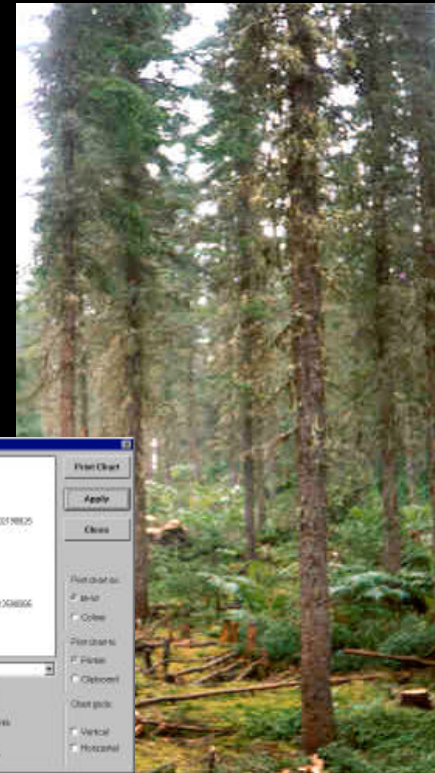


FVS Ontario

A Forest Vegetation Simulator for Ontario



- What is FVS?
- History of FVS
- Why FVS?
- Peek at FVS^{Ontario}
- Next Steps
- Future steps...



What is FVS?

- individual tree growth model
- simulates the interactions between species in mixed species and multi-aged (complex) stands
- great flexibility in scheduling a variety of thinning regimes
- model partial harvest systems

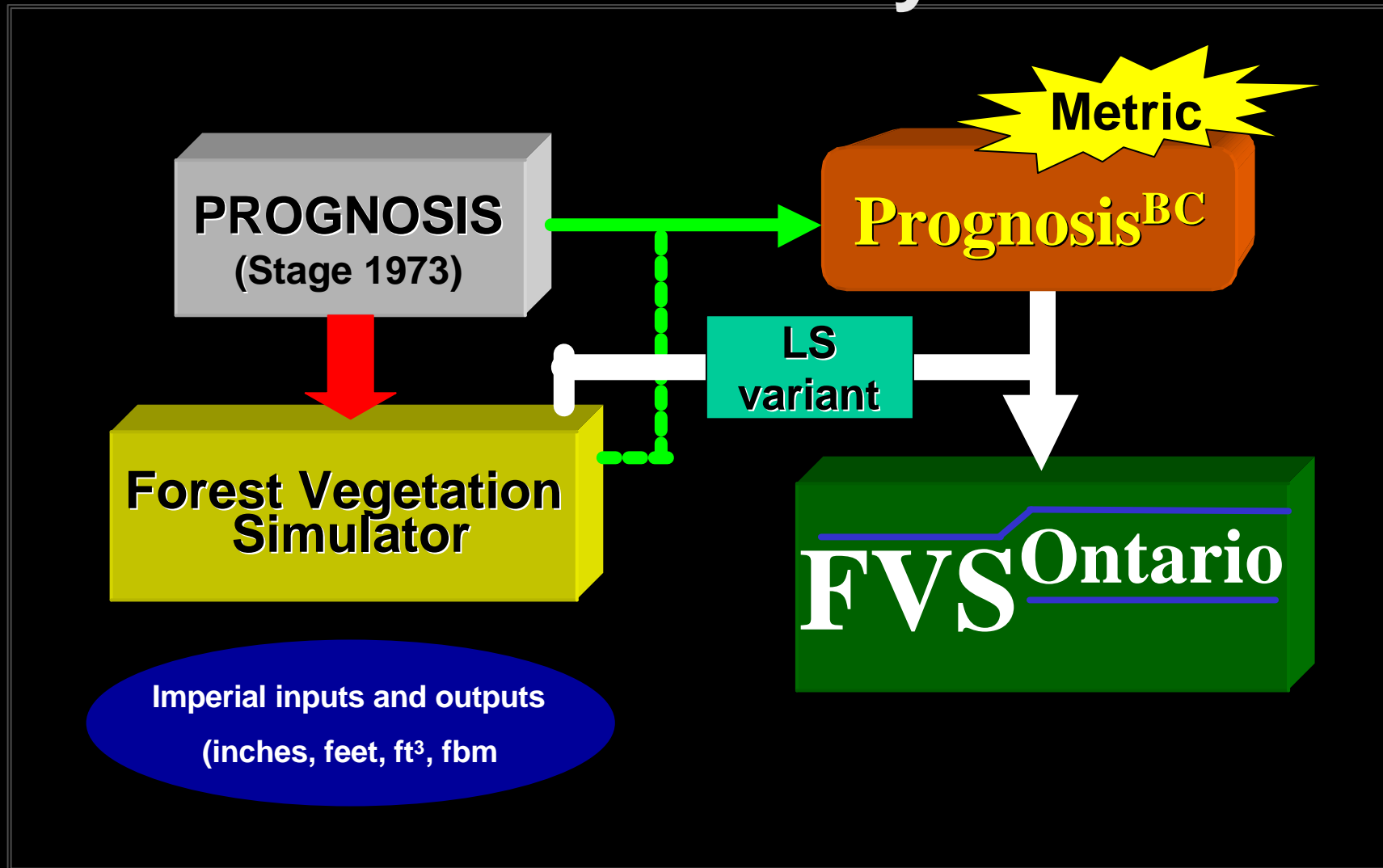
What is FVS?

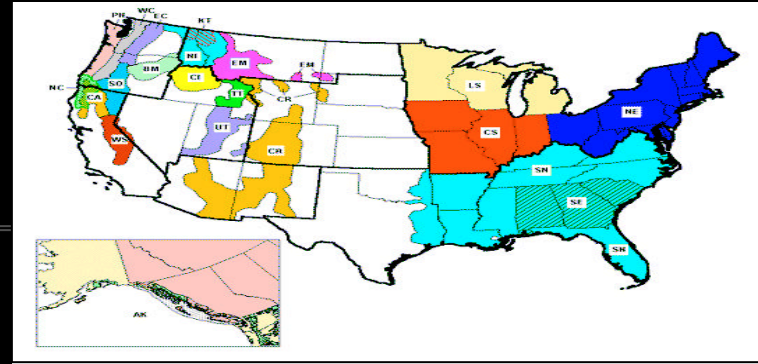
- an “empirical” model that predicts the change in crown length, diameter (dbh) and height over time
 - large-tree model - grows diameter
 - small tree model - grows height
- the spatial position of the competing trees is ignored

What is FVS?

- it was designed to project a ground based inventory
- linked to woodsupply modeling in the US
- FVS^{Ontario} could provide a growth engine for Ontario's future woodsupply modeling

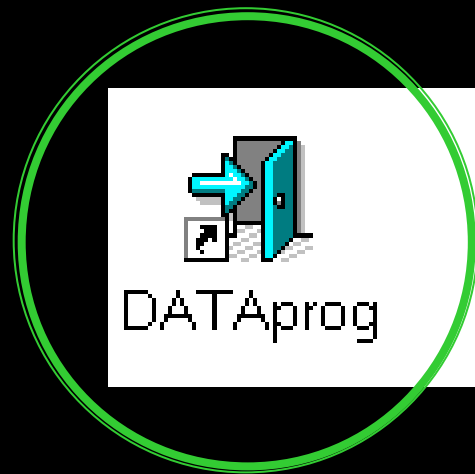
History of FVS?





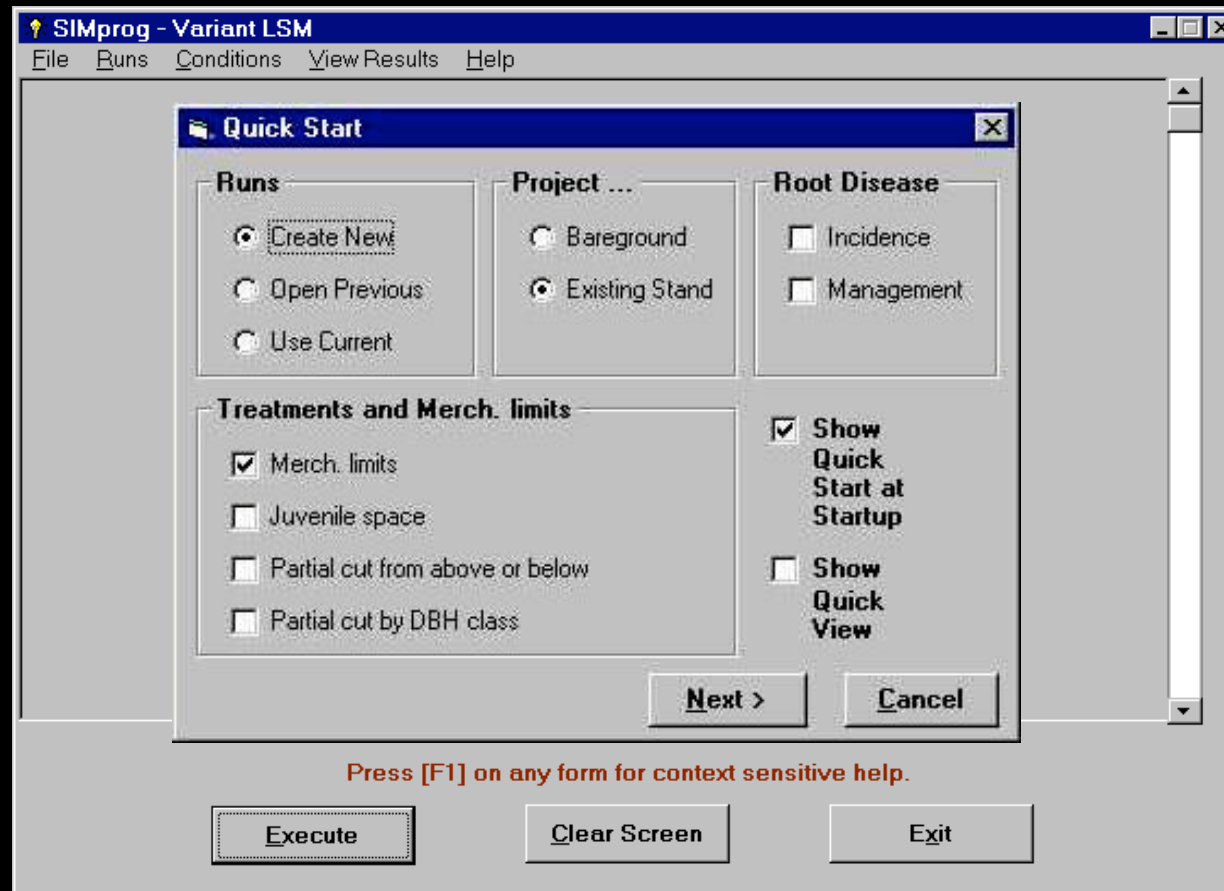
Why FVS?

