Pacific Southwest Region

A Novel Application of Wildland Fire Risk Assessments in Land Management Plans

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Acknowledgements to: Phil Bowden, retired Regional Fuels Planner

Regional Risk Assessment

1. SSRA –
   Southern Sierra Risk Assessment

2. NSRA –
   Northern Sierra Risk Assessment

3. CMRA –
   mid-Coastal Mountain Risk Assessment

4. SCRA –
   Southern California Risk Assessment

Why Assess Risk and Benefits?

- Policy

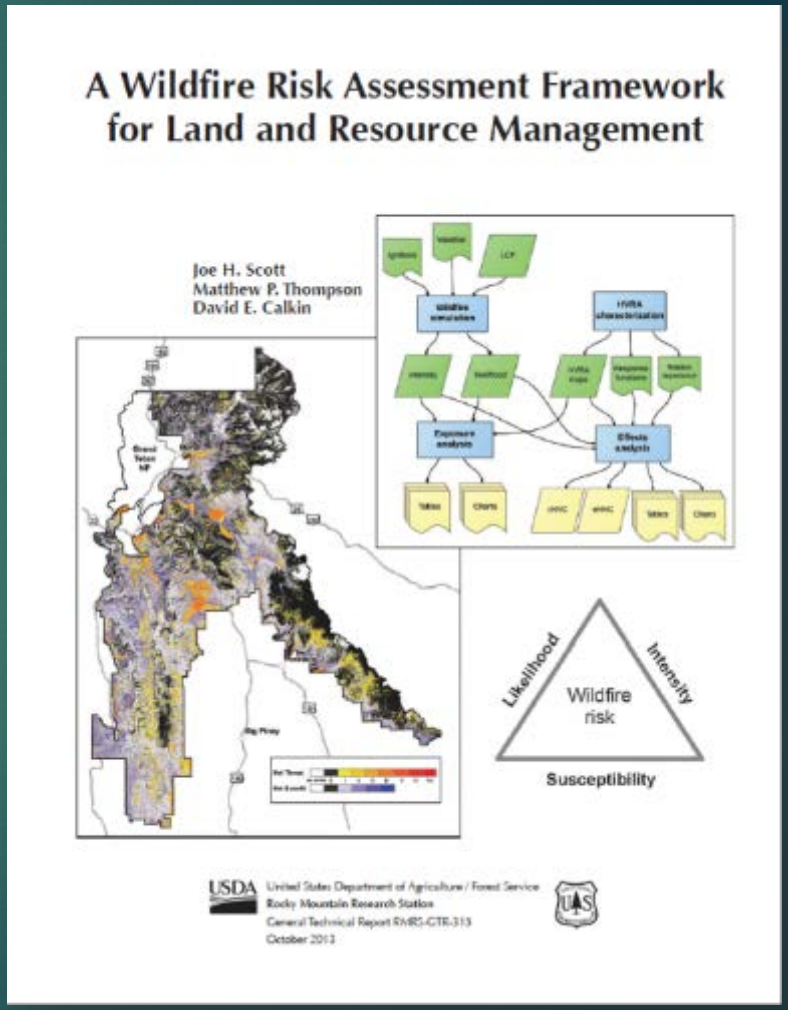
"Sound risk management is a foundation for all fire management activities"

  - 2009 Wildland Fire Policy
  - National Cohesive Strategy
  - U.S Forest Service FSM 5100

- Planning -Know where your risk resides up front

Risk Assessment Framework

- *A Wildfire Risk Assessment Framework for Land and Resource Management*
- RMRS-GTR-315
  - Joe H. Scott
  - Matt P. Thompson
  - David E. Calkin



