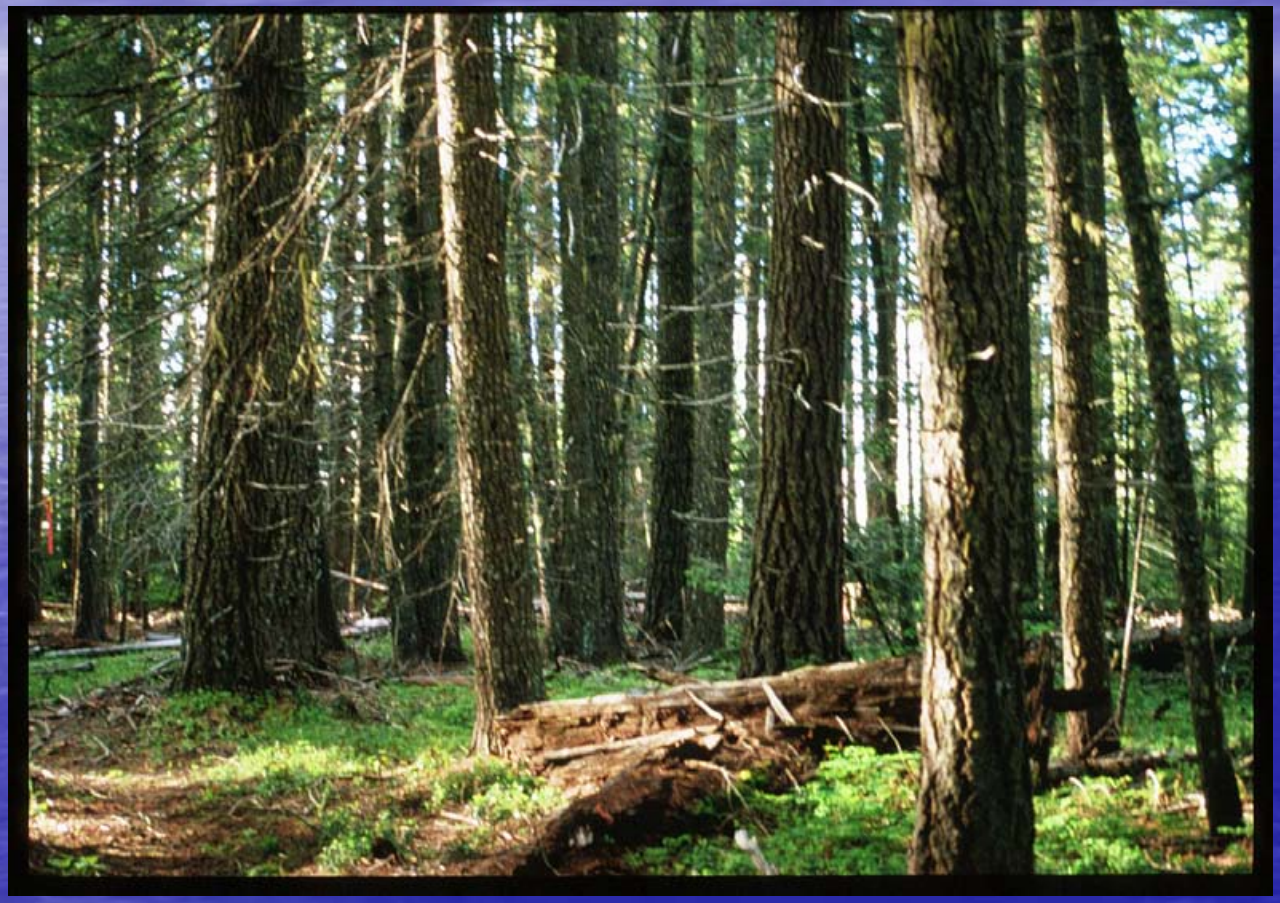
Bureau of Indian Affairs

Forest Management Program



Timothy Moriarty, Chief, BOFRP

Intertribal Timber Council – Vision 2000

- *"Forest resources are vital to the economic and social welfare of many Indian Nation and Native Alaskan Corporations. The management of these valuable and renewable resources not only provides income and employment opportunities for our people, but also affects our lives in many other ways. The harmony of man, trees , and other vegetation, soil, water, and wildlife, which collectively comprise the forest community influence our very emotional and spiritual well being….."*

NAEMI Biomass/Business Training Workshop
May 15-19, 2006
Spokane, WA

- What is forest management?
- What is a forest inventory?
- Why inventory or measure anything?
- What types of information do forest inventories provide?
- How do you quantify the current forest?