- 22 variants of the model currently exist and still expanding
 - dedicated development staff
 - US National Inventory model (annual update)
 - modular design
 - model source code available
- **PROGNOSIS^{BC}** 1st metric variant
 - model source code available



		
DATAprog	SIMprog	VIEWprog





Merchantable Volume Limits

Species	Min DBH	Top	Stump
Jp	10	10	30
Sc	10	10	30
Rn	16	10	30
Rp	16	10	30
Wp	16	10	30
Ws	10	10	30
Ns	10	10	30
Bf	10	10	30
Bs	10	10	30
Ta	10	10	30
Wc	10	10	30
Eh	16	10	30

OK Delete Cancel

Site Information

Site Index

Species: Jp - Jack pine

Site Index (m): 21.0

Physical site information

Aspect (degrees): 0

Slope (%): 5

Elevation (m): 17

Latitude (degrees): 47

US Forest Type

Forest: 909 - Superior

Other

Stand Age (yrs): 50

OK Delete Cancel

Inventory Design

Select plot types

Fixed Area

Variable Radius

Variable Radius plot information

Fixed Area and Variable Radius plot information

Fixed Area plot radius (m) ... OR ...

Fixed Area plot area (ha): 1

Number of plot centres:

Inventory Year (eg: 1999): 1995

OK Delete Cancel

Juvenile Spacing [X]

Space to a residual

Basal Area (sq.m/ha)

Density (sph)

Enter the residual Basal Area (sq.m/ha)

Timing of spacing specified by

Age

Year

Top Height

Enter the stand Age (years) prior to spacing

Partial Cutting ... from Above or Below

Thinning strategy

Thin from Below Thin from Above

Thin to a residual

Density (sph) Basal Area (sq.m/ha)

Enter the residual Basal Area (sq.m/ha)

Timing of cut specified by

Age (yrs) Basal Area (sq.m/ha)

Year Top Height (m)

QMD (cm)

Enter the Basal Area (sq.m/ha) prior to thinning

Regeneration

Yes No

Shelterwood [X]

Prep cut

Year

Residual Basal Area

Regeneration
Yes No

Seed cut

Year

Residual Basal Area
...OR...
Residual Trees per ha

Regeneration
Yes No

First Removal

Year

Residual Basal Area Amnt % of orig
...OR...
Residual Trees per ha ...OR...

Final Removal

Residual Basal Area Amnt % of orig
...OR...
Residual Trees per ha ...OR...

Planted/Natural Regen. Assumptions

Site Information

US Habitat Type ... OR ... BEC Subzone & Site Series

Aspect (degrees) Slope (%) Elevation (m)

Assumptions

Defaults Select Species

Establishment Regime

Natural Stand Plantation

Year of Disturbance Regeneration Delay (years)

Specify Stocking By: SPH % :Percentage

Species	SPH	% By Species	% Survival
▶ Wp	500	100	100

Total SPH:

OK Delete Cancel

SIMprog - Variant LSM
File Runs Conditions View Results Help

Edit Site/Stand info: Age = 63, US Hab = , Aspect = 247, Elevation = , Slope = 3, Latitude = 46

Edit Treelist = C:\FVSOntario\Work\12590085.tre

Edit Inventory Design: Year = 1995, BAF = 0(sq.m/ha), Plot Area = 1(ha), # plots = , DBH breakpoint btn fixed _prism plots = (cm) DBH

Edit Merch. Vol. limits have been specified for the following species:

Edit Run ID = 12590085, Projection Length = 50 years, Increment Step: Initial = 10, and others = 10 years, Run Description =

Press [F1] on any form for context sensitive help.

Execute **Clear Screen** **Exit**

Model Run Options

- Save Output as ASCII files
- Import Projected Treelist
- Create SVS files
- Review Actual Keywords
- Execute Model Run
- Overwrite Existing Run

Ok **Cancel**

Select Stand Data to Tabulate

Select Fields for reporting

Defaults

Manual

Pre-Harvest	Harvested	Post-Harvest
<input checked="" type="checkbox"/> Year		
<input type="checkbox"/> Time (yrs)		
<input checked="" type="checkbox"/> SPH	<input checked="" type="checkbox"/> SPH	
<input checked="" type="checkbox"/> Total Volume (cu.m)	<input checked="" type="checkbox"/> Total Volume (cu.m)	
<input checked="" type="checkbox"/> Merch. Volume (cu.m)	<input checked="" type="checkbox"/> Merch. Volume (cu.m)	
<input type="checkbox"/> Merch. Vol. DWB (cu.m)	<input type="checkbox"/> Merch. Vol. DWB (cu.m)	
<input checked="" type="checkbox"/> Basal Area (sq.m)		<input checked="" type="checkbox"/> Basal Area (sq.m)
<input checked="" type="checkbox"/> QMD (cm)		<input checked="" type="checkbox"/> QMD (cm)
<input checked="" type="checkbox"/> Top Height (m)		<input checked="" type="checkbox"/> Top Height (m)
<input type="checkbox"/> CCF (%)		<input type="checkbox"/> CCF (%)
<input type="checkbox"/> SDI (sph)		<input type="checkbox"/> SDI (sph)
<input type="checkbox"/> Increment Period (yrs)		
<input checked="" type="checkbox"/> Volume Accretion (/yr)		
<input checked="" type="checkbox"/> Volume Loss (/yr)		
<input checked="" type="checkbox"/> MAI (Volume)		

Cancel OK

```

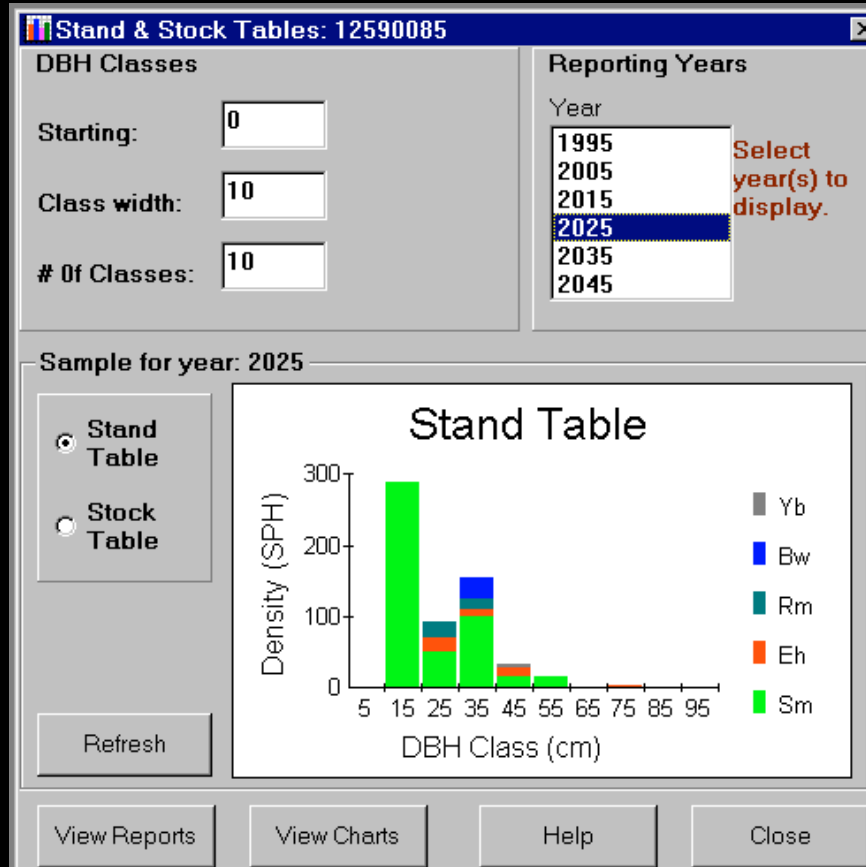
View Text
File Edit
All statistics are reported on a per hectare basis.

Run parameters for run: 12590085

1) Site/Stand info: Age = 63, US Hab = , Aspect = 247, Elevation = ,
Slope = 3, Latitude = 46
2) Treelist = C:\FVSOntario\Work\12590085.tre
3) Inventory Design: Year = 1995, BAF = 0(sq.m/ha), Plot Area = 1(ha),
# plots = , DBH breakpoint btn fixed & prism plots = (cm) DBH
4) Merch. Vol. limits have been specified for the following species:
Jp,Sc,Rn,Rp,Wp,Ws,Ns,Bf,Bs,Ta,Wc,Eh,Os,Rc,Ba,Ga,Cw,Sv,Rm,Bc,El,Se,Re,Yb,Ew,Sm,Bm,Ab,Wa,Wo,Sw,Br,Ck,
Keyword Field Descriptions
Species#  Min DBH  Top Diam  Stump Ht
1         10       10       30
2         10       10       30
3         16       10       30
4         16       10       30
5         16       10       30
6         10       10       30
7         10       10       30
8         10       10       30
9         10       10       30
10        10       10       30
11        10       10       30
12        16       10       30
13        10       10       30
14        10       10       30
15        20       10       30
16        20       10       30
17        20       10       30
18        20       10       30
19        20       10       30

```

Run_ID	Year	SPH (sq.m)	Basal Area (sq.m)	Top Height (m)	QMD (cm)	Total Volume (cu.m)	Merch. Volume (cu.m)	SPH (harv.)	Total Volume (harv.)	Merch. Volume (harv.)	Basal Area (resid.)	Top Height (resid.)	QMD (resid.)	Accre (resid.)
12590085	1995	704	22.7	17.7	20.3	116.2	43.7	0	0	0	22.7	17.7	20.3	
12590085	2005	670	27.5	18.3	22.9	172.2	77	0	0	0	27.5	18.3	22.9	
12590085	2015	633	32.4	18.9	25.5	211.5	114	0	0	0	32.4	18.9	25.5	



Stand & Stock Tables: 12590085

DBH Classes

Starting:

Class width:

Of Classes:

Reporting Years

Year

- 1995
- 2005
- 2015
- 2025
- 2035
- 2045

Select year(s) to display.