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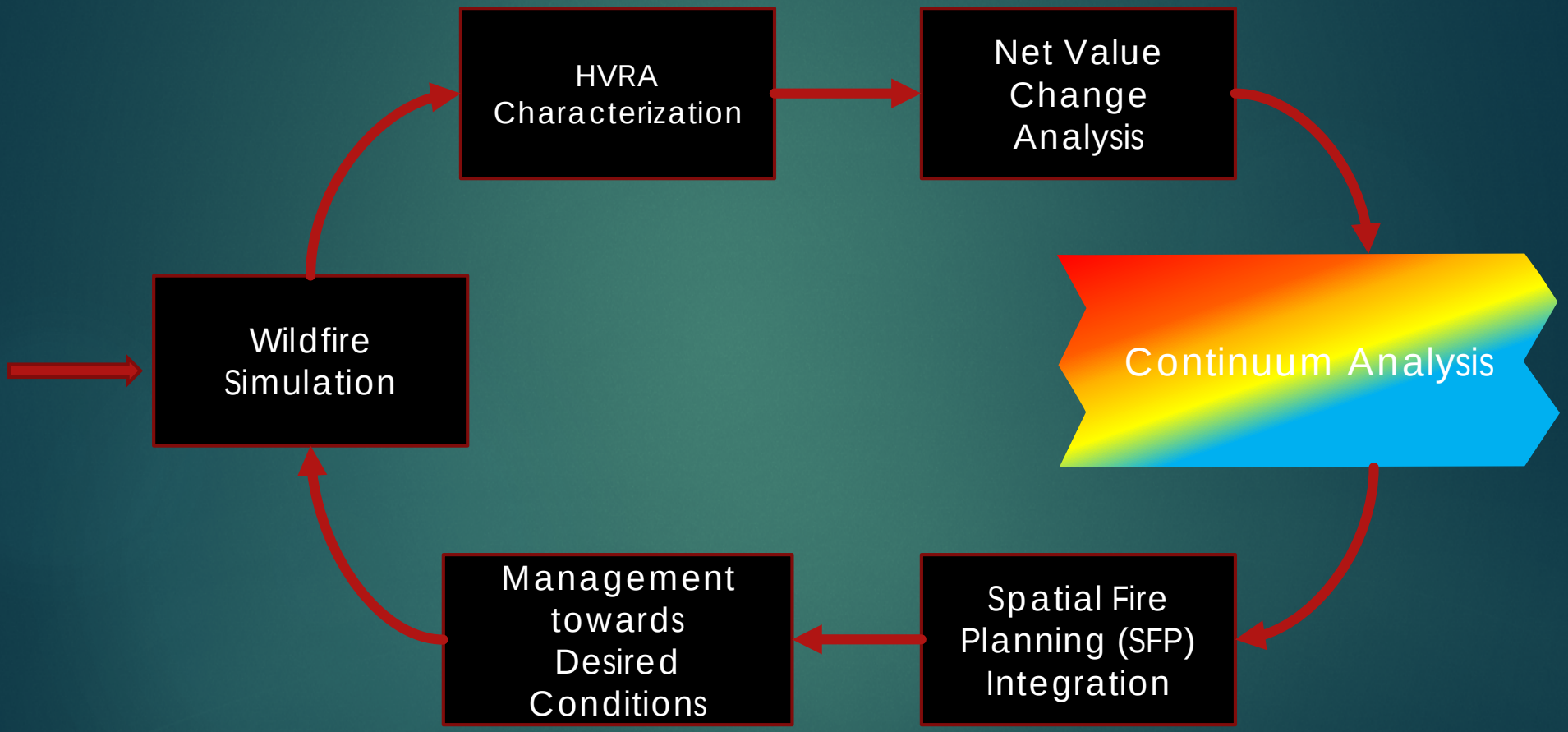
Risk-Based Fire Management Cycle



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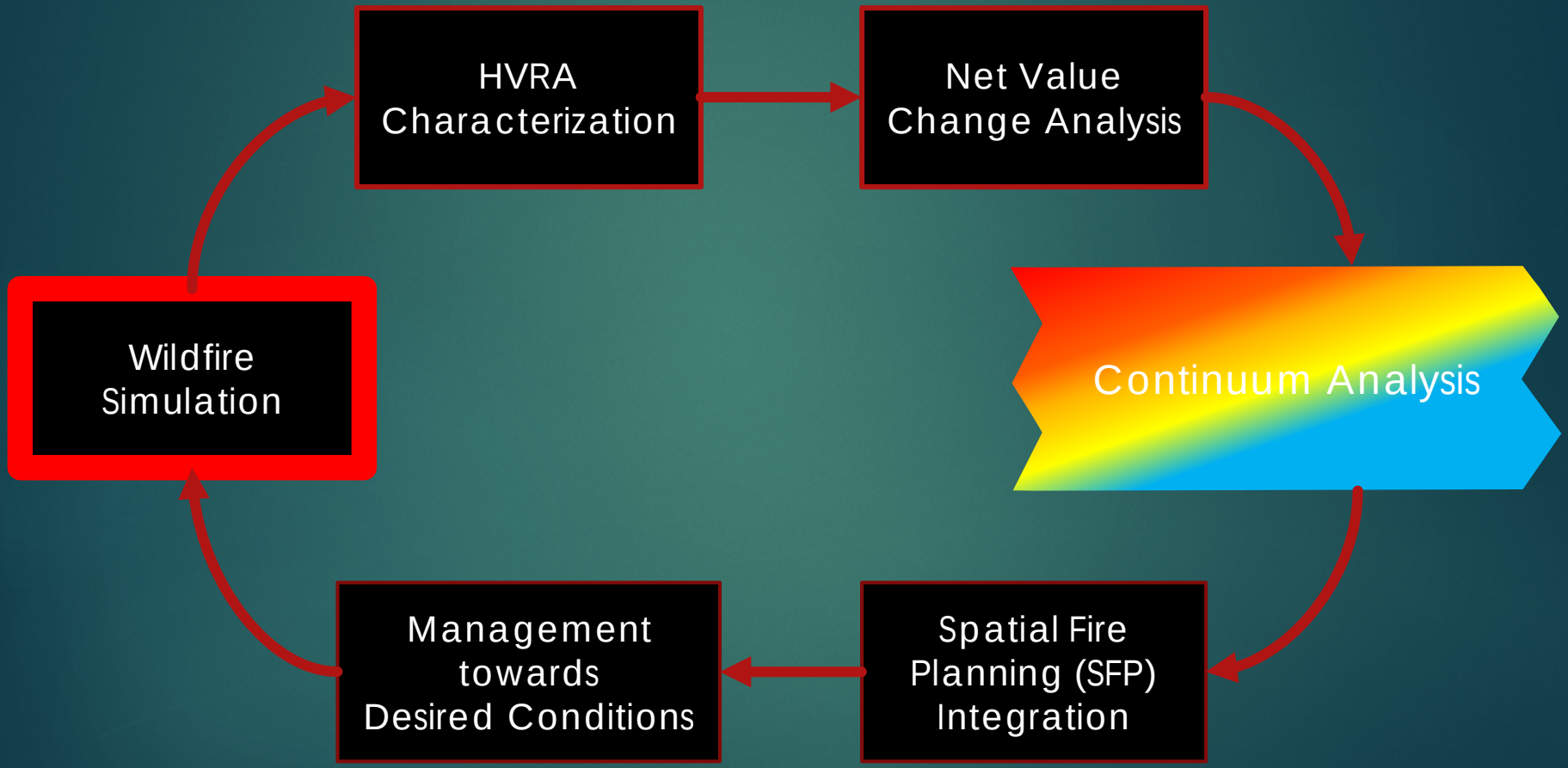
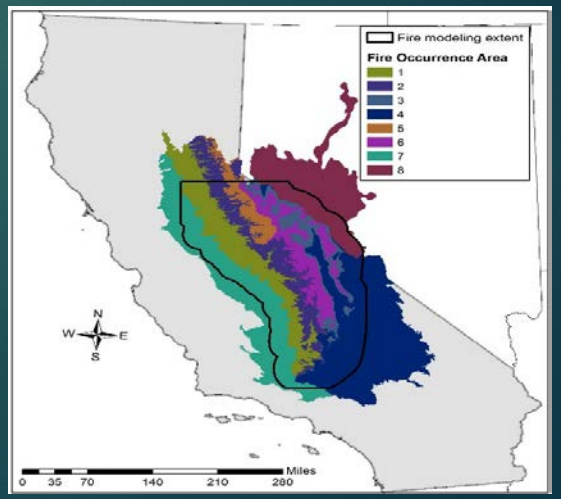
Risk-Based Fire Management Cycle: Step 1



