# Management of Invasive Plant Species in Jericho Beach Park, Vancouver

Photo: Janusz Kruszewski

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# 1.0 Introduction

## 1.1 Background

Prior to the arrival of western civilization in North America, native plant communities were parts of balanced ecosystems. Their growth and spread were kept in check by grazers and disease.

When settlers began to colonize North America in the 17th century, they brought with them non-native plants: some for food, some for medicine and others to remind them of the homes they left behind. Today, these non native, "invasive" plants have taken over many areas.

Invasive plants are species that have extraordinary reproductive success when introduced into foreign environments (Graham, 2003). They have the ability to establish quickly on new sites through prolific seeding, aggressive rooting structures, broad ecological amplitude and other characteristics (Fraser Basin Council, 2003).

Today, modern transportation of people and goods around the world has greatly increased the unwanted spread of invasive species. The clearing of land and creation of transportation corridors along with urban development create soil disturbances that create prime growing conditions for invasive plants. They are spread when forage, crop, wildflower, birdfeed and soil mixes are put into the ground because these mixes may unintentionally include invasive plant seeds. Seeds also spread when they are eaten and excreted by birds and other animals.

Although some introduced plants have improved the lifestyles of people, other species have found their new environments conducive to rapid establishment and growth – often to the detriment of natural ecosystems (Fraser Basin Council, 2003). British Columbia (BC) is no exception. Most invasive plants lack natural predators or disease and take advantage of the favorable growing conditions in the mild and wet climate of south-western BC. There are very few factors to inhibit their growth or spread. They often out-compete native species and form monocultures – areas where only one species grows. This results in a change in species composition and structure, reducing the diversity of native plant species (Graham, 2003). After habitat loss, invasive plant species are considered to be the second biggest threat to species at risk in BC (Fraser Basin Council, 2003).

One of the land use types most impacted by invasive plant species in BC are parks and protected areas. Recreational activities such as camping, mountain biking, and riding ATV's have created disturbed areas that create prime growing conditions for invasive species. In addition, until recently, parks have had more of a "hands off" policy toward active management to deal with invasive plant species. This has allowed invasive plants to spread out of control over large areas of land including many parks and protected areas across the province.

## 1.2 Jericho Beach Park

One of the sites hardest hit by invasive species in the Lower Mainland is Jericho Beach Park (Fig. 1). Jericho Beach Park, located in the Point Grey/Kitsilano area of Vancouver on the south coast of Burrard Inlet, is a popular city park with a range of natural features that include meadows surrounded by coniferous and deciduous forest, a marsh and a duck pond.

The site has been heavily disturbed over the past century. Over its one hundred year history, it has been home to a logging camp, a golf course and military base housing seaplanes. In the late 1970's, the City of Vancouver took over the land from the federal government and designated it as a park. The park is home to several walking trails, playing fields and a boat club. Jogging, bicycling and dog walking are also very popular recreational activities. The park is managed by the City of Vancouver's Parks and Recreation Department.

Figure 1: View of a duck pond, open park and Burard Inlet from Jericho Beach Park. (Photo: Janusz Kruszewski)

High visitor use and the various developments and disturbances over its history have greatly impacted the natural features of Jericho Beach Park. Invasive species such as Himalayan blackberry (*Rubus discolor*), English ivy (*Hedera helix*), Scotch broom (*Cytisus scoparius*), Japanese knotweed (*Polygonum cuspidatum*), and English holly (*Ilex aquifolium*) are now crowding or choking native plant species in the park that are important to wildlife both as a source of food and a source of shelter (Jericho Stewardship Group, 2004).

In response to the problem, local residents have started to take action against invasive plants. Over the past several years, a small group of volunteers has tried to maintain the park's upper meadows by manually cutting back the growth of invasive species like Himalayan blackberry.

In 2004, the Jericho Stewardship Group was formed to manage invasive species and to try to restore some of the natural habitat in the park. This volunteer group was led by Mike Mackintosh of the Vancouver Parks Board and Dawn Hanna of the Vancouver Natural History Society and Coast Mountain Field Institute. The Jericho Stewardship Group meets every second Sunday of the month for a work party where they removed infestations of invasive plants.

An invasive species management plan is needed for Jericho Beach Park. Working with the Jericho Stewardship Group, our overall goal is to gather information about the invasive plants in the park to contribute to the development of a management plan. The Jericho Stewardship Group will hopefully be able to use this information to realize their goal of managing invasive species and restoring natural habitat in Jericho Beach Park.

## 1.3 Project Objectives

The objectives of this project are to:

1) Conduct a literature review of the major invasive plant species in Jericho Beach Park to document:
    i) Identification features,
    ii) Ecology and reproduction,
    iii) Control options,

2) Survey and map the locations of invasive plant species in Jericho Beach Park, and

3) Provide recommendations for a management plan to systematically remove invasive plant species from Jericho Beach Park.

# 2.0 Study Area

## 2.1 Study Area Location

Jericho Beach Park is located in the city of Vancouver, British Columbia, Canada (Fig. 2). The park is on the west side of Vancouver in the Point Grey/Kitsilano area (Fig. 3). The park is bordered by North West Marine Drive to the west, West 4th Avenue to the south and Alma Street to the east.


Figure 2: Location of Vancouver in relation to the Pacific northwest of North America.

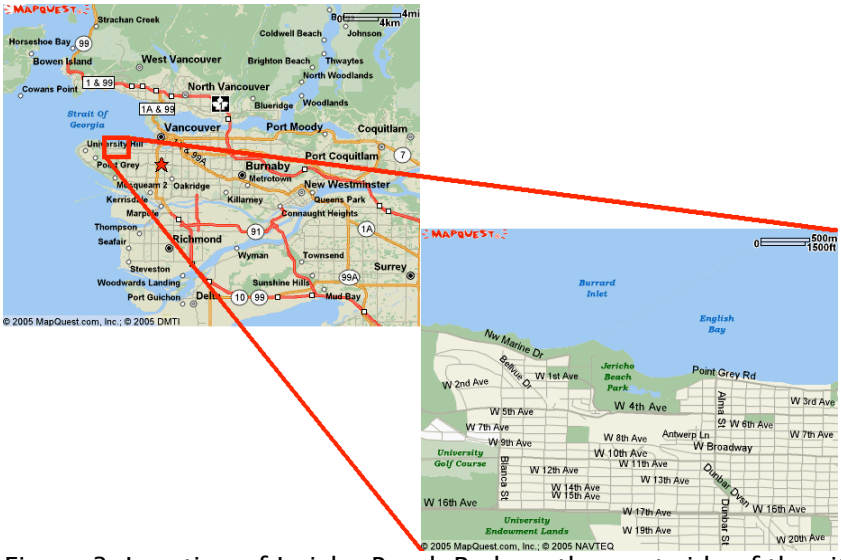


Figure 3: Location of Jericho Beach Park on the west side of the city of Vancouver.

## 2.2 Site Description

Found within the Coastal Western Hemlock biogeoclimatic zone (Meidinger and Pojar, 1991), the 9.31 hectare Jericho Beach Park has landscaped fields, exposed rough grassland, ponds (Fig. 4), marshes, and woodland. On the west side one can find a sailing club, tennis courts, and soccer fields. The east side has a concession stand. The park also has a beach and plenty of walking trails (Fig. 5). For the avid birdwatcher, over 200 bird species can be seen here throughout the year (Solecki, 1996). One hundred and eighty nine plant species grow in Jericho Beach Park (Taylor, 1996). Of these, 94 are introduced; 55 are native; 23 are planted trees; 12 are marsh plants; and five are native beach plants (Taylor, 1996).


Figure 4: One of the duck ponds in Jericho Beach Park (Photo: Janusz Kruszewski).


Figure 5: A trail along the beach in Jericho Beach Park (Photo: Janusz Kruszewski).

Jericho Beach Park now faces an epidemic of invasive plants, with the four species of highest concern (Jericho Stewardship Group, 2004):

- Himalayan blackberry;
- English ivy;
- Scotch broom; and
- Japanese knotweed.