Sample for year: 1995

Stand Table
 Stock Table

DBH Class (cm)	Yb	Bw	Rm	Eh	Sm
5	0	0	0	0	80
15	0	0	0	0	350
25	0	80	100	100	120
35	0	0	0	20	20
45	0	0	0	0	20
55	0	0	0	0	10
65	0	0	0	0	10
75	0	0	0	0	10
85	0	0	0	0	10
95	0	0	0	0	10

Stand & Stock Tables: 12590085

DBH Classes

Starting:

Class width:

Of Classes:

Reporting Years

Year

- 1995
- 2005
- 2015
- 2025
- 2035
- 2045

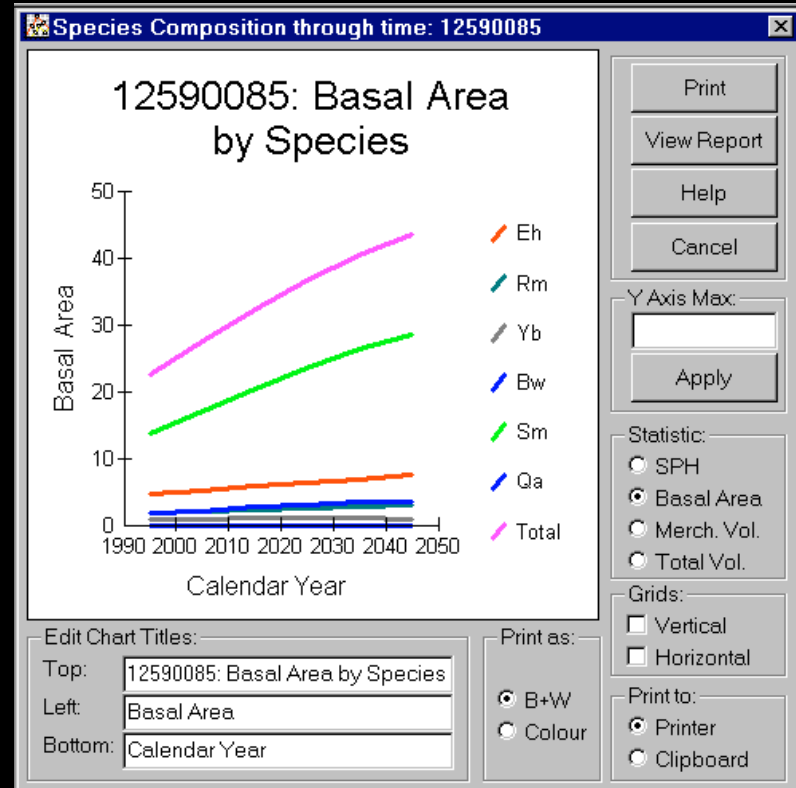
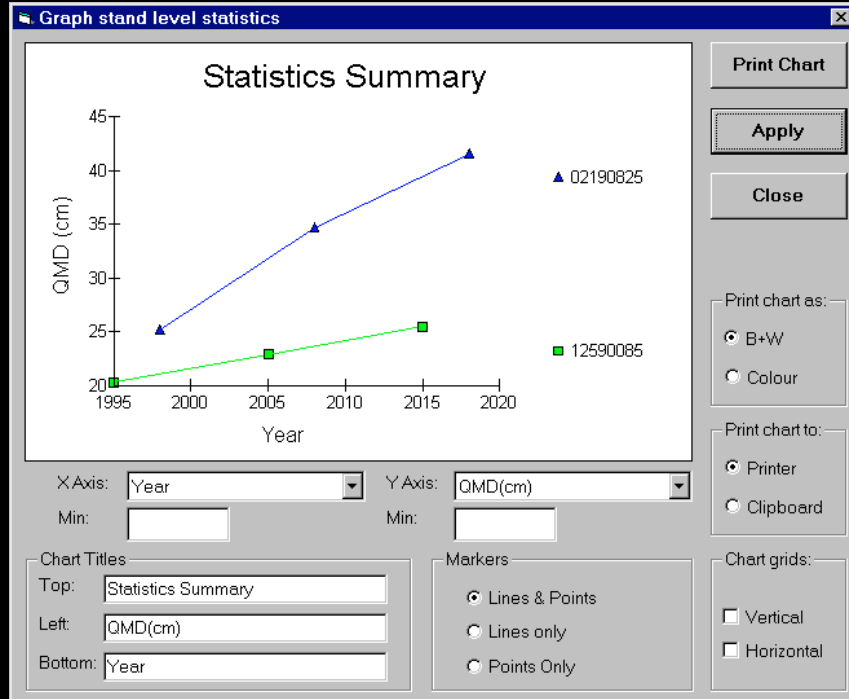
Select year(s) to display.

Sample for year: 2025

Stand Table
 Stock Table

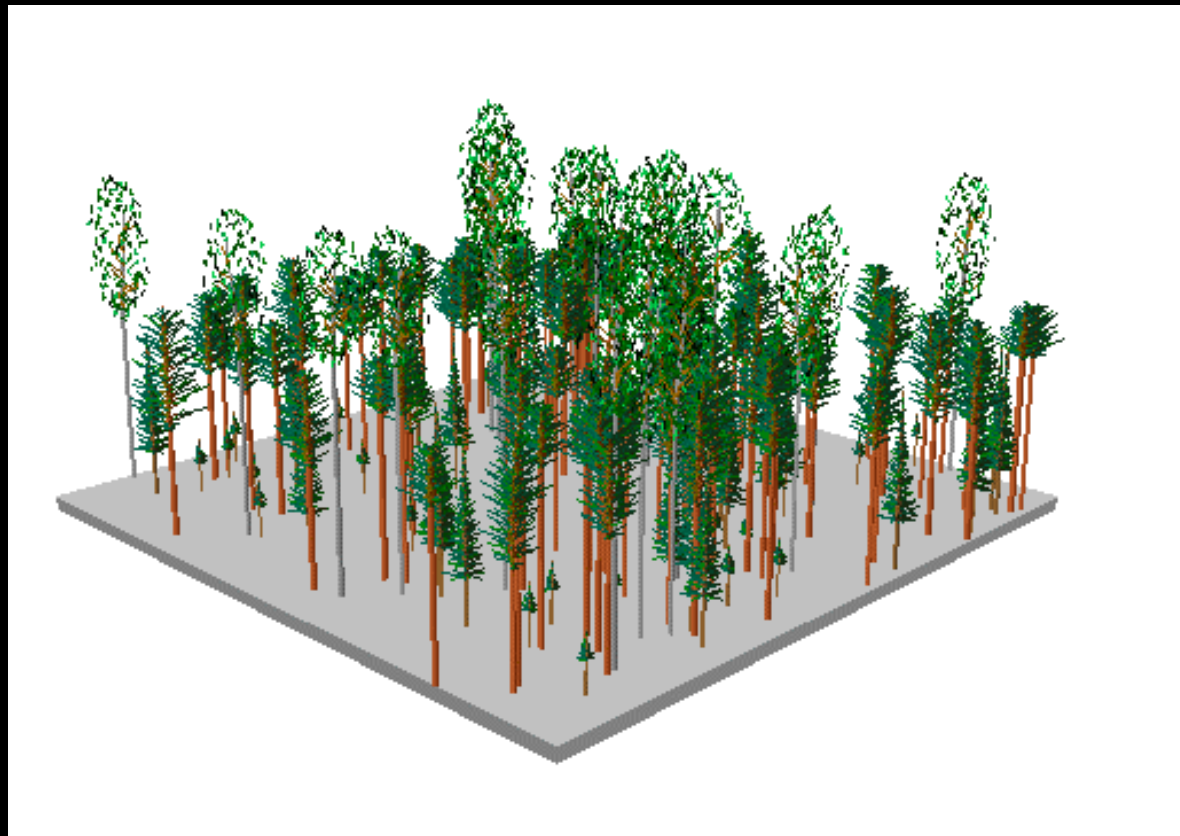
DBH Class (cm)	Yb	Bw	Rm	Eh	Sm
5	0	0	0	0	70
15	0	0	0	0	280
25	0	40	40	20	100
35	0	50	40	20	100
45	0	0	0	20	20
55	0	0	0	0	20
65	0	0	0	0	10
75	0	0	0	0	10
85	0	0	0	0	10
95	0	0	0	0	10

