School of Environmental Science
University of Victoria
ES 311/ER 341 Fall 2012
Dr. Brian Starzomski

Reintroduction of the Yellow-billed Cuckoo

Shelby Black
Chorong Kim
Arwen Palmer-Stone
Ira Webb

TABLE OF CONTENTS

1. Introduction (Ira Webb)

1.0 Introduction

The Yellow-billed Cuckoo (*Coccyzus americanus*) is a species of neotropical migratory bird that is one of the many victims of human expansion in British Columbia. According to the Canadian Conservation Data Centre (CDC) and E-Fauna BC (2012), the Yellow-billed cuckoo is primarily associated with deciduous woodlands and riparian groves, particularly consisting of willow or cottonwood. It forages mostly on insects, occasionally on fruit or small frogs or lizards. The CDC lists the species as extirpated from the province, likely due to destruction of appropriate habitat for agriculture, urban expansion, and hydroelectric development. The only recent records of its presence are as vagrants, but breeding formerly occurred on the south coast and in the lower Fraser River valley. There is controversy over the division of the species into two separate geographic subspecies, the western (*C. a. occidentalis*) and eastern (*C. a. americanus*), and therefore over the identity of birds sighted in BC, but their presence suggests that the possibility for a consistent population to exist in the province is there. Currently the species breeds widely Southeastern Canada, the Eastern United States, Arizona, and New Mexico, with smaller isolated populations in California, Utah, Wyoming, Idaho, and Montana.

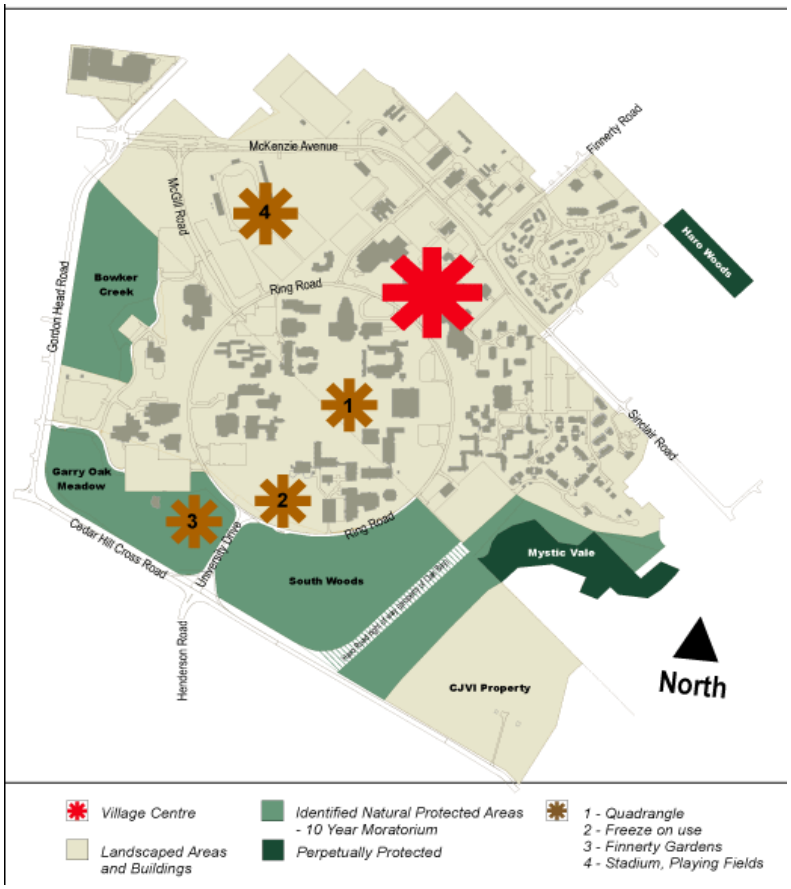
The current state of the Yellow-billed cuckoo is unfortunate, as it is a beautiful specimen. It is for these reasons that we propose the physical reintroduction of the bird to the southern BC region. We hope to monitor the release of captured cuckoos during breeding season into deciduous groves on campus at the University of Victoria, an area where predation pressures are less frequent, in hopes of reacquainting the species with the Pacific northwest climate, and laying

the building blocks for the successful return of breeding populations to suitable areas throughout the province. What follows is a reintroduction plan we hope will promote the return of a beautiful, unique species to its former range.

2. Site analysis (Chorong Kim)

2.0 Introduction

The University of Victoria is situated at 48° 28’ N and 123° 19’W on southern Vancouver Island, British Columbia, Canada. Sitting on traditional territories of the Straits Salish and Coast Salish peoples, the campus today occupies 162.7 ha (402 acres).



Source: University of Victoria, 2006.

Figure 1. Natural and protected areas of the University of Victoria campus.

Since 1967 the University has expanded to 91 buildings on campus; however, a large portion of the campus is still natural areas, extending over 116.6 ha (288 acres), or 71% of the land base. The woodlands of the University of Victoria contain relatively large areas of forested wildlife habitat within the Greater Victoria region (Harrop-Archibald, 2008).

Fifty years ago, the north part of the campus was a bare area while the south area was a second growth forest. The contrast was greatly reduced due to more than 10,000 trees being planted throughout the campus since then (University of Victoria, 2006). Our study site contains a mosaic of Douglas fir and grand fir (*Abies grandis*) forests, Garry oak meadows, forested creek ravines, and wetland habitats (Lloyd 2004). The natural areas which currently belong to the University of Victoria are mostly located on the outskirts of Ring Road including Haro Woods, Mystic Vale, the South Woods, the Garry Oak Meadow and the Bowker Creek Wetlands. The natural areas in the campus are not only invaluable to the university for the teaching, research, and aesthetics, but also for its importance in supporting the ecological and cultural knowledge of the community.

2.1 Biotic conditions

2.1.1 Abundance, Diversity and Distribution of Species

The major tree species found in our study site include: Douglas fir (*Pseudotsuga menziesii*), Broad-leaved Maple (*Acer macrophyllum*), Western Red cedar (*Thuja plicata*), Arbutus (*Arbutus menziesii*), Red Alder (*Alnus rubra*), Grand Fir (*Abies grandis*), Black Cottonwood (*Populus trichocarpa*), Garry Oak (*Quercus garryana*), Western Pacific Yew (*Taxus brevifolia*), and several species of willows (Harrop-Archibald, 2008). Both cottonwoods and willows serve as ideal tree species for Yellow-billed cuckoo (Gaines, 1974) and are found in

Mystic Vale and Haro Woods, which are currently under protection from development in perpetuity. The campus also abounds with dead or dying trees which increased wildlife habitats for organisms that require woody debris for reproduction, foraging, and/ or shelter (Hocking 2000; Harrop-Archibald, 2008). This wide range of vegetation allows a diverse array of wildlife in the study site.

