***SUPPLEMENTARY MATERIAL***

**PEDOLOGICAL TRENDS AND IMPLICATIONS FOR FOREST PRODUCTIVITY IN A HOLOCENE SOIL CHRONOSEQUENCE, CALVERT ISLAND, BRITISH COLUMBIA, CANADA**

**Lee-Ann Nelson1, Paul Sanborn1,2, Barbara J. Cade-Menun3, Ian J. Walker4, and Olav B. Lian5**

1University of Northern British Columbia, 3333 University Way, Prince George, British Columbia V2N 4Z9

2corresponding author (email: [Paul.Sanborn@unbc.ca](mailto:Paul.Sanborn@unbc.ca)); ORCID iD: <https://orcid.org/0000-0003-0920-4803>

3Swift Current Research and Development Centre, Agriculture & Agri-Food Canada, Swift Current, SK, Canada; ORCID iD: <https://orcid.org/0000-0003-4391-3718>

4Department of Geography, Division of Mathematical, Life and Physical Sciences, University of California Santa Barbara, Santa Barbara, California 93106, USA; ORCID iD: <https://orcid.org/0000-0001-5719-5310>

5 School of Land Use and Environmental Change, University of the Fraser Valley, 33844 King Road, Abbotsford, BC, Canada V2S 7M8; ORCID iD: <https://orcid.org/0000-0002-2810-6806>

**Tables:** 4 **Figures:** 0

Table S1. Climate data for the Coastal Western Hemlock zone, Very Wet Hypermaritime subzone, Central variant (CWHvh2), Bella Coola, and estimated climate data for northern Calvert Island.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Location** | | | |
| **CWHvh2a** | **Bella Coolab** | **Calvert Island Field Stationc**  **(Estimated data)** | |
| Time Period | 1961-1990 | 1981-2010 | 1961-1990 | 2001-2010 |
| Elevation of Reference Station (m) | 0-664 | 18.3 | 10 | 10 |
| Mean Annual Precipitation (mm) | 3254 | 1632 | 2832 | 2799 |
| Total Mean Annual Snowfall (cm) | N/A | 133.8 | 119 | 90 |
| Mean Annual Temperature (˚C) | 7.7 | 8.2 | 8.1 | 8.7 |
| Mean of Coldest Month (˚C) | 2.3 | -0.4 | 3.3 | 3.3 |
| Mean of Warmest Month (˚C) | 14.3 | 17.0 | 13.6 | 14.3 |

a Chourmouzis et al. (2009)

b Environment and Natural Resources (2018)

c calculated using ClimateBC Map (2015)

Table S2. The sampling sites used in this study, including chronosequence site name, the most accurate age [years (a)], location, and approximate elevation in meters above mean sea level (m amsl). Adapted from Nelson et al. (2020) with ages determined by Neudorf et al. (2015) for samples collected in 2013.

|  |  |  |  |
| --- | --- | --- | --- |
| **Site Name** | **Fading Corrected Age**  **(a)** | **Location**  **(Lat/Long coordinates)** | **Elevation (m amsl)** |
| CIDS1A | 0 | 51˚39.484’ N; 128˚08.643’ W | 5.3 |
| CIDS1B | 51˚39.479’ N; 128˚08.622’ W |
| CIDS3A | 105 ± 15 | 51˚39.218’ N; 128˚08.285’ W | 3.6 |
| CIDS3B | 51˚39.207’ N; 128˚08.273’ W |
| CIDS4A | 139 ± 17 | 51˚39.381’ N; 128˚08.316’ W | 7.8 |
| CIDS4B | 51˚39.383’ N; 128˚08.315’ W |
| CIDS9A | 605 ± 50 | 51˚39.599’ N; 128˚08.743’ W | 8.4 |
| CIDS9B | 51˚39.605’ N; 128˚08.736’ W |
| CIDS8A | 3,588 ± 303 | 51˚38.480’ N; 128˚09.109’ W | 34.6 |
| CIDS8B\* | 51˚38.484’ N; 128˚09.106’ W |
| CIDS15A | 4,198 ± 332 | 51˚39.721’ N; 128˚08.466’ W | 18.0 |
| CIDS15B | 51˚39.731’ N; 128˚08.465’ W |
| CIDS16A | 7,236 ± 546 | 51˚39.967’ N; 128˚07.067’ W | 6.7 |
| CIDS16B\* | 51˚39.966’ N; 128˚07.081’ W |
| CIDS10A\* | 10,760 ± 864 | 51˚38.663’ N; 128˚08.723’ W | 13.0 |
| CIDS10B | 51˚38.678’ N; 128˚08.759’ W |

\*original pit used during sample collection for optically stimulated luminescence dating sample was utilized.