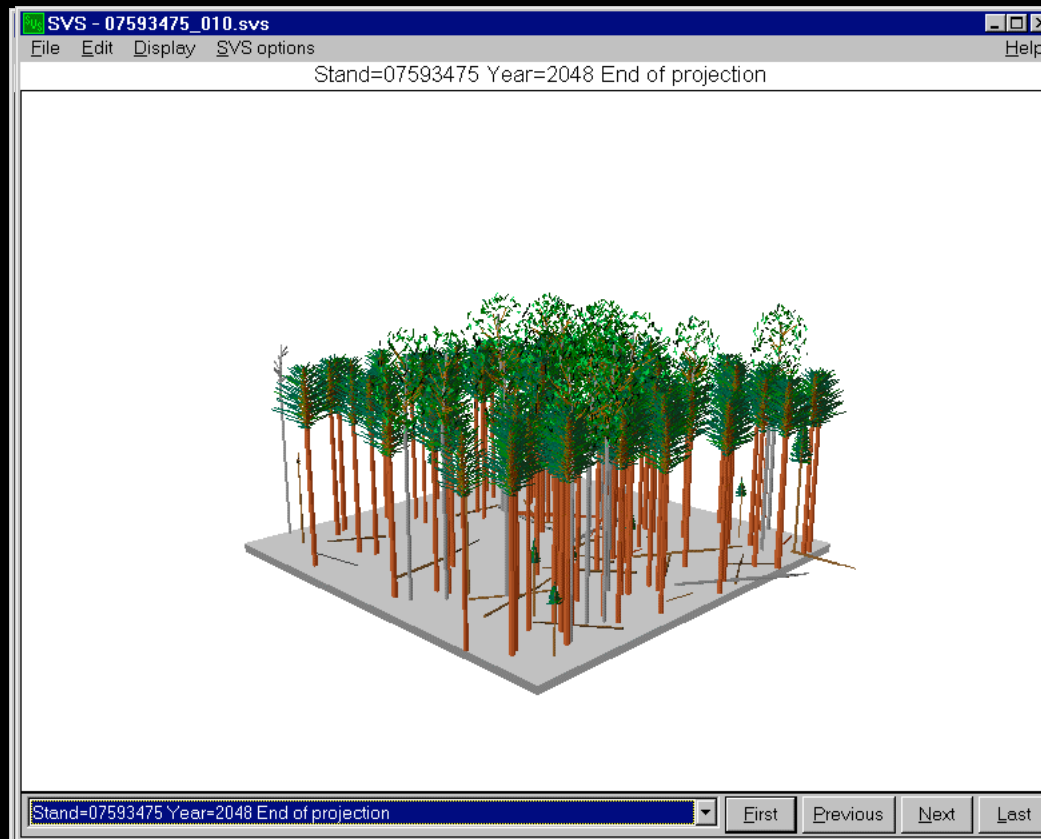
View Reports
View Charts
Help
Close



FVS Ontario

version 1.0





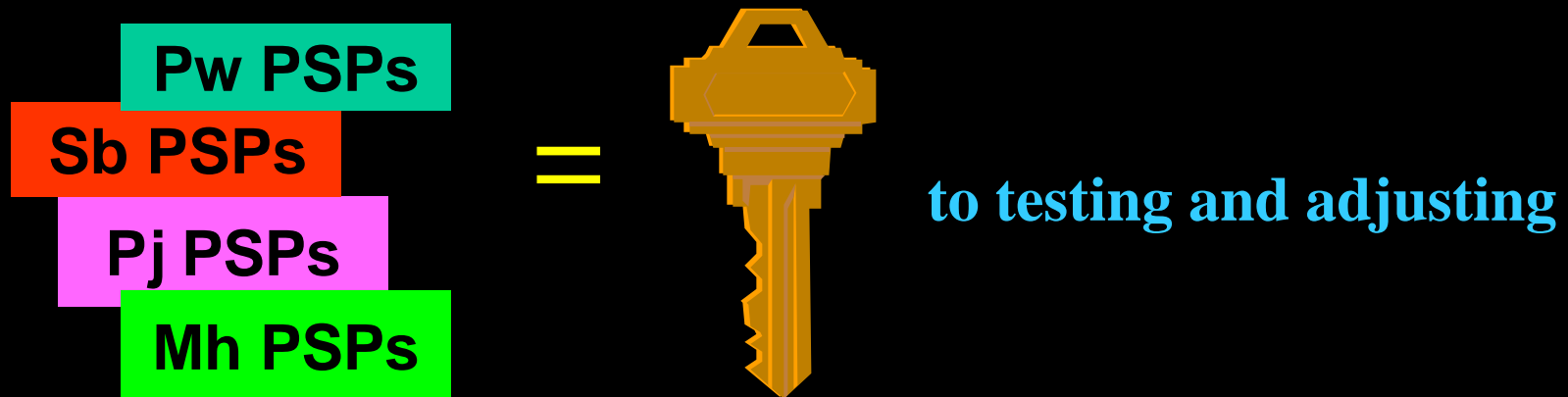
The screenshot displays the 'Partial Cutting ... by DBH Class' dialog box in the FVS Ontario software. The dialog is divided into several sections:

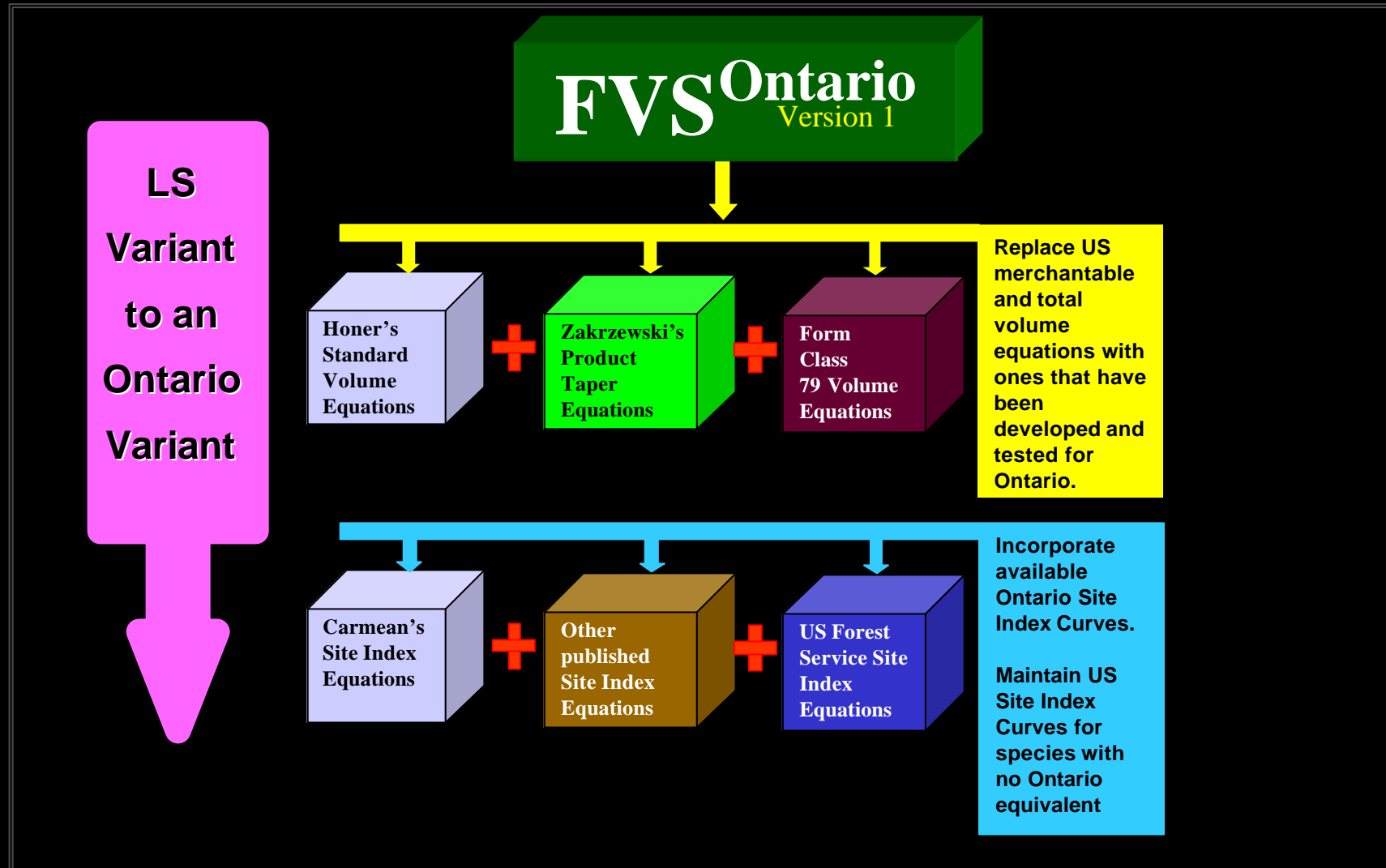
- Target stocking by DBH class:** A table with columns for Min, Max, SPH, and Species. The Species column is set to 'All'.
- Schedule cutting by:** Radio buttons for Age, Year, QMD (selected), Basal Area, and Top Height.
- Regeneration:** Radio buttons for Yes (selected) and No.
- Assumptions:** A button labeled 'Assumptions'.
- Enter the QMD (cm) prior to thinning:** A text input field containing the value '24'.
- Harvest ...:** Radio buttons for 'ONCE, when the above condition is met' (selected) and 'EVERY TIME the above condition is met'.
- Buttons:** 'OK', 'Delete', and 'Cancel' buttons.
- Warning:** A red text message at the bottom: 'Please refer to help for important caution'.

A red arrow points from the 'EVERY TIME the above condition is met' radio button to the 3D forest model on the right. The model is titled 'Scans=20001.20 Year=1200 Inventory conditions' and shows a 3D perspective view of a forest with various tree species and heights.

Validation of FVS^{Ontario}

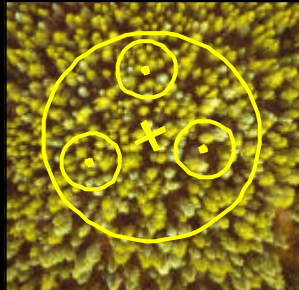
- Model forms are from the Lake States
 - How well do the site index curves work in Ontario?
 - How well does the model represent thinning in our stand conditions?





