

# The Economic Analysis of Biomass Utilization

**Introduce the BioSum Tool**

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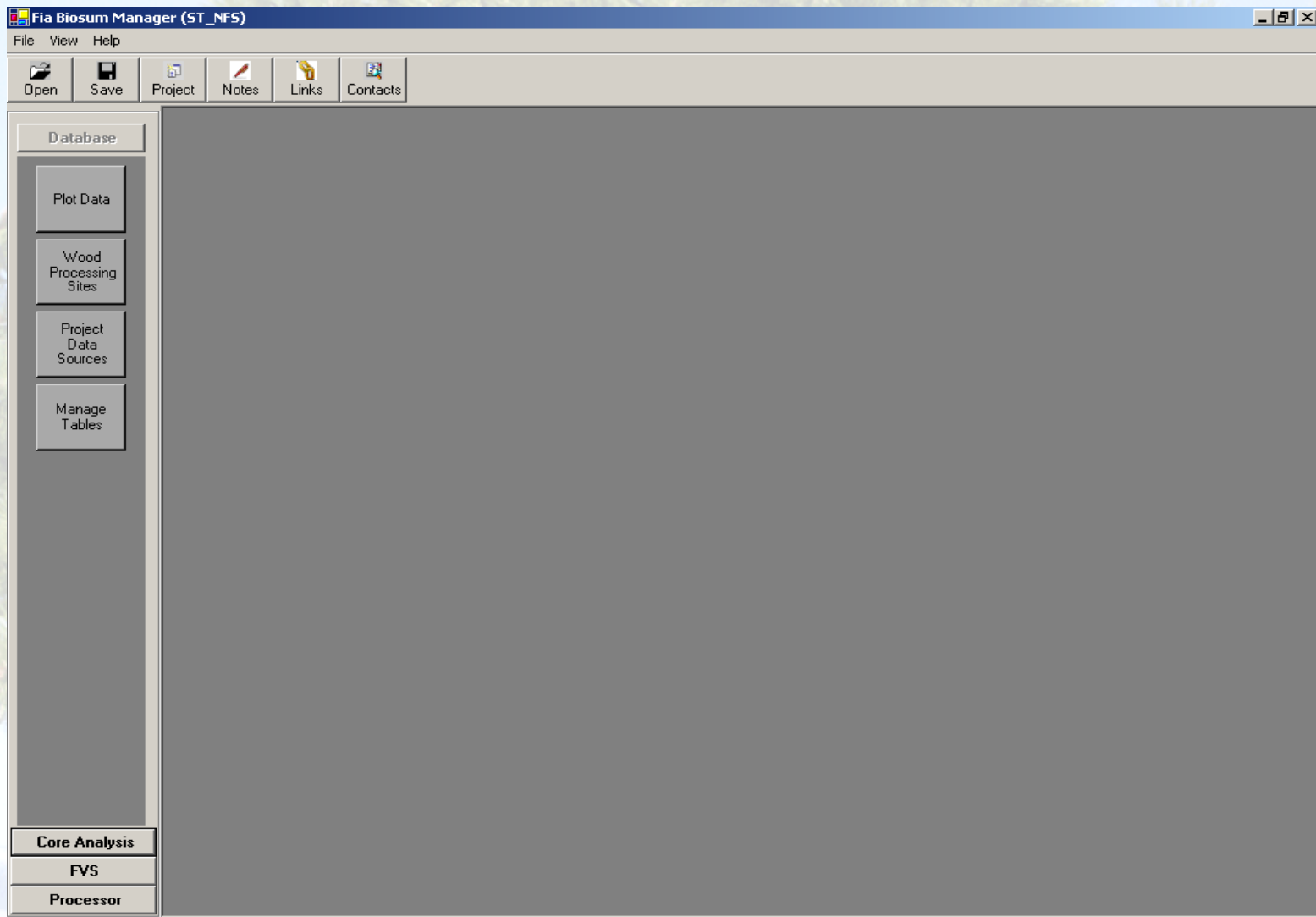
**Pacific Northwest Research Station  
USDA Forest Service**



# What is BioSum

- BioSum stands for **B**iomass **S**ummarization System
- BioSum is a tool and developed by PNW Research Station FIA Program (Jeremy Fried, Larry Potts, Dale Weyermann, Glenn Christensen, Bruce Hiserote)
- BioSum uses off-the-shelf models/software: GIS, FVS and FRCS in a modular way
- BioSum has four major modules: Database, FVS, Processor and Core analysis

