Deer Management and Native Plant Environmental Restoration Plan 2014

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1. Introduction

1.1 Background: Diminishing the deer population at the University of Victoria

In the spring of 2011, the University of Victoria was declared rabbit free. Previously, the rabbits caused tremendous damage to native plants and flowers on campus by grazing (University of Victoria, 2011). Nowadays, the University of Victoria faces a new pest, the infamous campus deer.

The University of Victoria is home to numerous native and rare plant gardens. These gardens serve a multitude of functions such as: an educational experience to students, a peaceful walk with nature, and a sanctuary to many plant species facing a loss of habitat and extirpation. Although many students enjoy the presence of the deer, these deer are the main threat to the gardens. The presence of the deer has increased gradually throughout the years to a point where they have become a nuisance to many of the native species present inside ring road.

As a group of students in environmental restoration, we recognize the need to protect these precious species for the future. Our approach to the restoration project and design was created with great consideration to the three E’s (effective, efficient and engaging) as outlined by the IUCN guidelines for best practices (IUCN, 2012). All of our goals are aimed at diminishing the deer presence and impact using strategies that are prosperous to all parties involved. If the previous is unattainable, then methods with the minimum risk and harm will be sought.

The following report describes the details of our restoration project design. The first portion describes the site’s past and current ecological and cultural usage. Secondly, specific goals and objectives are outlined as to guide the project in a definitive direction. Third, a plan of action is proposed that aims to fulfill our goals and objectives. Fourthly, a breakdown of the implementation and management strategies along with a budget breakdown. Lastly, our parameters of success are outlined along with the proposed stewardship program.

1.2 Scale of Restoration Project

The deer problem persists all around greater Victoria; however, we have decided to scale down our analysis and look at the deer problem in a restorative mindset on the UVIC campus within the ring road. This is where all of the academic buildings are located and where the deer come into contact with students the most. The site is within the ring road, which means it is completely surrounded by a hard, impermeable surface.
2. Site Analysis

2.1 History and current land use of the Site

The University of Victoria (UVIC) has a history that begins in the early 1960’s when it converted from a College to a University and moved from the Lansdowne campus to the campus in Gordon Head. (University of Victoria, 2014). Before this the land was used by the military and several ‘huts’ were located on site (University of Victoria, 2014). To date, some of these huts are still used and occupied by the university; however, most of them have been torn down. Much of the area that was previously forested has been logged and replaced with lecture halls, libraries, residence halls, and parking lots, roads, and paths.

For our restoration project we are solely focusing on the area on UVIC campus inside the ring (Ring Road). However, there are a couple key areas outside the ring to reference and take note from for the sake of bettering our restoration project. The area called Mystic Vale remains protected from logging and construction. University of Victoria describes the area through the statement, “11.6 acres of natural coniferous woodland, can be found in the south-east area of University of Victoria’s campus. Much of Mystic Vale comprises a steep-sided gully with slopes of 20-30º and belongs to the Hobbs Creek Watershed. The university campus is part of the Straits Coast Salish peoples’ traditional homeland. For thousands of years, Mystic Vale was utilized for harvesting plants, hunting and fishing” (Icons and Landmarks, Mystic Vale, Para. 1). The area called Finnerty Gardens also is located outside of the ring but provides necessary insight into possible restoration plans for restoring inside the ring. The gardens consist of a large collection of rhododendrons. Originally the gardens were located inside the ring but were struggling to survive and in 1988 300 of the plants were moved outside the ring to what is now the Finnerty Gardens (University of Victoria, 2014). The 100 plants that were left inside the ring turned into what is now known as the Native Plant Garden. This area is not currently fenced off like the Finnerty Gardens are and is therefore open to deer predation. In our visit to this area we photographed several deer prints and the rhododendron population looked to be struggling which is consistent with Bentley Sly’s (Grounds Manager and Finnerty Gardens Curator, 2014) remarks on how deer are heavily predating on ornamental vegetation.

The land inside of the ring is predominantly occupied by buildings, pathways, roads, and other impervious surfaces. However, the South-West section inside the ring consists of forested area that is mostly untouched. We have spotted several deer and deer prints in this area. We are focusing on the inside of the ring as a whole but will have extra attention on this forested area in the South-West as we have spotted several deer and deer prints there.

2.2 Plant Identification

A crucial part of any restoration project is to research which plants are found on campus. A list of common native plants can be found in Appendix 1. Yellow highlighted species are deer resistant according to the Victoria Master Gardener Association (Victoria Master Gardener Association, 2013) and the UBC Botanic Gardens Forum. Although the highlighted species are suggested to be “deer proof”, deer will resort to almost any plant species when favourable plants are low (VMGA, 2013). It is highly suggested that plants with strong aromas and tastes are unfavourable to deer and can be major deterrents (VGMA, 2013).
2.3 Vegetation Mapping

Another crucial part of any site analysis is to determine the placement, density, and spread of the plants on campus. Since the UVic campus is home to many plants, high density areas and areas with native species were outlined and described below. An aerial view of the scope of the project can be seen below. The large white circle was included to better highlight the overall scope of the project (inside ring road)

Figure 1. Vegetation Mapping; Source: Zachary Luck via Google Earth
Yellow Region – The Yellow region (seen below in Figure 2) was found to contain primarily Garry Oak trees, Douglas fir, and Grand fir throughout the grass meadow. Many of the building surrounding yellow are lined with native species such as sword ferns, Oregon grape, and many other small shrubs.