DATA SOURCES

PSP



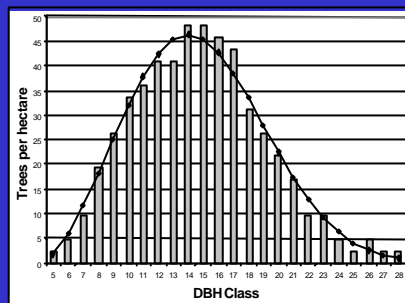
INVENTORY/ECOLOGICAL



OPERATIONAL CRUISING



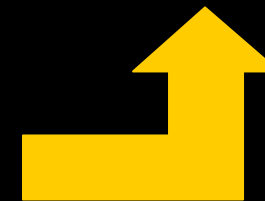
MODELLING



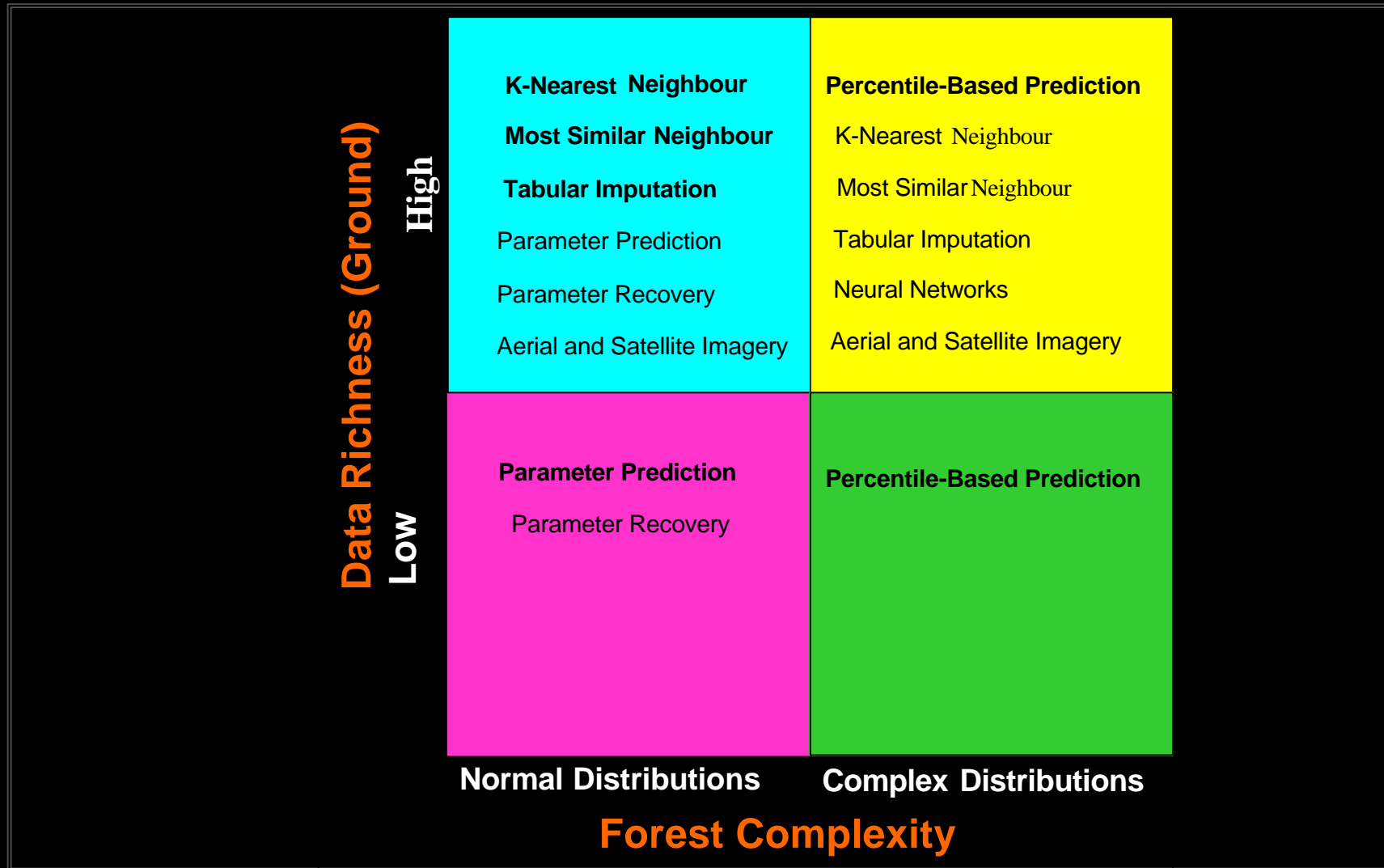
Estimated Tree List

Class (cm)	Species	Height (m)	per ha
4	Sb	3.7	75
5	Sb	4.6	60
6	Sb	5.5	54
7	Pj	6.4	18
8	Pj	7.4	25
9	Pj	8.5	32
10	Pj	9.6	38
11	Pj	10.7	42
12	Pj	12.1	58
13	Pj	13.3	67
~	~	~	~