In addition to these four species there are ten additional invasive plant species that have been identified as requiring management action (Dawn Hanna; pers. comm., 2004). These species are:

- English holly;
- yellow flag (*Iris pseudacorus*);
- purple loosestrife (*Lythrum salicaria*);
- Canada thistle (*Cirsium arvense*);
- policeman's helmet (*Impatiens glandulifera*);
- Oriental bittersweet (*Celastrus orbiculatus*);
- common tansy (*Tanacetum vulgare*);
- field bindweed/perennial morning glory (*Cunvolulus arvensis*);
- English hawthorn (*Crataegus laevigata*); and
- spurge laurel (*Daphne laureola*).

However, due to the winter season this study was conducted in, this project focused on plants that were visible at that time:

- Himalayan blackberry,
- English ivy,
- Scotch broom,
- Japanese knotweed and
- English holly.

# 3.0 Materials and Methods

## 3.1 Literature Review

### 3.1.1 Methods

A literature and Internet search was conducted to research the identification, ecology, reproduction and control options for Himalayan blackberry, English ivy, Scotch broom Japanese knotweed, and English holly.

## 3.2 Field Surveys and Mapping

### 3.2.1 Materials

- Compass
- 30m and 50m chain
- Clinometre
- Orthophotos
- GPS unit
- ArcGIS
- RoadEng
- Field book
- Calculator

### 3.2.2 Methods

In order to carry out the field surveys and mapping of invasive plants in Jericho Beach Park, orthophotos were obtained from BCIT and the City of Vancouver. The park was divided into polygons, which were delineated based on physical features such as trails and changes in vegetation.

In the north, open park and scrub land (Fig. 6) area of Jericho Beach Park, polygons of vegetation were delineated based mainly on trails, noticeable trees and differences in major visual physical characteristics in vegetation.


Figure 6. The three main vegetation areas of Jericho Beach Park.

In the southern forested area of Jericho Beach Park, distinguishable polygons were not visible from the orthophoto. Polygons were delineated in the southern areas based on trail

traverses. Trail traversing mapped out the trails hidden by tree foliage. These trails were traversed using a compass, clinometre and chain in February and March 2005. This traverse data was input into RoadEng software and then overlaid over the orthophotos with ArcGIS software. Vegetation polygons were then delineated with the aid of these overlaid trails.

These polygons were then identified on the ground and percent covers (one height class) of the invasive plants (Himalayan blackberry, English Ivy, Scotch broom, Japanese knotweed and English holly) were visually estimated within each polygon.

## 3.3 Removal Efforts

From fall, 2004 to spring, 2005 on every second Sunday of each month, the Jericho Stewardship Group met to remove invasive plants from Jericho Beach Park. To gain hands on experience we participated in the removal efforts of invasive plant species on October 9, 2004, February 20, 2005, March 13, 2005 and April 10, 2005.

During these weekend work parties, we aided in the removal of Himalayan blackberry, English ivy, Scotch broom, Japanese knotweed and English holly. These plants were removed manually, using hand tools such as loppers, saws, shovels and Weed Wrenches. The cuttings were trucked out by Vancouver Parks' staff.

# 4.0 Results

## 4.1 Overview of Methods and Techniques

Groups and agencies that want to manage invasive plant species in parks can only use manual or mechanical methods such as hand pulling, cutting and mulching. Burning and herbicides are not allowed to be used in Vancouver City Parks (Mike Mackintosh, pers. comm., 2005) and were subsequently not included in this report.

## 4.2 Invasive Species

Of the 14 species of invasive plant species of management concern in Jericho Beach Park, the four species identified by the Jericho Stewardship Group as having the highest priority were Himalayan blackberry, Japanese knotweed, Scotch broom and English ivy. This section includes the general description, ecology and reproduction as well as control methods that are suitable for Jericho Beach Park for these four invasive plants along with English holly, which was found to be abundant during the surveys (which were conducted in the winter months). These descriptions and control methods came from documents and web pages found during our literature and internet searches.

### 4.2.1 Himalayan Blackberry (*Rubus discolor*)

The following overview for Himalayan blackberry management was summarized primarily from Graham (2003) and Soll (2004).

#### General Description

Himalayan blackberry is a perennial, prickly, evergreen shrub (Fig. 7). It grows in the form of canes: long, bending branches with large, stiff prickles that can reach 3 metres in height and 6 to 12 metres in length. Stems initially grow upwards and then begin arching downward toward the ground when they reach lengths of several metres.

Figure 7: Himalayan blackberry, a common invasive plant species in Jericho Beach Park, Vancouver (Photo: Janusz Kruszewski).

The leaves of Himalayan blackberry are large and round with toothed edges and usually have three (side shoots) or five (main stems) leaflets (Fig. 7). These plants have white flowers with five petals that grow in clusters at the tips of the branches. The flowers appear from May to July. Round, black, shiny berries about 2 centimetres in size form from midsummer to autumn.

Figure 8: Leaf shape of Himalayan blackberry (Photo: Janusz Kruszewski).

## Ecology and Reproduction

Himalayan Blackberry grows mainly in moist soils, and tolerates a wide range of soil moisture and pH levels. It also has the ability to grow well on a variety of barren, infertile soils. It thrives in our wet coastal climate.

Reproduction occurs by both vegetative and sexual means. Birds and animals eat the berries and disperse the seeds through their feces. The hard seed coat allows seeds to remain viable in the soil for several years. Seedlings, however, have a hard time growing in shaded areas.

Vegetative reproduction occurs when the ends of the canes form roots where they touch the ground (John Coope; pers. comm., 2004). Shoots can rise from underground runners, roots that run parallel to the ground, that can grow up to a metre deep and over 10 metres long. Wild blackberry flowers are pollinated primarily by bumblebees and honey bees. The flowers can be self-pollinated but the fruit set is increased by cross pollination.

Dense thickets quickly displace native vegetation and hinder access to waterways for animals and people. Himalayan blackberry degrades the quality of riparian areas by preventing the establishment of deep rooted native shrubs, which are needed to help keep streams healthy and provide food, shade and bank stability.

However, Himalayan blackberry has some wildlife value. Its berries are eaten by birds, and birds use the thorny thickets for cover.

## Removal Options

Blackberries are difficult to manage. Continuous monitoring is necessary as new plants can grow from small pieces of the plant. The bottom line when managing blackberry is to ensure long-term control by shading these species out with native plants. To date, no biological control organisms have been successfully introduced, largely because of risks posed to commercial and native Rubus species such as trailing blackberry (*Rubus ursinus*).

*Hand pulling/digging:*
This method involves removing the entire stem and root system with hand and digging tools. This should be done with young plants up to 1 metre long and when soils are moist to completely remove the root system. It should be repeated year after year until the plant is

eradicated from the area. These methods are only effective where there are few plants that are in their first year of growth.

*Cutting:*
Hand operated tools such as loppers, machetes, clippers and power tools are used to remove above ground portions. The best time is when the plants begin to flower as the reserve food supply is used up. Cutting should be repeated for at least three years to kill root systems of the plants. Cutting is effective but is labor intensive and insufficient for complete control.

*Mechanical removal:*
Machinery is used to completely uproot Himalayan blackberry before planting competitive plants. It is important the soil disturbance be minimized when mechanical removal is conducted. Mechanical methods can be used in larger areas but they are non selective and inappropriate for sensitive ecological areas. It is important to note that mechanical removal may cause erosion.

## 4.2.2 English Ivy (*Hedera helix*)

The following overview for English ivy is summarized from Swearingen (2000), Graham (2003) and Langley Environmental Partners Society brochure on English ivy (date unknown) (a).

### General Description

English ivy is an evergreen climbing vine (Fig. 9). Vines attach to the bark of trees, brickwork, and other surfaces with small root like structures that release a glue-like substance.

Figure 9: English ivy, a common invasive plant found in Jericho Beach Park, Vancouver (Photo: Janusz Kruszewski).

