

S a r g e a n t B a y S o c i e t y

INVASIVE PLANT CONTROL

in

**Sargeant Bay
Provincial Park**



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by

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and
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January, 2003

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Introduction

This report describes the efforts by the Sargeant Bay Society to suppress the invasion of certain foreign plant species that pose a threat to the native vegetation in Sargeant Bay Provincial Park¹.

The most serious of these is **Himalayan Blackberry** (*Rubus armeniacus*, previously known as *Rubus discolor*²). It was well established in the area when it became a provincial park in 1990.

Scotch Broom (*Cytisus scoparius*) was introduced later, but poses an equally serious threat. Both species are well established around the park and are common all along the Sunshine Coast.

Yellow Flag (*Iris pseudacorus*) is a new but persistent invader in the wetland.

Evergreen Blackberry (*Rubus laciniatus*) has recently made its appearance on the island in Colvin Lake.

The rate at which these species were taking over from the native vegetation, made it clear that something needed to be done, or the foreshore section of the park would forever lose much of its attraction.

There are several hundred plant species in the park. On the beach berm alone 160 species have been identified. About 40% are introduced, but none of these appear to be increasing their coverage at the expense of the natives, now that the broom and blackberry are under control.

It is our hope and endeavour to maintain Sargeant Bay Provincial Park as a unique sanctuary on the Sunshine Coast, with its remarkable plant species diversity intact.

¹Sargeant Bay Provincial Park is situated on the Sunshine Coast, 8 km west of Sechelt in British Columbia. The park was established in 1990. The foreshore area includes a wetland that was rehabilitated by the Sargeant Bay Society in 1991. For more information, see: *Background Report for Sargeant Bay Provincial Park* by Sargeant Bay Society for BC Parks, March, 2000.

² Adolf Ceska of the BC Conservation Data Centre has sent collections of our Himalayan Blackberry to European experts for identification. As a result, a new scientific name, *Rubus armeniacus*, has replaced the older names for this plant: *Rubus discolor* or *Rubus procerus*. See: <http://www.ou.edu/cas/botany-micro/ben/ben230.html>

Short History

The first clearing of Himalayan Blackberry was done in the fall of 1993, by a volunteer who cut a path through a dense and completely impenetrable thicket in area L, Map 1, to gain access to the hiking trail that was to be built along Colvin Creek the following winter.

Scotch Broom appeared on the annual plant inventory list for the first time in 1992. It was limited to one patch at the location of the former cabins on the beach berm and a few plants at the trail head on Redrooffs Road (Areas A and B, Map 2.). In 1996 it was cut down in both areas by volunteers, just in time to prevent its spread.

Volunteers were then ready to tackle the Himalayan Blackberry, but this turned out to be a daunting task. Fortunately, 1997 was the year that the United Fishermen and Allied Workers Union (UFAWU) received a federal job-diversification grant for its unemployed fisheries workers, and were looking for projects. They cleared for the first time the area that formed an impenetrable barrier between one third of the beach berm and the wetland (Area B, Map 1).

The next two years, 1998 and 1999, we employed summer students, partially supported by a provincial Student Summer Works grant. In the fall of 1999 we also got help from an Environmental Youth Team (E-Team) that was working for BC Parks. Although the students worked hard enough, the problem was that they are only available by the middle of summer, at the end of the school year, when new blackberry shoots are already meters high.

For the years 2000 and 2001 we were able to hire adult workers, partially supported by an EcoAction grant from Environment Canada. This allowed us to get a head-start on the blackberries by starting in March. It also allowed us to cut down 80% of the thickets at the trailhead on Redrooffs Road (Area L, Map 1), with a road-side mower and use a high-power brush cutter to reach all other areas with 100% blackberry growth. At the end of 2000 the target areas had been cleared and re-cleared of blackberry as many as seven times.

In 2001 we changed strategy and went after the underground parts of the plants. A more detailed description of this effort follows. We awarded a contract to the foreman of the previous year's crew, Kye Goodwin, who did the work single-handedly and also contributed to documentation as co-author of this report.

Personpower

This section tabulates the invasive plant control personpower over the years for each species under control. It should be noted that the quality of the persons employed varied. The persons hired under the EcoAction project were noticeably more effective than the summer students, who were generally more playful and were not allowed to use power tools. 98% of the personpower was used to control the blackberries.

Himalayan Blackberry (*Rubus armeniacus*)

| Map 1 AREA | PERSON.HOURS | | | | | | | | | | | | Total |
|---------------|-----------------|-------------|-------------|--------------|---------------------------|--------------------------------|-------------|-----------|----------------------------------|--------------------------------|--------------------------------|------------------------|--------------|
| | 1993 | 1997 | 1998 | 1999 | | 2000 | | | 2001 | 2002 | 2003 | 2004 | |
| | Volun- teers | UFA WU | SS98 | July SS99 | E- TEAM Sep- Nov | Road side mower March | May | July | Eco Action Con- tractor | BC Parks Con- tractor | BC Parks Con- tractor | SBS Con- tractor | |
| A | 0 | 14 | 24 | 41 | 0 | 3 | 21 | 8 | 33 | 2.5 | | | 147 |
| B | | 55 | 183 | 205 | 35 | 0 | 73 | 10 | 141 | 27.25 | | | 729 |
| C | | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | | | 25 |
| D | | 15 | 26 | 39 | 11 | 0 | 31 | 4 | 12 | 3.25 | | | 141 |
| E | | | 52 | 49 | 20 | 0 | 26 | 4 | 14 | 3.75 | | | 169 |
| F | | | 0 | 0 | 0 | 1 | 52 | 3 | 4 | 0 | | | 60 |
| G | | | 0 | 0 | 0 | 0 | 16 | 4 | 6 | 0.25 | | | 26.25 |
| H | | | 0 | 0 | 14 | 0 | 15 | 4 | 1 | 0 | | | 34 |
| I | | | 0 | 27 | 0 | 0 | 5 | 4 | 2 | 0.5 | | | 38.5 |
| J | | | 0 | 0 | 0 | 1 | 5 | 2 | 3 | 0.5 | | | 11.5 |
| K | | | 48 | 83 | 0 | 0 | 10 | 4 | 5 | 1.0 | | | 151 |
| L | 8 | 0 | 0 | 0 | 0 | 10 | 81 | 12 | 159 | 18.25 | | | 288 |
| M | | | | | | 0 | 11 | 3 | 9 | 1.0 | | | 24 |
| N | | | | | | 0 | 4 | 2 | 1 | 0.75 | | | 7.75 |
| O | | | | | | 0 | 7 | 2 | 2 | 0.25 | | | 11.25 |
| P | | | | | | 0 | 21 | 0 | 26 | 3.25 | | | 50.25 |
| Q | | | | | | 3 | 0 | 0 | 0 | 0 | | | 3 |
| R | | | | | | 2 | 0 | 0 | 0 | 0 | | | 2 |
| S | | | | | | 1 | 0 | 0 | 0 | 0 | | | 1 |
| T | | | | | | | 10 | 2 | 35 | 1.75 | | | 48.75 |
| U | | | | | | | 4 | 0 | 1 | 0 | | | 5 |
| Z | | | | | | | | | 3 | 0.75 | | | 3.75 |
| Total | 8 | 84 | 333 | 444 | 80 | 21 | 417 | 68 | 457 | 65 | | | 1977 |
| | Volun- teers | UFA WU | SS98 | July SS99 | Sep-Nov E- TEAM | March Road side mower | May | July | Eco Action Con- tractor | BC Parks Con- tractor | BC Parks Con- tractor | | |
| Total | 8 | 84 | 333 | 524 | | | 506 | | 457 | 65 | | | 1977 |
| | 1993 | 1997 | 1998 | 1999 | | | 2000 | | 2001 | 2002 | 2003 | 2004 | Total |

