

Prognosis^{BC}

Model and Current Research

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Prognosis^{BC} Model

- Single tree, Distance-independent GY model
- A variant of the USDA Forest Vegetation Simulator (FVS)
- Forecasts future stand conditions based on the expected growth and mortality of individual trees of mixed-species and/or multi-aged (complex stands)

Main Features

- Can simulate
 - almost any form of harvesting, including thinning from below or above or by size class with or w/o species preferences
 - patterns of succession in complex stands (interaction between species and size classes)
- Has add-on components for insects and disease, fire, snag and CWD (e.g., root disease extension)
- Linkage to Stand Visualization System (SVS)

Species Modeled

Coniferous

- ♦ white pine
- ♦ lodgepole pine
- ♦ larch
- ♦ Douglas-fir
- ♦ grand fir
- ♦ W. hemlock
- ♦ W. redcedar
- ♦ Subalpine fir
- ♦ spruce
- ♦ Yellow Pine

Hardwoods (version 3.0)

- ♦ aspen
- ♦ birch
- ♦ cottonwood

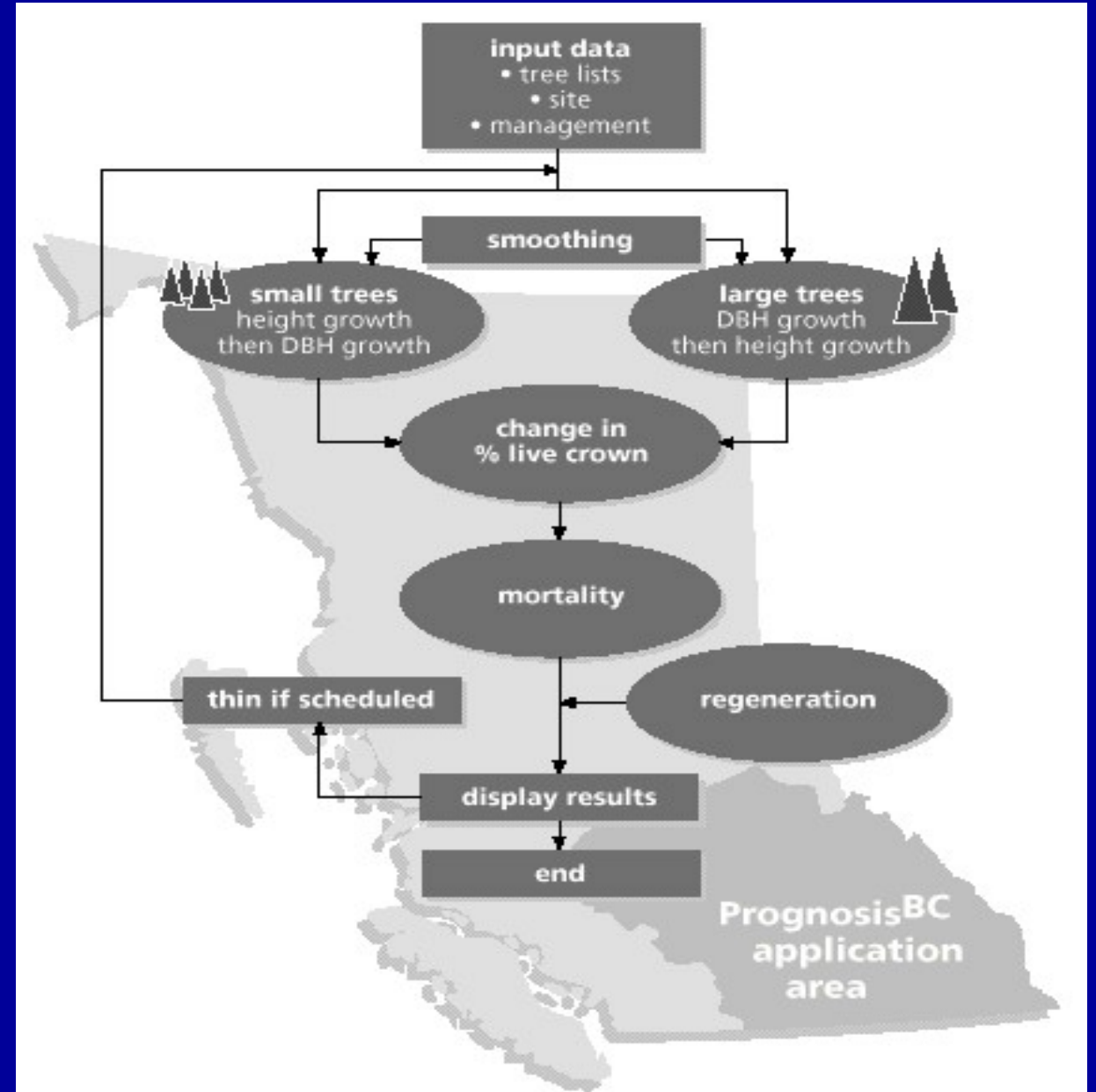


Ver. 2.0

- IDF
- ICH
- MS
- ESSF
- PP

Ver. 3.0

- IDF
- ICH
- SBS



Input Data Requirements

Required

Plot level information:

Aspect, Slope, Elevation
& BEC Site Series

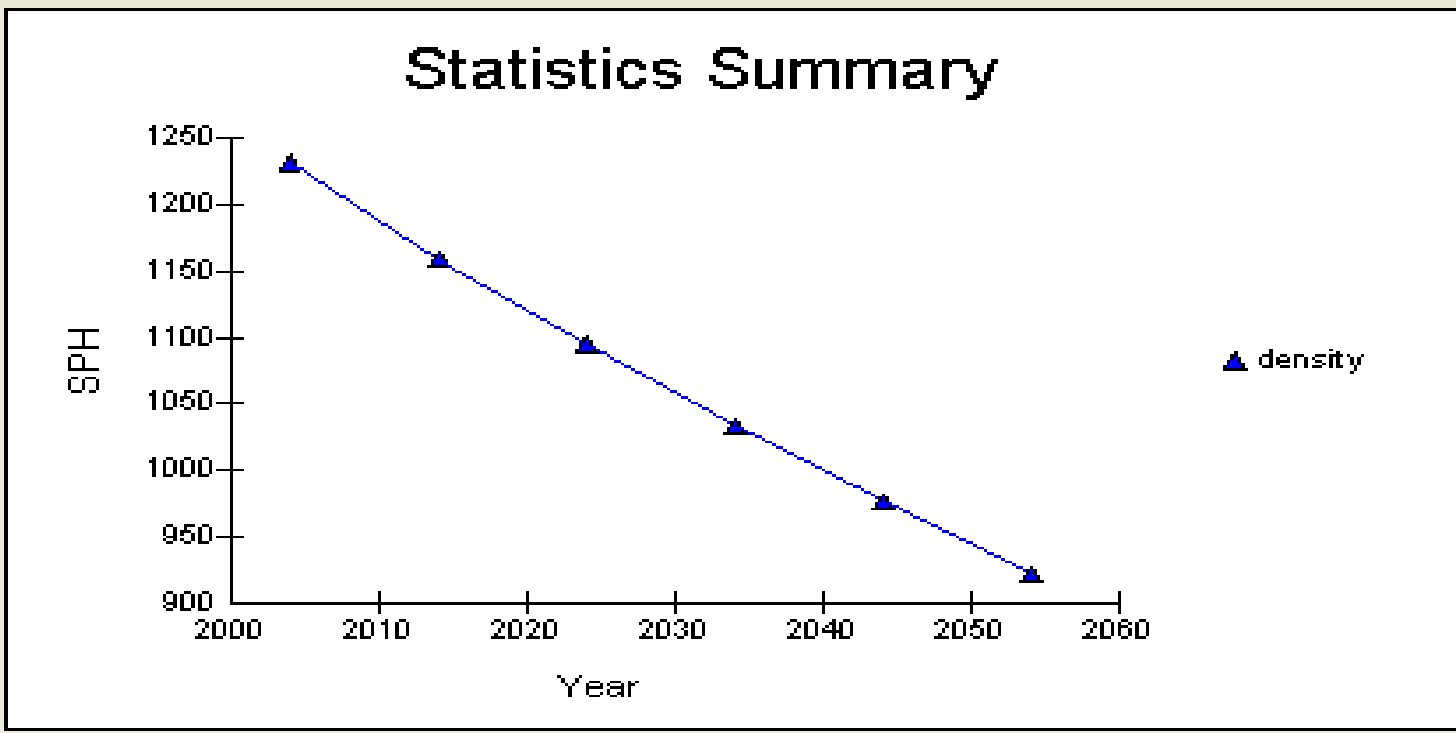
For every tree in the plot(s):

- Species
- DBH

Recommended

- Live crown %
- Subset of heights
- Subset of diameter increments
- Subset of height increments

Graph stand level statistics



Print Chart

Apply

Close

Print chart as:
 B+W
 Colour

Print chart to:
 Printer
 Clipboard

Chart grids:
 Vertical
 Horizontal

X Axis: Year
 Min:

Y Axis: SPH
 Min:

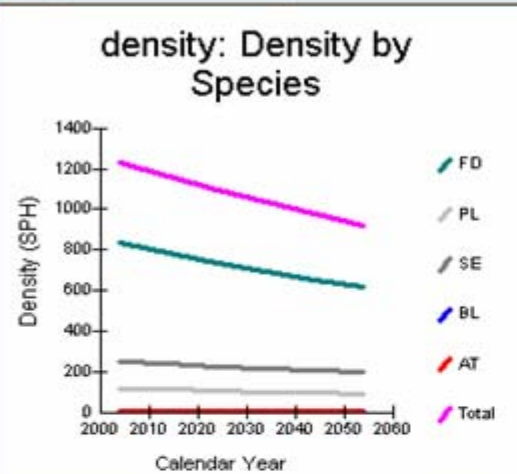
Chart Titles
 Top: Statistics Summary
 Left: SPH
 Bottom: Year

Markers
 Lines & Points
 Lines only
 Points Only

VIEWprog - [C:\WINDOWS\Data\fv_s_game.mdb]

File Window Help

Species Composition through...



density: Density by Species

Y Axis Max:

Statistic:

- SPH
- Basal Area
- Merch. Vol
- Total Vol.