English ivy leaves are alternately arranged, dark green, waxy and somewhat leathery. English ivy has several leaf forms, the most common being a 3-lobed leaf with a heart-shaped

base that grows on the ground (Fig. 10). Mature leaves growing on tree trunks in full sun are often unlobed, oval and have wedge-shaped bases (Fig. 11). Umbrella-like clusters of small, greenish-white flowers appear in the fall if enough sunlight is available. Black fruits with a fleshy outer covering enclosing one to a few hard, stone-like seeds mature in spring.

Figure 10: Immature English ivy leaf form found along the ground (Photo: Janusz Kruszewski).

Figure 11: Mature English ivy leaf form found on trees (Photo: Janusz Kruszewski).

## Ecology and Reproduction

English ivy can thrive in many environments but prefers moist, well-drained soils in partial sun. It is adapted to grow in many adverse conditions including heat, drought, a wide pH range, and compacted soils. However, it does not grow well in extremely wet conditions.

English ivy has both a ground and a tree form. The ground form grows like a thick mat over the ground, choking out other plants or even small streams (Fig. 12). This dense growth prevents sunlight from reaching plants underneath it.

Figure 12: Thick mat of English ivy in Jericho Beach Park, Vancouver (Photo: Janusz Kruszewski).

When it reaches a vertical face, English ivy grows upwards along the face, using hairy rootlets to tightly attach itself to rough surfaces (Fig. 13). Once it can no longer climb, it stops and sends out tendrils without rootlets. Soon after, the juvenile form transforms into a mature, arborescent form that has rounded and smooth edged leaves. At this time English ivy grows as a dense and heavy shrub that poses a threat to the trees and shrubs it grows on. Vines climbing up tree trunks spread out and surround branches and twigs, preventing most of the sunlight from reaching the leaves. The host tree will then lose strength and can typically die within a few years. The added weight of the ivy vines makes infested trees vulnerable to blow-over during storms.

Figure 13: English ivy growing up the trunks of trees (Photo: Janusz Kruszewski).

English ivy also serves as a reservoir for bacterial leaf scorch (*Xylella fastidiosa*), a pathogen that is harmful to native trees such as maples (*Acer spp.*). Leaf scorch bacteria plugs the xylem of the tree and prevents nutrients from being transported from the roots to the tree.

English ivy reproduces both vegetatively and by seed. New plants grow easily from cuttings or from stems making contact with the soil. Seeds can be dispersed to new areas primarily by birds, including English house sparrows (*Passer domesticus*), European starlings (*Sturnus vulgaris*), American robins (*Turdus migratorius*), Steller's jays (*Cyanocitta stelleri*), and cedar waxwings (*Bombycilla cedrorum*) (Swearingen, 2000).

Compounds in English ivy are somewhat toxic and include glycosides that cause vomiting, diarrhea, nervous conditions and dermatitis in sensitive individuals. This characteristic helps ensure spread of the seeds by many native songbirds that are attracted to the black berries in spring when other food sources are limited.

## Control Methods

It is important to take measures to kill both the tree form and groundcover vines since English ivy can cause trees to blow-over during storms.

*Hand pulling:*
Vines can be pulled out in the late summer or fall (Fig. 14). It is easier to remove them when the ground is moist and before the seeds set. This should be done over several years until the stands are eradicated. It is a safe and effective method but labour intensive. People working in a row can pull the vines from a edge of the mat and then roll English ivy out of the ground like a carpet. Hand pulling is the best method for removing English ivy as chemical methods harm surrounding vegetation.

Figure 14. English ivy being pulled from Jericho Beach Park in August, 2004 (Photo Mike Mackintosh).

*Cutting:*
Climbing vines can be cut to a height of 2 metres to kill the upper portions (Fig. 15). A large screwdriver or forked garden tool for small vines and an axe or pruning saw for large vines can be used to pry and snap the vines away from tree trunks. The best time for this is in the late summer or fall. However, the ground portions of vines will remain alive and should be pulled. This provides good results and is cost effective. However, it is labor intensive.

Figure 15. A young boy standing next to a tree recently freed of English ivy. The ivy should be cut up to about two metres high (Photo: Mike Mackintosh)

### 4.2.3 Scotch Broom (*Cytisus scoparius*)

The following overview for Scotch broom is summarized from Graham (2003), Plumas-Sierra County Department of Agriculture (PSCDA) (date unknown), Prasad (2002) and Langley Environmental Partners Society brochure on Scotch broom (date unknown) (b).

#### General Description

Scotch broom is an upright evergreen shrub that grows to 3.5 metres but usually grows to 1 to 2 metres (Fig. 16). The stems are erect, woody, green to brownish green, and are star shaped when cross-sectioned.

Figure 16: Scotch broom, a common invasive plant found in Jericho Beach Park, Vancouver (Photo: Janusz Kruszewski).

Scotch broom leaves grow alone or in clusters, with hairs surrounding the leaflets. Scotch broom's pea-like flowers are bright yellow, sometimes with red markings in the center and on short stalks (Fig. 17). They usually appear from April to June.

Figure 17. The Scotch broom flower. (Photo: Janusz Kruszewski).

## Ecology and Reproduction

Scotch broom grows best in dry sandy soils in full sunlight. It has a high tolerance for most soil conditions because it can fix nitrogen from the atmosphere. It is adapted to tolerate drought conditions with its deep taproot, small leaf area, stems that are able to photosynthesize and a thick wax coating that prevents water loss.

Scotch broom initially invades open disturbed sites with dry soils. It competes with native species for available light, moisture and nutrients, especially on disturbed sites. This plant also tends to acidify the surrounding soil, preventing other species from establishing. So far there are no known natural predators for this weed.

Scotch broom grows rapidly. It has an aggressive root system that consists of a taproot that may exceed half a metre in length, with a large shallow lateral root system. As plants grow, the inner stems die back providing a highly flammable fuel.

Scotch broom begins to reproduce at approximately three years of age. After flowering, it forms black seed pods, carrying an average of 5-9 seeds that disperse after the pods 'pop' open. Scotch broom is known as a 'prolific seed producer' with up to 18,000 seeds per plant that spread by wind, small animals, water and humans. These seeds are protected with a coat that can keep the seed alive for over 60 years but have an average lifespan of 17 years.

## Control Methods

Scotch broom is difficult to control due to its long living seeds, high seed production, tolerance to drought, long life span, and lack of natural enemies. Using mechanical control such as uprooting often triggers the germination of seeds in the ground. As a result, control efforts must be continued until the seeds on the ground are depleted. Despite these overwhelming odds, stewardship groups on Vancouver Island have managed to gain significant ground on some monocultures of Scotch broom through cutting and hand pulling. They have been able to reestablish native wildflowers at various sites. Since this invader is shade intolerant, planting native species after removal will likely assist in control by covering exposed soil to prevent Scotch broom seed germination. As for biological control agents, the Oregon Department of Agriculture released a seed weevil (*Apion fuscirostre*) in 1983, which has shown promising results with significant seed damage. There is also some hope that fungal agents could be used as a future control method. An integrated approach to controlling Scotch broom is recommended, combining both manual pulling and cutting with herbicide application.

*Hand pulling/cutting:*
Smaller plants can be pulled by hand while larger plants can have their stems cut down to the ground using loppers or saws. This is done when the plant is flowering and before seeds set. Cutting is effective during dry periods. The “Weed Wrench”, a tool that acts as a lever to pull the entire plant including the roots out of the ground, is great for pulling out Scotch broom (Alison Evely; pers. comm., 2005) (Fig. 18). Several years of cutting and pulling is needed until no new growth is detected. But Scotch broom may re-grow later on. Cutting is cost-effective and fairly unobtrusive but labor intensive and may cause excessive soil disturbance.

Figure 18. A volunteer removing Scotch broom with a Weed Wrench. This tool is highly effective at removing Scotch broom (Photo: Dawn Hanna).

*Machinery:*
Power tools, bulldozers and backhoes can be used to uproot or crush plants when the plant is flowering and before seed sets. This should only be performed once to minimize soil disturbance. However, this may harm sensitive habitat with excessive soil disturbance.

