# CHALLENGES TO OUR FUTURE TREE SEED SUPPLY

June 22 – 27, 2022

Vancouver Island & Surrey, BC

**Tree Seed Working Group**
**News Bulletin**
*Canadian Forest Genetics Association*
*l'Association canadienne de génétique forestière*

IUFRO

**Working Group 2.09.03:**
Seed Physiology and Technology

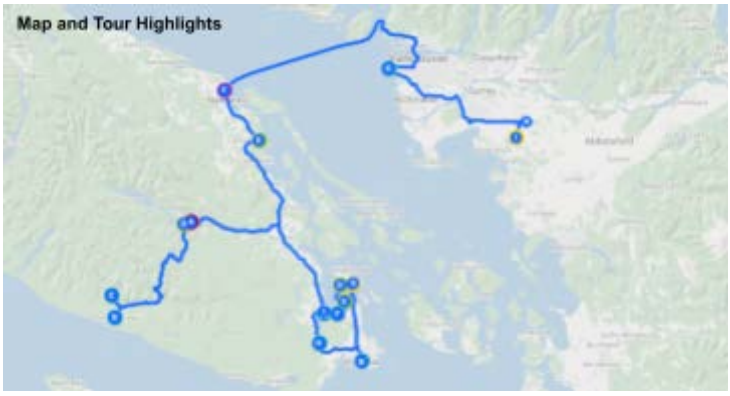
ISF International Seed Federation
Seed is Life

OECD
BETTER POLICIES FOR BETTER LIVES

**Forest Seed and Plant Scheme**

**ISTA**
Seed Quality Assurance
**Forest Tree and Shrub Committee**

**TREE SEED**
**HANDLE WITH CARE**
**STORE IN COOL AREA**
**OPEN UPON RECEIPT**
**PERISHABLE**



# Context: The Need for Seed

The purpose of this tree seed meeting is to address a key bottleneck in the highly ambitious global reforestation goals – the sustained availability of high-quality and adapted tree seed.

Challenges to our future tree seed supply are real and begin with a lack of educational coverage, research funding and interest, and continued infrastructure investment. The tree seed supply system is taken for granted and unsustainable in its current form.

One of the meeting goals is to build strong relationships between organizations involved in this field: **IUFRO 2.09.03: Seed Physiology and Technology**; **International Seed Testing Association Forest Tree and Shrub Committee, International Seed Federation Tree and Shrub group and our Canadian Tree Seed Working Group.** Prioritization of efforts needs to consider the whole spectrum of activities from tree seed science, to production and processing and ultimately the provision of the best seeds and information to the global tree seed market.

We have put together a program to showcase "beautiful British Columbia" that highlights our forests and tree seed facilities, allows for scientific and technical exchanges and attracts people globally that are involved in our highly specialized field. There will be plenty of natural marvels to see and fun to be had, but the goal is to build relationships among those that want to co-operate and improve the existing tree seed systems in place. The hope is that we can build on this meeting and create synergies and opportunities to ensure a clear and informed message is provided to decision and policymakers worldwide to address our challenges.

One of our goals is to assemble a team interested in raising awareness and furthering our message of the importance of our specialized field of practice. We have included some Seed Supply Solutions questions to the back of the booklet and appreciate your participation. Maybe you have additional questions? Some of us also envision the idea of a short white paper that could be easily translated and available to governments and funding bodies to ensure tree seed is not a bottleneck in the future. It's only one idea - we hope to hear yours.

## Sponsors & Acknowledgements: Thank You!


- Select Seed Ltd.
- Vernon Seed Orchard Company
- Arbutus Grove Nursery
- Mosaic Forest Management Corporation
- BC Tree Seed Centre
- Yellow Point Propagation
- National Tree Seed Centre and the 2 Billion Trees Program


# Organizer Contact Information

If you need assistance, have questions, comments or suggestions when booking or making travel plans, reach out to us at any time.


- Dave Kolotelo: Dave.Kolotelo@gov.bc.ca, office 778-609-2001; cell 604-790-3712
- Don Pigott including all health and safety concerns on tour: ypprop@shaw.ca, cell 250-668-4635
- Melissa Spearing: Melissa.spearing@nrcan-rncan.gc.ca, cell 416-909-9755 (while at the event, please email miss.shadyideas@gmail.com)
- Victoria Lei: Victoria.Lei@gov.bc.ca office 778-609-2009; cell 778-386-6117

## Organizer and Speaker: Dave Kolotelo, Cone and Seed Improvement Officer, BC Tree Seed Centre

Dave has been working at the provincial Tree Seed Centre for the past 30 years conducting research and extension, assisting with tree seed problem solving, operational efficiency improvements and successfully avoiding management. Dave obtained a BScF from the University of New Brunswick in 1997 and a MScF at the University of British Columbia in 1991 specializing in forest genetics and tree physiology. I was fortunate to get this position at the BC Tree Seed Centre in 1992 after working on contract for the Douglas-fir breeding program. It's been a great ride and I greatly enjoy the diversity of people I deal with involved in the reforestation system, cone collectors; seed orchardists, geneticists, seed researchers, processing facilities and nurseries. I am interested in tree seed science and technology, but feeling more like an advocate these days for investments in research, education and infrastructure to maintain these essential services at the global level. That's where the drive came from to organize this meeting and bring these groups together. In my spare time I enjoy gardening, travelling, bicycling, hiking and beach volleyball.

In keeping with the theme of the meeting I'll share a few links to presentations relevant to our meeting topic. The initial groundwork was established at our 2019 Tree Seed Working Group (TSWG) workshop in Quebec. https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/tree-seed/events#Tree%20Seed%20Working%20Group%C2%A0workshop. Fabienne Colas and Melissa Spearing have continued to support the cause ever since.

In trying to re-invigorate IUFRO 2.09.03 several of us produced a fun video to encourage participation in this working group which has such a strong history but has not been as active lately. I encourage anyone with an interest in Seed Science and Technology to get on our Mailing list. Here is the video: https://youtu.be/aay6WPJYBvo.

I have two specific areas that I believe are challenges or bottlenecks in ensuring our future tree seed supply is sustainable. The first is the lack of interest and investment in the infrastructure required for cone and seed processing to be sustainable and able to meet growing demands. Associated with infrastructure is training and interest in basic tree seed science and operational practices. The second is interest, research and funding of research in the area of reproductive biology and crop development. This is especially perplexing in my jurisdiction where we have such a huge investment in seed orchards with many species moving into advanced generation breeding programs. Both are touched on, but the former is emphasized in this IUFRO presentation https://www.canal-u.tv/video/rtr_midi/deployment_bottlenecks_cone_and_seed_processing_storage_and_inventory_management_dave_kolotelo.65337

## Organizer and Speaker: Don Pigott, Yellow Point Propagation

Yellow Point Propagation Ltd is a silvicultural consulting company established in 1982. The principals are Don and Sheila Pigott. Prior to starting the company, Don worked at MacMillan Bloedel in the Forest Research Division for 13 years in a variety of capacities including Silviculturist and Tree Improvement Supervisor. He was responsible for the planning, establishment, and management of their seed orchards, and the first containerized tree seedling nursery, and propagation facilities.

In the past 47 years the company has been active in numerous research projects, primarily tree improvement and seed related. The company has been responsible for planning and implementation of operational cone collection programs for MacMillan Bloedel, Weyerhaeuser Co, Island Timberlands, Timberwest, Interfor, and BC Timber Sales. There are two full-time employees, as well as several casual employees with up to 20 years' service. In exceptional cone crop years we may be responsible for over thirty casual employees. We also collaborate with other consulting companies on specific projects.

The company has a cone and seed processing facility capable of handling 30 hectoliters of cones per day. We also specialize in small lot processing, and have provided services for the Ministry of Forests, the previously mentioned companies, the University of British Columbia, Parks Canada, the Huallen Seed Orchard Co in Alberta, and the Nordic Forest Research Cooperative. In conjunction with these programs we have assisted in the establishment of many research trials for the Ministry of Forests, and private forest companies. We own and operate several seed orchards. In 1999 the company, in concert with Isabella Point Forestry Consulting, was contracted by the Forest Genetics Council to produce the report, "Seed Orchards in British Columbia – Historical and Projected Production." This report was the basis for the subsequent strategy, and investment in new seed orchards in BC. We have also provided technical advice and consulting services related to provenance testing and propagation for companies in Chile and China.

For the past 13 years we have been responsible for the collection and processing of the entire ex situ genetic seed collections for the Ministry of Forests (MoF). We have also been very active working with all aspects of whitebark pine recovery, and seed collections, and have produced reports for the BC Ministry of Forests and SER (Society for Ecological Restoration) on whitebark pine including; " Promoting Whitebark Pine Recovery in British Columbia" (http://whitebarkfound.org/wp-content/uploads/2015/03/promoting_recovery_in_bc.pdf) and " Best Management Practices for Whitebark Pine", (https://whitebarkpine.ca/best-management-practices/).

Don PIgott will be in charge of all health and safety planning and protocols on the field tours.

## Organizer and Speaker: Melissa Spearing, National Tree Seed Centre

Melissa is a budding seed biologist employed at the National Tree Seed Centre in Fredericton while working towards a Master of Forest Science degree at the University of New Brunswick. Melissa's prior experience includes nursery production and seed orchard management in Southern Ontario, supporting Species at Risk recovery programs, training at the Millennium Seed Bank in England, and a diploma from the Niagara Parks School of Horticulture. She is currently a Director with the Canadian Forest Genetics Association, Editor of the Tree Seed Working Group News Bulletin, and member of the Canadian Institute of Forestry. In her spare time, she enjoys gardening, cooking, hiking, botanizing, camping, food preservation, and restoring old farmhouses.

**About the National Tree Seed Centre:** The NTSC was established in 1967 to collect, test, store and distribute germplasm for seed science research and reforestation provenance testing. Today, NTSC's mandate includes conservation of shrubs, Species at Risk recovery, knowledge mobilization and training, advancing Canada's climate solutions including the 2 Billion Trees program, and supporting Indigenous-led conservation efforts across the country through the Indigenous Seed Collection Program. The current collection contains over 13,000 genetically distinct seedlots from over 200 species from 1948-2021. Seed is still provided at no cost to qualified research and educational projects. For more information, visit: https://www.nrcan.gc.ca/science-and-data/research-centres-and-labs/forestry-research-centres/atlantic-forestry-centre/national-tree-seed-centre/13449;

- Poster and presentation from the June 2021 Global Society of Ecological Conference workshop: https://drive.google.com/file/d/1i6h8Qweco4JD4LIGsq3Ca3fP-dSmFAJm/view?usp=sharing; Researchgate poster: 10.13140/RG.2.2.25949.90080
- 2022 Webinar Series "Scaling Up Seed Supply" recordings: https://www.youtube.com/playlist?list=PLn5sGR1lUtHT_9XglqkUg7Q-dZqE0_k1a

## Organizer: Victoria Lei, Testing Supervisor, BC Tree Seed Centre

I graduated from the University of British Columbia with a BSc in Biology, specializing in plant biology. After working for Agriculture and Agri-food Canada in various labs (crop seeds, entomology, and cherries), I was hired by the BC Tree Seed Centre in 2017. I've sat at almost every desk in the Seed Testing Laboratory – first as an auxiliary research technician, then a Testing Technician, and currently, the Testing Supervisor. My passions include gardening, singing in choirs and reading. I have just about exhausted my local library's offerings of Hercule Poirot mysteries and am moving onto science fiction.