Table S3. Pedon classification and select mineral soil chemistry including pyrophosphate- (p) and oxalate-extractable (o) iron (Fe) and aluminum (Al), estimated allophane, chemical index of alteration (CIA) and percent clay.

| **Pedon** |  |  | **(****g kg-1)** | | | | | | **CIAd** | **Claye (%)** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Horizon (CSSS)** | **Depth (cm)** | **Fepa** | **Feoa** | **FeTb** | **Alpa** | **Aloa** | **Allophanec** |
| **Age (a BP) Classification** |
| 0 | C | 0-27 | 0.0 | 0.2 | 6.2 | 0.1 | 0.1 | 0.3 | 45.7 | 0.40 |
| Replicate A | Ahb | 27-34 | 0.0 | 0.3 | 8.8 | 0.1 | 0.2 | 0.5 | 46.0 | 0.11 |
| CU.R | C2 | 34-62 | 0.1 | 0.2 | 6.7 | 0.1 | 0.2 | 0.3 | 44.6 | 0.61 |
|  | Ahb2 | 62-67 | 0.1 | 0.2 | 6.4 | 0.1 | 0.2 | 0.6 | 42.8 | 0.58 |
|  | BC | 67-116 | 0.1 | 0.2 | 7.5 | 0.1 | 0.2 | 0.5 | 44.6 | 0.34 |
|  | C3 | 116-122+ | 0.1 | 0.3 | 6.0 | 0.1 | 0.2 | 0.6 | 43.9 | <0.01 |
| 0 | C | 0-13 | 0.1 | 0.2 | 5.2 | 0.1 | 0.2 | 0.3 | 48.3 | 0.76 |
| Replicate B | Ahb | 13-18 | 0.0 | 0.0 | 9.0 | 0.1 | 0.0 | 0.0 | 46.6 | 1.57 |
| CU.R | BC | 18-92 | 0.0 | 0.2 | 5.0 | 0.1 | 0.1 | 0.3 | 44.5 | 0.30 |
|  | C2 | 92-111+ | 0.0 | 0.2 | 5.2 | 0.1 | 0.1 | 0.3 | 45.0 | <0.01 |
| 105 ± 15 | Ae | 0-3 | 0.1 | 0.2 | 13.9 | 0.1 | 0.2 | 0.2 | 47.8 | 1.24 |
| Replicate A | Bmj | 3-58 | 0.3 | 0.6 | 14.5 | 0.2 | 0.3 | 0.3 | 47.8 | 1.39 |
| E.DYB | BC | 58-93+ | 0.3 | 0.5 | 13.9 | 0.3 | 0.4 | 0.5 | 48.2 | 0.99 |
| 105 ± 15 | Ae | 0-3 | 0.1 | 0.2 | 15.1 | 0.1 | 0.2 | 0.2 | 47.2 | 1.10 |
| Replicate B | Bhj | 3-26 | 0.3 | 0.5 | 9.3 | 0.4 | 0.4 | 0.4 | 48.4 | 1.61 |
| E.DYB | Bm | 26-55 | 0.2 | 0.5 | 15.7 | 0.3 | 0.4 | 0.5 | 47.8 | 1.17 |
|  | BC | 55-120+ | 0.2 | 0.6 | 38.7 | 0.2 | 0.4 | 0.5 | 44.7 | 0.88 |
| 139 ± 17 | Ae | 0-3 | 0.1 | 0.2 | 6.4 | 0.2 | 0.2 | 0.2 | 48.7 | 1.62 |
| Replicate A | Bhj | 3-23 | 0.3 | 0.4 | 6.6 | 0.3 | 0.4 | 0.5 | 48.2 | 1.00 |
| E.DYB | Bm | 23-73 | 0.1 | 0.3 | 6.6 | 0.2 | 0.3 | 0.6 | 49.1 | 1.06 |
|  | BC | 73-111+ | 0.1 | 0.3 | 8.2 | 0.1 | 0.3 | 0.7 | 48.9 | 1.33 |
| 139 ± 17 | Ae | 0-5 | 0.4 | 0.5 | 8.5 | 0.3 | 0.4 | 0.5 | 48.5 | 1.92 |
