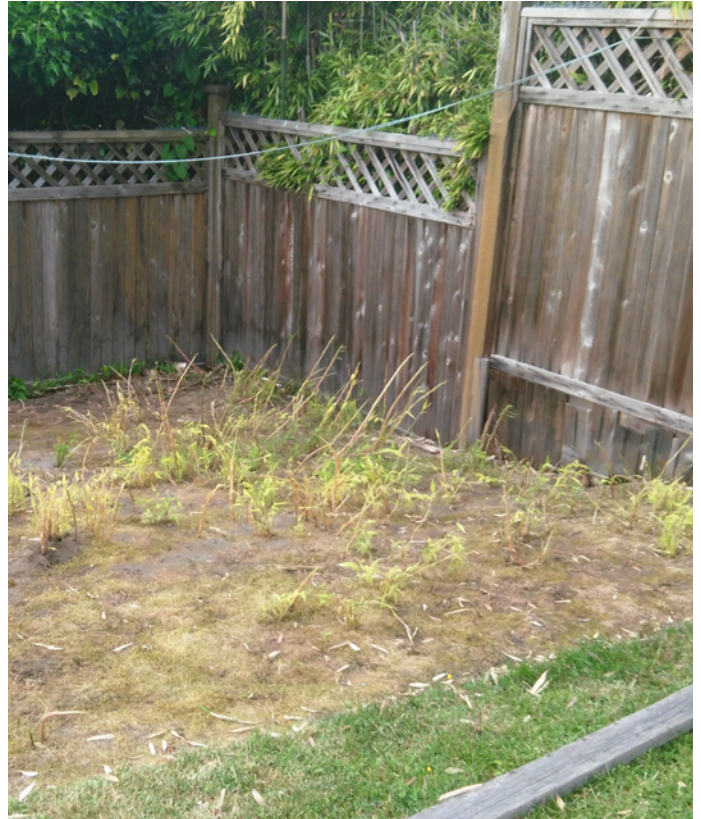
The buffer, trench, and barrier methods outlined below are suitable methods for containing bamboo or for limiting the spread of the plants where full control cannot be accomplished (e.g. if an adjacent property owner maintains bamboo and their neighbour's objective is to limit spread).

- **Buffers** created around bamboo groves can prevent spread (Alabama Cooperative Extension System, 2020). It is recommended to maintain at least a 6 metre buffer between bamboo and natural areas or other sites needing protection from invasion (Coyle, et al., 2019). In the spring, it is best to mow or manually remove new culms within the buffer (Alabama Cooperative Extension System, 2020) (see Manual/Mechanical Control section above for more details on removal methods).

- **Trenches** dug 30 centimetres deep by 30 centimetres around a bamboo infestation can prevent rhizome encroachment across property lines, but trenches will not eradicate the plants (Coyle, et al., 2019). Trenches should be monitored and any bamboo rhizomes and roots that appear should be treated using manual/mechanical or chemical methods (Coyle, et al., 2019). New rhizomes will be visible along the trench wall. Beware of the tripping hazard a trench may cause (University of Maryland Extension, 2022). The City of Burnaby is currently trialing this method at a bamboo infestation adjacent to a house, but results are unknown (Butcher, 2024).
- **Vertical Barriers** installed in the ground around a bamboo infestation may limit its spread, prevent rhizome expansion, or change the direction of growth but will not eradicate the plants. Barriers can be made of metal, heavy landscape cloth or plastic sheeting, or other materials that rhizomes cannot penetrate (Whatcom County Noxious Weed Board, 2023). At the point of purchase, it is advised to describe the intended use so that appropriate barrier material can be recommended. Concrete is not recommended for use as a barrier as rhizomes can find their way through cracks (Diamond Head Consulting, 2019).

It is best to bury barriers to a depth of 45-75 centimetres in the soil with at least 5 centimetres sticking above the ground to prevent rhizome growth overtop (Whatcom County Noxious Weed Board, 2023; University of Maryland Extension, 2022). If the barrier intercepts existing bamboo, use a shovel or saw to cut through the entire depth of the rhizomes and roots in the soil prior to installing the barrier. Take care to interlock or seal seams in the barrier, as bamboo can escape through any openings (Minter, 2019). Wooden forms can be used to hold the barrier material in place (Minter, 2019). Most barriers will eventually need to be replaced (Alabama Cooperative Extension System, 2020).

