Development of The Interagency Fuels Treatment Decision Support System

Stacy A. Drury, Tami H. Funk, Sean M. Raffuse
Sonoma Technology, Inc.
Petaluma, California

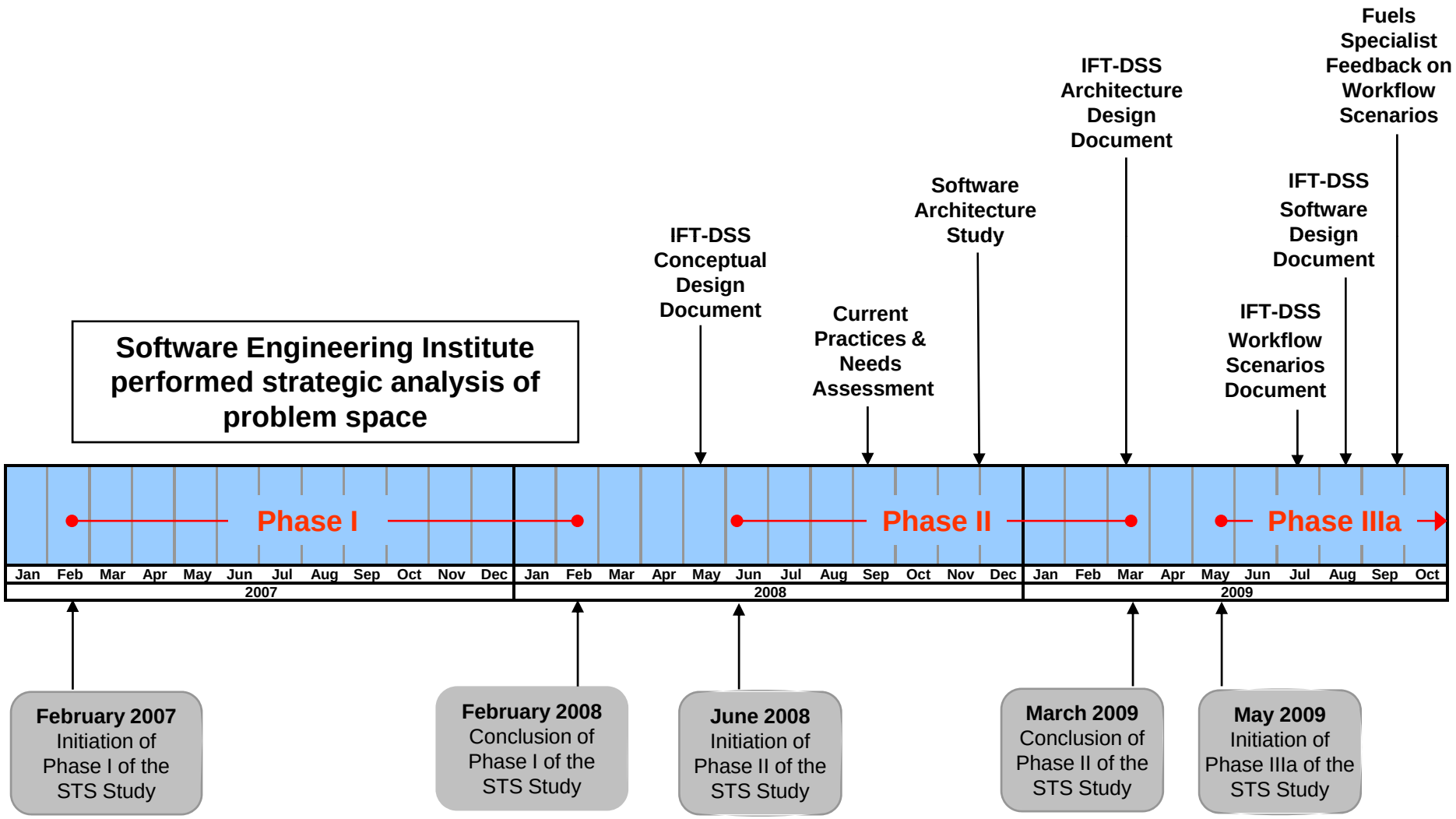
H. Michael Rauscher
Joint Fire Science Program

Technical Fire Management Course
Bothell, Washington
October 15, 2009

Overview of Presentation

- Introduction and background
- State of the fuels treatment community
- Workflow scenarios
- Proof of concept
- Vision for the future

Introduction and Background Software Tools and Systems (STS) Study



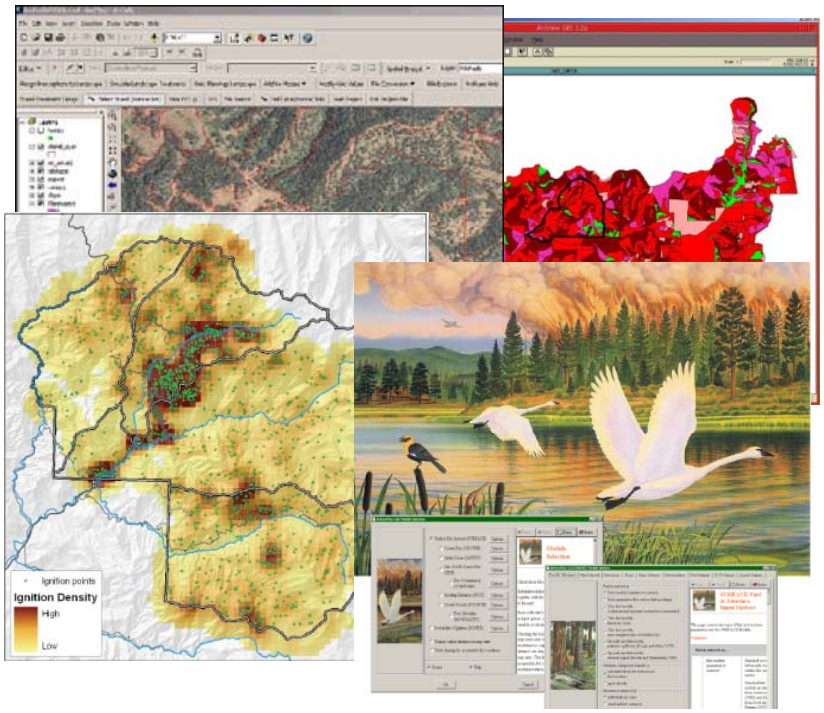
Sonoma Technology, Inc.

