

Western Screech Owl Restoration Project



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Roles

This is an outline of each group members' roles in the project. Certain sections were written by multiple group members. All group members were responsible for editing.

Taryn Pyke: Background information for Western Screech Owl and Barred Owl; Policy Goals and Objectives; Implementation and Management

Ali Chacalias: Policy, Goals and Objectives; Design

Ray Lewis: Monitoring and Evaluation; Photoshopped images

Logan Holmes: Site Analysis; Expenses; Photos; Appendix 1

Amelia Andrews: Introduction; Policy, Goals and Objectives; Implementation and Management; Closing Remarks; Appendix 2; Formatting

Introduction

This report focuses on providing thorough analysis of the Western Screech Owl and the biotic and abiotic conditions of Mystic Vale, Saanich, British Columbia on the University of Victoria Campus. The Western Screech Owl no longer lives on Southern Vancouver Island and this restoration project is based on the theoretical re-location of the owl to the region. This study provides recommendations for moving forward with the restoration of the Western Screech Owl to Mystic Vale and the implementation of a restoration plan. Through the construction and proper placement of nesting boxes, the monitoring of predation by the Barred Owl, and education within the community, there would be increased hope that the Western Screech Owl would be restored to Mystic Vale.

1.0 Background for Western Screech Owl

1.1 Identification

The Western Screech Owl is a smaller owl. It is typically 19-20 cm long with a weight of 120- 305g. Distinctions can be made between the Western Screech Owl and other owls because of its greyish brown coloring, yellow eyes and feather ear tufts (B.C Recovery Strategies, 2008).

1.2 Habitat

Western Screech Owls are usually found on the edges of Deciduous and Riparian forests, that open up to wetlands and pastures and have a water source (B.C Recovery Team, 2008). Since the Western Screech Owl is not a migratory bird they live in climates

with mild winters like the coast of British Columbia (B.C Recovery Team, 2008). They are not threatened by human activity and are often found in residential parks (B.C Recovery Team, 2008). Figure 1 shows the Western Screech Owls habitat in North America.

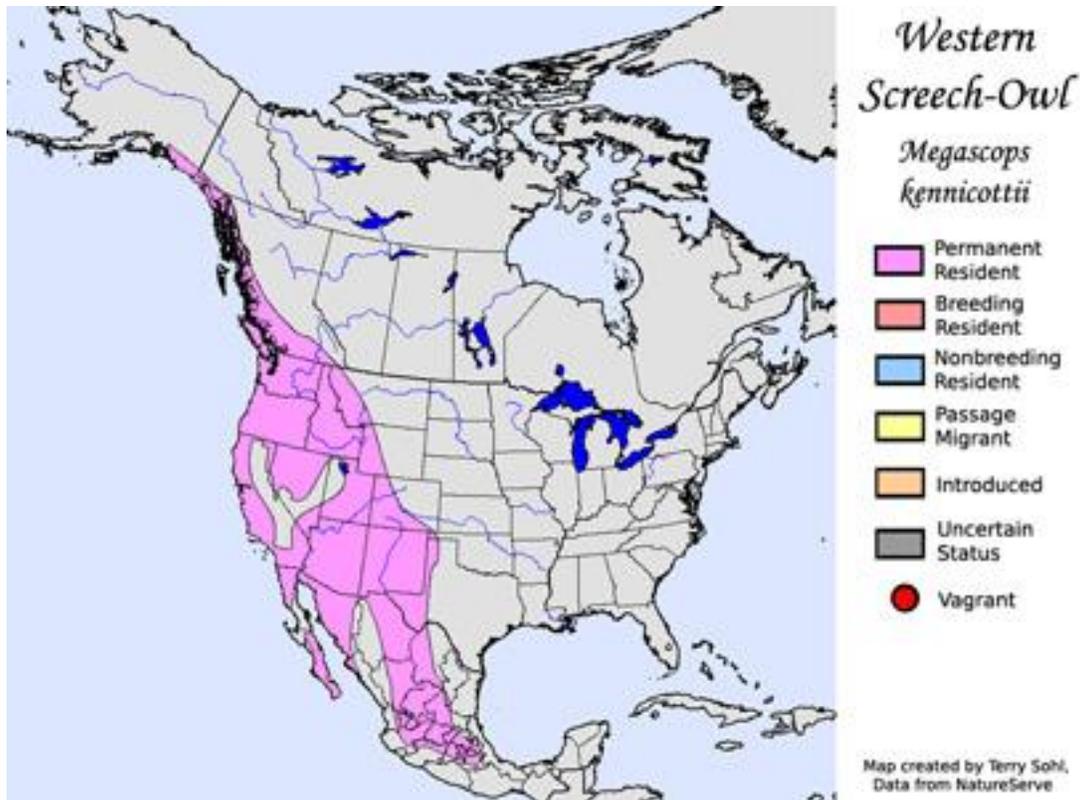


Fig. 1: Map of Western Screech Owl habitat (Taken from www.sdakotabirds.com)

1.3 Nesting

Known breeding areas for the Western Screech Owl are the Okanagan Valley, Shuswap Valley and the Kootenay Valley. There have also been reports of Western Screech Owls in Southern Alberta and Saskatchewan (B.C Recovery Team, 2008).

Cottonwood trees have been found to be the Western Screech Owl's favorite for nesting, although they will also nest in water birch and trembling aspen (see figure 2) (B.C Recovery Team, 2008). Desirable nesting sites are trees with a diameter greater than 30 cm at chest level, and have an opening greater than 7.5 cm in diameter. These openings are often made by woodpeckers (B.C Recovery Team, 2008). Nesting sites are usually 5 to 15 km apart (B.C Recover Team, 2008).

Western Screech Owls lay about 3-4 eggs in a 1-2 day period, and have an incubation period of 26 days (B.C Recover Team, 2008). Owlets do not leave the nest for the first 28 days of their life. Owlets will stay with their parents for another 5 to 6 weeks (B.C Recover Team, 2008). The life span of the owl is about 13 years. They do not live an active life and traveling is usually only done when finding their own habitat (B.C Recover Team, 2008).



Fig. 2: Western Screech Owl nesting site (taken from ofbirdsandb.wordpress.com)

Artificial nesting boxes can be used to protect the Western Screech Owls population from declining in an area that no longer has suitable natural nesting sites (B.C Recover Team, 2008).

1.4 Diet

It is important for the survival of the Western Screech Owl to have sufficient food source. They are known for their stalking and usually prey on mice, small birds, small fish, frogs, salamanders, crayfish, slugs, worms and large insects. They have also been known to eat cottontail rabbits and the Western Screech Owl has even been spotted eating animals that are larger than their own body size (B.C Recovery Team, 2008).

1.5 Habitat and Species Degradation

COSEWIC (Committee on the Status of Endangered Wildlife in Canada) named the Western Screech Owl as endangered in May 2002 and British Columbia put them on the Red list (Hocking, 2000). There are less than 250 adult owls alive in the Southern Interior of BC due to loss of native riparian woodlands in the lowland valleys. These lowland valleys are the usual breeding habitats for the interior species of the Western Screech Owl (Hocking, 2000).

1.6 Predators

The Western Screech Owl was once found in abundance on Vancouver Island. However, because of the introduction of the Barred Owl and the Great Horned Owl the Western Screech Owl population began to suffer and the Western Screech Owl no longer lives in Southern Vancouver Island (B.C Recover Team, 2008).