![Figure 2. Yellow region; source: Zach Luck](image)

![Figure 3: Yellow region cont.; source Zach Luck](image)

Red Region – Red represents three rows of Garry Oak trees. Similarly to the yellow region, the buildings are lined with ferns, Oregon grape, and many other shrubs.

![Figure 4. Red Area Garry Oak Rows Source: ZL](image)

![Figure 5. Red Area Oregon Grape source: ZL](image)
Green Region – This area is primarily barren of shrubs but contains a large number of Arbutus, Douglas Fir, Grand Fir and other larger trees.

Figure 6. Green Region – Old growth trees; source: Zach Luck

Purple Region – the purple region is heavily forested and a variety of species such as: Arbutus, Douglas and Grand Fir, Holly, English Ivy, Himalayan Blackberry, sword ferns and many more.

Pink Region – This region is a mixture of swamp and dense growth.

Figure 13. Pink Region; source: ZL
**Orange Region** – This is a new garden planted by the environmental studies department. It contains a variety of native species such as: Trailing blackberry, Sword ferns, Salal, Oregon grape and native grasses.

![Figure 7. Orange Region; source: Zach Luck](image1)

![Figure 8. Orange Region gardens; source: Zach Luck](image2)

**Blue Region** – The blue region represents a well maintained garden of native species primarily: sword ferns, Oregon grape and other native species.

![Figure 9. Blue region 1; source ZL](image3)

![Figure 10. Blue Region 2; Source ZL](image4)

![Figure 11. Blue Region 3; Source ZL](image5)

![Figure 12. Blue Region 4; Source Z](image6)
2.4 Problem Identification:

Principal Problem:

The Citizens advisory group believes that urban deer populations in Victoria are increasing and with it comes increasing deer-human conflicts (Citizens Advisory Group, 2012). Due to the abundance of deer entering within the ring road, they are causing major damage to plants, posing a risk to human health, and presenting a hazard to pedestrians and vehicles. They have been concentrating their feeding and entry to the ring in the southwest corner of campus where Cunningham Woods, South Woods, Finnerty Gardens, and relative lack of buildings and impermeable surfaces create a minor corridor for the deer to cross the ring in a more sheltered way.

Figure 13. Nested Problem Categories; Image Source: University of Victoria
1. Ecological damage to plant species on campus resulting from increased deer feeding
   a. 3 types of damage by deer (Hesse, 2010):
      i. Browsing of plant parts
      ii. Rubbing of antlers on bark
      iii. Trampling of plants
   b. According Bentley Sly, (UVIC grounds manager), the deer have been targeting ornamental plants such as flowers which are found on multiple flowerbeds and gardens within the ring road as well as young tree saplings but have been expanding their diet constantly. When asked about what should be done about the deer problem, he replied, “it’s too political, I can’t comment”.

2. Human Health concerns from parasites and disease resulting from close contact to deer and deer feces:
   a. Risk of contracting Lyme disease transmitted through deer ticks (Hesse, 2010)

3. The deer regularly cross the roads coming into campus and create a hazard for drivers which has resulted in collisions and damage to vehicle as well as risk to human life and costs of removal of deer carcass
   a. In B.C every year, 5 people are killed and 382 injured in wildlife vehicle collisions, 76% of which are from deer (Hesse, 2010)
      i. In the CRD, was an increase in annual deer collisions from 35 in 2000 to 103 in 2010(Citizens Advisory Group, 2012)
   b. Ministry of Transportation and infrastructure spends over $600 000 annually on highway clean-up and carcass removal annually (Hesse, 2010)
3. Policies, Goals & Objectives

Policy Statement

The Epic Deer Project Management Team will meet on a weekly basis and work with facilities management to create a safe and prosperous deer management plan that is effective, engaging and an efficient use of resources.

3.1 Goal 1: To diminish the deer population inside ring road

Objective 1.1: Gather information regarding the high deer population on campus by March 3rd 2014.

Objective 1.2: Prevent the deer from foraging on community, native, and important gardens by implementing fences where appropriate by May 2014.

Objective 1.3: Restrict the deer presence to the forested regions of the UVic campus through natural deterrents by 2015.

Objective 1.4: Eliminate the deer presence on campus completely through both natural deterrents and fencing by April 2016.

3.2 Goal 2: Increase the abundance native plants on campus

Objective 2.1: To protect community and native plant gardens through fencing by May 2014.

Objective 2.2: To promote native plant growth through propagation of deer deterrent species by May 2015.

3.3 Goal 3: Create a monitoring and maintenance program

Objective 3.1: To record and monitor the demographics of the deer inside the ring.

Objective 3.2: To monitor the recovery and abundance of native species inside the ring.

