M A G I S

Multi-resource

Analysis and

Geographic

Information

System

Developed by:

☆ Rocky Mountain Research Station

☆ University of Montana

MAGIS Description

★ Schedules Vegetation Treatments

　　★ User-specified Objectives

　　★ Access availability

★ Schedules Road Activites

　　★ User-specified Objectives

　　★ Access Needs

★ Solver analyzes vegetation treatments and road activities simultaneously

Why do optimization modeling?

- Large problems not easily solvable by 'back-of-the-hand' modeling
- Most prudent use of public money
    - Can save thousands of $$
- Most 'efficient' solution for veg and network problems
- Ecosystem benefits balanced with economic benefits

maGIS based SPATIAL analysis
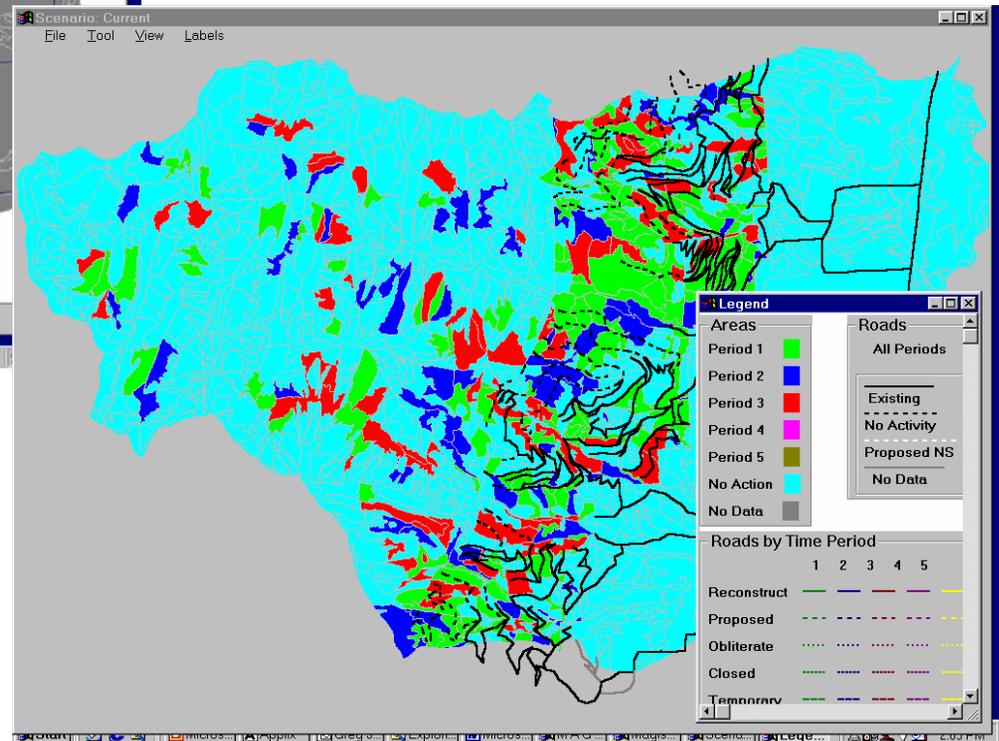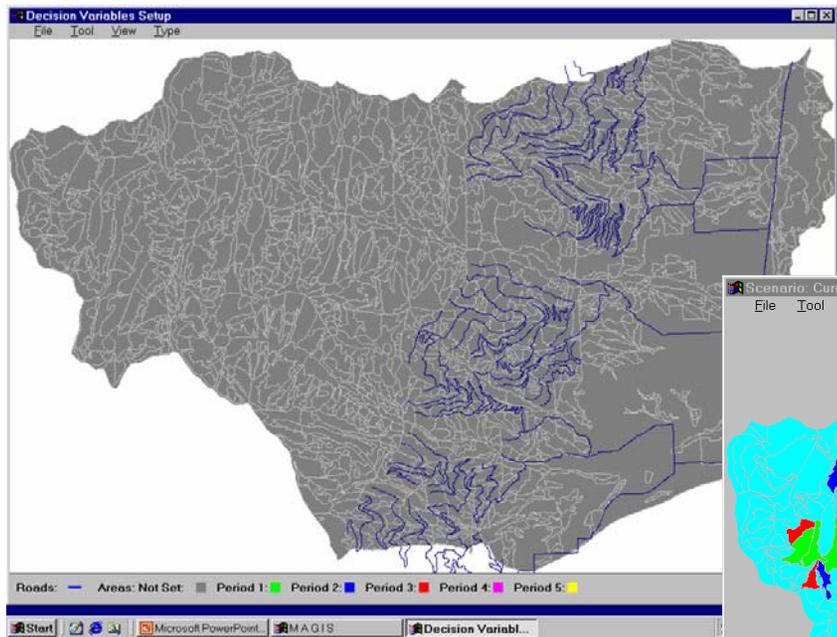
GIS coverages used as data input

Land Management Parameters

- Management Regimes
  - Prescribed Fire
  - Mechanical Thinning
  - Harvesting at various levels
    - Yarding methods
- Vegetation Characteristics
  - Successional changes
  - Residual Volume and Growth
  - Mortality

Transportation Parameters

⭐ Road Activities

    ⭐ Construction (temporary or classified)