1.7 Human Impact

British Columbia's Ministry of Environment has identified that rapid urbanization, growing agricultural areas and an increasing number of hydroelectric projects are responsible for the decline in habitats and species population. This has resulted in the loss of many of the large, old trees that Western Screech Owls commonly use as nesting sites. Their habitats have also been destroyed as a result of excessive grazing and burning to clear shrub lands (B.C Recovery Team, 2008). Although the Western Screech Owls is not hunted by humans and are not threatened by human activity, its population has declined because of an increasing human population, with it bringing increased car usage and traffic, pollution and decreased habitat areas (B.C Recovery Team, 2008).

1.8 Pollution

Up until the 1970's a chemical called Dichloro-Diphenyl-Trichloroethane (DDT) was used in many orchards in British Columbia (B.C Recover Team, 2008). There is no information that directly connects the decline of the Western Screech Owls population, although information has been published describing development, physiology, morphology and behaviour in other animals (B.C Recovery Team, 2008).

2.0 Background for Barred Owl

The Barred Owl preys on the Western Screech Owl and is partially responsible for a decline in the Western Screech Owls population, especially at the University of Victoria (B.C Recovery Team, 2008).

2.1 Identification

The Barred Owl's distinctive vertical bar markings on their lower breast set them apart from other owls. They have a greyish-brown coloring and a white and brown face that is outlined with brown circular shapes (Squidoo, 2012).

The Barred Owl is bigger than the Screech Owl with a height of 40 to 60 cm, a wingspan of 0.9 to 1.25 m and a weight of 0.5- 1 kg (Squidoo, 2012). The Barred Owl's long tail makes them agile flyers (Squidoo, 2012).

2.2 Behaviour

The Barred Owl is highly adaptable and has strong territorial instincts, making it a threat to other birds (Squidoo, 2012). The Barred Owl perches in tall trees and attacks its prey from above. Their mobility, hunting precision, and long agile tails for silent flying make them very good hunters (Squidoo, 2012). The aggressive behaviour of the Barred Owl makes them able to outcompete and prey on other, smaller birds – specifically, for this project, the Western Screech Owl (Squidoo, 2012).

2.3 Habitat

The Barred Owl migrated from eastern part Canada and was first spotted on the West Coast of British Columbia in 1960 (Squidoo, 2012). They are now one of the most common owls on Southern Vancouver Island. They are also prevalent in Vancouver, on the mainland (Squidoo, 2012). The reason the Barred Owl is so adaptable is because they have many different habitats. They can establish themselves in an area as long as there is an abundance of prey (Squidoo, 2012).

3.0 Site Analysis

3.1 Site History

Mystic Vale is a natural forested ecosystem on the University of Victoria campus that is 4.7 hectares (11.6 acres) in size. Mystic Vale sits on the southeast side of campus in both the municipality of Oak Bay and Saanich and it contains a ravine housing Hobbs Creek. Mystic vale was once the traditional territory of the Straits Coast Salish peoples, which included the Senchalhen (or Saanich), and the Lekwungen (or Songish) (Baum, Campbell, Chanoine & Struthers, 2009). These communities used Mystic Vale for a variety of activities such as hunting, fishing, harvesting, as well as spiritual uses. Through these uses First Nations people carried out important management of the area. In 1993 the University of Victoria purchased Mystic Vale from shareholders to protect it from development. It was purchased for 2.7 million dollars with the help of the municipality of Saanich and the provincial government. Mystic Vale is currently protected from development but not from frequent community use and disruption such as walking, biking, and running. See Figure 3 for an aerial photo of Mystic Vale.

Mystic Vale and the University of Victoria campus have experienced multiple land use changes since the first people's habitation. Mystic Vale started to experience major change in the late 1800's as a result of European settlement. The area has been logged by The Hudson Bay Company, farmed, and later used for military training. Prior to becoming a

university in 1963, 46% of the original 261 acres had been cleared and used by the military (Harrop-Archibald, 2007). The remainder of the land had been cleared by The Hudson Bay Company and was then second growth forest. By July 1st 1963 Victoria College became the University of Victoria and occupied 380 acres of land. These land uses along with several fires have altered the landscape and are important to consider when restoring, along with first peoples land management practices since restoration is not only about restoring historic landscapes but also historic practices.

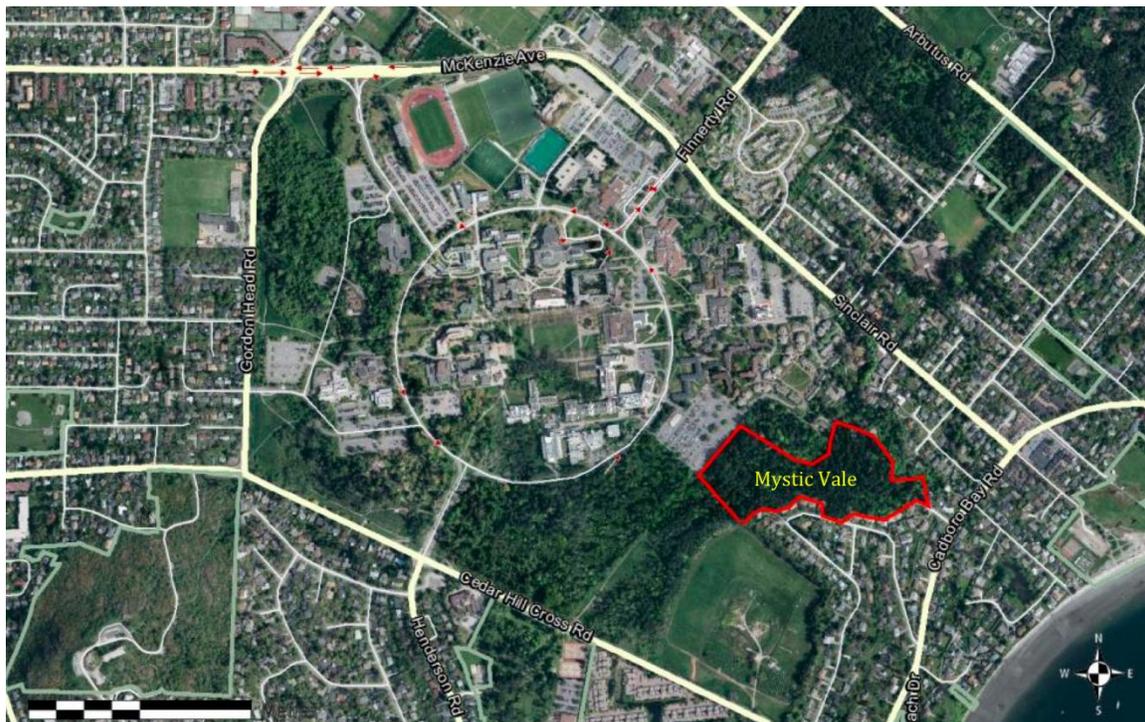


Fig. 3: Aerial photo of Mystic Vale (Taken from CRD document, 2012)

3.2 Site description

3.2.1 Climate:

The University of Victoria is located on the southeastern tip of Vancouver Island, B.C and has the coordinates of 48° 28" N and 123° 19" W (Harrop-Archibald, 2007). Victoria and Mystic Vale lie in the Coastal Douglas-fir Biogeoclimatic zone (CDF), which is characterized

by warm dry summers and wet but mild winters. Situated in the rain shadow of the Olympic Mountains, the CDF receives approximately 70 cm of precipitation annually with most of it falling in the winter months as rain (Harrop-Archibald, 2007). The southeastern region of Vancouver Island is the driest region of British Columbia has a very unique ecosystem which is important to remember when planning a restoration project.

