"Pre-settlement" Wildfire information from around Lasqueti

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I write this to get us all thinking about our goals/visions and options (how to achieve our goals) about our forests. For more than ten years I have been studying "What were our CDF pre-settlement forests like?" off the side of my desk. I'll start with a hypothesis: *Lasqueti forests were more open (less dense), multiple aged and diameters, less brush, created by active management with fire, experienced/used to frequent ground fires, often with small patch to larger prairie areas of forbs/forage and of coarse stands of nice old-growth trees. The northern Coast Salish frequently burned Lasqueti (Xwe?etay/Xwe"i"tay) to increase both wanted plant & fauna habitat for their food needs on the island. I believe such a forest (pre-contact) can be burned relatively safely (without crowning out and killing all/most of the trees) and would be at a lower wildfire risk than what we have today.*

If this hypothesis is correct, then our present forest is quite different; much denser, lots of fuel, filled with fire ladders, and too many crowns touching one another; in other words, just waiting for a major stand replacing fire to happen. Like what has been occurring up & down the west coast. The fire return was from about 6 to 45 years, which increases our wildfire risk with each additional decade without a fire. We need a to thin out the forest and possibly re-introduce fire by controlled burns, to protect our forests. This presentation is the first (part 1) about the pre-settlement CDF forest and is mostly about the time between wildfires and the mix of what old-growth was like on the island from my research.

History within the Douglas-fir region:

Lasqueti is in the Coastal Douglas Fir (CDF) zone where Douglas-fir can regenerate in some shade. The assumed beliefs (1900-2000) about most of the Douglas-fir region, is that Douglas-fir would only regenerate in nearly pure stands after a stand replacing fire. It was also assumed that Douglas-fir was shade intolerant, would not grow in shade of bigger trees. It was also assumed that fire returns were between 200 to 450 years, because of the ages of stands. It was assumed that clear-cutting would mimic a fire, so should become the major harvest method for Douglas-fir. In the late 1900's in the Douglas-fir region, clear-cutting was opposed by a segment of the public, as it still is objected to. Then Gerry Frankland introduced new forestry practices to retain structure while logging to better mimic ecology following wildfires and retention cutting has become the normal practice, but to many people retention cutting is still clear-cutting. In BC in 1995 the CDF zone was believed to have infrequent (200 year mean fire return) stand initiating fires by the Biodiversity Guidebook. The Biodiversity Guidebook is still the main reference for wildfire return and natural disturbance type (NDT) across most of BC.

I propose that the CDF and the drier Coastal Western Hemlock (CWH) zone had a fire frequency from 6 to about 31-45 years. This would have meant the normal fire regime was a low to mixed-severity fire regime between longer term stand replacing fires. I have found reference to this type of fire regime in a publication by Weaver, 1974 within a publication by Kilgore in 1981, but I am still trying to get the book (and other primary sources) as I have not found the supposed quotes in one primary source mentioned. I had thought this was a new type of fire regime, but Kilgore mention it in 1981; it has gotten lost in the accepted fire regime lists since then. This type of fire regime was mentioned in the Biodiversity Guidebook, 1995 for NDT 4 for Ponderosa Pine (PP) & Interior Douglas Fir (IDF) but not for any coastal areas. It takes studying the light burning vs total fire protection issue and history of climax type forests in forest succession/ecology to understand fire regimes [another article]. I believe it takes re-examining the older research with a different approach, to understand how this older research can show that the forest was created by a low to mixed-severity fire regime. If we believe that the pre-settlement fire return was mostly low to mixed-severity fire created by First Nation controlled burns, this would change the conclusions of most research abstracts about coastal wildfires from before 2000, and even some after this date [especially in Canada].

CD Howe:

The oldest published pyro-dendrochronology (tree ring & fire) study in Canada was two papers by Clifton Durant (C.D.) Howe who wrote in "Forest Protection in Canada 1913-1914", published in 1915. CD Howe wrote about fires in the Douglas-fir region of BC with his field study in BC being done in 1913. (This is a different CD Howe than the industrialist/politician of World War Two.)

Howe studied stumps and trees along 7 transects which were 5 miles long from the shore/beach inland to an altitude of >300 meters around the Gulf of Georgia. The areas of the transects were Shawnigan Lake, Lake Cowichan, Chemainus, Union Bay, north shore Burrard inlet, Gibsons, and Powell River, *but probably only the beginning of Chemainus and Powell River transects are in the present CDF biogeoclimatic (BEC) Zone.* He conducted smaller transects off these transects, to study regeneration and survivability of seed trees (the main reason for the study). He also counted trees left after logging and called them seed trees. He studied a square mile intensively outside Powell River to tentatively represent the whole area. He counted tree rings to determine tree ages and dates of fire scars, but recognized that his ages were approximate.

