Bringing Back Fire to Garry Oak Ecosystems in the Gulf Islands National Park Reserve: An Ecocultural Restoration Project

Dr. Marlow Pellatt

The Team

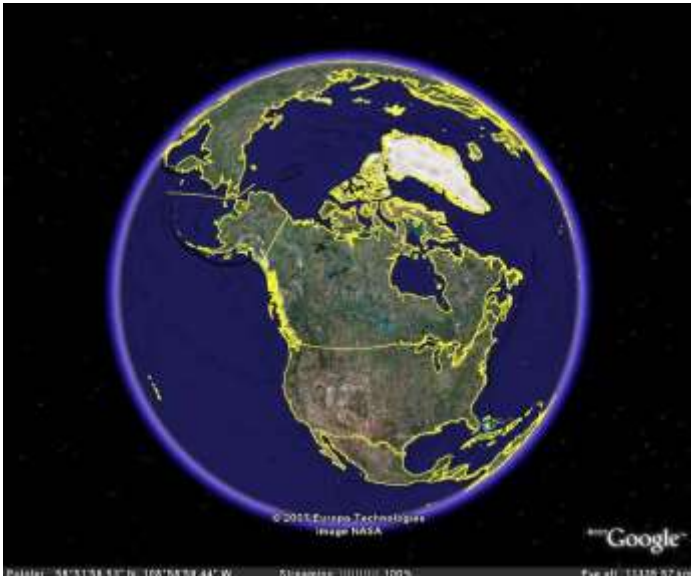
- Marlow Pellatt
- Jay Zakaluzny
- Nathan Cardinal
- Rob Walker
- Ze'ev Gedalof
- Jenny McCune
- Marian McCoy
- Shyanne Smith
- Celeste Barlow
- Sinead Murphy
- Mark Vellend
- Andrew MacDougal
- Rolf Mathewes
- Karen Kohfeld
- Dan Smith
- Numerous Parks Canada and SFU staff and students.

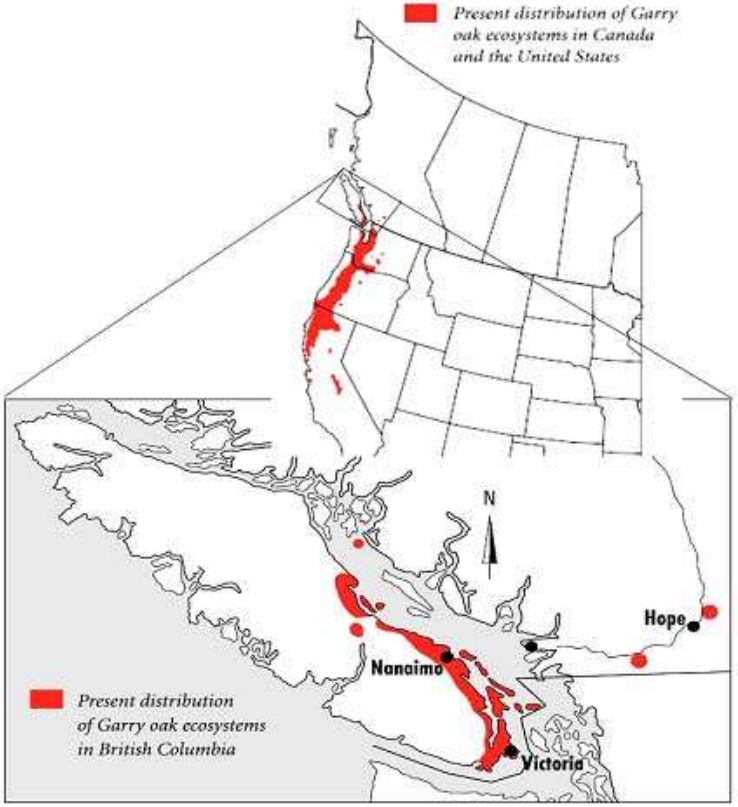
Garry Oak Ecosystems

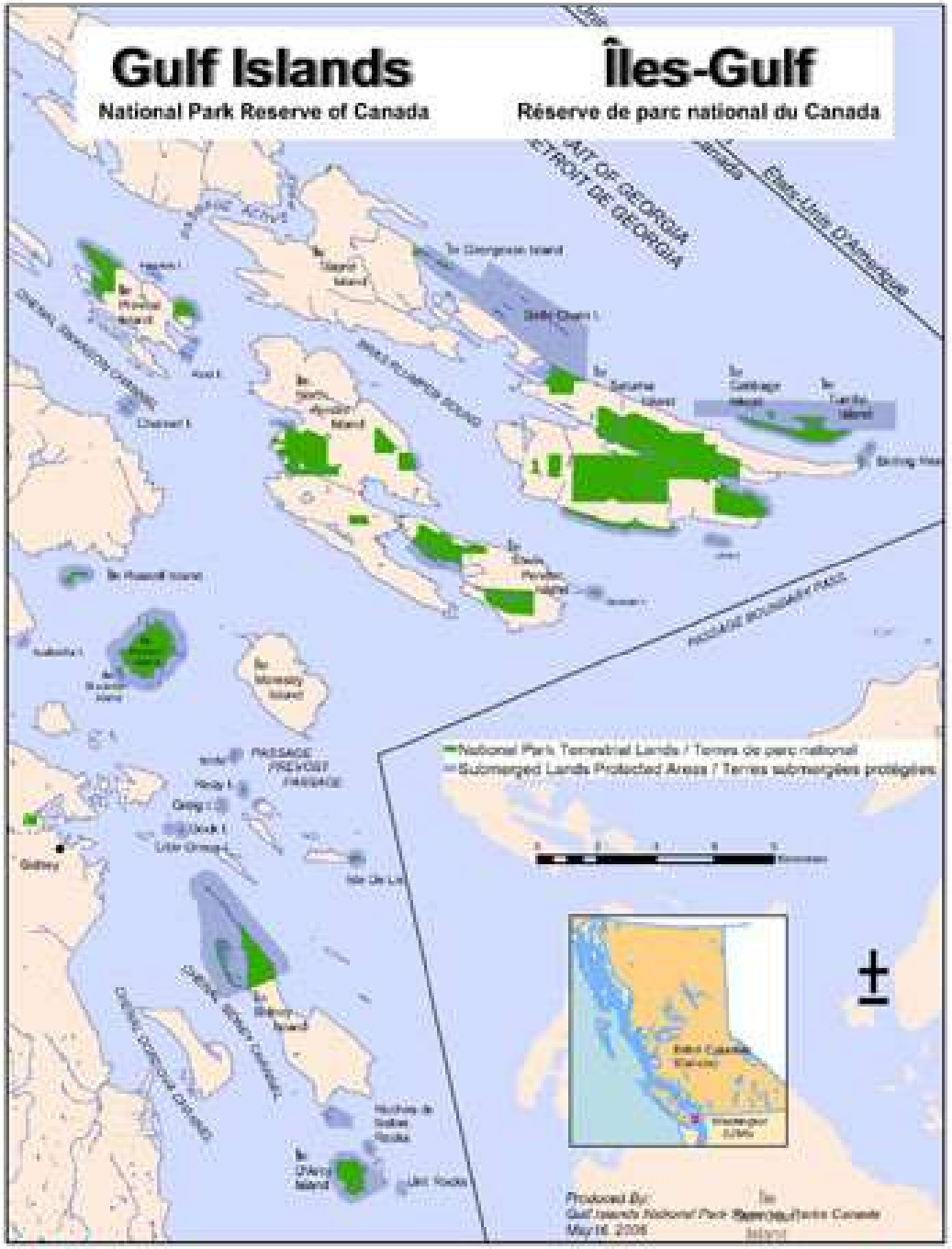
- A Garry oak ecosystem is one with naturally occurring Garry oak trees (*Quercus garryana*) and some semblance of the ecological processes and communities that prevailed before European settlement.