3.2.2 Vegetation

Mystic Vale is part of the Hobbs Creek watershed which includes a large ravine with 20 to 30 degree slopes (Baum, Campbell, Chanoine & Struthers, 2009). The ravine is originally coniferous woodland and supports Douglas fir trees (*Pseudotsuga menziesii*), Grand fir trees (*Abies grandis*), and Big Leaf maples (*Acer macrophyllum*). The moist conditions of the ravine support western red cedar but only few remain in the area (Harrop-Archibald, 2007). The upper edges of Mystic Vale include an abundance of species such as Arbutus (*Arbutus menziesii*), Oregon grape (*Mahonia aquifolium*), Oceanspray (*Holodiscus discolor*), and Snowberry (*Symphoricarpos*) (Fig. 5), as well as unhealthy amounts of English ivy (*Hedera helix*) and Holly (*Ilex aquifolium*), which are both non-native invasive species. The lower lying floor of the ravine supports species such as skunk cabbage (*Lysichiton americanus*), pacific water parsley (*Oenanthe sarmentosa*), and sword fern (*Polystichum munitum*). The steep slopes of the ravine are almost completely dominated by English ivy (*Hedera helix*) and sword fern (*Polystichum munitum*) (Fig. 4). For a complete list of native plant species see Appendix 1.



Fig. 4: Sword Fern

Fig. 5: Snowberry

3.2.3 Wildlife

Mystic Vale is home to a variety of mammals as well as bird species. Black-tailed deer (*Odocoileus hemionus*), Grey squirrels (*Sciurus carolinensis*), raccoons (*Procyon lotor*), and Eastern Cottontailed rabbits (*Sylvilagus floridanu*) can all be sighted in and around the ravine (Lucey *et al.*, 2002, as cited in Harrop-Archibald, 2007). Bald eagles (*Haliaeetus leucocephalus*), Great Horned owls (*Bubo virginianus*), and Coopers hawk (*Accipiter cooperii*) all use the ravines tall trees for resting (Lucey *et al.*, 2002, as cited in Harrop-Archibald, 2007). Other resident bird species include the Mallard duck (*Anas platyrhynchos*), Ring-Necked pheasant (*Phasianus colchicus*), Bushtit (*Psaltriparus minimus*), Barred owl (*Strix varia*), raven (*Corvus corax*) and five species of woodpeckers including Pileated (*Dryocopus pileatus*), Downy (*Picoides pubescens*), and Hairy woodpeckers (*Picoides villosus*) (Harrop- Archibald). The Barred owl is important as they pose a predatory threat on Western Screech Owls. Woodpeckers are also important due to their tendency to create cavities in trees suitable for Western Screech Owl nesting sites.

3.3 Cultural Conditions

Although Mystic Vale is a sensitive ecosystem, it is heavily used by students and members of the community. The series of trails that wind through the ravine are favorites of local joggers and dog walkers. The ravine is also used for a variety of academic purposes including field activities. Field activities such as English ivy removal can have positive effects on the ecosystem; however the large volume of people can also lead to trampled vegetation. The sheltered areas of Mystic Vale are culturally valuable to the cannabis smoking first year population as it is situated directly adjacent to the University of Victoria first year residence buildings.

3.4 Threats

3.4.1 Cultural disturbance

Human uses have a significant impact on the ecological health of Mystic Vale. The most frequently used areas are the trails. The extensive use of trails leads to a compact layer of soil that is not suitable for the growth of any plant species. The poor placement of trails can also lead to harmful soil erosion. Trails too close to the creek edge can lead to the collapse and erosion of the creek bank. Trails placed on the slopes also lead to soil erosion as water flows down them during heavy rain. Trails get increasingly muddy during heavy rain and users will often walk around the trail in wet spots, which can potentially lead to stunted plant growth. Dog walkers are also a threat as off lease dogs trample plants near the trails, as well as on the slopes, leading to slope instability. The frequent human use increases the occurrence of littering in and around the ravine. Many of these disturbances could be avoided if the users were informed on the importance and sensitivity of the ecosystem in Mystic Vale. Although signs prohibiting off lease dogs and other threats are found at entrances to Mystic Vale, the ravine has insufficient signage to inform users of the dangers it poses and how visitors of the forest should appropriately act, in treating the ecosystem with respect.

3.4.2 Invasive species

Invasive species can have a huge affect on plant and animal biodiversity over time and can irreversibly alter landscapes. English ivy (see Fig. 4 and 5) is an invasive plant species that was introduced to Mystic Vale and has had the biggest impacts on the ecosystem. English ivy has spread to all areas of the ravine and when given the opportunity, can almost completely dominate the understory and the forest canopy. English ivy outcompetes other shrubs and plants for nutrients, water, and light. English ivy climbs trees, extending onto branches and stealing sunlight from the tree to the point of death. This destructive invasive species also increases the weight a tree has to support which can make trees more susceptible to falling over during storms. These threats to tree life caused from English ivy

are especially important when restoring Western Screech Owl habitat as their nesting sites can be negatively impacted. Other less devastating invasive species include English holly, Scotch broom, Himalayan blackberry, and Daphne-laurel.



Fig. 6: English Ivy (Close up)



Fig. 7: English Ivy

4.0 Policy, Goals and Objectives

4.1 Policy

The Western Screech Owl, *Otis kennicottii*, will be restored to Mystic Vale found on the University of Victoria Campus. Mystic Vale, along with other areas of Greater Victoria, was once a habitat of the Western Screech Owl. Towards the late 1990's the Western Screech Owl was no longer found in the Greater Victoria area. British Columbia's Minister of Environment has initiated a restoration project to restore the Western Screech Owl to interior British Columbia. We would like to extend their plans by restoring the owl to the University of Victoria by creating a successful habitat in Mystic Vale. Due to increases in Western Screech Owl habitat degradation we would like to create a suitable habitat within Mystic Vale provided predation of the Barred Owl on the Western Screech Owl does not occur.

4.2 Goals and Objectives

The following gives a brief outline of the goals and objectives of the project. This list provides a quick reference or checklist for the success of the restoration project. Further detail of the implementation of these goals and objectives is provided in section 5.0.

Goal 1: *Distinguish and identify the proper location of the tree species within Mystic Vale required to support the nesting box.*

Objective 1.1: *Survey the area to find up to 5 trees, 5 to 15km apart with a diameter at breast height of greater than 30cm, to hold the nesting boxes.*

Objective 1.2: *Survey and record the locations of trees within a distance of 5km of water and out of heavy human traffic areas.*

Goal 2: *Build and install nesting boxes on the selected trees to provide temporary nesting sites for the Western Screech Owl while re-establishing a healthy habitat within Mystic Vale.*

Objective 2.1: *Build up to five nesting boxes that would be suitable temporary nesting site for the Western Screech Owl*

Objective 2.2: *Install up to five nesting boxes in trees that have the parameters we concluded would be integral to a successful nesting site for the Western Screech Owl.*

Goal 3: *Ensure that the nesting boxes are being successfully used by the Western Screech Owl.*

Objective 3.1: *Take quarterly observations about the strength of the newly introduced population of Western Screech Owls.*

Objective 3.2: *Assure proper maintenance of the nesting boxes through annual cleaning of the nesting boxes.*

Objective 3.3: *Take annual observations about the successfulness of the nesting boxes.*

Goal 4: *Ensure awareness within the community of the sensitivity of this re-established Western Screech Owl population.*

Objective 4.1: *Design and implement educational signage at each entrance of Mystic Vale and where the path intersects the ravine.*

Objective 4.2: *Create community engagement in the ongoing protection of the Western Screech Owl through social media and attendance at community events.*

Goal 5: *Ensure continued absence of predation of the Barred Owl on the Western Screech Owl through annual monitoring of both Barred Owl and Western Screech Owl populations.*