# Speakers and Workshops

| Date | Time | Title | Speaker / Lead By |
|---|---|---|---|
| **Thursday June 23, at the Mary Winspear Centre**<br><br>**2243 Beacon Ave. Sidney, BC V8L 1W9** | 8:30 AM | Welcome/ Building Relationships / Roundtable Introductions<br>● Name / Affiliation/ Country<br>● Tree Seed interests<br>● What do you want to get out of this meeting? | Dave Kolotelo |
| | 9:00 AM | Introduction to the ISF Tree and Shrub Group | Øyvind Meland Edvardsen |
| | 9:10 AM | International Seed Testing Association Overview (video) | Dr. Steve Jones |
| | 9:20 AM | TSWG / IUFRO 2.09.03 / ISTA FTS Overview | Dave Kolotelo |
| | 9:30 AM | Tree seed production and use in British Columbia: past, present and future | Brian Barber |
| | 9:45 AM | OECD Forest Seed and Plant Scheme in Canada: 2020-2022 Updates | Melissa Spearing |
| | **10:00 AM** | **Break** | |
| | 10:30 AM | DIY Climate Based Seed Transfer | Dr. Greg O'Neill |
| | 10:50 AM | BC Seed Planning Tools Overview | Sabina Donnelly |
| | 11:10 AM | Reproductive Biology – Why is it important?? | Dave Kolotelo |
| | 11:20 AM | Seed Production Efficiency Practices | Dr. Michael Stoehr |
| | 11:35 AM | The potential for molecular tools in seed provenance identification | Dr. Hayley Tumas |
| | 11:50 AM | Demonstration of the field PCR tool for seed pathogen detection | Dr. Nicolas Feau |
| | 12:00 noon | Lunch (included in in-person ticket) | |

| Date | Time | Title | Speaker / Lead By |
|---|---|---|---|
| **Monday June 27, at the BC Tree Seed Centre (Surrey, BC)**<br><br>**18793 - 32nd Ave Surrey BC V3** | 8:30 AM | Welcome/ Recap / Exchanging information | Dave Kolotelo |
| | 8:45 AM | Evolution of Seed Extraction Practices | Dr. Marilyn Cherry |
| | 9:00 AM | A brief history of cone and seed processing and looking to the future in BC.? | Don Pigott |
| | 9:15 AM | Challenges with processing, storage and pretreatment of recalcitrant tree species | Fabienne Colas |
| | 9:30 AM | Continuous Improvement: beyond the buzzwords | Dave Kolotelo |
| | 9:45 AM | Where the rubber hits the road: using greenhouse germination data to create a feedback loop with lab testing | Nabil Khadduri |
| | 10:00 AM | Break | |
| | 10:30 AM | **Cone and Seed Processing Panel Q & A**<br>● Jeff deGraan, WA State Reforestation Specialist<br>● Johanna Gårdebrink, Svenska Skogsplantor<br>● Don Pigott, owner Yellow Point Propagation Ltd.<br>● Michael Postma, Manager BC Tree Seed Centre | |
| | 11:45 AM | PCR detection of tree seed pathogens (video) | Dr. Richard Hamelin |
| | 12:00 noon | Lunch (included in in-person ticket) | |
| | 1:00 PM | **Demonstrations**<br>● Field PCR tool for pathogen detection<br>● Drone seeding – likely a static demonstration<br>● Fandrich harvester or rake possibility<br>● Water activity | |
| | 2:00 PM | Tour of BC Tree Seed Centre | BC TSC Staff |
| | 3:30 PM | End of Program, coordination of those continuing on to BCSOA. | |

# Full Program

| Date | Time | Location | Activity |
|---|---|---|---|
| **Wednesday June 22** | 8:00–11:00 AM | Mary Winspear Centre, Sidney BC | ISF Tree and Shrub Group Annual General Meeting |
| | 12:00–1:00 PM | Lunch in Sidney or Victoria | Lunch on your own |
| | 1:00–6:00 PM | Victoria | Sightseeing downtown Victoria |
| | 6:00–8:00 PM | Victoria | ISF Tree and Shrub Group Dinner |
| **Thursday June 23** | 8:30–12:00 AM | Virtual - via Zoom | Tree Seed Presentations |
| | | Mary Winspear Centre | |
| | 12:00 –12:45 PM | Lunch in Sidney | Catered lunch provided |
| | 1:00–2:30 PM | Arbutus Grove Nursery | Private Tree Seedling Nursery<br>Drinks and snacks. |
| | 2:45–4:00 PM | Mt Newton Seed Orchard Mosaic Forest Management | Private Forest Company Seed Orchard. |
| | 4:15–5:45 PM | Butchart Gardens | Tour gardens on your own |
| | 6:30 PM | Shaw Centre for the Salish Sea<br>Sidney, BC | Icebreaker and Dinner Banquet |
| **Friday June 24** | 8:30 AM | Sidney to Goldstream Park | Board bus at Mary Winspear Centre |
| | 9:15–10:45 AM | Goldstream Park | History of the Park, Coastal ecology |
| | 11:00 AM–1:00 PM | Malahat Skywalk | Skywalk. Botany and Forestry overview.<br>Lunch provided |
| | 2:00–5:00 PM | Cowichan Lake Research Station | Yellow cedar and Redcedar, cone induction, Douglas fir trials |
| | 6:00 PM | Dinner | Informal meetings and networking.<br>Overnight. |
| **Saturday June 25** | 7:30–9:00 AM | Breakfast | Provided at Cowichan Lake Education Centre |

| Date | Time | Location | Activity |
|---|---|---|---|
| | 9:00–12:00 AM | Travel to Port Renfrew | 56 km. Normally one hour drive. 3 or 4 stops to look at big spruce, plantations, and logging |
| | 12:00–1:00 PM | Bagged Lunch on Beach | Provided |
| | 1:30–3:00 PM | Avatar Grove | Avatar Grove is a spectacular section of old growth forest. |
| | 3:00–4:30 PM | Return to Cowichan Lake | Possibly one stop |
| | 6:00 PM | Dinner | Networking. |
| | 7:30 | | Cone and Seed Processing facility slideshows |
| **Sunday June 26** | 7:00–8:30 AM | Breakfast provided | |
| | 9:45–11:15 AM | Yellow Point Propagation | Tour of seed extractory, Christmas trees. |
| | 11:15–11:45 AM | Travel to Nanaimo ferry | **End of Bus tour ticket** |
| | 12:45–2:45 PM | Ferry to Mainland | Departure Bay to Horsehoe Bay 12:25 siling Lunch on ferry (not included) |
| | 3:30–5:00 PM | UBC Botanical Gardens | The oldest botanical garden in Canada started in 1916. |
| | 5:00–6:00 PM | | Drive to Langley City |
| | 6:00 PM | Langley / South Surrey | Dinner on your own |
| **Monday June 27** | Hotel pickup provided - schedule TBD based on confirmed bookings | | |
| | 8:30–12:00 AM | Virtual - via Zoom | Tree Seed Working Group Workshop |
| | | Tree Seed Centre, Surrey | |
| | 12:00–1:00 PM | | Lunch provided |
| | 1:00–2:00 PM | | Tree Seed Working Group Workshop Demonstrations |
| | 2:00–3:30 PM | | In-person tour of BC Tree Seed Centre |

| Date | Time | Location | Activity |
|---|---|---|---|
| | | | **END of Tree Seed Program and Eventbrite tickets** |
| | 3:45 – 8:00 PM | | For those continuing to BCSOA, transit options will be determined. Dinner en route |
| **Tuesday to Thursday June 28-30** | See BCSOA website | Vance Creek Conference Centre, Vernon, BC | |

# Meals

The following table clearly indicates the meals included as part of the program and part of the registration fee and those people are on their own to organize. For all program meals, when you check out from Eventbrite, you can specify food allergies, vegan, vegetarian, gluten-free, lactose-free or any other requirements.

| | Breakfast | Lunch | Dinner |
|---|---|---|---|
| June 22 | On Your Own | On Your Own | On Your Own |
| June 23 | On Your Own | Program | Program |
| June 24 | On Your Own | Program | Program |
| June 25 | Program | Program | Program |
| June 26 | Program | On Your Own (Ferry) | On Your Own |
| June 27 | On Your Own | Program | Program (Optional) |

# Restaurant Recommendations

## Sidney

**Breakfast**

- The Five and Dime Diner, 2305 Beacon Ave., 1 block from our workshop venue: https://fiveanddimediner.com/
- 3rd street Cafe, 2466 Beacon Ave.: https://www.facebook.com/3rdStreetCafeSidney/

**Lunch**

- Thai Corner, 2359 Beacon Ave.:https://thai-corner-restaurant.com/
  Taste of Tokyo, 101-9842 Resthaven Dr.: https://tasteoftokyo.ca/
- Fish on Fifth, 9812 Fifth St.: https://fishon5th.com/

- Maria's Souvlaki, 9812 Second St.: https://www.mariassouvlaki.ca/menu

**Dinner (in addition to all lunch places)**

- Surly Mermaid, 9851 Seaport Place: https://www.surlymermaid.ca/
- Riva, 2537 Beacon Ave.: https://rivasidney.ca/
- 10 Acres, 2538 Beacon Ave.: https://10acres.ca/pier-restaurant/
- Royal Aroma (Indian), 2470 Beacon Ave.: https://royal-aroma.com/
- SabHai Thai, 2493 Beacon Ave.: http://sabhai.ca/

### Surrey/Langley

**Dinner**

- Ban Chok Dee Thai Cuisine, 20563 Douglas Crescent: https://banchokdee.com/
- Langley Vietnamese Cuisine, 5521 203 St.: https://www.facebook.com/LangleyVietnameseCuisine/
- Annora Restaurant, 5572 204 St.: https://www.annorarestaurant.com/

# Health and Safety on Tour

**Don Pigott will be in charge of all health and safety planning while we are on the field tours. His cell is 250-668-4635.**

General links and reminders:

- Please show up at least 15 minutes early to workshop venues and group departure times.
- Coming from out of the country? Please use ArriveCAN
- Current COVID-19 protocols in British Columbia: we encourage the use of masks and continued physical distancing where possible. If you fall ill or are injured during the course of events, please notify the organizers as soon as possible. Emergency services are available by calling 911. Additional emergency information can be found here.

# Workshop: Thursday June 23

## In-Person Location:

**Mary Winspear Centre,** 2243 Beacon Ave. Sidney, BC V8L 1W9
**Google Maps directions**: https://goo.gl/maps/UM3X2YcpkCiGRdkM6

## Virtual Live Stream:

Purchase tickets until the start of the event - 8:30 AM PST:
https://www.eventbrite.ca/e/virtual-june-23-tree-seed-presentations-tickets-354966162347

### Speaker: Øyvind Meland Edvardsen Seed Manager, The Norwegian Forest Seed Center, International Seed Federation (ISF), Chair of Tree and Shrub Group

Øyvind Meland Edvardsen has studied and worked in the field of tree genetics and seed procurement on operational, management and research levels for thirty years, with more than twenty years at the seed center. The Norwegian Forest Seed Center procures tree seed for forestry, operates breeding programmes, manages seed orchards, runs a seed testing laboratory and supports research. Today about 90 % of our seed sales are *Picea abies* of which 95% are harvested in seed orchards. *Pinus sylvestris* and *Abies lasiocarpa* (for Christmas trees) are also major species. Large scale breeding programmes are established for *Picea abies* and *Pinus sylvestris*. There are also breeding activities on *Abies lasiocarpa*, *Betula verrucosa* and *Alnus glutinosa* of which seed orchards are established. Major research projects are established with international partners on; genomic selection in breeding, selection through “breeding without breeding” and implementing provenance transfer functions and climate change models in deployment recommendation tools.

The International Seed Federation is a non-governmental, non-profit making organization that represents the interests of the seed industry at a global level. The Tree and Shrub Group is a special group within the ISF organisation with its own governance but obliged to comply with ISF’s Articles of Association and Internal Rules. The group meets once a year in events hosted by the member organisations and addresses issues of interest and importance of the member organisations. The group has in recent years focused on advocating science-based regulations and taken positions against potential trade barriers.
**Email:** oyvind@skogfroverket.no

## Speaker: Dr. Steve Jones

Steve is the Immediate Past President of ISTA and the liaison to the ISTA Forest tree and Shrub Committee. His career started in the UK where he worked in horticulture , forestry and agriculture for 30 years. From 1998 to 1997 he was a tree seed researcher at the UK's Forestry Commission Research Centre (Alice Holt, Farnham). He has worked on ISTA committees since 2000. He moved to Saskatoon, SK in 2008 to work with the Canadian Food Inspection Agency (CFIA) which he will retire from later this year. He continues to have an interest in tree seed and expects to have a connection with us after retirement.
**Recorded presentation:** https://youtu.be/UmeGOtMXxs8
**Email:** stevek.jones@ista.ch

## Speaker: Dave Kolotelo, Cone and Seed Improvement Officer BC Ministry of Forests Tree Seed Centre

### Abstract: TSWG / IUFRO 2.09.03 / ISTA FTS Overview

An overview of the Canadian Forest Genetics Association (CFGA) Tree Seed Working Group; IUFRO 2.09.03 Seed Physiology and Technology; and the International Seed Testing association (ISTA) Forest Tree and Shrub Committee will be provided.
**Email:** Dave.Kolotelo@gov.bc.ca

## Speaker: Brian T. Barber, BSF, MA, RPF CEO, Select Seed Co. Ltd.

Brian obtained a BSF from the University of British Columbia in 1987, and a MA in Environment and Management from Royal Roads University in 2007. Brian has served as CEO, Select Seed Co. Ltd., a not-for-profit company owned by Forest Genetics Council of BC (FGC) since 2016. Select Seed produces tree seed under contract with companies in BC's southern interior. Prior to joining SelectSeed, Brian worked for the Ministry of Forests for 25 years; the last nine years as Director, Tree Improvement Branch. Brian also serves as FGC Program Manager, and is the current President, Canadian Forest Genetics Association. He is also an active member of the Association of BC Forest Professionals and the Canadian Institute of Forestry. He resides in Victoria, BC with his wife (in their now empty nest) and together enjoy hiking, birding, travel and astronomy.
**Email:** Brian.Barber@selectseed.ca
Phone: 250-888-7081

### Abstract: Tree Seed Production and Use in British Columbia: Past, Present and Future

British Columbia's (BC) tree improvement program began in the 1950 with Coastal Douglas-fir under the direction of Dr. Alan Orr-Ewing and the Plus Tree Board. Today, over 100 seed orchards representing a dozen species are managed by the Ministry of Forests and private companies in BC. These orchards produce approx. 70% of seed used to grow the 300 million seedlings planted annually in BC.