Scotch Broom (*Cytisus scoparius*)

| PERSON.HOURS | | | | | | | | | | | |
|--------------|-------------|-------------|-----------------|-----------------|-------------|-------------|----------------------|---------------------|---------------------|-------------|-------|
| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | | 2002 | 2003 | 2004 | |
| Map 2 AREA | Volun-teers | Volun-teers | Summer Students | Summer Students | Volun-teers | Volun-teers | EcoAction Contractor | BC Parks Contractor | BC Parks Contractor | | Total |
| A | 8 | 4 | | | 2 | 6 | 3 | 0 | | | 23 |
| B | 1 | | | | | | | 0 | | | 1 |
| Total | 9 | 4 | 0 | 0 | 2 | 9 | | | | | 24 |
| | 1993 | 1997 | 1998 | 1999 | 2000 | 2001 | | 2002 | 2003 | 2004 | |

Yellow Flag (*Iris pseudacorus*)

| PERSON.HOURS | | | | | | | | | | | |
|--------------|--|-------------|-----------------|-----------------|-------------|-------------|----------------------|---------------------|---------------------|-------------|-------|
| | | 1997 | 1998 | 1999 | | 2000 | 2001 | 2002 | 2003 | 2004 | |
| Map 2 AREA | | Volun-teers | Summer Students | Summer Students | Volun-teers | Volun-teers | EcoAction Contractor | BC Parks Contractor | BC Parks Contractor | | Total |
| C | | 3 | 2 | | | | 1 | 0.25 | | | 6.25 |
| D | | | | 3 | 4 | | 2 | 0 | | | 9 |
| E | | | | | | | 0.5 | 0.25 | | | 0.75 |
| F | | | | | | | 0.5 | 0 | | | 0.5 |
| Total | | 3 | 2 | 7 | | 0 | 4 | 0.5 | | | 16.5 |
| | | 1997 | 1998 | 1999 | | 2000 | 2001 | 2002 | 2003 | 2004 | |

Evergreen Blackberry (*Rubus laciniatus*)

| | | | | | | | 2001 | 2002 | 2003 | 2004 | |
|--------------|--|--|--|--|--|--|----------------------|---------------------|---------------------|-------------|-------|
| Map 2 AREA | | | | | | | EcoAction Contractor | BC Parks Contractor | BC Parks Contractor | | Total |
| D | | | | | | | 2 | 2 | | | 4 |
| Total | | | | | | | 2 | 2 | | | 4 |
| | | | | | | | 2001 | 2002 | 2003 | 2004 | |

Grand Totals

| SPECIES | PERSON.HOURS | | | | | | | | | |
|--------------------------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | 93/96 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | Total |
| Rubus armeniacus | 8 | 84 | 333 | 524 | 506 | 457 | 65 | | | 1977 |
| Cytisus scoparius | 9 | 4 | 0 | 0 | 2 | 9 | 0 | | | 24 |
| Iris pseudacorus | 0 | 3 | 2 | 7 | 0 | 3 | 0.5 | | | 15.5 |
| Rubus lacinatus | 0 | 0 | 0 | 0 | 0 | 3 | 2 | | | 5 |
| TOTAL | 17 | 91 | 335 | 531 | 508 | 472 | 67.5 | | | 2022 |
| | 93/96 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | |

The early Years: 1996 to 1999

From the outset the use of chemicals (herbicides) was considered unacceptable and it was decided that any attempt to eliminate the Himalayan Blackberries would be by mechanical means. This left us essentially two options, cutting the canes or digging out the root systems. Removing the roots by pulling them or digging them up is a very labour intensive process, especially if the plants are large and healthy. Digging can harm the roots of competing species and leave disturbed soil open to the seeds of invasive species. Where blackberry has come to completely dominate a site, neither of these drawbacks of root removal is very important, because clearance of just the canes alone leaves the ground bare of established competition and open for any seed already present to germinate.

The instructions to the field crews were to use only loppers or long-armed cutters and to cut the vines as close to the surface of the soil as possible, or, if possible, even under the surface. It was clear that we would have to keep cutting new shoots a number of times, but if this were done frequently enough and continued long enough the roots would have to die eventually. The theory seems irrefutable in principle, but, in practice, is difficult to achieve. Our accumulated experience now suggests that, where full sun is available, clipping the plants to the ground two or three times a year is no more than a holding action. Even five to seven such treatments during the 2000 growing season did not succeed in killing the roots on good growing sites.

The UFAWU crew, that cleared Area B, Map 1, in 1997, initially followed their instructions closely and only clipped the canes. Later they got a little over-ambitious and reverted to digging out the root systems in a wet area on the freshwater side of the beach berm. As this area was solidly covered with two-meter high blackberries, no other vegetation was lost, but the next year the area was covered with Canada Thistle (*Cirsium arvense*), another foreign invader, in spite of its name. This species is very much a pioneer. The area is now mostly covered with a variety of introduced herbs and grasses, but with an increasing presence of native wetland species.

The summer students we employed in 1998 and 1999 worked strictly with loppers and long-handled cutters. They felt quite helpless against the remaining 100% “old growth” areas, which they left untouched. They wished they were allowed to use a heavy-duty brush cutter, but we considered that too hazardous.

In the fall of 1999 the leader of the E-Team used a chainsaw to clear the 100% infested section of Area H, Map 1.

The recent Years: 2000 to 2002

March 2000

The other large Himalayan Blackberry thicket at the trailhead (Area L, Map 1), had not been touched at all, except for the path that gave access to the Colvin Creek hiking trail. The area is level and well drained and was completely covered with two meter high blackberries, so a road-side mower was employed to remove most of the thicket. The machine could not reach into the Red Alder grove at Redrooffs Road, which was left to be cleared with a brush cutter and loppers.

The machine was also used successfully in Areas F and J, south of Redrooffs Road. It also did Areas Q and R, north of the road, but these areas are very rocky, so the stems could not be cut close to the soil. It was decided not to work these areas any further, as the effort would be to labour-intensive and the road will hopefully provide a barrier against further infiltration into the more important wetland area south of the road.

May to October 2000

The stems of Himalayan Blackberry were repeatedly cut to the crowns¹ with loppers or a gasoline-powered heavy-duty brush-cutter, as many as 5 to 7 times in the sunniest areas, or as few as 2 to 3 times in relative shade. There was a gap in our suppression efforts between mid-July and late August, in which the most favoured sites regenerated up to 2 m of stem and foliage. Re-growth continued strong on sunny sites into early October.

March to November 2001

In 2001 we changed strategy and began removing the accessible underground parts of all Himalayan Blackberry that appeared above ground, usually before more than a few leaves could develop. This involved treating all the sunny areas every one to two weeks from early April to mid-September. Searches continued until late November as the fall of deciduous leaves revealed a few more occurrences that had been missed.

Method and Observations from 2001

It can be difficult to distinguish Himalayan Blackberry from related native species with which it grows, particularly Trailing Blackberry (*Rubus ursinus*). This is especially so if the introduced species is to be recognized and removed before it starts to recover vitality. Often the task is to spot a few leaves of *R. armeniacus* in a sea of *R. ursinus* and other plants.

A standard round-nosed spade was the digging tool used. Soil was never shifted from one place to another, but only loosened or lifted with the spade and then dropped back into place. Where turf was present it was cut, folded aside and then returned to its original position.

Once removed from the ground it is fairly easy to distinguish three types of Himalayan Blackberry occurrence based on the anatomy of the underground parts. With experience it is

¹ The crown of a plant is the part where the stem arises from the root.

often possible to recognize these three types from subtle differences in the above-ground shoots alone.

Old crowns have a swollen woody stem base at the soil surface. This can be tiny, if the crown has barely become established, to enormous (> 10 cm diameter) if the crown has had several years of good growing conditions. Usually, an octopus-like cluster of roots radiates from directly under the crown swelling, probably indicating that the crown originated from tip layering¹. Less often, a single large root descends from the crown, perhaps because it originated as a seedling plant. The roots of different crowns are *almost never structurally connected underground*, even when growing crowded together. In this way *R. armeniacus* differs from some other *Rubus* species, such as salmonberry, thimbleberry or domestic raspberry, which have true rhizomes or horizontal underground stems that connect leafy shoots growing upwards at intervals.