- Garry oak ecosystems are listed as an endangered ecosystem under Canada's Species at Risk Act (SARA). Parks Canada is obligated to work on the recovery of these ecosystems.

- Major threats are loss of habitat,
  invasive species and
  altered ecological processes.


Google

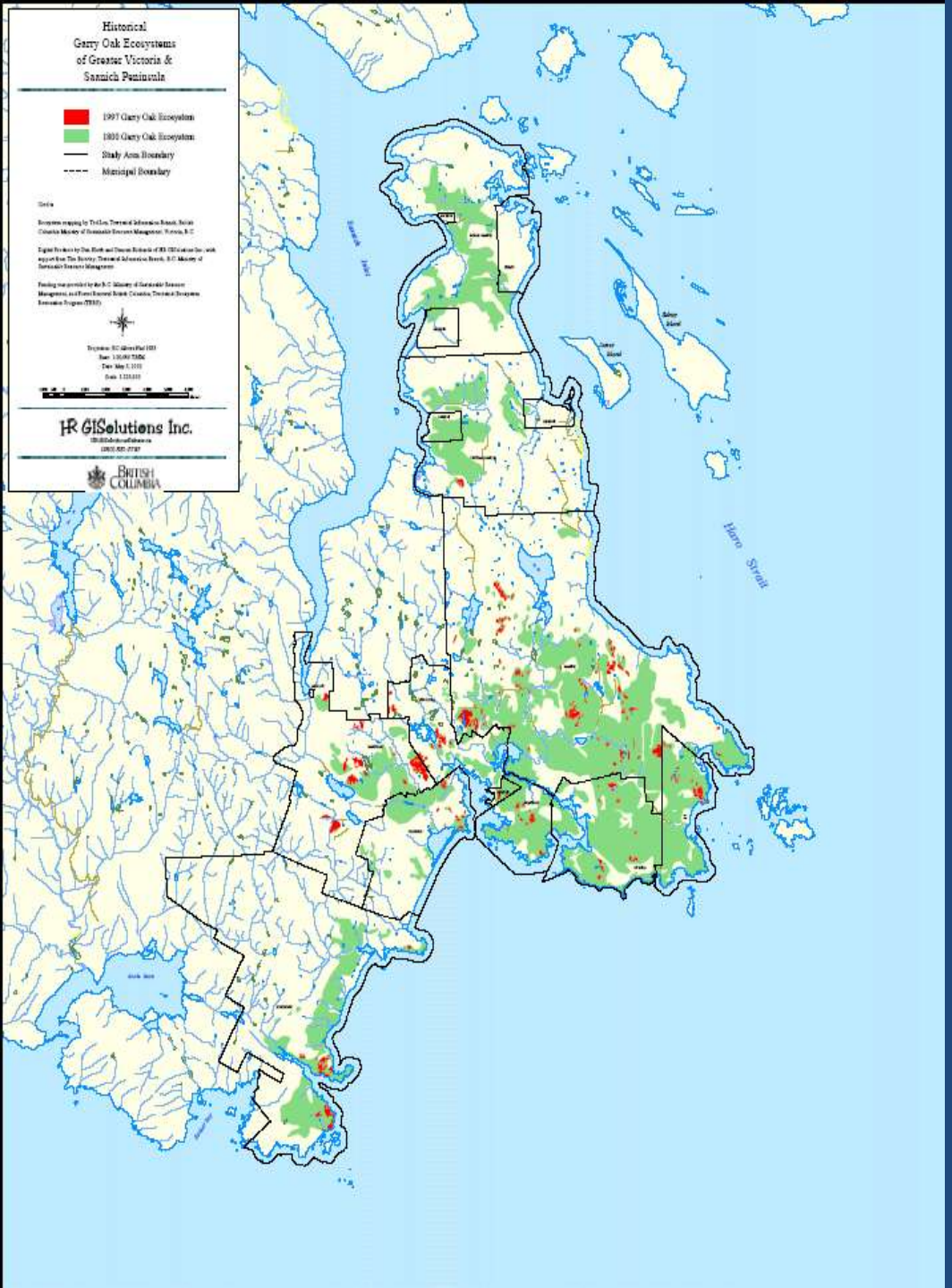

Present distribution of Garry oak ecosystems in Canada and the United States
N
Hope
Nanaimo
Victoria
Present distribution of Garry oak ecosystems in British Columbia


Gulf Islands
National Park Reserve of Canada
Îles-Gulf
Réserve de parc national du Canada
National Park Terrestrial Lands / Terres de parc national
Submerged Lands Protected Areas / Terres submergées protégées
Produced By:
May 16, 2006
Canada

Understanding an Endangered Ecosystem

Less than 5% of Garry oak ecosystems remain in a near-natural condition. More than 100 species of plants and animals are listed as “at risk of extinction”. Several species have already been extirpated.

The number of “at-risk” species and loss of habitat in the surrounding region make this park one of the most vulnerable in Canada.



Historical Garry Oak Ecosystems of Greater Victoria & Saanich Peninsula

1997 Garry Oak Ecosystems

1800 Garry Oak Ecosystems

Map: www.goert.ca

Ecological Integrity

An ecosystem has integrity when it is deemed characteristic for its natural region, including the composition and abundance of native species and biological communities, rates of changes and supporting process

(Panel on Ecological Integrity Report, 2000)

Temporal Scale

- What temporal baseline should be used to assess ecological integrity?
- Should ecological integrity based on the ecological makeup of the area in question:
  - When the protected area was established?
  - Based on Indigenous peoples land use patterns?
  - Climate change adaptation and mitigation?
  - Other disturbance regimes, ecological trajectories, and environmental change?

Research Objective

We take a multidisciplinary approach (paleoecology, experimental research, restoration ecology) to better understand the role of climate and fire in the formation of Garry oak ecosystems and provide guidance for active management activities.

A Journey from Research to Action

1) High Resolution Pollen Analysis (Holocene)

Ocean Drilling Program Leg 169S - Saanich Inlet, British Columbia (1 to 25 year intervals) for coastal BC over the last 12,000 years.