University of Victoria boasts its high richness in bird species across the campus. In addition to several small mammal species and many invertebrates, fauna at UVic relying heavily on wildlife trees include Pileated Woodpecker, Downy Woodpecker, Hairy Woodpecker (*Picoides villosus*), Northern Flicker (*Colaptes auratus*), Great Horned Owl (*Bubo virginianus*), Barred Owl (*Strix varia*), Brown Creeper, Red-breasted Nuthatch (*Sitta canadensis*), and Chestnut-backed Chickadee (Hocking 2000). Particularly within deciduous treed areas, small songbird population is said to be very stable and rich in number and variety. According to Harrop-Archibald (2007), there has also been an increase in bird population such as Cliff Swallow, Barn swallow, and European Starling.

There is minimal amount of recent information available on most of the vertebrate species found in campus; however, Harrop-Archibald reports the sightings of small mammals such as house mouse (*Mus musculus*), deer mouse (*Peromyscus maniculatus*), Norway rat (*Rattus norvegicus*), and some voles (Harrop-Archibald, 2007). Black-tailed deer (Odocoileus hemionus) and river otters (Lontra canadensis) were also found in Mystic Vale.

2.1.2 Potential Problem Species

Vancouver Island is considered to be containing the highest number of exotic species in British Columbia along with Haida Gwaii (Austin *et al*., 2008). The natural areas on campus are

especially vulnerable to invasions of foreign plants due to their high degree of disturbance and the widespread availability of seeds as a result of cultivation that has taken place in the nearby areas (Harrop-Archibald, 2008). Introduced species are dispersed throughout the entire natural areas studied in this project, posing as the most significant threat to the native species.

The majority of the introduced species recorded are vascular plants. The most prevailing exotic plant species on the campus are daphne (Daphne *laureola*), holly (*Ilex aquifolium*), English hawthorn, Himalayan blackberry, common periwinkle, and English ivy (*Hedera helix*) (Hocking, 2000). Of these species the ivy, holly and blackberry are the most invasive. Over time, invasive species have the potential to completely alter the forest community, leading to a major shift in vegetation dynamics and competition of species (Hocking 2000). There are ongoing concerns with regard to their impacts to soil conditions and drainage patterns from construction and other activities.

European rabbit (*Oryctolagus cuniculus*) was formerly the most prevalent introduced animal species in our study site when its population reached until 2500 rabbits. The University of Victoria performed a long-term feral rabbit management across the campus, which showed very effective results (Smith, 2012); however, the campus is now dominated by grey squirrel (*Sciurus carolinensis*). Other vertebrate species in the campus are common raccoon (*Procyon lotor*) and deer (*Odocoileus* sp.) The inventory of many alien insects, such as beetles, true bugs and plant lice, is incomplete, while the abundance of alien insects in other areas already far exceeds that of alien vascular plants (Harrop-Archibald, 2008).

Published data on introduced amphibian and reptile species on the campus are also lacking; however, record on Red-eared slider turtles' (*Trachemys scripta* ssp. elegans) introduction to a pond adjacent to the Cunningham building exists (Harrop-Archibald, 2008).

2.1.3. Rare, Threatened and Endangered Species

Native Douglas squirrel (*Tamiasciurus douglasii*) disappeared from campus on account of the invasion of the grey squirrel. Although the cause was not the introduced species, a number of disappearances of native bird species have been reported. Ground nesting birds such as Western Meadowlark and Common Nighthawk disappeared from campus since 1970's due to habitat destruction (Tatum et al., 1971; Harrop-Archibald, 2007). The number of wintering ducks and migrant shorebirds rapidly declined when the swampy area behind Vikes stadium became desiccated; however, Cinnamon Teal was still seen to be breeding on campus (Harrop-Archibald, 2007).

2.2 Abiotic conditions

2.2.1 Climate

Our site is included on the Coastal Douglas-fir Biogeoclimatic Zone, which lies in the rainshadow of the Olympic Mountains and the mountains of Vancouver Island. The site, therefore, receives approximately 70 cm of rain annually, and is characterized by a moderate climate with mild, wet winters and warm, dry summers (Cannings, 1996; Hocking, 2000). This climatic regime is deemed unusual for coastal B.C. It led to a diversity of ecosystem types and relatively high productivity, hence contributing significantly to biodiversity values in the province (Harrop-Archibald, 2007)

2.2.2 Hydrology

Our study site is located at a topographic high point between Gordon Head and Cadboro Bay and is part of four watersheds: Finnerty Creek to the north, Sinclair or Cadboro drainage

system to the north-east, Hobbs Creek to the east, and Bowker Creek to the west (Lloyd 2004). ` The characteristic topography of broad, gently sloping upland surface without a steep incline induces high runoff velocity along with vegetation (Harrop-Archibald, 2007). In an average year, only one third of the annual precipitation travelled to the streams on campus (Integrated Stormwater Management Plan). In addition, the forest canopy and organic-rich topsoil floor typical of the surrounding watershed intercepts large quantities of runoff (Harrop-Archibald, 2007).

In recent years, however, a significant change in hydrology was observed in wetland areas which are larger for longer periods of time (Harrop-Archibald, 2007). This is in part due to increasing impervious surfaces which do not allow water to be dissipated through soil infiltration. In 2004, impervious surfaces such as roofs, sidewalks, and parking lots increased to approximately 23.5% from 6.5% observed in 1956 (Lloyd 2004). The runoff volume from the campus lands has doubled, which resulted in water being focused in depressed wetland areas. Other potential factors responsible for the hydrological changes include changes in Faculty Club drainage, increased irrigation in the sports fields, and increased rainfall in recent years (Harrop-Archibald, 2007).

2.3 Cultural conditions

2.3.1 Changes in and impacts on nature due to humans

Some portions of the natural areas of University of Victoria campus suffer from human disturbances, and the best example for this is the Bowker Creek and Mystic Vale. Human waste was sighted across the site, also along pathways and roadways. Waste on the landscape becomes

a negative impact on the aesthetic for community members and others who are exposed to it, let alone the potential sources of pollution and toxic substances to the environment.

The most common contaminants in the University of Victoria stormwater are sediments and oily drippings that are washed off from parking lots and roads (Lloyd 2004). Furthermore, the low permeability of the soils due to marine clay composition makes a poorly drained surface that leads to flooding, erosion, and pollution (Hocking, 2000). Less tangible non-point source pollutants often include pathogens, nutrients, heavy metals, pesticides, and other toxins; however, these have not been quantified for the university campus (Harrop-Archibald, 2007).

2.3.2 Current and anticipated use

Despite the vital importance of natural areas on campus to the University, some of them are not protected from development. According to the 2006 Campus Plan, areas such as the South Woods, Finnerty Gardens, Garry Oak Meadow and Bowker Creek wetlands have a 10 year moratorium against development (University of Victoria, 2006); however, once the moratorium is up, it is possible that those regions are reconsidered for development. The Garry Oak Meadow, Mystic Vale, and Bowker Creek are classified as "sensitive ecosystems" as part of a municipal sensitive ecosystem inventory due to their unique ecological characteristics. Although the Mystic Vale and Haro Woods are protected areas (University of Victoria 2006), for many natural spaces on campus this is not the case. These areas are considered natural and relatively undisturbed by development. There is also a ten year freeze on development within Cunningham Woods (University of Victoria 2006).