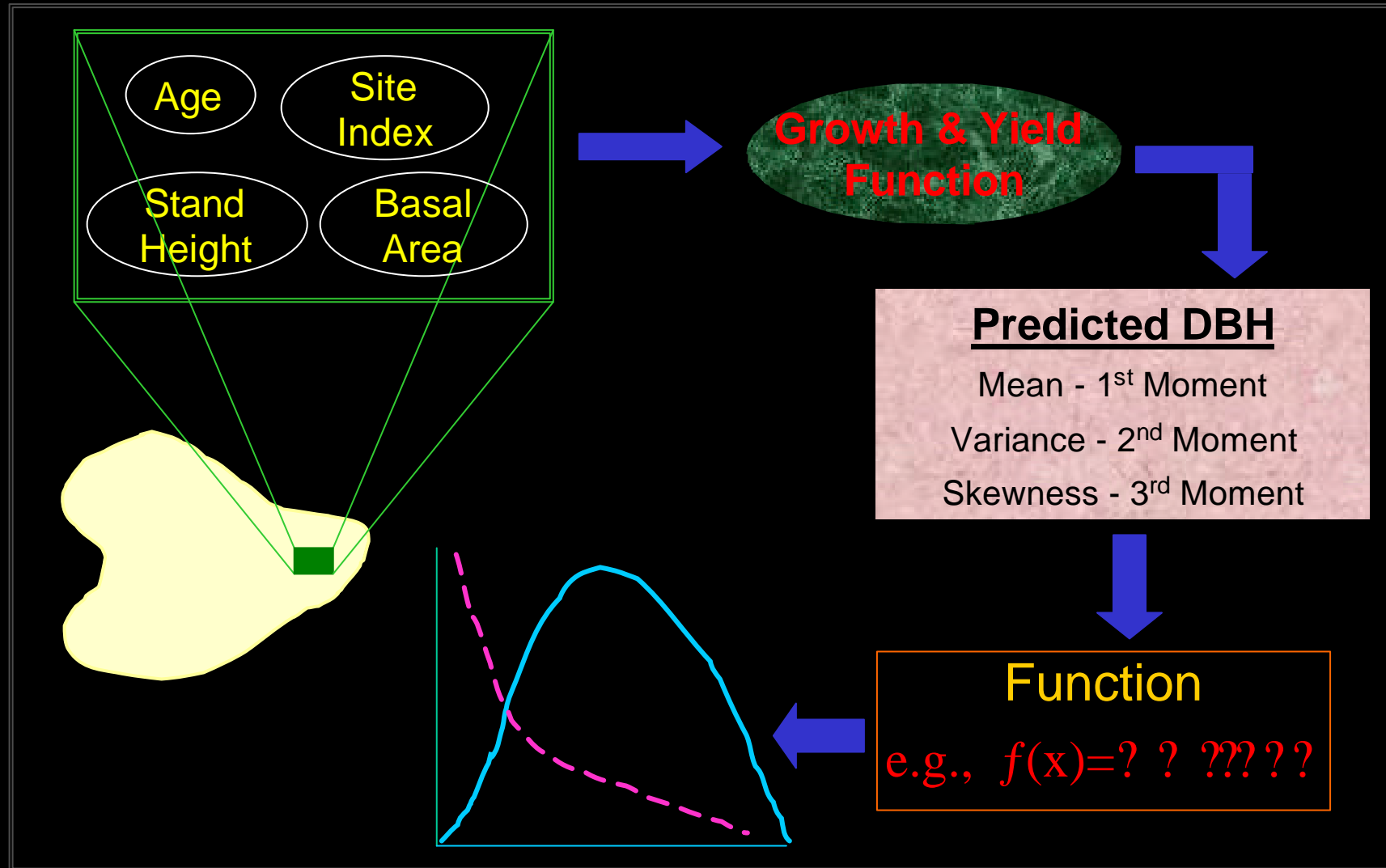
FVS Ontario



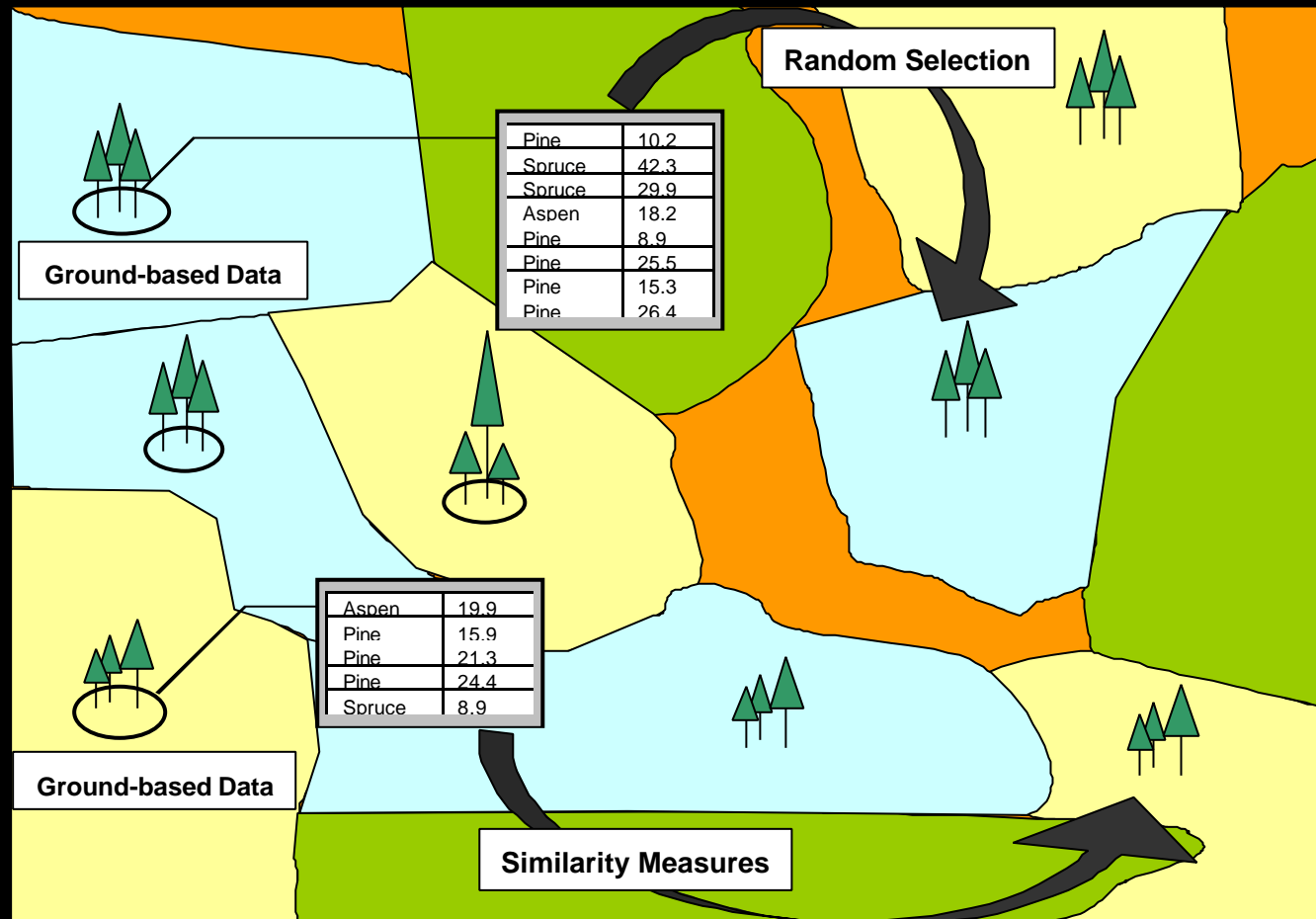
Tree List Generation Methods



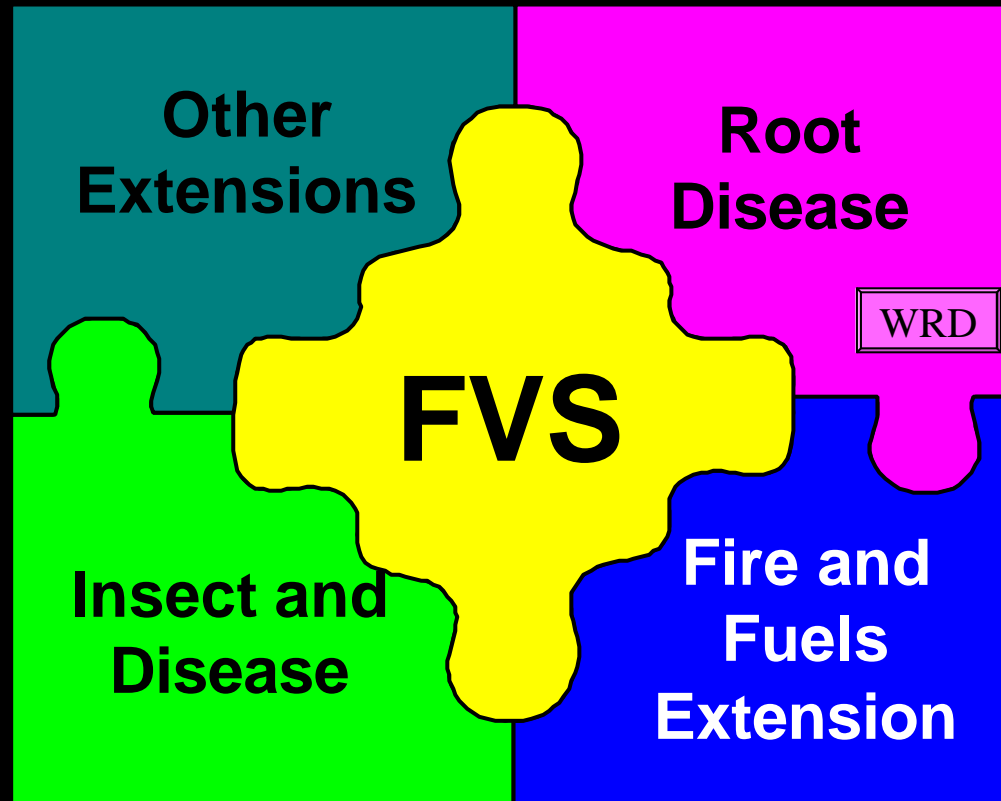
Parameter Recovery



Imputation



The future...



Modules and Extensions

Root Disease Information

General Information

Root disease: Stand area (ha)

Type of Information

Additional stumps Tree densities or % OR Damage codes Plot information

Centre Information

Distribution of the disease in the stand

Total area in centres (ha)

Number of centres

Select additional output information

Detailed root disease information

Buttons: OK, Delete, Cancel, Add details

Screens currently in FVS Ontario - but model developed for Western species

Stump Management

Stump Pushing

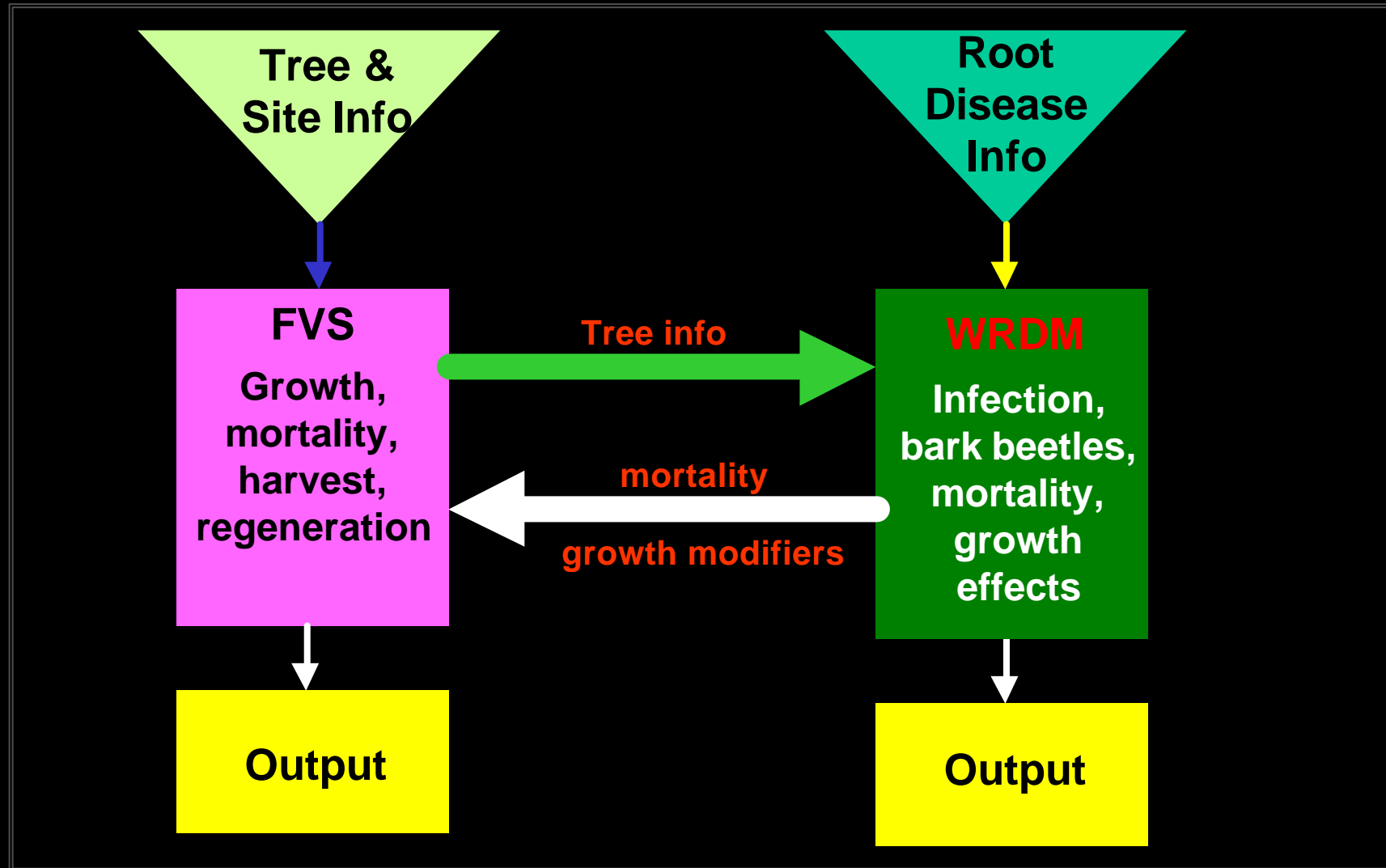
Note: there is no age dependency in stump pushing. The only requirement is that the stump is above the given minimum diameter.

What year should the stump removal occur? (year or timestep)

What is the minimum diameter stump to remove? cm

What proportion of the stumps will be removed?