National Forest Managers Meeting
May 15-19, 2006
Spokane, WA

- What types of forest inventories are applied on forest lands?
- Sampling methods and techniques
- Project planning & field measurement
- Data processing/inventory analysis
- Forest biomass
- Forest models

Forest Management

- The application of business methods and technical forestry principles to the operation of a forest property.
- Business/Social aspects.
  - accounting, economics, admin.
  - social and political science
- Technological aspects.
  - silvics, silviculture, mensuration, etc.

Forest Management Information Needs

- Information exterior to the forest – landownership, physical facilities, markets, political and public relations, etc.
- Information from the forest – area data, timber volume, stand data, individual tree data, forest dynamics or change data, etc
- Operations Information – cutting budgets, cutting reports, personnel time/activity cost, equipment use/cost, etc.

Forest Inventory

- An attempt to describe the *quantity* and *quality* of forest trees and characteristic of the land upon which they exist
- Its purpose is to take stock of the resource (find out what there is and where it is at) and to furnish necessary information for determining how these resources can or should be managed.

Continued…

- Forest inventories gather information needed to serve purposes of management.
- It is built into and used as a control in the organizational framework for continuing management.
- It does not mean collecting data for its own sake.

Why Inventory or Measure Anything?

- Provides data for policy planning
- Provides data for management planning
- Provides data from which conclusions of research can be drawn.
- Quantitatively benchmarks current forest conditions

Quantitative Data

- *"When you measure what you are speaking about and express it in numbers, you know something about it, but when you cannot (or do not) measure it, when you cannot (or do not) express it in numbers, your knowledge is of a meager and unsatisfactory kind". – Lord Kelvin 1824 – 1907 English physicist and mathematician*

Big Cypress Reservation

Qualitative Data

- *" When I use a word, it means exactly what I want it to mean, neither more or less." Humpty Dumpty*

“Hey Bubba – That’s one big gator”

What types of information do forest inventories provide?

- Forest acreage by cover type
- Species composition & stocking
- Tree size and distribution by class
- Wood quantity and quality
- Fuel loads and fire hazard
- Growth, harvest & mortality

How do you quantify the current forest?

- Determine resource question
- Determine what information is available
- Determine what needs to be collected
- Select a sampling scheme
- Select measurement techniques
- Train crews
- Implement the field procedures (Q&A)
- Process and check data
- Presents results with information and procedures

What types for forest inventories are applied on forest lands?

- Independent sampling systems – inventories designed to get a certain body of information at a given time.
- Permanent sampling systems – provide a continuing and consistent flow of information. Identical areas and trees are remeasured.
- Unit area systems – inventories designed to give on the ground forest information by individual stands to guide their treatment.

Examples of CFI Plots

Plot 543

N	E
S	W

Plot 109

N	E
S	W

Sampling Methods

- Selective sampling
- Simple random sampling
- Systematic sampling
- Stratified random sampling