Forest genetics activities are coordinated by the Forest Genetics Council of BC, whose members are appointed by the Provincial Chief Forester (CF). FGC's mandate is to enhance the conservation, adaptation, health, and productivity of BC's forests. The latter goals are largely accomplished through support and coordination of tree breeding and seed orchards.

The CF is also authorized to establish standards that regulate the production and use of tree seed.
In 2018, the CF introduced new climate-based seed transfer (CBST) standards that account for recent past and future climate. This new policy along with declining harvest rates, shifts in reforestation practices, and rehabilitation of large areas destroyed by wildfires are also changing seed supply and demand in BC.
This presentation will summarize the history, current practices and challenges of BC's forest genetic program, with emphasis on tree seed orchard production and use.

## Speaker: Melissa Spearing

### Abstract: OECD Forest Seed and Plant Scheme in Canada: 2020-2022 Updates

Canada has been a member of the Organisation for Economic Cooperation and Development (OECD)'s Forest Seed and Plant Scheme since 1970. The Canadian Forest Service (CFS) is the National Designated Authority (NDA) to certify the genetic origin and trueness to name of each seedlot, provide official labels, and maintain a National Register of approved basic material (stands, orchards, clones and other germplasm types). The primary demand for certified Canadian seed today is of western conifer species, notably Douglas Fir and true fir species. Though total certified volumes have decreased since the 1980s, the CFS continues to participate in the Scheme to stay current on forest genetic resource issues and facilitate trade opportunities for domestic producers. This talk will provide an update on recent CFS activities to maintain OECD Rules and new coordination efforts for annual reporting with the Canadian Food Inspection Agency. The National Tree Seed Centre (NTSC) has also been recommending that Parks Canada, researchers, and operational foresters utilize the OECD standards and retain records with NTSC when importing seed for assisted migration trials.
**Email:** melissa.spearing@nrcan-rncan.gca.ca
**Visit the OECD Forest Seed and Plant Scheme website:** https://www.oecd.org/agriculture/forest/

## Speaker: Dr. Gregory A. O'Neill, Climate Change Adaptation Scientist

Greg O'Neill studies the nature and distribution of adaptive variation of North American tree species and applies this understanding to develop resilient reforestation practices in a changing climate. Greg is a professional forester with degrees in biology, forest ecology, and forest genetics. He has worked for the last 20 years with the British Columbia government, and in previous careers as an arborist, tree seedling grower, and environmental consultant.

### Abstract: DIY – Climate Based Seed Transfer

The intention of this presentation is to make a case for "boldly going where no forester has gone before": for deconstructing the 100-year-old paradigm of reforesting with local seed sources. As the rate of anthropogenic climate change continues to outpace the ability of natural systems to respond through natural selection and

migration, tree populations are becoming increasingly distanced from their climatic optimum, maladapted and susceptible to pests and disease.

Assisted migration – reforesting or afforesting with tree seed sources from climates that are slightly warmer than the planting site – is intended to mitigate forest maladaptation associated with evolutionary lag due to anthropogenic climate change. This presentation will discuss a) the rationale for assisted migration in forestry; b) British Columbia's new Climate Based Seed Transfer system; c) practical tools seed users can use for building a CBST; and d) future seed procurement challenges.
**Email:** Greg.ONeill@gov.bc.ca

## Speaker: Sabina Donelly, BC Ministry of Forests Seed Resource Specialist

Sabina has been working with the Forest Improvement and Research Management Branch in the Ministry of Forests since 2017. She started working as a Research Technician in the Forest Genetics program before moving into the Seed Resource Special role in 2019. As a Seed Resource Specialist, Sabina has the pleasure of working with a wide range of clients across the province and assists users with policy questions, project and seed planning, and finding climatically suitable seed sources. In her spare time, Sabina likes to enjoy the outdoors and adventure near her home base in the Cowichan Valley on Vancouver Island, in the traditional territories of the Hul'qumi'num speaking peoples.

### Abstract: BC Seed Planning Tools Overview

During the BC Seed Planning Tools Overview, attendees will learn about seed use in BC for the purposes of reforestation on crown land and the tools available. Attendees will be given demonstrations of the Seed Planning and Registry (SPAR), the Seedlot Selection Tool and the Tree Seed Planning Dashboards.
**Email:** Sabina.Donnelly@gov.bc.ca

## Speaker: Dr. Michael Stoehr, RPF (retired)

Michael began his forestry career at Lakehead University and completed a BSc and MSc between 1978-1984. His Masters topic was actually on seed biology, but he got subverted to the dark side and abandoned our field. He completed a PhD in forest genetics at University of Toronto in 1988 and had postdoctoral appointments at McMaster University and the University of Victoria. From 1992-2000 he was the Seed Production Research scientist in Victoria. In 2000 he became the Coastal Douglas-fir breeder until his retirement in 2020. He still has time for the occasional contract if you can tear him off his bicycle or the tennis court.

### Abstract: Seed Production Efficiency Practices

Successful reforestation must be an integrated chain of processes involving seed production, seedling generation and plantation establishment. The first step is to have a reliable supply of high-quality seed on a yearly basis. Despite frequent successful seed orchard crops, the reproductive dynamics and random mating assumptions may not be met, especially with respect to that genetic diversity and the anticipated genetic quality (worth) associated with the selected parents. Therefore, it is prudent to check these assumptions as seed is deployed on public land with the public trusting our approaches. Due to the nature of genetic testing and selection, genetic gain and

genetic diversity are opposing forces and orchard seed genetic diversity, expressed as the effective population size (*Ne* of an orchard crop), must be optimized. There are several ways to achieve this.

In BC, the gain estimates of reforestation seedlings are reflected in future annual allowable cut allocations, necessitating the most accurate gain estimates possible of orchard crops. Large unknowns in these estimates are the levels of pollen contamination of a particular orchard crop. As more advanced-generation selections are used as orchard parents, pollen contamination effects have even more impact in reducing estimated genetic gains in future forests. Unaccounted for, this will lead to overestimations in anticipated genetic gain, resulting in false harvesting level estimates. Novel approaches are available to accurately determine contamination levels, but more R&D is needed to make them more economical to be applied on a routine basis.

## Speaker: Dr. Haley Tumas

Hayley Tumas is a postdoc in the Department of Forest and Conservation Sciences at the University of British Columbia. She obtained her PhD in Forestry and Natural Resources at the University of Georgia (USA) studying conservation genetics of a foundational salt marsh plant. Her work in forest genetics began with her postdoc at the University of Oxford with John MacKay where she developed a high-density linkage map for Sitka spruce. Her research has traversed elevations and ecosystems from coast to mountains with genetics and management application as the unifying themes. She is currently working on a project with Sally Aitken, the BC Ministry of Forests, and forestry industry that will assess genetic diversity of three conifer species at multiple spatiotemporal scales of forest management in BC.

### Abstract: Genetic population assignment: potential for seed provenance ID?

Pinpointing the geographic origin of a biological sample is a common challenge across conservation, management, and even law enforcement. Whether the sample is wood from illegally logged timber, a scale from a fisheries species, or a seed collected for reforestation, molecular tools can help solve this question through genetic population assignment. If genomic data is available for all possible provenances, an individual sample can be assigned to a geographically referenced provenance based on genetic similarity. However, the confidence of a particular provenance assignment is based on the scale of population assignment (e.g., assigning a sample to a locality vs. a region or subspecies), and also highly dependent on the type of genomic markers used and the life history of the species. Trees, specifically those with wind dispersed pollen like most temperate and boreal species, have limited capacity for high-confidence population assignment due to a general lack of fine-scale population structure. Fortunately, recent advances in assignment software, consistently evolving genomic marker technologies, and the potential use of adaptive data are promising for increasing the ability to assign seed to provenances in the future.

**Email:** hayley.tumas@ubc.ca

## Demonstration: Dr. Nicolas Feau

### Portable PCR Demonstration

Nicolas Feau is a research scientist in forest pathology with the Canadian Forest Service (Natural Resources Canada) in Victoria, BC. He completed his PhD at the Université Laval in Québec and a post-doc at the INRA

(French National Research Institute for Agriculture) of Bordeaux in France. Before joining Natural Resources Canada, he worked as a Research Associate in Richard Hamelin's lab at the University of British Columbia in Vancouver, BC. He conducted studies in several pathosystems, from poplar rusts and cankers, to blue stain fungi and oak powdery mildews. He developed a strong interest and expertise in the use of genomics and bioinformatics tools to detect and track forest pathogens and get a better understanding of their mechanisms of emergence and evolution.

**Email:** nicolas.feau@NRCan-RNCan.gc.ca

## Field Tour: Arbutus Grove Nursery Ltd.

At Arbutus Grove Nursery Ltd. we specialize in growing containerized seedlings for reforestation. Our customers include forest companies, governments, First Nations bands, and woodlot owners in British Columbia and the US Pacific Northwest. We also grow a selection of seedlings for Christmas Tree farms. We custom-grow seedlings to our customer's specifications producing quality container seedlings of all sizes. We also offer seed preparation services in our seed lab, quality assurance procedures, cold storage, seedling delivery and shipping logistics services. Started in the 1980s by Hans Stoffelsma, our nursery is located on the Saanich Peninsula at the southern tip of Vancouver Island, British Columbia and now owned and managed by his son Nathaniel Stoffelsma. We produced over 14 million seedlings in 2021 at our 10 hectare facility. We are proud to play a part in the forest industry by ensuring our customers get their plantations off to a great start with quality Arbutus Grove seedlings.

**Website:** http://www.arbutusgrove.com/

## Field Tour: Mosaic Forest Management Corp. & Mt. Newton Seed Orchard

Mosaic Forest Management Corporation is in the business of sustainable forest stewardship, managing private timberlands and Crown forest tenures in Coastal British Columbia for more than a century. Mosaic employs several thousand people directly and indirectly, and is strongly committed to achieving positive economic, social and sustainability outcomes from the working forest. Mosaic's Mount Newton Seed Orchard was established in 1979 to provide a reliable source of improved seed for reforestation. Since then the 40-hectare site has produced enough seed to grow nearly 300 million seedlings! Currently three species are managed for production. Douglas-fir is the most prominent, with 6000 multi-aged ramets producing an average of 180 kg of seed per year.

Western redcedar seed has been produced here since 1986, and a rust-resistant western white pine orchard was established in 2015.

**Website:** https://www.mosaicforests.com/

## Field Tour: Butchart Gardens

Robert Pim Butchart, a pioneer in the thriving North American cement industry, was attracted from Owen Sound, Ontario to Canada's West Coast by rich limestone deposits. In 1904, he developed a quarry and built a cement plant at Tod Inlet (on Vancouver Island) to satisfy Portland cement demand from San Francisco to Victoria. Jennie Butchart became the company's chemist. Close to the quarry, the Butcharts established the family home complete with sweet peas and rose bushes.

As Mr. Butchart exhausted limestone deposits, his enterprising wife Jennie, made plans to create something of beauty in the gigantic exhausted pit. From farmland nearby, she had tonnes of top soil brought in by horse and cart and used it to line the floor of the abandoned quarry. Little by little, the quarry blossomed into the spectacular Sunken Garden.