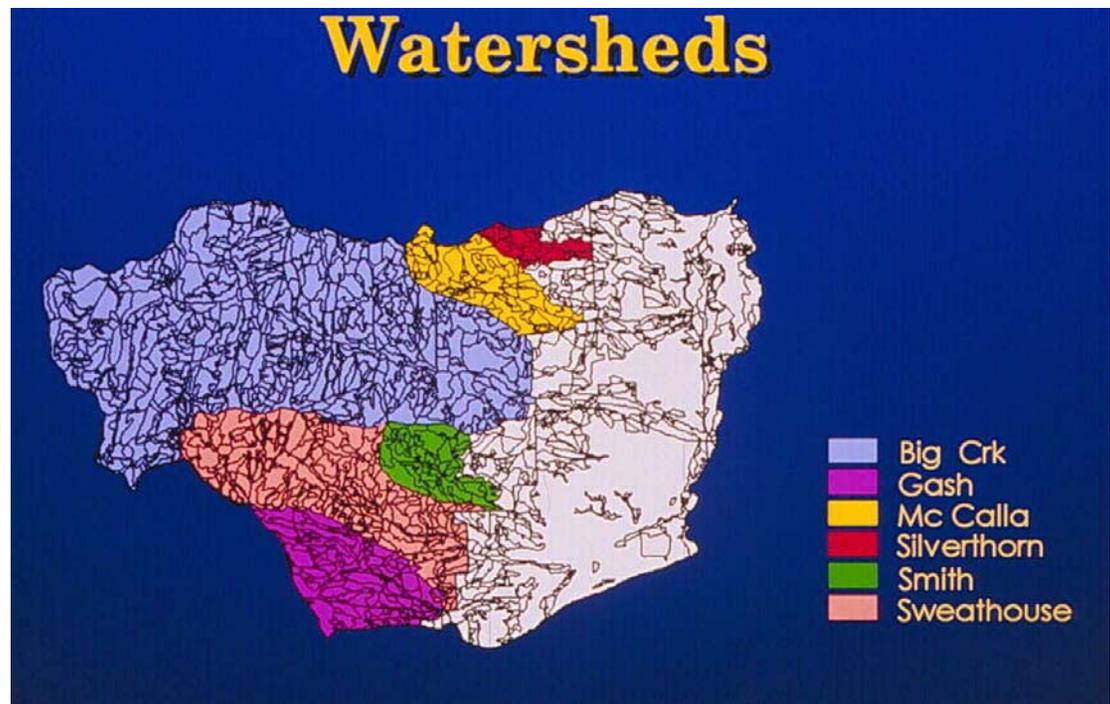   ⭐ Reconstruction

    ⭐ Decommissioning

⭐ Traffic routing

Effects Functions

* Harvest quantities

* Acres with specified characteristics

* Miles with specified characteristics

* Costs

* Net Revenues

- - - - - - - - - - -

Each can be computed by zone, eg. Watershed

Watersheds

Big Crk
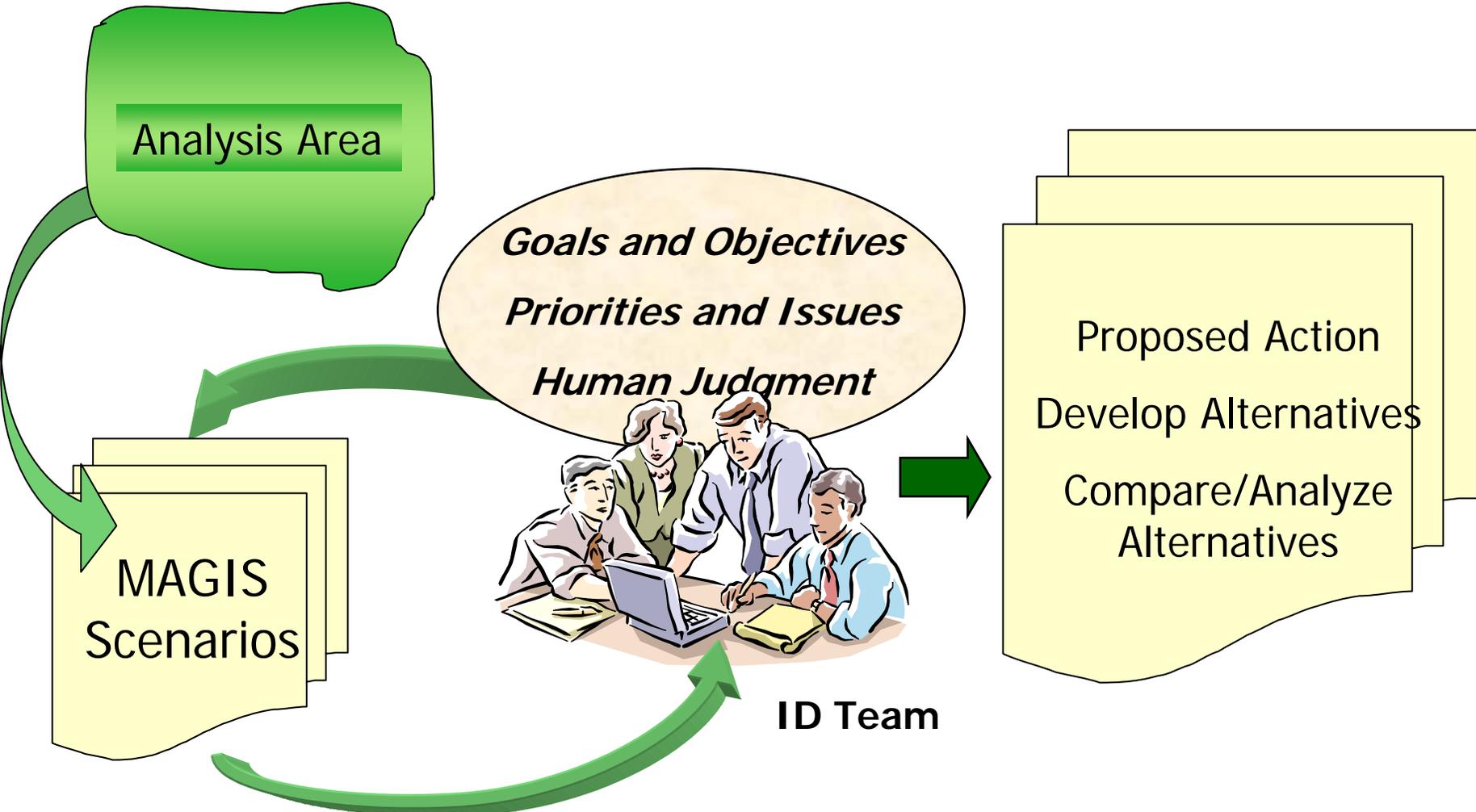Gash
Mc Calla
Silverthorn
Smith
Sweathouse

MAGIS Input

- ⭐ Pathways from SIMPPLLE (or other)
- ⭐ GIS data (veg polygons, network)
  - ⭐ Fixed and Variable road/traffic costs
- ⭐ Growth increment model (percent)
- ⭐ Rules for treatment assignment
- ⭐ Rules for harvest volume
- ⭐ Effects functions parameters
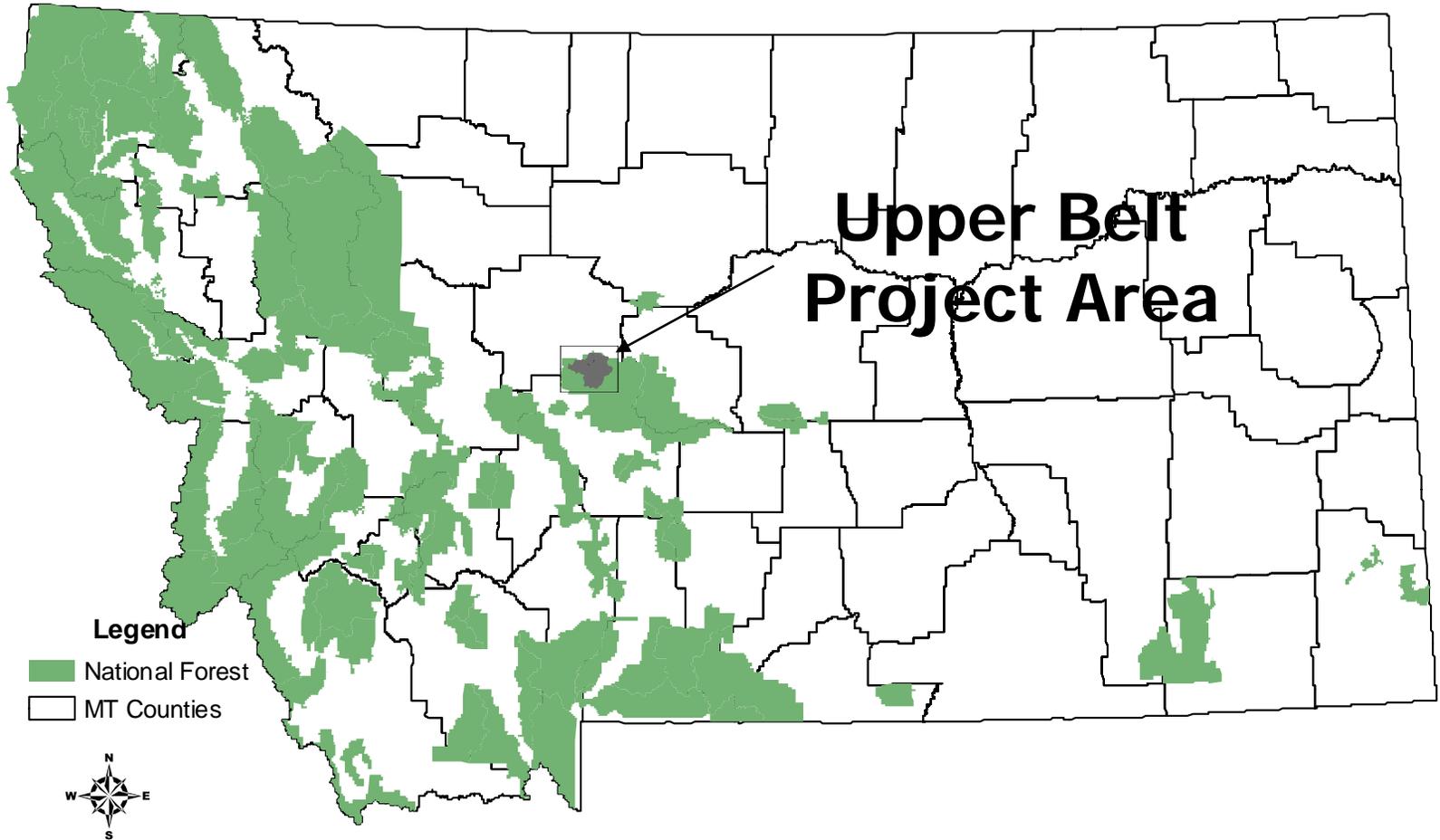- ⭐ Solution Setup-objective and constraints