Step 1: Wildfire Simulation

- FsSim modeling- Large Fire Simulator
- Uses a current fuelscape (LCP)
- Fires are modeled using a snapshot of the landscape
- Fire Occurrence Areas (FOA) – using ecologically based layers
- Generates burn probability & conditional fire intensity level (FIL) data



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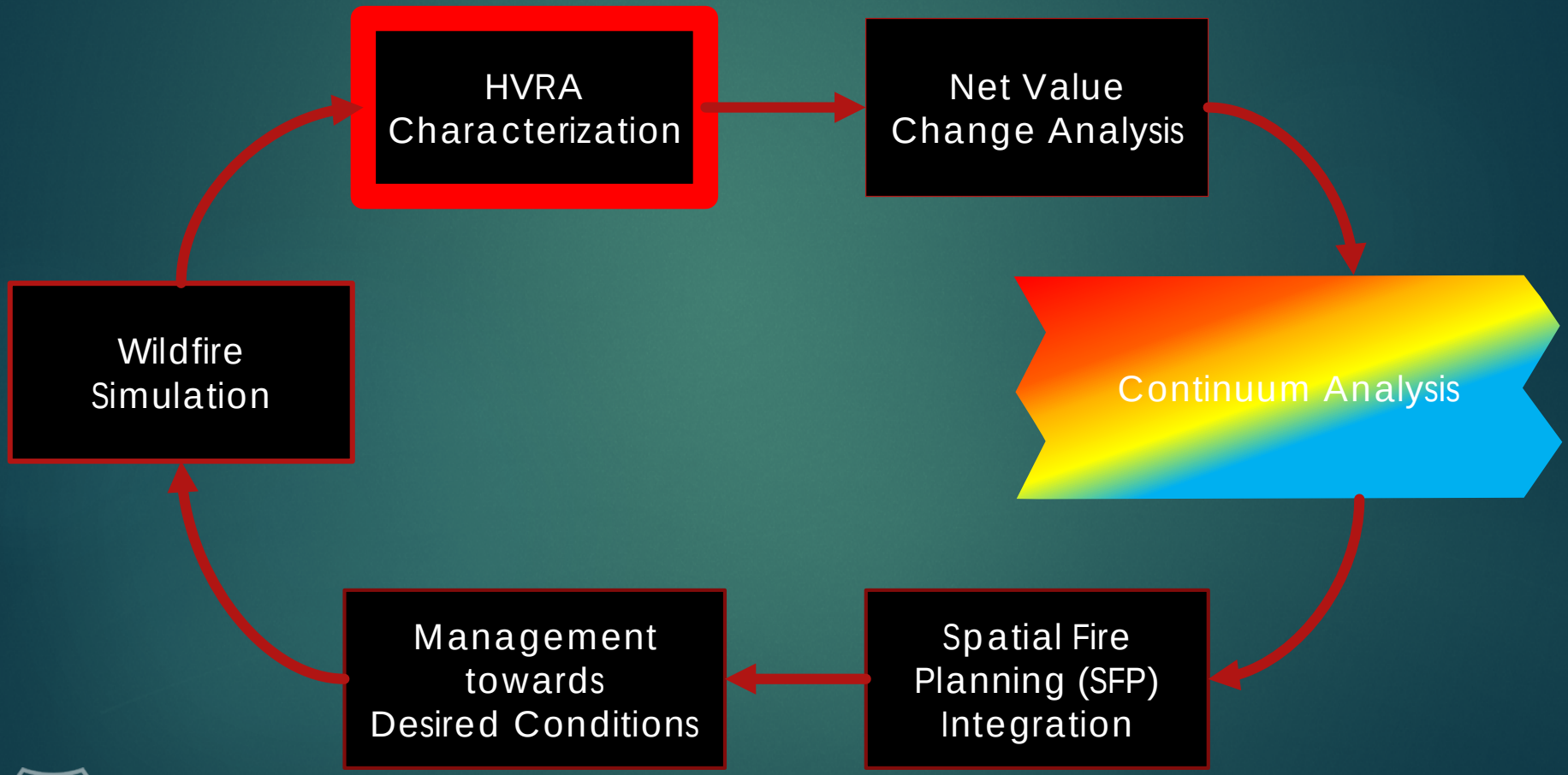
Risk-Based Fire Management Cycle: Step 2



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Step 2: Highly Valued Resources and Assets (HVRA) Characterization: What is an HVRA?