The University Campus Plan (2006) outlines their future implementation activities and monitoring programs to steward appropriate natural areas back to better conditions, such as

replacing invasive species with native plants, except in the University Gardens. It is anticipated that following the restoration, further protection of the area is employed.

3. Policy, Goals and Objectives (Arwen Palmer-Stone)

3.0 Policy

The Yellow-billed Cuckoo is a small gray bird with a bright yellow beak, a white breast and an interesting song, altogether a rather charismatic species. The Yellow-billed Cuckoo survives mostly on insects and is currently facing environmental pressures in almost every population, leaving its future uncertain. Our goal is to enable the successful establishment of a genetically diverse breeding population of the Yellow-billed Cuckoo on southern Vancouver Island, centered at the University of Victoria campus. This must be done while adhering to all laws pertaining to introduction and transportation of species and to the legal principals and guidelines set in place by the federal and provincial governments. The general public and the University staff and students will be encouraged to participate in the re-introduction project through various means, and by being given ample opportunities to provide feedback, input, and ideas.

3.1 Goals

3.1.1 Public Involvement

The public has the potential to play a key role in the successful introduction and monitoring of any species. As it is unlikely that the species being introduced will actually remain within the area of introduction, birds are particularly difficult in this respect as their movement is

much less restricted than ground or water bound species. It is almost certain that the Yellow-billed Cuckoo will range outside of its intended area of reintroduction; knowing this, steps can be taken to ensure its well being outside of the University campus.

3.1.2 Reintroduction

Before the birds themselves are reintroduced to the University campus preparations must be made to assure a smooth reestablishment. The site must be fully examined to determine if it is a suitable habitat for the intended species, the Yellow-billed Cuckoo, which has certain breeding, climatic, and nutritional requirements. Any potentially negative interactions between the target species and those already residing at the site must be considered, as well as, the number of birds to be reintroduced and the minimum population number require for a prosperous colony. The effect on the site and the population that the Yellow-billed Cuckoos are to be retrieved from should also be taken into account when planning the removal of bird's from their original population. All legal and transport paper work and any other species documentation required must follow the proper procedures and guidelines.

3.1.3 Future of the site

For the reintroduction of the Yellow-billed Cuckoo to be effective the program must be maintained, it must be flexible, and it must be highly visible. In order to maintain healthy breeding population environmental needs must be met, such as nesting sites and foraging areas, as well as, influxes of new genetic material to maintain genetic integrity. Effective monitoring and flexibility in management are also important. Change is constant, environmental change, social change, and climate change are just a few of the processes that could negatively impact the

Yellow-billed Cuckoo, threats that could be minimized by effective monitoring and a flexible management plan. Visibility is important for public involvement; the more people know what is taking place the more likely it is that volunteers and supporters will be found. By making use of social media and the internet in general, large numbers of people can be reached with very little effort. The future we hope to achieve is one where the University of Victoria campus is inhabited by many healthy breeding pairs of Yellow-billed Cuckoos.

3.2 Objectives

3.2.1 Considerations for Reestablishment

I. Population

The hazards of small populations are many and varied. Without a sufficiently large and genetic diverse population species can become vulnerable to complications such as, demographic and environmental stochasticity, allee effects, and inbreeding depression, all of which can lead to extinction. Alternately, any area will have a fixed carrying capacity, meaning that it can only support a certain number of individuals of any given species. If species numbers were to go beyond the carrying capacity the risk of die-offs due to things like lack of food or disease would greatly increase.

II. Implications for Relocation

Relocation can seem like giving these birds a new opportunity, but only if the population that the individuals are selected from does not dies out due to loss in numbers. Almost all populations of Yellow-billed Cuckoo are under multiple stressors and as a result, their population numbers are low. Removing too large a number of individuals could put potentially deadly strain

on the remaining population, which is why is it vitally important to research any potential donor populations before attempting a removal and relocation.

III. Breeding Pairs

After considering both a potential new population of Yellow-billed Cuckoos on the University campus and the current populations, it was determined that the extraction and re-introduction of 10 reproductively active adults from an American population located at a refuge in Arizona would be the most advantageous for the new population while causing the least harm to the existing populations. If the re-introduction is successful and several breeding pairs remain at the site the introduction of new genetic stock will be considered to maintain a higher level of genetic diversity than allowed by only 4-5 breeding pairs. If at any point in the future, lower Vancouver Island has a population large enough to hit carrying capacity, steps should be taken to propose further re-introductions and expansion of habitat into other locations.

3.2.2 Public Participation

The more people are behind a project, the more likely it is to flourish. It is our hope to combine support from students and faculty, government, NGOs, and the general public into a successful re-introduction of the Yellow-billed Cuckoo to the University of Victoria campus.

I. Students and faculty

There are many ways to involve the students and faculty of the University in this re-introduction project. Marks are a wonderful motivator; if every student in a class were given 1 mark per hour of time with a cap at 10 marks or so; many volunteer hours could be generated.

The best way to organize this would be as an optional replacement for marks that were unsatisfactory, rather than a required portion of a course, thus making it an option for many courses, as opposed to just one. For example, in a class of 30 students, with 15 choosing to gain extra marks in this way, there could be as much as 15 x 10 = 150 hours worth of volunteer time. Using these student volunteer hours and working with faculty, a website could be operated with links to social media and the University website. Another option could be student donations; if had the option to link the main website to their My page directory, they could receive regular updates, along with this there could be an option to add money to your fees, ranging from small amounts such as $1 to much larger ones. These strategies could be used for many different projects.

II. General Public

Civic support, both in spirit and financially, would be very helpful to this project. We live in a rapidly changing environment, which means ways used to inform some people will not work on others. For the most exposure possible we suggest the combination of a website, radio or T.V. spotlight, perhaps on the CBC, and possibly exposés in any local avian publications. The website would most likely reach the largest number of people and should include a linking option for Facebook, so that people could follow the recent events taking place in the re-introduction, links to the University My page directory, and a live feed so that people could actually watch the Yellow-billed Cuckoo from the comfort of their own homes. Support from governmental bodies, as well as, NGOs such as the Wild Arc would be very helpful. This support would not always come in the form of funding, the Wild Arc would be indispensable if one of the re-introduced birds were injured or was suffering from an illness.