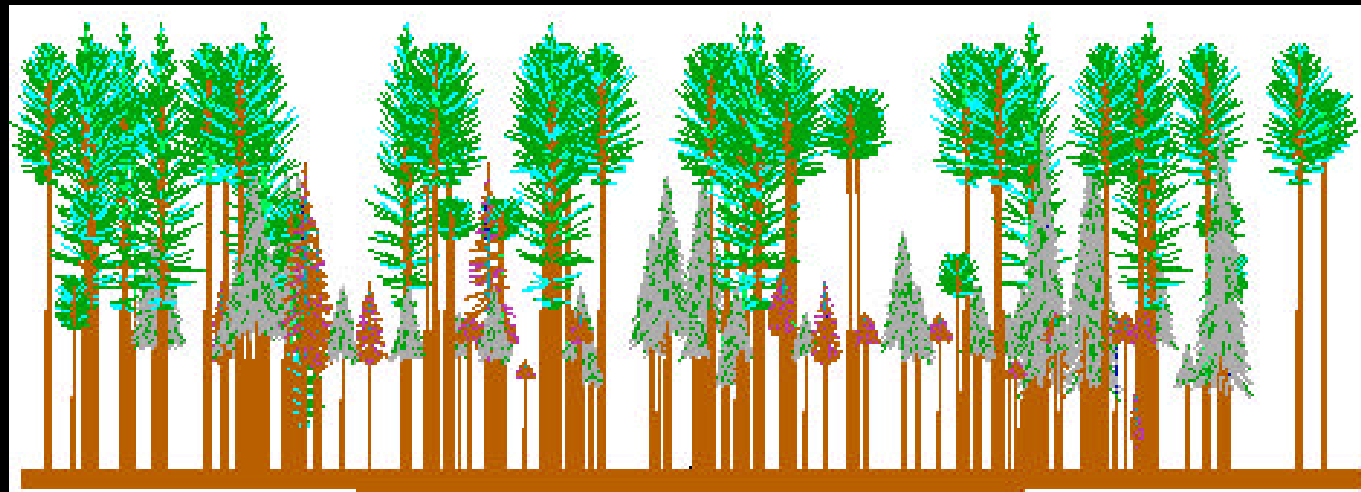
Buttons: OK, Delete, Cancel



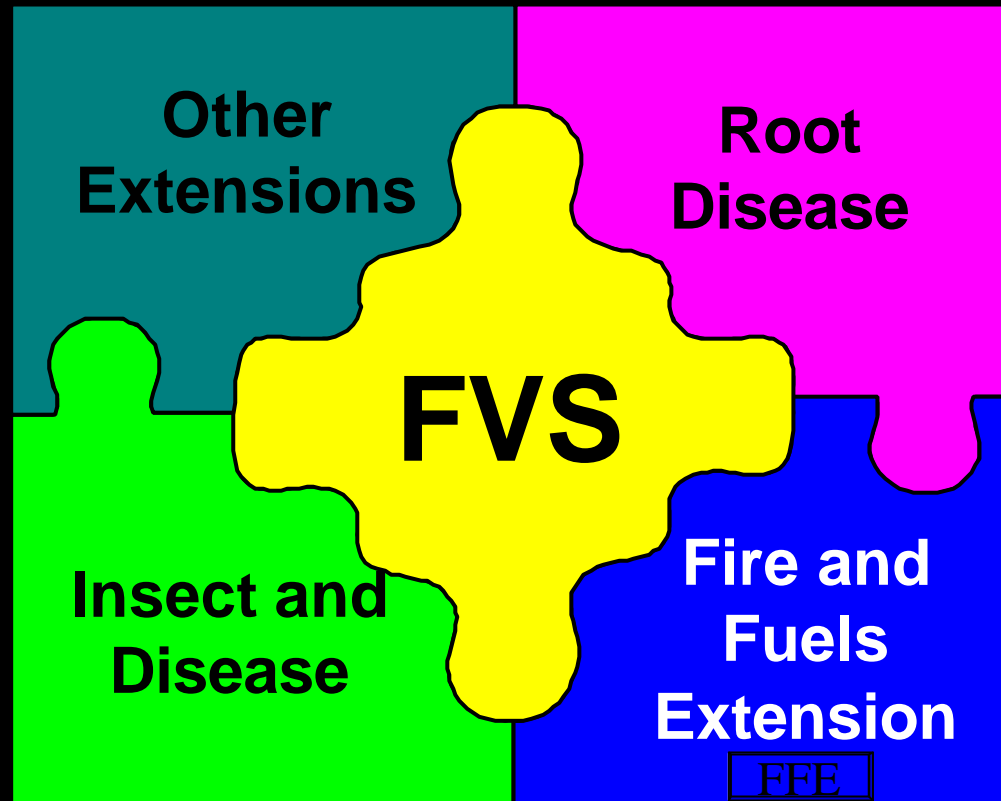
**No
Root
Disease**



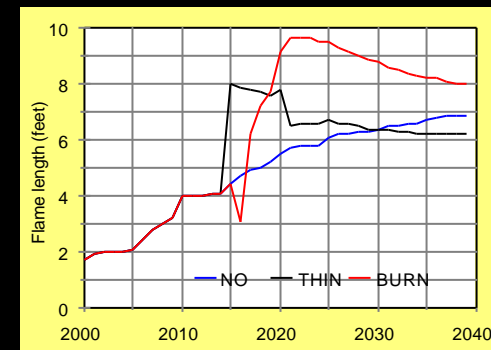
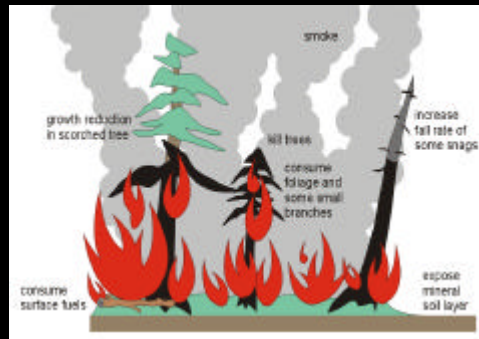
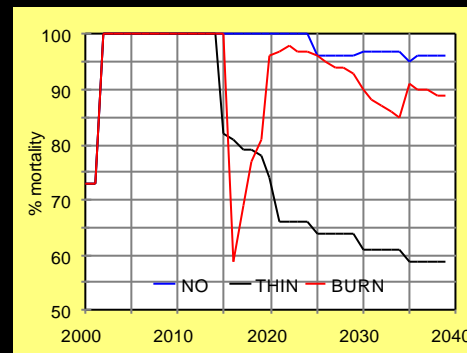
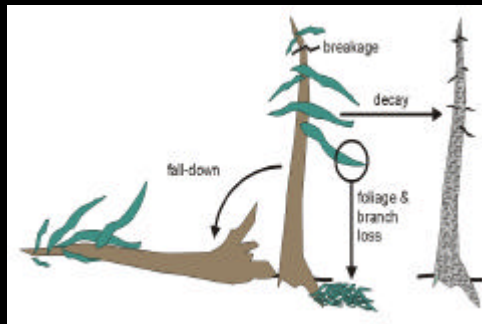
**With
Root
Disease**



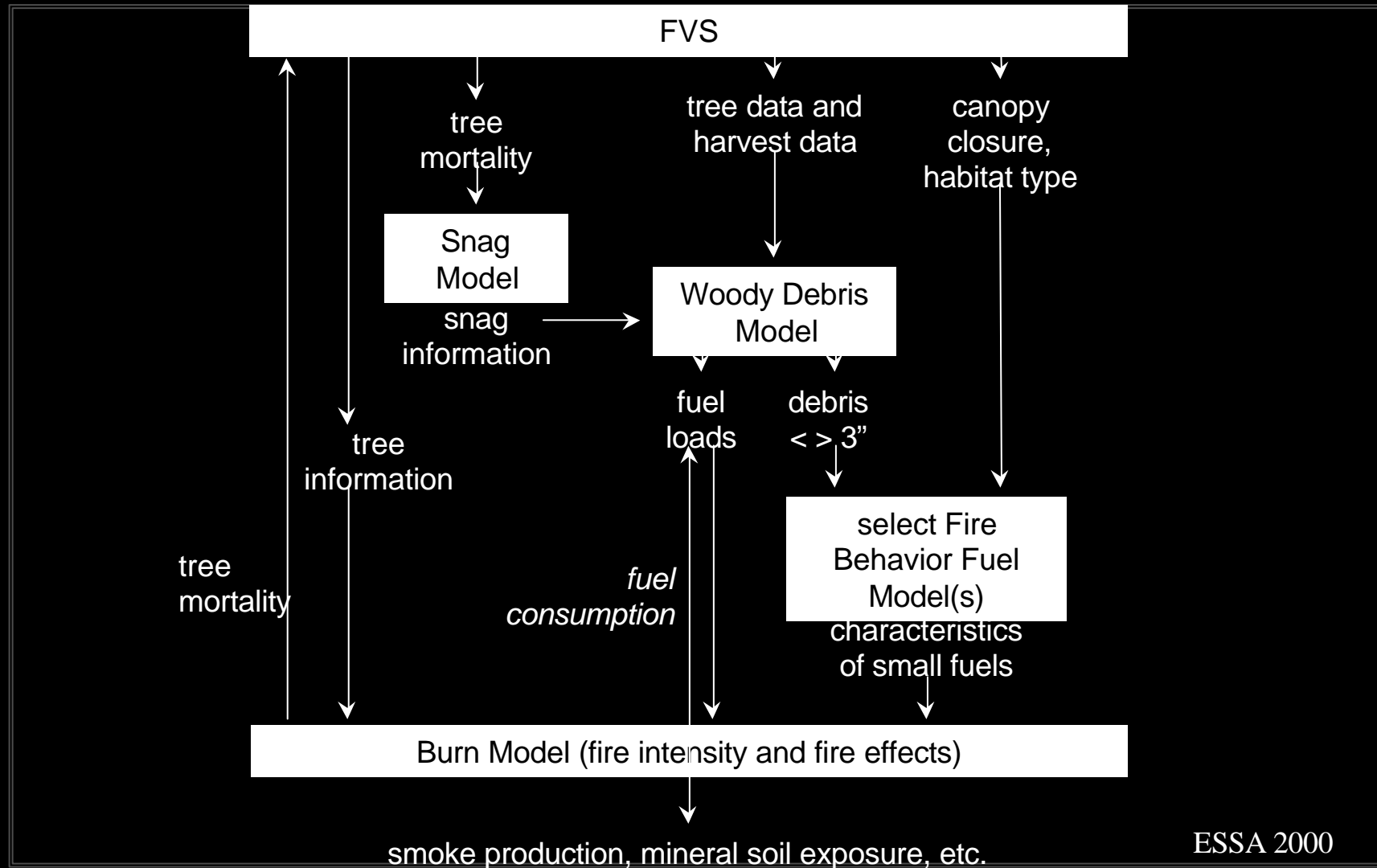
The future...



A model intended to simulate the effects of vegetation dynamics and management actions on fuel loadings and fire effects



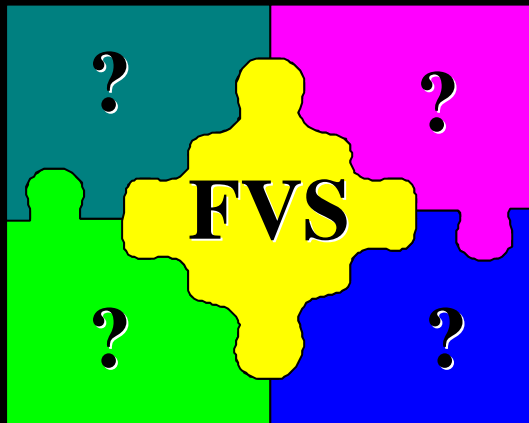
The Fire & Fuels Extension



The FFE Model CAN:

- simulate snag and fuel dynamics, with or without fires
- predict changes in fuel levels due to management, fire, or natural aging
- calculate the potential fire severity for the stand or landscape
- predict the effects of fire on various indicators

Future Modules...



