

Historical Garry Oak Ecosystems of Vancouver Island, British Columbia, pre-European Contact to the Present

Abstract

This paper summarizes the historical mapping of the major areas of *Quercus garryana* (Garry oak) ecosystems, from immediate pre-European settlement to present day. Less than 10 percent of the original Garry oak ecosystem remains on south-eastern Vancouver Island, British Columbia, Canada. Originally, there were two major ecosystem types, one on deep soils, known as Parkland Garry oak ecosystems, and the second on shallow soils, often referred to as scrub oak ecosystems because the oak trees are often of low stature. Little of the deep soil ecosystem remains, because these communities were the first areas cleared for agriculture and urban development. More of the shallow soil ecosystem remains, as many of these rocky areas were more difficult to develop in the early days of settlement and were not good for agriculture. However, many of these sites are presently being lost to development if they are not in protected areas. Much of the remaining area of these ecosystems is dominated by invasive alien plant species, so that less than 5 percent of the original area remains in natural condition.

Introduction

The Garry oak ecosystem in Canada, also known as ‘Oregon white oak ecosystems’ in the United States, is restricted to the southeast coast of Vancouver Island, adjacent Gulf Islands and two locations on the mainland of southwestern BC (Figure 1). This ecosystem is a distinctive feature of the landscape particularly around Victoria, Duncan, Nanaimo, Comox and on most southern Gulf Islands. The maps portraying the

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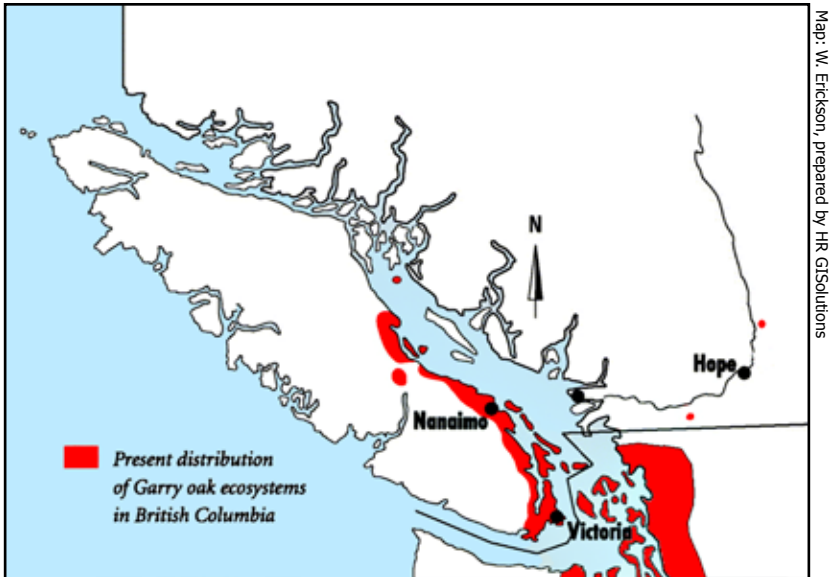


Figure 1. Distribution of Garry oak ecosystems in British Columbia (from Erickson, 1993).

Garry oak distribution in immediate pre-European settlement times (Figures 2, 4, 6 and 8) depict those areas where Garry oak was believed to be the dominant cover or co-dominant cover with *Pseudotsuga menziesii* (Douglas-fir) or *Arbutus menziesii* (arbutus or madrone) or, in the Comox area, *Pinus contorta* var. *contorta* (shore pine). Historical Garry oak ecosystem mapping for Vancouver Island, British Columbia allows comparisons between the likely pre-European settlement times and the present distributions. The study focused on 5 major areas known to support the Garry oak ecosystem in greater Victoria, Cowichan Valley, Nanaimo, Nanoose, and Comox areas, as well as where it is or was a major ecosystem on the southern Gulf Islands, including Saltspring Island and Hornby Island. Smaller areas of the Garry oak ecosystem occur on many other Gulf Islands, mainly along the shoreline and most of these remain intact, and are not the focus of this study. Other areas may have had or still have Garry oak as a minor component of the ecosystem; however, they were not considered for this mapping.