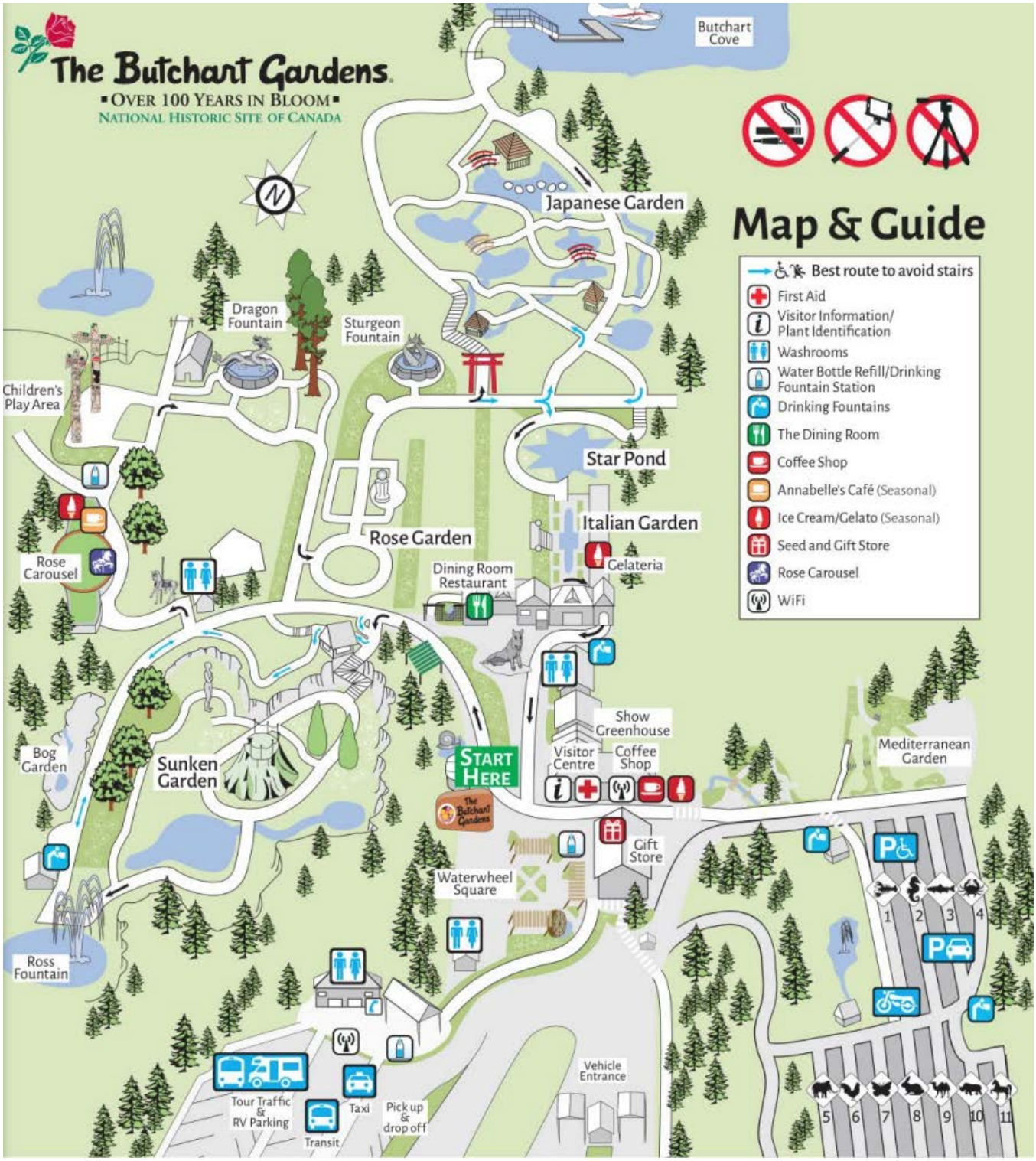
Between 1906 and 1929, the Butcharts created a Japanese Garden on the seaside, an Italian Garden on their former tennis court and a beautiful Rose Garden. Mr. Butchart took great pride in his wife's remarkable work. An enthusiastic hobbyist, he collected ornamental birds from all over the world. He kept ducks in the Star Pond, noisy peacocks on the front lawn and many elaborate birdhouses throughout the gardens.

The only surviving portion of the original cement factory is the tall chimney of a long vanished kiln still seen from the Sunken Garden lookout. The plant stopped manufacturing cement in 1916, but continued to make drain tiles and flower pots until 1950. Some of the original flowering cherry trees which extended from West Saanich Road to The Gardens' entrance may still be seen.

The renown of the family owned gardens is widespread. Each year over a million bedding plants in some 900 varieties give you uninterrupted bloom from March through October. Almost a million people visit annually for

spring's colourful flowering bulbs; summer's riot of colour, entertainment and Saturday Fireworks; fall's russets and golds; the Magic of Christmas' decorations; and winter's peacefulness. The Butchart Gardens was designated a National Historic Site of Canada in 2004.

**Website:** https://www.butchartgardens.com/



## Dinner Banquet at the Shaw Centre for the Salish Sea

Located on the breathtaking Sidney waterfront on the traditional lands of the W̱SÁNEĆ Nations of the Coast Salish Indigenous peoples, the Shaw Centre for the Salish Sea is Canada's only aquarium and cultural centre dedicated exclusively to the learning, exploration and conservation of the Salish Sea Bioregion. As the only aquarium on Southern Vancouver Island, the Centre displays the natural beauty and ecological diversity of the local Salish Sea through 28 aquarium habitats holding over 160 live marine species and over 3,500 animals including a giant pacific octopus, wolf eels, and pacific salmon. The Centre is also home to a rare, fully-intact killer whale skeleton, a unique collection of Coast Salish Indigenous art, a fun 'hands-on' Touch Pool experience, and a Salish Sea Store with one-of-a-kind, locally sourced and environmentally friendly arts, jewellery and crafts.

**Website:** https://www.salishseacentre.org/

# Bus Tour: Friday June 24 - Forest Ecology

## Field Tour: Goldstream Provincial Park

Goldstream Provincial Park is a provincial park in British Columbia, Canada. It is known for the annual fall salmon runs in the Goldstream River, and the large numbers of bald eagles that congregate to feed at that time. The total size of the park is 3.79 $km^2$ (1180 acres) 477 hectares. Based on information in records in the City of Victoria Archives (solicitor's files), Goldstream Park was created due to the foresight of Victoria's Mayor and City Council of 1925.

Goldstream Park comprises Sections 6 and 7, Goldstream District, include the salt marsh and the lower reaches of the Goldstream River, and protects some of the largest Western Red Cedars (Thuja plicata) in British Columbia. Lot 6 originally belonged to Langford's earliest settler, James Phair. He operated the original Goldstream Hotel, now a pub in competition with Six Mile for "oldest pub in BC". In 1908 he sold section 6 to the Esquimalt Water Works Company, a private firm supplying water to the City of Victoria. Section 7, the upstream half of the Park, was originally a Crown Grant to the National Electric Tramway and Lighting Company Ltd. (319 acres for $319) and was acquired from them by the Esquimalt Water Works Company. Financed by a mortgage held by the Dunsmuir Estate of Hatley Castle fame, they acquired the entire Goldstream watershed in order to have a monopoly on the water rights. This was intended to protect them from other corporations' applying for water rights, particularly the City of Victoria under 1873 legislation covering its water supply.

In order to retire the mortgage, the Company sold some of the watershed's timber to the Continental Timber Company (Fairservice Guerin) in 1925, for about $150,000. Within the same year, however, the Esquimalt Water Works Company Winding up Act had been passed by the city, expropriating the land and water works. Victoria re-negotiated the logging contract in order to remove the Goldstream Park area from that destined for logging.

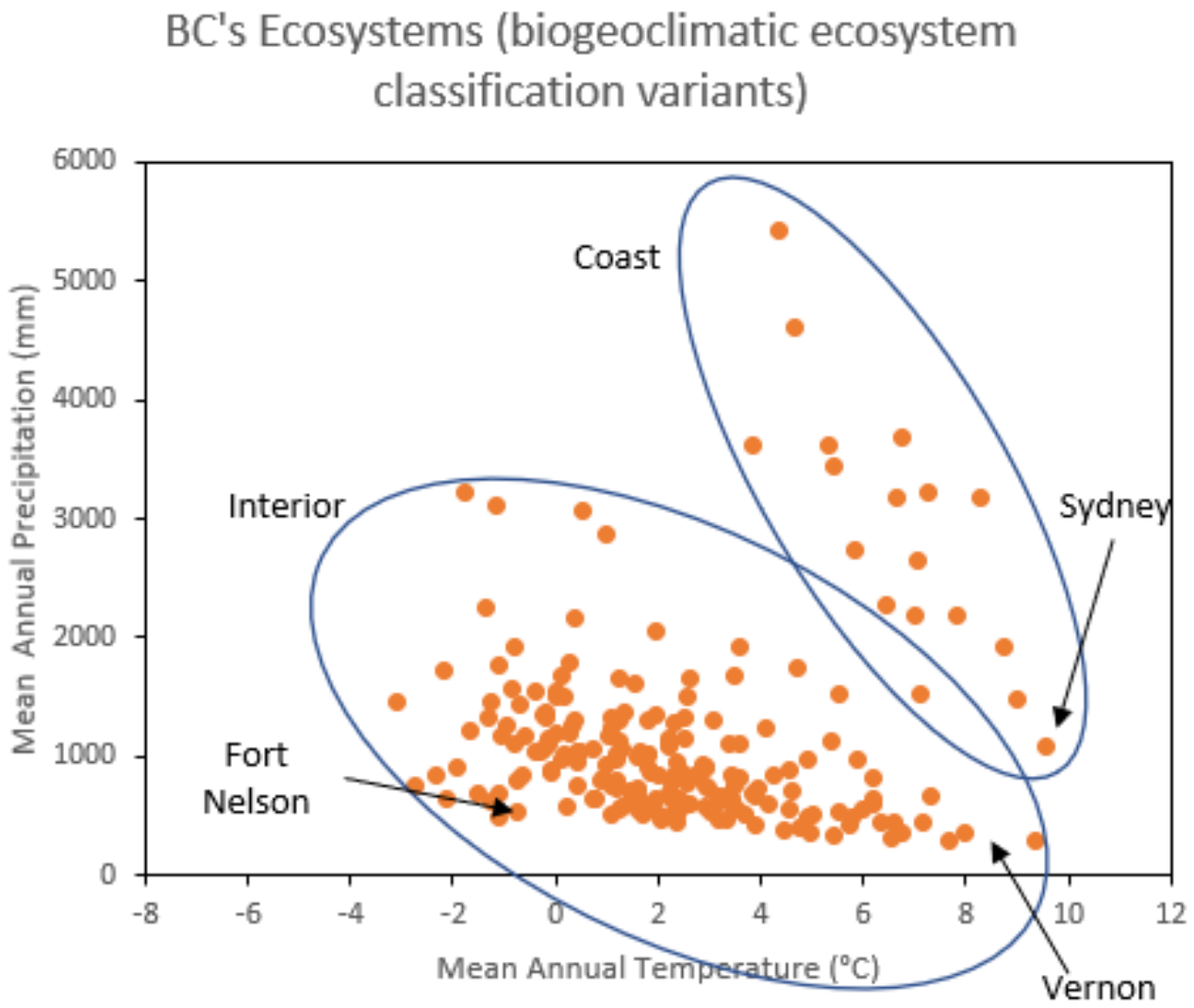
In 1926, the Goldstream Gardens Company submitted a proposal under which they would lease Sections 6 & 7 for 49 years and develop it as a commercial park. It was to have included "motor camp" accommodations, tea rooms, miniature golf course, Swiss Village, riding stables and equipment, gas stations, flower gardens, and fernery. The proposal was thankfully not approved, although a confectionery and a tearoom operated in the Park at different times in the 1930s and 1940s. In 1946, Council granted permission to the Rod and Gun Club for the construction of a Clubhouse which today is used as the Nature House. The City approached the Provincial Government to take over the responsibility for the park and it became a Provincial Park in 1958, the year of the Province's Centennial.[6] Although not the world famous attraction south of Toronto, the Niagara Falls waterfall in Goldstream Provincial Park just north of Victoria is still a spectacular sight. The waterfall is narrow but drops 47.5 meters (160').