MAGIS Output (Solution)

★ Schedule of treatments by polygon

★ Schedule of road projects by link

★ Value of each effects function

★ Map of treatment schedule

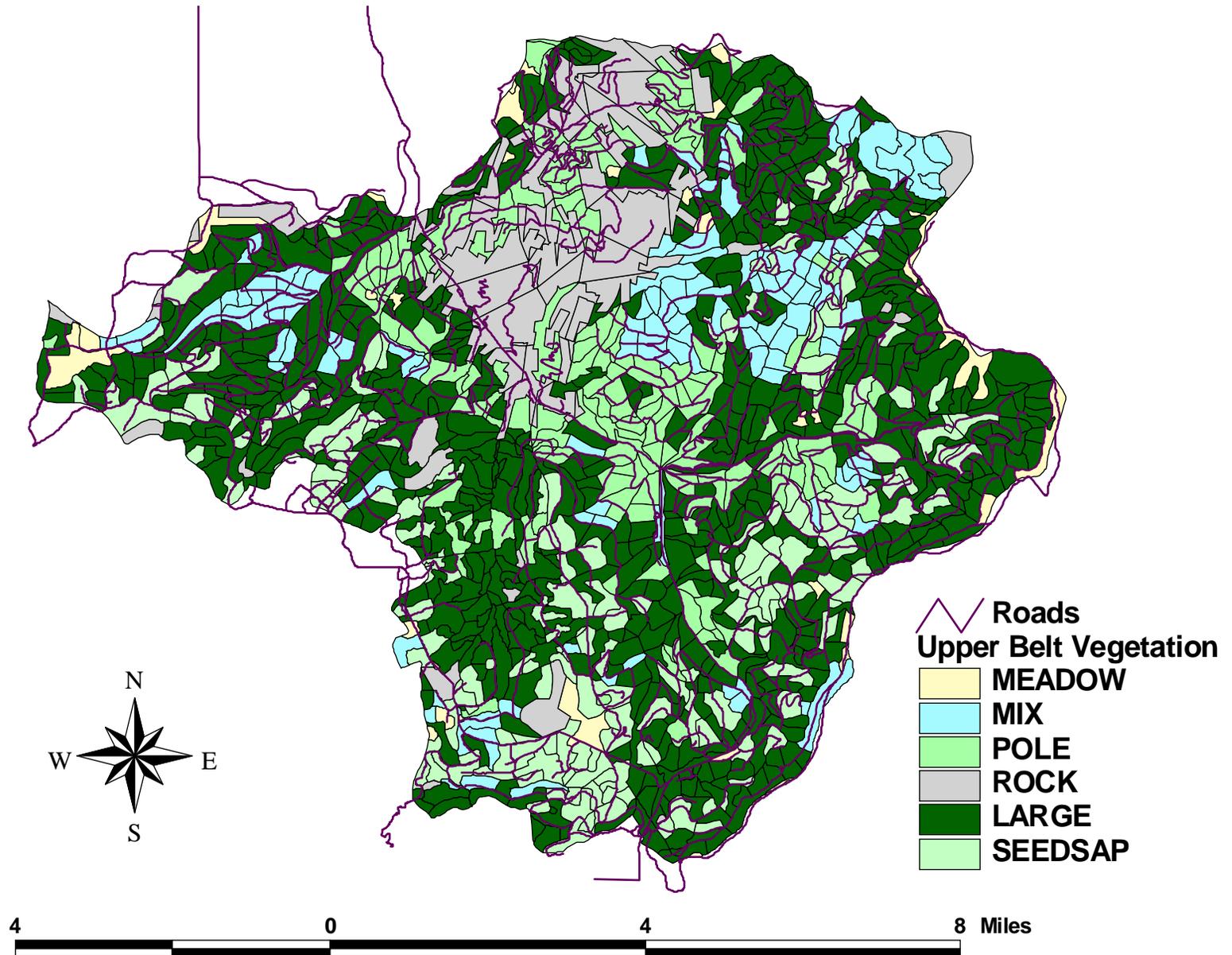★ Map of road 'schedule'

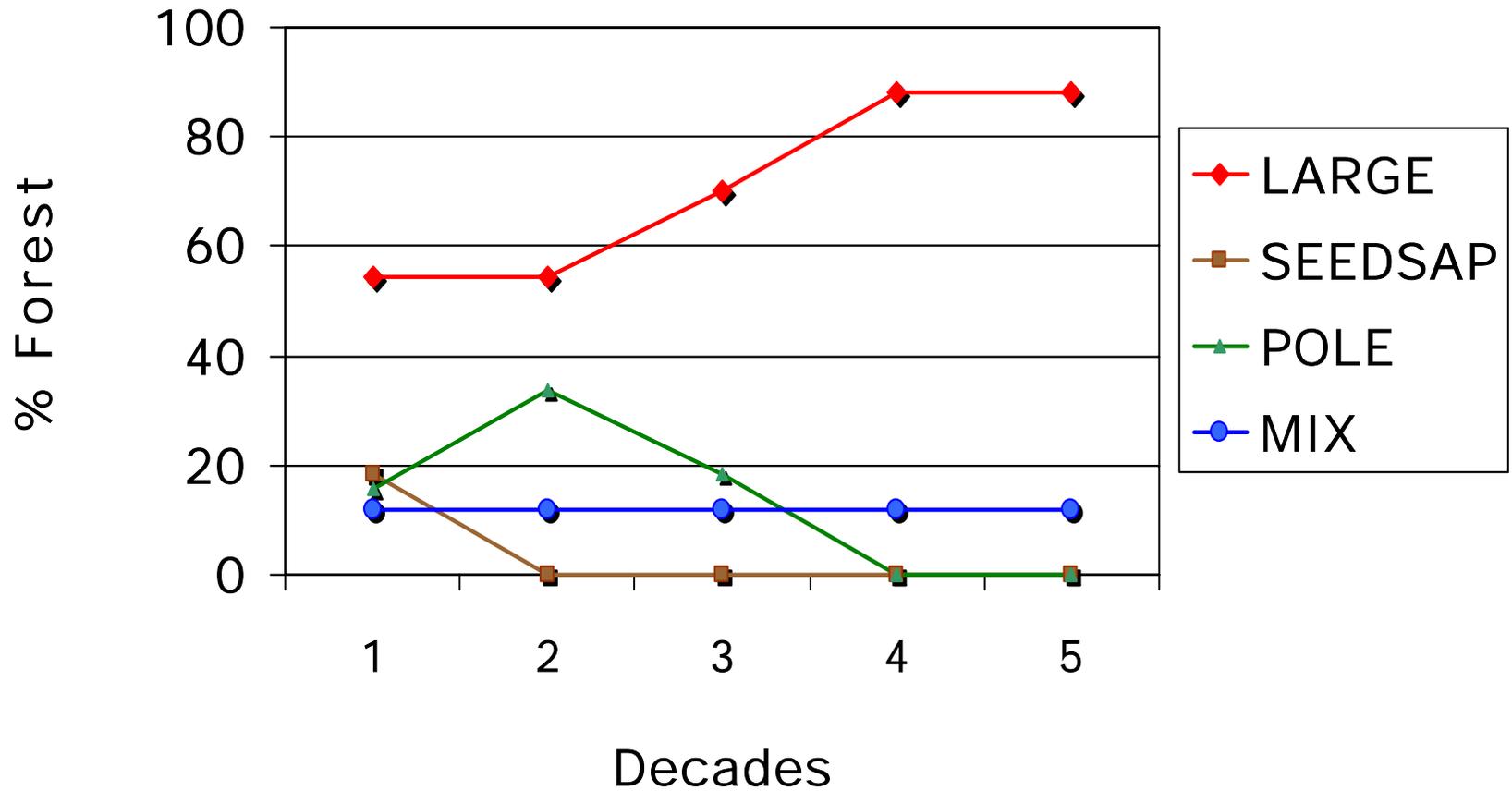★ Map displays of effects functions, traffic