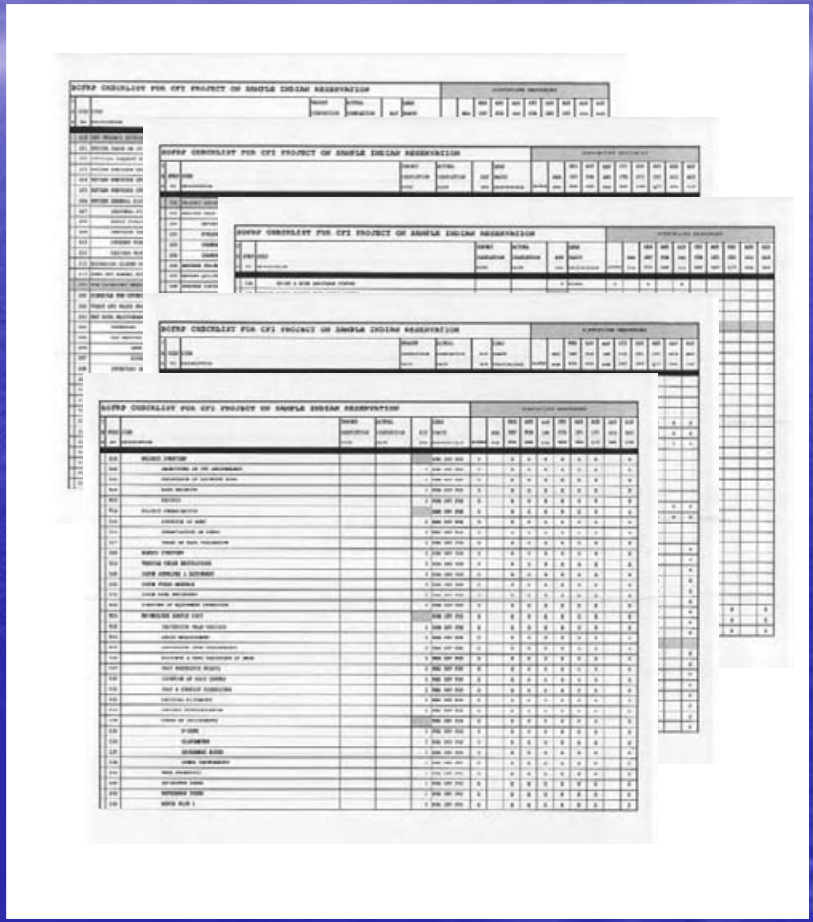
Sampling Techniques

- One-hundred percent cruise
- Strip method
- Fixed Plot
- Variable-plot sampling (probability proportional to size – prism)
- 3P sampling (probability proportional to prediction)

Project Planning

Project Initiation

- Purpose of inventory.
- Existing Data and Inventory systems.
- Design to meet management needs
- Define responsibilities and timeline
  - Keeps all parties informed of project status



Project Initialization – Goals and Objectives

- Goal:
  - Ensure that all aspects of the project initialization are completed in a timely fashion
- Objectives:
  - Document project timeline, assignments and responsibilities
  - Field manual that is clear, concise and meets regional standards
  - Data processing tools are in place that calculate the values that are of interest.

Field Measurement

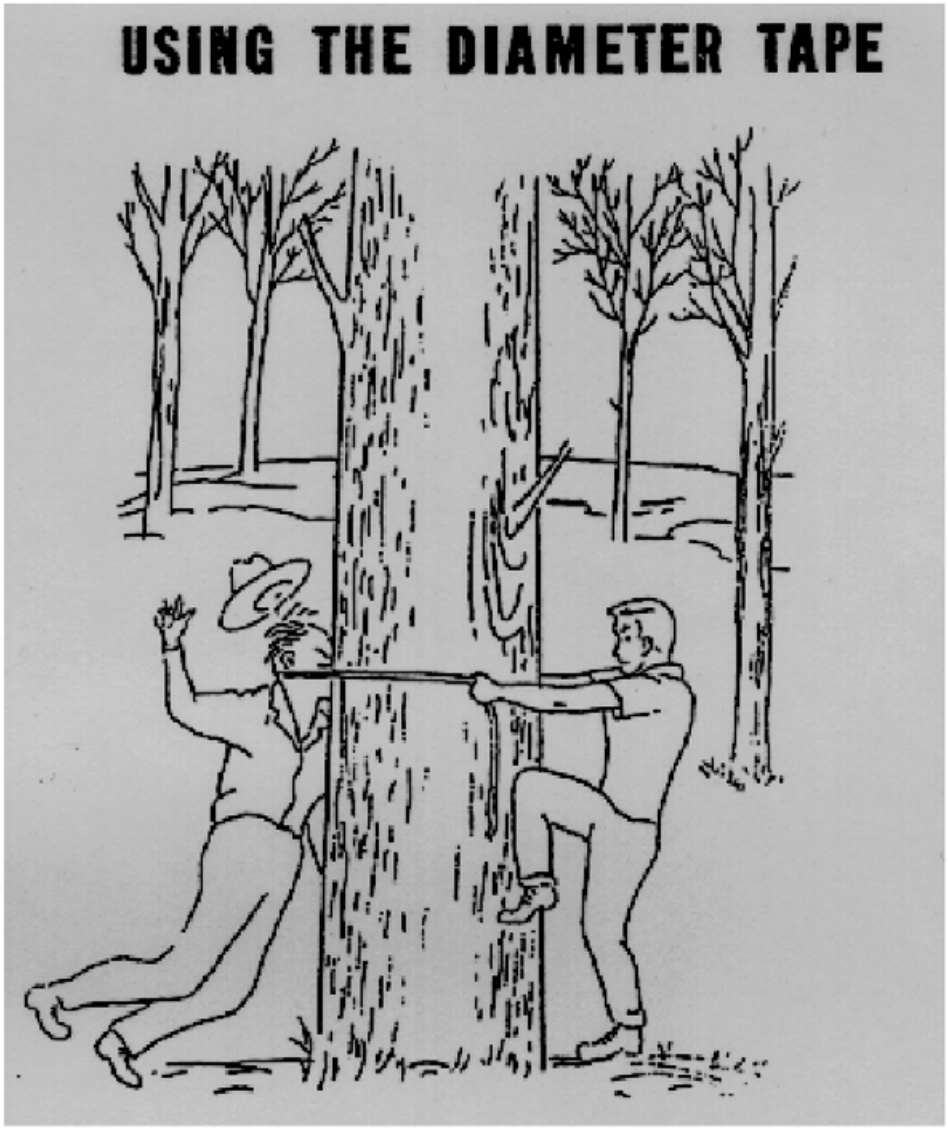
- Field Training
- Field Collection
- Data Quality