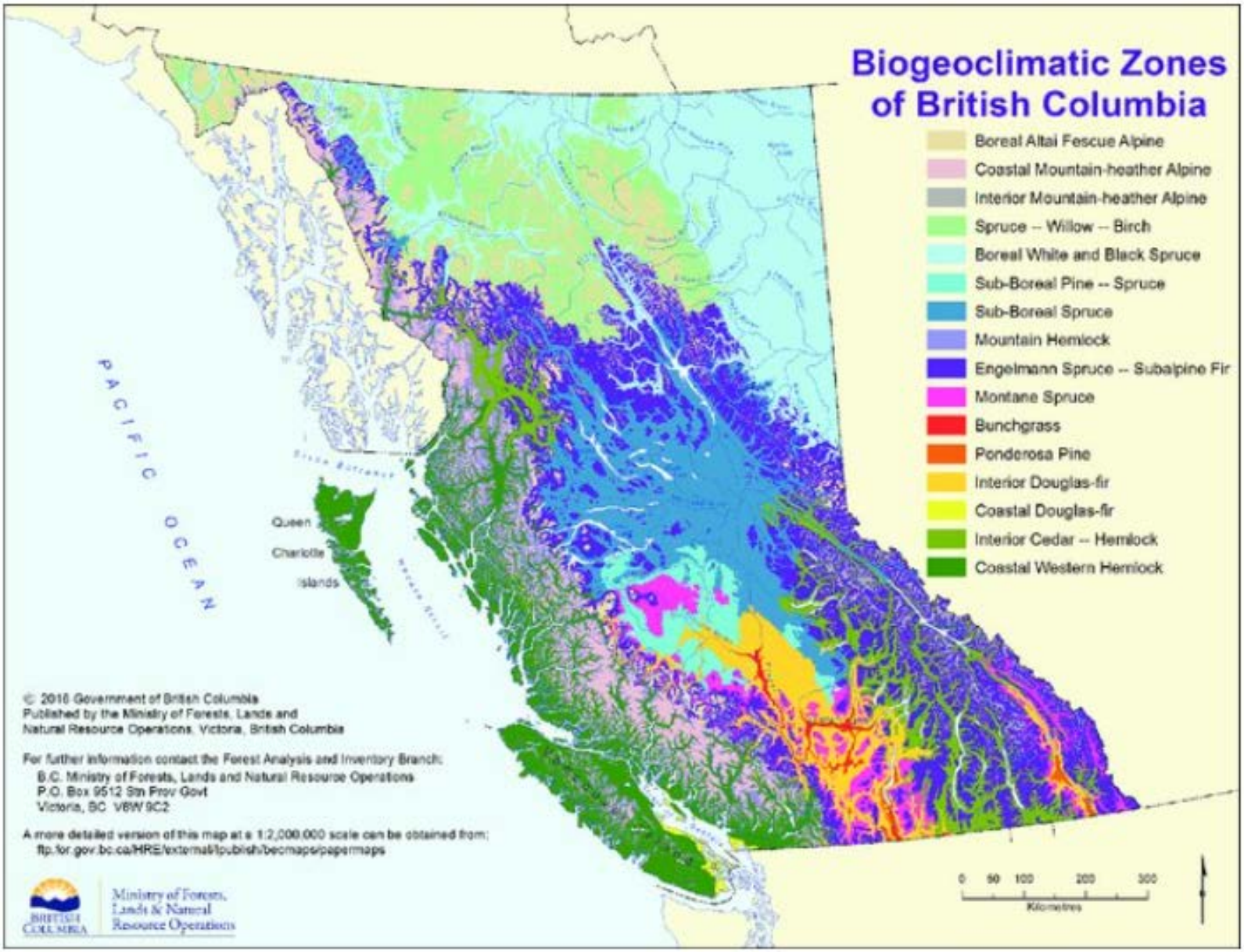
GOOOOOOOOOLD! Way back in 1863 there was a small gold rush in the Goldstream River area. Approximately 300 miners showed up here overnight with their mining equipment ready to excavate the land in hopes of striking it rich. The gold rush only lasted 9 months but it left us with some fairly spectacular exploratory sites.

From a personal perspective, I grew up less than one kilometre from the park. Our family lived for part of the year on the edge of Saanich Inlet. We lived in a rustic cabin, and the park was our playground. It was an idyllic place to live.

**About our tour guide - Bill Beese:**

Before teaching in the Forestry faculty at Vancouver Island University (2010-2021), Bill spent over 30 years as a Forest Ecologist in research and policy development for several forest companies on the BC coast. He is an RPF with an MF in Forest Ecology from UBC. Bill has an international reputation for practical implementation of innovative forestry. His research includes silvicultural systems, prescribed burning, forest regeneration and biodiversity. He coordinated the multi-disciplinary Montane Alternative Silvicultural Systems (MASS) study. He helped lead the phase-in of variable retention harvesting as part of Weyerhaeuser's Coast Forest Strategy—a team effort that received the Ecological Society of America's Corporate Award for 2001. He has served on numerous advisory committees on research, old growth forests and ecosystem-based management including an international science panel for Forestry Tasmania. He is a co-author of three book chapters and numerous research papers, including global overviews of retention forestry.


BC's Ecosystems (biogeoclimatic ecosystem classification variants)
Mean Annual Precipitation (mm)
6000
5000
4000
3000
2000
1000
0
-8
-6
-4
-2
0
2
4
6
8
10
12
Mean Annual Temperature (°C)
Coast
Interior
Sydney
Fort Nelson
Vernon


Biogeoclimatic Zones of British Columbia
Boreal Altai Fescue Alpine
Coastal Mountain-heather Alpine
Interior Mountain-heather Alpine
Spruce -- Willow -- Birch
Boreal White and Black Spruce
Sub-Boreal Pine -- Spruce
Sub-Boreal Spruce
Mountain Hemlock
Engelmann Spruce -- Subalpine Fir
Montane Spruce
Bunchgrass
Ponderosa Pine
Interior Douglas-fir
Coastal Douglas-fir
Interior Cedar -- Hemlock
Coastal Western Hemlock
PACIFIC OCEAN
Queen Charlotte Islands
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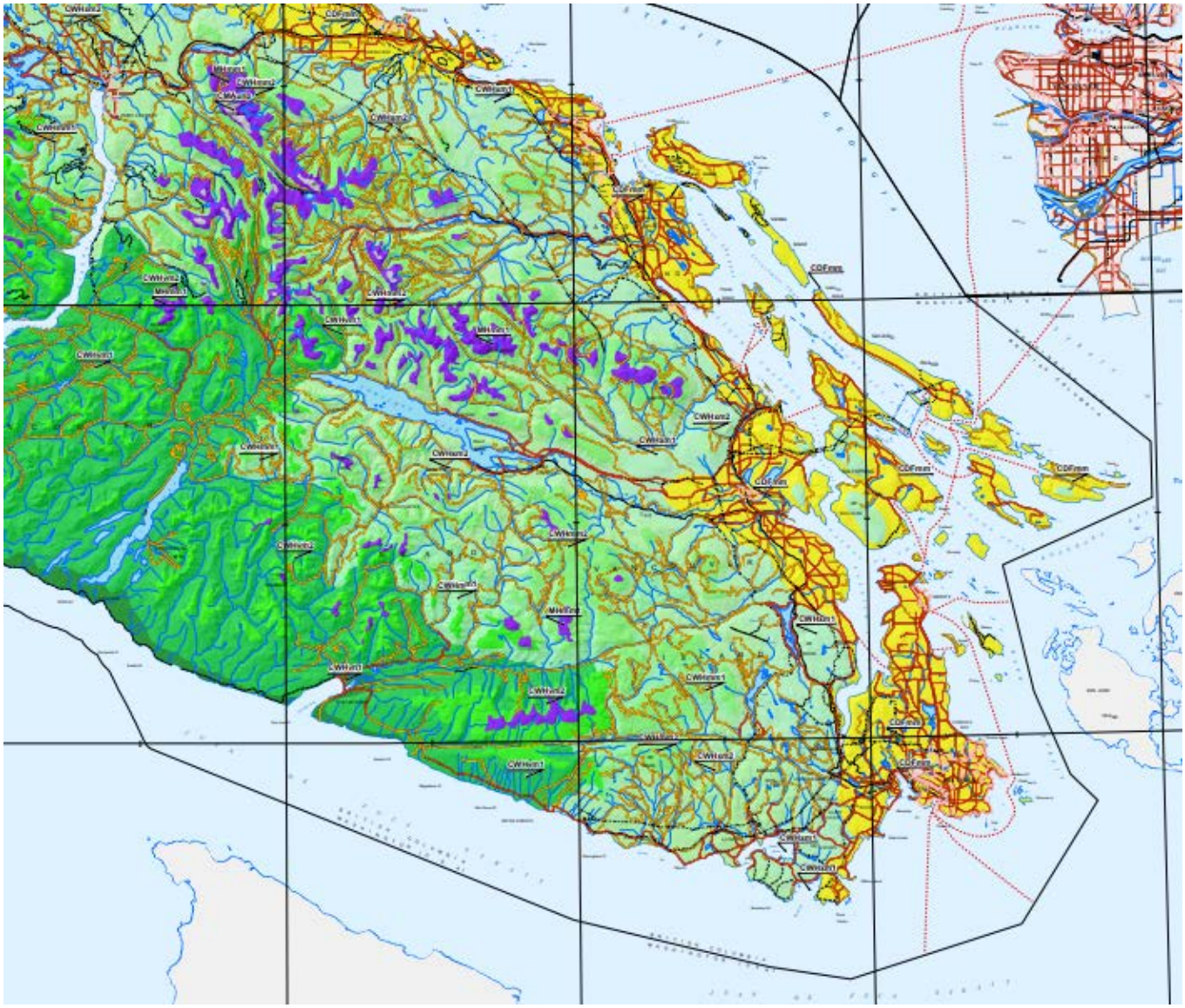
Published by the Ministry of Forests, Lands and Natural Resource Operations, Victoria, British Columbia
For further information contact the Forest Analysis and Inventory Branch:
B.C. Ministry of Forests, Lands and Natural Resource Operations
P.O. Box 9512 Stn Prov Govt
Victoria, BC V8W 9C2
A more detailed version of this map at a 1:2,000,000 scale can be obtained from:
ftp.for.gov.bc.ca/HRE/external/publish/becmaps/papermaps
BRITISH COLUMBIA
Ministry of Forests, Lands & Natural Resource Operations
0 50 100 200 300
Kilometres



| Label | Zone Name | Subzone Name | Variant Name |
|---|---|---|---|
| CMAunp | Coastal Mountain-heather Alpine | Undifferentiated and Parkland | - |
| CDFmm | Coastal Douglas-fir | Moist Maritime | - |
| CWHmm1 | Coastal Western Hemlock | Moist Maritime | Submontane |
| CWHmm2 | Coastal Western Hemlock | Moist Maritime | Montane |
| CWHvh1 | Coastal Western Hemlock | Very Wet Hypermaritime | Southern |
| CWHvm1 | Coastal Western Hemlock | Very Wet Maritime | Submontane |
| CWHvm2 | Coastal Western Hemlock | Very Wet Maritime | Montane |
| CWHxm1 | Coastal Western Hemlock | Very Dry Maritime | Eastern |
| CWHxm2 | Coastal Western Hemlock | Very Dry Maritime | Western |
| MHmm1 | Mountain Hemlock | Moist Maritime | Windward |

*Photo captions if desired*

## Field Tour: Malahat SkyWalk

Located 35 minutes north of Victoria, British Columbia, Malahat SkyWalk officially opens today as the newest year-round outdoor experience on Vancouver Island, providing the 'ultimate natural high.' Malahat SkyWalk immerses visitors in nature as they embark along a 600 m (1,968 ft) elevated, wooden walkway rising 20 m (65 ft) through an arbutus and Douglas fir forest. Guests then ascend a circular ramp gently rising to the top of a 10-storey, architecturally-inspiring spiral tower lookout – the first of its kind in B.C.

*Malahat SkyWalk from above on Vancouver Island, B.C.*
*Photo: Malahat SkyWalk/Hamish Hamilton (CNW Group/Malahat SkyWalk)*

At the top of the tower, guests are 250 m (820 ft.) above sea level and enjoy 360-degree views of two countries, including islands, Saanich Inlet, forests and mountains in B.C. and Washington State. On the other side of Saanich Inlet is the Gowland Todd Provincial Park. (see below) Also at the top, daring guests can walk on an adventure net suspended partially across the centre of the tower for another breathtaking perspective.  On the descent, guests can choose to retrace their steps or take an exhilarating ride down a 20 m (65 ft) spiral slide. Available to everyone over five years of age or minimum 107 cm (42 in) tall, guests can ride as many times as they like.

Malahat SkyWalk is located on the traditional territory of the Malahat Nation and their Indigenous stories are embedded in the visitor experience. Guests will find a deeper connection to nature learning about the trees, birds, animals and marine life of this coastal region unique to this area.
**Website:** www.malahatskywalk.com

## Field Tour: Cowichan Lake Research Station

Established in 1929, the Cowichan Lake Research Station is situated on a 175-hectare site located 63 kilometres northwest of Victoria, British Columbia. The station is the provincial centre for research into coastal tree improvement and forest genetic conservation. Long-term permanent forest productivity plots at the station contribute to understanding coastal stand dynamics and stand development modelling.

The station's nursery staff provide technical expertise and service in growing seedlings to be used in research trials and as rootstock for grafting programs. They also maintain gene archives and breeding arboretums for the coastal region, as well as research programs for Douglas-fir, yellow-cedar, western redcedar, western hemlock and Sitka spruce.