MAGIS in the Planning Process

Analysis Area

MAGIS Scenarios

Goals and Objectives

Priorities and Issues

Human Judgment

ID Team

Proposed Action

Develop Alternatives

Compare/Analyze Alternatives

National Forests in Montana

Upper Belt Project Area

Legend

National Forest

MT Counties

N
W — E
S

Upper Belt Vegetation by Size Class

Roads

Upper Belt Vegetation

- MEADOW
- MIX
- POLE
- ROCK
- LARGE
- SEEDSAP

N
W E
S

4   0   4   8   Miles

No Action

Sample Scenario 1

⭐ Size Class Objectives

    ⭐ MIX = 0 % by decade 5

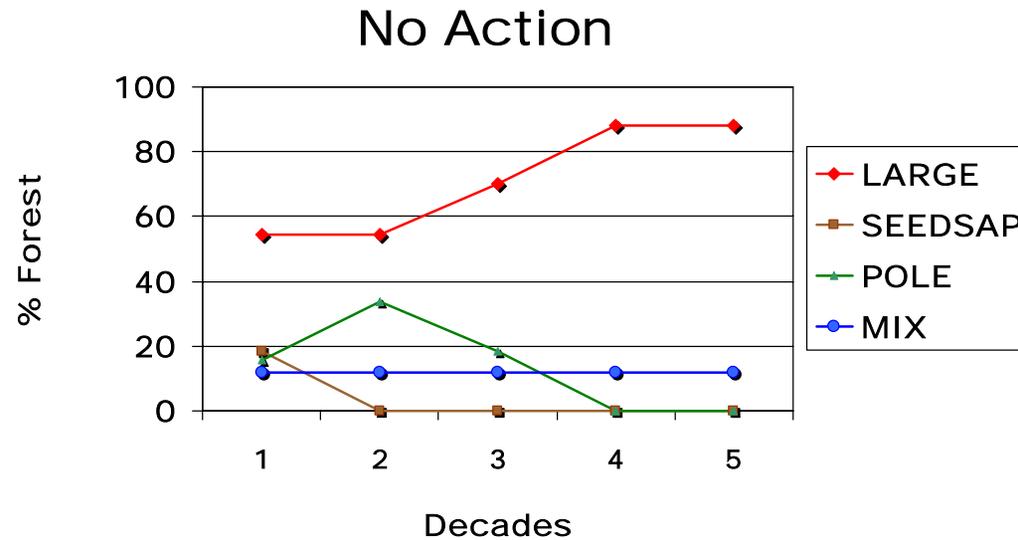   ⭐ POLE = 15 % by decade 5

    ⭐ SEEDSAP = 15% by decade 5

    ⭐ LARGE = 70% by decade 5

⭐ Minimize Cost

Scenario 1 Schedule of Treatments
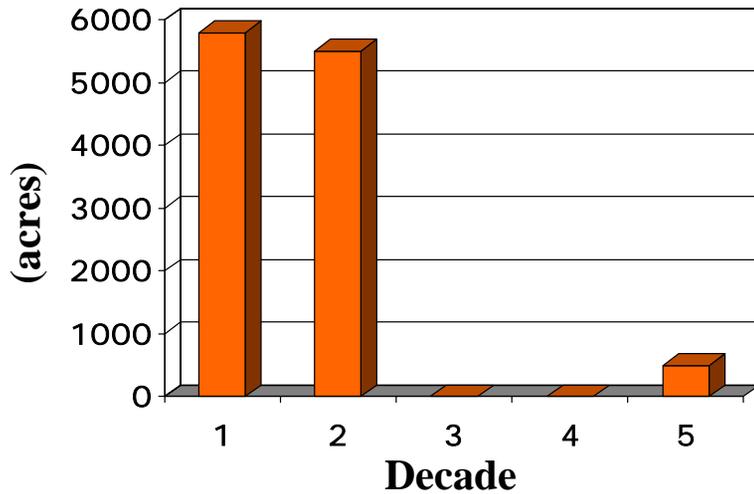
Compare No Action & Scenario 1
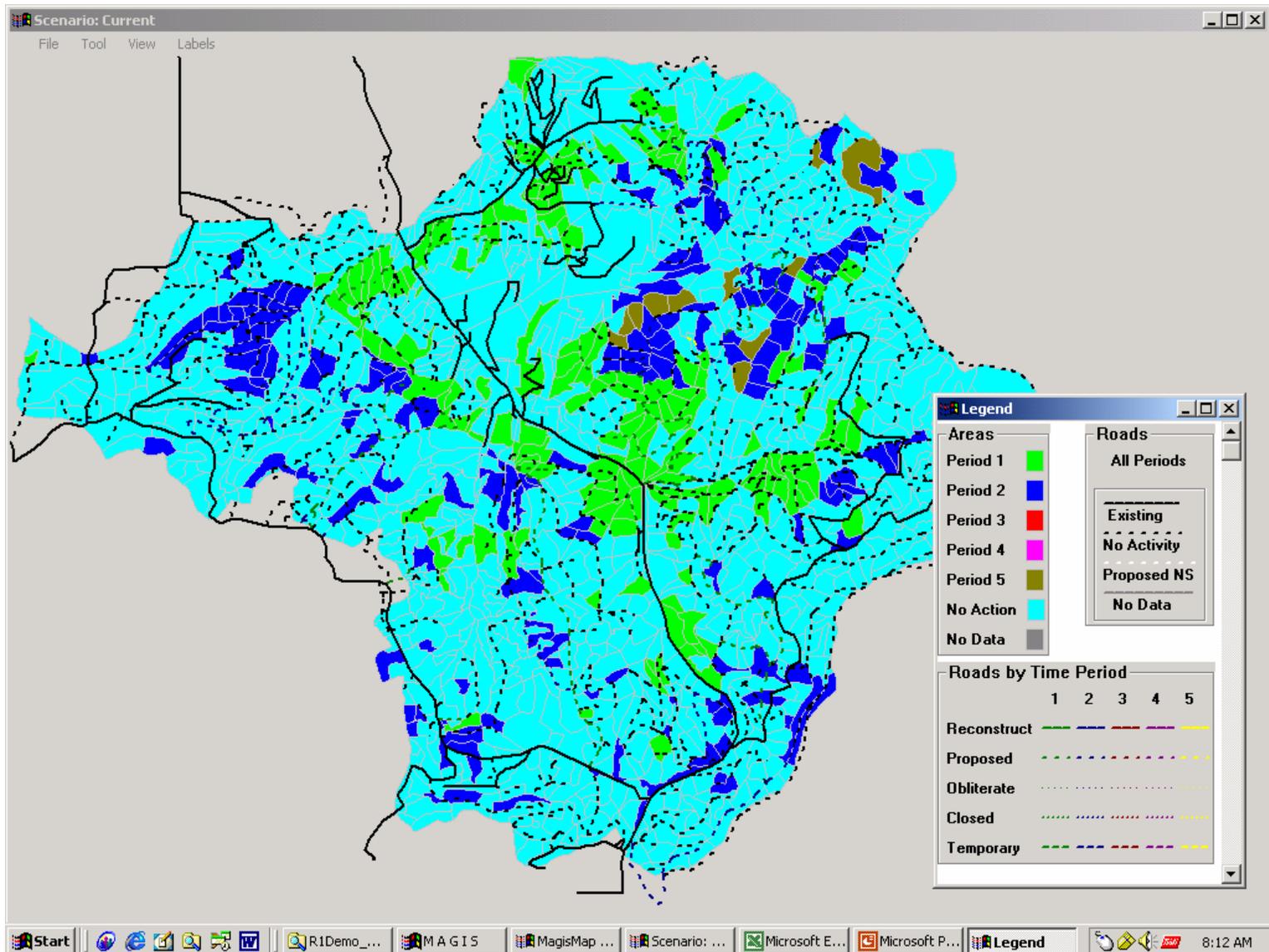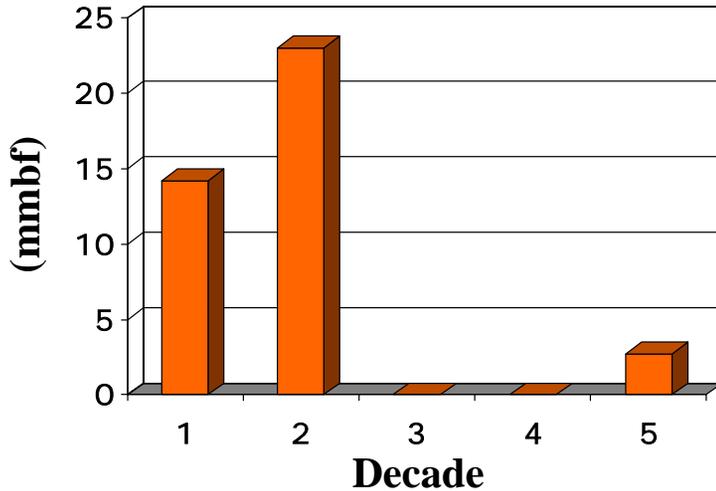