To remove old crowns the shovel blade was pushed under the crown and then levered upward. In most cases the crown can be loosened with a single pry and can then be pulled free with a gloved hand. Usually, much of the root system comes out of the ground with the crown. In a minority of cases the crown is too well anchored to be pulled until one or more of the larger roots are cut or broken. An effort was made to pull out these roots that remained in the ground, but success was mixed. Usually, horizontal roots must be pulled back toward the crown, not up through the soil surface, because tight turf or the woody roots of other plants block efforts to lift them. In some places, with loose soil and little other vegetation, it was possible to pull up great lengths of root.

Through April, May and June our work consisted almost entirely of removing old crowns as they revealed themselves by sprouting leaves. Old crowns in significant numbers continued to come to our attention right through the growing season. Generally, the bigger crowns formed shoots earlier in the year, but much more numerous smaller crowns continued to start their growing season well into autumn. This gradual appearance of the plants through the year was never apparent when we were only clipping the canes. Each complete search of the site was in fact finding only a part of the total number of living plants, as many remained dormant and undiscovered during each pass.

Root shoots (suckers) emerge from roots left in the ground when the crowns are removed. Most often these grow from the severed end nearest the missing crown, but they also form more remotely along the length of the roots. Below the ground surface, root shoots are fragile, white, generally unbranched, and of roughly even diameter along their length. They can originate from at least 30 cm underground, though the average length that we encountered was much less. Shoots seldom arise directly from roots unless a crown has been removed.

When digging root shoots the shovel was pushed deep into the ground and carefully lifted while trying to visually or manually follow the shoot to its source. One technique that often worked, was to pull gently on the shoot and at the same time vibrate the surrounding soil upward with the shovel blade. For most shoots it was possible to find and remove some older

¹Tip layering is the normal way in which the plant spreads vegetatively. A specialised cane tip with reduced leaves grows toward the ground, often coiling slightly into a helix, where it makes contact. It soon sprouts a profusion of roots into the soil, becoming a new crown, ready to send up canes.

root material. In a minority of cases the shoot broke off before its source was found. To avoid pulling up the roots of other species or wasting effort on blackberry roots already dead, roots were not removed unless they were clearly connected to living shoots. In chasing one shoot, hidden shoots were often intercepted growing toward the surface from the same origin.

Not until July 2001 did root shoots become a major part of the total number of occurrences, and then only in the sunniest areas. This was a welcome surprise.

New seedlings will appear in great numbers on ground laid bare by the removal of old thickets, if the right conditions exist for germination and establishment. New seedlings are easily distinguished from older plants by the presence of a small, complete, branched and tapering root system, and the absence of a crown swelling.

Seedlings are most likely to appear on moist ground or partially shaded ground, including areas where low herbaceous growth provides some shade but does not completely cover the soil. Seedlings generally will not appear in well established turf, unless they were already present as the turf was growing in.

New seedlings up to about 15 cm height can usually be pulled successfully, that is, with roots still attached, using just thumb and forefinger to grip the base of the stem. Larger seedlings or seedlings growing in turf may break off at the ground if the soil around the roots is not first loosened with a shovel. In some small areas, with many tiny seedlings and little competing vegetation, the plants were scuffed loose by dragging the shovel blade across the soil surface. Sometimes, when time was short, only the larger seedlings, those in danger of becoming established, were removed. Natural mortality of newly germinated seedlings can be high, especially if the weather turns dry.

The most labour-intensive site to clear (by area) was a low and wet patch on the freshwater side of the beach berm (Area B, Map 1), where apparently many seedlings had become established after the clearing of a thicket in 1997 and before turf fully covered the bare soil. Most of these seedlings were still small and trailing in 2001 as they had been clipped repeatedly. The thin stems were hard to follow through other vegetation to the ground, and then the fragile roots were difficult to untangle from the tightly enveloping turf. Though time-consuming, the careful removal of these small plants almost always resulted in there being no regeneration from residual roots.

Discussion

1. Overall, the large proportion of the total effort that went into removing old crowns was unexpected. Small to medium-sized crowns far outnumber large ones. Apparently, most of these smaller crowns were eliminated by the first attempt at removal, that is, no viable roots were left in the ground. In sunnier areas shoots from roots were fairly numerous, but considered over the whole year, the effort expended on root shoots was less than that needed against old crowns. We had expected the opposite relationship.
2. Can Himalayan Blackberry be killed by clipping the stems alone? In theory the plants cannot live without photosynthesis, but denying them light can be very difficult where they are growing on sunny ground. In hot weather, stems were observed to grow from ground level to a length of half a meter during a long weekend. In shade, on the other hand, clipping can be quite effective (see below). Though it is hard to kill the plants by clipping, it is much less labour-intensive than digging in the short term. Clearing a thicket to the crowns, stops seed production for a year or more and further vegetative expansion for at least several weeks even on the good ground for Blackberry.
3. Did the repeated clipping of the stems in 2000 help to make the roots less viable when we started pulling the crowns? Unfortunately we did not perform the right experiment to answer this question, which would have been to dig the plants from a large control area right after their stems were cut. However, a few small areas, all sunny, were cleared of crowns in May 2000 to make way for plantings. This resulted in a very strong proliferation of root shoots that, at the time, seemed to confirm the wisdom of our clipping strategy over digging. On the other hand, strong regeneration from roots on the beach berm in 2001, where plants have been clipped for years in some cases, suggests that there is probably a time limit on the usefulness of clipping to weaken the roots. Going after the underground parts seems to be effective, but we should not forget that we pulled up plants that had already been harassed by clipping for at least the previous year. On the other hand, it is quite possible that the total labour required for extirpation would be kept to a minimum if the roots were attacked right from the start. Whatever methods are used, the overall work will be reduced if the treatments are thorough and relentless. In sunny areas, if a plant is visible above ground, it should be removed. Time can only strengthen it.
4. As the number of living plants declines with repeated treatments, the work necessary to clear a given area declines somewhat more slowly, because the ground must still be searched even if no blackberry is found. As seeking without finding is a waste of time, it is good to optimize the search by looking longer and more frequently in the areas where plants have been found before. This is

especially true where native shrub thickets make the search slow and difficult. The occasional isolated plant that is missed by the regular treatments can be picked up eventually by a more wide ranging search. A worker's familiarity with the site much improves the searching efficiency.

5. Partial shade, especially by trees, makes *R. armeniacus* much easier to control or extirpate. In some locations, under combined shrub and tree shade, crowns died after two clippings of the stems. Shaded ground produces far fewer root shoots when crowns are pulled and much slower growth of any form of the plant. Establishing trees, especially fast growing species like Red Alder, might be the easiest way to extirpate *R. armeniacus* on some sites. The shade of shrubs alone is helpful but insufficient as the blackberry can quickly escape into the sun. Herbs and grasses should not be considered useful shade cover for suppressing established plants.
6. New seedlings that appear after thicket clearing must be attended to or a very troublesome new blackberry population can become established. We estimate that new seedling removal required about 10% to 15% of the total labour in 2001 though less than half the area we cleared was vulnerable to seeding-in.
7. The pulling of crowns and roots seems to have been a successful strategy. The effort required to remove all occurrences started to fall-off in July and continued to decline in August and September, a season when growth was strong in the previous year. We hope this indicates that most of the Himalayan Blackberry is now dead. We expect that old crown and root occurrences next year will number between 1% and 10% of those encountered this year. The future number of new seedlings is an unknown, but only a part of the site is vulnerable and this is mostly under partial tree shade.