Howes's abstract and conclusions about fire intervals are not supported by the data provided in the article, but his parameters for choosing intervals are different than what is accepted today. Even today, there are still problems with trying to compare fire data from different studies. The median fire interval for all seven transects was 31 years for the pre-settlement time period from the data provided.

The other main information was that there were both patches of Douglas-fir and individual trees growing within the harvested old-growth stands (230 to 540 years old). The ages of these Douglas-fir trees were 30, 50, 70, 100, 124, & 170 years old in 1913. These ages were found on all the transects and Howe found direct evidence of fires for each of these years. Howe said that from all seven transect there averaged about 195 trees per hectare (Ha) younger than 100 years old that were left standing after harvest and he called these seed trees. [This is different from today, where only big, usually the best form trees, are considered seed trees in forestry schools.] The average seed trees per species per hectare of the 195+ trees remaining were: Douglas-fir 54.3 trees/Ha, Hw 108.7 trees/Ha, Cw 32.1 trees/Ha. We do not know how many more were cut or knocked down during the logging. [These were probably some of the best Old-growth stands harvested before 1913 and probably had tradition OG densities of >400 trees/Ha.]

I have only found references to older publications about observations from late 1800's to early 1900's writings that talk about younger stand ages from fire, but not the younger Douglas-fir growing within an older stand. I have not been able to find any study that showed this type of information about original forests (so far). With recent information about low to mixed-severity fires, there is another way of looking at Howe, that within the areas Howe studied, the logged old-growth were not just the result of one stand initiating fire, but were the result of at least six different low to mixed-severity fires over the 230 or more years since the major stand replacement fire. These fires had to open the forest canopy enough to allow relatively shade intolerant Douglas-fir to regenerate in the dryer CWH zone. The wide distances and water bodies between the transect locations of these low to mixed-severity fires shows they could not have been one big fire, because such a stand replacing fire would have burned the older trees also.

Fire synchronicity:

It is interesting that from Howe, these fire years happen on all seven transects. In more resent fire history studies (Bakker et al, on two islands in the San Juans - CDF zone) with more low severity fires (about every 6 years from both studies) there were only seven common fire years. The earlier fire data (Howe) was not "what is called" cross dated, which is checking for accuracy of years along the trees age by matching tree ring patterns. Howe even wrote that the ages of the old trees were approximate. The difference between studies, showed more fires in the CDF zone: which may be from the difference between CWH and CDF zones and/or the nearness to native villages.

Howe and the last San Juan island's study had five synchronized years in the 1800's. There has to be a reason for this synchronicity from the spread and distance of sites Shawnigan Lake, Lake Cowichan, Chemainus, Union Bay, north shore Burrard inlet, Gibsons, Powell River, and two different islands in the San Juan's. I believe the most logical reason is fuel

and weather conditions were synchronized and many First Nations set controlled burns in dry years. Remember none of these fires were stand replacing fires [Howe said some younger trees were in patches, but any patch size data is unavailable].

Slavoj Eis:

In 1961 Slavoj Eis's Doctoral Thesis, reported that fires were more local than regional, different intensities different years, one lightning storm in July of 1941 set 240 wildfires in the Vancouver forest region. Eis believed that major high severity fires (stand replacement fire) started regeneration of most stands to Douglas-fir. He showed that there were multiple regeneration periods in all areas (species not indicated), indicating less severe fires causing additional regeneration after the original initiation of the stand. [The areas studied were UBC forest, Coquitlan valley, Mount Seymour, Lynn and Seymour valley, and Vancouver area].

Eis's "Year of Establishment indicating fire history" graph shows multiple fires and looks similar to fire and regeneration patterns from documented low to mixed-severity fire regime areas. This complements C. D. Howes finding and provides a continuum between recent CDF fire return studies versus the older belief that fire return in both CDF and drier CWH is mainly stand replacement. Again no one had todays knowledge about mixed-severity fires in 1961. There are different reports about lightning strikes on the BC coast, but Eis report and recent years has shown lightning started fires can happen over a widespread area on BC's coast both in CDF and even in the wetter CWH zones. This is very different interpretation about lightning, than Bakker et al see below whom believes lightning fires are rare in pacific northwest of USA. The reality about things (lightning in this case) are not always determined by published research and can be sometimes found in unrelated research, such as Eis's thesis.