Grids:

- Vertical
- Horizontal

Print to:

- Printer
- Clipboard

Print as:

- B+W
- Colour

Edit Chart Titles:

Top:

Left:

Bottom:

Buttons: Print, View Report, Help, Close, Apply

Stand & Stock Tables: density

DBH Classes

Starting:

Class width:

Of Classes:

Reporting Years

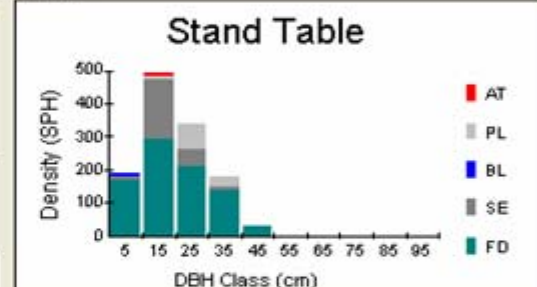
Year:

Select year(s) to display.

Sample for year: 2004

Stand Table

Stock Table



Refresh

Buttons: View Reports, View Charts, Help, Close

Limitations

- The spatial position of competing trees is ignored
 - Can only approximate the effects of clumped distributions or patch cuttings
 - Better early height growth and mortality models needed
 - Need better estimates of natural regeneration following disturbance: for current model release, user must input estimates
- Does not work well with aerial inventory
 - Requires stand table or individual tree list
- “Add-ons” – need better estimates of snags and regeneration following mountain pine beetle
- Geographic scope restricted.

Current Research Projects

- Develop:
 - Methods for estimating natural regeneration by species and height class based on site and overstory characteristic (more on this)
 - Small tree height growth and mortality models
 - Methods to estimate tree-lists from forest cover data (more on this)
 - Methods to estimate regeneration following MPB
- Implement the best estimates in Prognosis^{BC} for: ICHmw2, IDFdk1, dm2, dk2, dk3, and MSdk
- Extend the model to SBS (more on this)

Natural Regeneration and Tree-lists Using Imputation Methods

Use known auxiliary variables to estimate variables of interest by

- Selecting a “nearest neighbor” from a database where both are measured (reference database)
- Selection is based on a measure of similarity between the variables of interest and the auxiliary variables e.g., Most Similar Neighbor – weighted Euclidean distance
- Allows for “retention” of variability in the estimated variables of interest, unlike regression methods

Natural Regeneration and Tree-lists Using Imputation Methods

- For regeneration: residual stand structure, site ecology and disturbance history are auxiliary variables in the imputation
- For tree-list estimation: aerial variables from forest cover are used
- Results improve:
 - With a more comprehensive reference database
 - With a better relationship between auxiliary variables and variables of interest

Regeneration Imputation Example

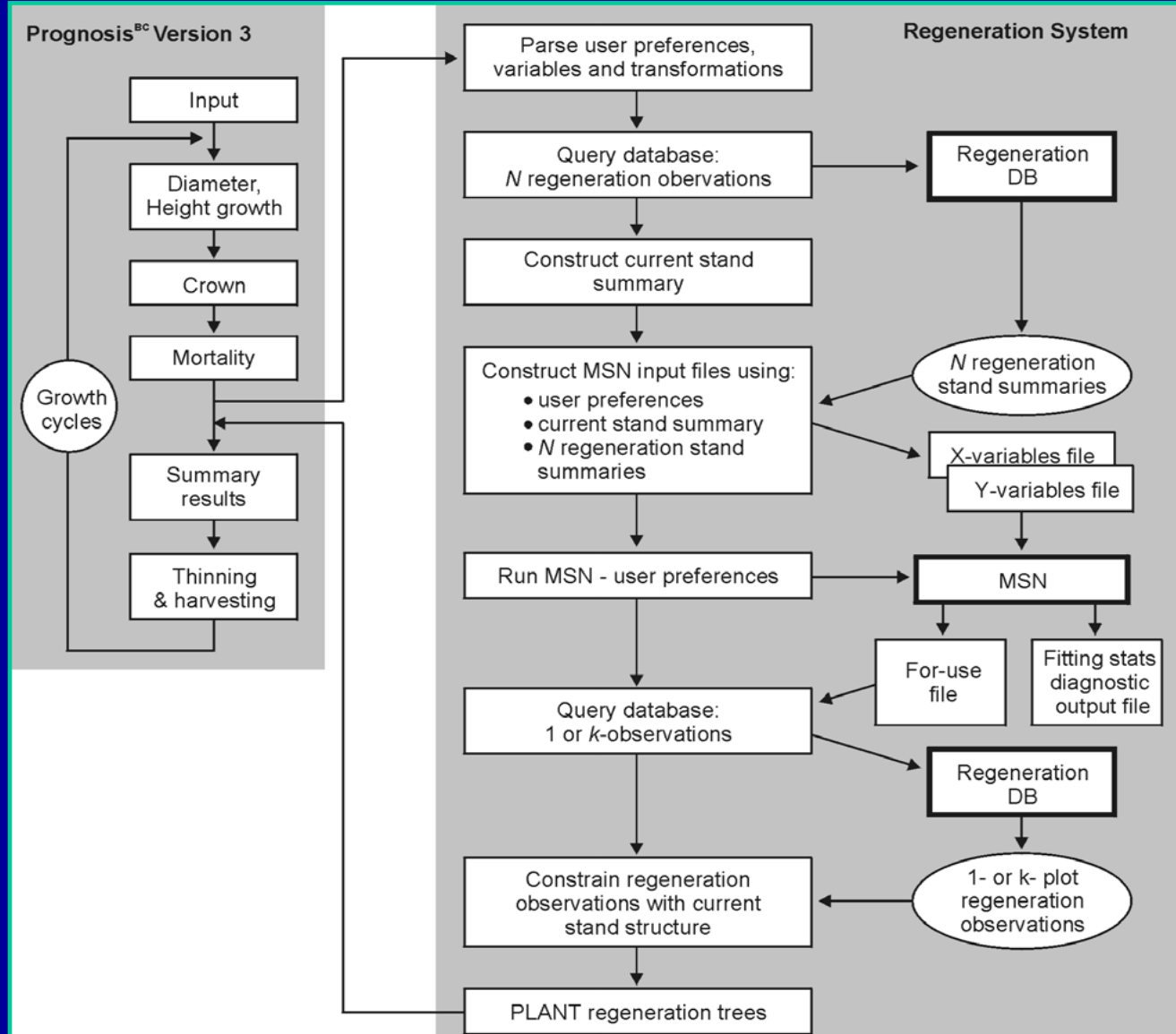
For:

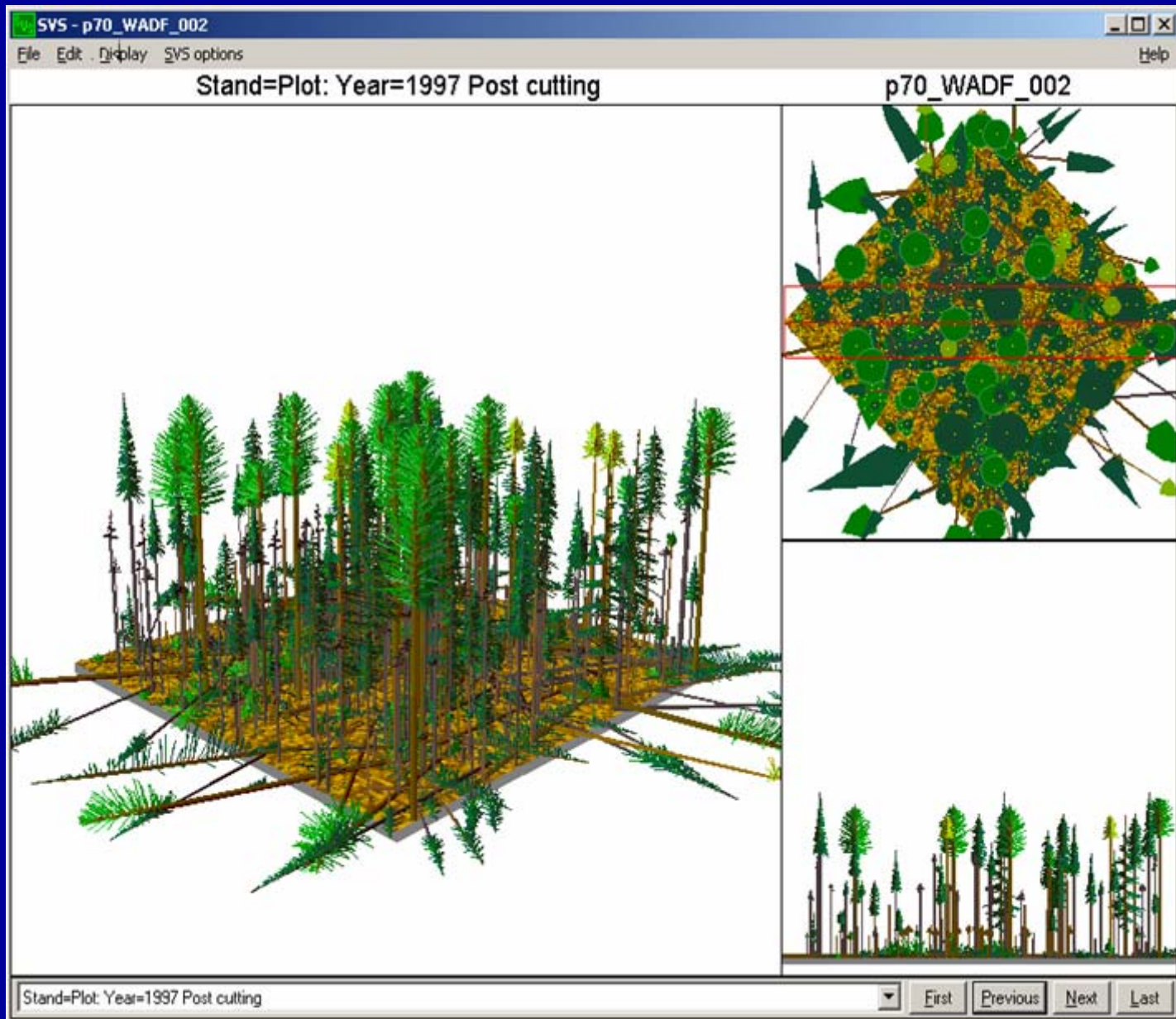


Use:

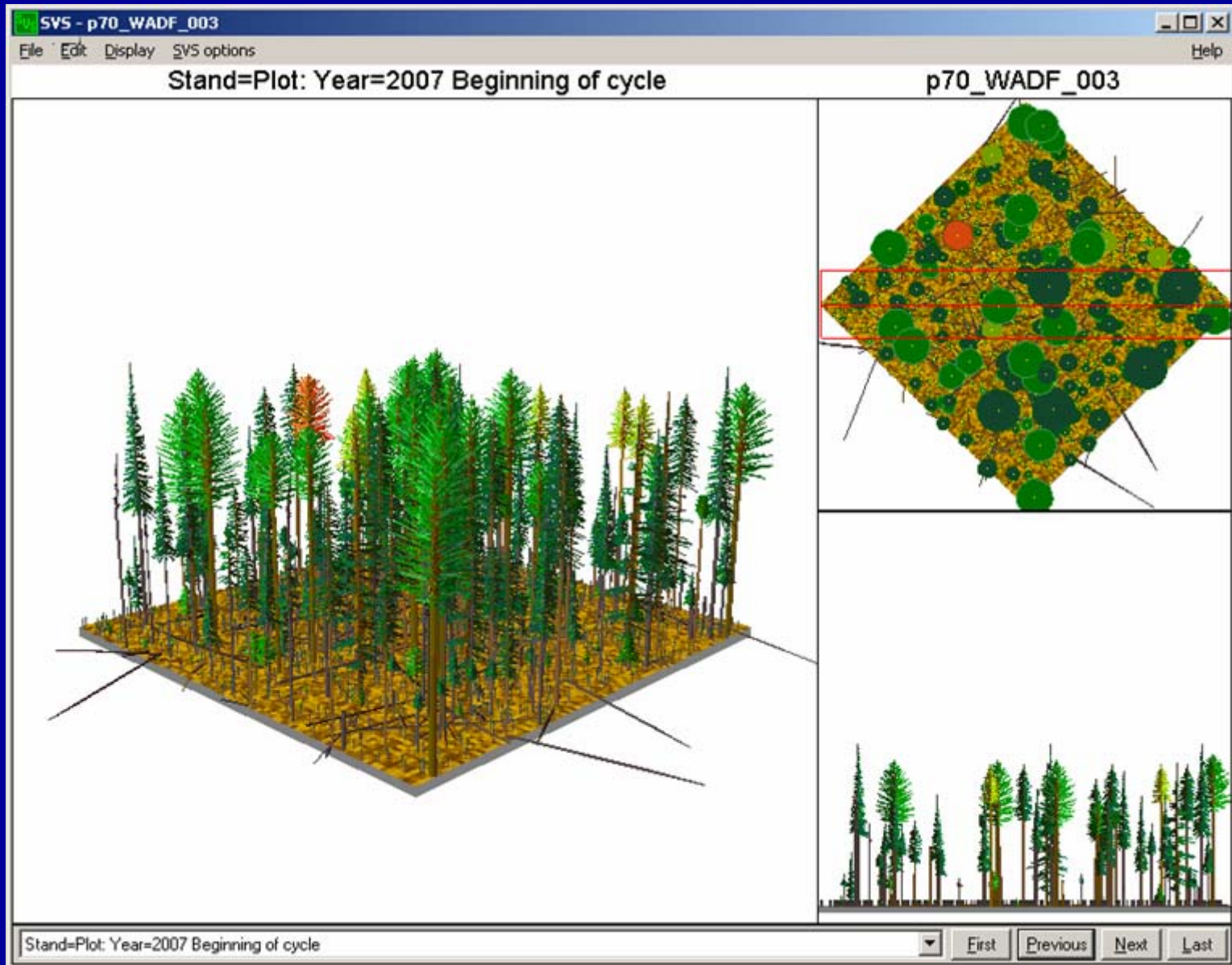


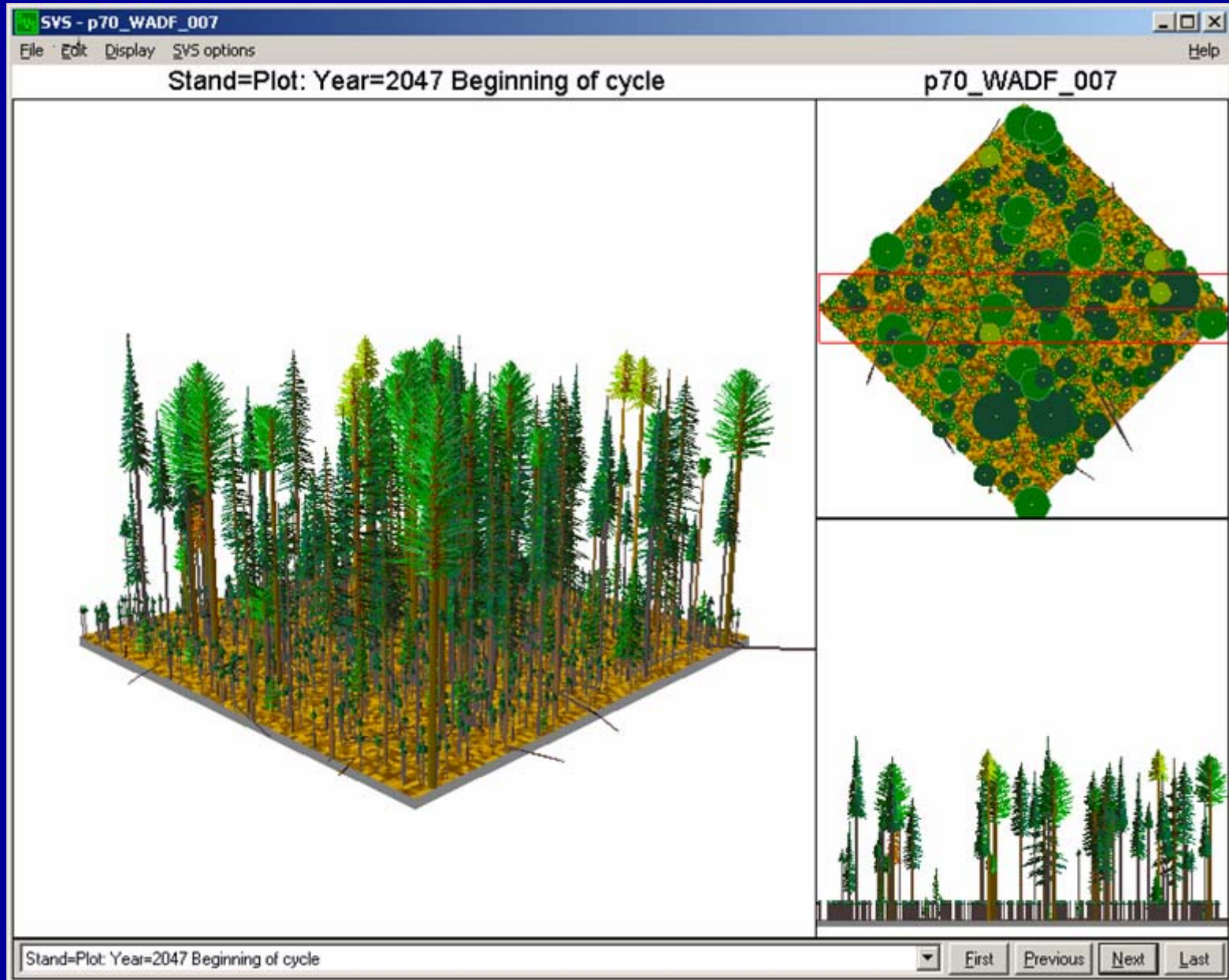
Regeneration Model Components & Dynamic Linkages





+10 years (imputation)