Conclusions November 2001

1. Fortunately, control of Scotch Broom was started before it became a problem. Seedlings will continue to appear for a number of years, but because these are all in one small area (roughly 0.25 ha) they can be taken care of by volunteers. We are less certain, but hopeful, that this will also be the case with Yellow Flag. Evergreen Blackberry is not likely to become a problem because, although its occurrence is widespread in our region, it is not as invasive as Himalayan Blackberry.

The control of Himalayan Blackberry required 98% of the total personpower effort to control all four species. Therefore, the following points apply only to Himalayan Blackberry.

2. Suppressing Himalayan Blackberry in a heavily infested area is a formidable task, but it is possible and practicable. Volunteers gave it an initial start, summer students, who were paid and consequently had more time to commit, had much greater effect, but only with dedicated and qualified personpower in 2000 and 2001, did we really get this species under control.
3. Short term results were quite dramatic. Even at the end of 2000, no more blackberries were visible in the target area. The areas that had 100% blackberry coverage were beginning to green up. At the end of 2001 it was hard to imagine what the area looked like before.
4. Long term results will vary strongly with the state of competing vegetation. In areas that are becoming progressively shadier because of growing trees and shrubs, blackberries cannot come back. In areas that will always be exposed to sun, such as the beach berm and the north margin of Redrooffs Road., blackberry could re-establish if no further control work is done. The seaward half of the beach berm produces no new seedlings because it is too dry, and the landward half produces few new seedlings because it is now almost completely covered by other plants. However, should any blackberry manage to reappear on the beach berm it will spread rapidly by tip layering if not controlled. The sunny edge of Redrooffs Road is similarly vulnerable but is also more hospitable to new seedlings because there is still some bare soil.
5. Vigilance and some control will always be necessary, particularly in sunny areas. In at least two locations blackberry thickets just outside the Park will continue to grow across the boundaries. Also, a few seedlings will always have a chance to establish where bird disseminated seed falls on naturally disturbed ground.
6. Based on the gradually diminishing effort required in 2001, the authors estimate that no more than 200 personhours, will be necessary in 2002 to keep the blackberry in continued decline. This is assuming that the effort begins at the start of the growing season and is as relentless and thorough as in 2001. In subsequent years this amount will be further reduced.

Conclusions November 2002

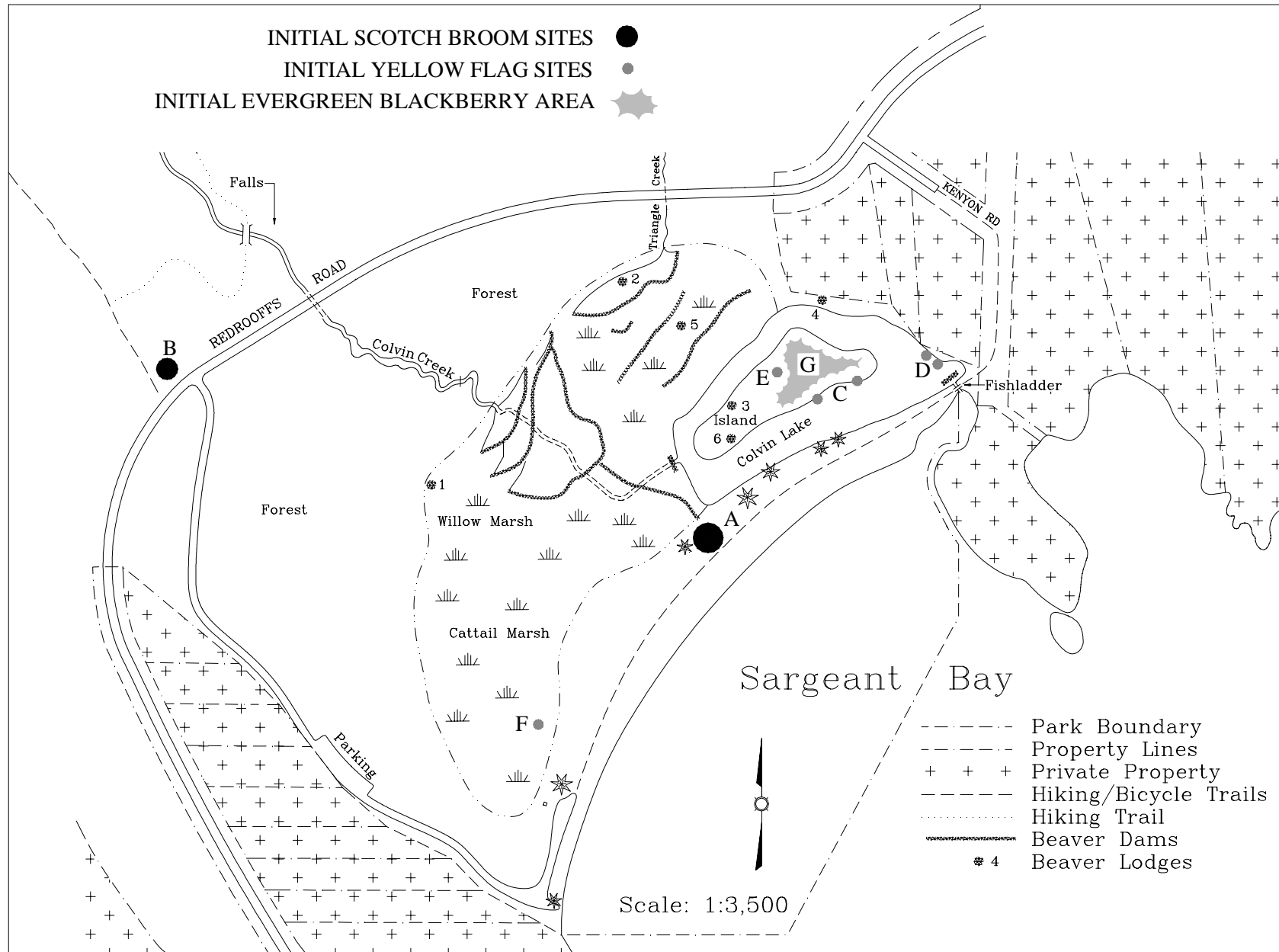
1. Our estimate that up to 200 hours might be required to ensure continued Himalayan blackberry decline in 2002, turned out to be quite pessimistic. Only 70 hours were actually needed.
2. Our estimate that old plants (excluding newly germinated seedlings) might continue to regenerate in numbers between 1% and 10% of those removed in 2001 was probably correct. Person-hours expended were about 14% of last years effort but this included a significant amount of work pulling new seedlings and the ratio of search time to removal time has also substantially increased.
3. New seedlings of *R armeniacus* have continued to appear in large numbers where thickets were removed and where conditions are still favourable for germination. This is good evidence that a significant part of the seed accumulated on the ground under long established plants remains viable for at least 3 years.
4. There was an obvious decrease this year in the number of Scotch broom seedlings appearing on the beach berm. This may indicate that the bulk of the accumulated seed on the ground has been exhausted in about 6 years since the bushes were removed.

Acknowledgements

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- A grant from Environment Canada's EcoAction program, in the amount of 50% of the cost of the project during 2000 and 2001.
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- The United Fishermen and Allied Workers Union, who provided the personpower in 1997 under a job diversification program from Human Resources Development Canada.
- Support from BC Parks, who paid for the rental of the roadside mower and contributed towards the continuation of the project after 2001.
- Donations from members of the Sargeant Bay Society, which, together with the dollar value of volunteer work, made up the balance of the cost of the project.

Special acknowledgement is due to BC Parks, Garibaldi/Sunshine Coast District, for its continued interest and encouragement, without which this project would not have been possible.