*Mulching:*
Native plants can be surrounded with canvas moss or landscape fabric to prevent broom from competing. Mulching is then done until the desired plant is established and the Scotch broom poses little threat. This is done at the same time as planting the exposed area with native plants. This is an effective, but costly and labor intensive form of control.

*Insects and Mites:*
Biocontrol strategies using parasitic insects and mites have been attempted in some jurisdictions. This has resulted in reduced Scotch broom populations but enough seed still matures and escapes to enable the broom to spread (Prasad, 2002).

*Fungal Pathogens:*
Under experimental conditions, three fungal pathogens, *Fusarium tumidum*, *Pleiochaeta setosa* and *Chrondrostereum purpureum*, have been investigated and have shown some promise for application in British Columbia. However, more research is required and a commercial bioherbicide agent is not yet available operationally.

## 4.2.4 Japanese Knotweed (*Polygonum cuspidatum*)

The following overview for Japanese knotweed management is summarized primarily from the BC Ministry of Agriculture, Food and Fisheries (BCMAFF) (2002) and Graham (2003).

### General Description

Japanese knotweed is a semi-woody perennial that can grow up to 3 metres in height (Fig. 19). The stems are stout, reddish-brown, round and hollow, and form dense clumps that look like bamboo. This characteristic gives rise to its other common names of Japanese and Mexican bamboo.

Figure 19: Japanese knotweed, a common invasive plant species in Jericho Beach Park, Vancouver (Photo: anonymous).

Japanese knotweed leaves grow alternately and form at the swollen joints along the stem (Fig. 20). The leaves are 10 to 15 centimetres long, egg-shaped, leathery and are dark green above and lighter green below. Greenish-white flowers bloom in clusters, at leaf axils along the stems, from August to September.

Figure 20. Japanese knotweed leaf form (Photo: Jack Ranney).

## Ecology and Reproduction

Japanese knotweed forms dense stands that grow up through the preceding years' dead thickets. The dead stems and leaf litter decompose very slowly, forming a deep organic layer that prevents native seeds from germinating. Once present at a site, Japanese knotweed increases in area very rapidly and soon forms monoculture stands.

Japanese knotweed is able to grow through concrete, walls and tarmac. It quickly spreads by its rhizomes that reach 15 – 20 metres in length. New plants can sprout from rhizomes that are transported downstream or when relocated by humans. Even tiny fragments of the plant can form new rhizomes; therefore it is important to remove all parts of the weed. Japanese knotweed also reproduces by seeds that spread by waterways. But since Japanese knotweed

is dioecious (ie. has individual male and female plants) and there is a disproportionate ratio of female to male plants, reproducing by seeds is a far inferior method to rhizome reproduction.

This invasive plant can grow in a variety of soils including silt, loam, and sand. Furthermore, Japanese knotweed can tolerate harsh conditions such as full shade, high temperatures, high salt levels, drought and flooding. It generally requires full sunlight, as dense stands do not tend to develop in shady areas. Japanese knotweed invades urban environments where humans routinely disturb and transport soils.

### Control Options

It is important to remember that any leftover portions of the root system of Japanese knotweed can re-sprout and all parts of the plant must be properly disposed of in strong plastic bags and transported to either landfills or incinerators. Although chemical treatment is not permitted in Vancouver parks, it should be noted that a combination of cutting and spot application of glyphosate (Roundup) is likely the superior choice of control as it is effective, cost-efficient, and practical. AquaMaster is a better herbicide to use because it does not contain the surfactant found in Roundup that is toxic to amphibians (Alison Evely, pers. comm., 2005).

*Digging/Grubbing:*
Digging tools like shovels and Pulaskis are used to remove the entire plant. This method is most effective where plants are less established and should be repeated until plants are no longer sprouting from the area. Digging and grubbing is extremely labor intensive and has the potential to spread plant fragments since Japanese knotweed has an extensive underground root system.

*Cutting:*
Loppers are used in the early to mid part of growing season. This should be repeated at least 3 times in the growing season to deplete food reserves. This is only suitable for relatively small stands.

## 4.2.5 English Holly (*Ilex aquifolium*)

The following overview for English holly management is summarized from Clements et al (1998) and Plants for a Future (2000).

### General Description

English holly is a large evergreen shrub to small tree (Fig. 21). Its leaves are thick and tough, dark green, glossy, indented and spiky (Fig. 22). On older branches they may be quite smooth. The flowers of English holly are small and white. They are generally pollinated by bees. Female trees typically need to grow within 30 metres of a male tree to be pollinated. Bunches of bright red berries, which are poisonous to humans but not to birds, grow on female trees during the winter.

Figure 21. English holly, a common invasive plant found in Jericho Beach Park, Vancouver (Photo: Janusz Kruszewski).

Figure 22. English holly leaf form (Photo: Janusz Kruszewski).

## Ecology and Reproduction

English holly grows slowly and reaches a maximum height of around forty feet. It primarily thrives in shade, but can also grow in the sun.

English holly thrives in cold, shaded areas and roots faster in fall than in the spring. This plant can grow in nutritionally poor soils and prefers sandy, loamy and clay soils that are acidic to neutral (pH of 3.5 to 7.2). It can grow on dry or moist soil and can tolerate drought, but needs good drainage and an ample supply of fresh water.

English holly requires a temperature of at least 12°C in July for good fruit production. It can tolerate short periods of temperatures down to -15°C, but severe frosts can kill whole branches, especially if they are open to the sky. The young growth in spring can be damaged by late frosts.

English holly uses more nutrients than it replaces, resulting in the degradation of nutrient levels in the surrounding soil. Holly leaves decompose at a slower rate relative to its rate of absorbing nutrients. This means that the English holly cannot replace all of the nutrients it takes from the soil. As a result of the nutrient-poor soil, it is difficult for other plants to receive the amount of nutrients required.

English holly dominates the tall shrub layer, creating deep shade in which native species cannot grow or germinate.

Birds spread the seeds of English holly; but holly may also spread by sending up shoots from roots and by growing roots where stems touch the ground. English holly can form dense thickets.

English holly, however, is a good bee plant and a valuable winter food source for birds. Rabbits are particularly fond of this plant and will eat the bark.

### Control Options

English holly can be controlled by cutting the plant to the ground (Fig. 23) or by pulling the plant out with a tool such as a Weed Wrench. This can be done anytime the plant is not fruiting (Lisa Burgess-Parker, pers. comm. 2005).

Figure 23. English holly being cut to the ground with a saw (Photo: Mike Mackintosh).

## 4.3 Removal Efforts

On October 9, 2004, the Jericho Stewardship Group removed Japanese knotweed from the area to the south of the duck pond. Loppers were used to cut the Japanese knotweed to about three inches above the ground. The cuttings were removed several days later by Vancouver Parks and Recreation staff.

On February 20, 2005, the Jericho Stewardship Group met in a small woodland near the West Point Grey Community Centre, where Northwest Marine Drive meets Second Avenue. The volunteers removed English ivy from almost all of the trees in the area by cutting the vines and stems from the base of the tree to breast height and pulling them off the trunks (Fig. 24). The English ivy remaining on the trees was left to die since they had no way of obtaining nutrients from their roots in the ground. The cuttings were again removed by Vancouver Parks and Recreation staff.

Figure 24. Volunteers at Jericho Beach Park using loppers to take out some English ivy growing up trees (Photo: Mike Mackintosh).

On March 13, 2005, the volunteers of the Jericho Stewardship Group cleared out areas along the service road formerly used by urban campers to prevent them from returning (Figs. 25 and 26). Japanese knotweed was again removed using loppers to cut the stems to three inches above the ground. Low hanging cedar branches were pruned to open up the area. The spread of Himalayan blackberry into a meadow just north of the entrance to the service road was cut back. Spreading blackberry canes were cut using loppers. Shovels were used to dig up the roots at the end of the canes. The cuttings were removed by Vancouver Parks and Recreation staff.

Figure 25. Abandoned urban campsite in Jericho Beach Park hiding behind Himalayan blackberry and Japanese knotweed (Photo: Mike Mackintosh).