2) High Resolution Pollen and Charcoal Analysis at sites representing local conditions and short time scales (Anthropocene and Late-Holocene).

3) Other Proxies i.e., Dendroecology, Phytoliths, Climate Envelope Modelling.

4) Determination of ecosystem history, natural disturbance regimes, fire return intervals and inference of Indigenous land management.

5) Scientific guidance to re-establish fire into ecological restoration activities.

Very Brief History of Fire in BC's Garry Oak Ecosystems

Historical accounts indicate that Garry oak ecosystems were ignited in late summer and fall (Boyd 1986; Fuchs 2001; Turner 1999).

By the mid-1800s, however, as Europeans began clearing portions of southeastern Vancouver Island for agriculture, large fires were commonly observed (Grant 1857; Maslovat 2002).

The new "Government" restricted cultural burning in southwestern BC through the Bush Fire Act of 1874 (MacDonald 1929).

Terra Nullius

- Throughout the world, colonialism resulted in the suppression of aboriginal land management practices, abetted by the concept of ***terra nullius***, ”belonging to no one”; the belief that aboriginal people had little influence on the land.

- Until recently, this ideology was entrenched in resource management and policy.

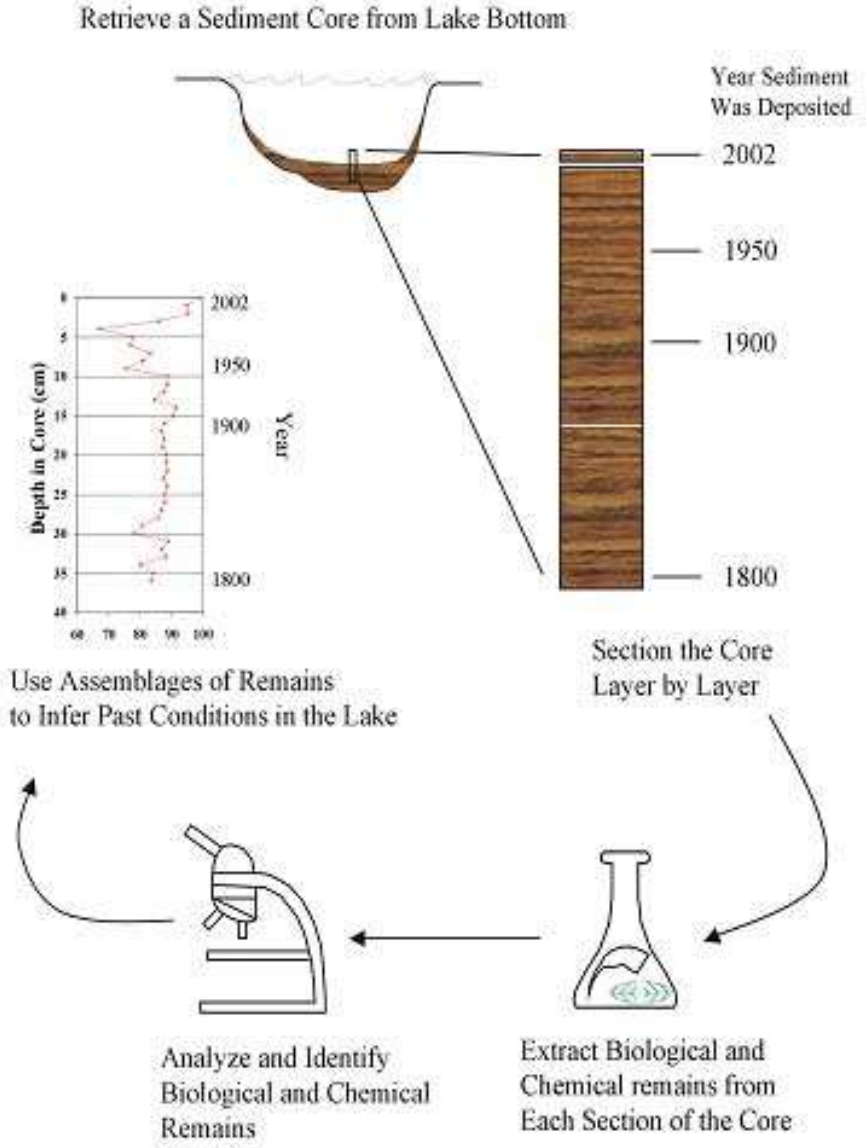
- Indigenous people know this is not true. Their knowledge is supported by archaeological, palaeoecological and anthropological studies.

Paleoecology

- Examine how ecosystems change through time to determine natural change and anthropogenic modification of the landscape

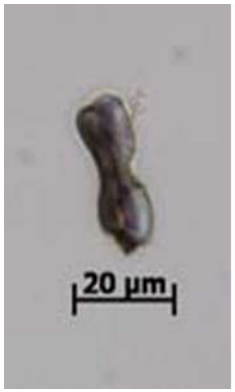
- The dynamic nature of ecosystems can be observed relative to time (seasonal to millennial scale) in order to understand ecological integrity