3.2.3 Monitoring

An ideal monitoring program for the University campus would be one that combines support from government, NGOs, and is well integrated within the community, combined within classes and easily accessible via social media. If the public integration in the project is successful the monitoring aspect could become much less arduous due to the ability of the general public to make posts on the website documenting sightings or possible sightings. The level of monitoring should be high enough to actually be of value but not so high that it becomes unfeasible or extremely costly. Any plan set in place must also be flexible to address any change in the needs of the species, the social conditions, or the climatic conditions; thus leaving room for frequent re-evaluations of the success and current functionality or the management scheme.

4. Project Design (Ira Webb)

4.0 Design

4.0.1 Capture

The controversy over subspecies designation has resulted in the Yellow-billed Cuckoo not being afforded endangered species status, therefore, it will be easier to approve a translocation project. We will capture adults from a western residing American population. The western individuals have been shown to be larger, with stouter bills, and also have been observed breeding later than their eastern counterparts (Farrell, 2006). These attributes may prove beneficial to the establishment of introduced individuals. Furthermore, keeping western birds in the west reduces the chances of introducing photoperiodic shock due to differing daylight hours. We propose capture of 10 reproductive adults, 5 males and 5 females, from a refuge in Arizona,

as survey numbers have been consistently higher than in surrounding states. A rough estimate for total cost per pair to be moved is approximately five to six thousand dollars per pair, putting first year costs for this project in the range of twenty-five to thirty thousand dollars at least.

4.0.2 Release Site

We feel that the University of Victoria campus is an area that is suitable for release due to the presence of appropriate habitat. It is for these reasons that we propose the release of captured birds in two areas on campus, Mystic Vale and Bowker Creek. These are the two significant riparian areas on campus, and both possess appropriate tree species (Figures 4 and 5). They also form a near-continuum of natural space with the other woodlands surrounding campus, particularly South Woods and Haro Woods, both of which also contain suitable habitat trees. Proximity of release to the campus also opens the door for future monitoring by students and faculty should the reintroduction prove successful.

4.0.3 Monitoring

Monitoring and management all depend on the activity of the birds beyond the initial release point. Hopefully the birds acclimatize to the release areas sufficiently before freeing occurs so they remain nearby for the breeding season. Released birds having been tagged will be followed and breeding behaviour monitored throughout the season. Behaviour at time of migration will also be monitored by our group. Migration will be tracked and location observed

regularly until the following breeding season, where the project will be reassessed depending on successful returns, mortality, etc., and further translocations likely undertaken. Opportunities also exist to work with other restoration projects on campus restoring habitat and species such as butterflies.

4.0.4 Population Establishment

It's hoped that after the first reintroduction season, 4-5 breeding pairs will have nested. Subsequently, we hope for return and nesting of a number of pairs similar to or slightly less than this. Subsequent reintroductions in the following 2 – 5 years would be made in hopes to obtain approximately 5 – 10 regular breeding pairs on and around the campus. These establishments would have to likely be subsidized with further introductions over 2 – 5 years in different areas around southern Vancouver Island. We estimate that successful recolonization in the south of the province would be achieved if in southern BC cuckoos were breeding in the hundreds of pairs.

Future release programs may incorporate the capture of eastern subspecies individuals, to examine their success in western breeding areas and to possibly increase the genetic diversity of western breeders through east-west hybridization.

5. Implementation and Management (Shelby Black)

5.0 Implementation

5.0.1 Site Preparation

In order for implementation to occur, site preparation must be conducted. In the case of species reintroduction there is not a lot of physical site preparation required, with the exception of creating an area for rehabilitation and monitoring before full release of the species. However, the site must be surveyed before and after the reintroduction to assure that all required aspects needed for the species are present. These aspects should be determined before any other part of the site preparation begins.

The first aspect that must be considered is the conditions of the release site. The site for release, discussed in section 2.0, should ideally be within the historic range of the Yellow-billed Cuckoo and possess the desirable habitat for such species. In this case, the Yellow-billed Cuckoo had once populated the southern tip of Vancouver Island until the 20th century (Fiore, 2003).

Source: Laymon, 1987.

Figure 2. Historic and current ranges of Yellow-billed Cuckoo.

As depicted in Figure 2, the designated release site for the re-introduction resides within the historic range of the Yellow-billed Cuckoo and many of the necessary habitats are present in these areas, also discussed in 2.1.0.

Another aspect that must be considered is the vulnerability of the release site. This includes an evaluation of the area and its uses. For example, if the release site is located within a protected wildlife refuge, then there will be little disturbances for the reintroduced species; however, other sites may possess threats. The release area should not contain threats beyond the capacity that the species can allow, such as diseases, pollution, competition with other species, and habitat loss. The release site should have a reliable plan of long-term protection for the species and their release habitat (Beck, 2007). The plan of further protection of the release areas was also discussed in section 2.4.1

When determining the proper release area the aspect of capacity must also be planned. The area selected for release must be able to sustain a growth of population in the case of successful reintroduction or have near surrounding area that may also be habitable for such a species. For the reintroduction of the Yellow-billed Cuckoo, the University of Victoria campus was designated a great location to begin the project. As stated in section 2.0, the university campus consists of over 116.6 ha of natural areas. In California, the Yellow-billed Cuckoo requires approximately 20 ha of riparian forest (Halterman, 1991) that consists of woodland with thick undergrowth. The ideal habitat would be deciduous riparian woodland with nearby water sources (Hughes, 1999). Several areas of the university campus provides these fundamental needs of the Cuckoo species.

The reintroduction of a species should only be performed once the proper preparation

and requirements are present and are likely to remain viable for the future populations. Many aspects need to be considered when preparing for a large translocation of species. These aspects include nesting habitat, food sources, predators, and many more. With the proper food sources, nesting habitats, and surrounding resources; the University of Victoria campus is a great location to designate the release site for the Yellow-billed Cuckoo.

5.0.2 Planning Procedures

I. Finance

In order to conduct a reintroduction project, funding must be secured. Reintroduction requires a substantial amount of funding from reliable sources. Before commencing any aspect of the project, the full funding is needed in order to conduct the pre-preparation steps, the reintroduction process, and the long-term monitoring of the species once released. When considering funding some aspects that will need to be included are: wages of all persons involved (excluding volunteer efforts), resources needed for the individual species, equipment needed for all aspects of the entire program, transportation, and any other resource needed during this time. The funding for the project can be from agencies, personal, private owners, donors, and other foundations. Much effort will be needed to acquire the proper funding amount.

II. Professional Assistance

Many professional team members are required during the reintroduction process. Some individuals that will be necessary, at minimum, are:

- A biologist familiar with the Yellow-billed Cuckoo and its needs
- A veterinarian for transport, health checks, and monitoring after transport.

- An individual familiar with habitat assessments to conduct a pre-planning inspection of the site.
- A government official to aid with documentation and licensing appropriate for reintroduction.