Objective 3.3: To determine which plant species best deter the deer from native plant gardens.

Objective 3.4: To develop a monitoring program that is both educates and engages students and various groups throughout UVic.
4. Action Plan
We intend to address the first two goals with a three-phase plan to diminish the deer population within ring road while at the same time increasing the abundance of native plants on campus. This plan includes deer preventative measures such as the fencing off of key plant species and gardens, using biodegradable non-harmful deer repellents, and guard dogs; along with increasing awareness of the hazards and reducing their food supply with deer deterrent, native species.

1. To implement protective measures for our native plants on campus

1.1. Implement cost-effective deer fences around important gardens and tree saplings to protect them from deer grazing, antler rubbing, and trampling. Our first priority should be to fence off the Native plant Garden beside parking lot E as we found ample evidence of deer feeding activity in there and it is the area closest to the deer’s main point of entry into the ring (see images below). Fencing individual tree saplings and the other native plant gardens should be our second priority.

![Figure 14. Fencing; Source: University of Victoria](image)

1.2 Replace invasive plants and other plant species that are most heavily damaged by the deer with species of native plants that deer will not eat. We should concentrate these replacements in areas that are too costly or where it is not feasible to fence off; eventually we should hope to be able to replace all invasive species that are taking root within the ring.
2. To deter the deer from entering the ring road by creating a repelling perimeter following the ring

2.1. To deter the deer from crossing the ring road, we plan to implement the use of deer repellant that is applied around the ring road to form a deterring barrier to prevent the deer from crossing the road. The repellent we are suggesting would have to be biodegradable, and not harmful to humans, plants, or the deer themselves. The repellent would have to be reapplied in designated time-periods using campus maintenance vehicles.

3. To raise awareness of the deer and the accompanying hazards for drivers and introduce guard dogs to protect the ring.

3.1 The first part to phase 3 of our plan is to implement signs along ring road; especially, before the southwest corner of the ring warning drivers and students of the potential hazard of deer crossing the road. This could raise awareness of the hazards; reduce collisions and the risk to human life by making drivers aware of the possibility of deer crossing. They would have to be put in highly visible locations alongside the road so that drivers would be sure to see them.

3.2 For the third, more imaginative phase of our plan, we propose to that UVIC acquire and train dogs of a personable and friendly species to live within ring road and chase off any deer that do venture past the other deterrents and enter the ring. We propose that they be fed and looked after either by student representatives or by grounds and maintenance staff. If this plan was implemented and the dogs trained properly, it could be the most effective method of deterring the deer as they could believe there is a potential predator within the ring which is not a current threat to most deer in Victoria. This could also bring loveable campus pets and a sense of identity for Uvic students to be proud of and socialize with.
5. Implementation and management

Introduction

The implementation and management for our campus deer restoration project is broken up into three phases. It is structured this way to minimize costs. With our adaptive monitoring program the effectiveness of each phase will be under close watch. Relying on our key indicators, we will assess and analyze whether or not the implementation of the succeeding phase is necessary. If we can achieve significant deer eradication and reestablishment of native species with the strategies included in Phase 1, then Phase 2 and 3 will not be necessary. This way we will avoid doing unnecessary work and avoid incurring extra costs.

Phase 1

Implementation

Fencing:

The fencing of the selected areas and small saplings around campus will be done by UVIC Facilities Management. More specifically Bentley Sly and the Ground Management team will be responsible for erecting all of the fences. This is a task that will require coordination and specific skilled labour sets so we have opted to forego seeking outside volunteer and community support for this portion of the project. However, volunteers from on campus and around the community will be necessary in other portions of our project, mainly the management and monitoring sections.

Poly Rope Mesh Fencing:

The type of fencing for the native plant gardens and other large areas is going to be a poly rope mesh fence. This is the preferred material because it has an increased surface area that allows for application of repellents, has a ‘medium’ maintenance rating, a height of 2.4 meters, and a cost of 15$ per meter of length (not height, height of fence is pre-set to 2.4 meters) (Hesse, Sec. Fencing, 2010). This fencing will be most effective because it is of significant height so that the deer cannot jump over it. Also, a specific repellent will be routinely applied to the fence (outlined in phase 2) that will deter the deer from approaching the fence. The cost is fairly high compared to other fencing options but we have evaluated it to be well worth the cost due to the benefits just outlined. The labour costs are significant in the installation of all of the prescribed fencing so it is worth paying a little extra to ensure reliability and lower maintenance costs.

Poly Rope Fencing

Figure 15. Horse Fence Direct, Centaur PolyPlus Fence
Most of the small saplings that are under deer predation (bark and leaves) have already been fenced off. To improve the condition of these trees we are going to have Ground Management routinely apply our specified repellent to the fencing. Adaptive monitoring will reveal whether or not this approach is sufficient enough to ward the deer off from degrading the small saplings.