Field Work – Goals and Objectives

- Goal:
  - Collect the best data possible in the most efficient manner
- Objectives:
  - Train qualified personnel
  - Provide proper tools to ensure quality data
  - Ensure quality control processes are followed

Field Training

- Proper training of crews imperative to ensuring good inventory data
- Time must be invested during the startup phase of inventory to ensure understanding
- Scheduled just prior to measurement start
  - Review field manual
  - Work at plots
  - Proper use of tools
- Office procedures just as important as field procedures
  - Walk through data entry
  - Walk through error checking



Delaying Field Training Leads to .....

Field Training

Timely Quality Control & Error Checking

- Timely
  - Catch field and application errors right away
  - Field crews still in woods
- Delayed
  - Compound & multiple errors
  - Crews no longer on site
  - Some errors can't be fixed from the office
  - Higher cost

Quality Control Experience

- Timely
  - 200 Plots
  - 27 Checked
  - (13.5%)
  - 0 Revisited
  - (0%)
  - 14 Person days
- Delayed
  - 317 Plots
  - 0 Checked
  - (0%)
  - 273 Revisited
  - (86%)
  - 85 Person days

Which would you prefer?

Total Tree Biomass

- The total dry material of a tree, from root tips to leaf hairs.
- Includes wood, bark, and foliage including standing dead material

Total Tree Biomass Distribution (dry weight)

- Stump/root system (17-23%)
- Merch. Bole to 4-inch top (55-65%0
- Crown wood (15-20%)
- Weight density - lbs/cuft