Extending the Model to SBS

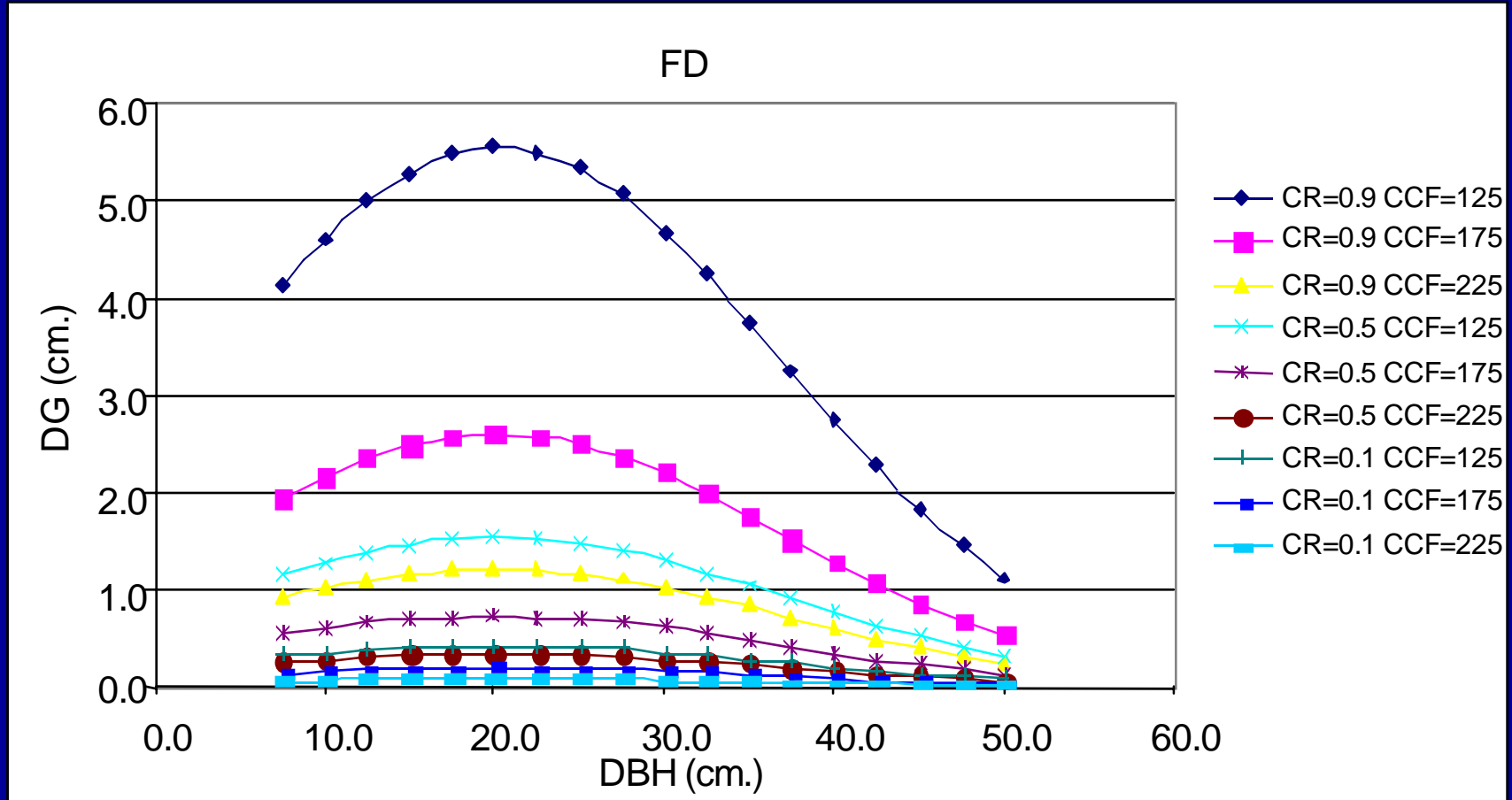
Objective: Calibrate the main component models of Prognosis^{BC} to allow its use in the SBS