Resources:

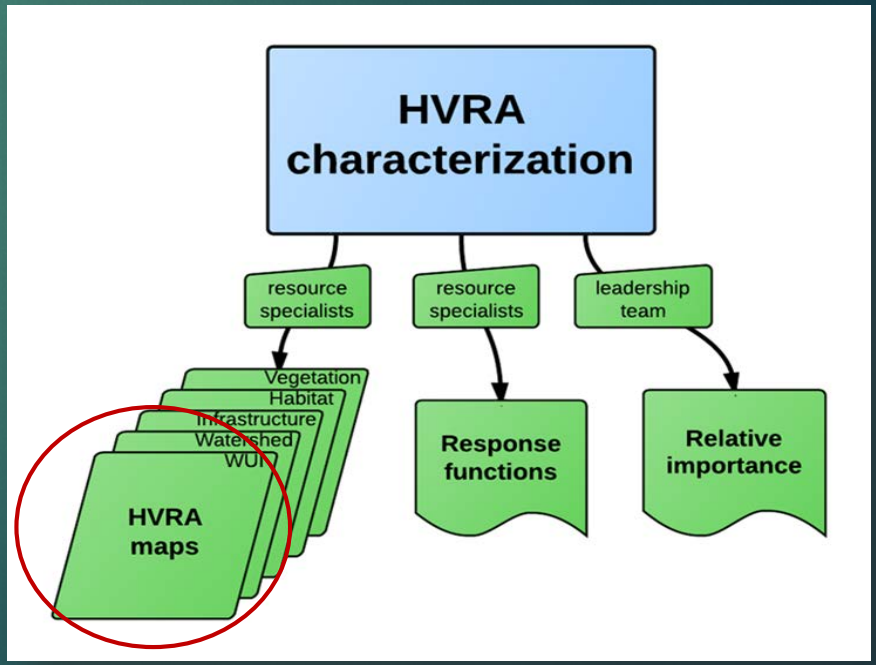
- Vegetation condition
- Wildlife habitat (e.g., Spotted owl, Goshawk, Fisher, Sage Grouse)
- Heritage/Cultural Resources
- Timber
- Municipal water
- Visual quality

Assets:

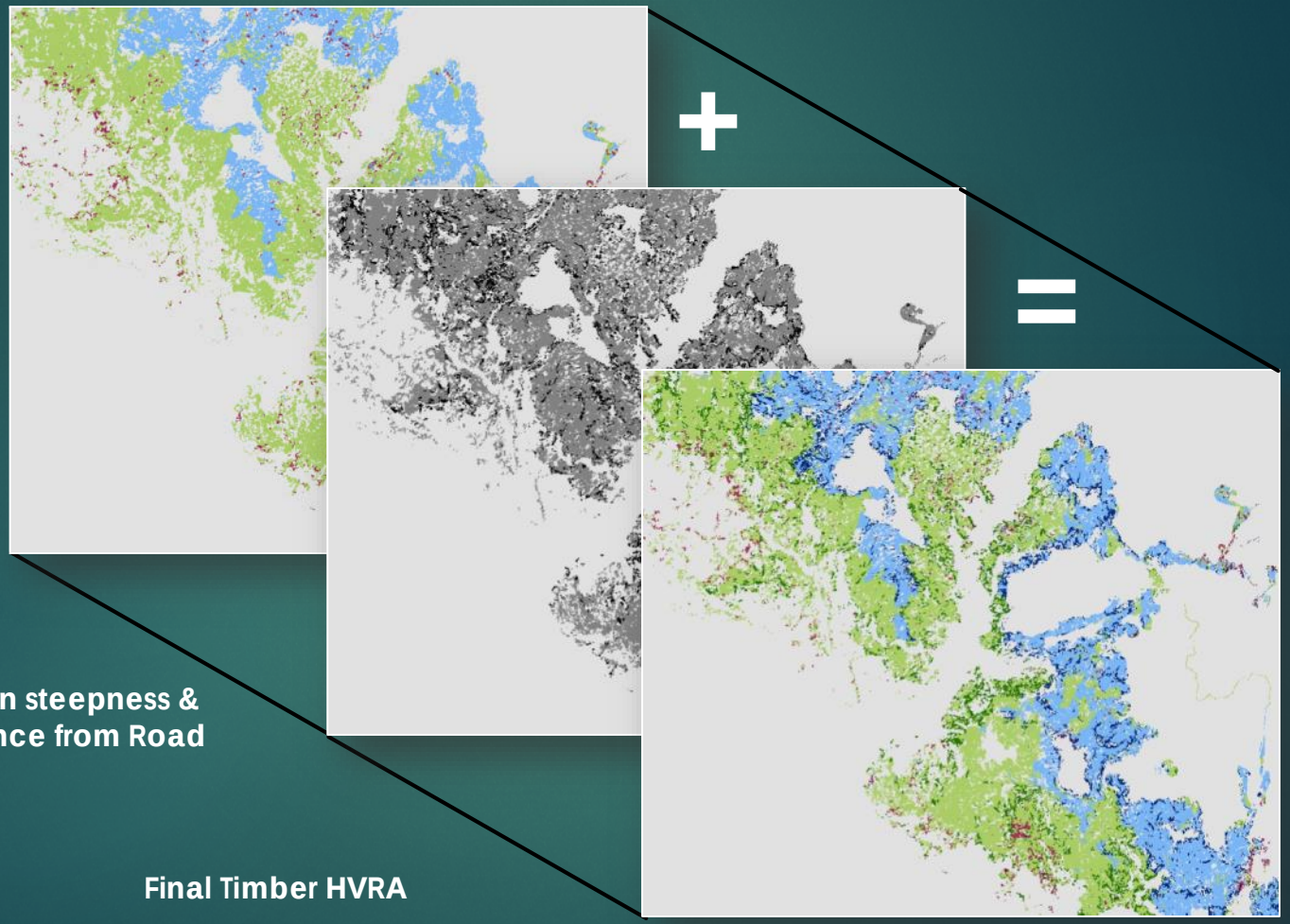
- Human Habitation
- Industrial Timber
- Major Infrastructure
- Rec/Admin Infrastructure