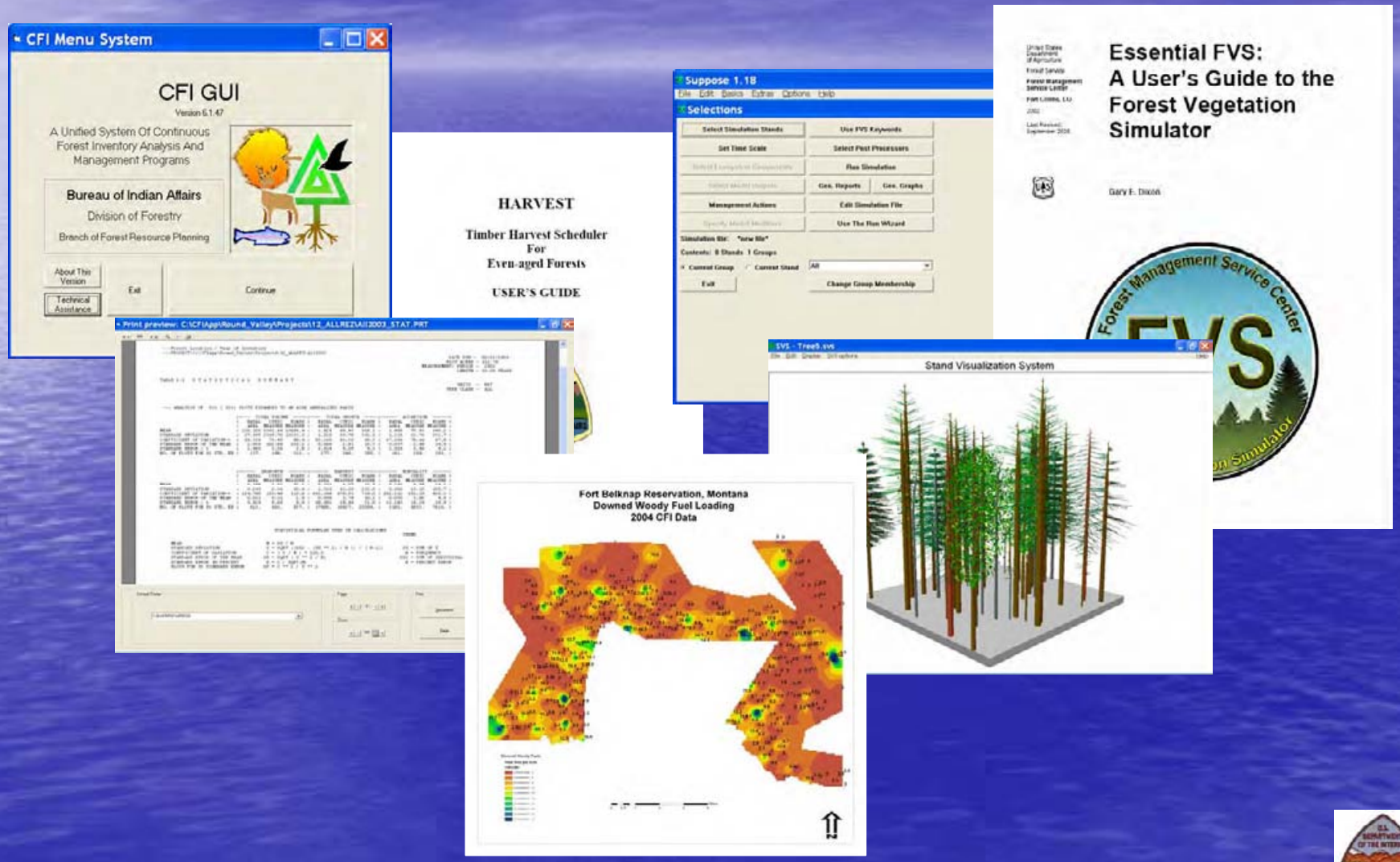
Forestry Operations - Biomass

- Generally refers to commercially marketable portion of tree (Above ground).
- Large Trees - poles or plywood bolts from lower portion, sawlogs from mid-portion and pulpwood bolts from upper most section.
- Small trees – pulpwood, fuelwood, fence posts, mine props, etc.

Continued …

- Topwood – volume between the sawlog top (9.0”) and the pulpwood top (4.0”)
- Crownwood – volume above the pulpwood top (4.0”) including the limbs

Inventory Analysis



National Cruise Program

185 Subroutines

439 variables

69,026 total lines

15,486 comment lines

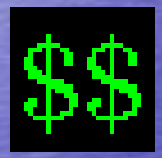
7 output files

218 reports

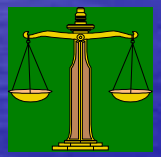
1.6 MB

Equations

VOLUME



VALUE



WEIGHT

QUALITY ADJUSTMENT

Weight Equations

Species code	Product code	Equation number	LBS/unit primary	LBS/unit secondary
AF	01	GENPP002	10.00	9.00
AF	02	GENPP002	10.00	9.00