**Website:**
https://www2.gov.bc.ca/gov/content/sports-culture/recreation/facilities/cowichan-lake-research-station

## Tour and Overnight Accommodations: Cowichan Lake Education Centre

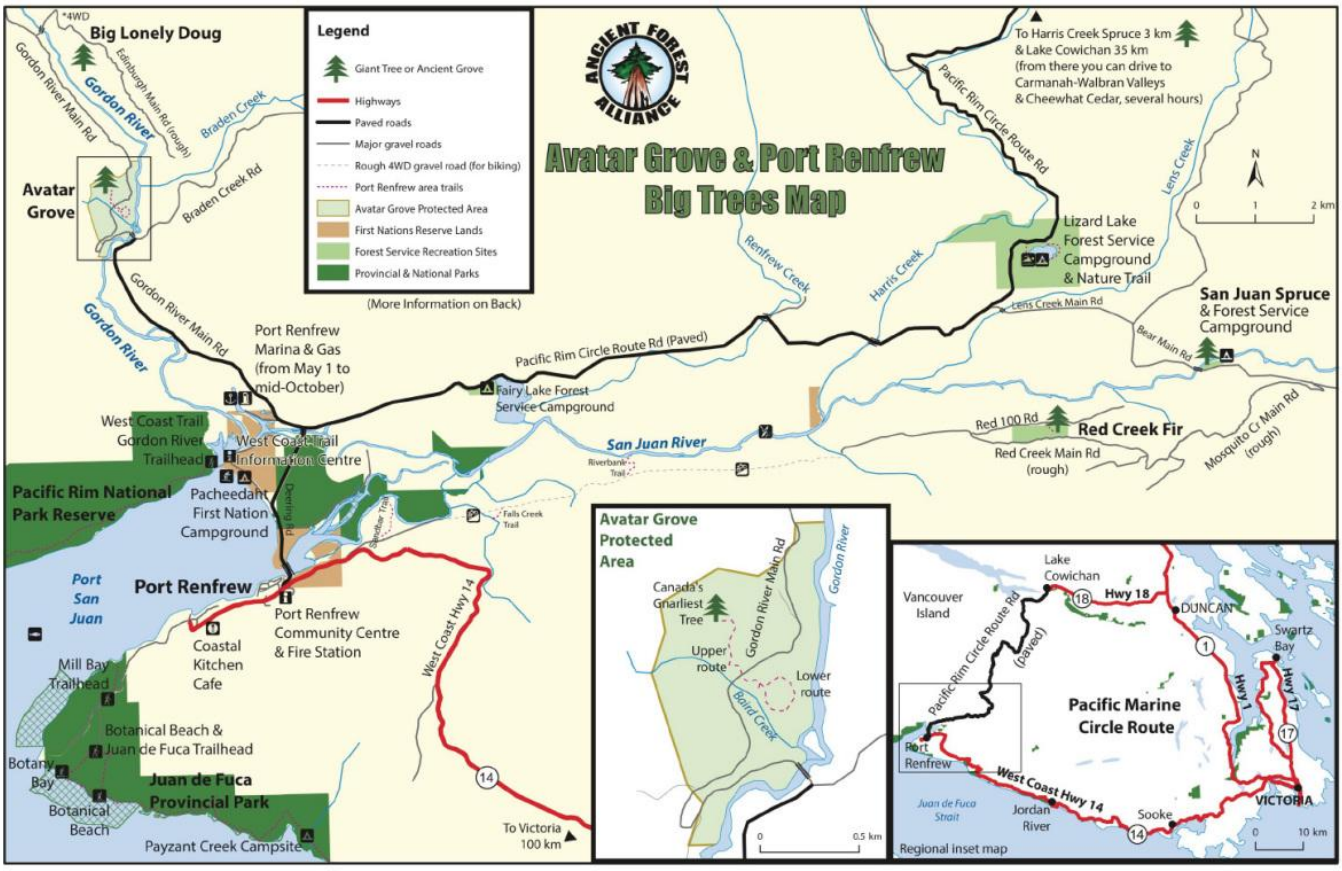
Nestled amidst 44 acres of Douglas fir forest with 1,200 feet of secluded Cowichan Lake shoreline, the Centre is a full service conference and outdoor learning facility. The Centre creates a flexible and relaxed atmosphere for guests to enjoy recreational activities from hiking and swimming, to birdwatching, photography, the arts and music. Visitors to the region will enjoy the spirit of adventure as they explore the West Coast temperate rainforests, mountains, wetlands and marine environments of the Cowichan Valley. The Centre is strategically located at the gateway to the majestic landscape of Carmanah-Walbran and the Juan de Fuca marine trail, as well as the spectacular rugged terrain of the world-renowned West Coast Trail.

**Website:** https://town.lakecowichan.bc.ca/clec/

# Bus Tour: Saturday June 25: Big Trees-Coast

The tour from Cowichan Lake will be along the Pacific Marine Circle Loop to Port Renfrew. The forests gradually change from the drier predominantly Douglas fir forests to the wetter Hemlock, Western red cedar, Sitka spruce forests in the fog belt. Harvesting started in 1890's, and there are three generations of forests, both naturally regenerated and planted.

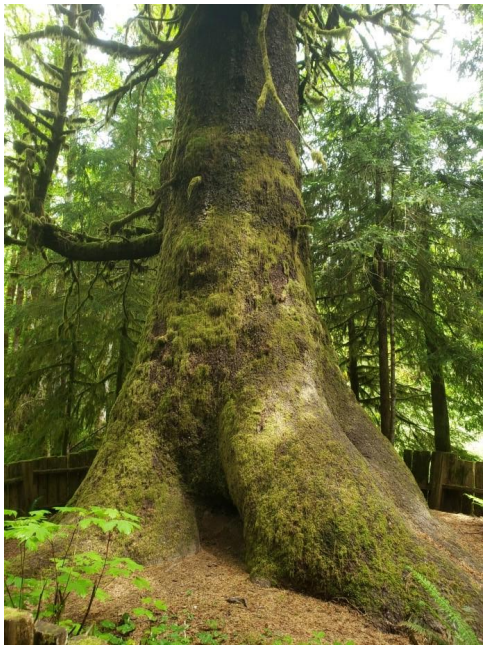
Port Renfrew is an old logging and fishing community of less than 200 people. It was originally called Port San Juan, but the name was changed to avoid confusion with the San Juan Islands, and honor Lord Renfrew. We will have lunch at what is called Beach Camp, formerly a logging camp, but now summer cottages and residences.




**Some of the many interesting stops will include:**

## The Harris Creek Sitka Spruce

This specimen is a large Sitka spruce tree, about 4 metres (13 ft.) in diameter and 80 metres tall near the creek bed of Harris Creek, off the Pacific Marine Road between Port Renfrew, BC and Honeymoon Bay. Although it is not the largest Sitka spruce on Vancouver Island, it is easily accessible and has become a famous tree along the Pacific Marine Loop between Port Renfrew and Lake Cowichan.



## Port Renfrew Hatchery (4 Mile Creek Hatchery)

The Hatchery was started in 1976 by Morris Tremblay , a former logger, with his own money. Today, the volunteer Society, in cooperation with the Pachedaaht First Nation, continues his mission to improve the Chinook salmon runs in the San Juan system. As there was no power to the site a water turbine system was built.

The Lizard Lake Fire started in the summer of 2015, likely human cause by shooting. It covered 265 hectares. At it's peak there were 150 firefighters, 10 pieces of equipment, 3 helicopters, and a water bomber. It took 5 week to extinguish.

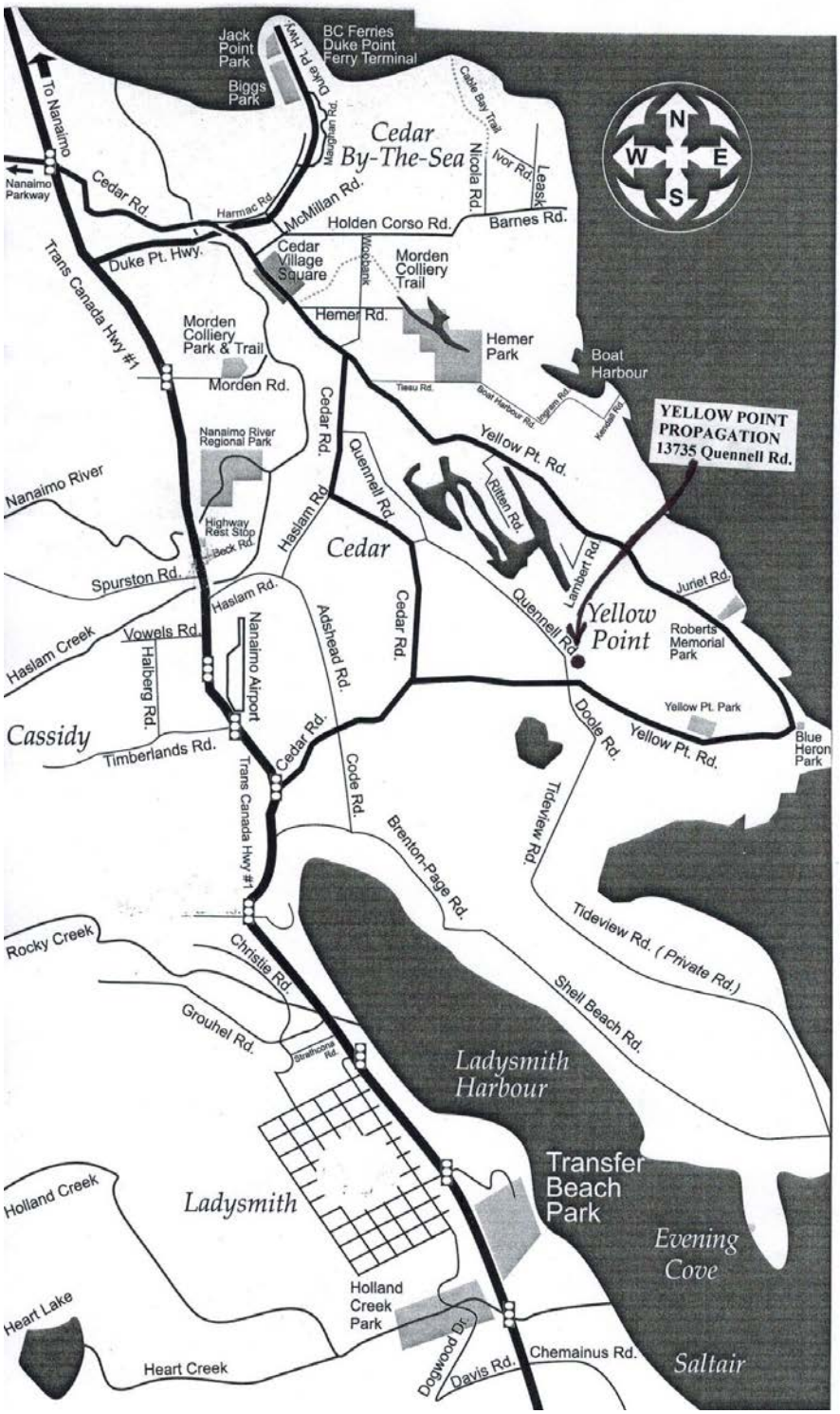
## Avatar Grove

A grove of large, gnarly western red cedar trees, known as the Avatar Grove, It is about 7 km from Port Renfrew. It was identified by the Ancient Forest Alliance.

Other Stops and points of interest will include several examples of both natural and artificial reforestation, and minor tree species considered important for gene conservation.

# Bus Tour: Sunday June 26: Ladysmith-Langley

## Field Tour: Yellow Point Propagation




**YELLOW POINT PROPAGATION**
**13735 Quennell Rd.**

**Phone: 250-245-4635**
**Cell: 250-668-4635**

**From: VICTORIA or DUNCAN**

- Drive north on Island Highway to Ladysmith.

- From Shell Gas station go 5.9 km to Cedar Rd.
- Go down Cedar Rd. 3.0 Km to Yellow Pt. Rd.

- Turn right on Yellow Pt. Rd. and go 2.5 Km to Quennell Rd.

Turn left on Quennell Rd, go 0.4 Km to Yellow Point Propagation on right.

**FROM NANAIMO:**

- Go south on Island Hy. to Nanaimo Airport entrance.

- Continue on Highway for 2.0 Km to Cedar Rd.
- Turn left on Cedar Rd. and go 3.0 Km.

- Turn right on Yellow Pt. Rd. and go 2.5 Km to Quennell Rd.

Turn left on Quennell Rd, go 0.4 Km to Yellow Pt. Propagation on right.