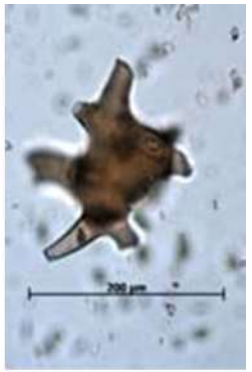
Lake Sediment Coring



Tools of the Trade

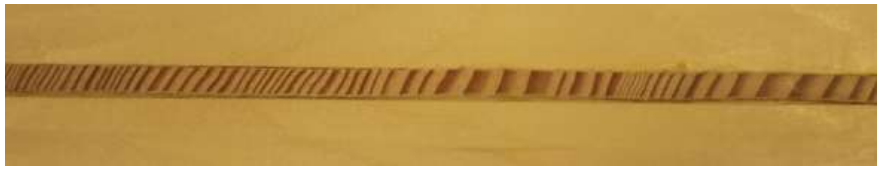
Abies pollen





Phytoliths

Charcoal



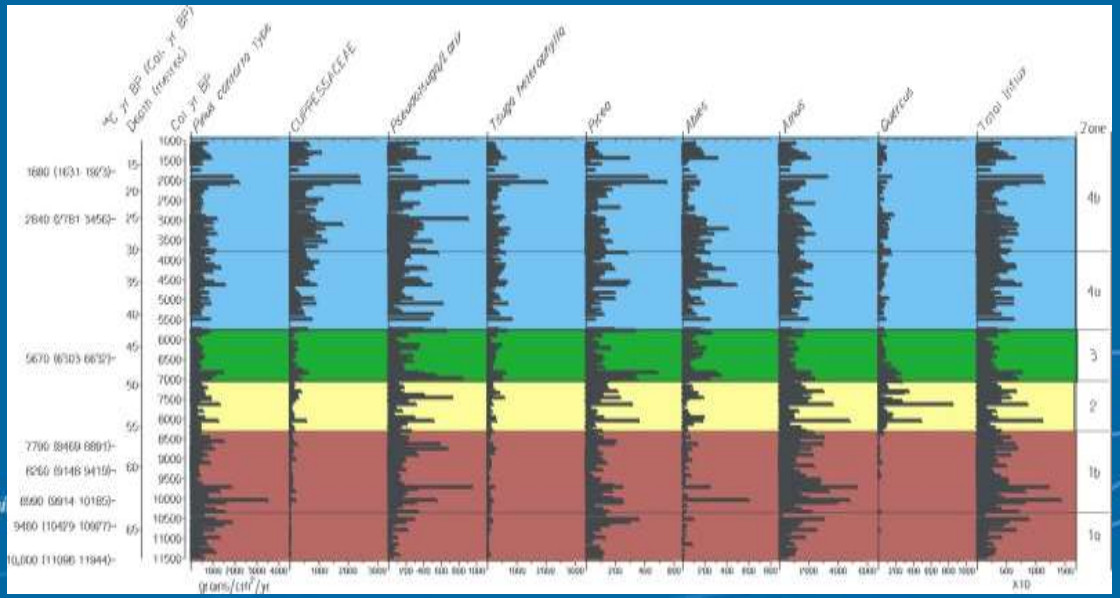
Tree Rings

Lessons from the Past

- Pollen analysis shows that in the early Holocene temperatures were 2 – 4C warmer than present. Oak greatly expanded about 8000 years ago, and although at lower values, oak and grass remain constant during a 5000 year period when shade-tolerant conifers such as cedar, western hemlock, and spruce are increasing.

- Since regional climate was becoming wetter, the persistence of oak pollen suggests that local influences maintained oak woodland and meadow environments near Saanich Inlet.

- Upon European contact, fire was observed in oak savannas in Oregon and southern Vancouver Island.



- Pollen analysis shows that in the early Holocene temperatures were 2 – 4C warmer than present (Heusser&Mathewes). Oak greatly expanded about 8000 years ago, and although at lower values, oak and grass remain constant during a 5000 year period when shade-tolerant conifers such as cedar, western hemlock, and spruce are increasing.

- Since regional climate was becoming wetter, the persistence of oak pollen indicates that local influences maintained oak woodland and meadow environments near Saanich Inlet.

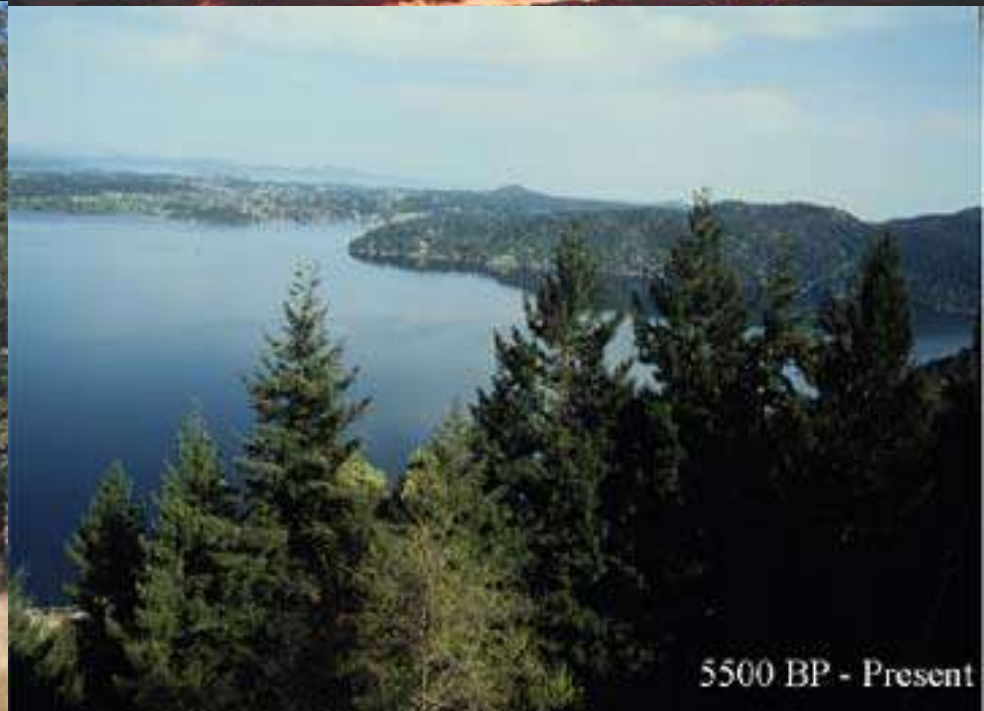
- Upon European contact, fire was observed in oak savannas in Oregon and southern Vancouver Island.

Pellatt et al 2001


11500 – 8500 BP


11500 – 8500 BP


8500 – 7000 BP


5500 BP - Present

It is reasonable to hypothesize that aboriginal burning may have been important in maintaining Garry oak ecosystems over the last 3400 years.