Available Biomass From Harvest Operations

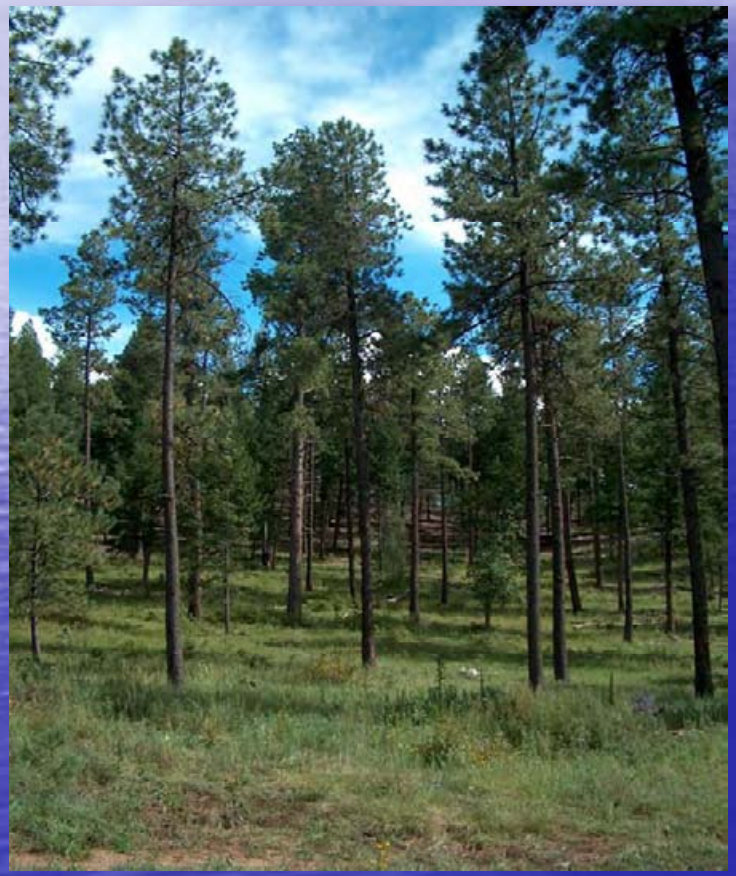
- Resource Management Objective
- Standing Inventory
- Forest Structure and Density
- Forest Health
- Future Target Forest Objectives
- Silvicultural Prescription Applied
- Harvest Equipment Utilized
- Wood Products Market

Harvest Operations

Before Treatment

After Treatment

To be successful all aspects of forest management plan, including silviculture, fuels, etc. must be considered and well coordinated.



Local Biomass Project

- Resource Assessment
- Market Analysis
- Economic Evaluation

Forest Models

- Forest Vegetation Simulator (FVS)

  - a growth & yield model that predicts forest stand dynamics under various management alternatives
- Forest Projection System (FPS)

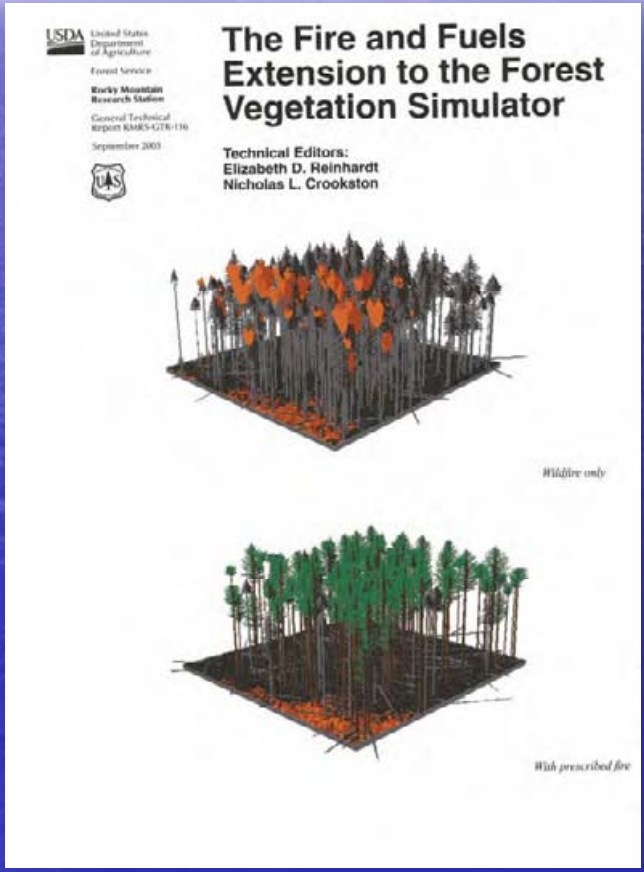
  - integrated forest inventory, growth projection and forest planning software