Objective 5.1: *Monitor the populations of the Barred Owl and Western Screech Owl on an annual basis to ensure that Barred Owl predation does not result in the Western Screech Owls population to decrease less than 6 owls in Mystic Vale.*

Goal 6: *Maintain a healthy ecosystem in Mystic Vale, so the Western Screech Owl can have a healthy population.*

Objective 6.1: *Ensure that there are no human disturbances to Mystic Vale without consideration for the Western Screech Owl's habitat needs.*

Objective 6.2: *Ensure that the ecological integrity and biodiversity of Mystic Vale is maintained through sustainable restoration projects.*

5.0 Design

With the assistance of our restoration project, Mystic Vale will become a suitable habitat for the Western Screech Owl. We will create desirable habitats within Mystic Vale for the Western Screech Owl to live and thrive by building and installing nesting boxes in areas that will benefit the repopulation of the owl. Ensured success of our restoration of the Western Screech Owl requires a careful and systematic planning process. Through this planning process we will ensure efficiency, effectiveness, and engagement in the facilitation of each of our objectives. A task breakdown provided below details the 7 specific phases of our project and the current status of each phase. Following the task breakdown a detailed description of materials, budget, and additional requirements of each phase is provided to ensure the success of objectives in the implementation and management stage. Phases are bolded with tasks listed below each.

5.1 Task Breakdown

5.1.1 Phase 1: Status = completed

Survey and record location of trees suitable for nesting box installation.

- Initial site analysis
- Identify parameters of suitable location for nesting box placement
- Select up to five trees 5 to 15 km apart from one another within this location that have suitable basal diameters (diameter at breast height) of over 30 cm

5.1.2 Phase 2: Status = completed

Build up to five nesting boxes.

- Acquire sufficient funding, materials and tools for nesting box construction
- Construct nesting boxes according to steps outlined in Appendix 2

5.1.3 Phase 3: Status = completed

Install nesting boxes.

- Acquire tools required for nesting box installation
- Identify specific placement, 3 - 5 meters above ground, for nesting boxes on each tree
- Secure nesting boxes to trees

5.1.4 Phase 4: Status = partially completed

Design and install signs to encourage community awareness.

- Contact University of Victoria Faculties Management to facilitate the installation of additional signage
- Outline sign specifications

- Outline sign placement

5.1.5 Phase 5: Status = ongoing

Ensure successful use of nesting boxes through monitoring.

- Take periodic observations to ensure occurrence Western Screech Owl nesting as further outlined in implementation and monitoring sections
- Annual cleaning and maintenance of nesting boxes : adaptable to possible reinstallation of defective nesting boxes

5.1.6 Phase 6: Status = ongoing

Monitor Barred and Western Screech Owl populations.

- Take annual observations on stability of Western Screech Owl population as further outlined in implementation and monitoring sections
- Ensure absence of Barred Owl predation on Western Screech Owl as further detailed in implementation and monitoring sections

5.1.7 Phase 7: Status = ongoing

Monitor Mystic Vale to ensure absence of human disturbance and maintenance of ecological integrity required for continued Western Screech Owl habitation.

- Control of invasive species
- Regulate littering
- Further details in implementation and management

5.2 Materials

Phase 1 requires various measurement devices to increase accuracy and efficiency. Measuring devices will be provided by the University of Victoria Environmental Studies Department and will include:

- Diameter tape: to measure the basal diameter or diameter at breast height of the trees
- Handheld GPS device: to measure 5 - 15 km distance between each selected tree
- Clinometer: to measure 3 - 5 meters above ground on each selected tree for exact nesting box placement

Phase 2 materials are listed in Appendix 2. Tools needed for both Phase 2 and Phase 3 will be provided by the University of Victoria fine arts department and include:

- Saw
- Electric drill
- Hammer
- Ladder
- Eye protection

Phase 4 requires the assistance of the University of Victoria Faculties Management as they must first approve and then provide additional signage. This phase is still in process as approval steps have not yet been completed. Fig. 8 below is a concept image of what the signage would look like.

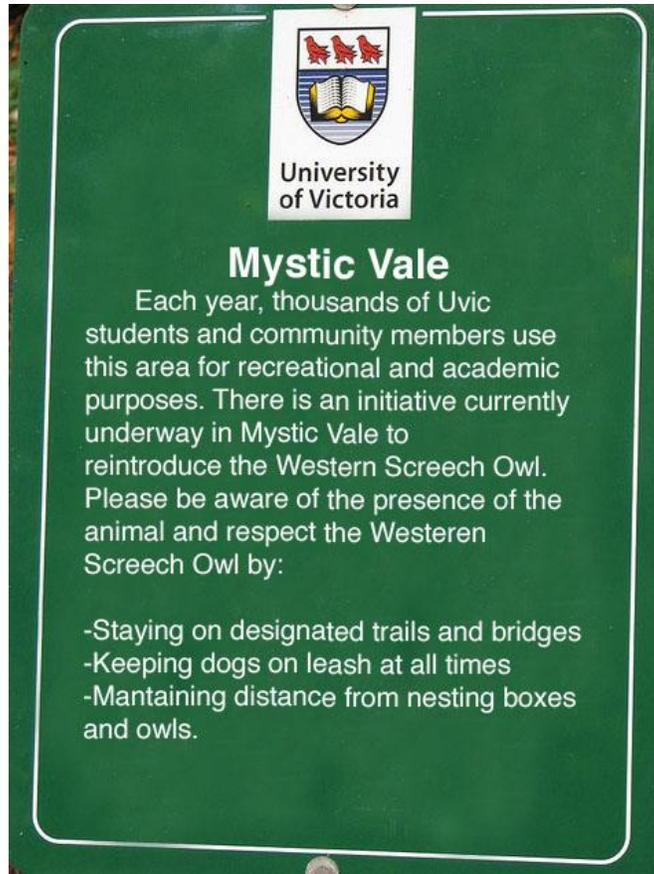


Fig. 8: Concept Sign

5.3 Expenses

The major expenses of our restoration project are the materials for Phase 2 and the cost of Phase 4. The budget for the materials required for 5 nesting boxes that match the specifications described in Appendix 2 will be \$47.46. The breakdown of these materials is as follows:

- 1 piece of plywood 1 inch thick 4 ft. x 8 ft. = \$ 34.47
- Pack of 100 1 ½ inch deck screws = \$ 12.99

Budget for signage will be evaluated following approval from the University of Victoria Faculties Management. Funding for all expenses will be mainly provided by the Victoria National History Society. The Victoria National History Society has agreed to designate a portion of their donations towards our restoration initiative. In addition, our

social media Facebook page will provide the opportunity for community involvement through donations.

5.4 Additional Requirements

Community engagement and awareness is a necessary aspect to ensure success of our restoration project. Since this initiative is tied into the Environmental Restoration 341 course at the University of Victoria, community assistance will be both encouraged in this course and through our Facebook page. Community engagement will assist with various aspects such as ivy removal to preserve the ecological integrity of Mystic Vale; human disturbances such as littering; and also in notifying nesting box detachment or destruction.

5.5 Summary

All 7 phases of the design outline are fully adaptable and flexible to any external factors that might arise. External factors might include re-installation of nesting boxes as they are susceptible to storm damage resulting in detachment and possible destruction. Following completion of all 7 phases, the Western Screech Owl will be successfully restored to Mystic Vale, maintaining successful habitation and reproduction within the Vale.

6.0 Implementation and Management

In order for the goals of our restoration of the Western Screech Owl to be successful we must develop in depth steps for implementing the restoration goals, as well as an outline for the management strategies. Ensuring that the boxes are built correctly, placed in the correct area and that Mystic Vale remains a healthy ecosystem is vital to our restoration project being a success. The activities for re-establishing the Western Screech Owl must be as minimally disruptive as possible. Each restoration goal and objective is described. Goals below are written in bold and objectives are italicized.