Anne Bjorkman:

Anne Bjorkman 2008/(2010 with Mark Vellend), published papers about pre-settlement forests in Duncan, Chemainus, and Saltspring. They compared 2007 conditions and about 1859 & 1874 land surveys. This table is my interpretation of the stand densities reported for Cowichian. Forests had an average of about 400 trees/Ha [often what people consider traditional old-growth (OG) density], open woods averaged 227 trees/Ha [just over 50% of traditional OG densities], plains were sparce at an average of 61 trees/Ha [@15% of traditional OG densities], and prairies averaged 8 trees/Ha [2% of traditional OG densities].

Cowichian Valley					
Cover type	Stocking of trees/ha (+/- 95% CI)	% of area in 1859	DV change because t/Ha were similar for undescribed as for forest	Removing the 11% swamp area for change of % of area in 1859	% of area in 2007
Forest	404 (296)	9	39	43.8	79
Open Woods	227 (187)	15	15	16.9	18
Plains	61 (41)	23	23	25.8	2
Prairies	8 (3)	12	12	13.5	1
Undescribed	394 (167)	30	moved up		
Swamp & Bottom land	N/A	11	11		N/A
Total %		100	100	100	100

My interpretation of Bjorkmans stocking and percent area table, I recognize that the swamp & bottom land percentages if removed from 1859 survey would likely affect the other percentages as presented.

So in 1859 only about 43.8%of the area had what is considered traditional old-growth (250-450 trees/Ha). About 56.2% of the area had about half the stocking of traditional old growth - or what would be considered full stocking. 39.3% of the total area was very sparsely treed; we need to remember these areas were in close proximity to multiple First Nation villages. I would expect much of Lasqueti stocking of trees was similar in 1850 to the above chart, because of our local First Nation population and multiple communities. I saw such prairies areas already infilling in the late 1980's around Richardson Bay, while walking the crown lands. From historical accounts and other areas, we know these prairies, plains, and open woods were created and maintained by fire. They also provided the observed forage that the first surveyor mentioned.

Bjorkman's conclusions: "The direction of these changes and the vegetation patterns [infilling] evident in the pre-settlement landscape likely derive from a frequent fire regime that was influenced by anthropogenic burning. Current vegetation patterns likely reflect the results of extensive logging and fire suppression."

In addition to the stocking densities above, Bjorkman also determined (overall) densities for Cowichian Valley and Saltspring Island at: 335.6 stems/Ha (+/- 125.3) in 1859 changed to 829.8 (+/- 171.9) in 2007 [Cowichian]; 258.6 stems/Ha (+/-196.2) in 1874 to 729.5 (+/- 169.0) in 2007 [Saltspring]. Bjorkman estimated all tree densities more than doubled between 1874 and 2007.

The other interesting part of this report was that for Saltspring Island, there were tree diameters recorded so 1874 to 2007 tree diameters could be compared. The nearest tree to a corner in 2007 showed a normal reverse-J curve for diameters, this may be a natural size curve without fire (for fire protection). While the 1874 tree frequency curve showed low frequency in the 10 to 30 cm diameter class, then had a high peak at 30-60 cm diameter, then a drop from 60-85 cm, and a slight rise in the 85-185 cm diameters, this may be the size distribution with many low intensity fires. The Bjorkman 1800's fire intervals were unknown, but possibly similar to Bakker et al below.

Bjorkman postulated that the infilling of the prairie and plains was caused by fire protection actions in the early 1900's after logging & settlement through late 1900's. She also recorded a species percentage change from fire protection.

I have compared other early survey maps of prairies to google earth images today and found forests occupying much of the First Nation created prairies mapped in the 1870's. The forest cover recovery, after a management practice change is amazing (such as frequent fire), also noted about certain garry oak stands, but again "it depends".

Poorer Quality Trees:

There have been reports [historically] of lower value stands on southern Vancouver Island and the gulf islands, compared to traditional old growth in the Douglas-fir region. These areas were used (and managed) by the First Nations for food and villages. Frequent low-intensity fires were a major management practice and tended to produced lower valued trees with big branches. This predominance of lower value trees has also been reported about Lasqueti by Elda Mason and other oral history accounts, though many were logged in the 1950's. Multiple low intensity fires have been shown to degrade the trees for commercial use, but to open a stand (for possible regeneration) and produce larger diameter trees. The more open and scattered the trees the bigger diameter branches such trees retain and more pitch pockets are created within the stems. There is a dichotomy about these wolf trees [big branches almost down to the ground] and frequent fire. Why do the frequent fires not burn these trees that have branches down to the ground? Interesting question, probably this should be researched better.