Figure 26: Former urban campsite in Jericho Beach Park after removal of Japanese Knotweed and pruning of cedar trees (Photo: Mike Mackintosh).

On April 10, 2005, The Jericho Stewardship Group returned to the areas where they removed Japanese knotweed the previous fall and cut down the new shoots growing up from the cleared ground with shovels and loppers (Fig. 27). Scotch broom was uprooted from the scrubland in the northwest corner of the park using shovels, Weed Wrenches, tools that work as levers that pull the entire plant including the roots out from the ground. Canes of Himalayan blackberry were cut back using loppers to prevent them from encroaching into the open meadows.

Figure 27. Volunteers cutting down Japanese knotweed in regrowing from previously cleared ground in Jericho Beach Park (Photo: Mike Mackintosh).

## 4.4 Field Surveys and Mapping

Figure 28 shows the distribution and percent cover of Himalayan blackberry in Jericho Beach Park.

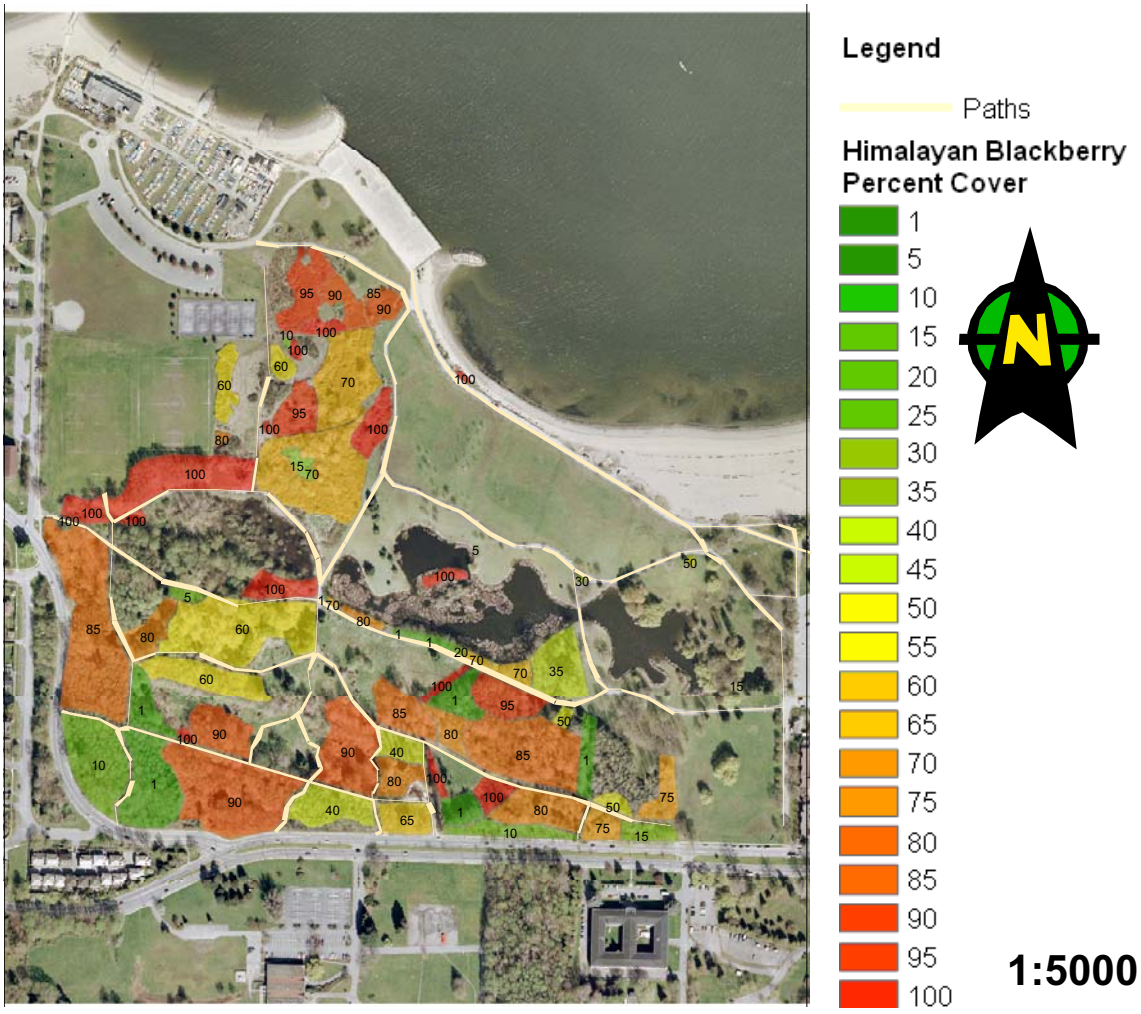


Figure 28. Distribution and percent cover of Himalayan blackberry in Jericho Beach Park, Vancouver, based on surveys conducted in the fall and winter (2004-2005).

Figure 29 shows the distribution and percent cover of English ivy in Jericho Beach Park.

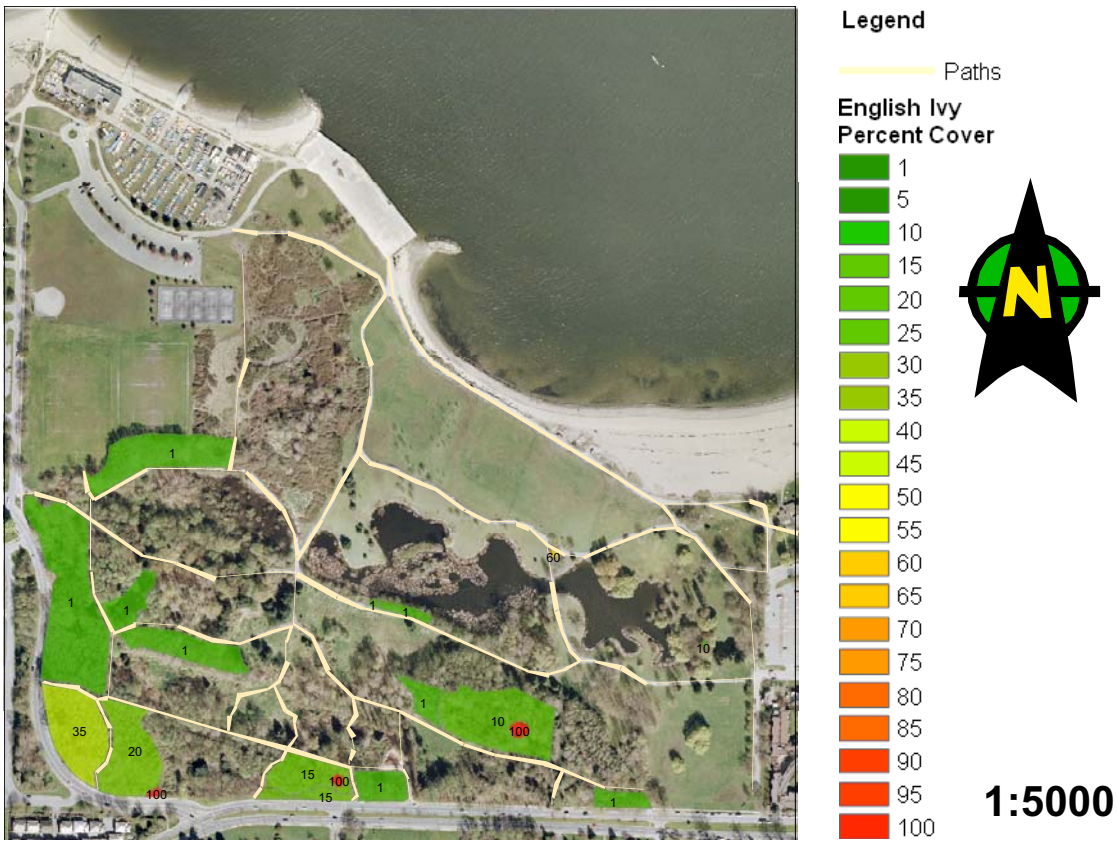


Figure 29. Distribution and percent cover of English iby in Jericho Beach Park, Vancouver, based on surveys conducted in the fall and winter (2004-2005).