6.1 Distinguish and identify the proper location of the tree species within Mystic Vale required to support the nesting box.

This initial goal is important because before we go about placing the nesting boxes in the trees we will collect data at the site to decide the location of the nesting boxes. This requires going out into Mystic Vale and performing a site analysis.

6.1.1 Objective: Survey the area to find trees with a diameter suitable to hold the nesting boxes.

Western Screech Owls naturally nest in trees that have a diameter at breast height greater than 30cm. Trees must be found that have this suitable diameter and are able to support a nesting box. The trees that the Western Screech Owl commonly nests in do not grow in Mystic Vale and therefore, the diameter of the trees is vital to its success.

6.1.2 Objective: Survey and record the locations of trees within adequate proximity of water and out of heavy human traffic areas.

Western Screech Owls do not nest in too close a proximity to each other. To achieve the most favourable habitat, it must be ensured that there is 5 to 15 km between each tree in which a Nesting box will be placed. The nesting sites must also be within a close proximity to the ravine in Mystic Vale, an adequate water source. There is heavy human traffic in Mystic Vale and this could have negative impacts on a successful Western Screech Owl population. Because of this, observations must be taken to see where the trails are and areas of the forest that are frequented the most by humans. Tree locations must take into account these three factors in order for the restoration project to be successful.

6.2 Build and install nesting boxes on the selected trees to provide temporary nesting sites for the Western Screech Owl while it re-establishes a healthy habitat within Mystic Vale.

6.2.1 Objective: Build up to five nesting boxes that would be a suitable temporary nesting site for the Western Screech Owl.

The nesting boxes will be built according to the steps outlined by BC Hydro's *Fish and Wildlife Compensation Program Build an Owl Nest* manual (See Appendix 1).

6.2.2 Objective: Install up to five nesting boxes in trees that have the parameters we concluded would be integral to a successful nesting site for the Western Screech Owl.

After appropriate observation, and the choice of acceptable trees, the nesting boxes will be placed 3 to 5 meters above the ground. The floors of the boxes will be covered in leaves or wood shavings. For a more detailed outline, see Appendix 1.

6.3 Ensure that the nesting boxes are being successfully used by the Western Screech Owl.

6.3.1 Objective: Take frequent observations about the strength of the newly introduced population of Western Screech Owls.

Observations must be taken to ensure that the newly introduced Western Screech Owl population is healthy and stable. This can be done through listening to call and assessing the health of the owls. The quality of the food source must be observed. The amount of predations from the Barred Owl must be observed. This predation must not result in a Western Screech Owl population fewer than 6 owls.

6.3.2 Objective: Assure proper maintenance of the nesting boxes

The nesting boxes must be cleaned annually and the floor of them covered with wood shavings or leaves. This should be done after July, when any fledgling owls would have flown the nest. Cleaning the boxes should be done so as to cause minimum stress on the owl. The boxes should be checked to ensure that they are stable. This must be done with care as the boxes are heavy and their structure may be compromised from being out in the elements for a full year.

6.3.3 Objective: Take annual observations about the successfulness of the nesting boxes.

Through periodic observations we will ensure the nesting boxes are being used successfully by the Western Screech Owl or if not that the Owl has established other satisfactory natural nesting sites. In the case that the Western Screech Owl has been outcompeted for the use of the nesting boxes and has not established natural nesting areas, we will then install additional nesting boxes.

6.4 Ensuring awareness within the community of the sensitivity of this re-established Western Screech Owl population.

6.4.1 Objective: Design and implement educational signage at the entrances of Mystic Vale

To promote the maintenance of a healthy Western Screech Owl population, signs should be installed at the entrances to Mystic Vale explaining the importance and sensitivity of the Western Screech Owl. The signs would offer information about the Western Screech Owl and its habitat within Mystic Vale. The signs would warn people of the re-introduction of the Western Screech Owl and that the population is sensitive to habitat destruction caused by human disturbances. Signage would also explain the significance of the restoration that is taking place. These signs would increase general knowledge and respect for the Western Screech Owl.

6.4.2 Objective: Create community engagement in the ongoing protection of the Western Screech Owl through social media and attendance at community events.

To promote knowledge about the Western Screech Owl we would attend small community events to provide information to the public. Attendance at events such as the University of Victoria Farmer's Market and in Cadboro Bay would allow for the community to become involved with the restoration of the owl. A Facebook page would allow for people to keep updated on the ongoing restoration of the Western Screech Owl (see Fig. 9). It would provide people a space to become educated and to get involved with bringing this owl back to Mystic Vale.

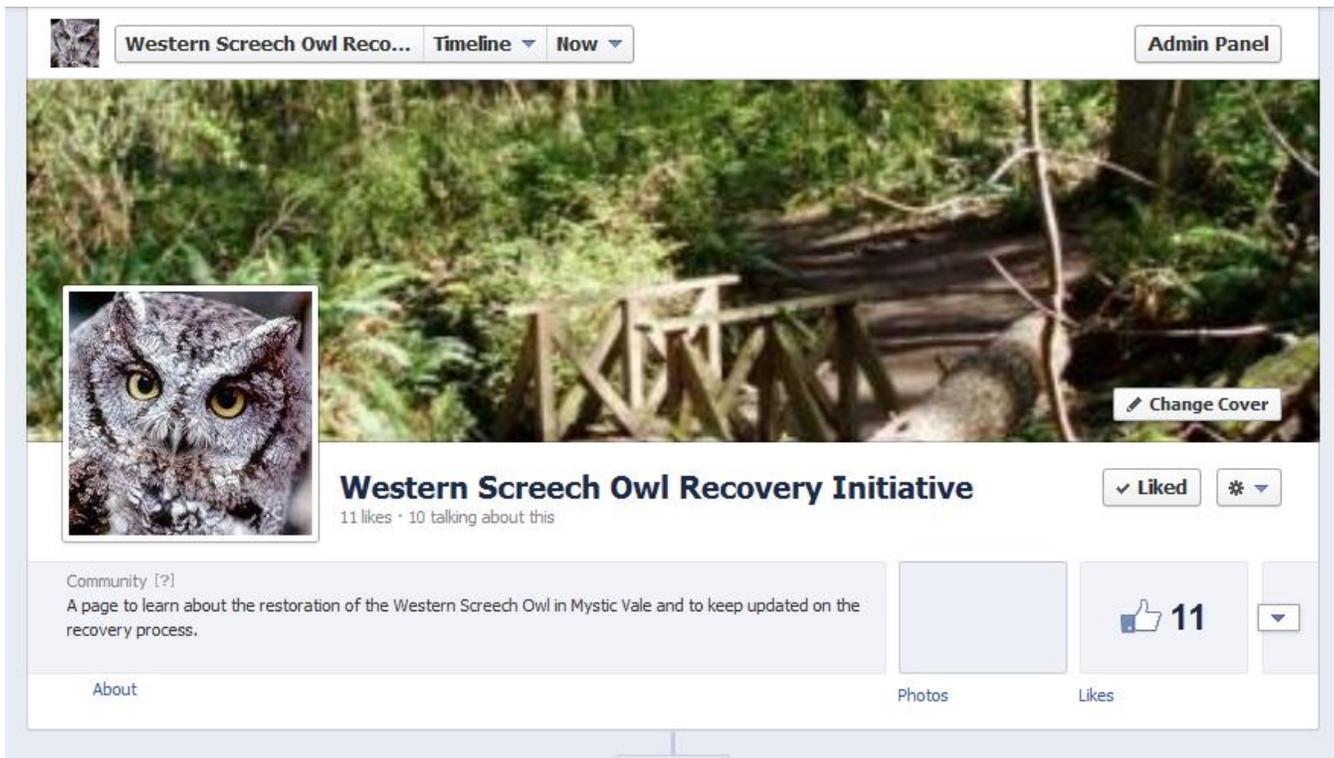


Fig. 9: Facebook page, 2012

6.5 Ensure continued absence of predation of the Barred Owl on the Western Screech Owl through annual monitoring of both Barred Owl and Western Screech Owl populations.