State of the Fuels Treatment Community (1 of 4)

- Fuels treatment planners are responsible for managing vegetation
  - Planning and the decision support process centers around modeling vegetation disturbances
- Seven steps in the decision support process
  - Define project, vegetation, landscape, and scale
  - Prepare and ensure quality of vegetation data
  - Simulate and analyze fire behavior
  - Analyze fire effects and/or risk
  - Design treatment strategies
  - Simulate treated vegetation, geophysical, and fuel conditions
  - Simulate treatment effectiveness of reducing fire behavior and fire effects potentials

State of the Fuels Treatment Community (2 of 4)

Currently an assortment of data, software applications and systems

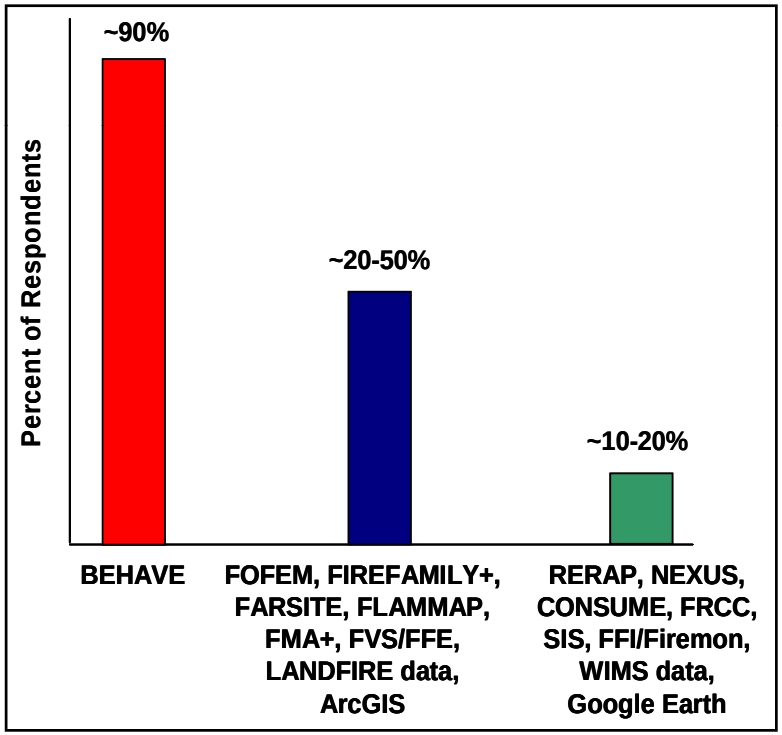


- Not all are accessible to the community
- Most are problem-specific
- Some are comprehensive but only support specific data and use-cases
- It is difficult to “string” them together

State of the Fuels Treatment Community (3 of 4)

What does this mean for the user community?

- Use what they know
- Use tools that are user-friendly, simple
- May not know that other tools exist
- Limited guidance on which to use
- A lot of time spent "stringing" tools together for specific purposes
- A lot of time spent acquiring and preparing data



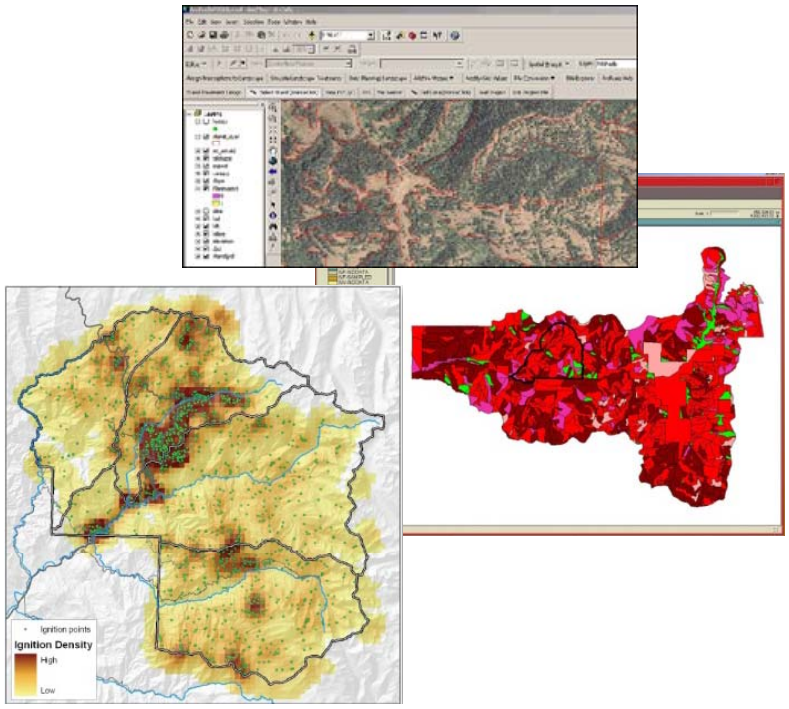
IFT-DSS must facilitate the most difficult and time consuming tasks to ensure success

State of the Fuels Treatment Community (4 of 4)

What about the existing comprehensive systems that "string" models together?

ArcFuels, INFORMS, LANDFIRE-IFP, Starfire = **VERY USEFUL SCIENCE**

- Some are inaccessible
- Some require "expert" knowledge
- Do not address all fuels treatment use cases



- User groups are small
- Do not facilitate collaboration

Objectives of the Interagency Fuels Treatment Decision Support System

- Simplify the fuels treatment planning decision support process
  - Improve the overall quality of analysis and planning
  - Provide new opportunities for data analysis and collaboration
- Control long-term costs by streamlining and optimizing workload and scalability
- Encourage scientific collaboration by providing a framework and tools that facilitate adding new software applications
- Reduce agency information technology (IT) workload
- Promote interagency collaboration within the fire and fuels community

Workflow Scenarios

Intended to capture the problem-solving needs of the fuels treatment analysis and planning community

Includes:

- Data acquisition and preparation
- Strategic planning
- Spatially explicit fuels treatment assignment
- Fuels treatment over time
- Prescribed burn planning
- Risk assessment