**Native Vegetative Species Planting:**
Species Planting:

We have established certain native plants already present on campus that deer prefer not to eat. As Bentley Sly stated, the deer are expanding the range of their diet and are becoming more willing to consume plants that they did not consume before. However, we hope that by making plants they don’t prefer more abundant inside the ring area this will make it a less preferred feeding area. In the process, native plant populations will be supported (and ideally increased) and invasive populations should be drawn down. Grounds Management will be responsible for acquiring additional native plant species from either a seed bank or plant donor. Plants that we will be focusing on include:

- Red Flowering Current – *Ribes sanguineum*
- Salal – *Gaultheria shallon*
- Tall Oregon Grape – *Mahonia aquifolium*
- Sword Fern – *Polystichum munitum*

The initial planting of these species will primarily be done by Grounds Management. It will be their duty to emphasize the plantings, survival, and existence of these native plants in the specified regions within the ring area. Volunteers and outside support will be required in the management portion of this phase.
Management

Fencing:
The choice of fencing for the native plant gardens and other regions will require a low degree of management due to the high quality of the fencing material. Grounds Management will be required to perform daily checkups on the fenced areas to make sure no damages or breaches have occurred.

Native Vegetative Species Planting:
Continual management will be necessary to ensure and encourage population increase of our specified native plant species. Grounds Management will be the underlying force behind this effort but other campus and volunteer engagement will be necessary for the proliferation of these native non-deer preferred species in the long run. Continual visits by volunteers to remove invasive species and help planting and cultivation of specified ‘deer-proof’ species will also alleviate financial pressure on UVIC Facilities Management. These volunteers will come from two sources: 1) individual volunteers from campus and community and 2) Environmental Studies and Ecological Restoration class field trips and participation. Facilities Management advertising on their website at (http://www.uvic.ca/facilities/service/grounds/grounds.php) that they are accepting volunteers for ongoing campus restoration projects will help to draw volunteers. Also, signage and physical advertising around campus will be needed. Facilities Management should be careful to construct a volunteer schedule that is accommodating to university students (Example: Saturdays from 12-4pm). The following is our proposal to the Environmental Studies and Ecological Restoration departments:

PROPOSAL:
Proposal: Course Participation in Campus Restoration
Attn.: Valentin Schaefer, Karena Shaw
Department of Environmental Studies and School of Environmental Studies Restoration of Natural Systems
March 28th, 2014

We are spearheading a campus restoration project to eradicate the deer population inside the ring and effectively alleviate pressure on present native vegetative species. The project is being run through Grounds Management here at UVIC. However, extra volunteer support is needed to achieve the goals of our project. We request your evaluation of our project in hope that hands on restoration work can be integrated into course(s) here at UVIC. If the efforts associated with restoring and achieving our project goals will provide practical educational experience for any of your ES and ER courses we would be happy to accept the support. We thank you for your consideration of our proposal.
Sincerely,
Epic Deer Project Management Team.
**PHASE 2**  
**Implementation & Management**

**Repellent Ring Road Perimeter:**

To establish the repellent perimeter Grounds Management will be applying Liquid Fence® all along the outside of Ring Road after every rainfall or every 2-4 weeks if there is limited rainfall. This application will be done after a scan for deer inside the ring. The optimal time to apply the repellent is in dry conditions during late afternoons because at this time campus is busy during these hours and therefore deer population inside the ring is more likely to be minimal. The goal before applying the repellent around the ring will be to make sure that no deer are inside the ring so that they don’t become trapped inside (the opposite of the purpose of the repellent Ring Road perimeter).

Liquid Fence®:

This product is safe and cost effective. On their website Liquid Fence® states, “It’s eco-friendly, EPA exempt and will not harm vegetation” (2014). This biodegradable product is perfect for our purposes of deterring deer from entering inside the ring. For our purposes the following will be purchased from http://www.liquidfence.com/pro/repellents/deer-rabbit-repellent.html#ProdInfo:

1) Liquid Fence Little Big Tank Sprayer 5 Liter Garden Sprayer – 24.99$  
2) Liquid Fence Deer & Rabbit Repellent 2 1/2 Gallon Concentrate – 259.99$

Recommended mix of water and concentrate is 16:1 (water to concentrate). This equates to 8 ounces of concentrate per gallon of water.

- **Total concentrate** = 2.5 gallons (320 ounces)  
- **Suggested mix** = 128 ounces water : 8 ounces concentrate , Total=128 + 8 = 136 ounces  
- **Total Solution created** = 136 (ounces)*(320/8) = 5,440 ounces (42.5 gallons)  
- 20 gallons of solution = approximately 1 acre (43,560 square feet)  
- This equates to, 0.0587 ounces per square foot (144 inches of area).  
- **Distance of Ring Road** = 6364.829 ft. = 76377.948 inches. ~Assume the solution is  
- applied in a 2 inch thick strip all around the ring. This gives us 152755.90 inches  
- (76377.948*2) of surface area to cover per trip around the ring.  
- **Total solution per trip around perimeter** = ((152755.90/144inches)*0.0587) = 62.270 ounces.  

- **Total Trips per batch of solution** = (5440 ounces total/62.70 ounces per trip) = 86 trips.

Assume that on average one trip around the ring per every two weeks is needed to keep application of Liquid Fence® at necessary level.  