6.5.1 Objective: Monitor the populations of the Barred Owl and Western Screech Owl to determine if the Western Screech Owl is being predated on more greatly by the Barred Owl than its population can handle.

As the Barred Owl is a significant predator to the Western Screech Owl, Barred Owl populations must be closely monitored along with the Western Screech Owl population. The Barred Owl population can be monitored through listening to its calls and direct observation of its numbers. If it is found that the Western Screech Owl is not being affected by the Barred Owl then no action will be taken. If it is found that the Barred Owl is significantly decreasing the Western Screech Owl population in Mystic Vale to less than 6

Western Screech Owls, then action should be taken to mitigate this. A potential cull or relocation of Barred Owls may be necessary for a stable Western Screech Owl population.

6.6 Maintain a healthy ecosystem in Mystic Vale, so the Western Screech Owl can have a healthy population

6.6.1 Objective: Ensure that there are no human disturbances to Mystic Vale without consideration for the Western Screech Owl's habitat needs.

The University of Victoria owns the land where Mystic Vale is located. This means that the University of Victoria should be aware that any development in Mystic Vale would be highly detrimental to the ecological integrity of the forest and would significantly compromise the newly restored Western Screech Owl population.

6.6.2 Objective: Ensure that the ecological integrity and biodiversity of Mystic Vale is maintained through sustainable restoration projects.

There are many types of invasive species in Mystic Vale. These should be kept under enough control so that they do not take over any food sources of the Western Screech Owl or affect where they are nesting. Also, due to the level of human activity of the area, restoration projects should take place to keep the forest clean. This means picking up garbage and preventing damage to the ecosystem.

7.0 Monitoring and Evaluation

Meeting the goals and objectives are only the first few steps for restoring a healthy, sustainable ecosystem. Once the Western Screech Owl has been sufficiently restored to Mystic Vale it is important to measure success through site monitoring in relation to the objectives and goals that were stated in the previous section. Monitoring will be done on both a short and long-term basis, to ensure the success of the Western Screech Owl. Data will be gathered empirically and quantifiably by environmental studies students,

community and student volunteers, as well as the University of Victoria grounds maintenance staff. The ecosystem will be evaluated on the basis of performance standards or success criteria, and the data collected will be used to determine how successful or unsuccessful the restoration project has been in completing the goals that have been set out (Society for Ecological Restoration International Science & Policy Working Group, 2004). If certain criterion fails to be met, further action will be required by the restoration team in order to completely fulfill the stated objectives.

7.1 Monitoring the Western Screech Owl Population

Once introduced the population of Western-Screech Owl will be recorded on a quarterly basis for five years, and then an annual basis for twenty years. After this time, as long as there is a lack of interference, it is to be assumed that the population of Western Screech Owls is stable – but time-to-time monitoring may still be needed. To monitor the population, survey stations will be set up in Mystic Vale 300-400 m apart to ensure wide spread coverage of the area (Hocking, 2000). At least three surveys should be taken during the known Western Screech Owl breeding period from mid-February to early-April, and only on dry evenings. The audio lure method will be used, but as we want to minimize harm, and do not have the resources we will not be capturing and banding owls. Each survey site will begin with a five window of listening for Western Screech Owl, followed by playing 5-7 pre-recorded owl calls on a tape player followed by five minutes of listening for responses (Hocking, 2000). This process will then be repeated with a further 5-7 Screech Owl calls, and then another five minutes of listening. Owls heard will be recorded, and used to determine if a reproducing population of Owls is residing in Mystic Vale. Success will be determined if there are 6-12 healthy individual Western Screech Owls detected. Figure 10 shows the survey sites for monitoring the Western Screech Owl population.

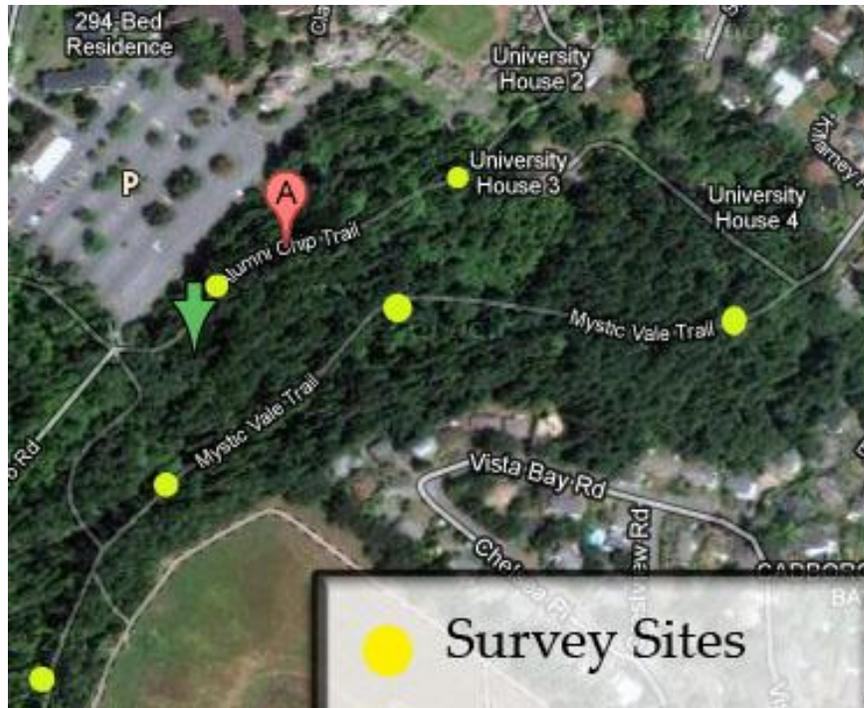


Fig. 10: Survey sites in Mystic Vale (Retrieved from Google Earth, 2012)

7.2 Monitoring the Use of Nesting Boxes

In order to monitor the use of nest-boxes, student volunteers will check them once a week. This will be done in the afternoon while the owls are asleep to minimize disturbance of the owls. Boxes will also not be checked during heavy rain, or during the Western Screech Owls incubation period. Data will be collected and analyzed to make sure that the nest-boxes are yielding positive use by the Western Screech Owl population of Mystic Vale. To determine the success of the nesting boxes, the data from the monitoring will be correlated with the data collected from the nest box surveys to determine if the owls are present in the areas near the nest boxes. Other species may have to be removed from the boxes if the Owl population is struggling to find habitat.

7.3 Monitoring the Barred Owl Population

The same audio lure process as monitoring the Western Screech Owl will be used to monitor the predator populations of the Barred Owl. Volunteers must be trained on recognizing the call of a Barred Owl, as opposed to the call of a Western Screech Owl. The pre-recorded calls of both Barred Owls and Western Screech Owls will be taken from <http://www.owlpages.com/sounds.php>, and recorded to a CD. The CD as well as a portable CD player will be stored in the Environmental Studies department and will be available for students, and staff interested in monitoring Owl populations. Success will be determined if there are no recorded Barred Owls recorded in Mystic Vale. If it determined that there are Barred Owls present in Mystic Vale that are actively preying on the Western Screech Owl remedial action in the form of culling will be required.

