Historical Garry oak ecosystems of Vancouver Island, British Columbia

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Abstract

Maps compare the 1800 and present day distribution of Garry oak ecosystems in the Vancouver Island area of Canada. Overall, less than 10 percent of the original ecosystems remain. Maps of the historical distribution of Garry oak ecosystems depict those areas where Garry oak (*Quercus garryana*) was believed to be the dominant cover or co-dominant cover in the early 1800s. Originally, two major types of ecosystems occurred in the Garry oak areas. These include ecosystems on deep soils, known as Parkland Garry oak communities. Almost all of this ecosystem type is now gone, as these were the first areas in the region that were cleared for agriculture and urban development. The second major Garry oak ecosystem type occurs on shallow soils and is often referred to as scrub oak ecosystems, as the oak trees are often of low stature, compared to those growing on deep soils. More of this ecosystem still remains, as many of these rocky areas were more difficult to develop and were not good for agricultural purposes. Some of these have been left in parks on hilltops that were difficult to use in early days. Many species at risk are associated with Garry oak ecosystems.

The Garry oak historical mapping is based on various sources of information including original land surveys done in the 1850s and 1860s, historical photographs and paintings, historical writings, and recent fieldwork to confirm areas that previously supported Garry oak ecosystems. Mapping for present day was taken from a variety of sources, including the Sensitive Ecosystem Inventory mapping done by the B.C. Ministry of Environment, Lands and Parks (Conservation Data Centre and MELP Nanaimo) and Environment Canada (Canadian Wildlife Service), field work throughout the area and input from local ecologists and naturalists.

Introduction

Historical Garry oak ecosystem mapping is completed for Vancouver Island, British Columbia. The mapping compares the 1800 and 2000 distribution. This includes mapping the original and present extent of Garry oak ecosystems in greater Victoria, Cowichan Valley, Nanaimo, Nanoose, and Comox areas, as well as where it occurs as major ecosystems on the southern Gulf Islands, such as Saltspring Island and Hornby Island. Smaller areas of Garry oak ecosystems occur on many other Gulf Islands, mainly along the shoreline. Most of these areas still remain intact. However, they require boat access to map them and will not contribute significant amounts of the ecosystem, as they are

often areas much smaller than one hectare in size. The Highlands area near Victoria, which also has smaller areas of oak ecosystem, has not been mapped to date.

Garry oak ecosystems are restricted in Canada to the southeast coast of Vancouver Island, adjacent Gulf Islands and a couple of locations on the mainland (See Figure 1). Garry oak ecosystems are a distinctive feature of the landscape of southeastern Vancouver Island, particularly surrounding Victoria, Duncan, Nanaimo, Comox and on most southern Gulf Islands. This mapping shows the historical distribution of Garry oak ecosystems, believed to exist in 1800, plus a recent inventory of remaining Garry oak ecosystems in existence in 2000 (MELP and Environment Canada,1997) and fieldwork. The map of historical distribution of Garry oak ecosystems depicts those areas where Garry oak (*Quercus garryana*) was believed to be the dominant cover or co-dominant cover with Douglas-fir (*Pseudotsuga menziesii)* or Arbutus (*Arbutus menziesii*), or in the Comox area occurring with shore pine (*Pinus contorta*). Other areas may have had and still have Garry oak as a minor component of the ecosystem; however, these areas were not considered for this mapping. Originally, two major types of ecosystems occurred in the Garry oak areas. These include ecosystems on deep soils, known as Parkland Garry oak communities (Pojar, 1980a, 1980b). Common understory plants included snowberry, camas, fawn lily and bracken fern. Almost all of this ecosystem type is now gone, as these were the first areas in the region that were cleared for agriculture and urban development starting in the 1840s. Many large Garry oak trees still remain, though most of these trees have lawns, roads, agricultural fields or blacktop beneath them, rather than natural 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, and areas at the Department of National Defence lands at Rocky Point, at the south end of Metchosin Municipality. The second major Garry oak ecosystem type occurs on shallow soils and is often referred to as scrub oak ecosystems, as the oak trees are often of low stature, compared to those growing on deep soils. More of this ecosystem remains, as many of these rocky areas were difficult to develop and have been left in protected areas such as Mount Tzuhalem ecological reserve, Mount Tolmie Park and Mount Douglas Park. The understory of these rock outcrop communities was originally dominated by many spring flowering perennial forbs, grasses and mosses. Much of this has been replaced by weedy species such as Scotch Broom, agronomic grasses and other weeds. Garry oak ecosystems have been described in detail by Roemer (1972) and Erickson (1995).