- Radial increment models (PSP data)
- Juvenile height growth models for mixed-species stands in the SBS (TSP data)
- Non-catastrophic mortality models (PSP data)

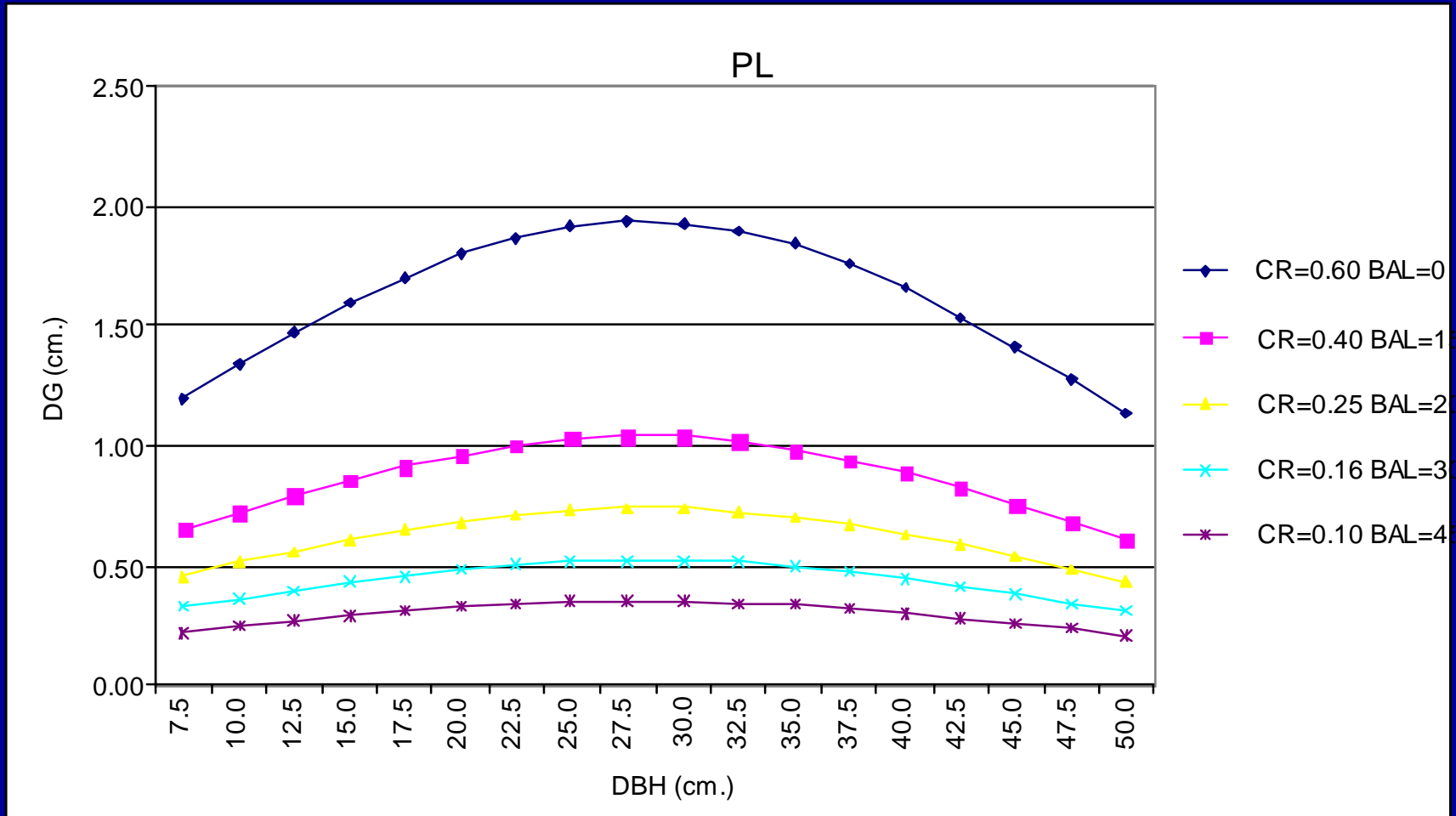
Models

- **Large tree 10-year radial increment: function of tree size, vigour (CR), density (CCF), relative position (BAL), aspect and slope**
- **5-year small tree height growth: function of tree height, relative position (CCF_large & CCF_small)**
- **Mortality: Tabular imputation (matrix indexed by tree size and stand density)**