7.4 Monitoring the Ecological Integrity of Mystic Vale

Populations of invasive species such as English holly, Scotch broom, Himalayan blackberry, and Daphne-laurel, will be monitored by volunteers during the regular invasive species culls that happen around the University of Victoria campus. If the invasive species are determined to become an issue to the habitat of the Western Screech Owl, remedial action will be taken in the form of more frequent invasive species culls.

Closing Remarks

The aim of this restoration project is to restore the Western Screech Owl to Mystic Vale on the University of Victoria campus. The Western Screech Owl will not be able to regain its population without human intervention; therefore we will try to ensure that the Western Screech Owl is maintaining a healthy population (greater than 6 owls). The restoration of the Western Screech Owl is important because it is an indicator species for healthy riparian ecosystems (COSEWIC, 2002). In order for this restoration project to be successful, nesting boxes must be constructed and the proper location of the nesting boxes must be found. They must be on properly sized trees, and adequate distance apart, adequate distance from water and as far away as possible from human disturbance. In order for the newly restored Western Screech Owl population to be successful, the amount

of predation by Barred Owls must be regulated. Along with these restoration initiatives, there must be increased community awareness. This will be done by the creation and implementation of signage. It is highly important that all these components of the project are done correctly in order for the restoration project to be successful. This restoration project has the potential to return the Western Screech Owl in Mystic Vale if they were to be re-located to Southern Vancouver Island. Through the use of short term goals to create a suitable habitat for the Western Screech Owl and by accompanying those short term goals with long term monitoring, we can hope for a successful re-establishment of the Western Screech Owl to Mystic Vale.

Appendices

Appendix I

Taken Directly from Native Plants of Mystic Vale (Turner 1993) as seen in Hilary Harrop-Archibald's "Natural Features Study" (2007)

Native plants of Mystic Vale, Saanich, British Columbia

Plant species list written by Nancy J. Turner and Brett Heneke, January 20, 1993 (updated March, 1993) Environmental Studies Program University of Victoria.

The following is a list of Plant Species from Brief Survey of rim, slopes and creek side areas of Mystic Vale. Please note that many herbaceous perennials and annual plant species are not visible at this time of year. Species are listed alphabetically by scientific name within major categories of: trees; shrubs; herbaceous flowering plants; ferns and fern-allies; mosses and liverworts; lichens and fungi; and birds. Major categories are bolded and capitalized. Species are listed by species name, with Latin name in parenthesis.

TREES

Grand fir (*Abies grandis*)
Broadleaf maple (*Acer macrophyllum*)
Red alder (*Alnus rubra*)
Arbutus (*Arbutus menziesii*)
Black cottonwood (*Populus balsamifera*)
Bitter cherry (*Prunus emarginata*)
Douglas-fir (*Pseudotsuga menziesii*)
Cascara (*Rhamnus purshiana*)
Hooker's willow (*Salix hookeriana*)
Scouler's willow (*Salix scouleriana*)
Sitka willow (*Salix sitchensis*)
Western red-cedar (*Thuja plicata*)

Pacific yew (*Taxus brevifolia*)

SHRUBS

Saskatoon berry (*Amelanchier alnifolia*)

Red-osier dogwood (*Cornus stolonifera* ; syn. *Cornus sericea*)

Salal (*Gaultheria shallon*)

Oceanspray (*Holodiscus discolor*)

Orange-flowered honeysuckle (*Lonicera ciliosa*)

Hairy honeysuckle (*Lonicera hispidula*)

Tall Oregon-grape (*Mahonia aquifolium*; syn. *Berberis aquifolium*)

Common Oregon-grape (*Mahonia nervosa* ; syn. *Berberis nervosa*)

Indian-plum (*Oemleria cerasiformis*)

False box (*Pachistima myrsinites*)

Mock-orange (*Philadelphus lewisii*)

stink currant (*Ribes bracteosum*)

black gooseberry (*Ribes divaricatum*)

Red-flowering currant (*Ribes sanguineum*)

Dwarf wild rose (*Rosa gymnocarpa*)

Nootka rose (*Rosa nutkana*)

Thimbleberry (*Rubus parviflorus*)

Salmonberry (*Rubus spectabilis*)

Trailing wild blackberry (*Rubus ursinus*)

Red elderberry (*Sambucus racemosa*)

Snowberry, or waxberry (*Symphoricarpos albus*)

Red huckleberry (*Vaccinium parvifolium*)

HERBACEOUS FLOWERING PLANTS

Vanilla-leaf (*Achlys triphylla*)

Sedge (*Carex* spp.)

Coralroot (*Corallorhiza maculata*)

Sweet-scented bedstraw (*Galium triflorum*)

Large-leaved avens (*Geum macrophyllum*)
Rattlesnake plantain orchid (*Goodyera oblongifolia*)
Purple pea (*Lathyrus nevadensis*)**
Twinsflower (*Linnaea borealis*)
Wood-rush (*Luzula* sp.)
Skunk-cabbage (*Lysichitum americanum*)
Indian pipe (*Monotropa uniflora*)
Siberian miner's-lettuce (*Montia sibirica*)**
Nemophila (*Nemophila parviflora*)
Water-parsley (*Oenanthe sarmentosa*)
Sweet cicely (*Osmorhiza purpurea*)**
Sanicle (*Sanicula crassicaulis*)
Yerba buena (*Satureja douglasii*)
False Solomon's-seal (*Smilacina racemosa*)**
Hedge-nettle (*Stachys cooleyae*)
Common twisted-stalk (*Streptopus amplexifolius*)**
Tall fringecup (*Tellima grandiflora*)
Fringecup (*Tiarella trifoliata*)
Starflower (*Trientalis latifolia*)
Western trillium (*Trillium ovatum*)
Stinging nettle (*Urtica dioica*)
(NOTE: a number of grass species were also observed, but not identified)
** additional species from May, 1993

FERNS AND FERN-ALLIES

Lady fern (*Athyrium filix-femina*)
Spiny wood fern (*Dryopteris expansa*)
Common horsetail (*Equisetum arvense*)
Branchless horsetail (*Equisetum hiemale*)
Giant horsetail (*Equisetum telmateia*)
Licorice fern (*Polypodium glycyrrhiza*)
Sword fern (*Polystichum munitum*) (NOTE: Mystic Vale contains one of the most spectacular

populations of sword fern anywhere on southern Vancouver Island)
Bracken fern (*Pteridium aquilinum*)

SOME MOSSES AND LIVERWORTS

(NOTE: This list is very incomplete, representing only a fraction of the species occurring in the Vale)

Antitrichia moss (*Antitrichia curtipendula*)

Fork moss (*Dicranum scoparium*)

Hypnum moss(*Hypnum circinale*)

Stolon moss (*Isoetecium myosuroides* ; syn. *I. stoloniferum* , *I. spiculiferum*)

Oregon feather moss (*Kindbergia oregana* ; syn. *Eurhynchium oreganum*)

Feather moss (*Kindbergia praelonga*; syn. *Eurhynchium praelongum*)

Palm-tree moss (*Leucopelis menziesii*)

Douglas neckera moss (*Neckera douglasii*)

Neckera moss (*Metaneckera menziesii*)

Mnium moss(*Plagiomnium insigne*)

Plagiothecium moss (*Plagiothecium undulatum*)

Leafy liverwort (*Porella navicularis*)

Mnium moss(*Rhizomnium glabrescens*)

Feather moss (*Rhytidiadelphus loreus*)

Triangle-leaved feather moss (*Rhytidiadelphus triquetrus*)

Leafy liverwort (*Scapania bolanderi*)

NOTE ON LICHENS and FUNGI

A complete inventory of Mosses, Liverworts, Lichens and Fungi in the Mystic Vale area should be made. A few identifiable lichens seen include: *Ochrolechia* sp.; *Cladonia* spp.; *Cetraria* spp.; *Platismatia glauca* ; *Parmelia sulcata* ; *Hypogymnia physodes* ; *Peltigera* sp.; *Usnea hirta* . A wide variety of fungi, including mushrooms and tree fungi, also occur in the area, contributing to the overall biodiversity.