- **Covering** a small bamboo infestation following cutting may hinder regrowth but will not achieve eradication (Alabama Cooperative Extension System, 2020). For example, covering materials consult the Vertical Barriers method above.
- **Grazing** animals will consume bamboo leaves but avoid the hard stems (Coyle, et al., 2019). Grazing as a control method for bamboo has not been well studied (Alabama Cooperative Extension System, 2020). Grazing opportunities are limited in urban areas due to municipal bylaws regulating agriculture animals, the high probability of interface with the public, and the damage animals could cause to other vegetation. Due to these constraints and the risk to animal health, grazing is not recommended as a management option for this species in Metro Vancouver.



After a covering attempt in a backyard, bamboo culms returned

CHEMICAL: NOT RECOMMENDED

When alternative methods to prevent or control invasive plants are unsuccessful, professionals often turn to herbicides. Typically, bamboo species are not controlled well using chemical methods and most chemical control applications require an additional kind of retreatment (Lieurance, Cooper, Young, Gordon, & Flory, 2018). Bamboo removal experts in the Metro Vancouver region do not frequently use chemical control and do not recommend it due to the volume of herbicide required and limited effectiveness (Diamond Head Consulting, 2019).

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

1. Weather conditions greatly influence treatment efficacy;
2. Bamboo often grows in riparian areas where pesticide use is restricted; and
3. Since bamboo 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 lands³; 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.

³ 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 bamboo 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, bamboo may be treated under the general application provision for perennial grasses. Information is from Whatcom County Noxious Weed Board (2023) and Czarnota & Derr (2007) unless otherwise noted. In field trials, imazapyr provided better control than glyphosate (Czarnota & Derr, 2007).

ACTIVE INGREDIENT (EXAMPLE BRAND NAMES)+	APPLICATION	PERSISTENCE*	GROWTH STAGE++	TYPE+++	COMMENT
Imazapyr (example: Arsenal™)	foliar application	residual	actively growing	non-selective	First cut stems to the ground, allow them to grow to 1 metre tall, and when new leaves expand, then spray the entire plant; may kill other woody plants and grasses that have roots extending into the treatment area; spray plants until they are just wet (thin film)
Glyphosate§ (many products)	foliar application	non-residual*	actively growing	non-selective	First cut stems to the ground, allow them to grow to 1 metre tall, and when new leaves expand, then spray the entire plant; multiple applications may be required for 2-3 years; avoid ready-to-use formulations available for the public with concentrations too low to be effective (Coyle, et al., 2019)

+ 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)⁴ in British Columbia in accordance with the *Integrated Pest Management Act* 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. **Bamboo is not listed and therefore glyphosate and other herbicides can only be applied on bamboo up to 10 metres away from the high water mark (HWM)⁵.** The 30 metre no-treatment zone around a water supply intake or well used for domestic or agricultural purposes may be reduced if the licensee 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 bamboo 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.

4 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.

5 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

Foliar application can be undertaken by hand or backpack sprayer. This method is most effective as a follow-up treatment to cutting, after the culms have regrown to one metre tall, and the new leaves expand. Bamboo that has been chemically controlled should not be cut for at least two weeks after herbicide application (Whatcom County Noxious Weed Board, 2023). Single applications of herbicide with any product are not likely to provide control (Czarnota & Derr, 2007). Complete control using

herbicide will likely take many years of treatments (Alabama Cooperative Extension System, 2020). Basal bark, cut stumps and stem injection treatments have not been evaluated for bamboo, and therefore those techniques are not recommended at this time (Coyle, et al., 2019).

BIOLOGICAL: NOT AVAILABLE

There are no biological control agents currently available for bamboo.

CONTROL SUMMARY

The following table provides a summary and comparison of control methods for butterfly bush.

CONTROL STRATEGY	TECHNIQUES	APPLICABLE SITE TYPE	PROS	CONS
Manual	Digging	Small stands of clumping and running bamboo	Selective, non-chemical, inexpensive	Labour intensive, regrowth may occur for several years, may create soil disturbance, must dispose of biomass
	Excavation	Large stands of clumping or running bamboo where heavy equipment is accessible	Non-chemical	Labour intensive, regrowth may occur for several years, requires trained staff and specialty equipment, expensive, causes soil disturbance, must dispose of biomass and possibly soil
	Repeated cutting or mowing	Any site	Selective, non-chemical	Labour intensive, regrowth may occur for several years, may require trained staff and specialty equipment, must dispose of biomass
	One-time cutting stems	Sites requiring immediate removal of stems, prior to some herbicide application	Selective, non-chemical	Labour intensive, regrowth will occur, not successful on its own, must dispose of biomass
	Root pruning	Running bamboo site	Selective, non-chemical, use with trenching method	Not successful on its own