III. Local Participation

It is very important in any restoration project to involve the local community in any plans prior to performing the project. The local community should be informed and approve of the project prior to commencing. It is also very important to engage the community in assisting directly with the project. This will allow for the education of these species and public interest and will ultimately help aid with their protection and the higher rate of success. The local public can help in a variety of aspects with the reintroduction process; such as, volunteering, field assistants, student positions, educators, monitoring positions, campaign help, perhaps even other scientists interested in aiding the cause.

IV. Documentation Approval

A very important aspect of reintroduction is the documentation and permits required to perform such a task. To allow for the legalization and approval of reintroduction of a species, especially from one country to another, is a difficult procedure. The appropriate documents and permits must be obtained in order to capture, transport, and release a species into a different region. Specialized permits are required if such a species is listed under the endangered species databases (Environment Canada, 2012). In order to be approved for such permits the proper information must be present. This information may include a detailed description of species,

habitat, and reintroduction process. The project will only be approved if government officials are aware of all aspects of the restoration and the proper scientific data is present (Government of Manitoba, 2012).

V. Release Site

As previously described in section 5.0.1, selection of the proper release site is a large component of site preparation. The release site should be assessed for habitat resources, population capacity, conservation, predator threats, health risks, human interactions, threats from surrounding areas, as well as others. The reintroduction should only take place if the site is adequate for the species being translocated. These assessments are also important for other reasons, such as the approval of permits, discussed in the previous subsection, and for the engagement of locals and other officials, discussed in part III of this section.

5.0.3 Sources of Individuals

Determining the source area for collection of individuals can be a difficult task. Populations of the Yellow-billed Cuckoo have become rare in the western regions, or extirpated completely, and are continuing to decline from these areas, especially in the north western region (Cornell Lab, 2012), making it difficult to obtain the species from surrounding areas. Much of the breeding areas for this species is found scattered throughout the mid to eastern states.

The assumption of the best source area would be the eastern states, however, the observations of numerous reports and studies conducted on the abundance of the Yellow-billed Cuckoo has resulted in the selection of a small reserve site located on the border of Arizona and California to be the best source area for this restoration. Even though the area is not very wide spread; the Bill

Williams River National Wildlife Refuge was found to possess one of the larger amounts of individuals present. In a 2-year study of abundance from 55 sites, the primary location was at this site; where 117 individuals were detected (Johnson, 2007). The Bill Williams River National Wildlife Refuge consists of a riparian forest of cottonwood and willow (Wall, 2002), which is similar to the cottonwood and willow present at the release site and the desired habitat.

5.1 Reintroduction

5.1.1 Reintroduction Process

As described in the previous sections, the source area and release site must possess many similar attributes. The reintroduction site of the Yellow-billed Cuckoo, from the Bill Williams River National Wildlife Refuge to the University of Victoria BC, shows many common attributes, such as necessary breeding habitats and food sources. Some of these aspects include the presence of cottonwood trees and insects, which are the primary food source of Yellow-billed Cuckoos (Cornell Lab, 2012).

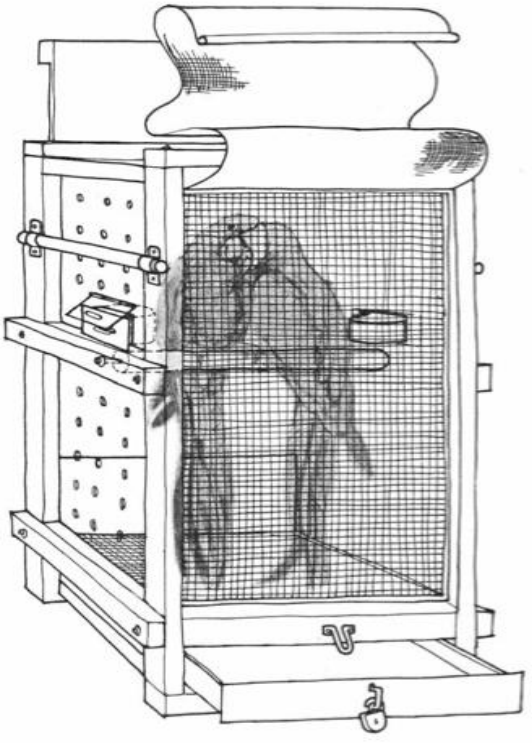
Within the Bill Williams River National Wildlife Refuge, the area with the most cuckoo activity will be determined. The use of nets is known to be one of the most successful ways to capture the Yellow-billed Cuckoo and the specific net instructions used for the re-introduction will be performed according to directions of Schreckengost (2012), a bird bander in the Kern River Valley. The nets used will be approximately 11 meters in height and 9 meters in length and will be placed in the areas of highest cuckoo traffic. These net measurements result in the best capturing placements for cuckoos since the breeding habitat of this species resides in short to medium treed areas and they are found commonly flying from neighboring treetops. When placing the nets in the designated areas be sure that the trees surrounding that net are, in fact

shorter than the net itself. Once the nets are established, speakers will be positioned within the net to call the birds in for capture.

Once the birds have been captured in the nets, they are removed and a professional biologist will record the necessary information. At this point during the capturing process, the individual birds will also be evaluated and assessed by a veterinary to ensure that the individual is free of diseases, sickness, or any other harmful effects towards itself and the species present at the release site. Once a veterinarian approves the health assessment, each individual will receive a geolocator. Geolocators, recently used instead of old tracking methods or bands, will allow for the long and short distance tracking of each individual through the reintroduction process and migrations. These tracking devices will allow for an accurate and detailed description of the whereabouts of this declining bird species (Kendrick, 2012) and will also be a great device for future research and data of these birds.

When the individuals have been approved by the veterinarian, had all necessary information recorded, and were tagged with a geolocator, they will then be prepared for transport. The guidelines for transporting the cuckoos will be provided by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (1981). Some of the general regulations of the birds' welfare during transport include: non-sedation of individuals, transportation should occur in semi darkness, birds should not be disturbed unless directed by veterinarian, all care directions should be labeled on the carrying containers, and any sick or dead birds during transport should be removed. Prior to transportation the birds should be held and allow for conditioning to avoid added stress. Advanced arrangements should also be made in the case of delayed arrival of birds to the destination. During transport the birds should be kept in approved containers. The container guidelines indicate that the container should be made of wood material,

with no sharp edges. The base of the container should consist of mesh material above a removable tray that is capable of absorbing waste material. The front of the container should consist of a mesh region with a cover that can be opened for regulated checks on the bird. The container should contain perches that allow for the regular positioning of the birds, where in their heads do not touch the top of the container and their tails do not touch the bottom; however, the container does not include enough room for flight. The container should contain a trough for water and food consumption, as well as extra ventilation holes. There should also be sturdy handles to allow for safe handling of the container. During transport the carriers should also include appropriate labels for each individual being transported.



Source: (Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1981).

Figure 3: Illustration of appropriate transport container.

Once all individuals have arrived safely to the release site, they will remain in an enclosed area within this site to allow for conditioning and a pre-release health evaluation from the veterinarian. When all the individuals are healthy and have been monitored in the enclosed area for 3 days, they will be freely released into the surrounding area.