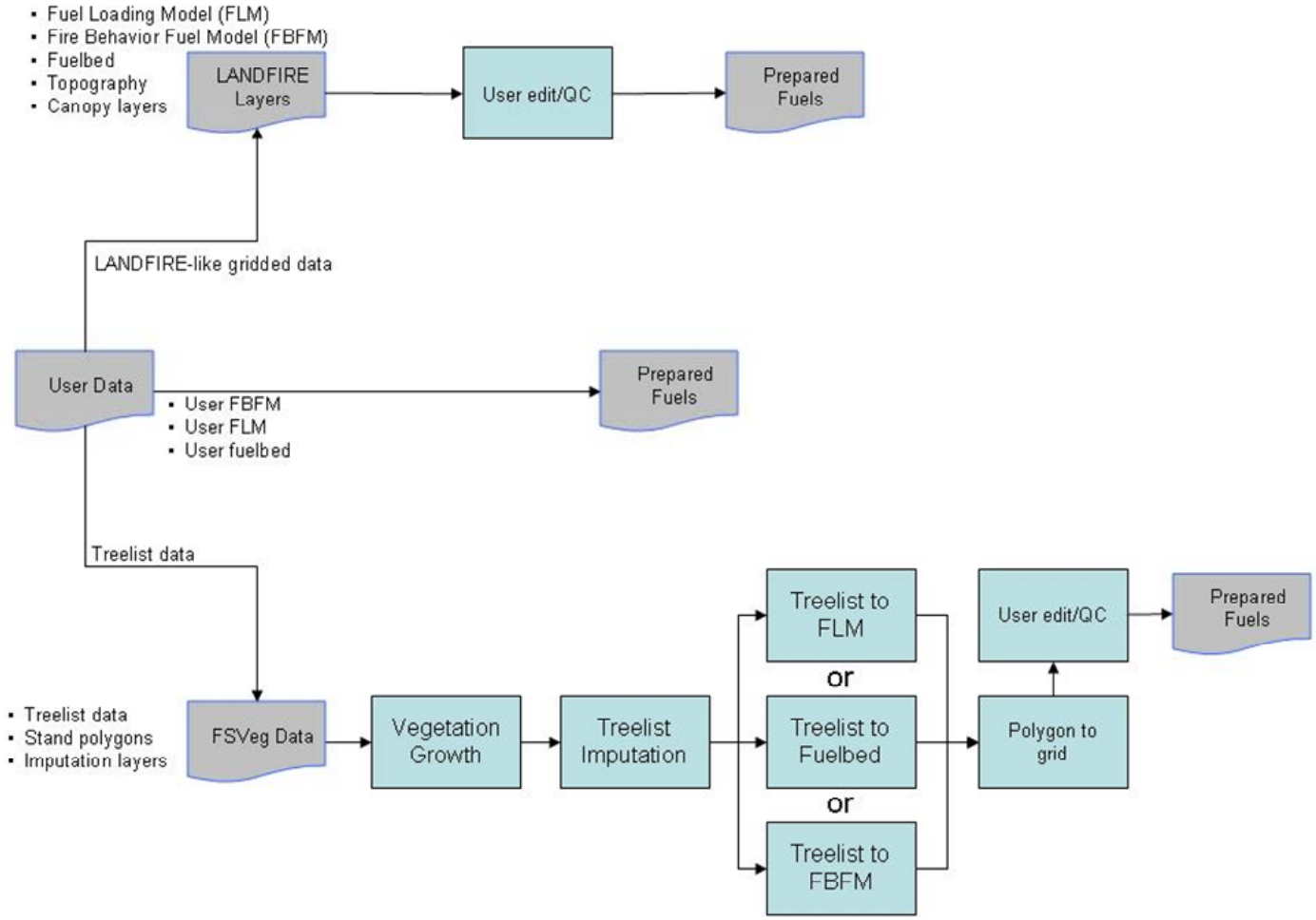
Data Acquisition and Preparation (1 of 2)

Objective: Acquire, prepare, and assure the quality of vegetation data for use in fuels treatment planning.

Inputs	Vegetation/ Fuels Data Types	Workflow	Outputs
Tree-lists	FSVeg point data FSVeg spatial user upload	Growth → Imputation → QC/edit	Current, complete fuels data for further analysis
Gridded fuels	LANDFIRE user upload	QC/edit	

Data Acquisition and Preparation (2 of 2)

Objective: Acquire, prepare, and assure the quality of vegetation data for use in fuels treatment planning.



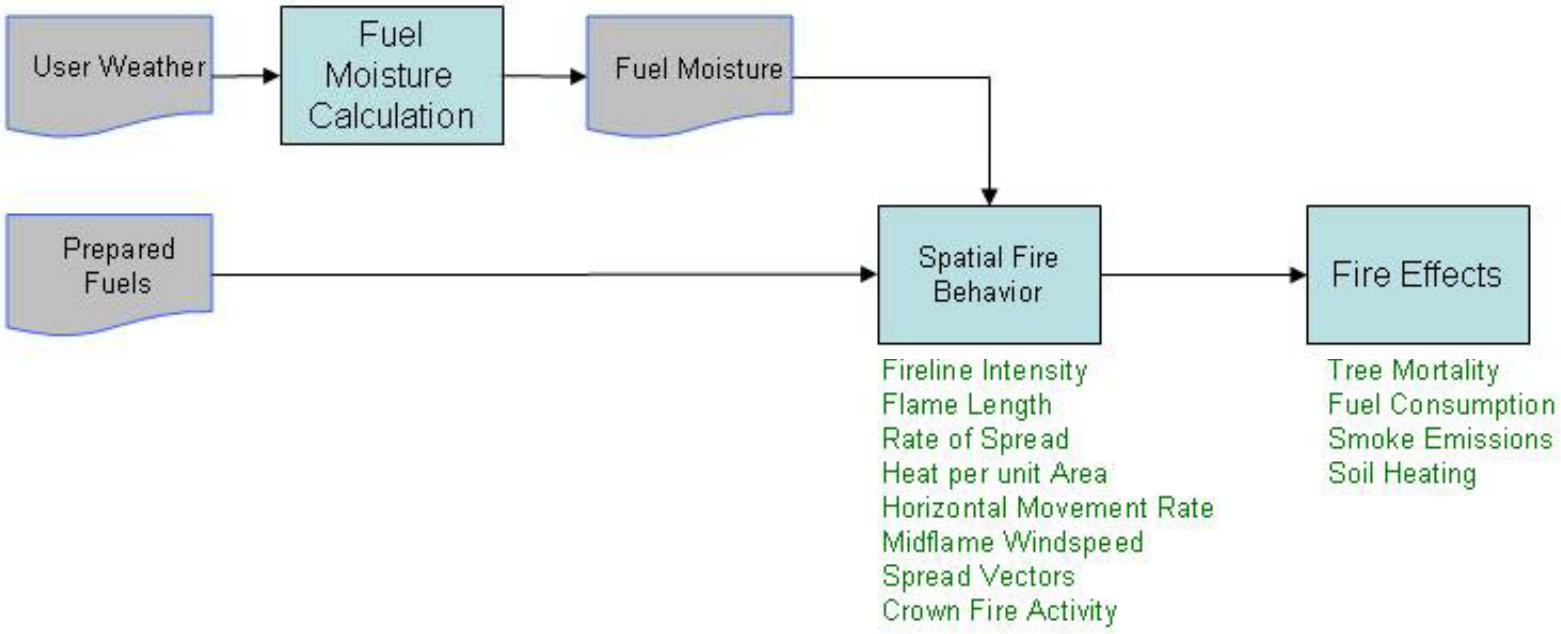
Strategic Planning (1 of 3)