Map 2. Scotch Broom, Yellow Flag and Evergreen Blackberry Locations at Sargeant Bay

Appendix

Detailed discussion of each invaded area

Himalayan Blackberry (*Rubus armeniacus*)

| ↓Area Map 1 | ↓ DESCRIPTION ↓ | Person.hours↓ |
|-------------|--|---------------|
| A | <p><u>Initial status</u> The berm at the intersection of the road and the parking area at the beach was 100% infested in 1990 and extended from the road down to a well defined boundary of 100% Salmonberry. A 3 meter strip along the road was cut about once a year with a roadside mower, but left 50% of the blackberries intact and was completely ineffective in controlling the blackberries.</p> <p><u>Control effort</u> March 1997. A UFAWU crew cut most of the blackberries with loppers. 14 July 1998. Summer students cut half the blackberries with long-arm pruners. 24 July 1999. Summer students cut most of the blackberries with long-arm pruners. 41 March 2000. Roadside mower cut 3 meter strip along the road. 3 May 2000. EcoAction team cut all blackberries with brush cutter and loppers and planted 4 ninebark (<i>Physocarpus capitatus</i>), 2 oceanspray (<i>Holodiscus discolor</i>) and 3 grand fir (<i>Abies grandis</i>). 21 July 2000. EcoAction team cut new shoots with loppers. 8 March – November 2001. Contractor worked the area as described in Section 4. 33 May – November 2002. Contractor worked the area as described in Section 4. 2.5</p> <p><u>Results</u> August 15, 2000. New shoots not very dense, but 40 cm long. Trees and shrubs doing well. November 2001. This seems to be the best blackberry growing site of any that we have cleared. It has full southern exposure to the sun and is protected from cooling sea wind. More rapid regeneration here has resulted in this area being more completely cleared of roots than most other areas at this time. The frequency of occurrences started to fall noticeably here in early July, somewhat before other areas, and continued to fall to almost no activity well before the end of the growing season. November 2002. Very little blackberry was found here in 2002. A few root shoots appeared. The ground is now well covered, mostly by introduced grasses and herbs. Scouring rush (<i>Equisetum hyemale</i>) and salmonberry (<i>Rubus spectabilis</i>) are expanding into the area from the low side. The grand fir (<i>Abies grandis</i>) and ninebark (<i>Physocarpus capitatus</i>) planted in 2000 are still alive and growing but could not be said to be shading a significant part of the area. One ninebark and one grand fir have grown to a noticeable size, above the metre tall herbs. (The two oceanspray were cut to the ground by roadside mowing in 2000 and 2001 and may be gone.)</p> <p>Total effort to-date</p> | 146.5 |
| B | <p><u>Initial status</u> The area between the beach berm and the wetland, under the Red alder grove, was one of the two largest 100% infested areas in the park completely obstructing access to and view of the wetland.</p> <p><u>Control effort</u> March 1997. A UFAWU crew cut 70% of this area with loppers and dug out many of the tubers, leaving essentially bare soil. The fringe near the beach berm was not done. 55 July 1998. Students cut most of the blackberries at the fringe with long-arm pruners 183 July 1999. Students cut most of the remaining blackberries at the fringe long-arm pruners. 205 November 2000. E-Team cut the last blackberries in this area with loppers. 35 May 2000. AcoAction team cut 90% of the new shoots with loppers. 73 July 2000. AcoAction team cut new shoots with loppers. 10 March–November 2001. Contractor worked the area as described in Section 4. 141 May–November 2002. Contractor worked the area as described in Section 4. 27.25</p> <p><u>Results</u> <u>August 15, 2000.</u> There are no more mature vines in this area. The 100% blackberry infestation has been replaced with a diverse vegetation of grasses, cattails, reed and low broadleaf plants. At the fringe near the beach berm Nootka rose has replaced the blackberries. The accessibility and</p> | |

visibility of the wetland has been restored. There are still many new shoots, but they are small and difficult to see among the new vegetation. At the same time the groundwater level was raised by about 60 cm by a beaverdam. This caused the alders to die. The resulting wetness of the area may have been a factor in suppressing the blackberries, but they should also have benefited from the increased light level, caused by the alder die-off.

Without the control effort the blackberries would still be the only undergrowth in the area.

November 30, 2001. This is a large, complex area of the beach berm that is of the highest priority for blackberry extirpation. A distinct low and wet sub-area under partial shade of red alder on the freshwater side of the berm, was largely cleared of blackberry roots in 1997. Nevertheless, this was the most labour-intensive site (per m²) to clear in 2000 and 2001. Apparently many blackberry seedlings became established after the clearing of the thicket and before herbaceous plants fully covered the bare soil. This year most of these seedlings were small and trailing, with stems that were hard to follow to the ground, and fragile roots difficult to untangle from the tightly enveloping turf. Small areas that were still partly bare were germinating new seedlings this year, but this activity had dropped off almost to nothing before the end of the growing season. Though this area had many occurrences their small size allowed the complete removal of each plant and little activity is expected here in the future.

November 2002. In 2002 this low wet site still had many blackberry occurrences but these were far fewer in number than in 2001 and similar in type, small plants but not newly germinated. These were probably already present but not discovered in the previous year. Activity here should be lower still next year.

November 30, 2001. The rest of Area B had supported very dense, well-established blackberry initially and had never been cleared of crowns or roots. A great many crowns, all that revealed themselves by growing leaves, were pulled up in 2001 and by now, almost all of the old crowns must have been removed. Root shoots, from roots left in the ground, were also very numerous and vigorous here, but had clearly declined in number before the end of the growing season. Some root shoots will no doubt appear here next year. These should be removed as they appear because blackberry grows very fast in this area.

November 2002. The rest of Area B did indeed continue to produce root shoots all through the 2002 growing season but in far smaller numbers and with a noticeable decline later in the summer. These shoots were often very long and the older roots from which they must have originated were not found. Nonetheless, treatments were frequent enough this year that these deep living remnants are probably steeply declining in number and far fewer still will be found next year. A few scattered overlooked plants, especially hidden in shrub thickets, will appear next year.

Total effort to-date

729.25

C

Initial status

Isolated vines in Triangle Creek and Colvin Creek beaverdams. Probably survived from when the area was dryer. Some tall vines at crossing of old creek bed and beaver dam in 1991-1998

Control effort

May 2000. Cut with loppers. The ones at the crossing of the old Colvin Creek bed and the beaver dam were already dead and replaced by willows.

25

Results

August 2000. Probably gone. Not inspected.

August 2002. No vines found in this location

Total effort to-date

25

D

Initial status

In 1991 the blackberries in this area were not very dense, but increasing, particularly at the location of the old breach in the berm that had been backfilled.

Control effort

March 1997. A UFAWU crew cleared all blackberries with loppers..

15

July 1998. Summer students cut new shoots with long-arm pruners

26

July 1999. Students cut new shoots with long-arm pruners.

39

September-November 2000. E-Team cut new shoots with loppers.

11

May 2000. AcoAction team cut new shoots with loppers.

31

July 2000. AcoAction team cut new shoots with loppers.