Under this assumption the 2.5 gallon tank of Liquid Fence® concentrate would last 172 weeks or roughly three and a quarter years. This makes the cost of purchasing the Liquid Fence® equal to about 80$ per year before consideration of labour costs. To minimize labour costs we suggest Grounds Management that they apply this repellent around the outside of the ring using a gator or other gas-powered vehicle to save time and energy. This would make the application quick and easy, while reducing labour costs. Estimates of these costs are outlined in the budget section of the report.
PHASE 3
Implementation & Management

Introduction of Campus Dogs:

The first portion of phase 3 includes the integration of two feline species into our restoration approach. The dogs will be adopted from the local Victoria SPCA branch by the University of Victoria’s Facilities Management Grounds Management section. The dogs will then be trained by a hired professional to defecate in established areas. Along with this, the dogs will be equipped with shock collars that release a mild but deterring shock whenever they breach the ring road perimeter. This phase requires overcoming several hurdles. We have broken it up into three sections: acquiring the dogs, training the dogs, installing the shock collar system.

Sec.1. Acquiring the Dogs:

This process will include going through the regular SPCA dog application. In terms of a department within an organization adopting an animal there will be some challenges. Most likely a specific individual will need to step up to be the primary care taker of the animals. This could be done if the right candidate currently working within ground management showed interest and passed the adoption procedures. This individual would most likely receive compensation for their increased duties and labor efforts. The logistics with this matter are somewhat beyond the scope of our restoration project. Regardless, we have estimated the costs of this situation in the budget section of our report. If this was not the case, an animal care taker/trainer would need to be hired. Both options are outlined in more detail in the budget section of the report.

The dog application form can be found through the Victoria SPCA branch here:
http://www.spca.bc.ca/pet-care/adoption/adoptions-applications.html#.UziJn_uJvZU

Sec.2. Training the Dogs:

If acquiring the dogs can be arranged there are still several issues that could potentially arise with have two live animals living with in the ring road portion of campus. Firstly, the problem of where and when the animals will be defecating. A specified area will need to be established where the dogs will be trained to go to defecate. Secondly, the problem of making sure the dogs are safe and friendly to students, faculty, staff, and visitors. Large legality problems could arise if the dogs are aggressive and cause harm to any individuals.

To overcome these potential problems we suggest two options: 1) Take the dog to a local training school for behavioral lessons and 2) Hire a personal dog trainer to train the dog and be its care taker. For the 1st option there is a great dog training organization in Victoria called Smart Dog Training and Consultation. We recommend that if the dogs are going to go to this dog training school they enroll in the 12 week “Gold” package with a total cost of $423 per dog. The link to their website can be found here: http://www.smartdogtraining.ca/

As before, this scenario is quite variable and depends on the condition of the dogs and what level of behavior and training they have. Also, the management scenario provides variability as well: will the dog be managed, trained and taken care of by somebody with grounds management or will a personal dog trainer/care taker be hired to train and manage the dogs? Included in these responsibilities would be daily check-ups, feedings, and dealing with issues and complaints. These decisions will have to be made within the departments of facilities management and grounds management. As stated before, we provide estimates for the costs of potential scenarios in the budget section of the report.
A more concrete aspect of this phase will be the need for a small dog housing unit. This will be necessary because the dogs will need a place to go to sleep and take shelter during extreme weather events. For this component of the project we suggest that facilities management hire a private construction contractor. This would be preferred because our project places large amounts of pressure on the grounds management department. It will require this department to increase labor, increase funding, and increase duties. For these reasons we recommend that this portion of the project be attained through pursuing private construction contractors. The dog housing unit will not be a major construction project. All that is required is a small wood structure that can comfortably house two average size dogs. It is likely that facilities management can hire a construction company that is already engaged in construction projects on campus to take this dog housing unit as a small side project.

Sec.3. Shock Collar System

For the shock collar system there will also be several logistical and ethical problems to overcome. In terms of logistics, implementing them properly will have to be overcome. This is a bit of a tricky thing to do because you are dealing with live animals. Implementation and training of the dogs with improper technique with the shock collars will result in unnecessary discomfort shouldered by the animals. Shibe Shake discusses this issue on her popular blog as shown through the statement, “Too much force and our dog may break down, and become extremely stressed or fearful. Too little force and our dog will get habituated to the corrections, and just ignore them.” (2014). This shows that this is a delicate process which means which ever option grounds management decides to go with training the dogs, there needs to be sufficient effort given to allocating proper care with the shock collar component of acclimating the dogs to their new home (and perimeter).

The product we are going to use is SportDOG In-Ground Fence System. The product info can be accessed at:

Product price: 239.95$
Length of Wire: 1000 ft.
Coverage: 100 Acres

For our purposes the coverage of 100 acres is more than enough to cover the area inside the ring. However, the wire length of 1000 ft. is less than the circumference perimeter of the ring road (6364.829 ft.). Therefore, we will need an additional 5365 ft. This will result in a total product price of $(30.00\times5.365) + 239.95 \times 2 = 640.85$

The wire has to be installed underground throughout the perimeter. This will be done just inside of the road around the ring perimeter as to deter the dogs from crossing the road and causing traffic incidents. This poses several additional costs. Where there is dirt or grass a small ditch of approximately 6 inches in depth can be dug. However, where there are concrete and other impervious surfaces a more extensive installation project is required. For this we suggest grouping this project with the dog housing project and offering it to a current construction company already working on campus.