Objective: Identify high fire hazard areas within an area of interest and identify where further analysis may be warranted based on potential fire hazard. High fire hazard is expressed by high potential fire behavior and/or undesirable fire effects.

Inputs	Vegetation/ Fuels Data Types	Workflow	Outputs
Current, complete fuels; topography	Tree-list Polygon data LANDFIRE grid data	Fire Behavior → Fire Effects → QC	Maps and data of fire behavior and fire effects

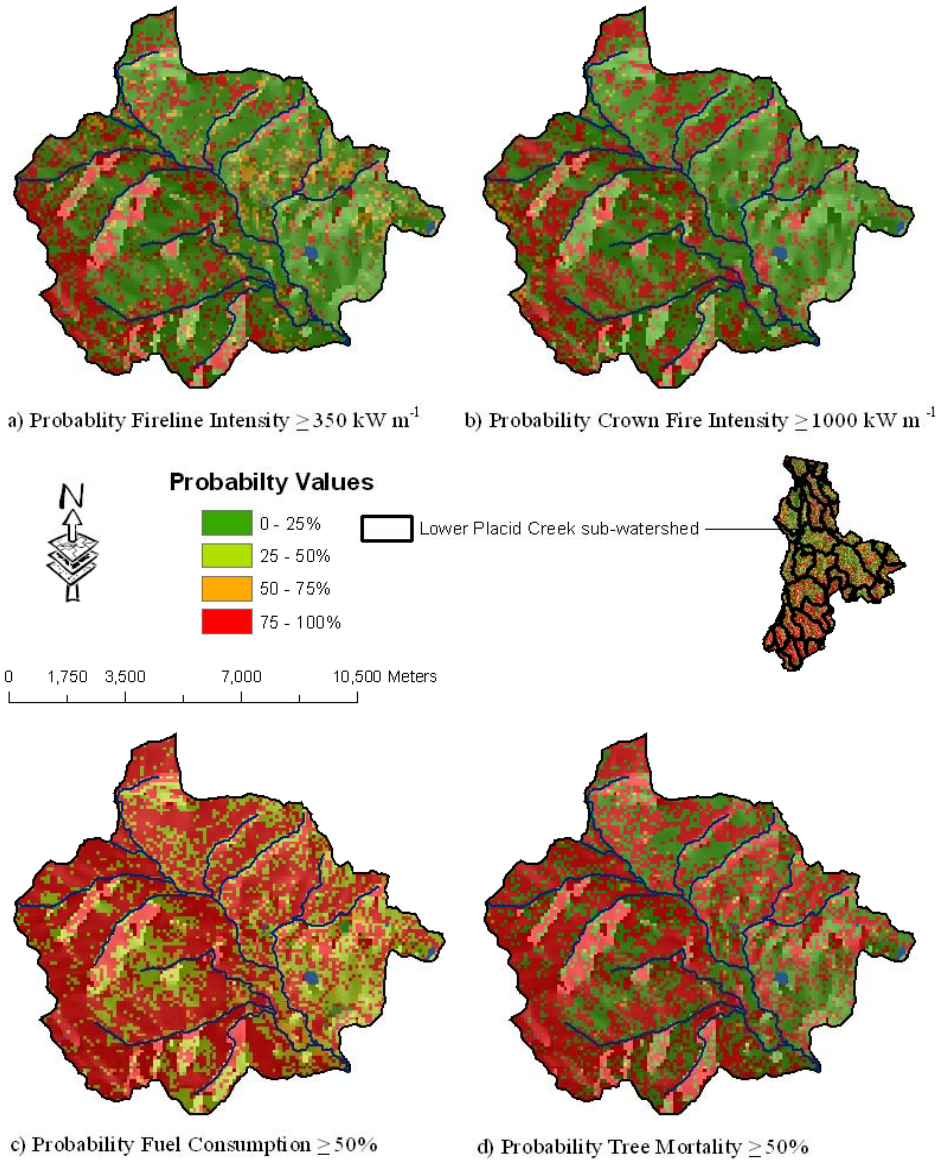
Strategic Planning (2 of 3)

Objective: Identify high fire hazard areas within an area of interest and identify where further analysis may be warranted based on potential fire hazard. High fire hazard is expressed by high potential fire behavior and/or undesirable fire effects.