| Replicate B | Bhj | 5-19 | 0.7 | 0.7 | 8.0 | 0.6 | 0.6 | 0.2 | 48.6 | 1.50 |
| E.DYB | Bm | 19-64 | 0.1 | 0.3 | 8.8 | 0.2 | 0.3 | 0.6 | 48.5 | 1.50 |
|  | BC | 64-103+ | 0.1 | 0.3 | 5.5 | 0.1 | 0.3 | 0.7 | 48.9 | 1.67 |
| 605 ± 50 | Ae | 0-6 | 0.1 | 0.1 | 11.5 | 0.2 | 0.4 | 0.9 | 48.2 | 1.58 |
| Replicate A | Bhj | 6-36 | 0.8 | 0.8 | 12.0 | 1.1 | 1.1 | 0.4 | 48.0 | 2.02 |
| E.DYB | Bhc | 36-39 | 1.4 | 1.4 | 8.4 | 2.6 | 2.8 | 0.6 | 49.5 | 2.23 |
|  | Bmj | 39-90 | 0.4 | 0.5 | 9.3 | 0.7 | 0.9 | 0.7 | 48.9 | 1.53 |
|  | BC | 90-112+ | 0.3 | 0.4 | 5.9 | 0.6 | 0.8 | 1.0 | 49.4 | 1.53 |
| 605 ± 50 | Ahe | 0-13 | 0.6 | 0.7 | 8.0 | 0.5 | 0.7 | 0.7 | 48.8 | 3.35 |
| Replicate B | Bm | 33-58 | 0.4 | 0.5 | 10.0 | 0.3 | 0.4 | 0.8 | 48.7 | 1.56 |
| E.DYB | Bhjcj | 58-113 | 0.9 | 1.0 | 10.1 | 0.8 | 1.0 | 0.8 | 48.4 | 1.92 |
| 3,588 ± 303 | Ahe | 0-6 | 0.2 | 0.1 | 6.4 | 0.4 | 0.3 | 0.0 | 48.2 | 3.69 |
| Replicate A | Ae | 6-25 | 0.0 | 0.1 | 4.8 | 0.1 | 0.3 | 1.0 | 49.0 | 2.34 |
| OT.HP | Bhc | 25-43 | 0.2 | 0.2 | 10.6 | 2.7 | 2.8 | 0.3 | 49.1 | 2.45 |
|  | Bfc1 | 43-45 | 19.7 | 21.1 | 26.5 | 4.4 | 4.6 | 1.9 | 50.0 | 1.11 |
|  | Bm1 | 45-65 | 0.9 | 0.7 | 9.9 | 1.7 | 1.9 | 1.2 | 49.3 | 1.69 |
|  | Bfc2 | 65-67 | 19.6 | 34.2 | 43.2 | 3.2 | 4.0 | 3.3 | 50.0 | 1.90 |
|  | Bm2 | 67-95 | 0.7 | 1.2 | 12.2 | 1.0 | 2.0 | 4.2 | 48.9 | 1.75 |
|  | BC | 95-163+ | 0.2 | 0.6 | 13.4 | 0.5 | 1.1 | 2.6 | 48.5 | 1.34 |
| 3,588 ± 303 | Ae | 0-22 | 0.2 | 0.3 | 10.4 | 0.2 | 0.3 | 0.8 | 48.8 | 2.83 |
| Replicate B | Bhc | 22-57 | 1.9 | 1.9 | 10.5 | 3.3 | 3.4 | 0.6 | 49.6 | 4.44 |
| OT.HP | Bfcj1 | 57-58 | 11.0 | 13.2 | 20.9 | 4.4 | 5.4 | 4.1 | 49.7 | nd |
|  | Bh | 58-72 | 0.7 | 0.8 | 10.1 | 2.2 | 3.2 | 4.5 | 49.2 | 2.05 |
|  | Bhcj2 | 72-106 | 1.7 | 1.6 | 12.1 | 2.7 | 2.9 | 1.4 | 49.5 | 2.53 |
| 4,198 ± 332 | Ae | 0-4 | 0.1 | 0.2 | 3.0 | 0.7 | 0.8 | 0.7 | 51.0 | 4.66 |
| Replicate A | Ahe | 4-12 | 0.2 | 0.2 | 2.0 | 1.0 | 1.1 | 0.3 | 50.8 | 6.73 |
| OT.HP | Bhc | 12-21 | 0.2 | 0.2 | 2.6 | 4.9 | 5.2 | 1.2 | 52.3 | 8.36 |
|  | Bfcj | 21-23 | 4.7 | 6.9 | 13.2 | 4.1 | 10.1 | 23.2 | 51.4 | 3.29 |