4

| | | |
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| | <p>March–November 2001. Contractor worked the area as described in Section 4. May–November 2002. Contractor worked the area as described in Section 4.</p> <p>Results August 2000. Very few new shoots. November 30, 2001. This area of the beach berm, the north-east third, retains greater native plant diversity than the rest. Notable species include: tall Oregon grape (<i>Mahonia aquifolium</i>), Pacific crabapple (<i>Malus fusca</i>), Menzies' larkspur (<i>Delphinium menziesii</i>), Yampah (<i>Perideridia gairdneri</i>), Field chickweed (<i>Cerastium arvense</i>), fool's onion (<i>Brodiaea hyacinthina</i>), tapered onion (<i>Allium acuminatum</i>), and chocolate lily (<i>Fritillaria lanceolata</i>). Except for a small area to the south-west, adjacent to area B, Himalayan blackberry seems to have been eliminated. November 2002. This area was searched thoroughly in 2002 after the leaves had fallen from the native shrubs. A few hidden scattered occurrences were found and pulled up.</p> <p>Total effort to-date</p> | <p>12 3.25</p> <p>141.25</p> |
| <p>E</p> | <p>Initial status In 1991 there were no blackberries on the north-east shore of the new lake. There was a dense stand just outside the parks boundary (S), which had spread down to the shore by 1997. The vines were extremely tall, climbing the trees.</p> <p>Control effort July 1998. Summer students cut the vines with long-arm pruners. July 1999. Students cut the meter-long shoots with long-arm pruners. November 2000. E-Team cut new shoots with loppers. May 2000. EcoAction team cut new shoots with loppers. July 2000. AcoAction team cut new shoots with loppers. March–November 2001. Contractor worked the area as described in Section 4. May–November 2002. Contractor worked the area as described in Section 4</p> <p>Results August 2000. Few new shoots. November 30, 2001. This area is a high priority for compete extirpation of blackberry. It is isolated from other infestations but likely to remain excellent blackberry habitat, because of its sunny location on the north-east shore of the wetland. Careful clearing of crowns and roots in 2001 has reduced occurrences here to a very low level. New seedlings were a significant problem in 2001 and a few may continue to appear on the small amount of remaining bare ground. Also, large plants on the cliffs above, which are privately owned, will continue to grow down into this area and take root if not stopped. November 2002. This site is now almost completely free of blackberry. Late summer searches revealed as few as one or two plants. A late season search found no occurrences in the area once heavily infested, but did turn up a few cryptic plants further north toward the beaver lodge. The plants on the cliffs above were set back this year by drought.</p> <p>Total effort to-date</p> | <p>52 49 20 26 4 14 3.75</p> <p>168.75</p> |
| <p>F</p> | <p>Initial status This is an old road, made in 1998, from Redrooffs down to Triangle Creek, to where in 1978 an Application for a Water Lease was posted, which eventually caused it to be fully overgrown with blackberries</p> <p>Control effort March 2000. Roadside mower cut the area accessible from Redrooffs Road. May 2000. EcoAction team cut remaining blackberries with brush cutter and loppers. July 2000. EcoAction team cut new shoots with loppers. March–November 2001. Contractor worked the area as described in Section 4.</p> <p>Results August 2000. New shoots vary from 10 to 40 cm, but not very dense. November 30, 2001. Adjacent to Redrooffs Road but largely shaded by trees this area was clipped 3 times in 2001 but never dug. Regeneration of canes has been slow but the sunniest fringe could possibly return to blackberry eventually if no further work is done. November 2002. The blackberry here has never been pulled up and no work at all was done here in 2002. Canes to about half a metre length have managed to regenerate. Perhaps this could be an experimental control area. Will a thicket ever reappear if no further suppression is done?</p> <p>Total effort to-date</p> | <p>1 52 3 4</p> <p>60</p> |

| | | |
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| <p>G</p> | <p><u>Initial status</u> This is a treeless spot of 20 m diameter, invisible from the road, fully covered with very dense and tall blackberries.</p> <p><u>Control effort</u> May 2000. EcoAction team cut all blackberries with brush cutter. July 2000. EcoAction team cut new shoots with loppers. There were not that many. March–November 2001. Contractor worked the area as described in Section 4. May–November 2002. Contractor worked the area as described in Section 4. A quarter hour of pulling seedlings was the only work done here in 2002.</p> <p><u>Results</u> <u>August 2000.</u> Few new shoots, 10 - 20 cm, nibbled by deer. Virtually no new vegetation yet. November 30, 2001. This patch of blackberry isolated in the forest has never shown strong regeneration since initial clearing in 2000, at least in part because of very heavy browsing by deer. Late in 2001 all old crowns and new seedlings were pulled up. No further attention should be required because of increasing tree shade. <u>November 2002.</u> Himalayan blackberry has been slow to regenerate here but no other plants have done very well either and most of the ground remains bare.</p> <p>Total effort to-date</p> | <p>16 4 6 0.25</p> <p>26.25</p> |
| <p>H</p> | <p><u>Initial status</u> This is where the trail down to the Colvin Creek spawning beds leaves Redrooffs Road. The blackberries were competing with the original vegetation and winning.</p> <p><u>Control effort</u> November 1999. E-team cut densest area with chainsaw, rest with loppers. May 2000. EcoAction team cut all blackberries selectively with loppers. July 2000. EcoAction team cut new shoots with loppers. March–November 2001. Contractor worked the area as described in Section 4.</p> <p><u>Results</u> <u>August 2000.</u> Few new shoots. Gone. Replaced by willows. <u>November 30, 2001.</u> This diffuse, partially shaded area was clipped once or twice in 2001. Regeneration was generally found to be weak. Increasing shade will probably keep blackberry from returning here without further effort. <u>November, 2002.</u> This area was not treated in 2002. No obvious regeneration.</p> <p>Total effort to-date</p> | <p>14 15 4 1</p> <p>34</p> |
| <p>I</p> | <p><u>Initial status</u> This is at the left side of the road to the beach, 100 m down from the BC Parks sign, where material was temporarily dumped when the road was relocated in 1991. In 1999 the blackberries were climbing the 6 m tall firs that were planted by Halfmoon Bay Elementary School in 1993.</p> <p><u>Control effort</u> July 1999. Students cut the 3 meter-long shoots with long-arm pruners. May 2000. EcoAction team cut new shoots with loppers. July 2000. EcoAction team cut new shoots with loppers. March–November 2001. Contractor worked the area as described in Section 4. May–November 2002. Contractor worked the area as described in Section 4.</p> <p><u>Results</u> <u>August 2000.</u> New shoots are few and hard to find in the tall grass that recovered. <u>November 30, 2001.</u> Much of this area is deep in regenerating forest. In 2000 tall vines sprawling over salmonberry were clipped once late in the season. After two not-very-thorough clippings in 2001, these plants seem in permanent decline. Partial tree shade and shrub competition together, apparently create a habitat in which the blackberry can be defeated without resort to digging up the roots. In a smaller part of this area, adjacent to the park access road, some crowns were dug up this year. This area now seems clear of blackberry but it should be monitored because it gets some sun. <u>November 2002.</u> Two brief visits to clip surviving vines in 2002 confirmed that this area is almost entirely free of blackberry and would not return to thicket even if no further work is done.</p> <p>Total effort to-date</p> | <p>27 5 4 2 0.5</p> <p>38.5</p> |