Step 2: Highly Valued Resources and Assets (HVRA) Characterization: HVRA Maps

- Data must be available spatially
- Use corporate regional datasets
- Methods of Mapping
- Simple
- Spatial modeling

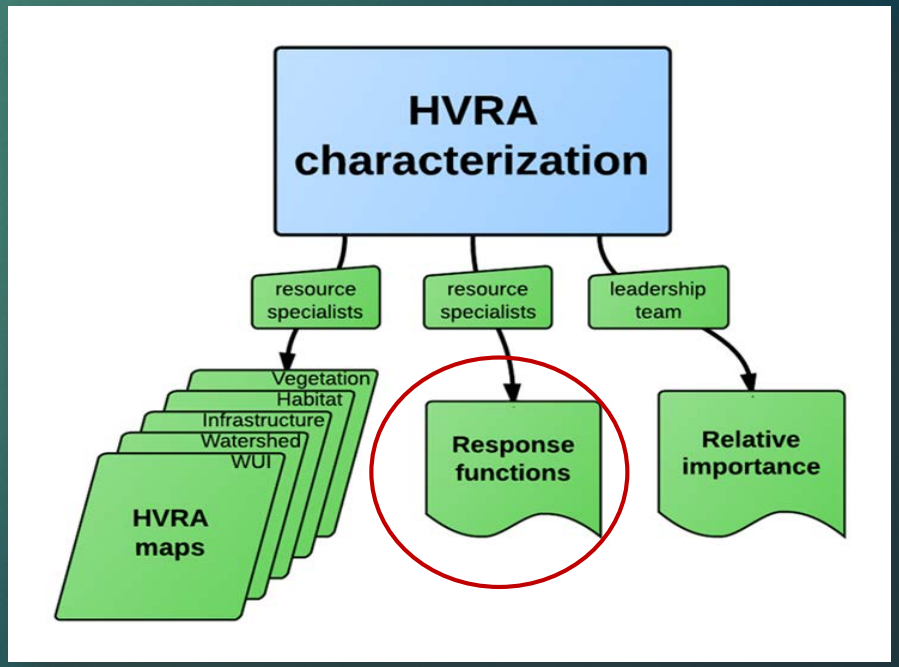


Step 2: Highly Valued Resources and Assets (HVRA) Characterization: Example of Spatial Model -Timber Resource



Step 2: Highly Valued Resources and Assets (HVRA) Characterization: Response Functions

- Susceptibility of HVRA to fire
- Loss & Benefits
- Use best available science



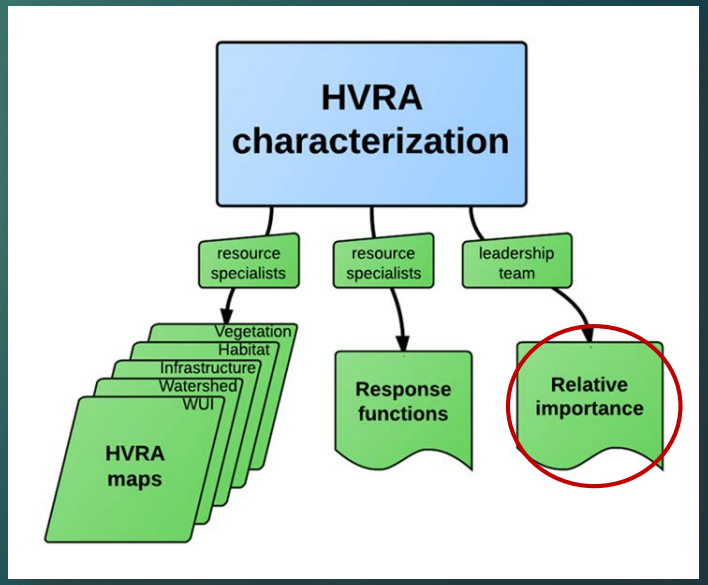
Step 2: Highly Valued Resources and Assets (HVRA) Characterization: Example of Response Functions

- Relative value based on flame length classes
- Values Range from -100 to +100

Species	Covariate	Respose Function Values by Fire Intensity Level					
		FIL1 (0-2 ft)	FIL2 (2-4 ft)	FIL3 (4-6 ft)	FIL4 (6-8 ft)	FIL5 (8-12 ft)	FIL6 (12+ ft)
Spotted Owl	Owl, mature	60	80	90	-10	-30	-60
	Owl, immature	70	90	90	-10	-50	-80

Step 2: Highly Valued Resources and Assets (HVRA) Characterization: Relative Importance