5.1.2 Quantity and Distribution

The release site for the reintroduction of the Yellow-billed Cuckoo was determined as the University of Victoria campus. However, there are many different types of habitat associated with the university campus, as described in 2.0, so two specific release sites within the campus were determined for higher success. Mystic Vale and Bowker Creek, which are located on the university campus, possesses the best starting habitat for the release of the birds. The necessary habitat in these areas incudes: cottonwood, willow, and a wide variety of insect species; which are all necessary requirements of the Yellow-billed Cuckoo breeding sites, previously described. Initially, 10 individual adult birds will be released into these areas. If needed after later monitoring, more individuals may be required to continue in the relocation process.

5.1.3 Performance Standards

The performance standard is a very important part of implementation. This involves the process of constantly evaluating the project to ensure that everything is going according to plan and that all the designed objectives, discussed in 3.3, are being accomplished. Proper management of post-reintroduction is another very important aspect of performance and ensuring that it continues. This topic will be discussed in the following section.

5.2 Management

5.2.1 Management Schedule

Management planning is a very important aspect of restoration. If the project is not properly managed and monitored, then the chances of success will majorly decrease. Management becomes particularly important during the establishment time, which is roughly 2 to 5 years. During this time the restoration must be routinely managed.

The Yellow-billed Cuckoo should be monitored throughout its breeding season, before migration. The breeding season of the cuckoo resides during the summer months (Hughes, 1999). Since cuckoos can be difficult to spot, the best way to observe their presence is by vocalization, which is most prevalent during the early summer months of courtship (Halterman, 2001), or by recapture. For the first breeding summer of relocation the birds can be monitored based on vocalizations. However, during the following breeding seasons' recapture will be a beneficial research method. The recapturing will allow for the collection of the migration data from the geolocators and to determine the number of original individuals returning. Since the birds only return during the short breeding months, it is essential to continue monitoring the population for a minimum of 10 years following reintroduction. This time will allow for the re-evaluation of the restoration if needed, and also allow for any other actions that may be needed to continue increasing the population.

During the management and surveying process the local communities, volunteers, workers, and all persons involved in the restoration project should be included and informed on the management plan. It is very important to include locals in all processes of the restoration and inform them of the ways in which they can help. Management and monitoring is a great way in which these individuals can aid in the success of a restoration, such as reintroduction.

5.2.2 Surveys

During the scheduled management and monitoring of the reintroduced Yellow-billed Cuckoo, specific guidelines and surveys must be conducted. A description of surveying methods and processes are described and will be followed according to Halterman (2009). During the survey periods, the surveys should be conducted 12 days apart. This time frame allows for the observations throughout the different nestling stages, as well as allows for increase in the detection of the maximum number of individuals. The surveying should be categorized into four survey periods: Survey 1 being the arrival of cuckoos to the breeding grounds in early to late June, Survey 2 being during the breeding period in late June to mid-July, Survey 3 being the final arrival of all breeders and possibly some juveniles in mid-July to early August, and Survey 4 being when all the cuckoos that may use this area will be present and fledglings are present in early August to early September.

6. Monitoring (Shared)

6.0 Monitoring

6.0.1 Long Term Monitoring

The long-term goal of a healthy and successful reintroduction of the yellow-billed Cuckoo is discussed in section 3.2.3. In order to achieve this goal of creating a sustained and ongoing population of cuckoos at the release site, the regular monitoring of the species must be done. Since reintroduction is a lengthy restoration the minimum length of monitoring is approximately 10 years. During this time regular seasonal monitoring will be conducted within

the release site and the observations and monitoring of non-breeding seasons and migration will be performed with the use of the geolocator data, discussed in section 6.0.2. During the monitoring period many other biotic and abiotic factors will be observed in order to fully determine the rate of success. During this process, the data and surveys collected will allow for the significant determination of success rates among the individuals introduced, as well as the success rates of the other biological factors. These factors include neighboring bird species, surrounding and direct habitats, food source quantity, and species impacts. Each of these factors will play a crucial role in determining the success of the restoration goal.

6.0.2 Geolocators

The data from the geolocators will be collected for the non-breeding season upon recapture, and a record of migration patterns and locations will be made. This will provide valuable information as to the corridors the cuckoo uses in its seasonal migration. These will also provide information as to return times, and estimated numbers returning the following season. This information will be archived also for use by interested outside parties for research and similar conservation programs.

6.0.3 Future Breeding Season Surveys

We will conduct breeding season surveys for all years of the reintroduction program, using methods described earlier. If initial years of monitoring show increased population numbers or an established population, then a full 10 years of breeding surveys will be undertaken by us or future parties. The results of these surveys will guide the following year’s translocation program, if necessary. Surveys will also include monitoring of other bird species in the area, and

trends in numbers of these species will also be examined to observe the relationship among neighboring birds. These surveys will also include monitoring of interactions between the cuckoos and resident birds, as well as behavioural responses of the different species.

One possibility for future monitoring assistance exists within the school of environmental studies and the faculty of biology. Relevant summer courses in ES, as well as summer courses in vertebrate biology could incorporate bird surveys into coursework, thus providing summer monitoring of returning cuckoo populations integrated as fieldwork into a summer course. Opportunities will also exist for directed studies should a breeding population be established. Other surveys could be performed by contributors to the Breeding Bird Atlas of BC, providing distribution information to all interested parties.

6.0.4 Assessment of Reintroduction Success

Second year translocations will be undertaken if at least 1 breeding pair returns to nest early enough in the season the following summer. Successful return of an introduced pair will prove the translocation distance was not too great to recreate, and that desirable habitat could lead to the re-colonization of the Pacific west coast by the Yellow-billed Cuckoo. If monitoring reveals that the cuckoo is negatively affecting the physical environment or the resident species, the project will be stopped and a full impact assessment undertaken to guide the necessary steps to be taken.

7. Conclusion (Shared)

Though translocation generally has low levels of success, we feel that the necessary elements to sustain this former resident bird still remain within the province, and changing the status of the bird from an extirpated vagrant to a resident is within the realm of possibility. We believe with an effective re-introduction strategy, a well-planned management scheme, public participation, careful study, and educated future management decisions that the Yellow-billed cuckoo can be restored to its former range.