Garry oak ecosystems have been described in detail by Roemer (1972) and Erickson (1995). Originally, there were two major communities

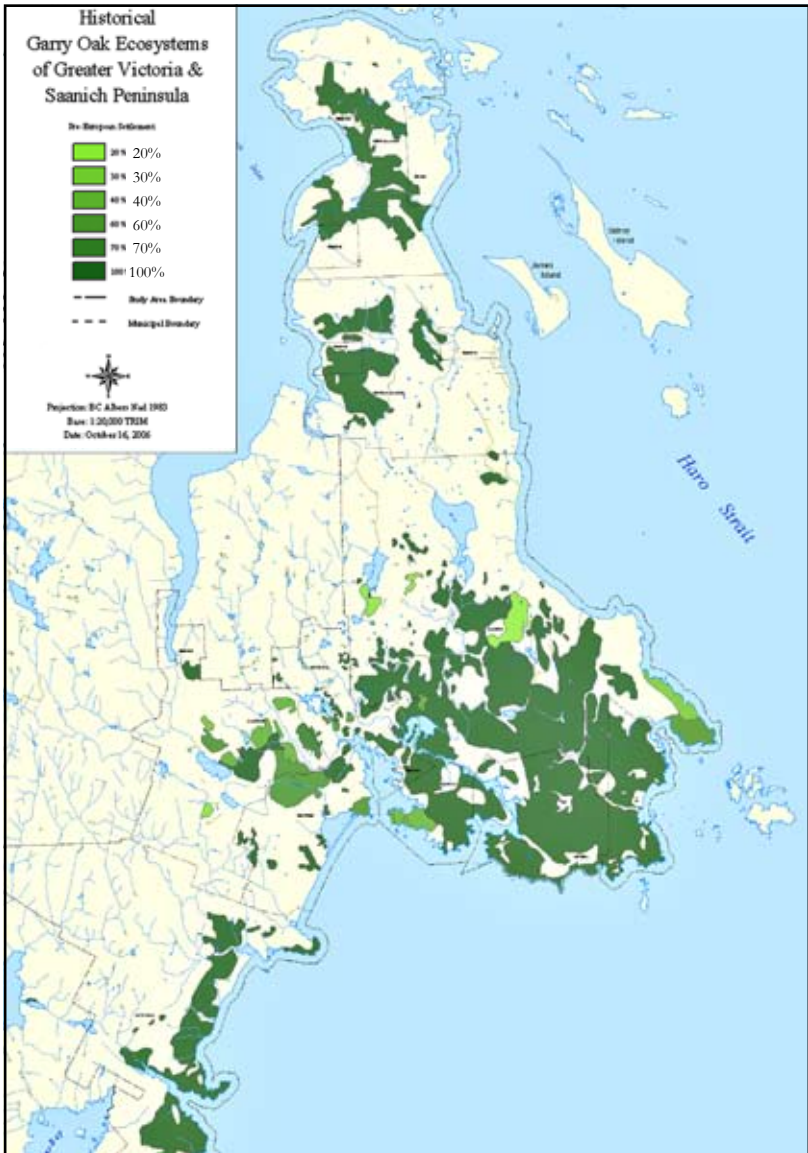


Figure 2. Garry oak ecosystems in the greater Victoria area for pre-European settlement.



Figure 3. Garry oak ecosystems in the greater Victoria area in 1997.

recognized within the Garry oak ecosystem. Those on deep soils, known as the Parkland Garry oak ecosystem (Pojar, 1980a, 1980b), supported common understory plants including *Symphoricarpos albus* (snowberry), *Camassia leichtlinii* and *C. quamash* (camas), *Erythronium oregonum* (fawn lily), various graminoid species and *Pteridium aquilinum* (bracken fern). Almost all of this community type has gone, as it occupied areas that were most suitable for crops and were cleared for agriculture and urban development starting in the 1840s. While many large Garry oak trees remain, most have lawns, roads, agricultural fields or blacktop beneath them, rather than the original plant communities. The few examples of this ecosystem still remaining include the Nature Conservancy of Canada's Cowichan Garry oak preserve, a stand in Beacon Hill Park, Victoria and areas at the Department of National Defence lands at Rocky Point in Metchosin Municipality.

