Session 1 – Background and Model Description
FVS Overview - outline

- FVS Background
- FVS Model Structure and Behavior
  - Data Needs and Requirements
  - Model Components
  - Example: Large Tree Diameter Growth
- FVS Suite Software
FVS: Background

- Represent species commonly found in a geographic region
- Local Data are used to create models that predict tree growth, mortality, and regeneration
The FVS Code repository:

Outside the FS firewall – Google Code

FVS Documentation:

Forest Service web site
FVS: Stand Inventory Data

Stand/Site:
- Location
- Ecological Code: Ecoregion, Plant Assoc, Habtype
- Slope
- Aspect
- Elevation
- Site Index
- Carrying Capacity (Max SDI/MaxBA)

Tree:
- Species
- DBH (required)
- Height
- Crown Ratio
- Past Growth Increment
- Tree Count (from inventory design)
Process Keywords
Read Input Data

Compute Initial Stand Characteristics

Backdate Densities
Compute Calibration Statistics

Check Event Monitor for Before Thinning Actions

Process Thinning and then Pruning Requests

Check Event Monitor for After Thinning Actions

Grow Large Trees
(in order: diameter, height)

Grow Small Trees
(height, diameter)

Compute Mortality

Adjust Growth and Mortality Estimates for Fire, Insect, and Pathogen Impacts

Add Regeneration

Compute Crown Ratio Change

Update Stand Characteristics
Compute Volume

More Cycles Scheduled?

Yes

No

Produce Final FVS Reports
FVS: Diameter Increment Model

- Based on a prediction of a mean growth rate that is corrected for tree size, site quality, and the level of competition

- Derive diameter increment (DG) from predicted periodic change in squared inside-bark diameter (DDS)

  - equivalent to a basal area increment model

  - linear relationship between $\ln(dds) \& \ln(DBH)$

$$
\ln(dds) = \text{SIZE} + \text{SITE} + \text{COMPETITION}
$$

$$
DG = \sqrt{\text{dib}^2 + dds} - \text{dib}
$$
**FVS: Tree Size Effects**

Size = ln(DBH) + DBH^2
Site = \text{fx}\{ \text{Location, Habitat Type, Site Index, Elevation, Slope, Aspect} \}
FVS: Site Conditions

- Location
  - US Forest Service National Forest
  - Code is based on Region, Forest
FVS: Site Conditions

- **Site Index**
  - single measure that integrates the effects of soil and climate on tree growth for a given site
  - used to identify potential height growth and affects diameter growth

- **Habitat Type**
  - Montana, Idaho (R1&R4)
  - List are in the back of the variant overviews
  - Embedded in diameter growth equations
FVS: Site Conditions

- Slope, Aspect, Elevation
- combined measures that integrate the effects of topography on tree growth for a given site
- can identify an optimal location for growth
- affects diameter growth

Wykoff 1990, Forest Science 36(4): 1077-1104
FVS: Competition Effects

\[ \text{Competition} = f(x)\{\text{Crown ratio, Relative Height, Crown Competition Factor, Basal Area, Basal Area in Larger Trees, Plot Level Basal Area in Trees Larger}\} \]
The diameter increment model shows how FVS is designed to handle differences in stand structure.

Focusing on the growth of individual trees allows FVS to handle most stand structures:
- even aged stands
- two-aged stands
- uneven-aged Stands
FVS Software

- Inventory Data Processors
- FVS Variant Growth and Yield Model
- Post Simulation Data Processors
- Suppose User Interface
FVS: Inventory Data Processors

- FSVeg (Field Sampled Vegetation tool)
- FFI (FEAT/FIREMON Integrated tool)
- FIA2FVS (Forest Inventory and Analysis)
- MS Access database
FVS: Growth and Yield

- Projects single or multiple stands in a single simulation
- Models stand development with and without taking into consideration forest health concerns
- Simulates user-defined management actions
  - thinning
  - regeneration harvests
  - fuels and fire management
FVS: Post Simulation Data Processors

- Viewing stand and tree outputs
- Yield tables
- Stand and stock tables
- Stand images (SVS)
- Linkages to GIS
FVS: Suppose User Interface

- Graphical user interface
- Uses common Windows based options
- Is an easy way to run FVS without having to understand the complex structure of the model
Model is supported by Forest Management Service Center: A sub-staff of the USDA Forest Service National Forest System National Headquarters Forest Management Staff

Located in Fort Collins, CO