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| <p>J</p> | <p><u>Initial status</u> At the intersection of the road to the beach and Redrooffs, opposite the BC Parks sign. The tall Bigleaf maple there died around 1995 and was cut. In the spring of 2000 the stump and surrounding area was covered with a dense patch of blackberries .</p> <p><u>Control effort</u> March 2000. Roadside mower cut the area. May 2000. EcoAction team cut remaining vine ends with brush cutter.. July 2000. EcoAction team cut new shoots with loppers. March–November 2001. Contractor worked the area as described in Section 4. May–November 2001. Contractor worked the area as described in Section 4.</p> <p><u>Results</u> <u>August 2000.</u> No new shoots visible. Area covered with dense growth of 30 cm high Snowberries, likely from seeds from nearby Snowberry bushes. <u>November 30, 2001.</u> This area and the adjacent road margins were dug twice in 2000 with the second visit finding very few occurrences. This area should be monitored, as it gets enough sun to allow fairly fast growth, and at times there have been new seedlings present in moderate numbers. <u>November 2002.</u> This area produced very little blackberry in 2002 despite plenty of sun. Herbaceous competition has filled in and new seedlings no longer seem to be a problem.</p> <p>Total effort to-date</p> | <p>1 5 2 3 0.5</p> <p>11.5</p> |
| <p>K</p> | <p><u>Initial status</u> This is the area between Redrooffs Road, the road to the beach and the park boundary. It includes the de-activated road, where Halfmoon Bay Elementary School planted fir trees in 1993. The trees were 3 to 7 meters tall in 1998 and blackberry vines were climbing the trees up to height of 2 to 3 meters. Blackberries were also infiltrating narrow strips along Redrooffs and the road to the beach.</p> <p><u>Control effort</u> July 1998. Summer students cut half the vines with long-arm pruners. July 1999. Students cut new shoots and a further 25% of the vines with long-arm pruners. May 2000. EcoAction team cut new shoots and remaining vines with loppers. July 2000. EcoAction team cut new shoots with loppers. March–November 2001. Contractor worked the area as described in Section 4. May–November 2002. Contractor worked the area as described in Section 4.</p> <p><u>Results</u> <u>August 2000.</u> This area is free of blackberries now. <u>November 30, 2001.</u> Much of this area is in sufficient shade from trees and shrubs that crowns, clipped 2 or 3 times in 2000, failed to regenerate at all in 2001. The sunnier fringe of this area along Redrooffs Road and a private driveway was dug twice in 2001 and is now fairly clear of blackberry, but this area should be monitored as there is enough light to allow blackberry to return. <u>November 2002.</u> A little blackberry regenerated here on the sunny fringe but was pulled up. Blackberry apparently cannot return to the shaded areas.</p> <p>Total effort to-date</p> | <p>48 83 10 4 5 1</p> <p>151</p> |
| <p>L</p> | <p><u>Initial status</u> The trailhead area has been used for log storage and as the site of a real estate sales office before the park was established in 1990. Surplus material was dumped there when the road to the beach was relocated. Years earlier blackberries flourished along a 400 m stretch of the old logging road to Northwood Road up to the intersection with an old logging road that used to cross Colvin Creek. The blackberries soon covered the whole clearing in a dense, tall, impenetrable growth, including a part of the clearing where a stand of Red alders grew up at the same time. .</p> <p><u>Control effort</u> In 1993 a volunteer cleared a 20 m long path through the blackberries to provide access to the soon to be built Colvin Creek hiking trail. March 2000. Roadside mower cut the blackberries, except under the alder grove.. May 2000. EcoAction team cut the tall vines under the alders and the fairly long ends left by the roadside mower, using a brush cutter. They also planted 11 grand fir (<i>Abies grandis</i>), 2 Douglas fir (<i>Pseudotsuga menziesii</i>), and 10 oceanspray (<i>Holodiscus discolor</i>).</p> | <p>8 10 81</p> |

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|---|---------------|
| July 2000. EcoAction team cut new shoots with brush cutter and loppers. | 12 |
| March–November 2001. Contractor worked the area as described in Section 4. | 159 |
| May–November 2002. Contractor pulled up the new seedlings which germinated in large numbers where the ground is bare and shaded. | 18.25 |
| Results | |
| <u>August 2000.</u> The removal of the tall blackberry growth opened up the view of the surrounding forest, substantially improving the scenic quality of the area. However, there are still many new shoots varying in height from 20 to 40 cm and in density from 4 to 9 per m ² . In some limited areas new growth is starting to shade out the blackberries, notably Nootka rose along Redrooffs and Thimbleberry along the bicycle trail. | |
| <u>November 30, 2001.</u> At the end of the 2001 season almost all of the old blackberry crowns and viable roots had been removed from this large area. The process was relatively easy here because much of the soil is loose fill with few other woody roots. Only on the sunniest margin along Redrooffs Road did a few shoots from roots continue to appear until the end of the growing season. On ground close under trees, where digging is difficult and destructive to competing roots, not all crowns have been pulled up, but fortunately these small areas are also usually shaded. | |
| New seedlings appeared in this area in such large numbers that the effort expended to remove them is approaching the same order as that needed to remove the old plants. Seedlings tend to occur on shaded ground because it is slower to grow a complete cover of turf and because shade protects the vulnerable new plants from drying in the sun. At the end of 2001 there were no established seedlings in evidence, but no doubt many tiny ones wait hidden by fallen leaves, and further germination is likely. Much of this area, perhaps half, is now so shaded by trees that it grows blackberry only slowly and would not likely return to thicket even if no further suppression is carried on. | |
| <u>November 2002.</u> In 2002 almost all the work in this area consisted of pulling up the new seedlings which germinated in large numbers where the ground is bare and shaded. This must mean that the seed that had accumulated on the ground under the original thicket has not been exhausted after three full years without seed production. Fortunately the sunnier areas produced few seedlings and little regeneration from old roots. The sunny edge of the clearing along Redrooffs Road seems to be entirely clear of living old roots, a condition achieved more easily here, for some reason, than on the beach berm. The plantings of May 2000 are all still present except for 2 oceanspray that were mowed. The Douglas fir and grand fir, especially those that were larger when planted, have grown well, and are now a noticeable part of the scene. | |
| Total effort to-date | 288.25 |

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| M | Initial status 10 x 15 m clearing across “Welcome Woods Creek” covered with a dense growth of mature blackberries. | |
| | Control effort | |
| | May 2000. EcoAction team cut all blackberries with brush cutter. | 11 |
| | July 2000. EcoAction team cut new shoots with loppers. | 3 |
| | March–November 2001. Contractor worked the area as described in Section 4. | 9 |
| | May–November 2002. Contractor worked the area as described in Section 4. | 1 |
| | Results | |
| | <u>August 2000.</u> New shoots 20-30 cm long, about 3 / m ² . Not much other growth. | |
| | <u>November 30, 2001.</u> Blackberry regenerated only slowly here after initial clearing in 2000 due to partial shade and deer browsing. The area was briefly clipped twice in 2001 and then late in the season all viable crowns and many new seedlings were pulled up. Little or no further action should be necessary. | |
| | <u>November 2002.</u> Two brief visits in 2002 kept this area free of new seedlings. Surrounding shrub thickets that were initially infested with blackberry now seem to be entirely free of it. | |
| | Total effort to-date | 24 |

| | | |
|----------|---|---|
| N | Initial status 7 m diameter spot, deep in forest, with 100% blackberry. | |
| | Control effort | |
| | May 2000. EcoAction team cut blackberries with brush cutter. | 4 |
| | July 2000. EcoAction team cut new shoots with loppers. | 2 |

| | | |
|----------|--|--|
| | <p>March–November 2001. Contractor worked the area as described in Section 4.</p> <p>May–November 2002. Contractor worked the area as described in Section 4.</p> <p>Results</p> <p><u>August 2000.</u> Few new shoots. Little other growth.</p> <p><u>November 30, 2001.</u> This area is now hard to find. Weak growth was probably clipped once in 2001.</p> <p><u>November 2002.</u> An area on the wetland margin near area N was discovered late in 2002 to have scattered large canes growing on downed logs. These were clipped or pulled. This area should get further treatments.</p> <p>Total effort to-date</p> | <p>1</p> <p>0.75</p> <p>7.75</p> |
| O | <p>Initial status</p> <p>7 m diameter spot next to road to beach but hidden from view by Salmonberries covered with 100% blackberry.</p> <p>Control effort</p> <p>May 2000. EcoAction team cut blackberries with brush cutter.</p> <p>July 2000. EcoAction team cut new shoots with loppers.</p> <p>March–November 2001. Contractor worked the area as described in Section 4.</p> <p>May–November 2002. Contractor worked the area as described in Section 4.</p> <p>Results</p> <p><u>August 2000.</u> Few new shoots. Little other growth.</p> <p><u>November 30, 2001.</u> Some crowns were pulled here once in 2001. Late season inspection found very little blackberry.</p> <p><u>November 2002.</u> A single brief visit in 2002 removed some slowly regenerating blackberry. The entire east road margin was cleared again late in the season. This was very effective as several small isolated plants were found and entirely removed.</p> <p>Total effort to-date</p> | <p>7</p> <p>2</p> <p>2</p> <p>0.25</p> <p>11.25</p> |
| P | <p>Initial status</p> <p>The area between Triangle Creek, Redrooffs Road, the wetland and the park boundary had some strips of 50% blackberry along the road and the wetland, hidden under low tree cover.</p> <p>Control effort</p> <p>May 2000. EcoAction team cut blackberries with loppers.</p> <p>March–November 2001. Contractor worked the area as described in Section 4.</p> <p>May–November 2002. Contractor worked the area as described in Section 4.</p> <p>Results</p> <p><u>August 2000.</u> Low density of new shoots, 30-60 cm tall.</p> <p><u>November 30, 2001.</u> This is a complicated area shown on the map as three separate patches. Blackberry along the margin of Redrooffs Road and along the overgrown road crossing Triangle Creek was clipped once in 2001 and this is now probably in permanent decline due to increasing tree shade.</p> <p>Another larger area adjacent to the wetland was much more densely infested initially and remains good blackberry habitat because the location prevents trees from fully shading the site. This area was cleared four times in 2001 through a combination of digging where possible and clipping where competing roots make digging difficult. On the last occasion many new seedlings were removed from wet ground on the rock outcrop. Adjacent private land still supports blackberry thicket. This area should be monitored.</p> <p><u>November 2002.</u> The two more shaded areas mentioned were not treated in 2002 but are not returning to blackberry. The area adjacent to the wetland, which has the potential to return to a heavy infestation was treated for three hours late in the year. This action was probably sufficient to hold off any net expansion of blackberry here for another year. This area should still be monitored and treated.</p> <p>Total effort to-date</p> | <p>21</p> <p>26</p> <p>3.25</p> <p>50.25</p> |
| Q | <p>Initial status</p> <p>Strip of 100% blackberry along Redrooffs Road, within the park boundary but on road allowance.</p> <p>Control effort</p> <p>March 2000. Roadside mower cut 3 meter strip along the road.</p> | <p>3</p> |