BIRDS

NOTE: It is particularly important to survey this area on a year-round basis, not just over a short period, because the woods of Mystic Vale and surrounding areas may provide critical habitat not just for resident bird species, like winter wren and rufous-sided towhee, but also for migratory species, which need these areas for resting and feeding on their northward and southward journeys. Woodpeckers abound in the vale, as do a wide variety of small songbirds--kinglets, bush tits, juncos, creepers, wrens. Owls, eagles and other raptors need the tall trees and snags for nesting and perching.

Appendix 2

Taken directly from BC Hydro's Fish and Wildlife Compensation Program Build an Owl Nest manual.
Screech Owl Nesting Box Instructions

Measurements

3" Entrance Diameter

Wood Requirements

One piece of lumber (untreated solid wood or plywood) – 1" x 10" x 8'

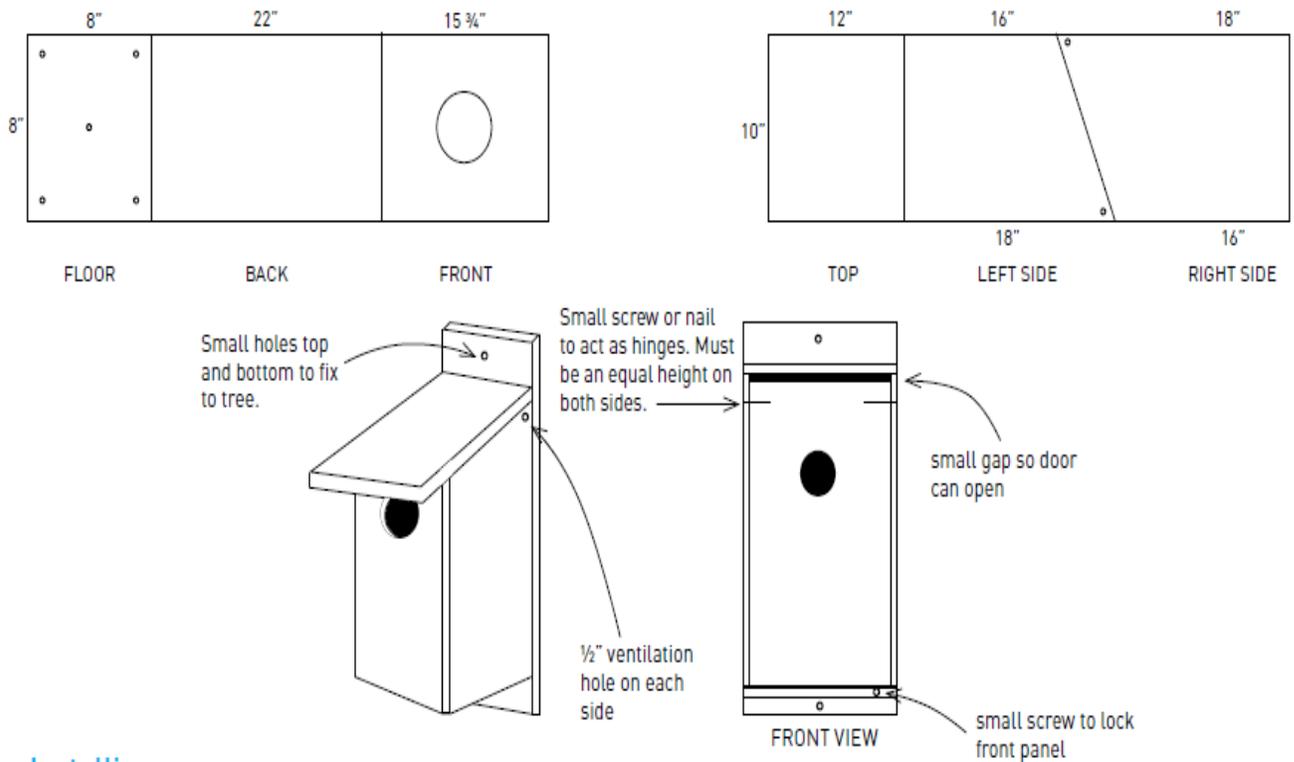
Key points

- Floor should be at least 7 ¾" x 7 ¾".
- The hole should be at least 10" above the floor.
- Score the inside of the front panel to allow the young birds to climb up.

Steps

1. Cut the wood as per the measurements below.
2. Cut the entrance hole in the front panel (should be at least 10" above the floor).
3. Score the inside of the panel with horizontal cuts (1/4" deep and 1" apart) from the base to the hole.
4. On the side panels drill two ½" ventilation holes, 1" from the top.
5. On the bottom panel drill five ½" drainage holes (at the corners and one in the centre).
6. For the top, cut a small angle off the back edge to allow it to fit properly.

7. Screw all panels together, except the front, using 1 ½" galvanized or coated screws. Make sure that the longer edges of the side panels are attached to the back panel to allow for the sloping roof.
8. Add the front panel remembering to leave a small gap at the top. Use two nails, or pivot screws (at exactly the same height) to act as hinges. Use a small screw at the base that can easily be unscrewed to allow for annual cleaning. (See front view.)
9. Seal the top with caulking compound.



Installing

- Attach the box to a large tree near streams or rivers for screech-owls
- Place the box 3 to 5 metres above the ground. **Warning: The box is heavy so use caution when on the ladder. Get professional help if required.**
- Face the nest box opening to the south or southwest.
- Clean the box every year, placing a 1" layer of clean shavings or leaves in the bottom (not sawdust)

References

- Baum, J., Campbell, K., Chanoine, M., Struthers, D. (2009). *Towards a future for Mystic Vale*. University of Victoria, BC: School of Environmental Studies.
- Committee on the Status of Endangered Wildlife in Canada. (2002). *Assessment and Update Status Report on the Western Screech Owl*.
- Cannings, R.J. and T. Angell. 2001. Western Screech-Owl (*Otus kennicottii*). In *The Birds of North America*, No. 597 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Harrop-Archibald, H. (2007). *University of Victoria natural features study Bowker Creek, Cunningham Woods, Upper Hobbs Creek/Mystic Vale*. University of Victoria, BC: Restoration of Natural Systems Program.
- Help an Owl. Build a Nest. *BC Hydro Fish and Wildlife Compensation Program*. Retrieved from:
http://www.bchydro.com/etc/medialib/internet/documents/about/our_commitment/fwcp/pdf/build_an_owl_nest_box.Par.0001.File.gds11_076_fwcp_owl_nest_box_plans.pdf
- Hocking, M. (2000) Uvic Sustainability Project. Retrieved from:
http://www.geog.uvic.ca/dept2/faculty/dearden/uvsp_hocking%20report.pdf
- Recovery Team, . British Columbia. Ministry of Environment. *Recovery Strategy for the Western Screech-Owl, macfarlanei subspecies*. 2008. Print.
- Society for Ecological Restoration International Science & Policy Working Group (2004). Retrieved from: <https://www.ser.org/resources/resources-detail-view/ser-international-primer-on-ecological-restoration>
- Squidoo. (2012). Retrieved November 18, 2012, from:
<http://www.squidoo.com/barredowlvancouverisland>