- Weighted sum across HVRAs
- Assign each HVRA with a ranking (1-100)
- Provide justification for rankings (i.e., policy, guidance)



Step 2: Highly Valued Resources and Assets (HVRA) Characterization: Example Relative Importance

Highly Valued Resources and Assets (HVRA)	Relative Importance (max. 100)
Human habitation – (classified into 3 sub-HVRAs) High-density human habitation, Moderate-density human habitation, and low-density human habitation	97
Major infrastructure – (classified into 4 sub-HVRAs) Electrical power transmission lines, non-hydroelectric power plants, communication sites, hydroelectric power plants	83
Watershed resources – (classified into sub-HVRAs) based on number of people served (Forest to Faucets), vegetation, slope and erosion potential	80
Critical terrestrial habitat (classified into sub-HVRAs) based on 4 habitat types: spotted owl, Pacific fisher, goshawk, and greater sage-grouse and different species type & size of trees	78
Timber resources – 3 groups of tree species and size (classified into 6 sub-HVRAs) based on access (terrain steepness and access from road)	74
Inholdings - State forests and private timber lands	67
Recreation and administrative infrastructure – (classified into 2 sub-HVRAs) Low and high developed sites	65
Visual resources - Scenic byways	60
Vegetation condition class – (classified into 15 sub-HVRAs) based on biophysical settings, succession class, and relative abundance	50

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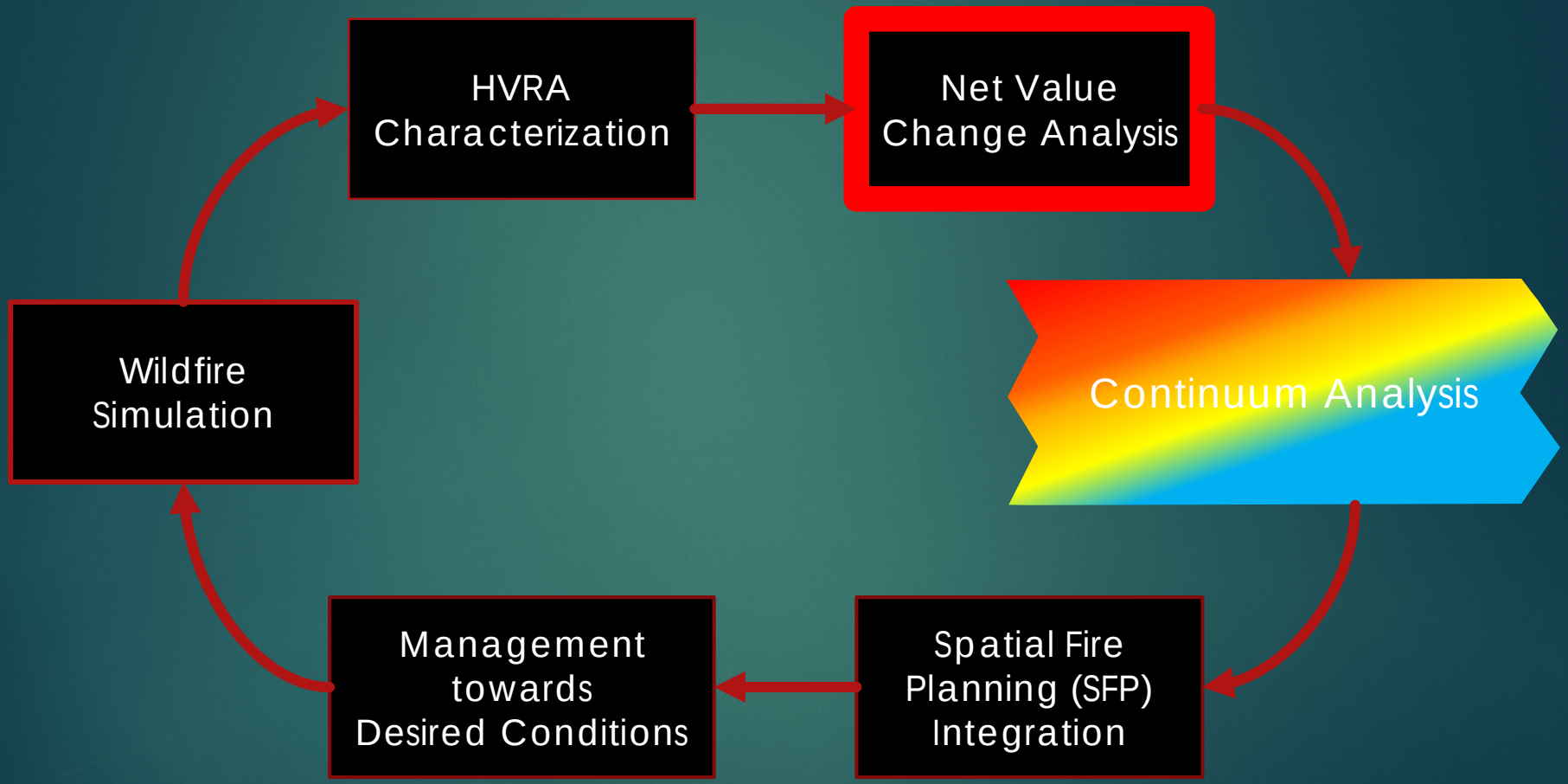
Risk-Based Fire Management Cycle: Step 3