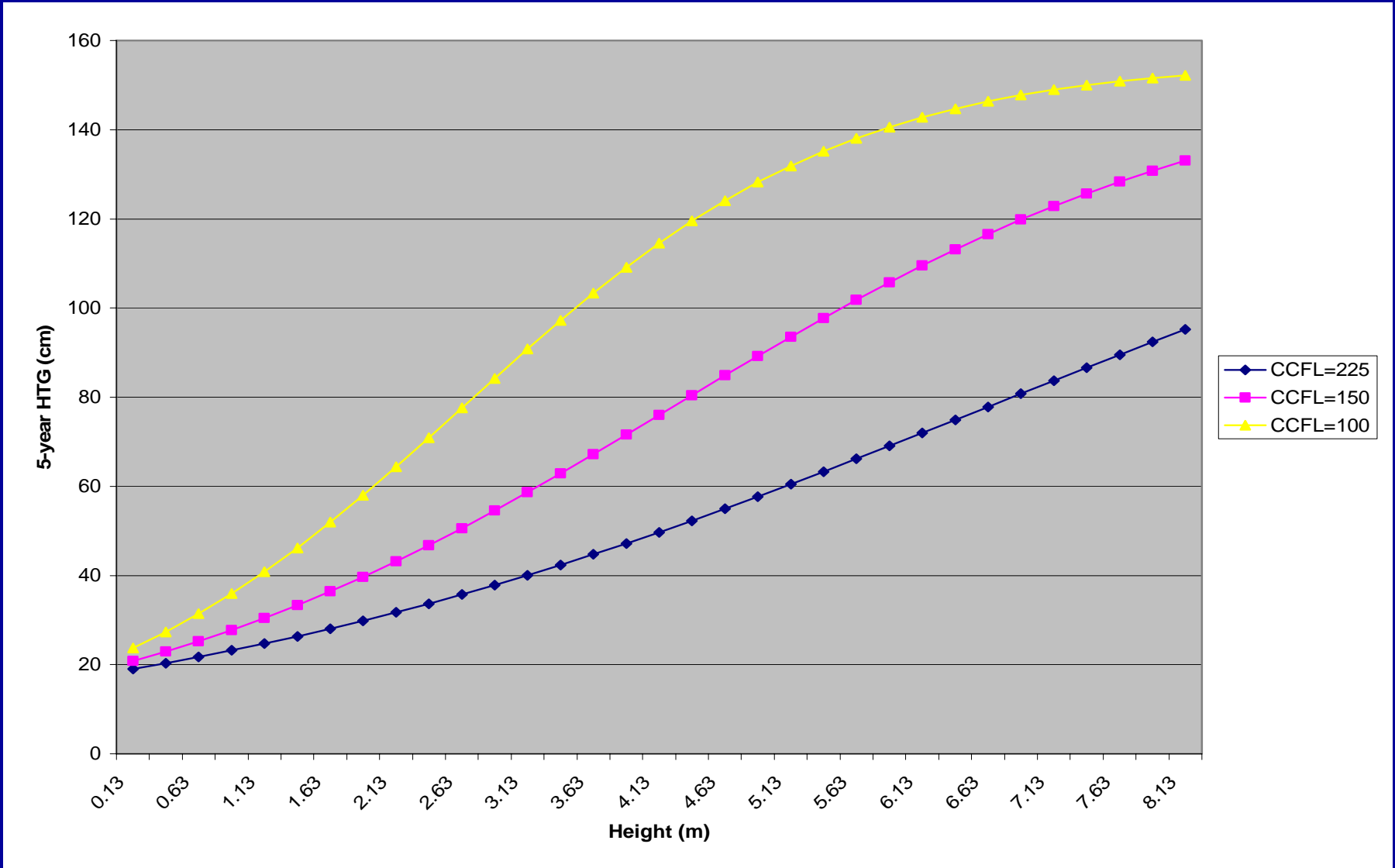
Douglas-fir Radial Increment SBSmm



Pine Radial Increment SBSmm



Spruce small tree HTG SBSdw1&2



Future Research Projects

- **Model Validation (FSP)**
 - test performance and integrity of all components including regeneration imputation (ICH, IDF, SBS)
 - tree-list imputation not implemented
- **MPB Linkages (MPBI):**
 - Performance and linkages to the Westwide MPB model
 - Modeling Natural Regeneration Following Mountain Pine Beetle Attacks

Acknowledgements and Websites

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<http://www.for.gov.bc.ca/hre/gymodels/progbc/index.htm>

www.forestry.ubc.ca/PrognosisBC