Appendices

Yellow-billed Cuckoo Recording Sheet

Recorders Name: _____

Date: _____

Site: _____

Time	Coordinates	Weather	# of Birds	Additional Comments

Weather Code

0	Clear sky or few clouds	3	Fog or smoke	6	Light wind
1	Partially cloudy	4	Light rain	7	Heavy winds
2	Overcast	5	Showers	8	Flurries

Table 1. Example of a monitoring sheet for vocalization/observation surveys. (Shelby Black)

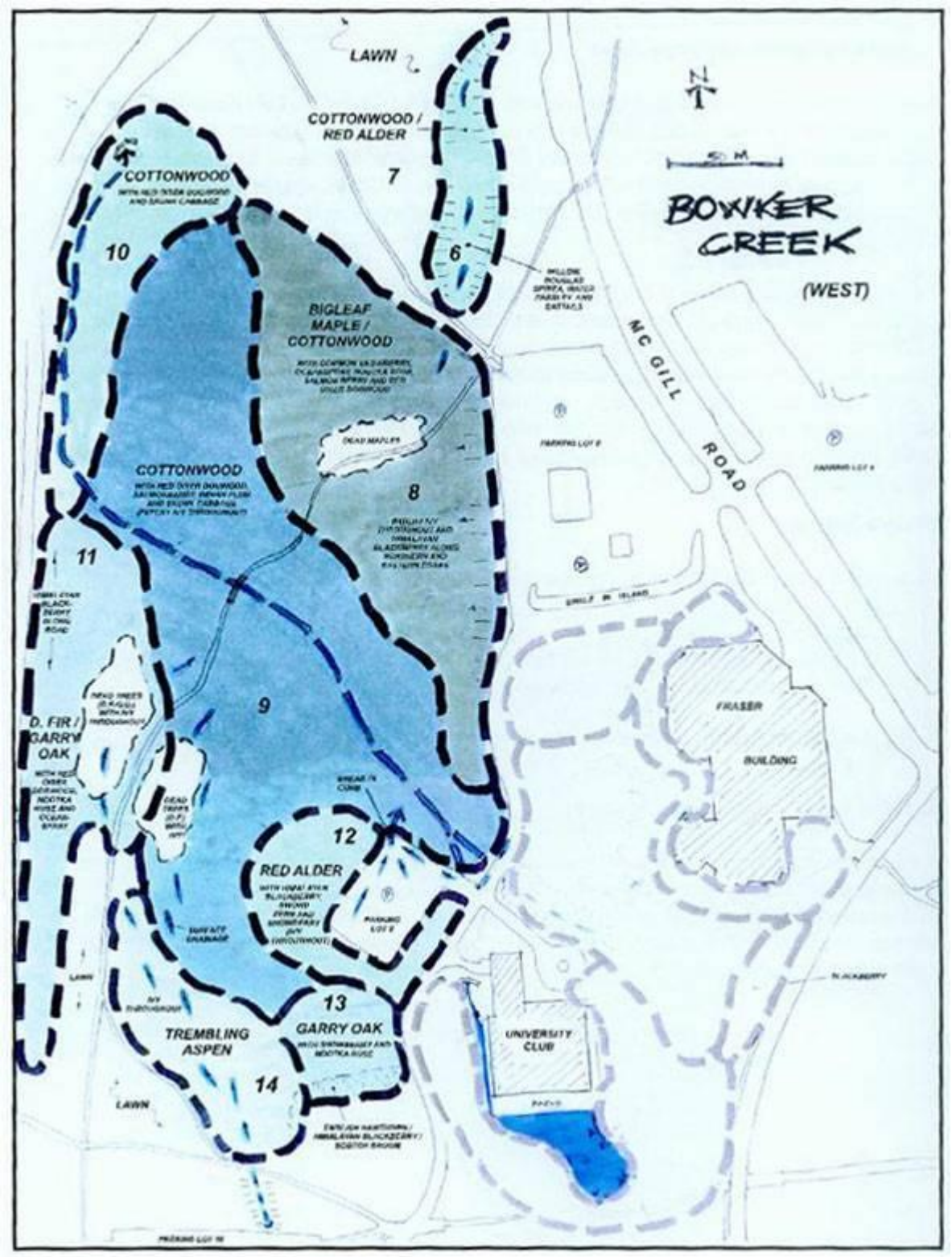


Figure 3. General distribution of tree species in Bowker Creek (Harrop-Archibald, 2007).

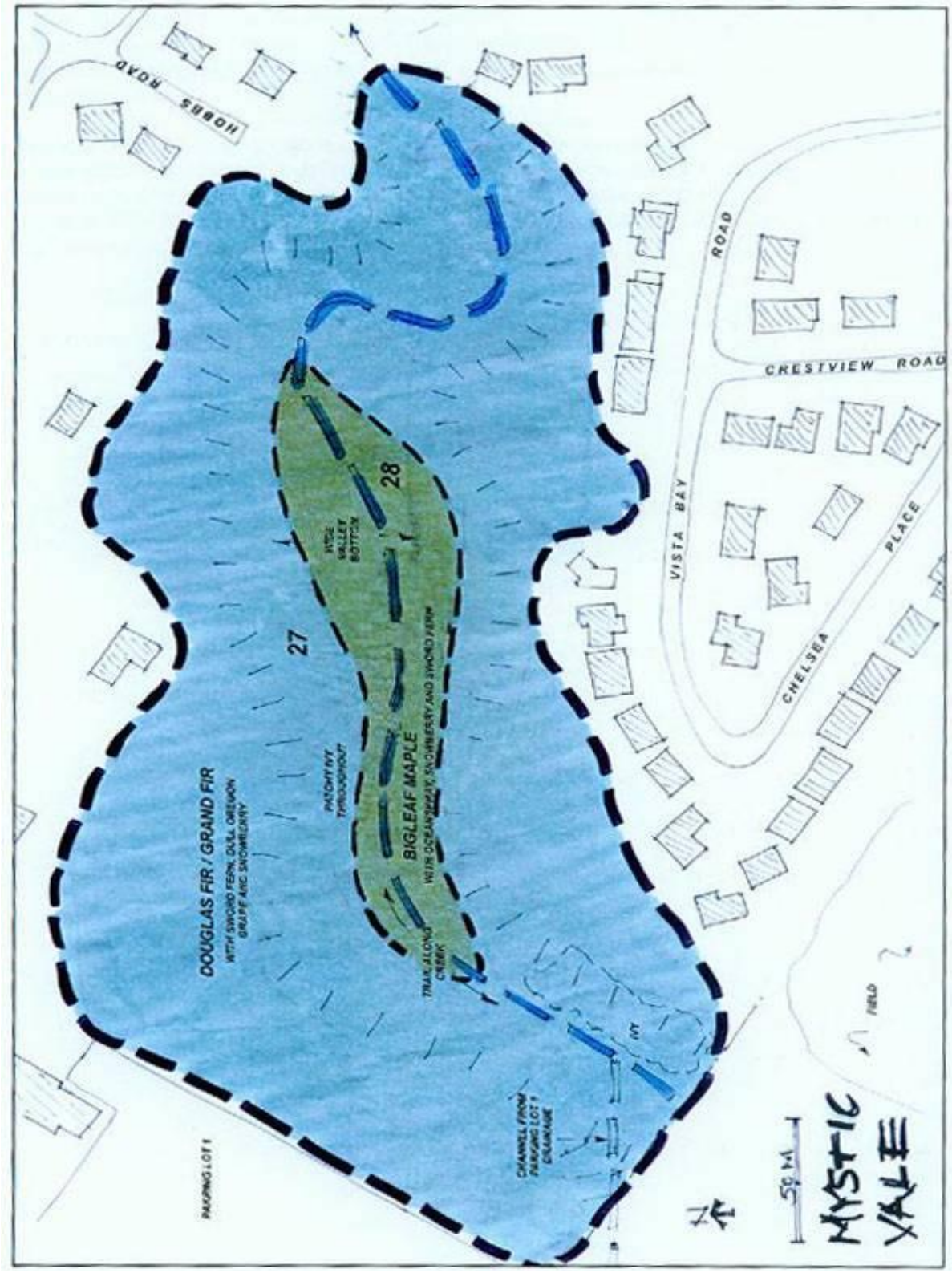


Figure 4. General distribution of tree species in Mystic Vale (Harrop-Archibald, 2007).