| | | |
|---|---|--------------------------------------|
| V | <p><u>Initial status</u> Dense 100% Redrooffs road allowance, outside park boundary.</p> <p><u>Control effort</u> None. The area is outside the target area.</p> <p><u>Results</u> August 2000. No change.</p> <p>Total effort to-date</p> | <p>0</p> <p>0</p> |
| W | <p><u>Initial status</u> Dense 100% blackberry outside park boundary.</p> <p><u>Control effort</u> None. The area is on private property.</p> <p><u>Results</u> August 2000. No change.</p> <p>Total effort to-date</p> | <p>0</p> <p>0</p> |
| X | <p><u>Initial status</u> Dense 100% blackberry outside park boundary.</p> <p><u>Control effort</u> None. The area is on private property.</p> <p><u>Results</u> August 2000. No change.</p> <p>Total effort to-date</p> | <p>0</p> <p>0</p> |
| Z | <p><u>Initial status</u> Road-to-beach east shoulder. < 10% but growing.</p> <p><u>Control effort</u> March–November 2001. Contractor worked the area as described in Section 4. The entire east margin of the park access road was cleared of blackberry by digging twice in 2001. May–November 2002. The entire east road margin was cleared again late in the season.</p> <p><u>Results</u> <u>November 30, 2001.</u> Many small isolated plants were removed and few of these will regenerate. <u>November 2002.</u> This year's effort was very effective as several small isolated plants were found and entirely removed.</p> <p>Total effort to-date</p> | <p>3 0.75</p> <p>3.75</p> |

Evergreen Blackberry (*Rubus laciniatus*)

| ↓ Area Map 2 | ↓ DESCRIPTION ↓ | Person.hours ↓ |
|--------------|---|----------------|
| G | <p><u>Initial status</u> August 2001. Five or six bushes had grown to 2 m high.</p> <p><u>Control effort</u> Dug out by contractor. 2 August 17 2002. Another 4 or 5 bushes dug out by contractor. 2</p> <p><u>Result</u> <u>November 2001</u>. Probably no more left on island. Surprisingly this is the only spot it occurred in the target area. <u>November 2002</u>. A cluster of seedlings was found near the south shore of the island where a large plant had been removed in an earlier year. These were pulled up. No other plants were found on the island in 2002.”</p> <p>Total effort to-date</p> | 4 |

Scotch Broom (*Cytisus scoparius*)

| ↓ Area Map 2 | ↓ DESCRIPTION ↓ | Person.hours ↓ |
|--------------|--|----------------|
| A | <p><u>Initial status</u> Appeared in 1992 in the middle of the berm. A mature 15 x 20 m patch by 1996.</p> <p><u>Control effort</u> 1996. The patch was cut down by a volunteer. 8 1997. New seedlings were pulled out by volunteers 4 2000. Hundreds of new seedlings were pulled out by a volunteer. 2 April – August 2001. Hundreds of new seedling were pulled out by volunteers. 6 November 2001. All visible new seedlings were pulled up by contractor. 3</p> <p><u>Results</u> 1998 and 1999. Sporadic new shoots and seedlings. August 20, 2000. Only a few new seedlings appearing from time to time. November 2001. This year many new seedlings continued to appear. <u>November 2002</u>. Scotch broom seedlings appeared in far lower numbers this year than in 2001. This implies that the bulk of the seed on the ground when the bushes were removed has been exhausted in about 6 years.</p> <p>Total effort to-date</p> | 23 |
| B | <p><u>Initial status</u> Four tall bushes at intersection of bicycle trail and Redrooffs Road in 1997.</p> <p><u>Control effort</u> 1997 A volunteer cut them down. 1</p> <p><u>Results</u> August 21, 2000. No regrowth at all. November 30, 2001. Surprisingly, never any new seedlings here. November, 2002. A single broom plant was pulled up here in 2002, but the area has not been watched closely for this species and, perhaps, should be searched again.</p> <p>Total effort to-date</p> | 1 |

Yellow Flag (*Iris pseudocorus*)

| ↓ Area Map 2 | ↓ DESCRIPTION ↓ | Person.hours ↓ |
|--------------|--|--------------------------------------|
| C | <p><u>Initial status</u> August 2001. Two new patches appeared in cattails.</p> <p><u>Control effort</u> August 20, 2000. One patch dug out by contractor. Roots of other patch too deep under water. August 17, 2002. Patch in cattails dug out by contractor.</p> <p><u>Results</u> November 30, 2001. One patch will regrow. To be done next year. November 2002 A single occurrence was removed from the south shore of the island nearer the west end in 2002. Clumps in soil dug and left high and dry on the island in previous years are now dead.</p> <p>Total effort to-date</p> | <p>0.5 0.5</p> <p>1</p> |
| D | <p><u>Initial status</u> 1999. Two flowering 2 m² patches on lake shore replacing cattails.</p> <p><u>Control effort</u> July 1999. Dredged out by summer students, but most of root masses remained. November 1999. Dredged out thoroughly by E-team. November 2001. New patch in slightly different location. Dug out by contractor.</p> <p><u>Results</u> November 1999. Both patches regrown to 1 m tall. August 20, 2000. No regrowth! November, 2002. No regrowth.</p> <p>Total effort to-date</p> | <p>3 4 2</p> <p>9</p> |
| E | <p><u>Initial status</u> 1997. A 1 m² patch was flowering on the island.</p> <p><u>Control effort</u> 1997. Dug out by volunteers. 1998. Patch re-appeared. Dug out thoroughly by summer students. August 9, 2001. Two new patches appeared. Dug out by contractor. Seeds destroyed.</p> <p><u>Results</u> 1999. No regrowth at that spot. November 30, 2001. Dry part of island must be free of this species.</p> <p>Total effort to-date</p> | <p>3 2 1</p> <p>6</p> |
| F | <p><u>Initial status</u> 2001. A small patch (2 m²) was discovered here in flower.</p> <p><u>Control effort</u> The above-ground parts of the plants were removed.</p> <p><u>Results</u> November 30, 2001. A late-season effort to return and remove the roots failed to find the occurrence. For the record, this spot was just beyond the log islands and nearer to the southwest end of area T, Map 1. November 2002. The yellow flag patch was never rediscovered despite a visit during its flowering season.</p> <p>Total effort to-date</p> | <p>0.5</p> <p>0.5</p> |