No Action
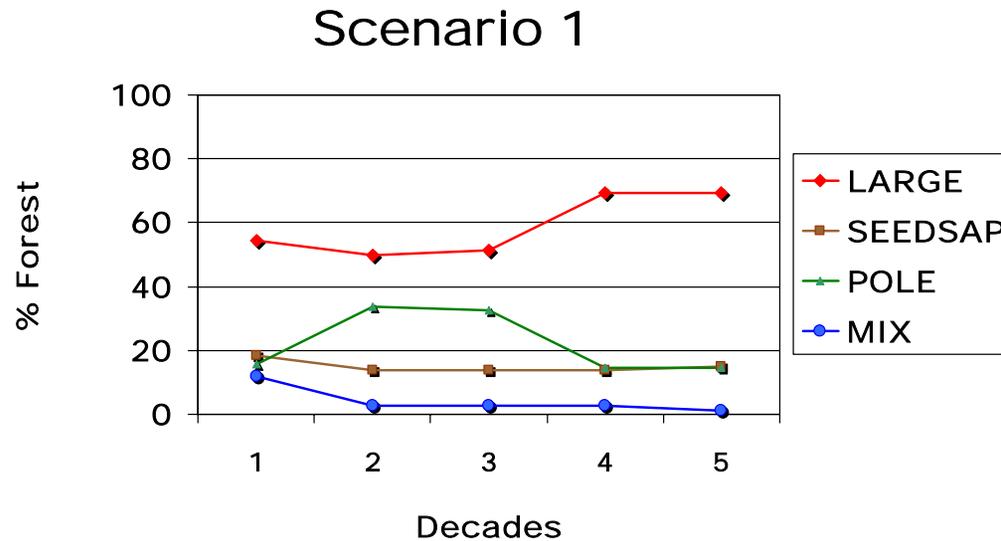
Scenario 1

Scenario 1 Stats ...

Vegetation Treatments

Total Cost = $6.2 million
(Discounted)

Harvest Volume

Road Construction
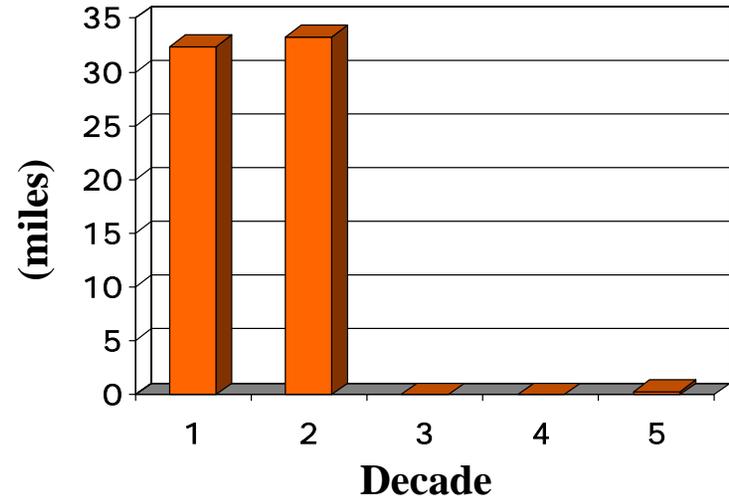
Scenario 2

⌘ Size Class Objectives
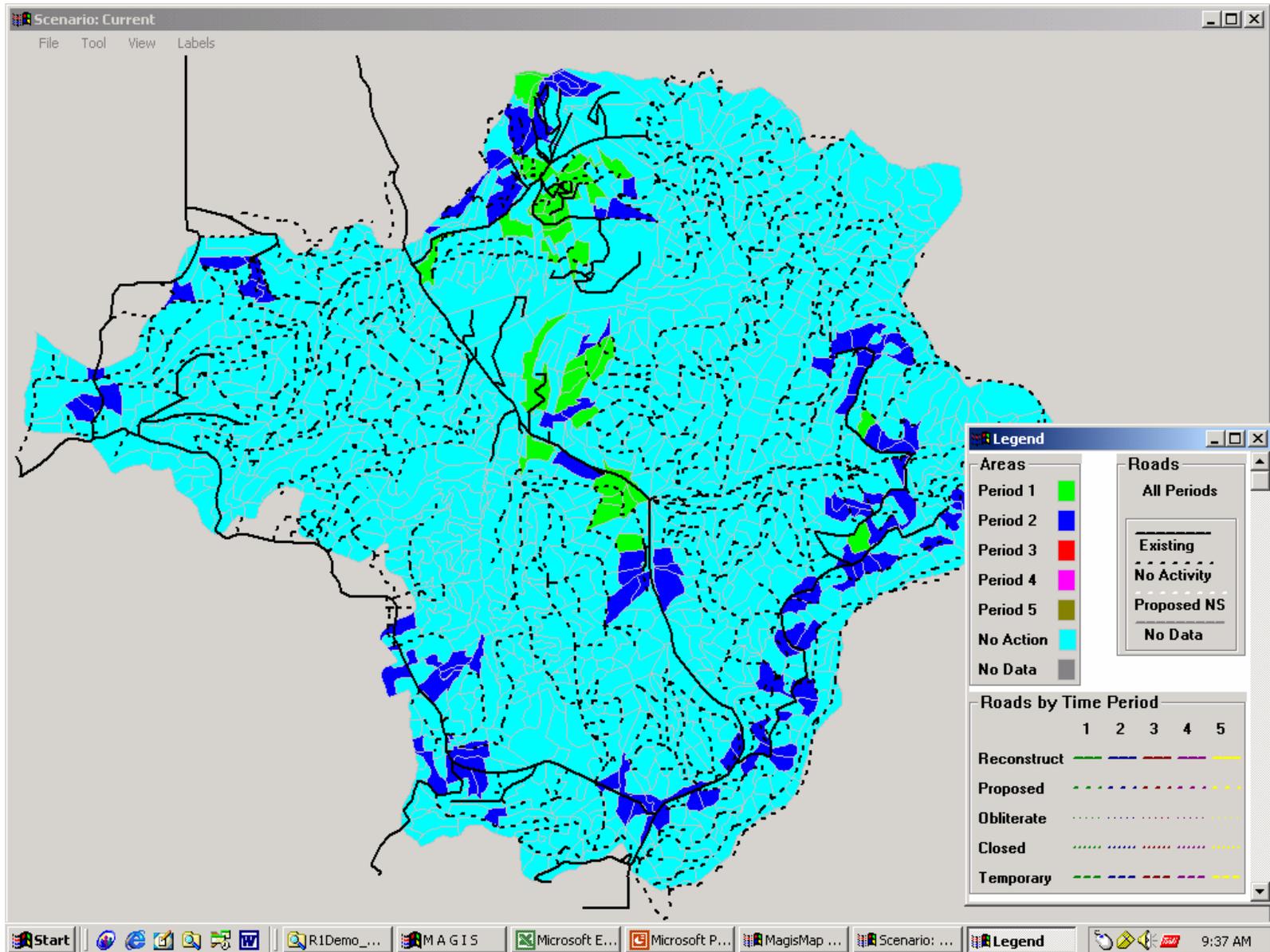
  ⌂ MIX = 0 % by decade 5