References

Austin, M.A., *et al*. 2008. Taking Natures Pulse: The Status of Biodiversity in British Columbia.Available from www.biodiversitybc.org [accessed 6 November 2012].

Banks, R.C. 1988. Geographic Variation in the Yellow-Billed Cuckoo. The Condor. **90**(2): 473-477.

Beck, B., *et al.* 2007. Best Practice Guidelines for the Re-introduction of Great Apes. The World Conservation Union, Gland, Switzerland.

Cannings, R.J. 1996. British Columbia: A Natural History. Greystone Books, Vancouver, B.C.

Convention on International Trade in Endangered Species of Wild Fauna and Flora. 1981. Guidelines for Transport and Preparation for Shipment of Live Wild Animals and Plants. International Environment House. Geneve, Switzerland.

Cornell Lab of Ornithology. 2012. Yellow-billed Cuckoo. Available from http://www.allaboutbirds.org/guide/Yellow-billed_Cuckoo/lifehistory [accessed 17 November 2012].

Environment Canada. 2012. The Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act. Available from http://www.ec.gc.ca/alef-ewe/default.asp?lang=en&n=65FDC5E7-1 [accessed 13 November 2012].

Farrell, L. L. (2006). Subspecies status of the western yellow-billed cuckoo *(*cuculidae: *Coccyzus americanus occidentalis):* Using cytochrome B to elucidate the enigma. Lakehead University (Canada)). *ProQuest Dissertations and Theses,* , 105-105 p. Retrieved from http://search.proquest.com.ezproxy.library.uvic.ca/docview/304923983?accountid=14846. (304923983).

Fenneman, J. Species profile: Yellow-billed Cuckoo (*Coccyzus americanus*). in Klinkenberg, B. (Editor). 2012. *E-Fauna BC: Electronic Atlas of the Fauna of British Columbia* [efauna.bc.ca]. Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia, Vancouver.

Fiore, J.L. 2003. The Biogeography of the Western Yellow-billed Cuckoo. San Francisco State University [Online]. Available from http://online.sfsu.edu/bholzman/courses/Fall%2003%20project/WYBCuckoo1.htm [accessed 11 November 2012].

Gaines, D. 1974. Review of the Status of the Yellow-Billed Cuckoo in California: Sacramento Valley Populations. The Condor. **76**(2): 204-209.

Givetz, E.H., and Greco, S.E. 2009. Multi-scale predictive habitat suitability modeling based on hierarchically delineated patches: an example for yellow-billed cuckoos nesting in riparian forests, California, USA. Landscape Ecol. **24**(10): 1315-1329. doi:10.1007/s10980-009-9384-2.

Government of Manitoba. 2012. The Endangered Species Act. Available from https://web2.gov.mb.ca/laws/statutes/ccsm/e111e.php [accessed 13 November 2012].

Halterman, M.D. 1991. Masters Thesis: Distribution and Habitat Use of the Yellow-billed Cuckoo (Coccyzus *americanus occidentalis)* on the Sacramento River, California, 1987-1990. California State University.

Halterman, M.D., *et al*. 2001. Status of the Yellow- billed Cuckoo in California: 1999-2000. Report to the USGS-BRD Dixon Field Station. Dixon, CA.

Halterman, M.D., *et al.* 2009. Western Yellow-billed Cuckoo Natural History Summary and Survey Methodology. Southern Sierra Research Report. Version 3.4.

Harrop-Archibald, H. 2007. University of Victoria natural features study: Bowker Creek, Cunningham Woods, Upper Hobbs Creek/ Mystic Vale. University of Victoria Restoration of Natural Systems Program. Supervisor: Dr. Val Schaefer, 1-90.

Harrop-Archibald, H. 2008. University of Victoria natural features study: University Cedar Hill corner property, Garry Oak meadow and camas meadow area, Finnerty ravine, Harrow Woods, South WOods, Lower Hobbs Creek/Mystic Vale. University of Victoria Restoration of Natural Systems Program. Supervisor: Dr. Val Schaefer, 1-152.

Hocking, M. 2000. UVic sustainability project: 2.1 campus ecology. Unpublished document. Victoria, British Columbia.

Hughes, J.M. 1999. The Birds of North America, No. 418: Yellow-billed Cuckoo (*Coccyzus americanus*). The Birds of North America, Inc., Philadelphia, PA.

Johnson, M.J., *et al.* 2007. Yellow-biled Cuckoo Distribution, Abundance, and Habitat Use Along the Lower Colorado and Tributaries, 2006 Annual Report. Southwest Biological Science Center. US Geological Survey: 1097.

Kendrick, S. 2012. Reclamation Biologist Participates in Western Yellow-billed Cuckoo Migration Study. Western Field Ornithologists Website [http://www.westernfieldornithologists.org/journal.php].

Laymon, S.A. and M.D. Halterman. 1987. Can the Western Subspecies of the Yellow-Billed Cuckoo be Saved from Extinction?. Western Birds. **18**:19-25.

Lloyd, R.H. 2004. Integrated Stormwater Management Plan. University of Victoria Project No. 02-4367. Victoria, British Columbia.

Smith, T. 2012. The rabbit problem: University of Victoria story. Columbia Mountains Institute of Applied Ecology, 13.

Schreckengost, T. 2012. Banding Yellow-billed Cuckoos in the Kern River Valley. Available from http://www.thermalbirding.com/2012/07/banding-yellow-billed-cuckoos-in-the-kern-river-valley/ [accessed 17 November 2012].

University of Victoria. 2006. UVic Campus Plan [online]. Avaliable from web.uvic.ca/vpfin/campusplan/toc.html [accessed 1 November 2012].

Tatum, J.B., *et al*. 1971. Report of the ad hoc committee to investigate campus bird populations. Unpublished report. Victoria, B.C.

Wall, D. 2002. Western Wildlife Refuges: Thirty-Six Ecological Havens from California to Texas. US Fish & Wildlife Service. Museum of New Mexico Press.