FVS Main Output

- **Input Summary Table**
  Keywords, scheduled activities, error messages and calibration statistics
- **Stand Composition Table**
  Stand attributes by species and diameter based on percentile
- **Tree and Stand Attributes Table**
  Cross-section of tree response to changes in stand structure
- **Summary Statistics Table**
  TPA, BA, SDI, QMD, MAI, accretion, mortality, total and merchantable cubic foot and board foot harvest volumes

```
------------------------------------------------------------------------------------------------------------------------------
                                                OPTIONS SELECTED BY INPUT
------------------------------------------------------------------------------------------------------------------------------
KEYWORD    PARAMETERS:
-------    ----------------------------------------------------------------------------------------------------------------
STDIDENT   STAND ID= C315S01          Stand C315S01 at Smokey District

STDINFO    FOREST-LOCATION CODE=  80308; HABITAT TYPE=  0; AGE=  77; ASPECT AZIMUTH IN DEGREES=  0.; SLOPE=  0.%
           ELEVATION(100'S FEET)=  0.0; LATITUDE IN DEGREES=  0.

DESIGN     BASAL AREA FACTOR=  10.0; INVERSE OF FIXED PLOT AREA=   1.0; BREAK DBH=   0.0
           SEE "OPTIONS SELECTED BY DEFAULT" FOR PLOT COUNTS AND SAMPLING WEIGHT.

THINBBA    DATE/CYCLE= 2007; RESIDUAL=  80.00; PROPORTION OF SELECTED TREES REMOVED= 1.000
           DBH OF REMOVED TREES WILL RANGE FROM  0.0 TO 999.0 INCHES, AND
           HEIGHT OF REMOVED TREES WILL RANGE FROM  0.0 TO 999.0 FEET.

THINABA    DATE/CYCLE= 2027; RESIDUAL=  60.00; PROPORTION OF SELECTED TREES REMOVED= 1.000
           DBH OF REMOVED TREES WILL RANGE FROM  0.0 TO 999.0 INCHES, AND
           HEIGHT OF REMOVED TREES WILL RANGE FROM  0.0 TO 999.0 FEET.

OPEN       DATA SET REFERENCE NUMBER =   2; BLANK=ZERO; STATUS=UNKNOWN
           MAXIMUM RECORD LENGTH (IGNORED ON SOME MACHINES) = 150; FILE FORM= 1 (1=FORMATTED, 2=UNFORMATTED)
           DATA SET NAME = C315S01.trx

TREEDATA   DATA SET REFERENCE NUMBER=  2

CLOSE      DATA SET REFERENCE NUMBER =   2

SPLABEL    STAND POLICY LABEL SET:
           All, C315

PROCESS    PROCESS THE STAND.
------------------------------------------------------------------------------------------------------------------------------
                                                OPTIONS SELECTED BY DEFAULT
------------------------------------------------------------------------------------------------------------------------------

TREEFMT    (I4,T5,I7,F6.0,I1,A3,F4.1,F3.1,2F3.0,F4.1,I1,3(I2,I2),2I1,I2,   2I3,2I1)

DESIGN     BASAL AREA FACTOR= 10.0; INVERSE OF FIXED PLOT AREA=   1.0; BREAK DBH=   0.0
           NUMBER OF PLOTS=   10; NON-STOCKABLE PLOTS=    0; STAND SAMPLING WEIGHT= 10.00000

           SITE SPECIES=NO CODE=  100
------------------------------------------------------------------------------------------------------------------------------

                                                ACTIVITY SCHEDULE
------------------------------------------------------------------------------------------------------------------------------
CYCLE  DATE  EXTENSION  KEYWORD   DATE  PARAMETERS:
-----  ----  ---------  -------  ----  ----------------------------------------------------------------------------------
  1   1997
  2   2007    BASE     THINBBA   2007     80.00     1.00     0.00   999.00     0.00   999.00
  3   2017
  4   2027    BASE     THINABA   2027     60.00     1.00     0.00   999.00     0.00   999.00
------------------------------------------------------------------------------------------------------------------------------

CALIBRATION STATISTICS:

                                                  SN   WP   MO
                                                  ---  ---  ---
NUMBER OF RECORDS PER SPECIES                       6   18   77

NUMBER OF RECORDS WITH MISSING HEIGHTS              6   18   77

NUMBER OF RECORDS WITH BROKEN OR DEAD TOPS          0    0    0

NUMBER OF RECORDS WITH MISSING CROWN RATIOS         6   18   77

NUMBER OF RECORDS AVAILABLE FOR SCALING
THE DIAMETER INCREMENT MODEL                        0    0    0

RATIO OF STANDARD ERRORS
(INPUT DBH GROWTH DATA : MODEL)                  1.00 1.00 1.00

WEIGHT GIVEN TO THE INPUT GROWTH DATA WHEN
DBH GROWTH MODEL SCALE FACTORS WERE COMPUTED     0.00 0.00 0.00

INITIAL SCALE FACTORS FOR THE
DBH INCREMENT MODEL                              1.00 1.00 1.00

NUMBER OF RECORDS AVAILABLE FOR SCALING
```