# Interface of BioSum Manager



# Major Steps in Using BioSum

- Step 1 Loading plots (FIADB or PNWIDB)
- Step 2 Spatial analyses (GIS)
- Step 3 Simulating treatments at stand level (FVS)
- Step 4: The Processor (FRCS)
- Step 5: Core Analysis (Scenario analysis)

# Basic Data Requirements

- Forest inventory data: FIADB or PNW-IDB data format (plot, condition and tree tables)
- Road information: road layer with roads classified by road speed (mph)
- Processing facility locations for merchantable product and biomass
- Silviculture prescriptions (for FVS)
- Forest product prices and parameters for harvest and transportation costs

# Inventory data input

Database: Add Plot Data ✕

*Plot Data Input*

Inventory Type

**FIADB Data**

**PNW IDB Data**


Input Data Source Type

Access Tables

FIADB Text Files (\*.csv)

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# Example of FIADB input

Database: Add Plot Data 


*Plot Data Input*

FIADB Access MDB Input


Plot Data



Condition Data



Tree Data



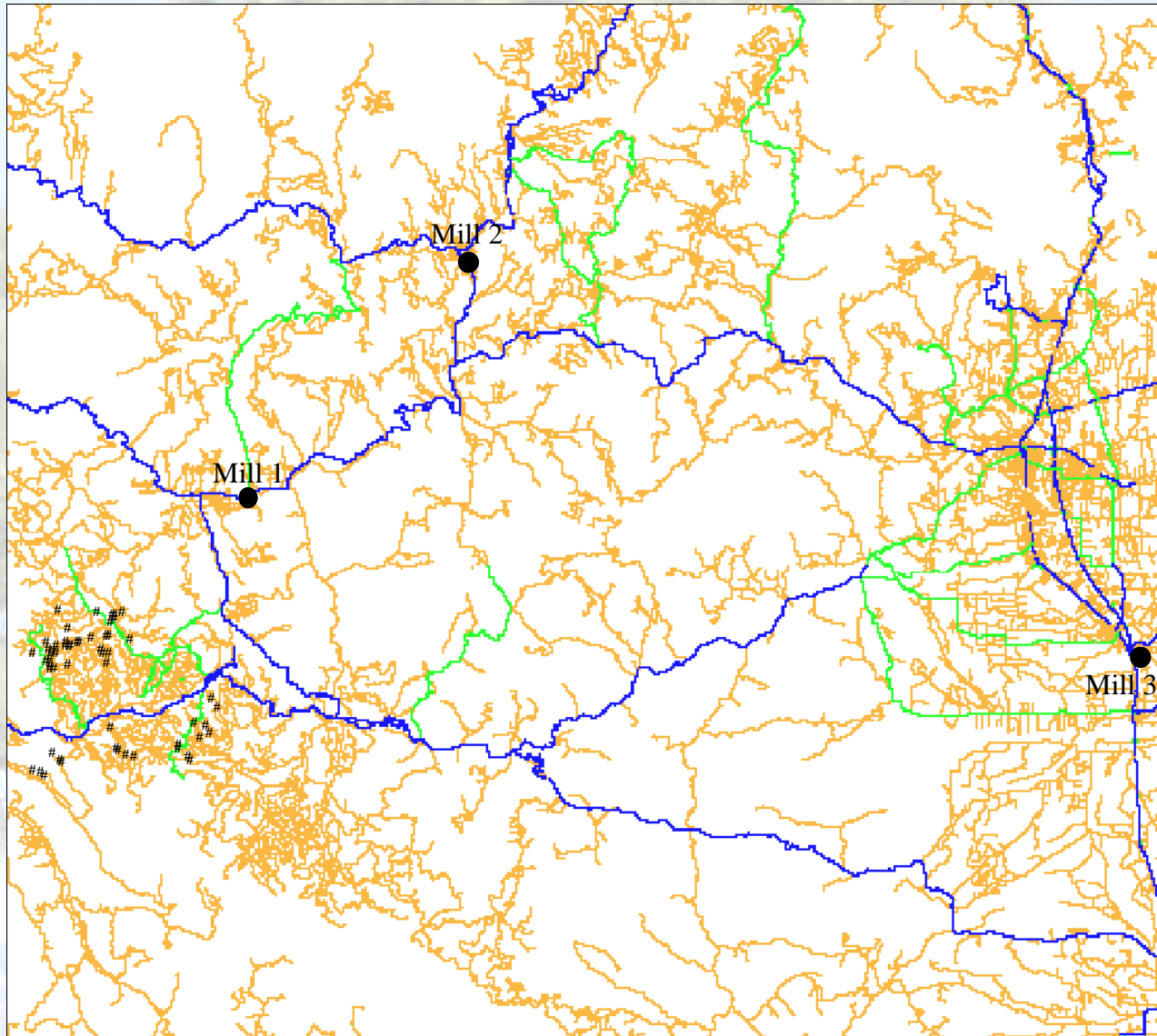
# GIS ArcMap

(TTC --- Travel Times Calculator)

- Estimates the travel time of transporting harvested materials from forested plots to each of the processing sites in hours
- Travel time data stored in Access database table
- Require point layers of plot locations and processing site locations and raster layer (grid) of road speeds
- ArcGIS 9.2 or later version



# Road classes and mill locations



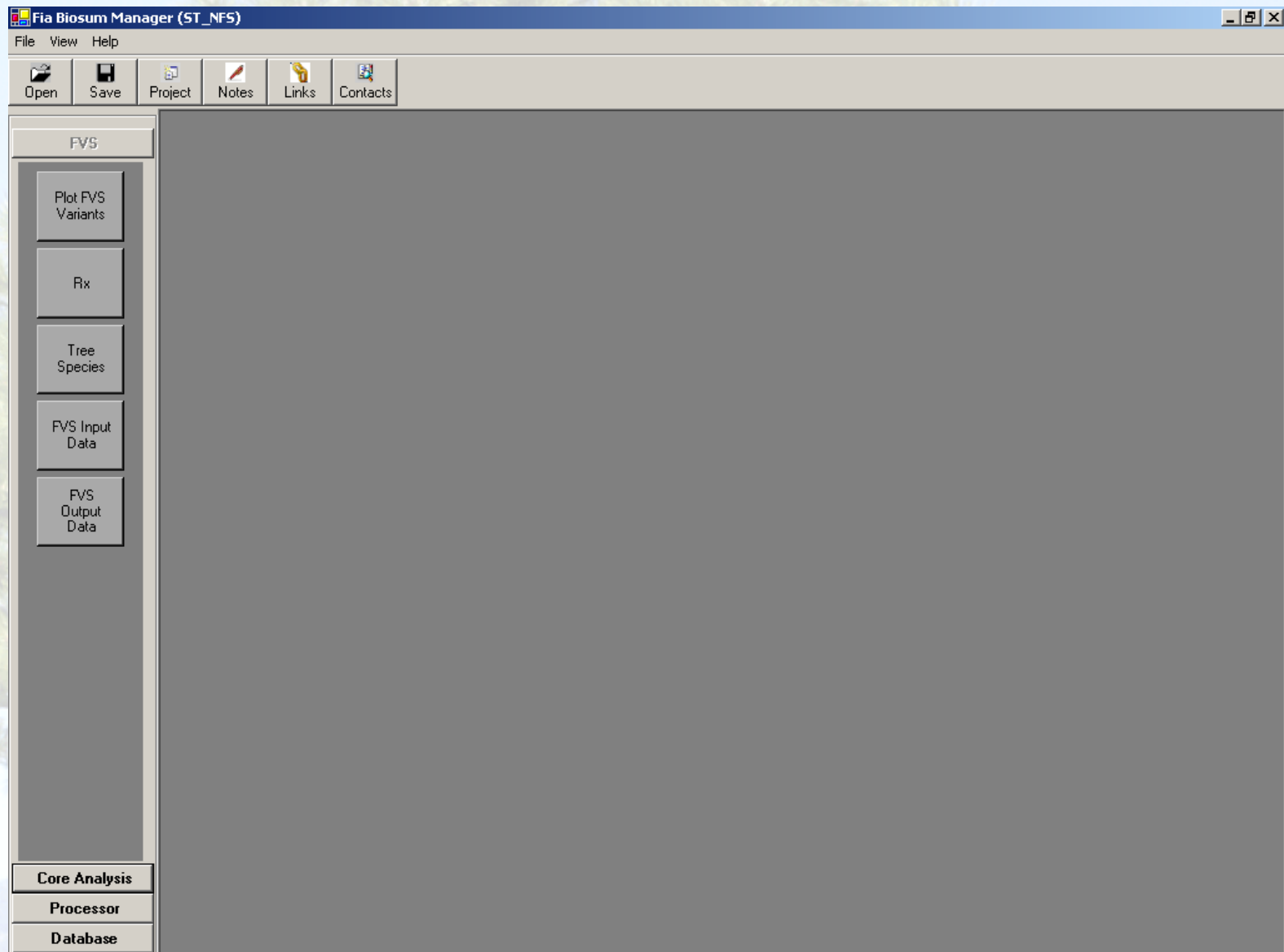
# Example of travel time (hour)