The second major Garry oak community type occurs on shallow soils and is often referred to as the scrub oak ecosystem. The oak trees are often of lower stature than those growing on deep soils. More of this ecosystem remains, probably because many of these rocky habitats were difficult to develop. Many are now in protected areas such as Mount Tzuhalem Ecological Reserve, Mount Tolmie Park and Mount Douglas Park. The understories of these rock outcrop communities were originally dominated by many spring flowering perennial forbs, grasses and mosses, but now often contain extensive cover of invasive alien species such as *Cytisus scoparius* (Scotch broom), agronomic grasses and other weeds.

The loss of much of these ecosystems and recent dominance of invasive alien species, has led to more than 100 Garry oak-associated plant and animal species being placed on the BC Species at Risk list. These include more than 75 plant taxa, 2 reptiles, 14 birds, 3 mammals, 13 butterflies and 10 other insect species (GOERT 2005). The plant species include the *Castilleja levisecta* (golden paintbrush), *Balsamorhiza deltoidea* (deltoid balsamroot), *Meconella oregana* (white meconella), and *Bartramia stricta* (rigid apple moss). Two notable animals are the butterfly, *Euchloe ausonides* (an undescribed subspecies of island marble), which is extirpated, and *Contia tenuis* (sharp-tailed snake). Unfortunately, species

at risk numbers are expected to increase as species assessments are completed and if the threats to Garry oak ecosystems continue.

Egan and Howell (2001) recognized a variety of information sources to determine historical ecology of an area, including cultural evidence—land surveys (both mapped and in journals), written records, and historical photographs—and biological evidence—forest stand history, observational field evidence, pollen records, geomorphology, hydrology and soil, and inferring vegetation history. Many of these methods were considered in the present study.

The objective of this mapping was to provide information on the loss of Garry oak ecosystems that could be used for a variety of purposes, including, understanding the value of the remaining pieces, understanding the cultural values associated with these ecosystems, determining which areas might be suitable for restoration or reconstruction of these ecosystems and to indicate areas that can be conserved to maintain species at risk.

Methods

The mapping in this study was mainly based on (1) original land surveys done in the 1850s and 1860s, and (2) recent field observations of forest stand history. Maps were prepared at a 1:20,000 scale and included areas where Garry oak was a dominant or co-dominant component of the ecosystem. The land survey maps in the Victoria area often distinguished between coniferous forest and deciduous forest and prairies, as well as larger wetlands. Other data sources used included written records, maps, historical photographs, paintings and some soil, geomorphology and floodplain mapping. An ecosystem map for greater Victoria was created for the Canadian Forest Service by McMinn et al. (1976) that was used for comparison to known Garry oak occurrences.

Information on present day areas of Garry oak ecosystems was prepared using data from a variety of sources, including the Sensitive Ecosystem Inventory prepared by the BC Ministry of Environment, Lands and Parks (MELP), the BC Conservation Data Centre, MELP Nanaimo, and the Canadian Wildlife Service of Environment Canada.

Extensive field work undertaken between 2001 and 2004 established present distribution of oaks, and allowed estimation of the pre-European potential, assuming that the climate has not changed significantly over the last 200 years. Advice from local ecologists and naturalists who had considerable experience and expertise was used to determine areas that had the potential to support Garry oak ecosystems before urban, suburban and agricultural development took place in the greater Victoria area.

The study included a 'depth of soil' attribute allowing comparison of the remaining areas in the parkland and scrub oak ecosystems. Mapping was done on 1:20,000 Terrain Resource Information Mapping (TRIM) base map sheets by indicating the presence of existing trees and extrapolation using all sources of information and then drawing polygons depicting pre-European and present day extent of the ecosystems.