Research has found that fire scarred trees are more commonly found closer to pre-settlement First Nation village sites. Prairies were also more likely to be in close proximity to larger First Nation population centres, such as Victoria, Duncan, Chemainus, Courtenay, which all had large areas of prairies nearby. Both fire scarred trees, plains, and prairies are a result of frequent burning. Non-treed prairies need burning at less than 3 years frequency; while open oak savanna may need fire less frequently but as with most things biological there are a lot of "it depends". There were maple plains, oak

plains, Douglas-fir plains, and multiple species plains mapped on the 1800's survey maps; I surmise they were all created by fire.

Bakker et al, Comparisons among San Juan island fire history studies:

Some local fire return studies just south of the Gulf Islands in what BC would classify as CDF ecosystem probably gives a good indication of CDF fire return intervals in areas close to First Nation populations such as Lasqueti:

Fire studies from three islands in northern San Juan's, Wa. For composite median and mean fire return periods for the sites (all trees & all scars)

	Weibull median probability interval (WMPI)		(MFR) mean fire return
Henery Island – Kellett Bluff	6		9
(2019 Bakker et al)		15 fires I 1800's	
Stuart Island – Turn Point	5		7
(2019 Bakker et al)		18 fires in 1800's	
Waldron Island – Point Disney	7.4	pre-settlement	8.5
(2006 Sprenger)		14 fires in 1800's	

Bakker et al also compared seven different fire studies in the San Juan's:
"The seven fire history studies recorded evidence of fires in 111 years between 1530 and 1964 (Fig. 5). The MFI was 4 years and the WMPI was 3 years; fire occurred in at least one site in about a quarter of years. There was little correspondence or synchronicity between sites in terms of when fires occurred: in most years (81 of 111), fire was only recorded at one site. Fires were recorded at two sites in 24 years, at three sites in only four years (1712, 1850, 1868, 1870), and at four sites in only two years (1765, 1839)."

Bakker et al reported that these fire intervals were the shortest he could find in western Washington. Bakker et al provided the most complete "Discussion" about the limitations of fire studies and how that study was related to other studies in the region. Bakker et al used only one 10 year period (2003-2012) to determine lightning strike ignition likelihood. "but western Washington has one of the lowest lightning-strike densities in the continental United States (Koshak et al. 2015), and thunderstorms that do occur are typically accompanied by precipitation, which makes fires unlikely." Well recent years fires (2015-2020) on southern and northern Vancouver Island and Eis record of 1941 where 240 fires were started by one storm shows that using a limited period to explain lightning probability, can be misleading.

Discussion:

There are some unanswered questions about synchronicity between fire years with Howe's fire years and both Eis's study and the San Juan Island studies, but that is fire research especially in the low to mixed-severity fire types. We are still determining how best to get all the information needed to understand mixed-severity fires and maybe even low severity fires.

I surmise from all the above that in the CDF and dryer-CWH zones fire returns were frequent and of low to mixed severity, but over a longer period there can still be high severity fires (such as what created the original stands around Odgin Lake, Rat Portage, and Rouse Bay). This type of fire regime is similar to some NDT 4 areas, in the Biodiversity Guidebook. I have now come across another reference to this type of fire regime and it was called a "#5 variable regime - frequent low-severity fires [to moderate-severity fires] with long return intervals of stand-replacing fires", Bruce Kilgore, 1981 where he found many assumptions from older publications for both coastal to inland Douglas-fir having this fire regime. I am presently trying to follow his references up.

Factors that seem to be needed for stand replacement fires in areas of more frequent low severity fires:

- It is surmised it takes some type of disturbance (wind, fire, disease, pathogen, wet year, or time without fire) to cause the fuel load to build up on the forest floor, followed by a dry year, and one or more lightning storms to start the conditions for a stand replacement fire.
- The lightning started or pre-settlement First Nation started fire then needs high winds to both spread and put the fire in the crown, which increases fire intensity.
- For the large stand replacing wildfires that started the original Douglas-fir old-growth, there seems to be an additional factor of multiple fires running into one another (fire seasons 2000-2020 for example) for the large area fires that caused some old growth Douglas-fir to regenerate.

These multiple combinations of factors all together, do not happen too often with short fire return periods, but they happen as shown by the forest around Ogden lake, which have older trees that are over 250 years old. And probably the early Rat Portage logging area as well as Rouse Bay.