|  | Bmcj | 23-49 | 0.5 | 1.1 | 7.0 | 1.9 | 5.6 | 13.2 | 50.6 | 1.75 |
|  | BC | 49-103+ | 0.1 | 0.5 | 9.4 | 0.7 | 2.3 | 6.0 | 49.5 | 1.54 |
| 4,198 ± 332 | Ae | 0-9 | 0.2 | 0.2 | 2.0 | 1.5 | 1.7 | 0.7 | 51.7 | 9.07 |
| Replicate B | Ahe | 9-14 | 0.0 | 0.1 | 2.1 | 1.0 | 1.1 | 0.5 | 50.4 | 4.37 |
| OT.HP | Bhc1 | 14-28 | 0.4 | 0.5 | 5.2 | 5.5 | 6.2 | 2.6 | 50.9 | 7.22 |
|  | Bhc2 | 28-38 | 0.2 | 0.3 | 6.0 | 4.4 | 8.4 | 13.3 | 50.3 | 2.10 |
|  | Bh | 38-43 | 0.1 | 0.2 | 7.8 | 3.0 | 8.5 | 19.6 | 50.9 | 1.45 |
|  | Bfc | 43-45 | 15.0 | 28.8 | 33.0 | 5.6 | 11.0 | 21.6 | 51.4 | 4.28 |
|  | Bm | 45-128+ | 1.2 | 1.0 | 9.1 | 1.4 | 3.8 | 9.3 | 49.7 | 1.58 |
| 7,236 ± 546 | Bhc | 55-64 | 0.2 | 0.2 | 3.8 | 6.6 | 7.1 | 2.2 | 51.6 | 2.71 |
| Replicate A | Bhcj | 64-80 | 0.1 | 0.2 | 5.1 | 4.6 | 5.7 | 5.7 | 50.6 | 1.71 |
| HU.FOf | Bfc | 80-81 | 7.6 | 11.9 | 14.8 | 4.2 | 6.6 | 9.6 | 50.6 | 1.63 |
|  | Bm | 81-136+ | 0.6 | 0.9 | 7.9 | 1.4 | 3.2 | 6.9 | 49.4 | 1.21 |
| 7,236 ± 546 | Bhc | 63-85 | 0.1 | 0.1 | 7.0 | 5.4 | 5.5 | 0.9 | 50.5 | 1.98 |
| Replicate B | Ae | 85-86 | 0.1 | 0.2 | 5.9 | 0.4 | 0.6 | 1.1 | 48.0 | nd |
| HU.FOf | Bmcj | 86-103 | 0.0 | 0.1 | 5.9 | 1.7 | 4.1 | 8.4 | 49.8 | 1.64 |
|  | Bh | 103-223 | 0.3 | 0.3 | 6.2 | 1.5 | 1.9 | 2.0 | 48.6 | 1.47 |
| 10,760 ± 864 | Bhcj | 0-10 | 0.2 | 0.2 | 2.8 | 4.9 | 5.0 | 0.6 | 52.8 | 7.12 |
| Replicate A | Ae | 10-12 | 0.1 | 0.3 | 12.3 | 1.3 | 4.7 | 13.0 | 51.1 | n.d. |
| P.HP | Bfc | 12-15 | 12.9 | 23.3 | 42.0 | 5.7 | 15.9 | 35.6 | 55.2 | 5.66 |
|  | Bmcj1 | 15-70 | 0.3 | 2.1 | 20.7 | 1.6 | 9.6 | 28.3 | 52.4 | 2.60 |
|  | BCg1 | 70-138 | 0.1 | 0.5 | 21.5 | 0.7 | 2.8 | 8.4 | 49.9 | 1.35 |
| 10,760 ± 864 | Bhc | 0-7 | 0.2 | 0.2 | 2.9 | 3.0 | 3.0 | 0.0 | 51.9 | 6.60 |
| Replicate B | Ae | 7-10 | 0.7 | 0.7 | 6.5 | 0.8 | 1.2 | 1.1 | 49.4 | nd |
| E.DYB | Bfc | 10-13 | 3.8 | 10.1 | 18.8 | 3.5 | 12.9 | 35.8 | 53.0 | 3.41 |
|  | Bmcj | 13-33 | 0.1 | 2.6 | 10.8 | 1.2 | 11.9 | 40.9 | 51.9 | 3.09 |
|  | BC | 33-90+ | 0.0 | 0.7 | 12.7 | 0.6 | 3.8 | 11.5 | 49.5 | 1.51 |
|  | BC2 | 170-204 | 0.0 | 0.9 | 18.4 | 0.4 | 3.5 | 0.0 | 49.0 | 1.62 |

