Figure 1

Integrated System Modeling

- Multi-Component System
- Fire Simulation
  - Herbivore Density
  - Soil Nutrients
  - Vegetation Growth
- Simulation Driver
  - Ground Water
  - Surface Hydrology
  - Rainfall

Optimal Control Schemes
- Fire Management Scenarios
- Disease Control Scenarios
- Invasive Species Control

Computational Steering Console
- Real-Time Fire Suppression
- Shared Equipment Coordination
- Fire Crew Scheduling
- Remote Sensing

Job Scheduler

feedback
High Performance Services

Figure 2

Software Architecture for GIS Enabled Systems

GIS System
- Geodatabase
- Geoprocessing
- Visualization
- Map Representation

Data Extraction/Conversion Tools

Dynamic Simulation Package
- Spatial Analysis Libraries

High Performance Services

Simulation and Analysis
- Fire Simulation
- Control Model

Future Tools

Data
- Remote Sensing
- Field Studies

Fire Frequency
Fuel Load
Vegetation
Topography

Software Tools for GIS Enabled Systems

Fire Simulation
Geospatial Visualization
GIS System Integration
Data Extraction/Conversion
Simulation and Analysis
Optimal Control of Disease

Rabies in Ohio

Data
- Demographics.
- Locality records.
- Movement patterns.
- Infection rate.
- Disease virulence.
- Effectiveness of vaccination baits.

Model
- Spatially explicit dynamics.
- Search for optimal strategy.
  PARAMETERS
  - Cost of control efforts
  - Control Success Rate
  - Disease Dynamics

Control Strategy
Aerial release of vaccination baits creates geographic “fire-break” to slow the encroaching wave of infected animals.

Computational Support
Use of parallelization and optimization techniques improve speed, allowing greater freedom in modeling and more accurate forecasts of disease incidence and spread.

Monitoring
- Trap and test individual animals.
- Remote sensing of radio-collared individuals.
- Molecular analysis of disease demographics and viral strain diversity.
Figure 4

Cyber-Infrastructure for Natural Resource Management

Web Portal and User Interface

GIS Tools

High Performance Resources

Dynamic Model

Data Storage

Web Server

Data

Grid-Based Services