Ethical issues will be an issue with the shock collars. However, this can be largely overcome if proper training techniques and implementation protocols are used. Educating people and campus about proper shock collar usages will be the key in overcoming these ethical issues.
Signage and Awareness:

For our adaptive monitoring program it will be crucial that proper signage and awareness devices are in place. As outlined in the ‘action plan’ section of the report signs will be strategically located in deer hot spots throughout campus. On the signs a hotline number will be listed where anyone who sees a deer can call or text in and report it. When an individual calls in they will be taking to an automated system that allows them to briefly describe their spotting through programed responses via key pad inputs.

The cost of this portion of phase 3 is quite low. Sign construction can be done directly by grounds management. Labor costs are not negligible but not significant. Due to the automated system, managing and monitoring the system have negligible costs. Grounds management can check the automated system for reported deer sightings at their convenience. Estimates of these costs are addressed in the budget section of the report.

Figure 16. Potential Sign Locations; Source: University of Victoria
**Budget and Funding**

Portions of calculations in this section are based on estimates. Also, costs will vary based on implementation and management decisions within the jurisdiction of grounds management. We have outlined the options above, but ultimately some of these decisions cannot be made by us. This budget represents the total costs of the 3 different phases. These costs are largely pertaining to the budget increase necessary to grounds management to take on this campus deer restoration project.

<table>
<thead>
<tr>
<th>PHASE</th>
<th>COSTS</th>
<th>TOTAL COST</th>
</tr>
</thead>
</table>
| 1     | Fence: 15$X500m = 7500$  
Fencing labor: 200 man hours*20$ wage = 4000$  
Planting labor: 200 man hours *20$ wage = 4000$ | 15,500$ |
| 2     | Liquid Fence® = 285$  
Perimeter Labor = 520$ | 805$ |
| 3     | Dog Adoption(2): 600$  
Dog Housing: 1000$  
Shock Collars: 640.85$  
Training Labor: 846$  
Care Taking Labor: 3000$  
Signage: 1500$  
Signage Labor: 5 man hours*20$ wage = 100$ | 7,686.85$ |
| PACKAGE 1 (phase 1) | | 15,500$ |
| PACKAGE 2 (phase 1, 2) | | 16,305$ |
| PACKAGE 3 (phase 1, 2, 3) | | 23,991.85$ |

~Care taking labor is based on annual salary.  
~Perimeter labor is based on annual salary
6. Monitoring

Goal 3: Create a monitoring and maintenance program
We will begin the monitoring process before the implementation of the deer eradication program to better understand the issues at hand, and to identify where to focus our efforts. The deer are less likely to be on campus (within ring road) during peak class hours because of the high human traffic; therefore, our monitoring program will be carried out at dusk and dawn, when the deer are most likely to be present. (Lobo and Millar, 2013)

6.1 Through this monitoring we will establish the locations where the deer regularly congregate, and determine the environmental factors that entice them to these locations. This initiation process will include a population count of how many deer are visiting UVic’s campus within Ring Road. We will also locate their common points of entry into Ring Road. In this monitoring, we will observe the flora species that the deer are consuming and affecting. As well, we will consult and include the UVic grounds management on their observations of which locations are high-use deer areas, and which plant species they are having influences upon.

6.2 Our next monitoring step will be to record and evaluate the plant species health and populations inside Ring Road, indicating which plant species have been most affected by the deer. After this step has been completed, there will be continual monitoring on a monthly basis, post implementation of the Epic Deer Management Program, to measure and evaluate how the plants are doing with the deer being actively managed. Public involvement in the monitoring process will be of great value once the program has been put into effect, this will be encouraged through the deer sighting signage hotline. The dusk and dawn campus deer monitoring will continue post program implementation, initially being conducted every second day, then once results have started to occur, this monitoring will be reduced to once a week, and then halted once the goals have been met. The public monitoring and participation will contribute to the ongoing monitoring of the deer population inside UVic’s ring road. The health and reestablishment of the previously damaged and degraded plant species on campus will help be an indicator to the success of the conducted strategies.