Western Distribution of Camas and Garry oak

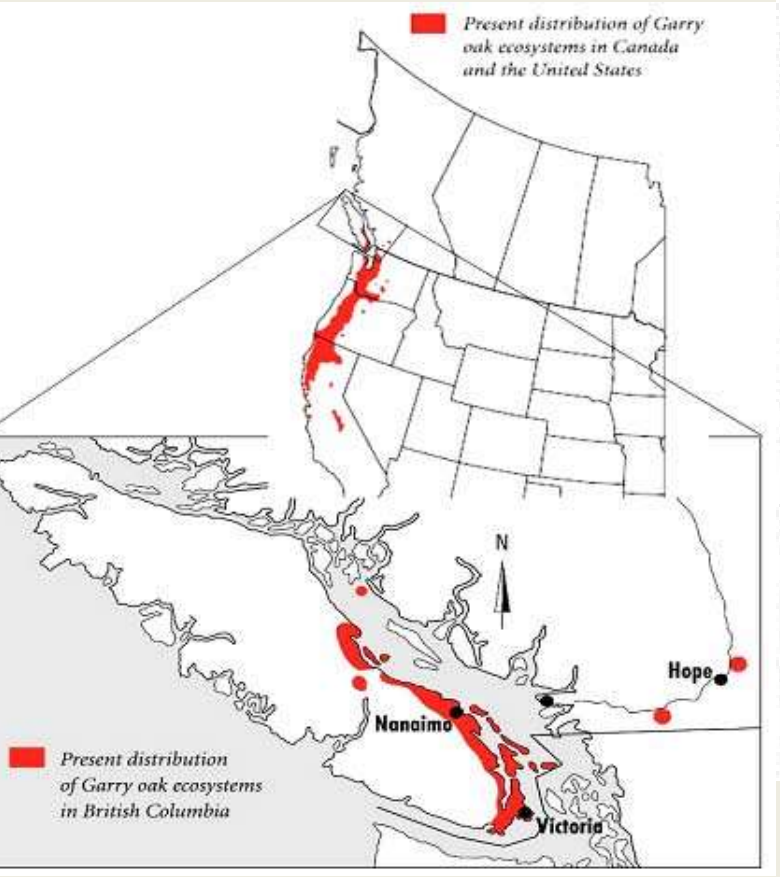
Fire History Research

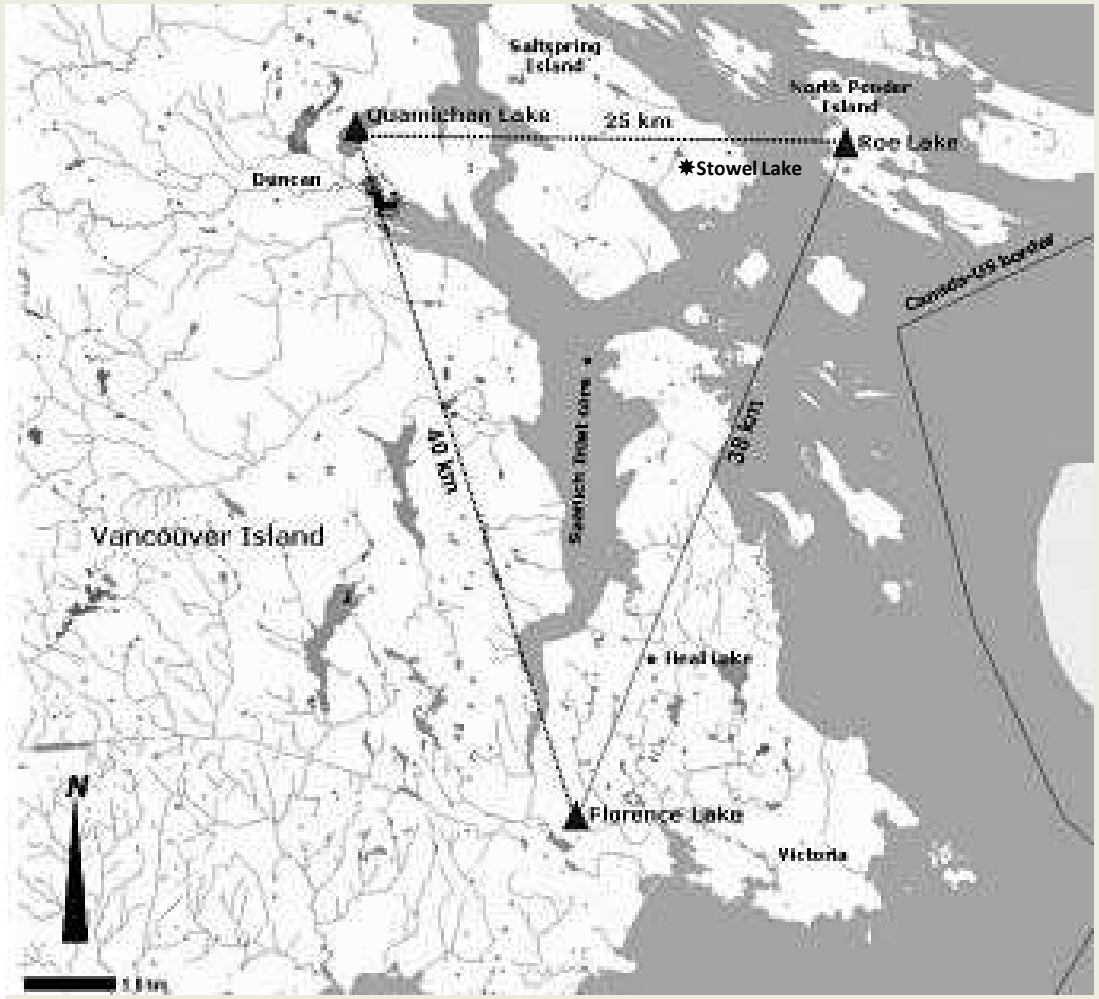
How often did fires occur?

- Pollen
- Charcoal
- Tree Rings

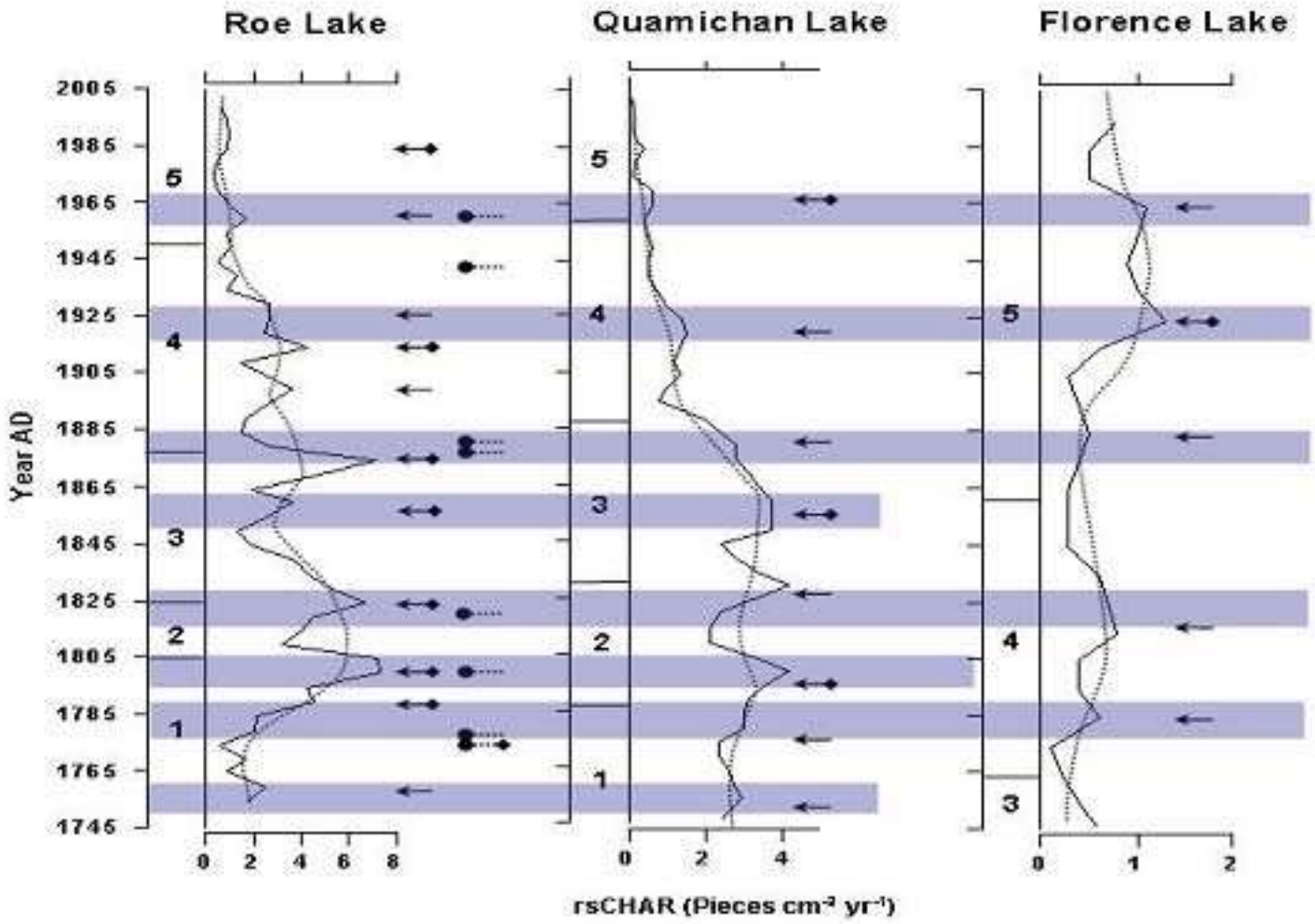
- Short cores – high resolution analysis