TraTime_id	Mill_id	Biosum_plot_id	railhead_id	Travel_time
1	1	120070601011050000001000		0.856
2	1	120070601011050000007000		0.938
3	1	120070601011050000010000		0.988
4	1	120070601011050000011000		0.959
5	1	120070601011050000012000		0.985
6	1	120070601011050000013000		0.996
7	1	120070601011050000020000		1.022
8	1	120070601011050000023000		1.06
9	1	120070601011050000024000		1.056
10	1	120070601011050000025000		1.104

# Forest Vegetation Simulator (FVS)

- Simulate the stand fuel treatments and obtain tree cutlists and fire potential data with 6 major steps
- Step 1: Assign FVS variants
- Step 2: Define and label silvicultural treatments
- Step 3: Inspect and assign FVS trees species codes
- Step 4: Create FVS input files
- Step 5: Processing treatments using the FVS
- Step 6: Combine all FVS outputs into a single database table

# Interface of FVS Module



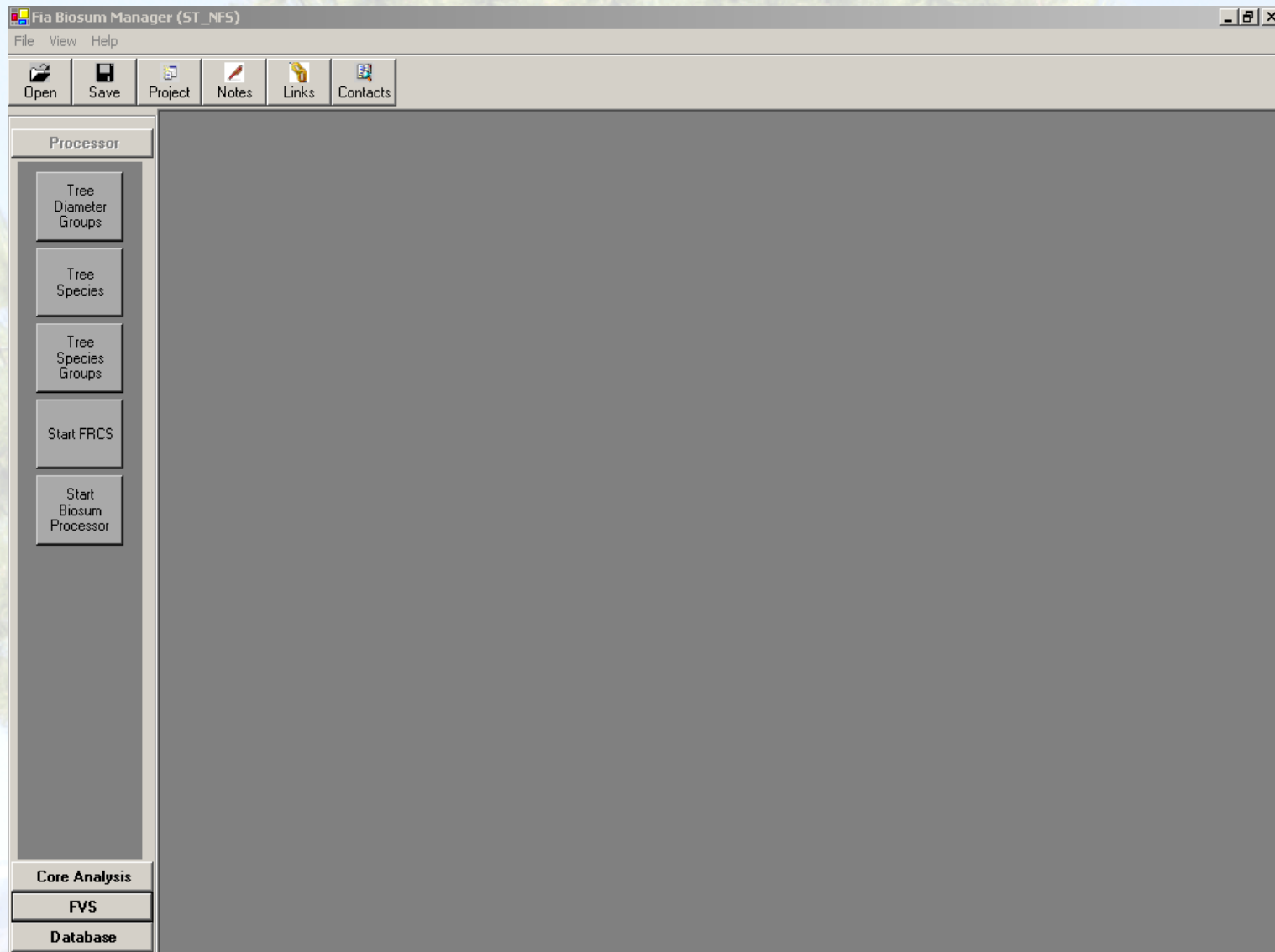
# Processor

- Define tree diameter groups and tree species groups
- Stand level summaries of projected yields of merchantable wood and “dirty chips” based on FVS output
- Calculates harvest and hauling costs based on the input data prepared (\$/acre for each plot and treatment)
- Estimates cost of transporting harvested materials from forested plots to processing sites based on the TTC output through FRCS

## Processor (cont.)

- FRCS define parameters: cutting type (partial cutting, clear cut, etc.), harvesting system, residue Handling)
- FRCS require average cubic foot value (\$/cf) for each species group and diameter class
- Start processor