FVS - Fire and Fuels Extension



FFE – continued…

- Volumes calculated by FVS (National Volume library)
- Live tree & hard snag bole volumes converted to biomass using wood weight densities given by Brown and others (1977).
- Biomass tracked & reported by dry weight
- DF 31.9 lb/cuft; PP 26.4 lb/cuft

FFE continued…

- FFE estimates tree crown material on each tree using equations in Brown and Johnson (1976).
- Estimates total dry weight of live & dead material in each crown, as well as foliage.
- 0-0.25”, 0.25-1.0”, 1.0-3.0”, 3.0”+ branchwood

FFE continued…

- YARDLOSS keyword specifies portion of crown material from harvested trees to be left in the woods.
- Can specify harvested tress left in the stand as standing dead or felled.
- Default FFE assumes all harvested boles are removed but crown material is left in the woods.
- Whole tree yarding can be simulated

FUELOUT

- FUELOUT keyword provides a detailed fuel report showing surface fuels and stand wood.
- Fuel in specific years or intervals.
- All values, including live components given in dry weight tons per acre.
- Biomass removed shows amount of wood harvested.

Fire and Fuels Extension

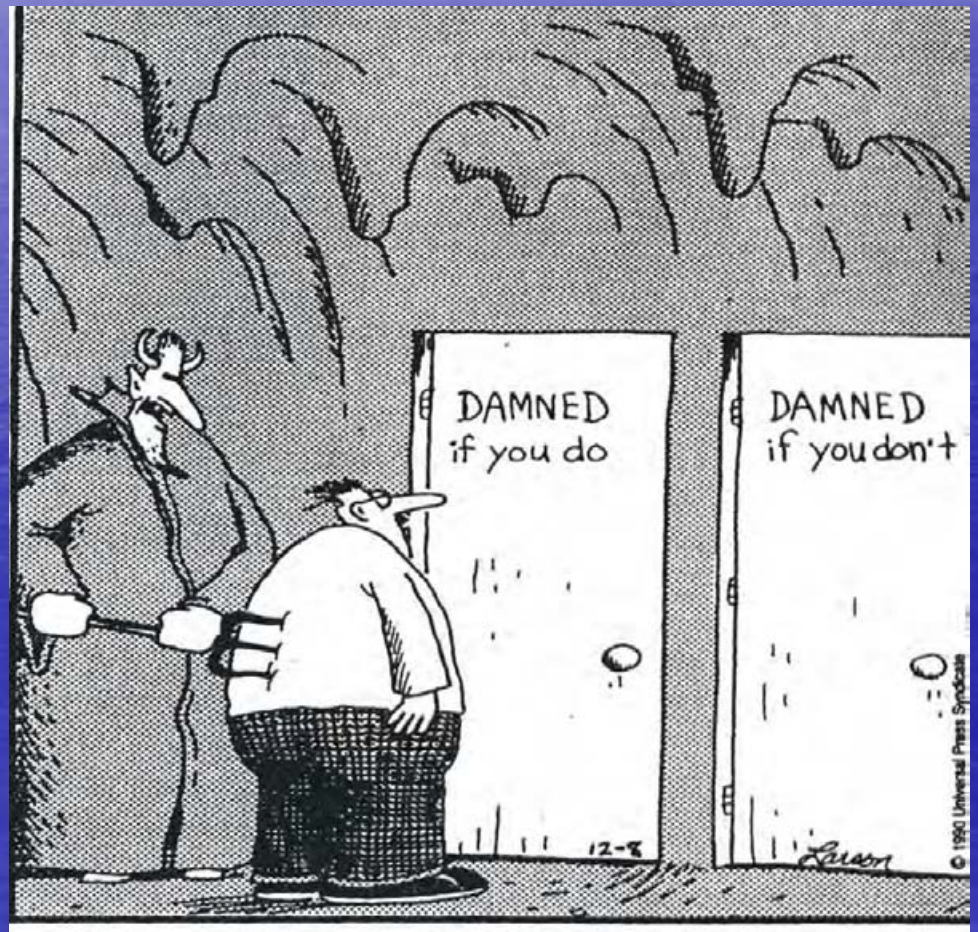
Fire and Fuels Extension

Fire and Fuels Extension

Timothy Moriarty
Bureau of Indian Affairs
Division of Forestry
Branch of Forest Resources Planning
12136 W. Bayaud Ave., Suite 300
Lakewood, CO 80228

303-969-5270 x238 or 720-407-0632

FINIS



"C'mon, c'mon — it's either one or the other."