Some shortcomings of this mapping exercise exist. Data source information was inconsistent throughout the study area. The most detailed land survey maps, which show the differences in vegetative cover, are only available in parts of the greater Victoria area. However, there was no record of vegetation cover for either Colwood or Esquimalt. Similarly, survey information for areas farther north on Vancouver Island was restricted by property lot boundaries. Some areas had soils and floodplain mapping while other areas did not. In some historical oak areas, where Douglas fir has now replaced Garry oak, there may have been cover underestimations, especially where less detailed land survey information was available.

Results

The maps (Figures 2 through 9) and Table 1 allow comparison of the Garry oak ecosystem distribution on Vancouver Island in immediate pre-European settlement times and now. Table 1 shows that approximately 10 percent of the area that was originally Garry oak ecosystem now remains as remnants. However, since much of this area is now dominated by invasive alien species, less than 5 percent of the

Table 1. Area coverage of the Vancouver Island Garry oak ecosystems for pre-European settlement and present day, broken into deep and shallow soil ecosystems.

	Deep Pre- European	Deep Present Day	Shallow Pre- European	Shallow Present Day	Overall Pre- European	Overall Present Day
Greater Victoria	9564 ha	45 ha	890 ha	440 ha	10454 ha	485 ha
Cowichan Valley/ Saltspring Island	1824 ha	83 ha	1301 ha	619 ha	3125 ha	702 ha
Nanaimo/ Nanoose	29 ha	29 ha	951 ha	298 ha	980 ha	327 ha
Comox	527 ha	7 ha	0 ha	0 ha	527 ha	7 ha
Hornby/ Denman Island	65 ha	11 ha	98 ha	57 ha	163 ha	68 ha
Total	12009 ha	175 ha	3240 ha	1414 ha	15249 ha	1589 ha
Percent of Original		1.5%		44%		10%

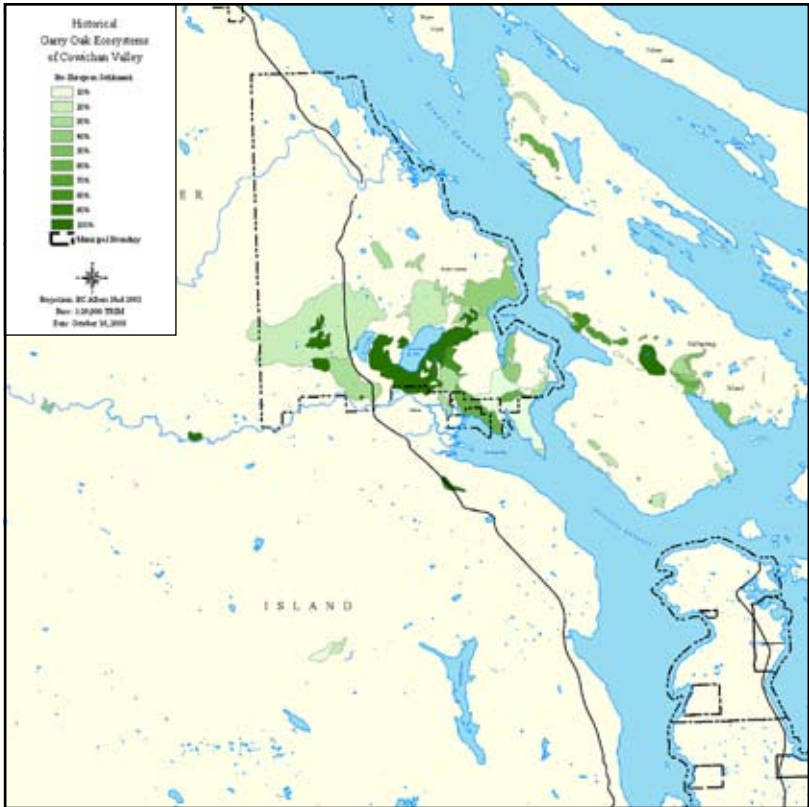


Figure 4. Garry oak ecosystems in the Cowichan Valley and Saltspring Island area for pre-European settlement.

original ecosystem remains in a near-natural condition, where native species dominate the understorey. Most of the remnants are in isolated, fragmented locations that have no connection to other Garry oak areas. The remaining remnant areas of Garry oak ecosystems are dominated by invasive alien plant species such as Scotch broom, agronomic grasses and weedy forbs.