# Interface of Processor Module

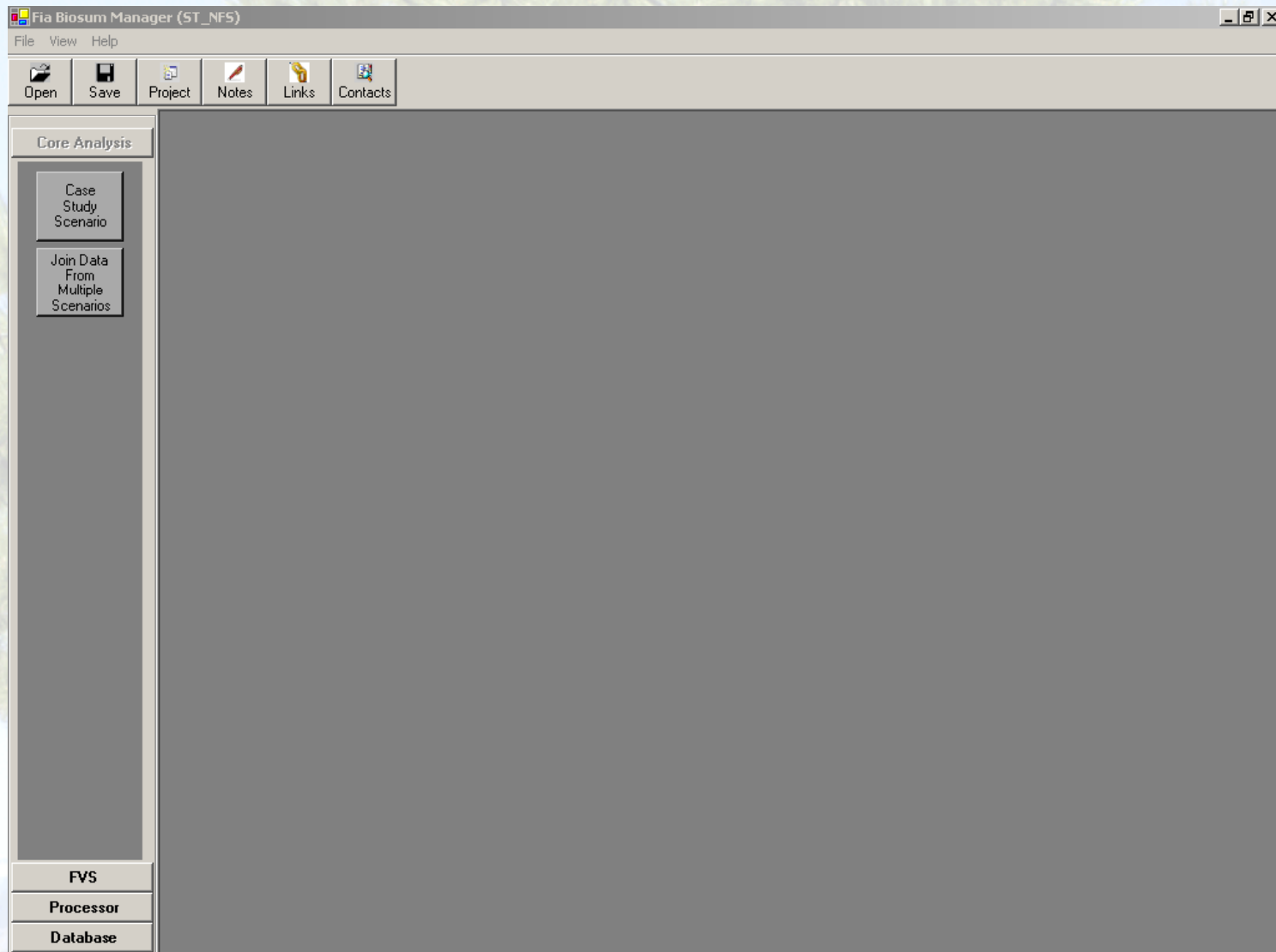


# Core Analysis

- Applies a set of user defined rules to the data output to identify effective and best treatments
- Rules guiding the choice of which treatment is “best” on each plot
- Rule definitions allow specification of land ownership groups to consider for