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#### **RESOURCE PRACTICES BRANCH, OCFD, FLNRORD**

(ON BEHALF OF WILL MACKENZIE, PROVINCIAL ECOLOGIST, SKEENA REGION)

CLIMATE CHANGE INFORMED SPECIES SELECTION (CCISS) DECISION AID – UPDATE –

### FOREST GENETICS COUNCIL 2020 INTERIOR TECHNICAL ADVISORY COMMITTEE MEETING

JANUARY 22, 2020

### climate change & uncertainty



increased uncertainty and increased likelihood of extreme outcomes

- < 2° MANAGABLE CHANGES</p>
- 2 3° SYSTEM LOSS, IRREVERSIBLE LOSS
- ➢ 3 − 5° CATASTROPHIC LOSS

CC MODELING AND DATA HAVE IMPROVED, MID-TERM AND LONG-TERM PREDICTIONS HAVE WORSENED BUT "EVEN 50-YEAR-OLD CLIMATE MODELS CORRECTLY PREDICTED GLOBAL WARMING"

(Hausfather et. al. 2019) https://doi.org/10.1029/2019GL085378

## THE EMISSIONS GAP HAS WIDENED OVER THE PAST DECADE

"... The global challenge – the ambition level of current [contributions] needs to be tripled to get on track to 2°C and increase fivefold to align with 1.5°C..."

UNEP (2019; "Lessons from a decade of emissions gap assessments")



https://www.unenvironment.org/resources/emissions-gap-report-10-year-summary



# **CCISS DECISION AID - OVERVIEW**

- I. Leverage what we already know (BEC + interpretations)
  - **Tree species suitability ratings** by site series are basic information for building stocking standards currently
- 2. Use machine learning to forecast future redistribution of BGC climates
- 3. Link current site series concepts to equivalent future site series for stand level applications
- 4. Compare site series interpretations (species suitability ratings) between current and all plausible futures
- 5. Consolidate to CC informed species selection guidance
- 6. Deliver analysis through a web-based application

# **COMPONENTS OF CCISS**



## INCORPORATING UNCERTAINTY IN DECISION MAKING



Graphic courtesy of Colin Mahony











Landscape level changes, individual examples – tree species







### ONGOING DEVELOPMENT I. USA BEC SUBZONES

- Analogue Future Climates of BC
- Machine learning with:
  - ClimateNA data +
  - Ecosystem plot data classified to BGC by Del Meidinger
- Pseudo site series with tree species suitability for each modelled USA\_BGC
- BioRxiv paper in process



### ONGOING DEVELOPMENT II. SPECIES ENVIRONMENTAL SUITABILITY RATING

- Chief Foresters Reference Guide ratings = sawlog desirability
- New ESuitability ratings = constraints to establishment (and growth)
  - E1: No limitations to establishment across the entire range of site series conditions
  - E2: Some establishment constraints must be managed on some (or all) site series conditions (CFR footnotes, environmental modelling)
  - E3: Serious establishment constraints on some portions of the site series range.
  - E4: Off-site species with unknown constraint levels
- Adding general environmental constraint footnotes for tool

# ONGOING DEVELOPMENT





- Existing off-site trials as evidence: extrapolate to areas without trials
- Identify off-site species suitable in 1961-1990 reference period (Fundamental niche versus Realized niche)
- Some species were already suitable in 1961-1990 beyond their observed range (e.g. Lw and Fd in Skeena)
- Modelled suitability ranges
- CCISS meta-analysis planning tool for operational trials, etc.

ONGOING DEVELOPMENT IV. PORTFOLIO THEORY IN SPECIES SELECTION FOR RISK REDUCTION

- Current CCISS (and CBST) outputs can be used for picking single 'winners' = landscape monoculture.
- We want to encourage diversity (stand and landscape).
- Efficient portfolios perform better than picking a few "winners"
- Portfolio theory is for risk/return management

### MARKOWITZ PORTFOLIO THEORY IN FINANCIAL MANAGEMENT



- Risk can be minimized by choosing a mix of assets or asset classes that do not covary
- Over time balanced portfolios perform better than picking a few "winners"
- Has been proposed for application in conservation biology, forestry, fisheries, and other natural resource applications
- Proposing to apply to both CCISS output and CBST





### SPECIES / SEEDLOT PORTFOLIOS

 'Efficient Frontier' = ratios of assets at different risk levels

### Portfolio options for species



Source subzones for each species based on genetic gain matrix for all CC future subzones

### ONGOING DEVELOPMENT

- V. SPADES MODULE
- VI. JOURNAL PAPER ECOLOGICAL APPLICATIONS
- VII. GOVERNMENT HOSTING PLATFORM
- V. SpaDES module for landscape level planning:
  - Desired future forest condition
  - Interactions with harvesting systems (silv systems), fuel management, disturbance (fire, insect, disease), other values
  - Dynamic spatial and temporal change
  - Nimble to data updates, additions
- VI. journal paper Ecological Applications
  - Internal review Feb 2020
  - Submit March 2020
- VII. Government hosting platform
  - BCDevExchange "One place that brings together resources to help build digital products for the BC Government"
  - OpenShift container
  - Code with us / Sprint with us (project team)



## Thank you. Questions?

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FOREST GENETICS COUNCIL INTERIOR TECHNICAL ADVISORY COMMITTEE MEETING

### **Project Contributors and Cooperators**

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