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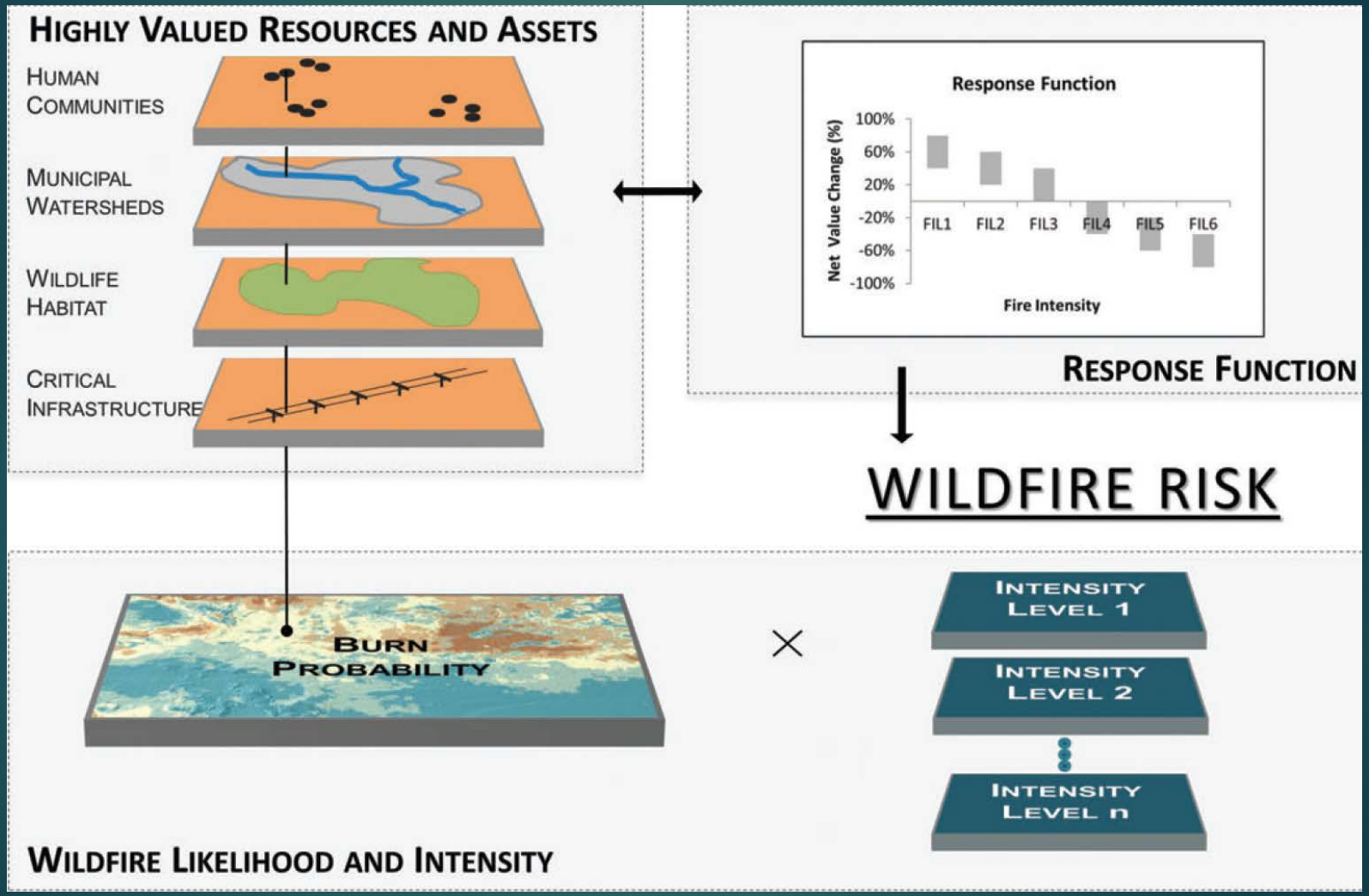
Step 3: Net Value Change Analysis