treatment, definition of treatment effectiveness regarding crown fire potential and constraints/assumptions regarding cost and revenue —→ Scenarios
- Results of scenarios can be easily viewed and further manipulated via queries in MS Access



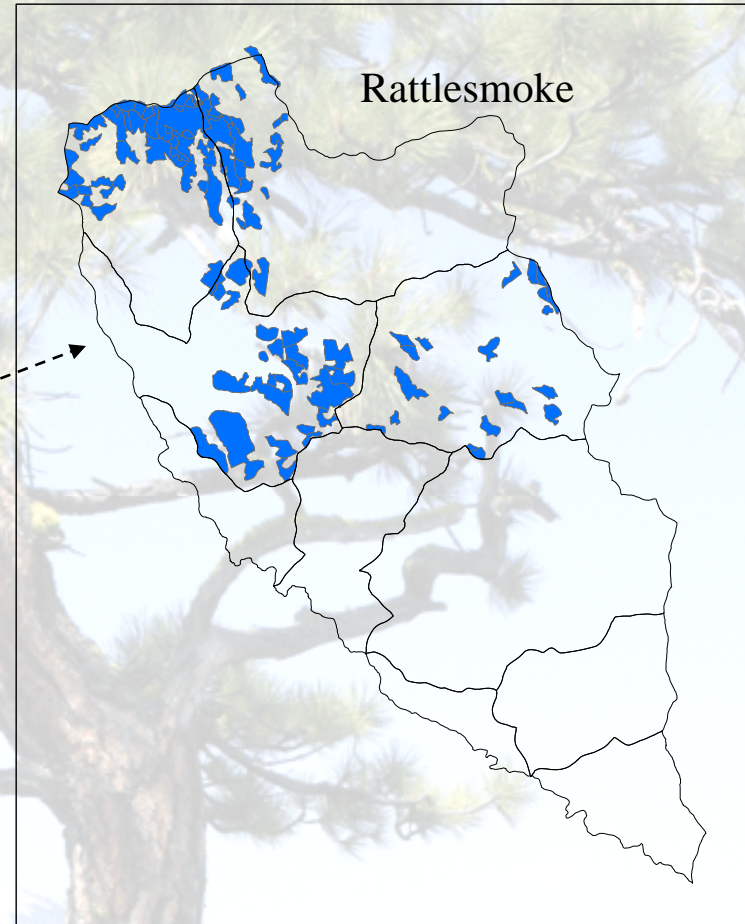
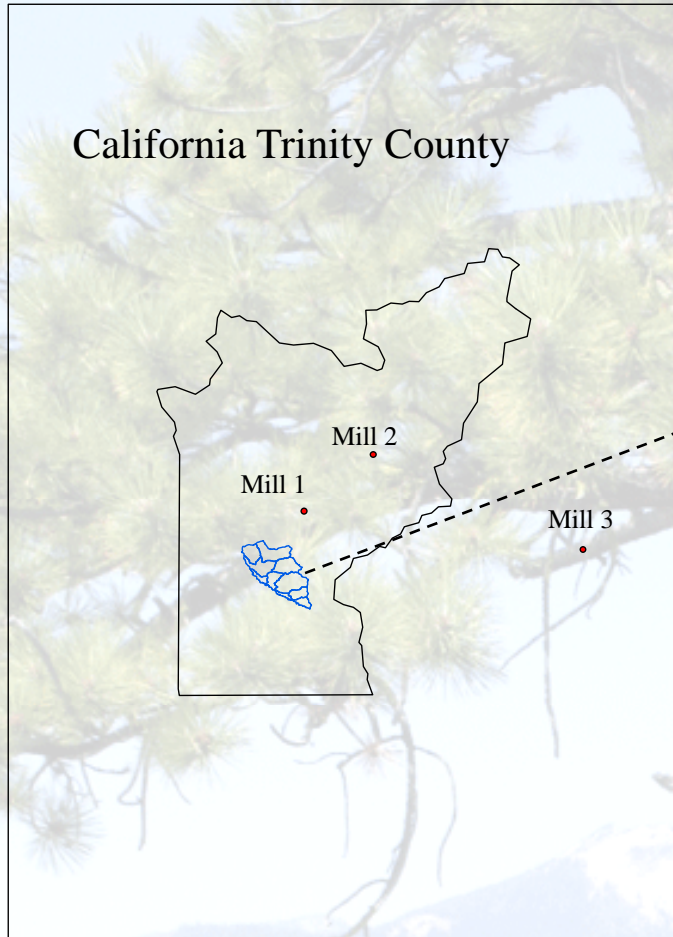
# Interface of Core Analysis