  ⌂ POLE = 15 % by decade 5

  ⌂ SEEDSAP = 15% by decade 5
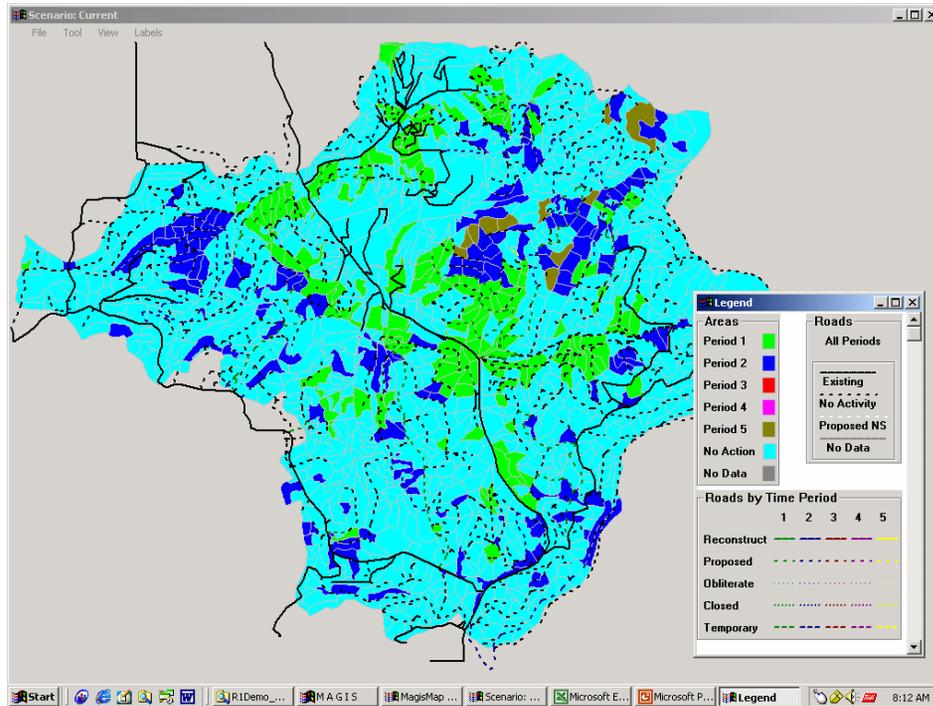
  ⌂ LARGE = 70% by decade 5
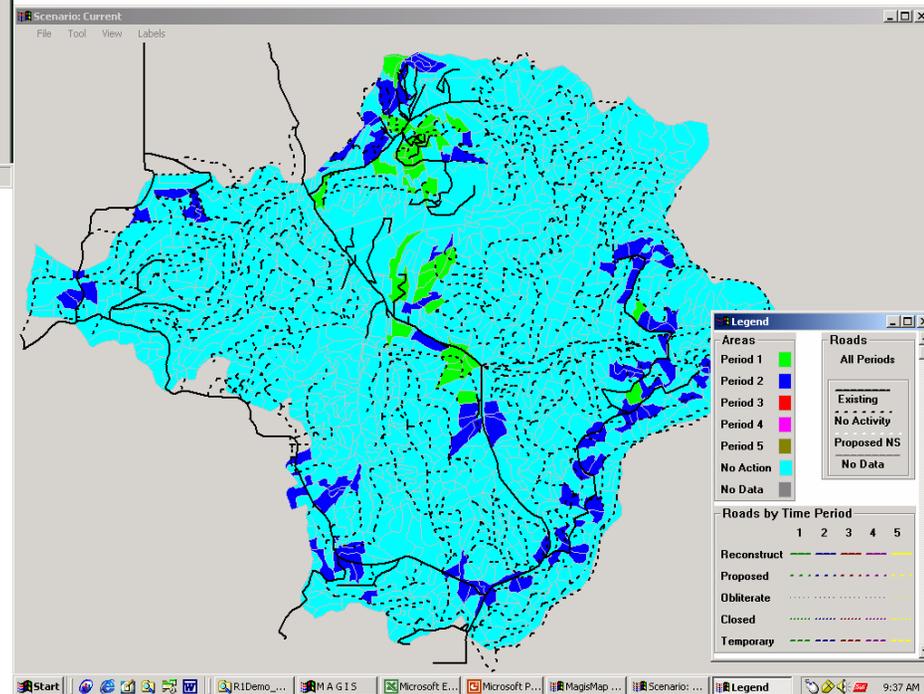
⌘ No Road Construction