As a result of loss of much of these ecosystems and recent dominance of invasive alien species, more than 100 species associated with Garry oak ecosystems are on the BC Species at Risk list. Unfortunately, this number is expected to increase as species assessments are completed, and if the threats to Garry oak ecosystems continue. Species at risk associated with Garry oak ecosystems include over 75 plant taxa, 2 reptile, 14 bird, 3 mammal, 13 butterfly and 10 insect species (GOERT 2005). These species include the golden paintbrush (*Castilleja levisecta*), deltoid balsamroot (*Balsamorhiza deltoidea*), montane yellow violet (*Viola praemorsa*), rigid apple moss (Bartramia stricta), Island marble (Euchloe ausonides - undescribed subspecies), which is extirpated, and sharp-tailed snake (Contia tenuis).

Methods

Historical Garry oak ecosystems were mapped at a 1:20,000 scale. These maps include areas where Garry oak was a dominant or co-dominant component of the ecosystem. Other areas had and presently have Garry oak as a minor component and these areas are not mapped or included in this analysis. Egan and Howell (2001) and Noss (1985) recognize a variety of sources of information for determining 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. The present Garry oak historical mapping is mainly based on original land surveys done in the 1850s and 1860s, and recent forest stand history observational field evidence. The land survey maps often showed the difference 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 by the Canadian Forest Service in the 1970s (McMinn et al, 1976). Information was collected in field studies from 2001 to 2004, to determine present distribution of oaks, but also to determine the pre-European potential, assuming that the climate has not changed significantly over the last 200 years. Expert opinion 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. Mapping for 2000 in greater Victoria was extracted from the Sensitive Ecosystem Inventory mapping done by the B.C. Ministry of Environment, Lands and Parks (Conservation Data Centre and MELP Nanaimo) and Environment Canada (Canadian Wildlife Service). For the rest of the study area, present day mapping was done through field work.

Depth of soil was added to the later mapping areas, as it was important to determine how much deep soil ecosystem was left in comparison to shallow soil ecosystem. Depth of soil was done from field work. It has been estimated for the greater Victoria area to provide for overall figures for the whole mapping area. Mapping was done on 1:20,000 TRIM sheets by mapping the presence of existing trees and extrapolation the historical using all sources of information.

Some shortcomings of the mapping exist. There is inconsistent data source information throughout the study area. The most detailed land survey maps, which showed the differences in vegetative cover, were only available in the greater Victoria area, although even in this area the Colwood and Esquimault areas did not have this vegetative cover. For areas farther north on Vancouver Island, land survey information only showed proposed lot lines. Some areas had soils mapping and floodplain mapping while other areas did not. Another shortcoming is that in some historical oak areas, where Douglas-fir has now overtopped Garry oak, may have been underestimated in the study, especially where less detailed land survey information was available.

Value of Mapping Historical Ecosystems

There are many reasons to map historical ecosystems, including showing areas for the potential for restoration, understanding regional heritage and how humans have affected ecosystems, indicating the importance of the remaining areas of an ecosystem, and to predict future potential vegetation with climate change. Historical ecosystem mapping provides an indication of how much of a particular ecosystem has been lost, which can demonstrate the importance of the remaining areas of this ecosystem, especially in ecosystems such as Garry oak ecosystems which contain large numbers of species at risk. Many of these species will not be supported if all of the ecosystem is removed or degraded. Preservation and stewardship of the remaining pieces will be required to maintain these species at risk.