Strategic Planning (3 of 3)

Example of strategic planning output



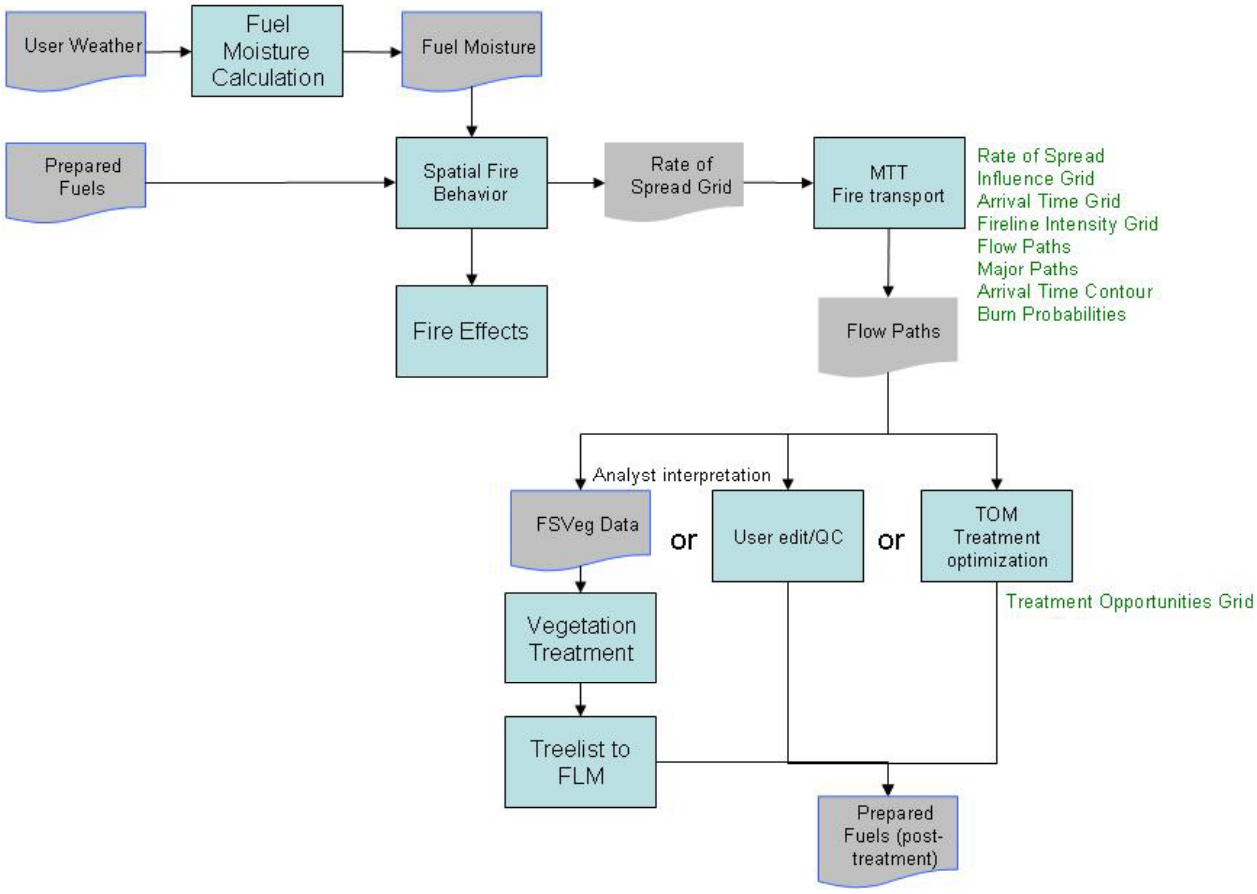
Spatially Explicit Fuels Treatment Assignment (1 of 3)

Objective: (1) Simulate fuels treatment placement in areas of high fire hazard within an area of interest and (2) simulate post-treatment influences on fire behavior and fire effects potentials.

Inputs	Vegetation/Fuels Data Types	Workflow	Outputs
Current, complete fuels; topography	Tree-list polygon data LANDFIRE	Fire Behavior/Effects/MTT → User Treatment → Fire Behavior/Effects/MTT	Maps and data of treatment locations; pre- and post-treatment fire behavior and fire effects
		Fire Behavior/Effects/MTT → FVS Treatment → Fire Behavior/Effects/MTT	
		Fire Behavior/Effects/MTT → TOM → Fire Behavior/Effects/MTT	

Spatially Explicit Fuels Treatment Assignment (2 of 3)

Objective: (1) Simulate fuels treatment placement in areas of high fire hazard within an area of interest and (2) Simulate post-treatment influences on fire behavior and fire effects potentials.