Study Sites for Palynological Research





Charcoal accumulation rate fire history for Study Sites (1745- 2003)

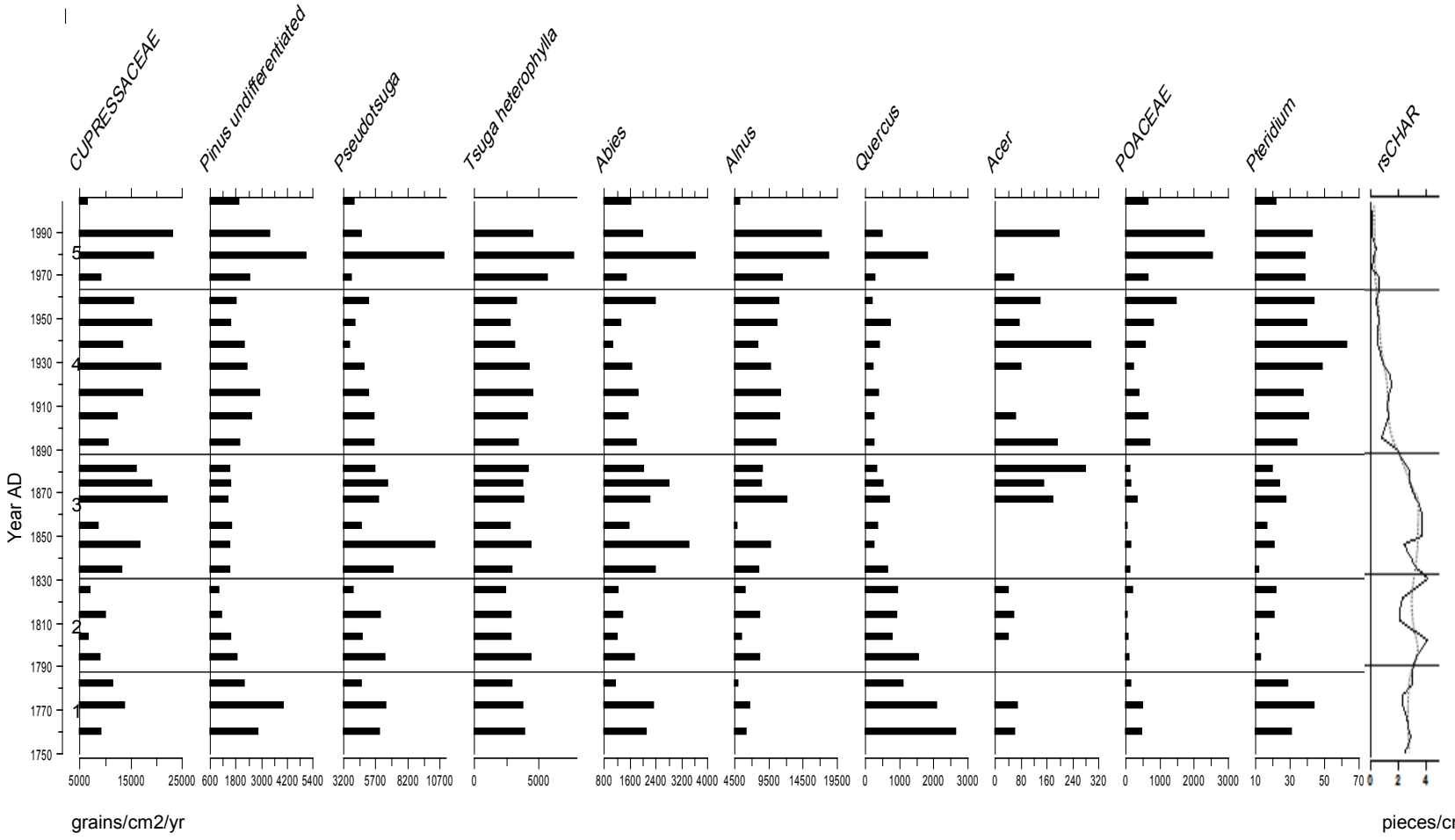


Grey bars span ca. 10 years and highlight fire events that appear coeval ± 10 years.

Mean Fire Return Intervals

- Roe Lake ~ 27 years
- Quamichan Lake ~ 26 years
- Florence Lake ~ 41 years
- Fire events that occurred after ca. 1880 were excluded from the MFRI calculations.

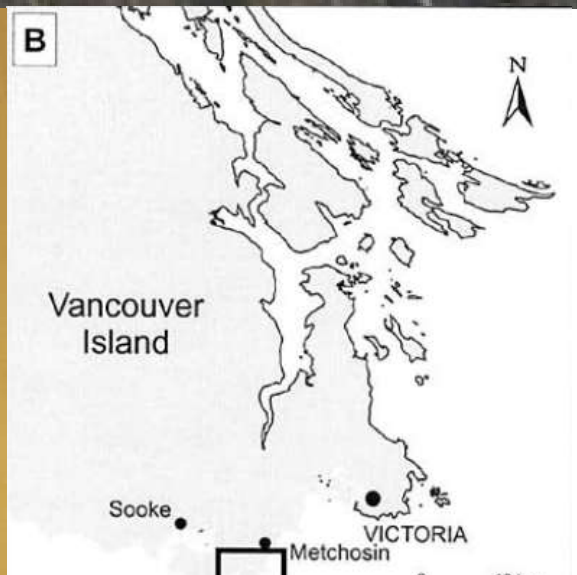
Quamichan Lake Pollen Accumulation Rate Diagram



