

How the CCISS tool works

The CCISS tool contains the following model components:

- ClimateBC climate surface with modelled future climates for 15 GCM models X 2 carbon scenarios for 3 future time periods
- A statistical randomForest model of Biogeoclimatic subzone/variant climates
- Library tables for edatopic space and tree species suitability ratings for all site units

CCISS performs the following steps to create predicted new species suitability aligned to current guidance:

Step 1. Predicts the future BGC membership of points of interest (POI) for all 30 future modelled climates from ClimateBC (15 Global Circulation Models X 2 carbon scenarios) for each future time period.

Step 2. Align current focal site series to site series of future BGCs through edatopic overlap.

Step 3. Align the current species suitability with suitability of all future site series

Step 4. Calculate the ratio of models predicting each suitability rating for each species. Report predicted species suitability ratios for each future period.

Step 5. Apply a rules set to the data in Step 4 to generate a simplified new species suitability recommendation.

Step 6. Report future species suitability aligned to current Chief Forester's Reference Guide.

Executive Summary

The Climate Change Informed Species Selection tool is based on the Biogeoclimatic Ecosystem Classification (BEC) and the site series-specific tree species suitability rankings presented in the Chief Foresters Reference Guide to Stocking Standards (2017). The tool employs a “space-for-time” approach to modelling which states; if a modelled future climate at a point of interest (POI) resembles a climate of another existing climate, we can apply our knowledge and management guidance of that other climate to anticipate the changes that will occur at our POI.

The tool relies on an embedded version of ClimateBC to generate modelled future climate data for specific points on the landscape. ClimateBC contains data on 15 Global Circulation Models (GCM) each with 2 future carbon scenarios (30 possible future climates) over three future periods: 2010-2040, 2040-2070, 2070-2100 (these are labelled as mid points 2025, 2055, 2085 in some applications). Each GCM makes different analyses of future climate and predicts different future climate outcomes. The CCISS tool uses all of GCM models and scenarios in the analysis to provide guidance that accounts for this uncertainty of future climates.

A machine-learned (RandomForest) model of biogeoclimatic unit climates has been built to define climatic “space” of existing BGCs, including adjacent jurisdictions of Alberta (Natural Subregions) and the

Northwest of the USA (modelled from classified ecosystem data and forest inventory information). Future climate data from the GCMs models in the CCISS tool can be put through the randomForest model to predict the closest equivalent future BGCs for any point(s) on the landscape. The ratio of GCM models that predict specific BGCs is used in the tool to assess variability and uncertainty in future climate condition.

The site series describes the site-level ecological variability within each BGC unit. The environmental relationship between site series within a BGC is commonly documented as relative position on a 2-axis edatopic grid. Such relative placement allows equivalent site series concepts to be aligned between BGC units. For example, a subxeric site remains relatively subxeric whatever the climate space. The tool uses this attribute of BEC to align site series concepts through a two-way comparison of current focal site series edatopic space with the edatopic space of all future predicted BGCs. Alignment of concepts is rarely exact, so a weighted overlap of edatopic space is used adjust for the most probable match as well as less likely (but possible) equivalent site series.

The probability of a future BGC multiplied by the weighted overlap ratio of site series in that BGC give an overall probability of a future site series.

Tree species suitability ratings of primary, secondary, and tertiary (or not suitable) are assigned to a species deemed feasible on all site series. Equivalent species suitability ratings are often found on edatopically adjacent site series within a BGC and edaphically equivalent positions between climatically similar BGCs. In this case, many different site series modelled for a location may be equivalent in terms of a future suitability rating. As climate distance increases or ecological thresholds are crossed, suitability ratings will deviate from the current rating.

The CCISS tool simply sums the weighted probability of future site series which have the same suitability ranking for each species. This summary provided the raw future species suitability data presented in the CCISS tool.