On the maps, the original pre-European distribution of Garry oak ecosystems is displayed in green, while the remaining present day areas are shown in red. For the mapping, shading is used to indicate the percentage of Garry oak ecosystems occurring in a particular polygon. The darkest shade means that one hundred percent of an area was Garry oak ecosystem, while the lightest shade indicates that ten percent

of the area would be Garry oak ecosystem, and the other ninety percent would be another type of ecosystem. This was determined using all available data sources

The Victoria area (Figures 2 and 3) had mainly deep soil Garry oak ecosystems (9564 ha). Very little of this ecosystem remains (45 ha). Less shallow soil ecosystem occurred originally (890 ha), and a greater percentage (440 ha) remains to date. In the Cowichan Valley and on Saltspring Island (Figures 4 and 5), deeper soil areas (1824 ha) were more common than shallow soil ecosystems (1301 ha), but as in Victoria, a greater percentage of shallow soils (619 ha) remains. For the Nanaimo and Nanoose areas (Figures 6 and 7), very little deep soil ecosystem (29 ha) occurred in the 1800s and all of it is still present.

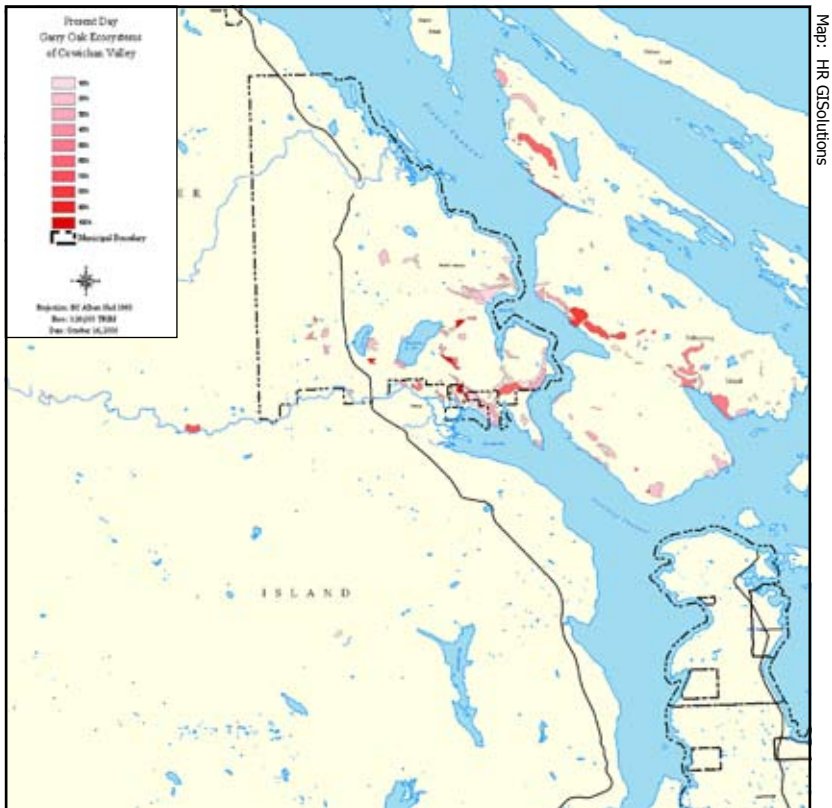


Figure 5. Garry oak ecosystems in the Cowichan Valley and Saltspring Island area for present day.