It is also important to know the original conditions of ecosystems before restoration is attempted (MacDougall et al 2004). Historical mapping generally only gives one point in time and usually is not able to describe the detailed plant composition of communities that existed 150 to 200 years ago. To determine plant composition one must look at the remnants that still exist on the landscape. Successional changes over time can confound what one might have expected in historical situations. For areas that support Garry oak ecosystems, successional stages can include early grassland or prairie stages, to a variety of Garry oak dominated stands, from relatively open to closed stands, or mixed stands that include Douglas-fir and oak, to Douglas-fir dominated communities. A study in the Puget Sound of Washington on deep soil ecosystems (Peter and Harrington, 2003), describes succession as following one of two pathways. The first pathway which occurs after fire starts at open prairie, and progresses through oak savanna, oak woodland, oak forest and then to a climax of Douglas-fir. Fire during early stages of succession maintains prairie or oak savannah. The second pathway begins with a herb-shrub-seedling stage, followed by a shrub-sapling-herb stage, a coniferous tree-shrub-herb stage and finally the climax Douglas-fir forest. With fire suppression, many stands that were previously open prairie or Garry oak dominated have now been replaced by Douglas-fir, within a very short period of time. Often restorationists pick a particular successional community and attempt to get their area back to that "ideal state". In the case of Garry oak stands, that is often an oak savanna or oak woodland with a meadow like understory of camas, fawn lily and other attractive flowers, when many other stages could also be quite appropriate. As with 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).

Results

The maps (Figure 2 to Figure 7) and the table (Table 1) compare the 1800 and 2000 distribution of Garry oak ecosystems on Vancouver Island. Overall, less than 10 percent of the original Garry oak ecosystems remain in a near-natural condition. Less than 2 percent of deep soil Garry oak ecosystems remain. Most of the remnants are in isolated, fragmented communities that have no connection to other Garry oak areas, thereby

reducing species migration or mixing of genetic material from one area to another. Most remaining pieces, although still having remnants of native understory species, are dominated by invasive alien plant species such as Scotch broom, and many agronomic grasses and forbs.

Table 1. Area of Garry oak ecosystems for Vancouver Island in 1800 and 2000

	Deep 1800	Deep 2000	Shallow 1800	Shallow 2000	Overall 1800	Overall 2000
Greater Victoria[1]	9043 ha	83 ha	1400	429	10443	512
Cowichan Valley /Saltspring Island	1824 ha	83 ha	1301	619	3125	702
Nanaimo/ Nanoose	29	29	951	298	980	327
Comox	527	7	0	0	527	7
Hornby/ Denman Island	65	11	98	57	163	68
Total	11488	213	3750	1403	15238	1616
Percent		1.8 percent of original		37% of original		10% of original

1 Figures for Victoria are estimates – deep and shallow soil attributes were not recorded in the original mapping

Conclusions

According to this study, only xx percent of all Garry oak ecosystems remain, as compared to the extent in 1800. Garry oak ecosystems were quite rare in their original 1880 state, even though First Nations people had maintained them through regular burning. However, they are now critically imperilled, due to their rapid loss with 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. Invasive alien species dominate most of these fragmented areas. The future for Garry oak ecosystems is not a bright one. Some individuals have said that with climate change the range of Garry oak ecosystems could expand. The author believes that Garry oak, the species, may have the potential to expand its range, but natural understory components will not be able to move ahead of the many alien species that now occur. The only way to maintain this ecosystem will be with extensive human intervention, at a significant cost in terms of money and human effort. The main lesson that should be learned from this study is that rare ecosystems can and will be lost over time. Unless

humans find a way to protect rare ecosystems, through a variety of mechanisms, including legislation (similar to what presently exists for species at risk), as well as stewardship and restoration activities, many more ecosystems at risk will be lost.

The following activities must be considered for Garry oak ecosystems to have a future – protect the remnants, deal with invasive species, restore suitable areas, purchase lands to conserve, promote stewardship on private lands, assess the potential to introduce appropriate species at risk, prevent other ecosystems from becoming so threatened, and plan for climate change.

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

Figure 2. Garry oak ecosystems in the greater Victoria area for the 1800s (green – light) and 2000 (red – dark).

Figure 3. Garry oak ecosystems in the Cowichan Valley and Saltspring Island area for the 1800s (green – light) and 2000 (red – dark).

Figure 4. Garry oak ecosystems in the Nanaimo area for the 1800s (green – light) and 2000 (red – dark).

Figure 5. Garry oak ecosystems in the Nanoose area for the 1800s (green – light) and 2000 (red – dark).

Figure 6. Garry oak ecosystems in the Comox area for the 1800s (green – light) and 2000 (red – dark).

Figure 7. Garry oak ecosystems in the Hornby and Denman Island area for the 1800s (green – light) and 2000 (red – dark).