Figure 30 shows the distribution and percent cover of Scotch broom in Jericho Beach Park.

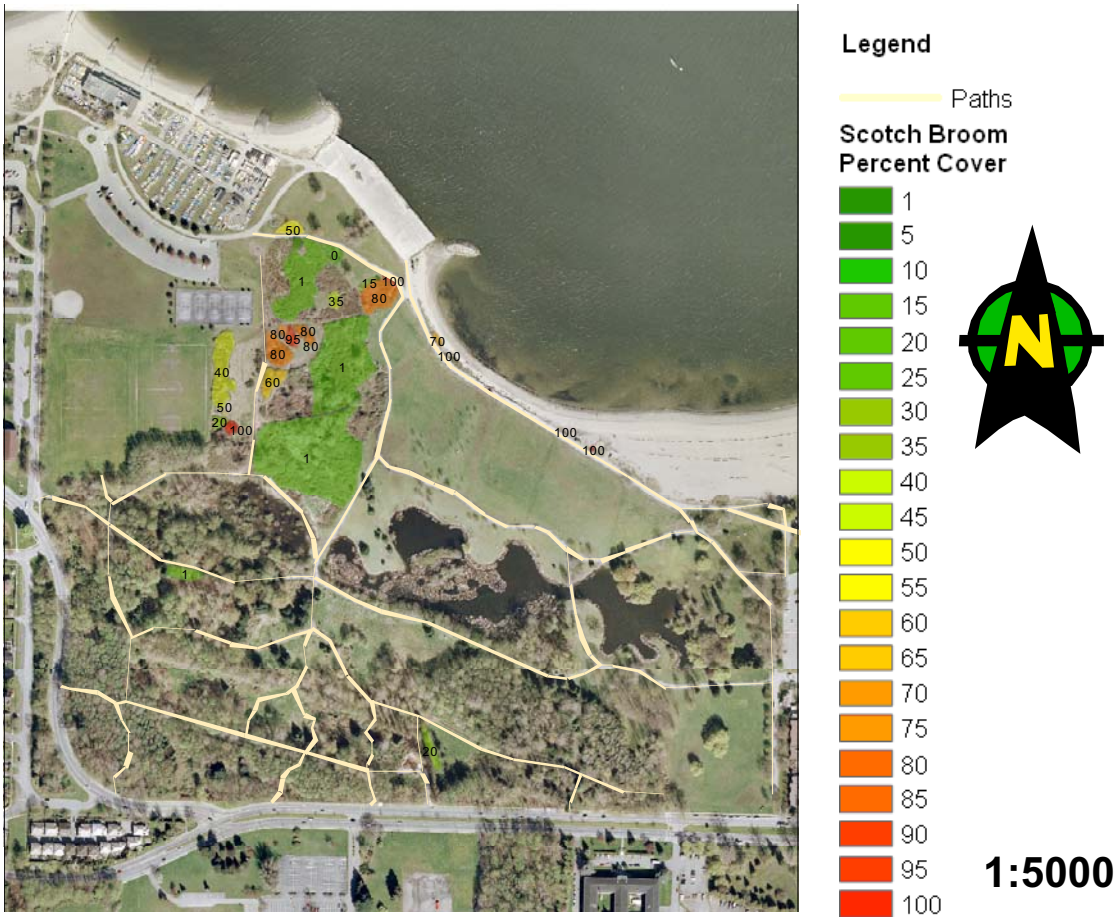


Figure 30. Distribution and percent cover of Scotch broom in Jericho Beach Park, Vancouver, based on surveys conducted in the fall and winter (2004-2005).

Figure 31 shows the distribution and percent cover of Japanese knotweed in Jericho Beach Park.

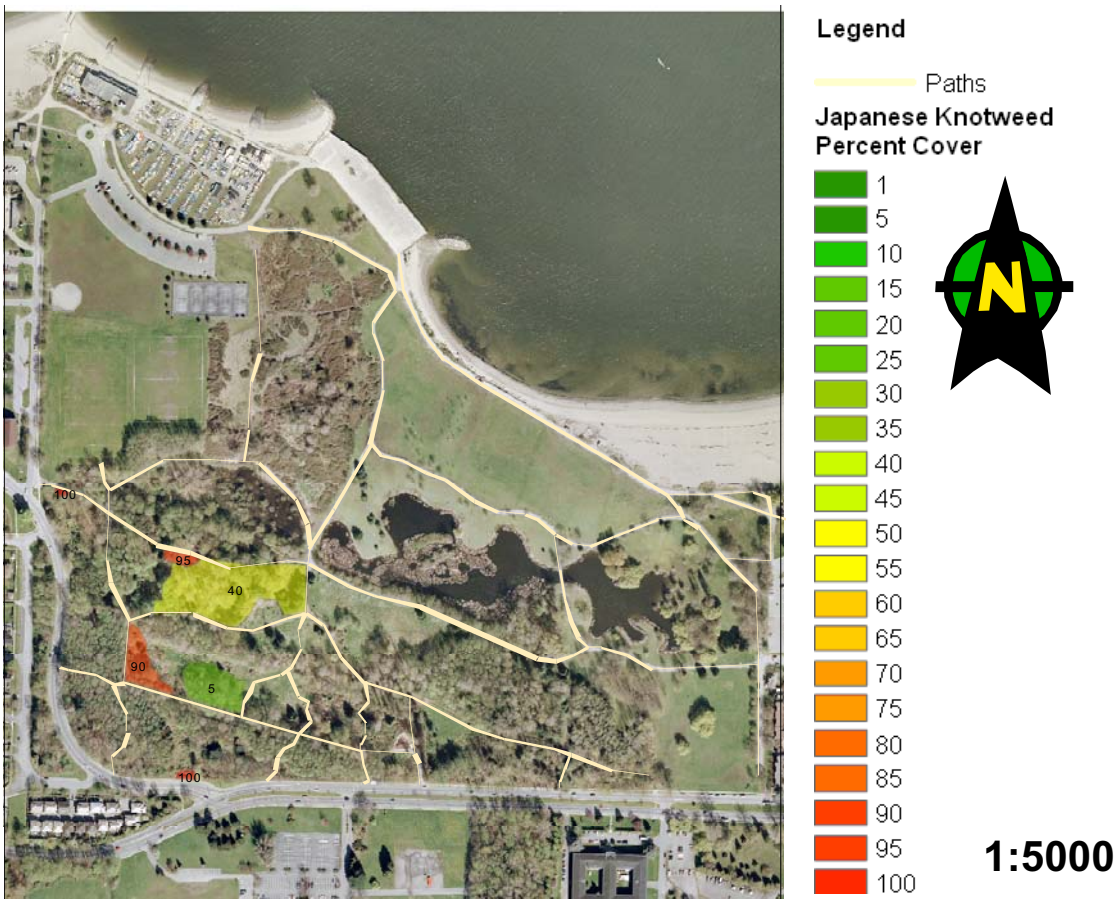


Figure 31. Distribution and percent cover of Japanese knotweed in Jericho Beach Park, Vancouver, based on surveys conducted in the fall and winter (2004-2005).

Figure 32 shows the distribution and percent cover of English holly in Jericho Beach Park.