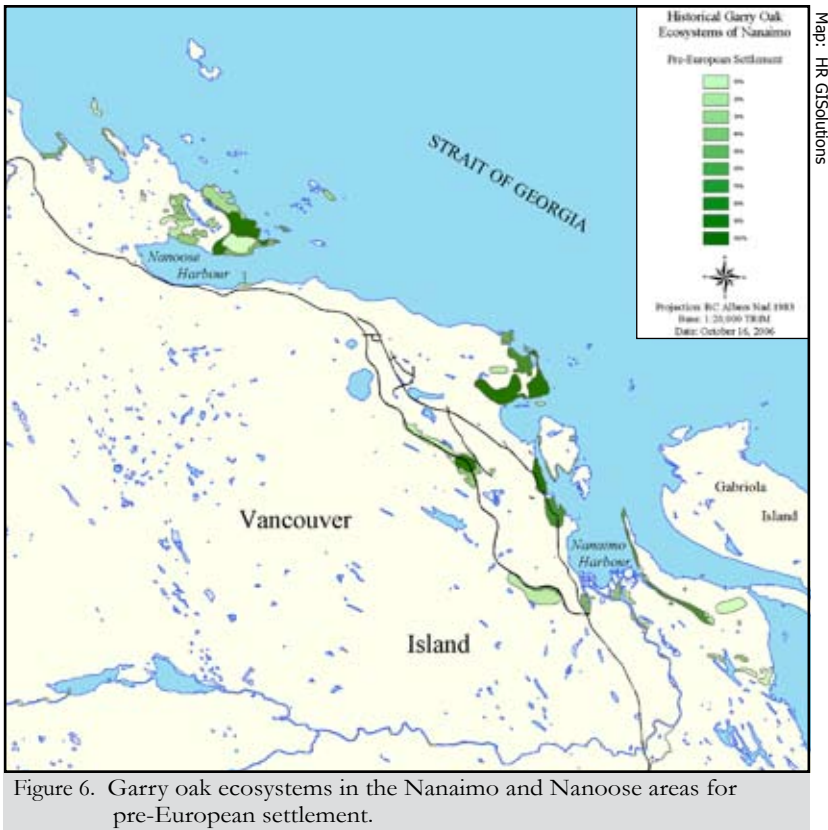


Figure 6. Garry oak ecosystems in the Nanaimo and Nanoose areas for pre-European settlement.

Approximately one third (298 ha) of the original (951 ha) shallow soil ecosystem still remains. In the Comox Valley and Hornby/Denman Island areas (Figures 8 and 9) areas, deep soils ecosystems were originally fairly limited (592 ha) and little remains (18 ha). No measurable shallow soil ecosystem occurred in the Comox Valley, but on Hornby Island 98 ha originally occurred and over one half of this (57 ha) still remains. Overall, for Vancouver Island, only 1.5 percent of the original deep soil Garry oak ecosystem remains, while approximately 44 percent of shallow soil Garry oak ecosystem remains.

Discussion

Mapping ecosystems over time allows us to record the historical ecosystem loss and to identify areas with potential for restoration. It also allows landscape managers to understand regional heritage, how humans have affected ecosystems, the importance of the remaining areas of an ecosystem, and to make general predictions about future vegetation that may result from climate change. Measurement of ecosystem loss allows us to assess the importance of the remaining areas, especially in the Garry oak ecosystems, which contain large numbers of species at risk (Fuchs 2000). Many species at risk are not adequately supported if the ecosystem is reduced in size or otherwise degraded. Preservation and stewardship of the remaining areas will