- **Validation of US modules?**
- **Development of new modules for:**
 - **vegetation control - or not?**
 - **Impacts of logging and site damage?**
 - **fertilization?**
 - **tree improvement?**

US Post Processor Software for FVS

- **Stand Visualization System (SVS)**
- **FVSStand - Stocking and Yield Tables**
- **Vegetation Structural Stage calculations**
- **SPECTRUM Export Tables - US Woodsupply**
- **Elk Hiding Cover calculations**
- **Tables of Computed Variables**
- **Mountain Pine Beetle Risk Rating**
- **Economic Analysis (CHEAPO)**

Why am I here ?

- **Introduce you to this modelling approach and hopefully pique your interest**
- **Get you thinking about the benefits and opportunities of Ontario having a modelling tool like FVS^{Ontario}**
- **Get some feeling on your support of this type of modelling efforts**
- **Suggestions on how this type of project forward**



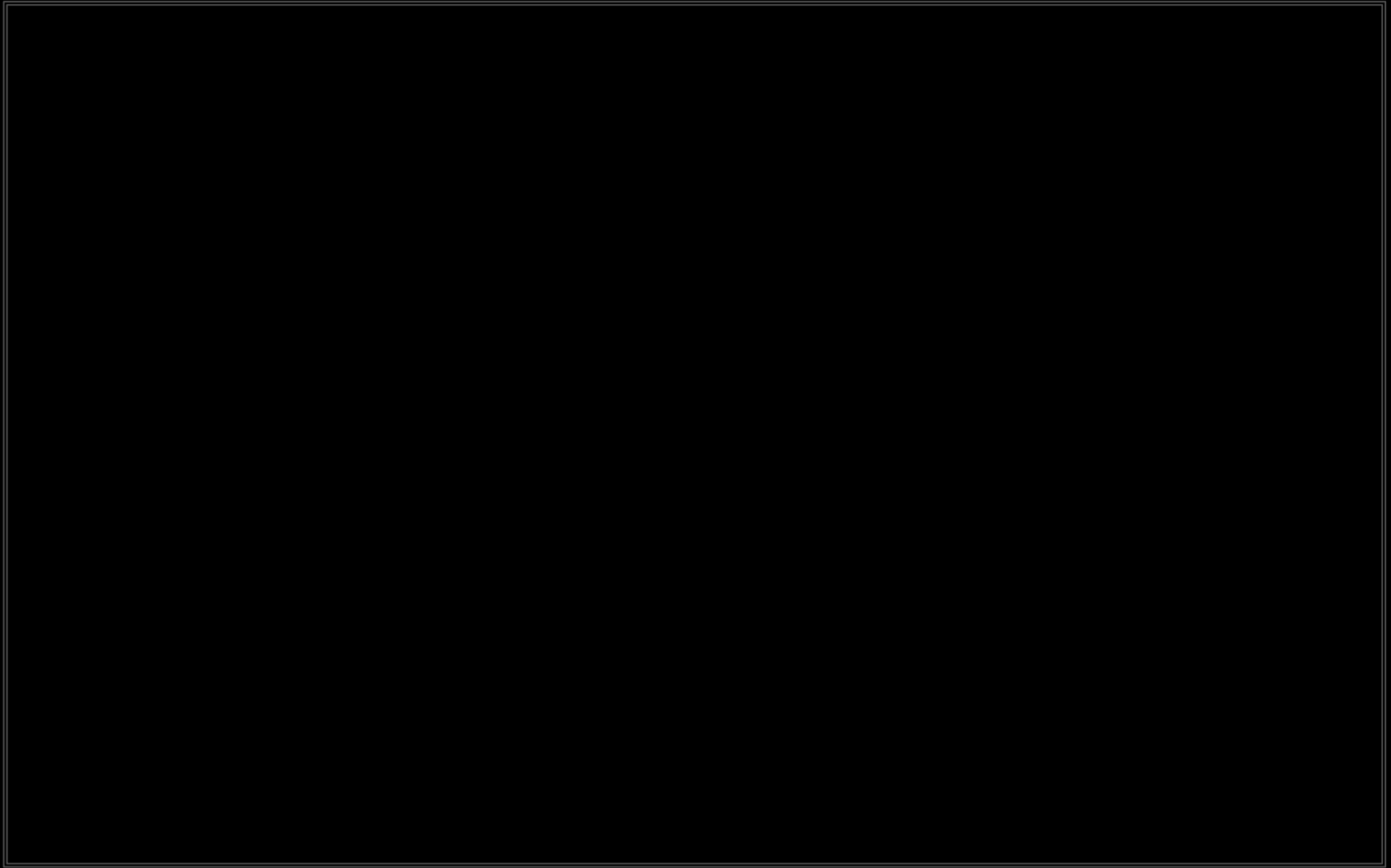
Thank You

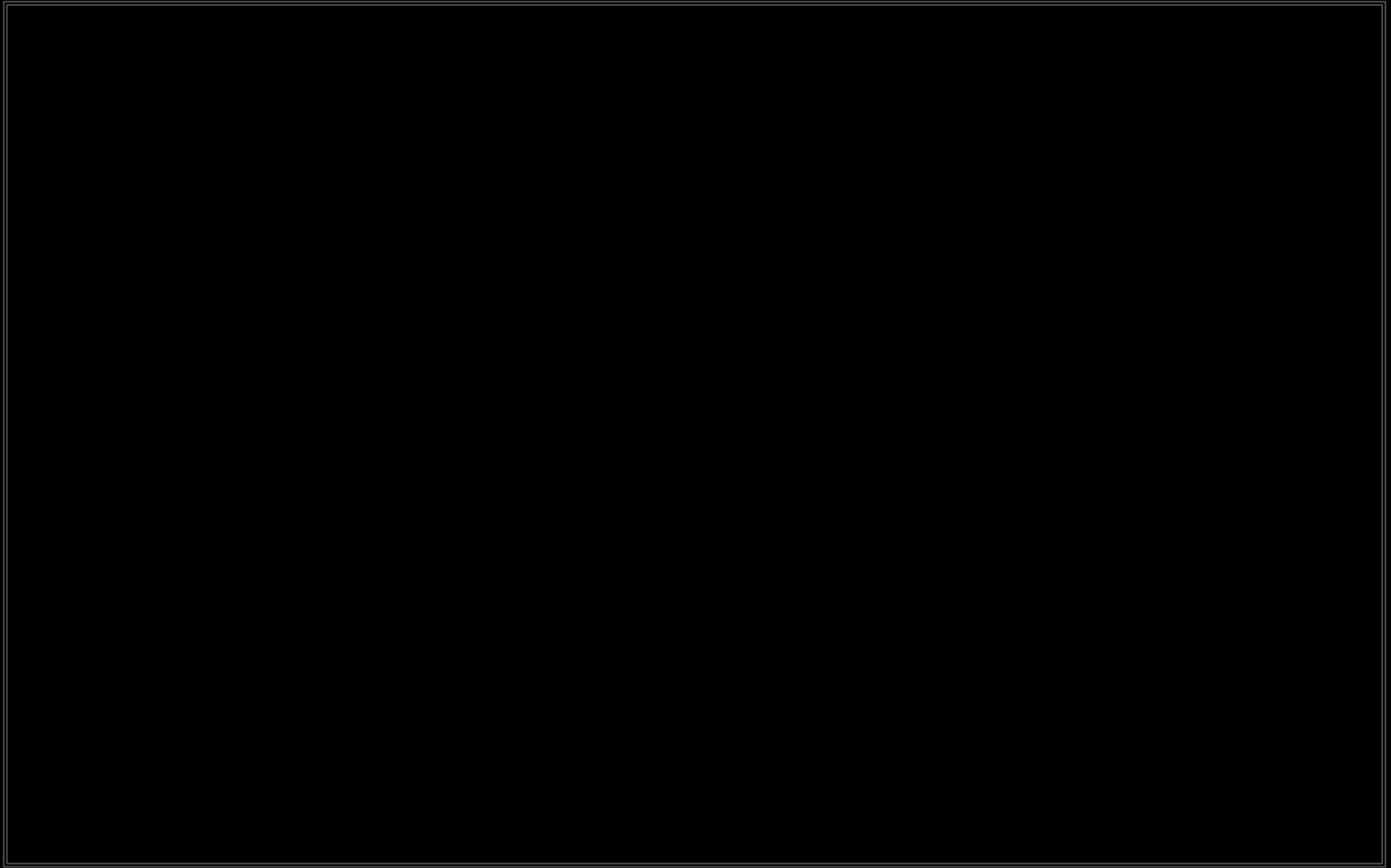
Murray Woods - John Parton

Ontario Terrestrial Assessment Program

Special Thanks to:

- BC Ministry of Forests
- ESSA Technologies Ltd. (Vancouver, BC)





Tree Level Input Data

Plot ID

Tree ID

* **Tree count**

Tree history

* **Species code**

* **DBH**

Diameter increment

Live height

Height to topkill

Height increment

Damage and severity

Tree value class

Prescription code

* **Required field**

**Input files are simple
ASCII text files.**

**Required fields must be
supplied for FVS to run.
FVS will dub in any
other needed information
which is missing from
the tree data file.**

Stand Level Input Data

- * **Stand ID**
- Inventory year**
- Latitude**
- Longitude**
- Location code**
- Plant association**
- Stand origin year**
- Aspect**
- Slope**
- Elevation**
- * **Basal area factor**
- * **Fixed plot size**
- * **Breakpoint DBH**
- Number of plots**
- Number nonstockable plots**
- Stand size**
- Stockable percent**
- Diam. growth meas. method**
- Diam. growth meas. period**
- Ht. growth meas. method**
- Ht. growth meas. period**
- Mortality meas. period**
- Maximum basal area**
- Maximum SDI**
- Site species**
- Site index**
- Model type**
- Physiographic region**
- Forest type**
- Grouping code**

* Required field