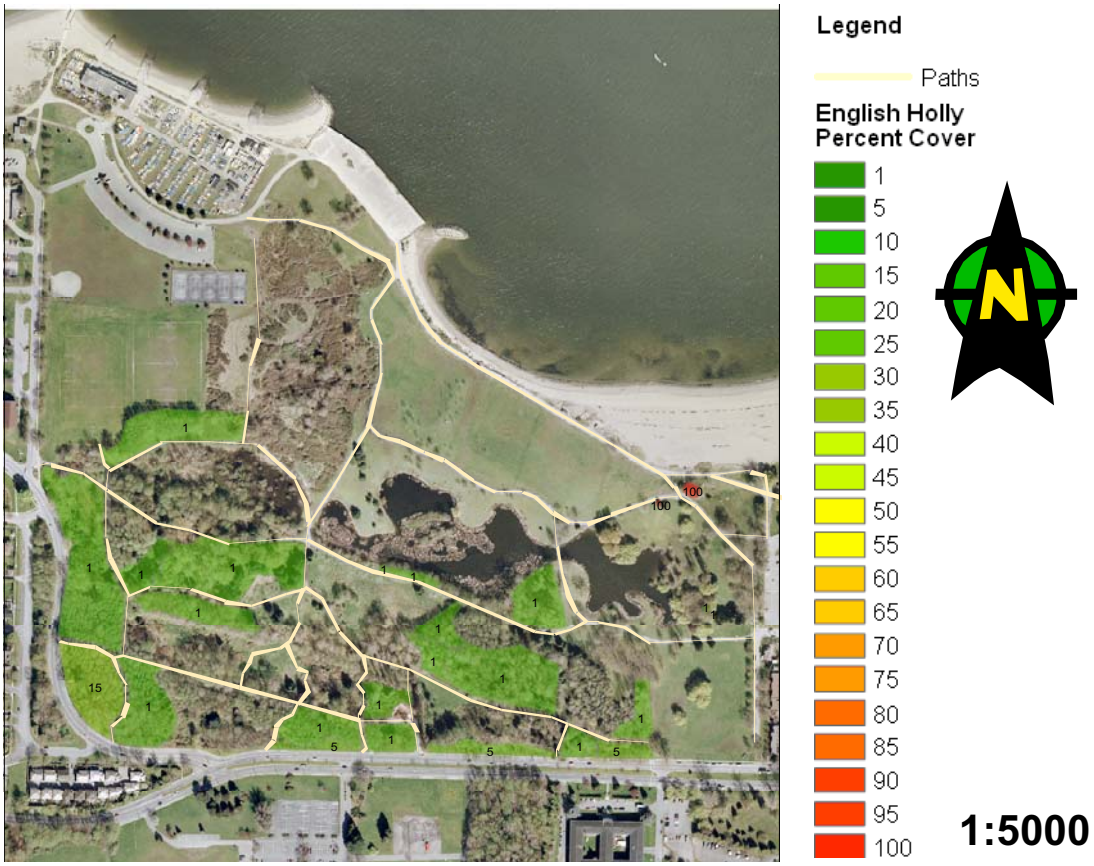


Figure 32. Distribution and percent cover of English holly in Jericho Beach Park, Vancouver, based on surveys conducted in the fall and winter (2004-2005).

# 5.0 Recommendations

Through our personal experience removing invasive plants from Jericho Beach Park and talking to local invasive species experts, Alison Evely of the Greater Vancouver Regional District and Lisa Burgess-Parker of the Langley Environmental Partners Society, we have developed the following recommendations for managing invasive plants in Jericho Beach Park.

## 5.1 General Control Recommendations

The most cost-effective method for controlling invasive plant species is to prevent the establishment of these plants by monitoring areas for new introductions. When new colonies are identified, people must quickly act to remove these stands. Small stands should also be identified and removed.

The duck ponds of Jericho Beach Park are some of the park's most valued assets (Fig. 33). Invasive plant control efforts should be focused primarily in the areas around these ponds in order to keep the pond area as natural as possible.

Figure 33. The duck ponds of Jericho Beach Park are valued assets (Photo: Janusz Kruszewski).

The removal of invasive plant species from Jericho Beach Park should be executed during the growing season of the plants when their roots are weakest and they are diverting most of the energy to growth.

Table 1 illustrates the recommended times of the year each invasive species should be removed. Himalayan blackberry and Japanese knotweed are best removed during the spring and summer months. English ivy can be pulled year round. Scotch broom can also be removed any time of the year except for June and July when the seed pods form. Pulling out Scotch broom at this time can cause the seed pods to pop open and can result in the spread of seeds. English holly should not be removed during the winter months when its berries form to prevent germination of its seeds.

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Himalayan blackberry | | | ● | ● | ● | ● | ● | ● | ● | | | |
| English ivy | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Scotch broom | ● | ● | ● | ● | ● | | | ● | ● | ● | ● | ● |
| Japanese knotweed | | | ● | ● | ● | ● | ● | ● | ● | | | |
| English holly | | | ● | ● | ● | ● | ● | ● | ● | ● | ● | |

Table 1: Timetable for removal of the invasive plant species found in Jericho Beach Park.

Biological control methods are living organisms that are used to control the growth of invasive plant species, such as the insects, mites and fungi suggested for controlling Scotch broom. If biological control methods are being considered, extensive studies should be conducted to ensure that there is minimal negative impact to the habitat (Graham, 2003).

## 5.2 Specific Species Control

### 5.2.1 Himalayan blackberry

Controlling all of the Himalayan blackberry in Jericho Beach Park is not recommended for volunteers because of its wide spread and thick growth. Heavy concentrations of Himalayan blackberry should be left alone (Fig. 34). They provide good cover for small birds and mammals. Blackberry is not known to cross over the walking paths in Jericho Beach Park and will likely remain confined within these trails.

Figure 34. A thick concentration of Himalayan blackberry in Jericho Beach Park that should be left alone by volunteers (Photo: Janusz Kruszewski).

Instead, the volunteers of the Jericho Stewardship Group should focus on the Himalayan blackberry encroaching into the park's meadows (Fig. 35). The upper meadows in the park's forested area are valued by visitors and should be protected. Canes reaching into these areas should be cut back using loppers to prevent them from establishing new thickets.

Figure 35. Himalayan blackberry encroaching into meadows in Jericho Beach Park (Photo: Janusz Kruszewski).

If the thick concentrations of Himalayan blackberry are to be dealt with, a great deal of support from Vancouver Parks' staff is needed. If the blackberry is low enough, tractor mowers can be brought in to mow the plants down. Mowing should occur at least three times during the growing season.

Mulching has been known to be very effective with removing blackberry. This work is usually contracted out and is fairly expensive.

### 5.2.2 English ivy

Control efforts should be immediately implemented on the English ivy growing up the many trees in Jericho Beach Park. Climbing vines should be cut at a height of about 2 metres. Once they are separated from the roots that provide them with nutrients, the vines on the trees should die and fall off in time.

The trace amounts of English ivy should be removed next to prevent them from forming ground covering carpets.

Carpets of ivy on the ground can be removed by pulling the vines out by hand. Where there are few or no native plants growing, these carpets can be pulled and rolled with volunteers working in rows.

### 5.2.3 Scotch broom

Control efforts for Scotch broom should focus on the infestations along the main trails by the beach. Removal of Scotch broom with Weed Wrenches has proven to be effective. The large number of entire plants that can be removed using this method is excellent for volunteer morale. Parks' staff should assist in this removal if the resources are available.

The two small patches of Scotch broom in the Jericho Beach Park's forested area should be removed first to prevent the plant from spreading over the meadows (Fig. 36). This would isolate Scotch broom in the northern scrubland area where removal efforts can be focused.

Figure 36. Scotch broom growing in a meadow of Jericho Beach Park (Photo: Janusz Kruszewski).

### 5.2.4 Japanese knotweed

The only proven way to prevent Japanese knotweed from growing back in an area is to use herbicides. Since the use of chemicals is not permitted to be used in Vancouver's city parks, cutting is the best option to control their growth. Japanese knotweed should be cut down to the ground at least three times each growing season. The method of covering cut down Japanese knotweed with mulch and cardboard that was used by the Jericho Stewardship Group is not known to effectively prevent the invasive plant from regrowing.

Japanese knotweed is a large plant that can easily be cut down. Volunteers see a big difference when Japanese knotweed is removed.

### 5.2.5 English holly

English holly does not grow in dense stands in Jericho Beach Park, but rather as solitary plants scattered throughout the forested area of the park. Each single plant should be located. Small plants can be pulled by hand while larger ones can be removed with Weed Wrenches. Control efforts should be conducted before the plants begin to produce fruit in the winter.