1880s – Fire suppression and Colonization

~1965 – Recovery and conservation

Dendroecology at Rocky Point



Brief History of Rocky Point

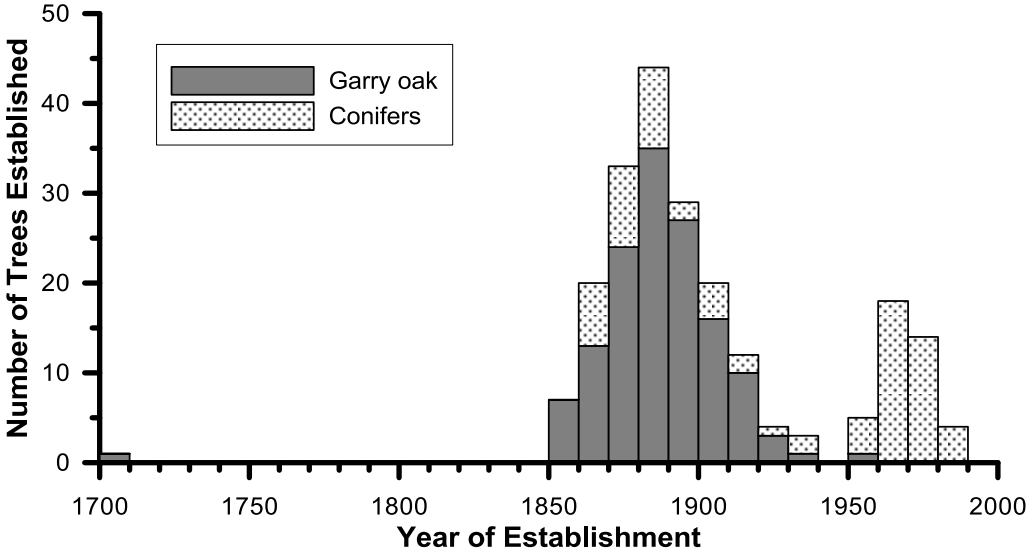
- Captain W. Colquhoun Grant, who explored the west coast of Vancouver Island beginning in ca. 1850, describes the point as "a fine open prairie extending nearly across to Becher Bay…interspersed with oak trees" (Grant 1857).

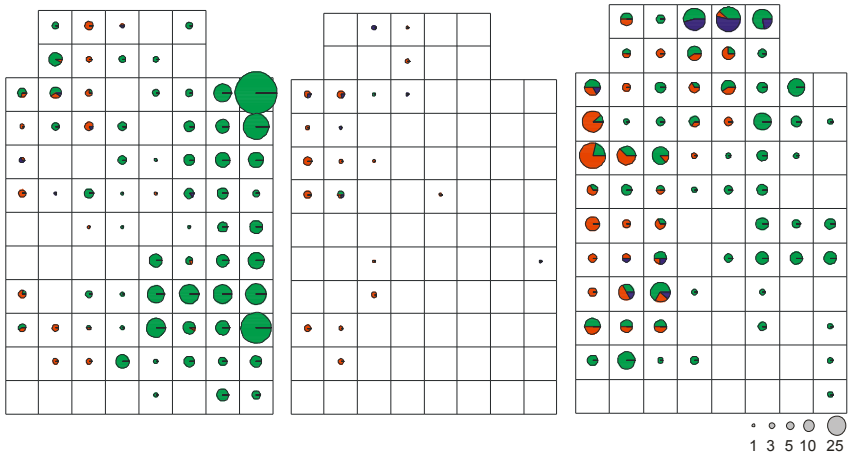
- In May, 1850, the Metchosin region including Rocky Point was sold by the Ka-Ky-Aakan Nation to the Hudson's Bay Company, resulting in the relocation of the residents to Sooke and Victoria (Weir 1983).