Cultural	Buffers	Sites where containment is the goal or where full control cannot be accomplished	Non-chemical, least labour intensive of the cultural control methods, doesn't require installation of a material	May prevent spread or contain the infestation but not eradicate it, must be maintained
	Trenches		Non-chemical, doesn't required installation of a material	May prevent spread or contain the infestation but not eradicate it, must be monitored, possible tripping hazard
	Vertical Barriers		Non-chemical, can be used at sites where there is no space to instal a buffer or trench	May prevent spread or contain the infestation but not eradicate it, must be monitored, requires installation of a barrier material, difficult to establish an impenetrable barrier
Chemical	Foliar application	Any site	Effective as a follow-up to cutting, selective with appropriate herbicide and application, less labour intensive	Unintended environmental/health impacts, high public concern, weather dependent, requires trained staff, most successful when used with other methods
Manual	Burning	None		Not a recommended management option for this species
Cultural	Covering	None		
	Grazing	None		Not a suitable management option for this species
Biological	No biological control agents are currently available for bamboo			

CONTROL SUMMARY COLOUR LEGEND
GREEN: RECOMMENDED
ORANGE: CAUTION
RED: NOT RECOMMENDED OR NOT AVAILABLE

Disposal

Since bamboo spreads primarily through rhizomes, proper disposal is essential when control methods involve removing plant material (Diamond Head Consulting, 2019).

ON SITE DISPOSAL

Leaves pose no risk of spread (Butcher, 2024). Culms cut from rhizomes normally pose no risk of spread; however, if the lower nodes of culms of some running bamboo species have existing buds or roots growing from the nodes, they may continue to grow if they are buried in soil (Kigomo, 2007). Care should be taken to ensure culms are not left buried in the soil. Culms can be dried and used as plant stakes, supports, fencing or crafts (University of Maryland Extension, 2022). Rhizomes and roots exposed to soil can regrow and should not be left onsite.

OFF SITE DISPOSAL

In the Metro Vancouver region, several facilities accept bamboo plants and/or infested soil. Please consult [this disposal facility list](#) for current details.

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

CLEANING AND DISINFECTION⁶

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 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, chipboxes, 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 bamboo growth.

⁶ Adapted from Metro Vancouver 2017 Water Services Equipment Cleaning Procedures and Inspection Protocols.

Follow-up Monitoring

Whatever control method is used, follow-up monitoring and maintenance treatments are components of an integrated management plan or approach. Sites that have been manually or mechanically controlled (especially digging, excavation and cutting) should be carefully monitored for at least three years after treatment (Whatcom County Noxious Weed Board, 2023; Butcher, 2024). Any rhizome and roots fragments left in the soil can resprout (Coyle, et al., 2019).

Restoration

Restoration of bamboo sites after treatment may not be necessary depending on the site, size of the grove, and control methods used (Diamond Head Consulting, 2019). Methods involving soil disturbance should be evaluated for restoration.

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 bamboo re-invasion.

Bamboo 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

- Alabama Cooperative Extension System. (2020). *Forestry & Wildlife: Bamboo Growth and Control*.
- BC Ministry of Environment. (2011). *Canadian Pesticide Education Program: Applicator Core Manual. Federal, Provincial, Territorial Working Group on Pesticide Education, Training and Certification*.
- Brown, B. (2020, April 22). *Grass Gone Bad! New Invasive Species of Concern to B.C. Grasslands webinar*. Retrieved from https://bcinvasives.ca/wp-content/uploads/2021/01/Grass_Gone_Bad_Webinar.pdf
- Butcher, A. (2024). Restoration Biologist, Diamond Head Consulting. (T. Murray, Interviewer)
- Buziquia, S. T., Freitas Lopes, P. V., Almeida, A. K., & de Almeida, I. K. (2019). Impacts of bamboo spreading: a review. *Biodiversity and Conservation*.
- Coyle, D., Loewenstein, N., Lieurance, D., Bean, R., Li, Y., Enloe, S., & Khanal, P. (2019). *Forest Health - Growing Bamboo for Commercial Purposes in the Southeastern U.S.: FAQs*. Southern Regional Extension Forestry.
- Crosby, K. (2018, December). Natural Areas Coordinator, City of Surrey. (F. Steele, Interviewer)
- Czarnota, M. A., & Derr, J. (2007). Controlling Bamboo (*Phyllostachys* spp.) with Herbicides. *Weed Technology*, 80-83.
- Diamond Head Consulting. (2019). City of Burnaby - *Best Management Practices for Bamboo Species*. Vancouver.
- Franklin, D. C., Prior, L. D., Hogarth, N. J., & McMahon, C. R. (2010). Bamboo, fire and flood: consequences of disturbance for the vegetative growth of a clumping, clonal plant. *Plant Ecology*, 319-332.
- GardenWorks. (2021). *Lucky Plants for an Auspicious New Year*. Retrieved from <https://www.gardenworks.ca/news/43/lucky-plants-for-an-auspicious-new-year>
- GardenWorks. (2024). *Nandina domestica*. Retrieved from Plant Database: <https://plants.gardenworks.ca/11190002/Plant/276/Nandina/>
- Government of Canada. (2024). *Giant reed - Arundo donax L. (Poaceae)*. Retrieved from Invasive Plants: <https://inspection.canada.ca/plant-health/invasive-species/invasive-plants/invasive-plants/giant-reed/eng/1557939393747/1557939394042>
- Griscom, B. W., & Ashton, P. S. (2003). Bamboo control of forest succession: *Guadua sarcocarpa* in Southeastern Peru. *Forest Ecology and Management*, 445-454.
- Gucker, C. L. (2009). *Phyllostachys aurea*. Retrieved from Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory: <https://www.fs.usda.gov/database/feis/plants/graminoid/phyaur/all.html>
- Janzen, D. H. (1976). Why Bamboos Wait So Long to Flower. *Annual Review of Ecology and Systematics*, 347-391.