Figure 17. Monitoring Mind Map
6.3 Monitoring our restorative and preventative measures will be conducted throughout the three-phase plan. The initial phase of providing fencing around valued gardens and vegetation, along with an increased planting of more natural native plant deterrents, will be monitored in order to assess the effectiveness of this initiative. The deer plant deterrent species effectiveness will be observed by seeing if the plants around the deterrents have thrived more than the other affected plant species that were not surrounded by deer deterrent plants. If this stage of the plan is not providing the desired results, then it will be re-evaluated, and adjusted as necessary. If our goals are still not being met through phase-one, then we will shift into phase-two of the plan and invest in Liquid Fence. Initially, the Liquid Fence will be distributed along Ring Road to deter deer from crossing over to the campus within. Monitoring will be held daily, at dawn and dusk, for the first month to view the deer’s reaction to the Liquid Fence application. This initial month long monitoring will observe and evaluate whether or not the proper amount of Liquid Fence is being applied at appropriate time intervals to be effective as a deterrent. Variables such as rain and heavy foot traffic will have to be considered when monitoring the effectiveness of Liquid Fence. Readjustments to the application can easily be adapted for this strategy. If this inexpensive solution is doing an insufficient job of keeping the deer out of Ring Road, then we will resort to our final third-phase- integration of campus dogs. These dogs will take some time to become fully effective on campus. Their performances can be best-observed and monitored during dusk and dawn hours, when the deer are most likely to visit the campus to feed. (Lobo and Millar, 2013) Over time, the deer would likely become knowledgeable of the dogs territory and avoid the region all together, this could make the dogs importance seem less significant, but these campus dogs would most likely become well-loved members of the UVic campus. Besides monitoring the visiting deer population within Ring Road, the native and non-native plant species who were being negatively impacted by these deer, should be observed at least once a month in the first year of the Deer Management Plan, and then bi-annually after the proper strategy has been implemented.

6.4 The maintenance of the monitoring program will be decreased over time with successful implementations of the described strategies. Public reporting practices will be encouraged and promoted with signage around campus; urging students and the public to text or call their deer sightings to the UVic grounds management hotline. This public reporting strategy will effectively get the community aware of campus issues and engage them in the process of UVic deer management. Additionally, UVic Restoration and Environmental Studies courses can get students involved by incorporating some of the monitoring and observing portions of the Deer Management Plan into their syllabus, allowing the students to gain hands on experience. UVic grounds management will follow through with the remaining upkeep of this program.

Conclusion
In conclusion, we hope that the deer population may be diminished using humane, effective and efficient means. All steps and strategies will be carefully evaluated to ensure minimal harm while maximizing results.
Acknowledgements

The Epic Deer Project Management Team would like to thank the following individuals for their time and effort:

Dr. Angeline Tillmans
Heike Lettari
Bentley Sly

References


Appendix A. Some Common Plant Species found on Campus

<table>
<thead>
<tr>
<th>Name</th>
<th>Picture</th>
<th>Ecological/Cultural Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arbutus <em>Arbutus menziesii</em></td>
<td>![Arbutus Photo](Photo: Lotus Johnson)</td>
<td>Common to the Greater Victoria Area, Native. Facilitates growth of other species in mixed evergreen forests (Kennedy <em>et al.</em>, 2012)</td>
</tr>
<tr>
<td>Baldhip Rose <em>Rosa gymnocarpa</em></td>
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<tr>
<td>Big Leaf Maple <em>Acer macrophyllum</em></td>
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<tr>
<td>Bitter Cherry <em>Prunus emarginata</em></td>
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<tr>
<td>Black Cottonwood <em>Populus balsamifera ssp. Trichocarpa</em></td>
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<td></td>
</tr>
<tr>
<td>Black Hawthorn <em>Crataegus douglasii</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bracken Fern <em>Pteridium aquilinum</em></td>
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</tr>
<tr>
<td>Camas <em>Camassia quamash</em></td>
<td>![Camas Photo](Source: Lyn Topinka)</td>
<td>Native. Traditionally valued for food by Salish peoples.</td>
</tr>
<tr>
<td>Chocolate Lily <em>Fritillaria lanceolata</em></td>
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<tr>
<td>Creeping buttercup <em>Ranunculus repens</em></td>
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<tr>
<td><strong>Daffodil <em>Narcissus</em></strong></td>
<td></td>
<td>Deer Resistant.</td>
</tr>
<tr>
<td>Dandelion <em>Taraxacum officinale</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **Daphne**  
**Daphne laureola** | ![Daphne laureola](image) | Invasive. Deer-Resistant. Toxic. | Source: Rick Johnson and Thurston County |
| --- | --- | --- | --- |
| **Douglas-Fir**  
*Pseudotsuga menziesii ssp. Menziesii* |  |  |  |
| **Dull Oregon grape**  
*Mahonia nervosa* | ![Dull Oregon grape](image) | Native. Deer-Resistant. | Source: Arthur Lee Jacobson |
| **English Daisy**  
*Bellis perennis* |  |  |  |
| **English Hawthorn**  
*Crataegus monogyna* |  |  |  |
| **English Holly**  
*Ilex aquifolium* | ![English Holly](image) |  | Source: Dave Ingram |
| **English Ivy**  
*Hedera helix* | ![English Ivy](image) | Invasive. Deer-resistant. Common on UVIC campus. | Source: Christy Burns |
| **Garry Oak**  
*Quercus garryana* |  |  |  |
| **Gooseberry**  
*Ribes divaricatum* |  |  |  |
<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Scientific Name</th>
<th>Additional Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grand Fir</td>
<td><em>Abies grandis</em></td>
<td></td>
</tr>
<tr>
<td>Himalayan Blackberry</td>
<td><em>Rubus discolor</em></td>
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<tr>
<td>Indian plum</td>
<td><em>Oemleria cerasiformis</em></td>
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<tr>
<td>Lady Fern</td>
<td><em>Athyrium filix-femina</em></td>
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<tr>
<td>Licorice Fern</td>
<td><em>Polypodium glycyrrhiza</em></td>
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<tr>
<td>Nootka Rose</td>
<td><em>Rosa nutkana</em></td>
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<tr>
<td>Oceanspray</td>
<td><em>Holodiscus discolor</em></td>
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</tr>
<tr>
<td>Pacific Crab Apple</td>
<td><em>Malus fusca</em></td>
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<tr>
<td>Pacific Ninebark</td>
<td><em>Physocarpus capitatus</em></td>
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<tr>
<td>Pacific Willow</td>
<td><em>Salix lucida ssp. lasiandra</em></td>
<td></td>
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<tr>
<td>Red Alder</td>
<td><em>Alnus rubra</em></td>
<td></td>
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<tr>
<td>Red Elderberry</td>
<td><em>Sambucus racemosa ssp. Pu bens</em></td>
<td></td>
</tr>
<tr>
<td>Red Flowering Current</td>
<td><em>Ribes sanguineum</em></td>
<td>Native</td>
</tr>
<tr>
<td>Red Huckleberry</td>
<td><em>Vaccinium parvifolium</em></td>
<td></td>
</tr>
<tr>
<td>Red-osier dogwood</td>
<td><em>Cornus stolonifera</em></td>
<td></td>
</tr>
<tr>
<td>Rhododendron</td>
<td></td>
<td>Native. Deer-resistant.</td>
</tr>
<tr>
<td>Salal</td>
<td><em>Gaultheria shallon</em></td>
<td>Native. Deer resistant.</td>
</tr>
<tr>
<td>Salmonberry</td>
<td></td>
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</tr>
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</table>