- 1850s to 1951 – Settlement and Farming

- 1951 Department of National Defence site – Active fire suppression

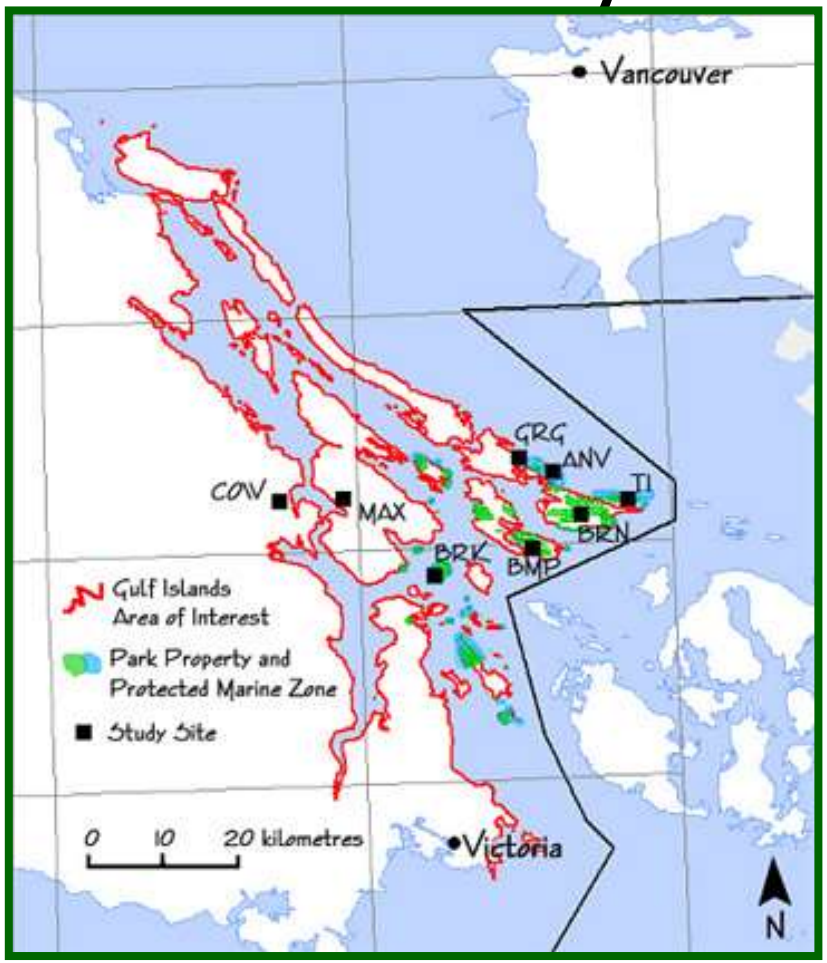
Rocky Point Stand Age

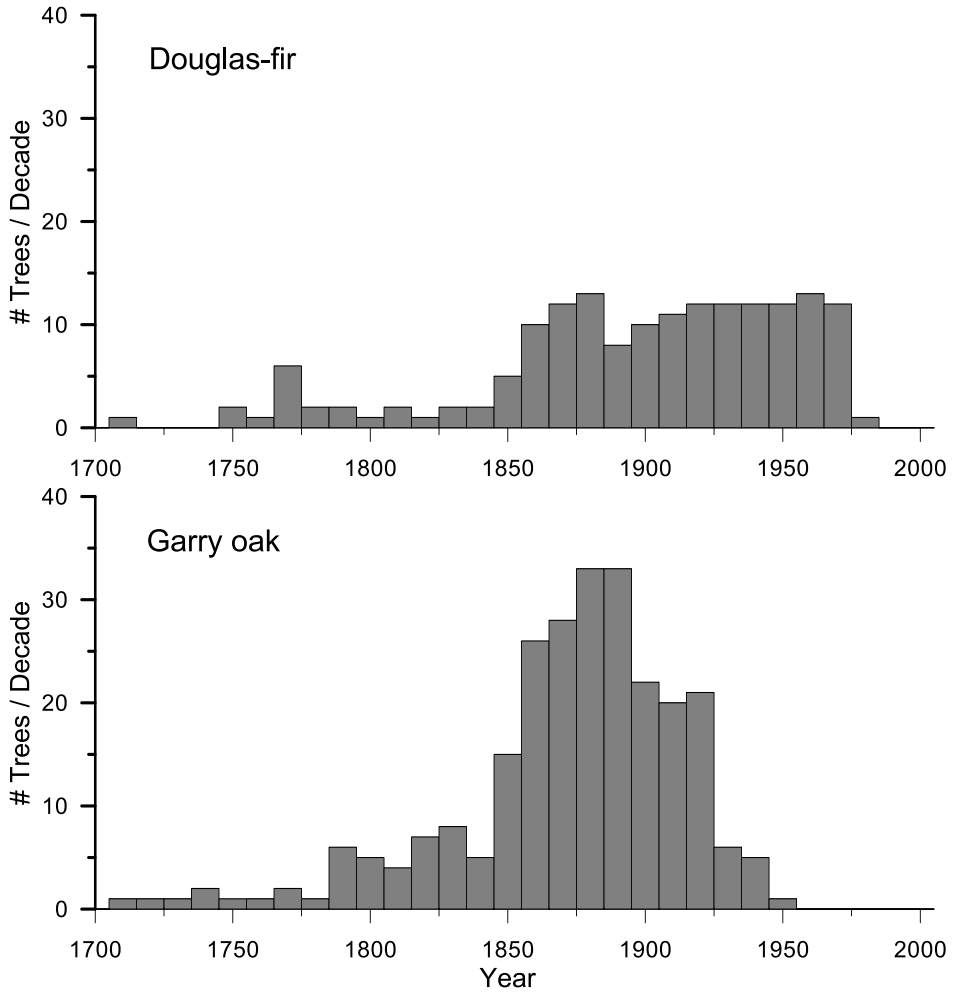




Number of trees per quadrat, and relative species proportions at site RPA for (A) seedlings, (B) saplings, and (C) trees sampled at site RPA. Garry oak is shown in green, Douglas-fir in red, and grand fir in blue.

Dendroecology
Garry Oak Stands SW BC





Eco-Cultural Landscape

- Charcoal analysis indicate continuous and frequent fire events, with more severe fires occurring every 26–41 years in southwest British Columbia throughout the Anthropocene (last ~250 years) that substantially altered forest structure and composition.

- These results are consistent with stand age reconstructions in BC and Washington with Garry oak establishment beginning ~1850 AD, corresponding with modern fire exclusion, aboriginal population decline, and end of the Little Ice Age.

- Douglas-fir recruitment has been continuous since ~1900, with succession of oak woodland to closed conifer forest at most sites.

- These findings illustrate the change in ecosystem structure as a result of fire suppression and show that many Garry oak ecosystems may have been profoundly influenced by eco-cultural practices.

- In many cases these ecosystems are dependent on prescribed fire for their open structure.

- In the absence of aboriginal land-management practices, active management will be necessary to maintain Garry oak woodland.

From Research to Eco-Cultural Restoration (2012 onward)

An experimental approach to reintroduce fire into Garry oak ecosystems.

Tumbo Island Prescribed Burn

Our goal is to re-introduce fire following 150 years of fire suppression.

- **The principle strategic goal is simple: to assess the consequences for plant communities of using prescribed fire as a restoration tool.**

- **In addition to fire we are excluding areas from deer browsing.**

Photo by: Rob Walker

Tumbo Island - September 30th , 2016

Involved Participants

- Parks Canada
- Coast Salish Elders
- Saturna Volunteer Fire Department
- Capital Regional District
- Khowutzun Forest Services
- BC Forest Service

Goals and Successes

- Build regional relationships/capacity
- Connecting people with use of fire
- Small steps
- Communicate with public
- Engage with media

Next Steps

- Monitor, monitor, monitor.
- Addition of selected plants including ethnoecologically important species.
- Expand plots for conifer removal and other treatments.
- Expand program to other sites.
- Repeat burn.

Funding Agencies

- Parks Canada
- Interdepartmental Recovery Fund (SARA)
- Climate Change Action Fund (NRCan)
- Pacific Institute for Climate Solutions
- NSERC

Our Team's Research into Garry Oak Ecosystems

Pellatt, M.G., McCoy, M. and Mathewes, R.W. (2015) Paleoecology and Fire History of Garry Oak Ecosystems in Canada: Implications for Conservation and Environmental Management. *Biodiversity and Conservation*, 24:1621-1639.

McCune, J.L., Vellend, M., and **Pellatt, M.G.** (2015) Combining phytolith analysis with historical ecology to reveal the long-term, local-scale dynamics within a savannah-forest landscape mosaic. *Biodiversity and Conservation*, 24:609-626.

Pellatt, M.G. and Gedalof, Z. (2014) Environmental change in Garry oak (*Quercus garryana*) ecosystems: The evolution of an eco-cultural landscape. *Biodiversity and Conservation* 23: 2053-2067.

McCune, J.L. and **Pellatt, M.G.** (2013). Phytoliths of southeastern Vancouver Island, Canada, and their potential use to reconstruct shifting boundaries between Douglas-fir forest and oak savannah. *Palaeogeography, Palaeoclimatology and Palaeoecology*. 383-384: 59-71.

McCune, J.L., **Pellatt, M.G.**, and Vellend, M. (2013). Multidisciplinary synthesis of long-term human-ecosystem interactions: A perspective from the Garry oak ecosystem of British Columbia. *Biological Conservation.* 166: 293-300

Pellatt, M.G., Goring S. Bodtker, K. M., and A.J. Cannon (2012) Using a down-scaled bioclimate model to determine long-term temporal connectivity of Garry oak (Quercus garryana) habitat in western North America: Implications for protected area planning. *Environmental Management*, 49:802-815 (DOI 10.1007/s00267-012-9815-8)

Gedalof, Z., **Pellatt, M.G.** and Smith, D.J. (2006) From prairie to forest: three centuries of environmental change at Rocky Point, Vancouver Island, BC. *Northwest Science*, 80: 34-46.

Bodtker, K.M., **Pellatt, M.G.** and Cannon, A.J. (2009) A Bioclimatic Model to Assess the Impact of Climate Change on Ecosystems at Risk and Inform Land Management Decisions. Report for the Climate Change Impacts and Adaptation Directorate, CCAF Project A718. Parks Canada Agency, Western and Northern Service Centre Publication. Vancouver: Canada.

Pellatt, M.G., Gedalof, Z., McCoy, M., Bodtker, K., Cannon, A., Smith, S., Beckwith, B., Mathewes, R., Smith, D. (2007) Fire History and Ecology of Garry Oak and Associate Ecosystems in British Columbia. Parks Canada Agency, Western and Northern Service Centre Publication. Vancouver: Canada