## 5.3 Removal of Cuttings

The cuttings of invasive plants created by control efforts were left exposed alongside trails for Vancouver Parks' staff to pick up at later time. Japanese knotweed and Himalayan blackberry cuttings were sometimes left on top of the area they were cut from (Fig. 37). These small pieces started to grow into full plants in the following spring (Fig. 38). Cuttings from these plants should be placed in thick plastic bags to prevent them from germinating. Japanese knotweed cuttings should be incinerated.

Figure 37. Japanese knotweed cuttings left on the ground in Jericho Beach Park (Photo: Janusz Kruszewski).

Figure 38. Japanese knotweed growing up from clippings left from the previous year's removal in Jericho Beach Park (Photo: Janusz Kruszewski).

## 5.4 Replanting

The removal of invasive plants should continue for several years, until no or little regrowth is observed (Lisa Burgess-Parker, pers. comm., 2005). Only then should replanting of native plant species occur to ensure that the invasive plants do not out compete the natives.

Areas where invasive plants have been removed should be replanted with native plants that are growing in Jericho Beach Park such as Indian plum (*Oemleria cerasiformis*), false lily of the valley (*Maianthemum dilatatum*), thimbleberry (*Rubus parviflorus*), elderberry (Sambucus *racemosa*), oceanspray (*Holodiscus discolor*) and beaked hazelnut (*Corylus cornuta*). A more thorough list can be found in Appendix A.

Salal (*Gaultheria shallon*) is a great species to be replanted in the forested areas of Jericho Park that are now covered with English ivy.

Riparian areas where Himalayan blackberry and Japanese knotweed have been removed are excellent sites for replanting salmonberry (*Rubus spectabilis*), a plant that thrives in moist and rich soil.

Scotch broom does not grow well away from the light. Therefore, plants the provide shade should be planted where Scotch broom grows to prevent the invasive plant from returning. Snowberry (*Symphoricarpos albus*) is an excellent option.

## 5.5 Mapping

The maps produced for this report illustrate the locations and densities of the invasive plants during the winter of 2005. Since invasive plants grow very rapidly, the ranges of these plants can easily grow larger in a few years. The maps should be updated every few years to keep track of this growth.

Since this project was conducted in the winter months, only invasive plants visible during that time were mapped. The locations and densities of the nine other invasive species of concern should be mapped in the near future.

## 5.6 Public Relations

The public often views the destruction and removal of plants in a negative light. Many highly visible areas of Jericho Beach Park, especially along the paths, will be barren as invasive plants are removed from the park. The public should be informed through signs that harmful invasive plants are being controlled and that these activities are part of a habitat improvement project to protect biodiversity.

Presentations can also be made at the nearby West Point Grey Community Centre, informing the public of the negative effects of invasive plants in Jericho Beach Park and what is being done to control them. Many frequent users of Jericho Beach Park can be reached here.

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## 6.1 Personal Communications

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- Coope, John. Jericho Stewardship Group member.
- Evely, Alison. Research Technician, Regional Parks, Central Area. Greater Vancouver Regional District. E-mail: Alison.Evely@gvrd.bc.ca
- Hanna, Dawn. Representative from the Vancouver Natural History Society from former instructor and director for Coast Mountain Field Institute.
- Mackintosh, Mike. Fish and Wildlife. Vancouver Parks and Recreation. E-mail: mike.mackintosh@vancouver.ca

# 7.0 Appendices

## Appendix A: Plants of Jericho Beach Park

On July 31, 1996, Terry Taylor observed these plants in Jericho Beach Park:

| Common name | Scientific name |
|---|---|
| **Trees and Shrubs:** | |
| Broadleaf maple | *Acer macrophyllum* |
| Vine maple | *Acer circinatum* |
| Red alder | *Alnus rubra* |
| Bitter cherry | *Prunus emarginata var. mollis* |
| Indian plum | *Oemleria cerasiformis* |
| Salmonberry | *Rubus spectabilis* |
| Black cottonwood | *Populus trichocarpa* |
| Red cedar | *Thuja plicata* |
| Red elderberry | *Sambucus racemosa vas. Arborescens* |
| Trailing blackberry | *Rubus ursinus vas. Macropetalus* |
| Douglas fir | *Pseudotsuga menziesii var. menziesii* |
| Pacific crab apple | *Malus fusca* |
| Scouler's willow | *Salix scouleriana* |
| Pacific willow | *Salix lasiandra var. lasiandra* |
| Hazel | *Corylus spp.* (probably *C. cornuta*) |
| Pacific dogwood | *Cornus nuttallii* |
| Hardhack | *Spiraea douglasii var. douglasii* |
| Red huckleberry | *Vaccunium parvifolium* |
| **Herbs** | |
| Bleeding heart | *Dicentra Formosa* |
| Large leaf avens | *Geum macrophyllum* |
| Canada goldenrod | *Solidago Canadensis var subserrata* |
| Pineapple weed | *Marricaria matricarioides* |
| Pacific silverweed | *Potentilla pacifica* |
| Cut leaf water horehound | *Lycopus americanus* |
| Water milfoil | *Myriophyllum spp.* (probably *M. exalbescens*) |
| Small flowered forget-me-not | *Myosotis laxa* |
| Water smartweed | *Polygonum amphibium* |
| Beach pea | *Lathyrus japonicus var. glaber* |
| Orache | *Atriplex patula* |
| Sea rocket | *Cakile edentula* |
| Few seeded bittercress | *Cardamine oligosperma var. oligosperma* |
| Leafy bur marigold | *Bidens frondosa* |
| Watson's willow herb | *Epilobium ciliatum* |
| **Grasses** | |
| Thin rush | *Juncus tenuis* |
| Common rush | *Juncus effuses* |
| Jointed rush | *Juncus articulatus* |
| Soft-stemmed bulrush | *Scirpus validu* |

| | |
|---|---|
| Bur reed | *Sparaganiu emersum* |
| Cat tail | *Typha latifolia* |
| Small flowered sedge | *Scirpus micropus* |
| Common spike rush | *Eleocharis palustris* |
| American dune grass | *Elymus mollis* |
| Sitka brome grass | *Bromus sitchensis* |
| Large headed sedge | *Carex macrocephala* |
| Baltic rush | *Juncus balticus* |

### Ferns and allies

| | |
|---|---|
| Giant horsetail | *Equisetum telmateia var. braunii* |
| Lady fern | *Athyrium filix-femina* |
| Sword fern | *Polystichum munitum* |
| Field horsetail | *Equisetum arvense* |
| Bracken fern | *Pteridium aquilinum var. pubescens* |

### Mosses

| | |
|---|---|
| an acrocarp moss | *Orthotrichum consimile* |
| a pleurocarp moss | *Brachythercium spp.* |
| a pleurocarp moss | *Eurhynchium stokesii* |
| a haircap moss | *Atrichum undulatum* |
| a pleurocarp moss | *Calliergonella cuspidate* |
| an acrocarp moss | *Dicranoweisia cirrata* |
| a pleurocarp moss | *Homalothecium fulgescens* |
| an acrocarp moss | *Orthotrichum lyellii* |
| a pleurocarp moss | *Isothecium myosuroides* |
| a pleurocarp moss | *Homalothecium fulgescens* |

### Lichens

| | |
|---|---|
| a foliose lichen | *Melanelia subaurifera* |
| a foliose lichen | *Hypogynmnia physodes* |
| a squamulose lichen | *Candelaria concolor* |
| a foliose lichen | *Parmelia hygophila* |
| a crustose lichen | *Lecanora spp?* (possibly this genus) |
| a crustose lichen | *Lecidea spp?* (possibly this genus) |
| a foliose lichen | *Physcia tenella* |
| a foliose lichen | *Physcia adscendens* |

### Fungi

| | |
|---|---|
| a mildew on broadleaf maple | *Uncinula bicornis* |
| a rust fungus on Scouler's Willow | *Melampsora epitea* |

# Appendix B: Other Invasive Plant Control Organizations

### Evergreen
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