*Source: Greg Miller, Denise Wymore*
<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Native/Invasive Status</th>
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<tbody>
<tr>
<td><em>Rubus spectabilis</em></td>
<td></td>
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<tr>
<td>Saskatoon</td>
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<tr>
<td><em>Amelanchier alnifolia</em></td>
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<tr>
<td>Scotch broom</td>
<td>Invasive</td>
</tr>
<tr>
<td><em>Cytisus scoparius</em></td>
<td></td>
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<tr>
<td>Scouler's Willow</td>
<td></td>
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<tr>
<td><em>Salix scouleriana</em></td>
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<tr>
<td>Sitka Sedge</td>
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<tr>
<td><em>Carex sitchensis</em></td>
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<tr>
<td>Skunk Cabbage</td>
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<tr>
<td><em>Lysichitum americanum</em></td>
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<tr>
<td>Snowberry</td>
<td></td>
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<tr>
<td><em>Symphoricarpos albus</em></td>
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<tr>
<td>Sticky Current</td>
<td></td>
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<tr>
<td><em>Ribes viscosissimum</em></td>
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<tr>
<td>Stinging Nettle</td>
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<tr>
<td><em>Urtica dioica</em></td>
<td></td>
</tr>
<tr>
<td>Sword Fern</td>
<td>Native. Generally Deer Resistant. Deer may nibble on tips, fauns may browse.</td>
</tr>
<tr>
<td><em>Polystichum munitum</em></td>
<td></td>
</tr>
<tr>
<td>Tall Oregon grape</td>
<td>Native. Deer resistant.</td>
</tr>
<tr>
<td><em>Mahonia aquifolium</em></td>
<td></td>
</tr>
<tr>
<td>Thimbleberry</td>
<td></td>
</tr>
<tr>
<td><em>Rubus parviflorus</em></td>
<td></td>
</tr>
<tr>
<td>Trailing blackberry</td>
<td>Native.</td>
</tr>
<tr>
<td><em>Rubus ursinus</em></td>
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<tr>
<td>Trembling Aspen</td>
<td></td>
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<tr>
<td><em>Populus tremuloides</em></td>
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<tr>
<td>Wall Lettuce</td>
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<tr>
<td><em>Lactuca muralis</em></td>
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</tr>
</tbody>
</table>

Source: Paul Noll

Source: Clay Antineau

Source: Ross Heidebrecht
<table>
<thead>
<tr>
<th><strong>Wild Strawberry</strong> <em>Fragaria</em></th>
<th>Native. Deer Resistant.</th>
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<tbody>
<tr>
<td><img src="image" alt="Image of Wild Strawberry" /></td>
<td>Source: Dorothy Birch</td>
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</table>

<table>
<thead>
<tr>
<th><strong>Western Redcedar</strong> <em>Thuja plicata</em></th>
<th>Native. Traditionally used for canoes, housing and more by BC first peoples.</th>
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</thead>
<tbody>
<tr>
<td><img src="image" alt="Image of Western Redcedar" /></td>
<td>Native. Traditionally used for canoes, housing and more by BC first peoples.</td>
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