# Shasta National Forest

- Inventory data in FVS database format ---  
Converted to FIADB format
- Total 55 stands, 854 acres for natural stands and  
526 for plantation stands
- Three mills provided including (Hayfork,  
Weaverville and Whellabrator in Anderson)
- The treatment prescriptions from Shasta NFS
- Road layer from PNW-FIA and Shasta NFS Shasta  
NFS

# Study Region



# Product-Yield-Cost-Value-Profit (Example)

Biosum_cond_id	Rx	Chip_Yd	Mch_Yd	Chip_V	Mch_V	Hvst_cpa	haul_C_cpa	haul_M_cpa	Mch_C_nr	M_nr_dpa
500000400002	B	544.8	399.1	235.7	654.1	89.0	20.3	14.9	765.7	550.2
500000130002	B	576.7	378.0	256.3	465.3	86.0	28.4	18.5	588.7	360.8
500000240002	B	627.7	383.3	293.0	347.3	145.4	34.4	20.8	439.8	181.2
500000300002	B	384.3	234.3	169.0	287.0	91.6	20.8	12.6	331.0	182.8
500000250002	B	328.1	206.6	145.5	289.6	89.7	17.9	11.2	316.3	188.6
500000100002	B	384.4	236.2	166.7	273.9	123.4	18.3	11.3	287.7	139.3
500000230002	B	261.7	175.9	114.2	250.7	61.6	13.5	9.0	280.8	180.0
500000010001	B	197.7	130.7	84.8	130.8	51.0	8.1	5.3	151.1	74.4
500000110002	B	171.8	110.2	75.0	139.6	59.9	8.0	5.1	141.6	74.6
500000200002	B	108.6	63.2	53.9	65.8	44.3	6.1	3.5	65.7	17.9
500000310002	B	69.7	42.8	39.2	43.3	32.5	4.8	2.9	42.3	8.0
500000260002	B	44.9	28.3	19.7	28.6	33.2	2.4	1.5	11.2	-6.1

Yield in thousand cubic feet and cost and value in thousand dollars



# Thank You

Contact Jeremy Fried in PNW-FIA program for more information about BioSum

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