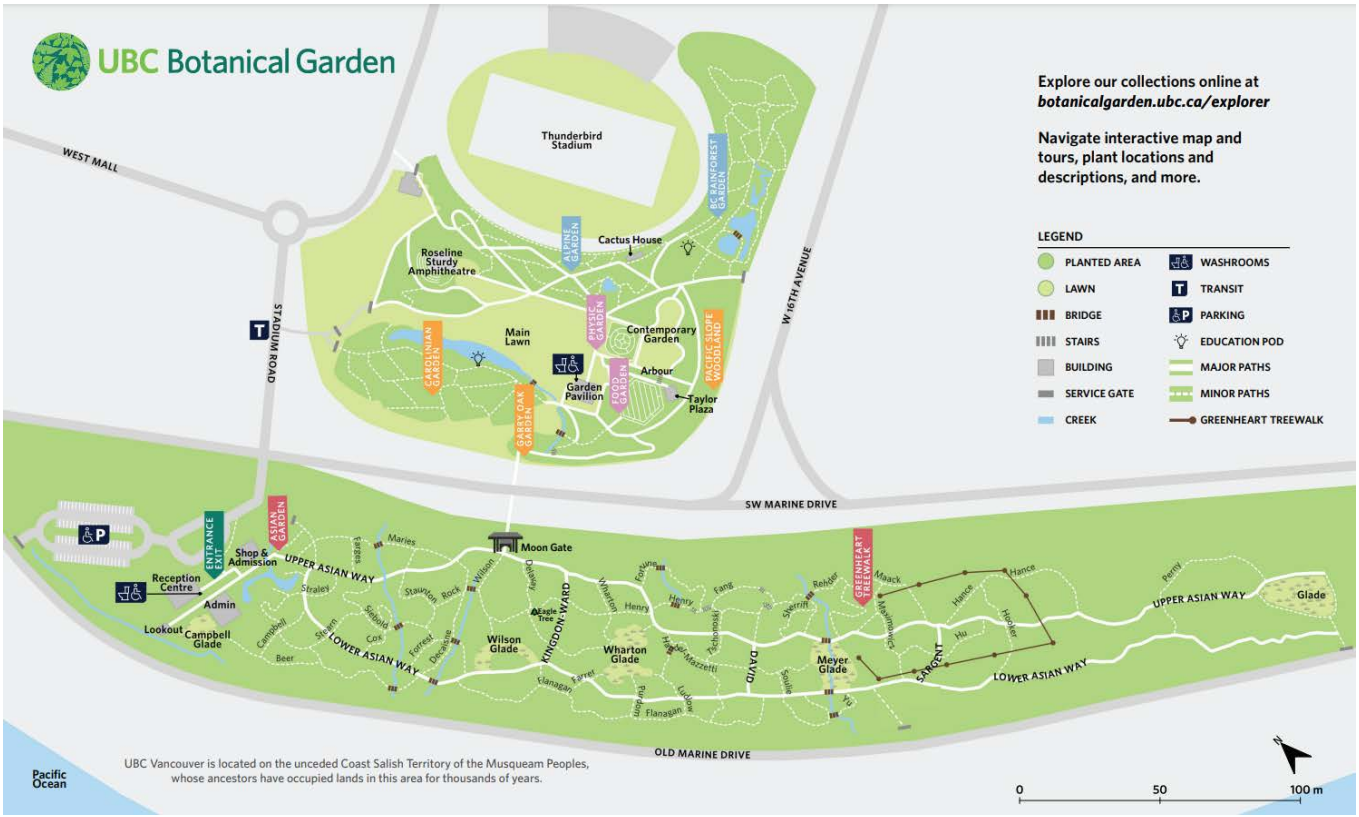
**See Organizer and Speaker description.**
**Website:** http://www.yellowpointpropagation.com/
**Email:** ypprop@shaw.ca

## Field Tour: UBC Botanical Garden

UBC Botanical Garden is Canada's oldest university botanic garden, established in 1916 under the directorship of John Davidson, British Columbia's first provincial botanist. The original mission of the garden was research into the native flora of British Columbia. Over the past 100 years, the mission of UBC Botanical Garden has broadened to include education, research, conservation, community outreach, and public display of temperate plants from around the world. The garden encompasses a total collection of approximately 120,000 accessioned plants, representing some 6,000 taxa. This includes significant collections of Magnolia, Acer (maples), Sorbus (mountain ash, Styracaceae (storax family), Rhododendron and climbing plants. https://botanicalgarden.ubc.ca/
**UBC Highlights:**

- Greenheart TreeWalk – A 310 metre-long tree top canopy walkway suspended from huge Douglas firs, cedars and grand firs, reaching a height of nearly 20 metres above the forest floor.
- David C. Lam Asian Garden - Coastal native second-growth forest under-planted with Asian plants.
- E.H. Lohbrunner Alpine Garden - Mountainous plants from around the world organized into geographic areas.

- BC Rainforest Garden - Showcasing elements of the coastal rainforest of southwestern BC and the southern interior wet-belt
- Carolinian Forest Garden – A garden area representing an eastern North American deciduous hardwood forest.
- Food Garden - Edible crops worked in a sustainable manner, using organic techniques.
- Harold & Frances Holt Physic Garden - The original botanical gardens built to educate physicians and apothecaries.
- Garry Oak Meadow and Woodland Garden - A threatened ecosystem showcasing biodiversity and First Nations influence.



# Workshop: Monday June 27

## In-Person Location:

**BC Tree Seed Centre,** 18793 - 32nd Ave, Surrey BC V3Z 1A7
**Google Maps directions:** https://goo.gl/maps/FjA7tqkP1hf9EB8k8

## Virtual Live Stream:

Purchase tickets until the start of the event - 8:30 AM PST:
https://www.eventbrite.ca/e/virtual-june-27-tree-seed-workshop-tickets-354976864357

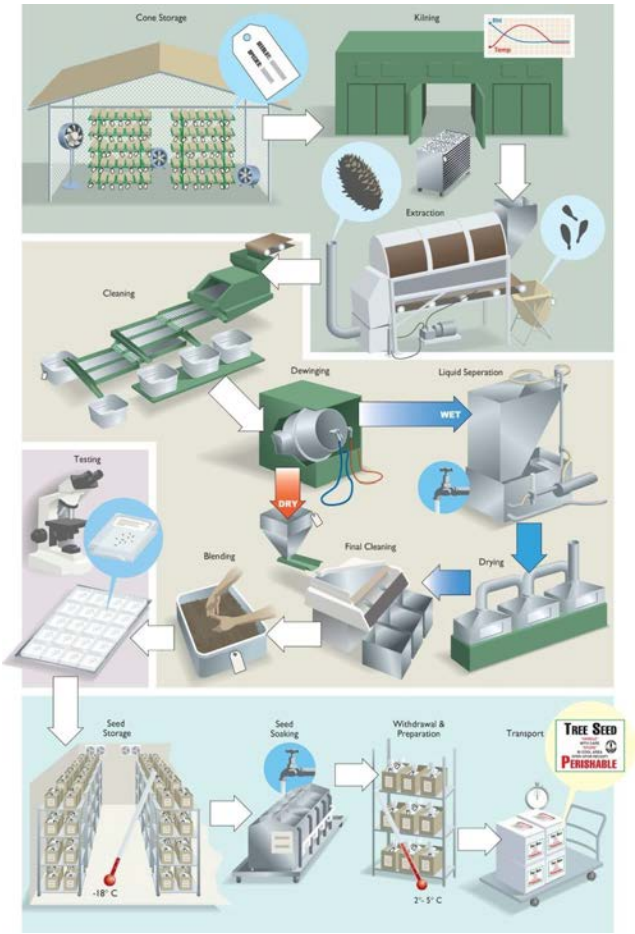
## BC Tree Seed Centre Overview

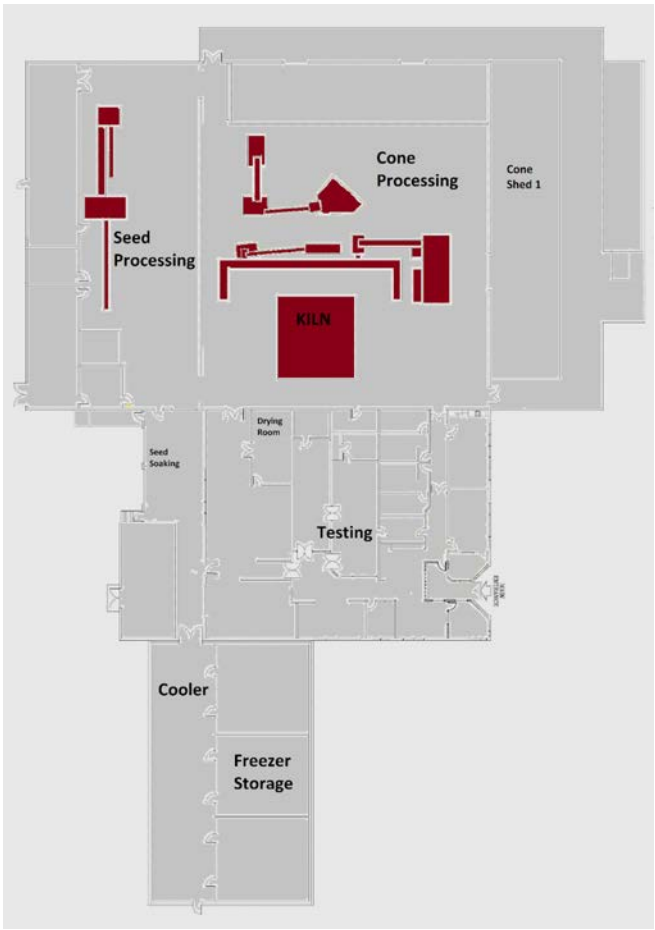
The Tree Seed Centre (TSC), as part of the BC Ministry of Forests, Forest Improvement and Research Management (FIRM) branch, is located in south Surrey, BC. A little over 65 years ago, the British Columbia Forest Service began operating a provincial seed centre in Duncan on Vancouver Island. By the late 1970s, operations at the Duncan location were significantly constrained as a result of infrastructure age, size, production capabilities, capacity to handle various species and seedlot sizes, and physical proximity to clients or service providers. In and in the 1980s, the design and construction of a new facility specifically designed for the delivery of cone and seed services was completed. In 1986, operations were closed in Duncan and resumed in Surrey.

The prime purpose of the Tree Seed Centre is to provide the necessary services to maintain a supply of quality controlled seed within the specifications of the Chief Forester's Standards for Seed Use. The Tree Seed Centre provides a variety of tree seed services including stewardship of the provinces seed inventory (valued at over

$100M) in freezer storage, the testing and quality assurance of this inventory, cone and seed processing and preparation of seed for sowing through stratification or facilitation of the pelleting process. We also maintain a genetic conservation seed bank for tree species which are not currently used in reforestation.

The TSC mission is “Excellence in Cone and Seed Services.” The variety of services provided by the TSC, often referred to as the Seed Handling System, forms a chain of custody and is an integral link in a complex gene resource management system that continues into our future forests. Seedlot diversity, identity and quality must be ensured, maintained and carefully tracked during and after a seedlot’s active life. Best scientific and technical information guide and inform decision making and continuous improvement. The TSC’s Quality Assurance (QA) Program evaluates and monitors current practices and products to assist with our continuous improvement philosophy. We have been fortunate in BC for Executives and leadership to understand the value we play in the province’s reforestation system and investments continue to ensure seed is not a bottleneck in BC.




## Speaker: Marilyn Cherry, Ph.D., RPF, BC Tree Seed Centre

Marilyn received a B.Sc.F. at UNB and a Ph.D. at UBC, and is a Registered Professional Forester (BC). Previously, Marilyn worked in BC forest nurseries, and as a tree improvement contractor – including a few days spent doing helicopter cone collections with Don Pigott. Marilyn was a forest geneticist at the Ontario Forest Research Institute, and a research assistant at Oregon State University in the tree improvement research and nursery

technology cooperatives, working on various forest genetics and seedling studies. Currently, Marilyn is the Cone & Seed Operations Officer at the BC Tree Seed Centre, overseeing cone and seed processing and inventory management.

### Abstract: BC TSC Evolution of Seed Extraction Practices

Extraction of most species processed at the BC Tree Seed Centre involves kilning to flex cone scales open so that seed can be released and extracted. Equipment capabilities and crop handling knowledge have both improved and increased over time, allowing for continual improvements to extraction procedures that have built upon former best practices. By being able to access better and more current feedback on internal kiln environmental conditions during operations, the best information available can be used for real time decision-making and crop handling. A brief history of recent improvements is discussed.
**Email:** Marilyn.Cherry@gov.bc.ca
**Note: Marilyn's talk will not be available as a recording.**

## Speaker: Don R. Pigott

### Abstract: A brief history of cone and seed processing in British Columbia and looking to the future.

**History:** The first tree seed extractor in British Columbia was established in New Westminster in 1922 by the Dominion of Canada Forest Branch, Department of the Interior in 1922. It was built at the request of the British Forestry Commission to supply seed for reforestation and afforestation after the devastation of World War 1. In 1927 another plant was built in Salmon Arm by Percy Ruth called the Shuswap Tree Seed Company. By 1945 there were only the same two extractories which each produced about 450- 500 Kg of seed a year.

In 1957 the BC Forest Service built a large extraction facility near Duncan BC. By 1969, the seed demand reforestation in BC increased, and the export market improved, and there were six extraction plants operating in BC. Due to the need for increased capacity for BC tree seed needs, the BC Forest Service moved to an even larger facility at Surrey in 1986. In 1991, the BC Tree Seed Dealers Association was formed at the request of Forestry Canada to collectively address issues around tree seed certification, seed testing, and the export of tree seed. The original members were Western Tree Seed Reid Collins Nurseries, Silva Enterprises, and Yellow Point Propagation. Gradually, several other seed collection and seed orchard companies joined including; Canadian Forest Products, Timber West , Vernon Seed Orchard Company, and Quality Tree Seed.. The Association was active for many years, but eventually three of the seed processing companies ceased to process, or retired, and today there is only one private extractor, and the owner has plans to retire.