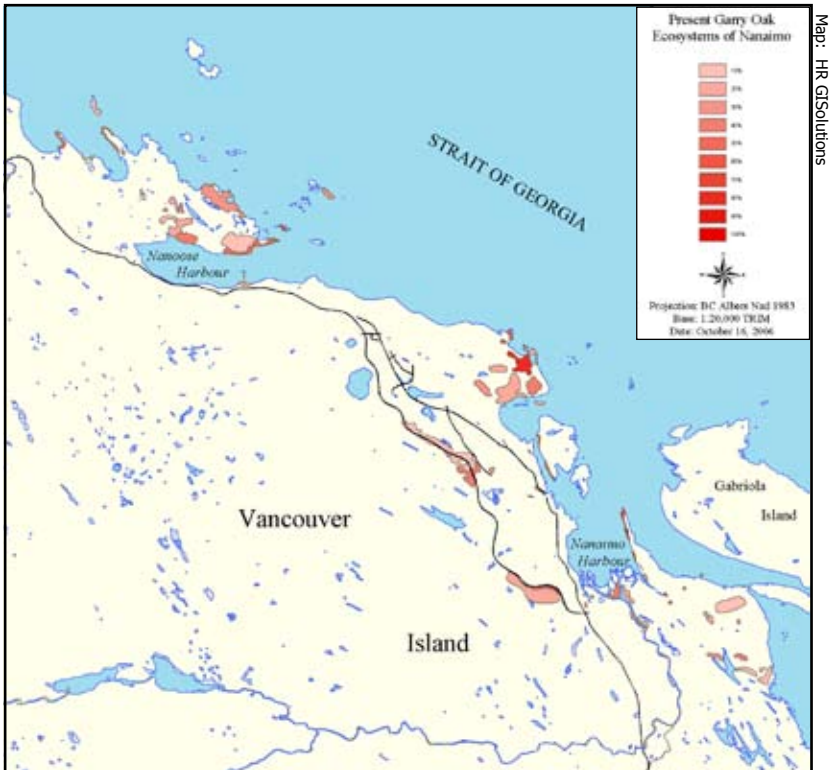
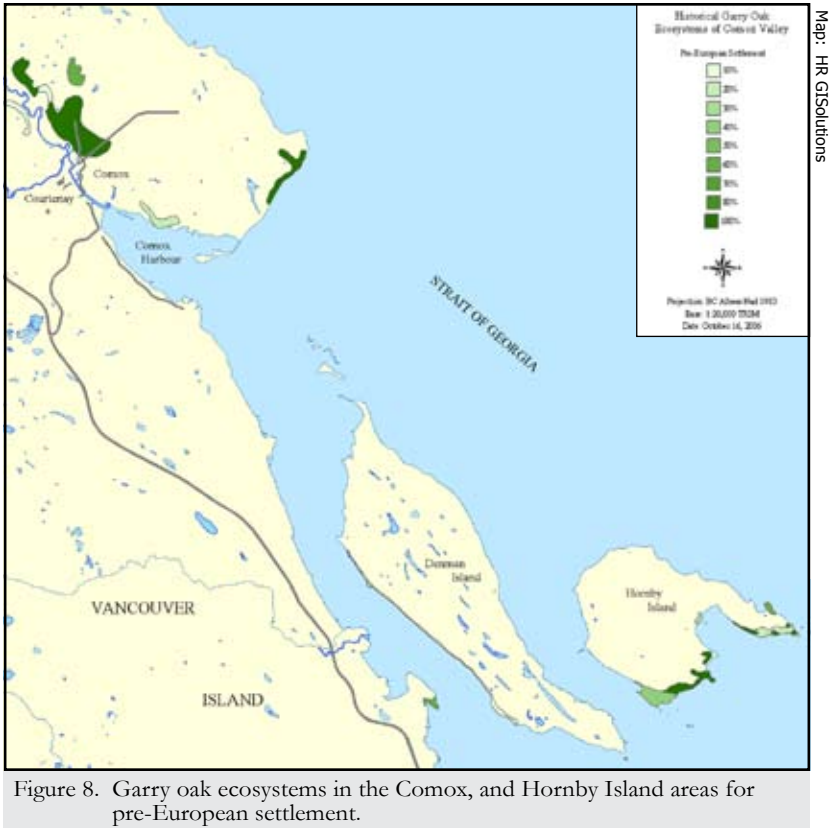


Figure 7. Garry oak ecosystems in the Nanaimo and Nanoose areas for present day.



be essential.