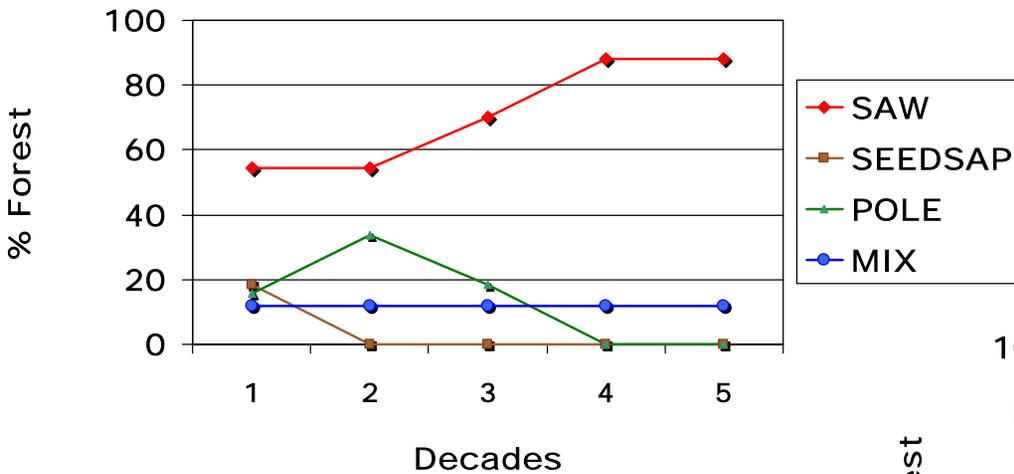⌘ Minimize Cost

Scenario 2 Schedule of Treatments

Scenario 1

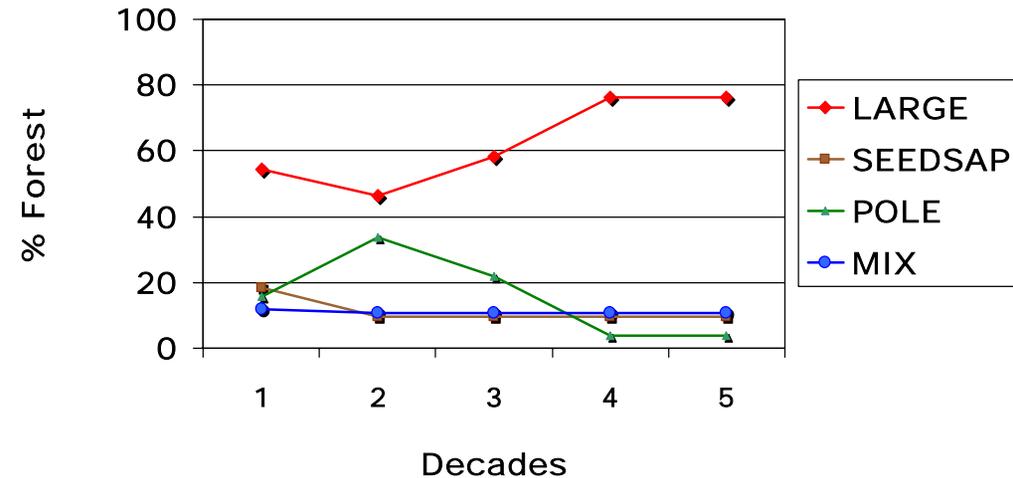# Scenario 2

Compare No Action & Scenarios

Scenario 1
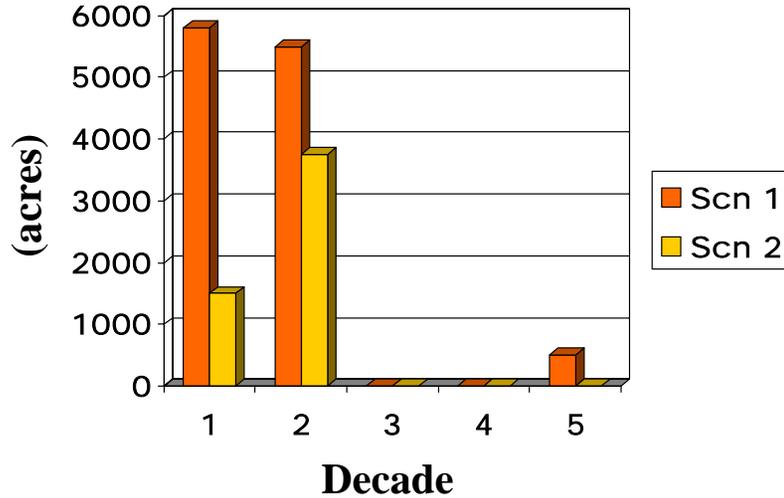
No Action
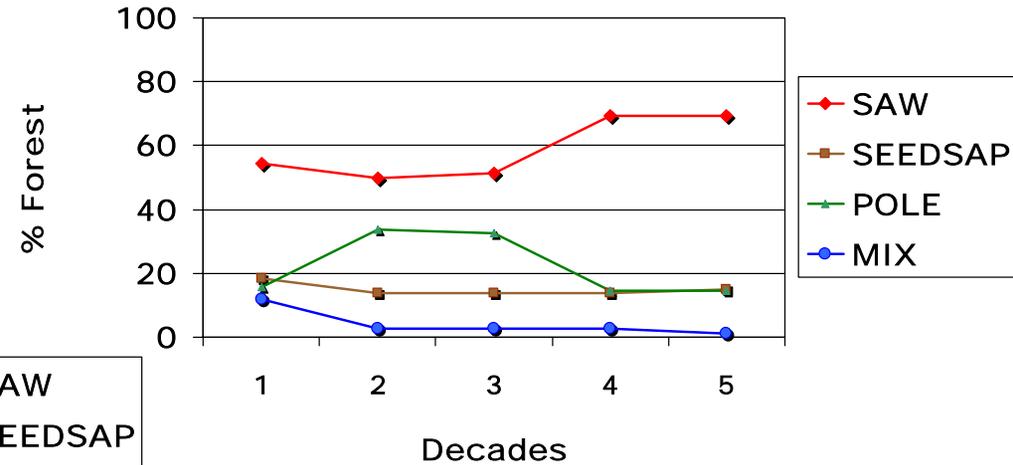
Scenario 2

Scenario 1 and 2 Stats...

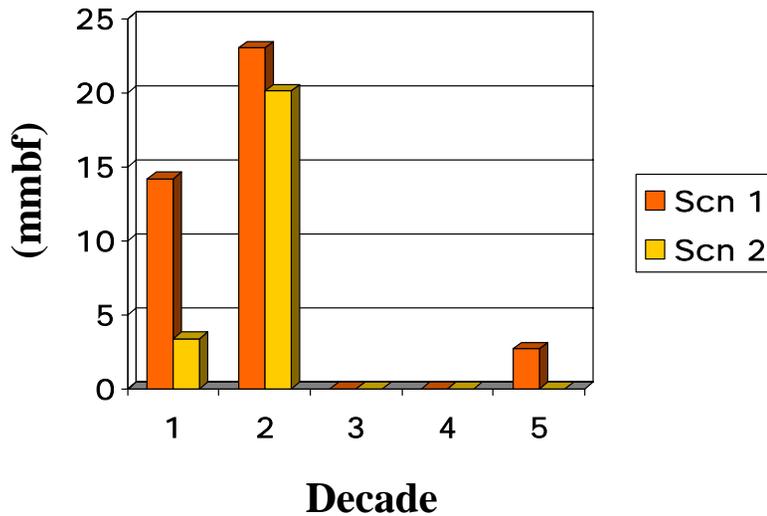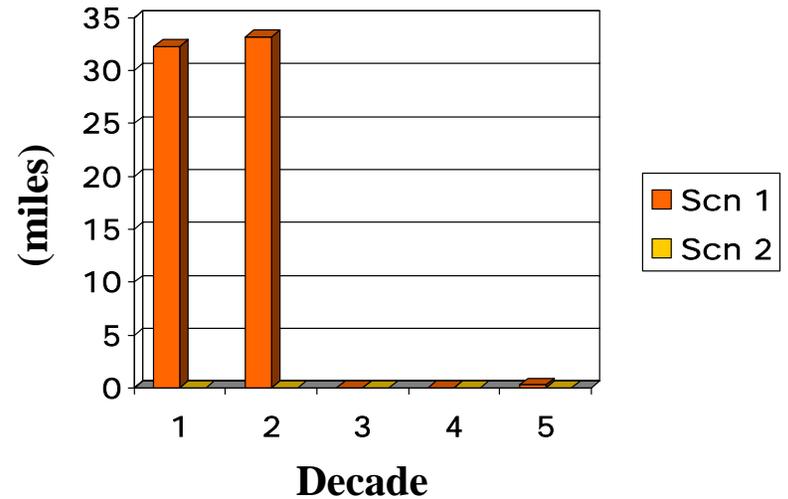# Comparing MAGIS Express and Pro...

	Express	**Pro**
Target Application	Project Planning	Watershed Analysis (5th code HUC+)
ArcGIS Interfaces	Yes	Yes
Modeling Options	Simple	Flexible
Solver	Heuristic (planned)	Mathematical Programming

Comparing MAGIS Express and Pro...