a McKeague and Day (1966)

b Claisse (2003)

c Parfitt (1990)

d Nesbit and Young (1982)

e Gee and Bauder (1986)

f Note that these pedons are classified as Organic soils thus the mineral horizon depths do not begin at 0 cm.

Table S4. Biogeoclimatic (BEC) site series classification for each site and presence and absence data from plant surveys (n=2) using Latin and common plant names (X indicates presence).

| **Latin Name** | **Common Name** | **Site Age (a BP) and BEC Site Series Classificationa** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **~0** | **105** | **139** | **605** | **3,588** | **4,198** | **7,236** | **10,760** |
| N/A | 15 - Ss | 01 - CwHw | 03a - CwYc | 14 - Ss | 01 - CwHw | 11 - CwYc | 11 - CwYc |
| *Achillea millifolium* | Yarrow | X |  |  |  |  |  |  |  |
| *Alnus rubra* | Red alder |  | X |  | X |  |  |  |  |
| *Arctostaphylos uva-ursi* | Kinniknick |  |  |  |  |  |  | X |  |
| *Blechnum spicant* | Deer fern |  | X | X | X |  | X | X |  |
| *Castilleja miniata* | Indian paintbrush | X |  |  |  |  |  |  |  |
| *Chamaecyparis nootkatensis* | Yellow cedar |  |  |  |  |  |  | X | X |
| *Cladina portentosa* | Coastal reindeer lichen |  |  |  |  |  |  |  | X |
| *Coptis asplenifolia* | Goldthread |  |  |  |  |  |  | X | X |
| *Cornus canadensis* | Bunchberry |  |  |  | X |  | X | X | X |
| *Elymus mollis* | Dune wildrye | X |  |  |  |  |  |  |  |
| *Empetrum nigrum* | Crowberry |  |  |  |  |  |  |  | X |
| *Festuca rubra* | Red fescue | X |  |  |  |  |  |  |  |
| *Fragaria chilonensis* | Coastal strawberry | X |  |  |  |  |  |  |  |
| *Gaultheria shallon* | Salal |  | X | X | X | X | X | X | X |
| *Hylocomium splendens* | Step moss |  |  |  | X |  | X |  |  |
| *Lathyrus japonicus* | Purple peavine | X |  |  |  |  |  |  |  |
| *Ledum groendlandicum* | Labrador tea |  |  |  |  |  |  | X | X |
| *Lonicera involucrata* | Black Honeysuckle |  |  |  | X |  |  |  |  |
| *Menziesia ferruginea* | False azalea |  |  |  | X | X | X | X | X |
| *Mianthemum dilatatum* | False lily of the valley |  | X |  | X |  | X | X | X |
| *Picea sichensis* | Sitka spruce |  | X | X |  | X | X |  |  |
| *Pinus contorta* | Shore pine |  |  |  |  |  |  | X | X |
| *Polystichum munitum* | Sword fern |  | X |  |  |  |  |  |  |
| *Pterdium aquilinum* | Bracken fern |  | X |  | X |  |  |  |  |
| *Rhytidiadelphus loreus* | Lanky moss |  |  |  | X |  | X |  |  |
| *Rubus spectabilis* | Salmonberry |  | X |  | X | X |  |  |  |
| *Smilacina racemosa* | False Solomon's seal |  |  |  | X |  |  |  |  |
| *Sphagnum sp.* | Sphagnum |  |  |  |  |  |  | X | X |
| *Thuja plicata* | Redcedar |  |  | X | X | X | X | X | X |
| *Tsuga heterophylla* | Western hemlock |  | X | X | X | X | X | X | X |
| *Tsuga mertensiana* | Mountain hemlock |  |  |  |  |  |  | X |  |
| *Vaccinium parvifolium* | Red Huckleberry |  |  | X |  |  |  |  |  |
| *-* | Upland moss |  | X | X |  | X | X | X | X |
| *Vaccinium* sp*.* | - |  | X |  | X |  | X | X |  |

a Green and Klinka (1994)

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