While the maps provide substantial information about the changes and current existence of major fragments of the Garry oak ecosystem, they give less detailed insight to the original conditions which we must understand more fully before restoration is attempted (MacDougall et al., 2004). Historical mapping generally only gives one point in time and usually does not describe the detailed plant composition of communities that existed 150 to 200 years ago. Often restoration workers seem to have selected a particular successional community and tried to manage their area to that “ideal state.” In the case of Garry oak stands, this is often an oak savanna or oak woodland with a meadow-like understorey of camas, fawn lily and other attractive flowers, but many other stages could also be appropriate (see Peter and Harrington 2004). As with

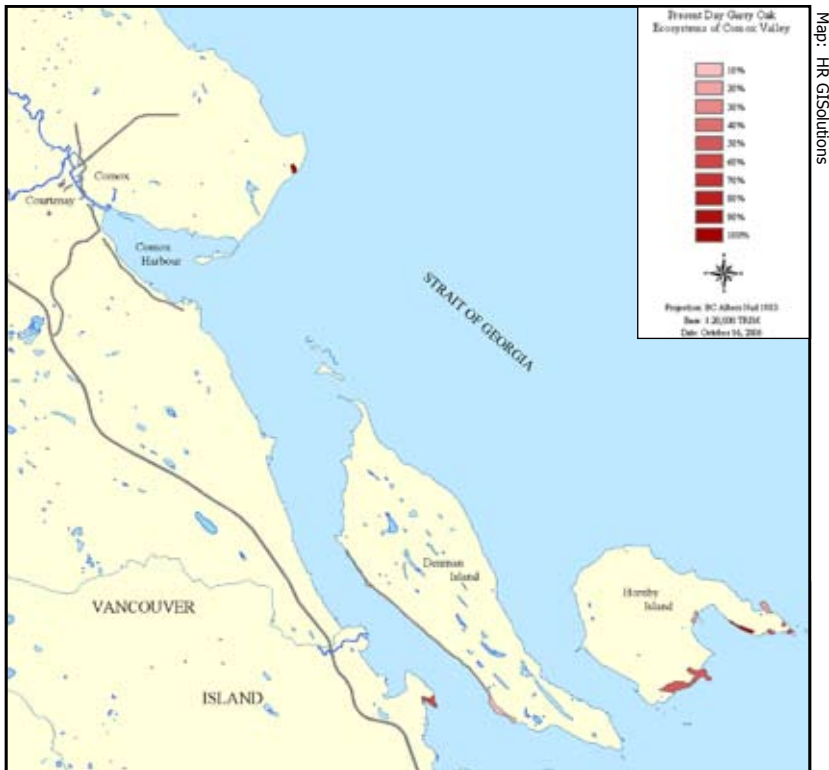


Figure 9. Garry oak ecosystems in the Comox, and Hornby Island areas for present day.

many natural ecosystems, successional stages often existed in mosaics in the landscape, depending on disturbance history. A very important part of the Garry oak landscape for thousands of years was the influence of First Nations people who burned many areas for maintenance of plant resources such as camas, and other root crops, such as bracken fern (Turner 1999).

According to this study, only 10 percent of the Garry oak ecosystem that existed in immediate pre-European settlement times, remains now. These ecosystems are now critically imperilled, due to their rapid loss since the European migration to Vancouver Island beginning in the 1800s. Losses of these ecosystems continue even today, except for the small remnants that occur on some hilltops protected in parks and Ecological Reserves. Invasive alien species dominate most of these

fragmented areas. The future for Garry oak ecosystems is not bright. Some individuals have suggested that with climate change, the range of Garry oak ecosystems could expand (Hebda, 2004). I believe that *Q. garryana* may have the potential to expand its range as an individual species, but natural understorey components may not be able to expand and compete with the many alien species that now occur. The only way to maintain this ecosystem will be with extensive human intervention, at a significant cost of both money and human effort. The main lessons to be learned from this study are (1) that slow, but continued human land use can largely eliminate ecosystems over time, and (2) a fact overlooked as coming generations only know what they see is that historical mapping shows us what we have lost and what we have forgotten. Unless humans find a way to protect rare ecosystems, through a variety of mechanisms, including legislation (similar to present laws covering species at risk), as well as stewardship and restoration activities, many more ecosystems at risk may be lost.

The following activities must be considered to improve the survival possibilities for Garry oak ecosystems: protect the remnants; deal with invasive species; restore suitable areas; purchase lands for conservation; promote stewardship on private lands; assess the potential to introduce appropriate species at risk; prevent other ecosystems from becoming threatened; and plan for climate change.

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