Kigomo, B. N. (2007). *Guidelines for Growing Bamboo, KEFRI Guideline Series: No 4*. Nairobi, Kenya: Kenya Forestry Research Institute.

Lieurance, D., Cooper, A., Young, A. L., Gordon, D. R., & Flory, S. (2018). Running bamboo species pose a greater invasion risk than clumping bamboo species in the continental United States. *Journal for Nature Conservation*, 39-45.

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

Minter, B. (2019, February 25). *Expert tips to grow bamboo*. Retrieved from Vancouver Sun: <https://vancouversun.com/homes/gardening/brian-minter-expert-tips-to-grow-bamboo#:~:text=To%20perform%20best%2C%20bamboos%20like,Watering%20is%20critical>.

O'Connor, P. J., Covich, A. P., Scatena, F., & Loope, L. L. (2000). Non-indigenous bamboo along headwater streams of the Luquillo Mountains, Puerto Rico: leaf fall, aquatic leaf decay and patterns of invasion. *Journal of Tropical Ecology*, 499-516.

Proudfoot, B., Fretwell, K., & Starzomski, B. (2016). *Common horsetail, field horsetail, Equisetum arvense*. Retrieved from Biodiversity of the Central Coast: <https://www.centralcoastbiodiversity.org/common-horsetail-bull-equisetum-arvense.html#:~:text=A%20number%20of%20other%20horsetail,telmatiea>.

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

Smith, M. C., Gomulkiewicz, R., & Mack, R. M. (2015). Potential Role of Masting by Introduced Bamboos in Deer Mice (*Peromyscus maniculatus*) Population Holds Public Health Consequences. *PLoS ONE*.

UBC Botanical Garden. (2023). Bamboos. Retrieved from Plant Collections: <https://botanicalgarden.ubc.ca/research-collections/plant-collections/bamboos/>

University of Maryland Extension. (2022). Containing and Removing Bamboo.

Whatcom County Noxious Weed Board. (2023). *Noxious Weed Fact Sheets*. Retrieved from Control Options for Bamboo: <https://www.whatcomcounty.us/DocumentCenter/View/26961/Bamboo-Management>

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
- Buziquia, S. T., Freitas Lopes, P. V., Almeida, A. K., & de Almeida, I. K. (2019). Impacts of bam-boo spreading: a review. *Biodiversity and Conservation*. [For history, use and impacts of bam-boo]
- Diamond Head Consulting. (2019). City of Burnaby - Best Management Practices for Bamboo Species. Vancouver. [available from the City of Burnaby]
- Grow Green Guide. www.growgreenguide.ca
- Grow Me Instead. <http://bcinvasives.ca/resources/programs/plant-wise/>
- Pesticides and Pest Management. Province of British Columbia <https://www2.gov.bc.ca/gov/content/environment/pesticides-pest-management>

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:

Aubrey Butcher, Diamond Head Consulting Ltd.
The Regional Invasive Species Working Group

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Running bamboo encroaching onto a sidewalk
CREDIT: ISCMV



Running bamboo growing next to a foundation
CREDIT: ISCMV