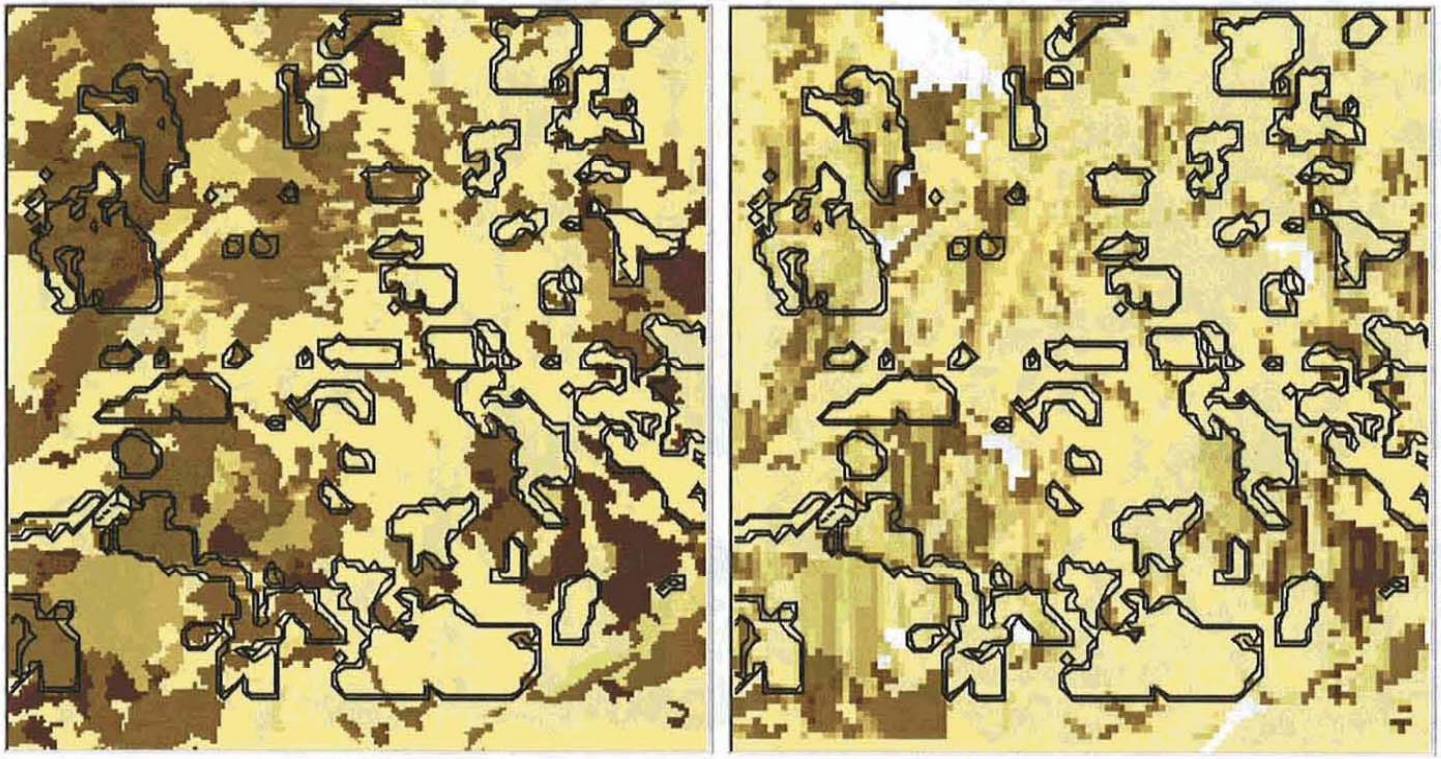


Spatially Explicit Fuels Treatment Assignment (3 of 3)

Example of fuels treatment optimization

Pre-treatment

Post-treatment



Simulated fireline intensity for a hypothetical landscape. Light colored areas indicate low fireline intensity potentials and dark colors represent high fireline intensity potentials (from Finney et al., 2006).

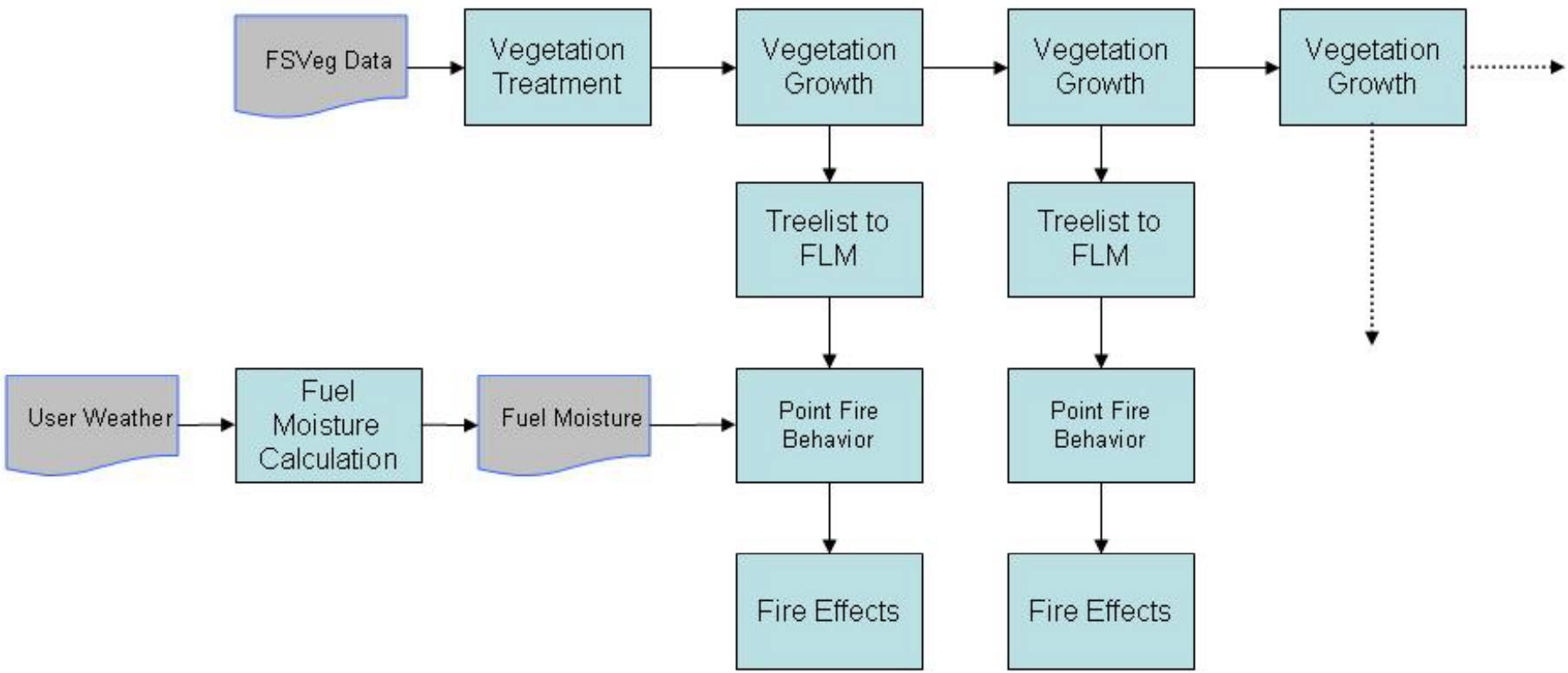
Fuels Treatment Effectiveness Over Time (1 of 3)

Objective: Evaluate the temporal durability of fuels treatments; i.e., how long, in years to decades, a treatment will continue to lower potential fire behavior and fire effects.

Inputs	Vegetation/Fuels Data Types	Workflow	Outputs
Current, complete fuels; topography	Tree-list polygon data User supplied data	Growth → Fire Behavior → Fire Effects → Growth → Fire Behavior → Fire Effects → Growth…	Graphs and data of fuels, fire behavior, and fire effects over time

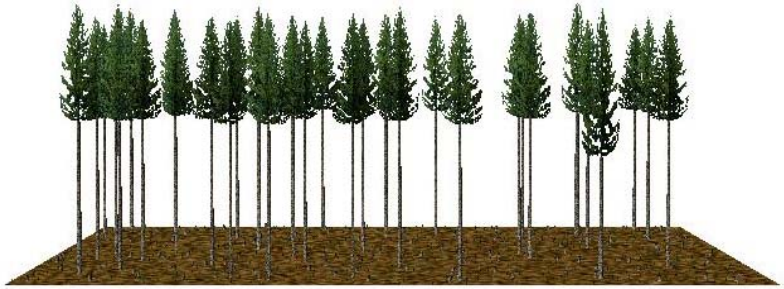
Fuels Treatment Effectiveness Over Time (2 of 3)

Objective: Evaluate the temporal durability of fuels treatments; i.e., how long, in years to decades, a treatment will continue to lower potential fire behavior and fire effects.