	Express	Pro
Multiple Timber Products	X	X
Non-timber outputs		X
Non-harvest activities	X	X
Network Projects/Traffic	X	X
Percent Growth Model	X	X
State Growth Model		X
Fixed Road Cost Lookup Table		X
Fixed Road Cost by Link (GIS)	X	X
Multiple Traffic Types	X	X
Traffic Cost Lookup Table		X
Traffic Cost by Link/Rd Option	X	X

Connections with other models...
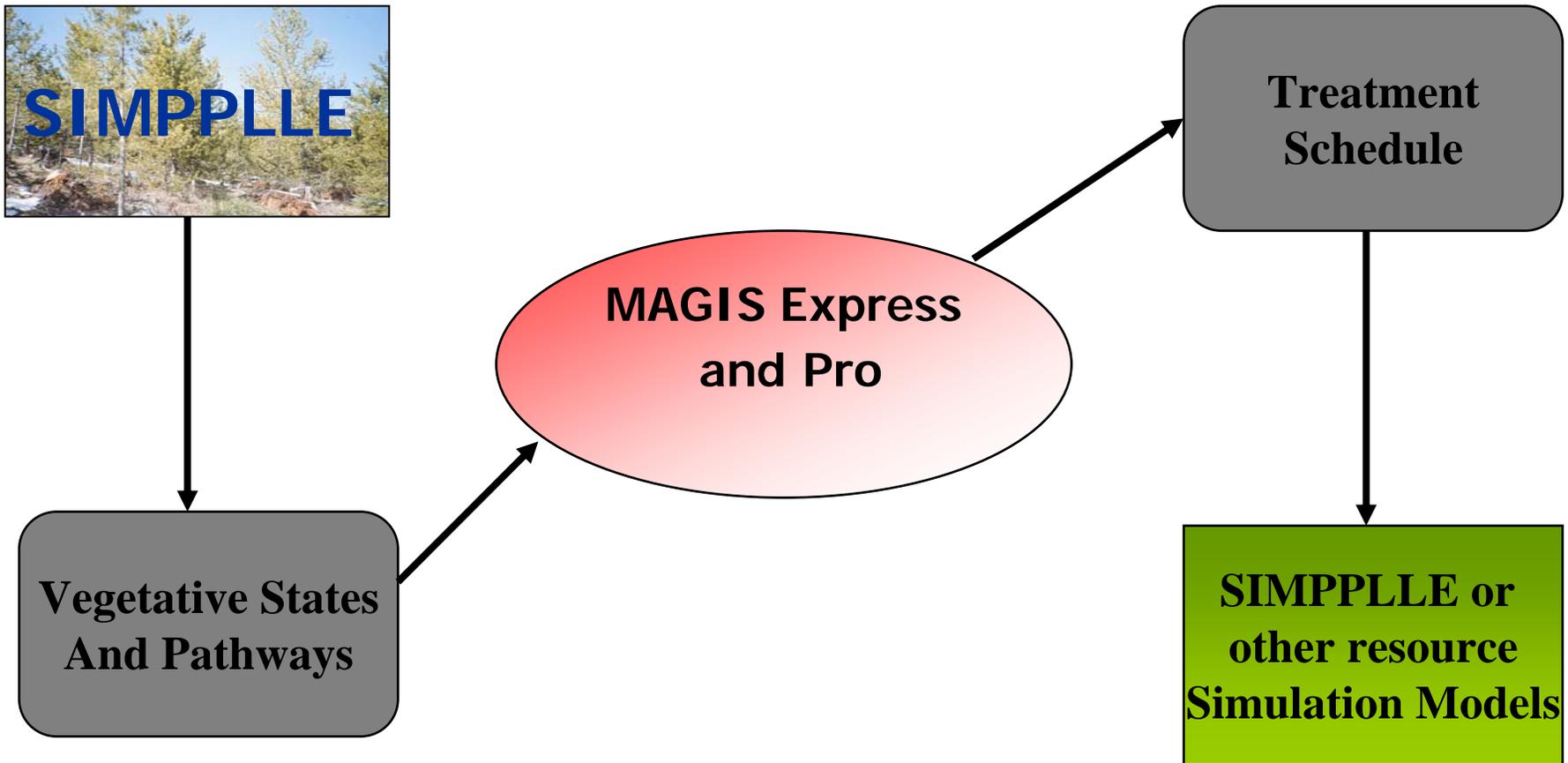
Modeling Approach

SIMPPLLE

Step 1: 20 Simulations of No Action

Location & Severity of Disturbance Processes

RISK INDEX

MAGIS

Step 2: Optimization based on Management Objectives & Constraints

Schedule of Treatments in Time & Space
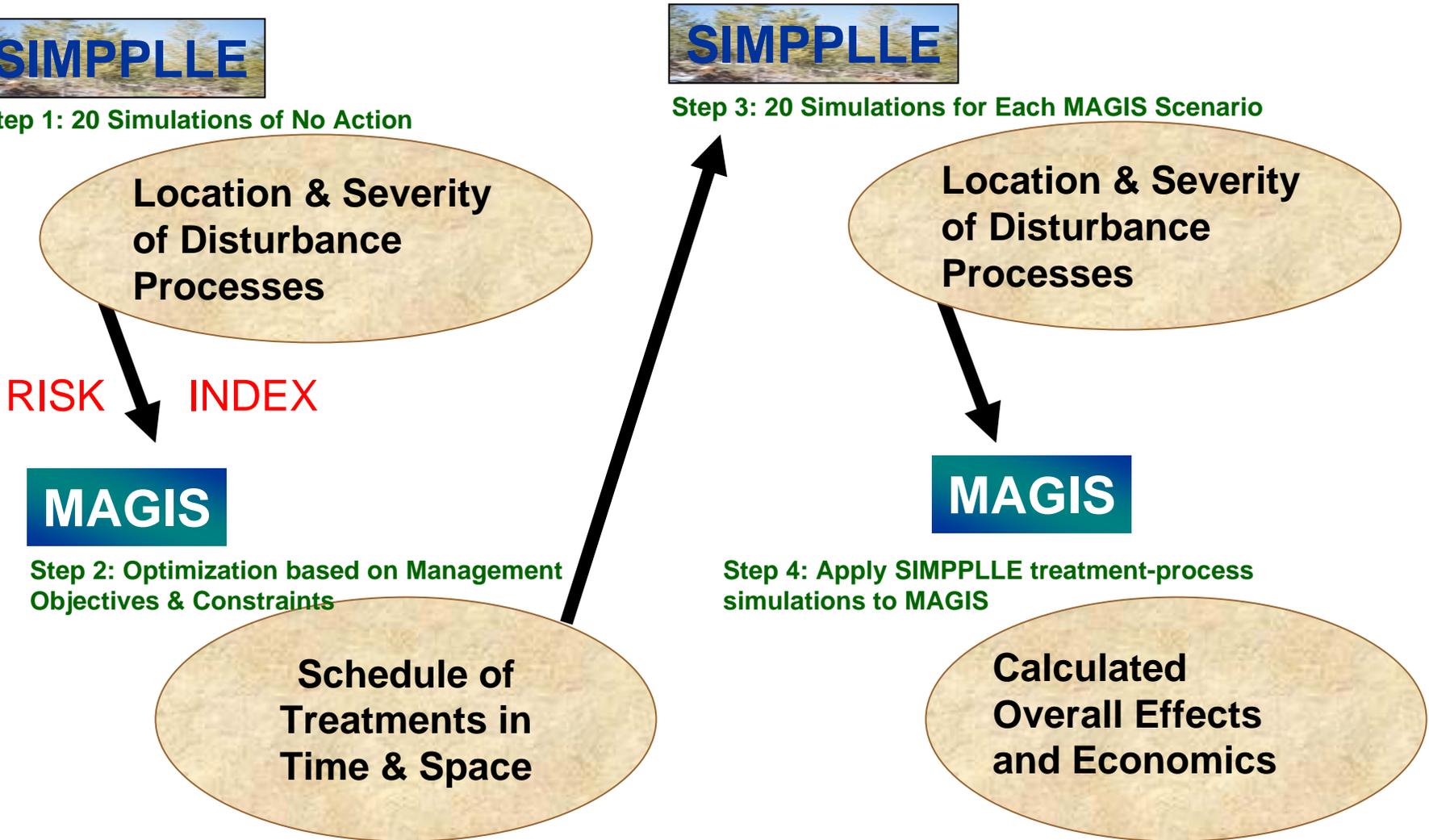
SIMPPLLE

Step 3: 20 Simulations for Each MAGIS Scenario

Location & Severity of Disturbance Processes

MAGIS

Step 4: Apply SIMPPLLE treatment-process simulations to MAGIS

Calculated Overall Effects and Economics

Availability Information

- MAGIS on web:
  - http://www.fs.fed.us/rm/magis

- Technical Support 'Hotline'
  - jsullivan@fs.fed.us
  - 406-542-4185