Our forests today have not had a forest fire on Lasqueti since pre-1900, except slash fires [clean-up after logging] whether the fire was intended or an accident. The infilling since 1900 and regeneration from logging is way denser than it would have been with frequent fires as per First Nation management. More shade tolerant species, such as western red cedar have regenerated within our stands creating a high density of fire ladders; compared to stands with frequent fire. I have observed that around older stands on Lasqueti, the edges have the most fire ladders, other than shade tolerant species (ie. Cw, Bg) within the stands. The infilling (and sometimes selective logging) in our rocky areas have turned these areas from low-severity fire carrier to stand replacement fire carrier areas, because of fire ladders. Most of our stands would rank high in risk of wildfire according to the latest qathet-Community Wildfire Protection Plan, which used the Biodiversity Guidebook [that stated the fire return is > 200 years], not the documented 6 to 45 years shown above.

Fire return can be directly related to wildfire risk. In an area of historical frequent fire return (6-45 years), the potential fire risk increases dramatically with continued years fire protection, lengthening the amount of fuel build-up in the forest. (Unless the tree age creates a >6 m bottom of crown height with no fire ladders and enough inter tree distance.) The increased forest density, surface fuel loads, and ladder fuel presence often change the low to mixed severity fires into stand replacement fires, from resent experience, up and down the west coast. This forest we have today if dry and **in a high wind situation**, would probably burn as a stand replacement wildfire leaving possible patches of forest, if the patch has the characterizations of FireSmart (less fire ladders, crowns beginning quite high [>5m], and some distance between crowns). This is different than the slow spreading wildfire situation the FireSmart representative talked about in 2019.

The UBC Centre for Conservation Genetics climatic analysis: puts the CDF zone at about the same dryness as the Bunch Grass (BG) zone and the Ponderosa Pine (PP) zone in the interior; both are dryer than the Interior Douglas-fir (IDF) zone. Where were the biggest wildfires in BC in the last few years? This surprised me as I would have thought the CDF and IDF would have had similar dryness. I believe this is another sign, unrecognized, of the wildfire risk in the CDF. *I surmise that our forests may burn like the fires of the last few years from California to central BC, if a fire starts during a real dry summer and grows because of high winds.* Not all wildfires are started by people on the coast. One lightning storm in July of 1941 set 240 wildfires in the Vancouver Forest Region and in the last few years two lightning storms have set multiple fires each on Vancouver Island, one of these were in much wetter CWH ecosystems and units.

The Vision for Coastal Douglas-fir and Associated Ecosystems Conservation Partnership (CDFCP) in their Conservation strategy 2015 is that by 2045: Coastal Douglas-fir and associated ecosystems have ecological integrity and resilience to change. A system of core protected areas are actively managed to provide habitat for native species and places to learn about the importance of healthy ecosystems. Working landscapes are actively managed to enhance their ecosystem values, while also supporting jobs and economic development opportunities. The public and land managers understand that Coastal Douglas-fir and associated ecosystems are special places that merit support and investment.

To put it in my words the main goal of the CDFCP is to maintain forest cover and native species, increase old-growth conditions, protect forests and old-growth, restore forests, and protect land actively managed to achieve these aims. The “so called” “protection” status of any area has to take into account the wildfire risk today and the pre-settlement condition of the CDF in consideration when planning for sustainability.

Is there a way to return some areas of Lasqueti to pre-settlement conditions? More open stands of trees, bigger diameters, with limited younger regeneration among the bigger trees. Is there a way to protect our old-growth and late mature stands from a potential high-severity wildfire? There may be a way with the unceded crown land, but not unless this forest condition is a part of setting the initial AAC and planned for, under any present forest licence conditions. Otherwise it is up to us, as landowners, to rethink how we manage our woodlands.

Wildfires not only increase the risk to our homes, but they risk our old-growth and late mature forests as well. If we consider so called “protected areas” like covenants areas; are these areas protected in the face of increasing wildfire risk? If we do not consider wildfire risk in our sustainability planning, both as a community and for our forest, we will not achieve anyone’s concept of ecosystem or forest preservation. The last few years have demonstrated that there is a wildfire problem in dry forests like ours. We may need to consider adding controlled burns to most of our old-growth and late mature stands or use some method to lower wildfire risk, to ensure sustainability of these areas. Otherwise, I predict a wildfire will eventually cause a massive environmental change to the island, and we may very well lose all of our older stands as well as the main part of our forest. The do-nothing option to management, keeps increasing the possibility of an uncontrolled wildfire on Lasqueti.

If my analysis is correct, what are our goals/vision for our future forests? What should they look like? Can we agree we need to work toward lowering wildfire risk? Then is this potential common goal/vision(s) different, or should it be different for the unceded/crown lands? I hope these questions help you start the conversation about our forest’s future.

Any questions or for reference details contact dvarney@shaw.ca

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