Fuels Treatment Effectiveness Over Time (3 of 3)

Example of vegetation growth over time



Post-treatment

+10 years

+ 20 years

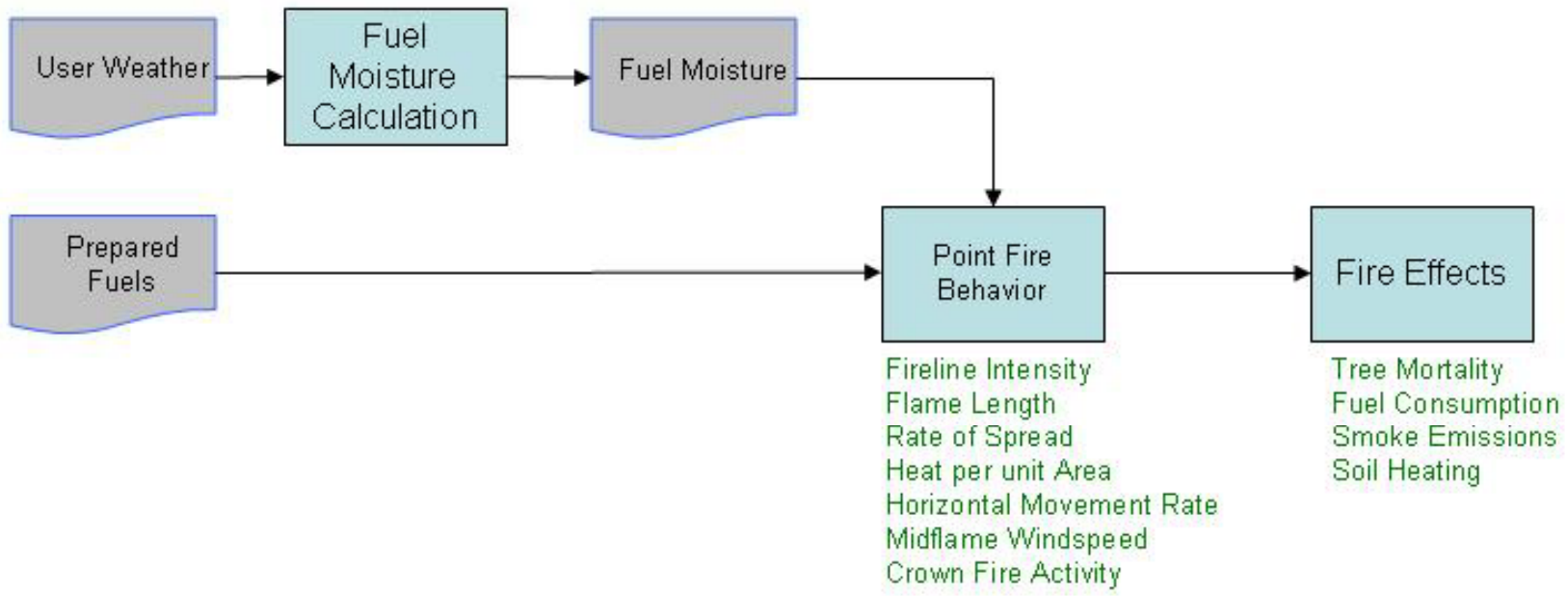
Prescribed Burn Planning (1 of 3)

Objective: Provide the information needed to plan, document, and conduct a proposed, prescribed fire.

Inputs	Vegetation/ Fuels Data Types	Processes	Outputs
Fuels; range of weather conditions	User entered single stand level data	Fire Behavior → Fire Effects → QC	Graphs and data of fire behavior and fire effects over a range of conditions

Prescribed Burn Planning (2 of 3)

Objective: Provide the information needed to plan, document, and conduct a proposed, prescribed fire.



Prescribed Burn Planning (3 of 3)