**The Future:** Currently, almost all of the tree seed used for reforestation in BC is processed at the Ministry of Forest Tree Seed Centre in Surrey. The demand for seed has increased to almost 300 million in some years recently. Much of this seed comes from seed orchards. Additionally, forest companies in Alberta are requesting processing services. In peak years there can be significant delays in having seed processed. One seed orchard company is presently establishing an extraction plant to process their own seed. Seed not considered a priority for imminent sowing, or for export will be considered the lowest priority. In order to achieve national tree planting objectives, investment in seed collection and processing is required.

## Speaker: Fabienne Colas

After more than 20 years at the Québec Research branch, working on seeds and seed orchard management, Fabienne Colas now coordinates the technical staff of the provincial Tree Seed Center (TSC) and nursery in Berthierville. The TSC is the unique centre that extracts and cleans all the seeds needed for the Quebec reforestation program. Fabienne is also in charge of seed orchard management located in the nursery. The Berthier nursery, oldest forest nursery in Quebec, is the only public nursery producing hardwood seedlings for reforestation in Quebec.

### Abstract: Challenges with Processing, storage and pretreatment of recalcitrant tree species

Each autumn, the Berthier Tree Seed Centre staff runs out of time to receive, clean and prepare the hardwood seedlots dedicated to seedling production at the Berthier nursery. Among the 9 hardwood species harvested, 4 are recalcitrant: bur and red oak, black walnut and bitternut hickory. Those 4 species are mainly produced bareroot, and sowing must be done in the first week of November. Determining germination capacity, the main data used for the allocation, is also a challenge since all those species are deeply dormant.
**Email:** Fabienne.Colas@mffp.gouv.qc.ca

## Speaker: Dave Kolotelo

### Abstract: Continuous Improvement: beyond the buzzwords

Continuous Improvement (CI) is central to our Tree Seed Centre vision of “Excellence in Cone and Seed Services”. I’ll look at CI from a few perspectives, some well established and some my perception of reality. Many systems are available to take you on the path to continuous improvement. Several focus on reducing variability, but this is such an important attribute of our product! I found some alignment with these four principles – food for thought:

1. Stop fixing and start improving
2. The best practices are the ones you already have
3. Changing behaviour is more important than changing processes
4. If you aren’t failing, you aren’t trying

CI also speaks to the implementation of scientific findings into operations. With our highly variable product I am often skeptical of science producing ‘answers’ without any operational verification. The limitations of these answers are often a result of a limited range of genetic material, methods and environmental sampling. They are useful guides and stepping stones to reality. I view it as a continuum needing multiple verification points and the lack of that can result in the persistence of myths and create an environment reluctant to evolve.

The science being performed on tree seeds is going deeper to use the latest tools, to get funding, to publish, but these are removed from operation and extension has become something abandoned on the global scale when it is needed more than ever. Its like a grand canyon between tree seed science and operations. I’m not sure what the answer is – we need more research, but I’m not really sure on what and how it will meet both academic and operational goals. I’ll provide a few examples from our facility that I consider success stories with continuous

improvement – it's an ongoing voyage.
**Email:** Dave.Kolotelo@gov.bc.ca

## Speaker: Nabil Khadduri

Nabil is a scientist with the Washington State Department of Natural Resources' Webster Forest Nursery. Over the past 20 years he has served in operational and research capacities with the agency nursery and seed programs. In his current position he engages in applied research, seedling crop advising and nursery extension.

### Abstract: Greenhouse germination evaluation of lab-tested seed: a feedback loop

The Washington State Department of Natural Resources has a vertically integrated reforestation program. This includes land stewardship; seed orchard and wild seed collection, processing and testing; and nursery production. Co-location of the seed center and nursery compound facilitates internal information exchange. Sharing realized nursery germination in comparison with lab-tested seed can create a (hopefully positive) feedback loop. Ideally, informed decisions can be made that reconcile the sometimes competing desires for increased seed use efficiency from the seed program with the focus on space use efficiency at the nursery. For various reasons, lab and greenhouse results can and will differ, with generally higher germination in the lab. The goal of a feedback loop is to develop protocols which minimize the discrepancies between lab and greenhouse that can ultimately drive up labor costs in both programs.
**Email:** nabil.khadduri@dnr.wa.gov

## Cone and Seed Processing Panel

### Panelist: Don R. Pigott

Biography and previous session abstracts, see above. **Email:** ypprop@shaw.ca

### Panelist: Jeff deGraan

Jeff deGraan is the Seed Program Manager and Reforestation Specialist for Washington Department of Natural Resources. He is responsible for ensuring that the Department has a high quality, genetically diverse long-term seed supply to support a range of deployment approaches in preparation for future climatic conditions. Jeff's education is in forest management from Clemson University and Oregon State University, and he spent the early part of his career working in a range of field forestry endeavours for the Department. He has been in his current role since 1997, working to build a fully self-contained program that optimizes seed quality at every step from collection planning to nursery delivery. Over the course of his career he has benefited greatly from his interactions with like-minded seed and seedling professionals in BC.
**Email:** jeffrey.degraan@dnr.wa.gov

### Panelist: Johanna Gårdebrink

I received in 2012, a MSc in Forestry with a major in Biology at the Swedish University of Agricultural Sciences (SLU), Umeå. The same year, I was employed as an industrial doctoral student by the Swedish state forest

company Sveaskog Förvaltnings AB, stationed in the seed and plant division - Svenska Skogsplantor. The PhD project was conducted within the 2nd Research School for Forest Genetics, Biotechnology and Breeding, and was a collaboration with Umeå Plant Science Centre (UPSC), Department of Forest Genetics and Plant Physiology, SLU, and Svenska Skogsplantor. I defended my thesis - *Nitrogen uptake and assimilation during Norway spruce somatic embryogenesis - investigating the role of glutamine*, in September 2018. After the dissertation, employment continued at Svenska Skogsplantor as a Seed Specialist, which is the current position today.
**Email:** Johanna.Gardebrink@skogsplantor.se

### Panelist: Michael Postma

Michael has been the BC Tree Seed Centre (TSC) manager for 4 ½ years and has spent much of that time brainstorming, planning and executing plans for capital projects related to the TSC facility & specialized equipment. Before he was manager, he spent more that 25 years in government working on Information Technology projects for a variety of ministries. For 15 of those 25 years he worked on SPAR (Seed Planning and Registry)and CONSEP (Cone and Seed Processing), the 2 major systems used here at the TSC. Michael has 4 grand children and spends much of his spare time visiting with his extended family.
**Email:** Michael.Postma@gov.bc.ca

## Speaker: Dr. Richard Hamelin, Professor, Faculty of Forestry, The University of British Columbia

Dr. Richard Hamelin obtained a B. Sc. from McGill University (1982), a Master's of Pest Management from Simon Fraser University (1986) and a Ph. D. from the University of Kentucky (1990). He has 30 years of experience in forest health research and has published over 160 peer-reviewed scientific articles. His work aims at protecting forests by improving our understanding of disease outbreaks, improving tree resistance, and developing tools for detection and monitoring of pathogens and pests. He was president of the Canadian Phytopathological Society (2004) and the Quebec Society for Plant Protection (1998). He is a Fellow of the American Phytopathological Society (2020), and received the International Union of Forest Research Organization Scientific Achievement Award (2014), the Queen Elizabeth II Diamond Jubilee award (2012), Merit Awards from Natural Resources Canada (2008), the Canadian Forest service (2008), the Canadian Food Inspection Agency (2007), and the Quebec Society for Plant Protection (2008) for his pioneering work on the application of genomics in forest protection.

### Abstract: Genomic tools for tree pathogen detection and surveillance

Forest disease diagnostics has greatly benefited in the last few decades from the advances in genomics and the development of tools that allow rapid and accurate identification of pathogens using the Polymerase Chain Reaction (PCR). Pathogen detection using PCR has become an essential part of diagnostic labs. But PCR normally requires having access to a laboratory with expensive equipment and highly specialized personnel. To address this issue, we have developed a point-of-use real-time PCR system using a crude buffer-based DNA extraction protocol and lyophilized, ready-to-use reactions for point-of-use applications. We demonstrated the use of this approach with a broad spectrum of forest enemies, from fungal tree pathogens such as Septoria canker of poplar and sudden oak death to lepidopteran insects such as the spongy moth. DNA can be obtained within a few minutes from a variety of tissues, including infected leaves, pathogen spores, or insect legs and antenna. The kit required

to conduct this method fits in a backpack and can be carried to remote locations for point-of-use accurate and rapid detection of pests and pathogens. Additional new tools that are complementary to PCR include DNA barcoding, a method that allows the precise identification of fungi and oomycetes from cultures using a short DNA fragment that acts as a unique barcode, and metabarcoding, which can use environmental DNA (eDNA) and generate lists of microbes, including fungal pathogens. These new approaches are currently used to develop PCR pathogen detection from conifer seeds and show some promises.
**Recorded presentation:** https://www.youtube.com/watch?v=FhB7xmOA-3Q
**Email:** Richard.Hamelin@ubc.ca

## Speaker: Dr. Ehren Moler

Dr. Ehren Moler is a Biological Systems Scientist with the Seattle-based startup DroneSeed, where he conducts research on aerial seeding and planted seedling establishment in post-wildfire forest and rangeland systems across western North America. Ehren completed postdoctoral research with the University of Idaho Center for Forest Nursery and Seedling Research focusing on coupled cultural- and provenance-based approaches to optimizing seedling root systems for enhanced drought acclimation. He earned a PhD in Biology from Northern Arizona University from the evolutionary ecology lab of Dr. Amy Whipple and a MS from Idaho State University from the community ecology & statistics lab of Dr. Ken Aho. His graduate work in both labs entailed studies of white pine (subgenus Strobus). Ehren enjoys backcountry skiing in the Pacific Northwest when he is not studying plant regeneration in a warming climate.

### Demonstration: DroneSeed - A Canopy-Level View of Making Reforestation Scalable

DroneSeed is a vertically-integrated reforestation company that develops economical solutions to restoring wildfire-affected landscapes through seed- and seedling-based artificial forest regeneration, and the use of geographic information systems coupled with novel unmanned aerial vehicle technology. We are especially interested in restoring ecosystems that have diminished potential to regenerate naturally. In this talk, I present a seed- and seedling-level view of the manner in which emerging climatic patterns influence forest regeneration potential. I also introduce a typical DroneSeed project workflow including onsite planning via survey for site assessments and to refine project scope, planning of aerial deployment missions through GIS data processing, onsite seed deployment, and post-deployment monitoring of seedling establishment. Finally, I present a heavy-lift drone typical of those used in DroneSeed aerial seeding missions.
**Email:** ehren.moler@droneseed.co

## Demonstration: Fandrich Cone Harvesters

Fandrich aerial cone rakes rapidly and efficiently collect cones from the tops of trees, where the best cones grow. Fandrich aerial desailers reduce crown size to help trees remain upright, even during exposure to severe winds. Fandrich aerial grapples clean creeks and move material at 80-120 loads per hour. See website for more information.
**Website:** http://www.coneharvesters.com/

# Other Attractions

Our program is full of British Columbia wonders, but it is still a snapshot and we recommend if you are travelling from afar that you spend a few extra days in BC. The following are some general recommendations and additional links. If you have specific questions or require additional help, please contact Dave Kolotelo Dave.kolotelo@gov.bc.ca

## Vancouver

Vancouver isn't our provincial capital, but it is our largest city and If you plan to stay in Vancouver for a few days our Skytrain is the easiest way to get to/from the airport (https://www.translink.ca/schedules-and-maps/skytrain). There is an endless list of possible activities in and around Vancouver –highlights below.

- Stanley Park: https://vancouver.ca/parks-recreation-culture/stanley-park.aspx
- Grouse Mountain: https://www.grousemountain.com/
- Granville Island Public Market: https://granvilleisland.com/public-market
- UBC Museum of Anthropology: https://moa.ubc.ca/
- Vancouver Art Gallery: https://www.vanartgallery.bc.ca/

## Victoria

Victoria is our provincial capital and the airport is closer to Sidney and our Thursday activities. It is a great place for a walk around the harbour, Beacon Hill Park or Chinatown. The Royal BC Museum is certainly a highlight attraction if you are looking for something to do indoors. https://www.royalbcmuseum.bc.ca/

# Feedback: Seed Supply Solutions

**Instructions for those in-person:** write down your thoughts and resources under each question. Please submit to the workshop organizers before you depart for your final destination.

**Instructions for those online:** Submit your thoughts here: https://forms.gle/YxZqNZ3u1upTYjK4A

## What is your highest tree seed research priority?

## What is your biggest concern with tree seeds?

## What is your biggest tree seed extension/information need?

## What is your most critical infrastructure need to secure your required tree seed supply?

## What tree seed information is critical to have in professional or post-secondary courses dealing with trees/forestry?

**Notes:**