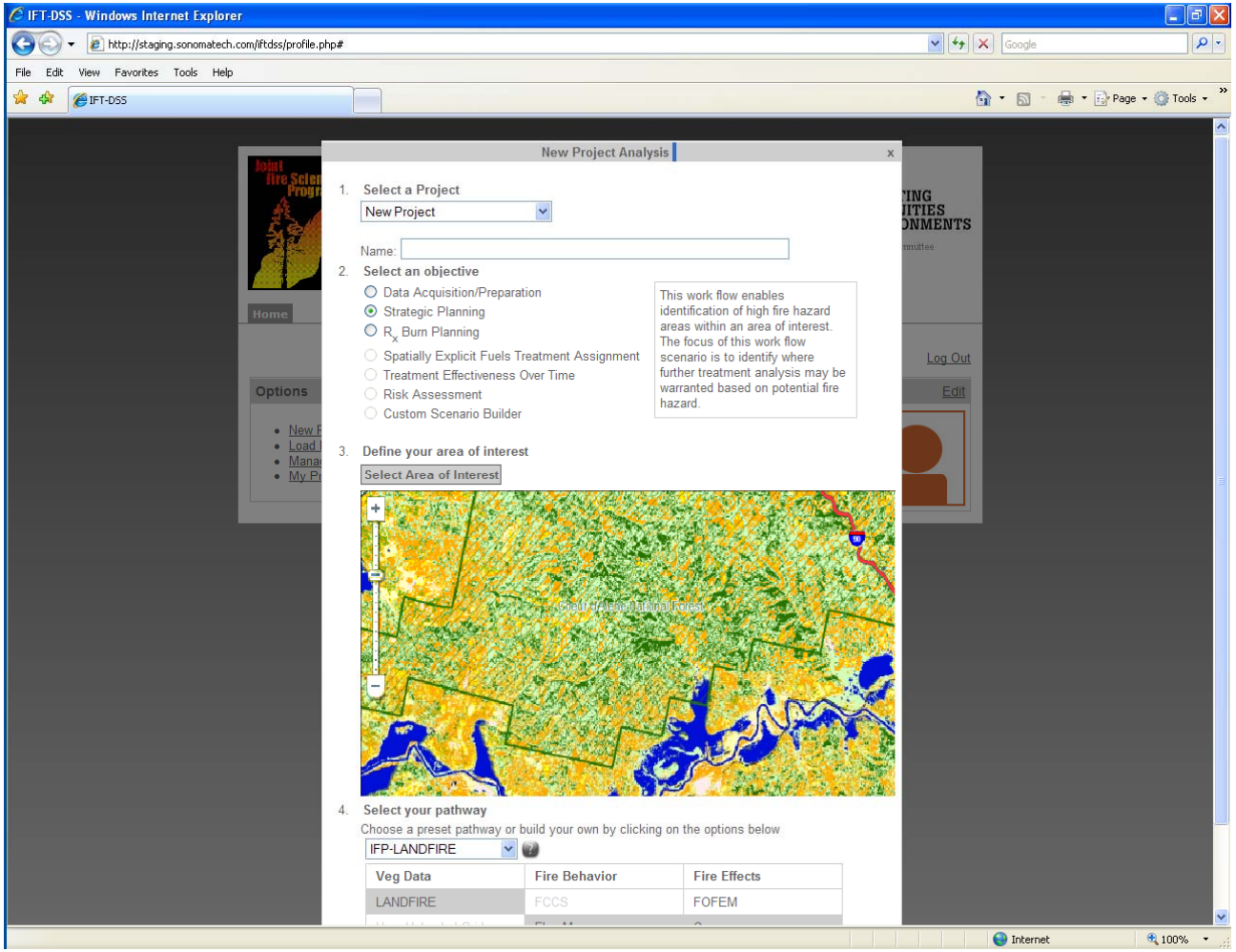
Risk Assessment

Objective: Provide a probabilistic risk assessment for fuels treatment planning.

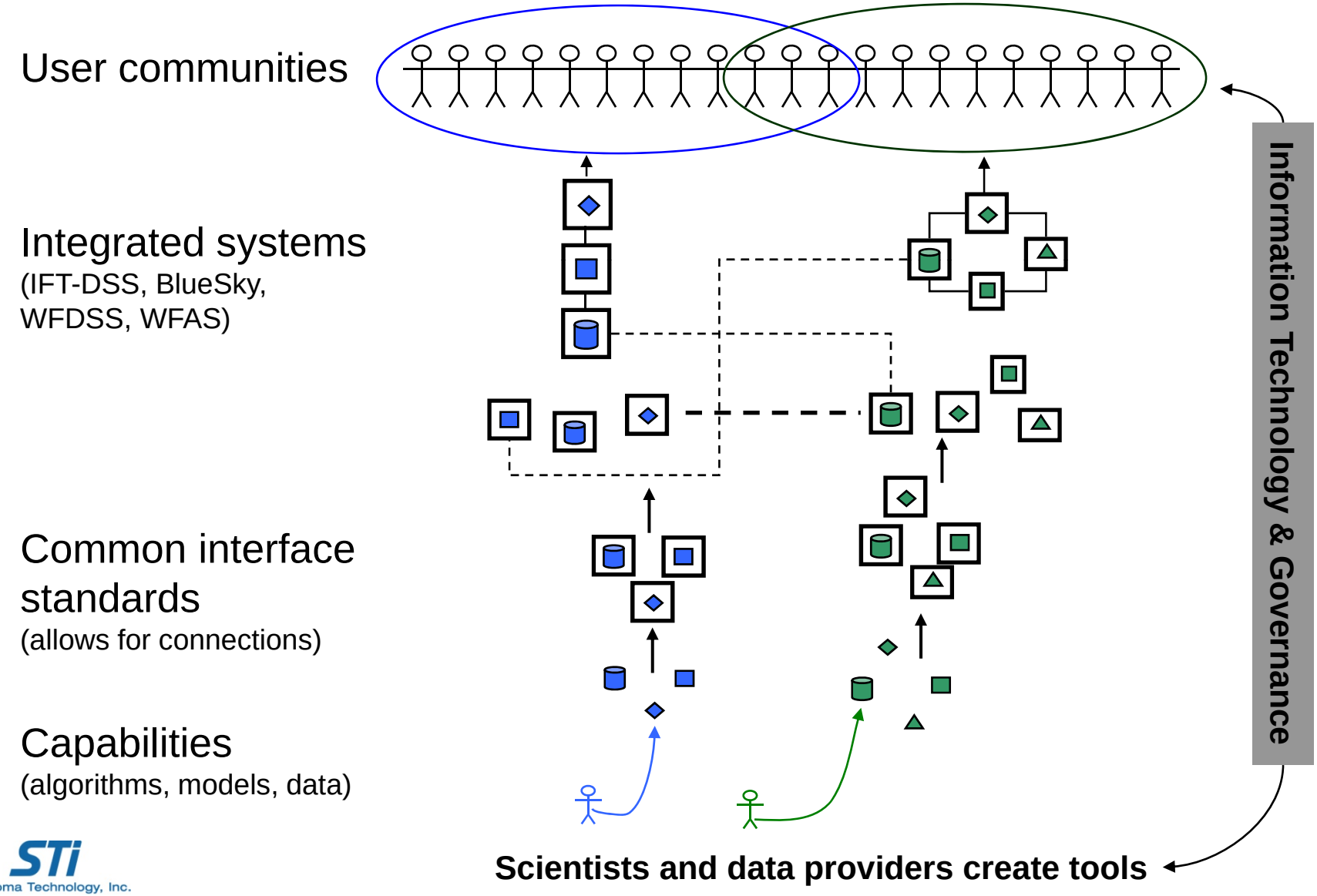
Inputs	Vegetation/ Fuels Data Types	Processes	Outputs
Current, complete fuels; topography	Tree-list polygon data LANDFIRE data User supplied data	Fire Behavior → MTT Burn Probability Mode → QC	Maps and data for fire behavior, burn probability, and values at risk

Fire risk = (burn probability) × (fire hazard index) × (value at risk)

IFT-DSS Proof of Concept



Vision for the Fuels Treatment Community



Supporting Information

- Background and supporting information can be found on the STS Frames website at:

  http://frames.nbii.gov/portal/server.pt?open=512&objID=629&mode=2&in_hi_userid=952&cached=true

- The full document, “Refined Work Flow Scenarios and Proposed Proof of Concept System Functionality for the Interagency Fuels Treatment Decision Support System,” can be downloaded from the STS Frames website at:

  http://frames.nbii.gov/documents/jfsp/sts_study/ift_dss_refined_workflow_scenarios_20090709.pdf