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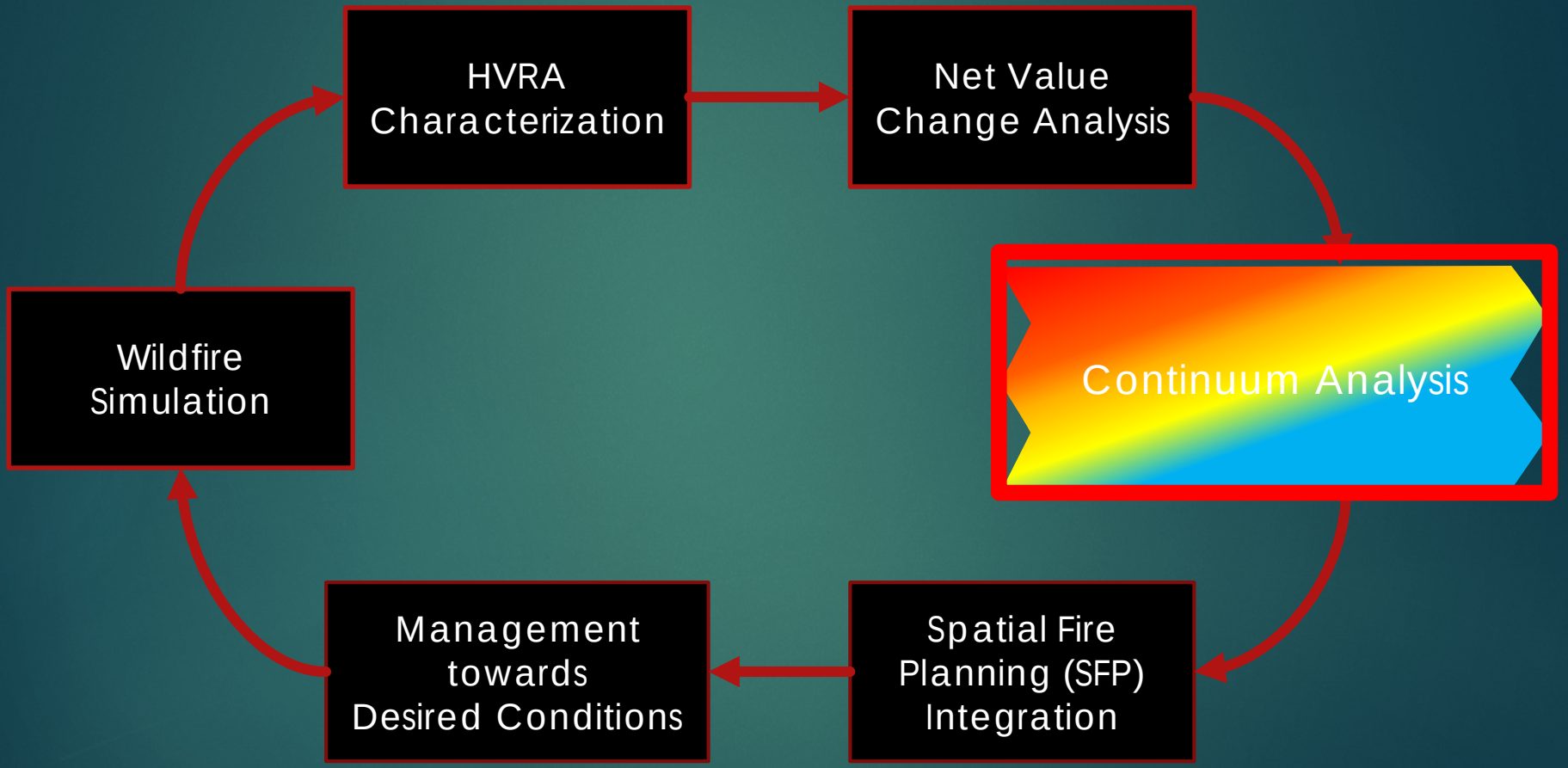
Step 4: Risk-Based Fire Management Cycle



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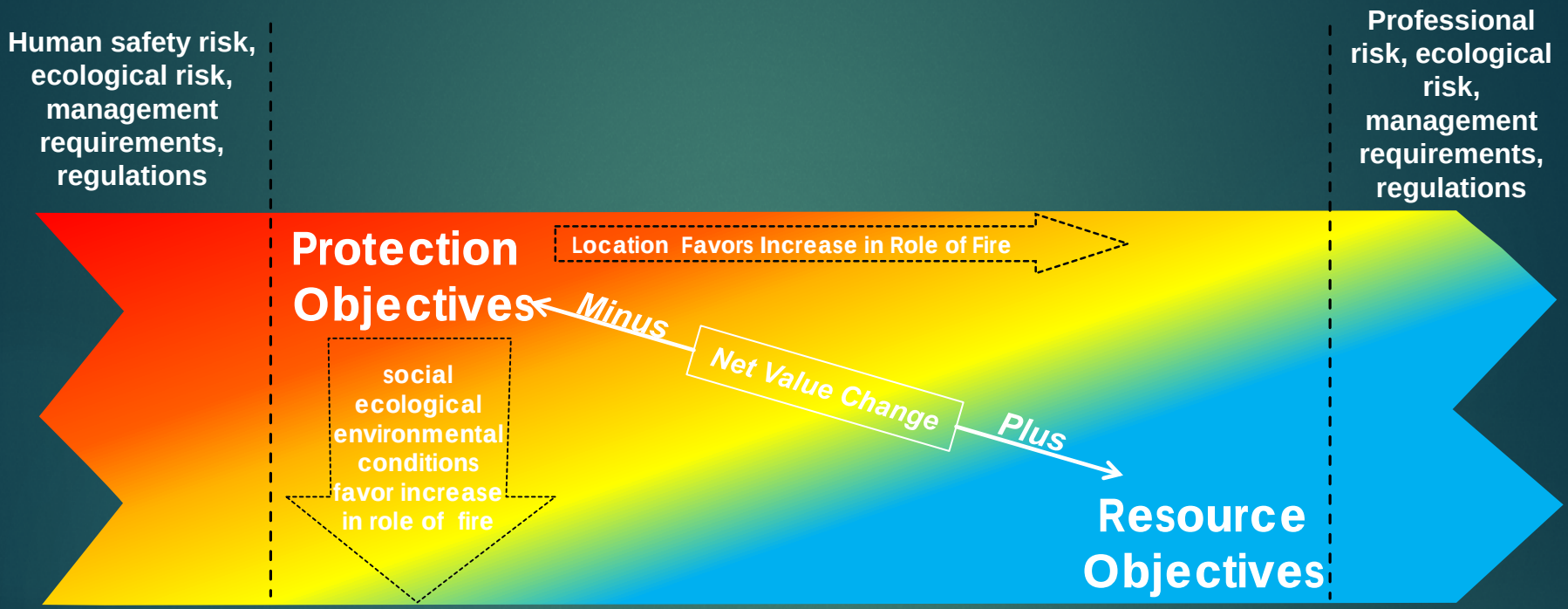
Step 4: Wildland Fire Management Continuum



"Bowden-Taylor Continuum" (Thompson et al. 2016)

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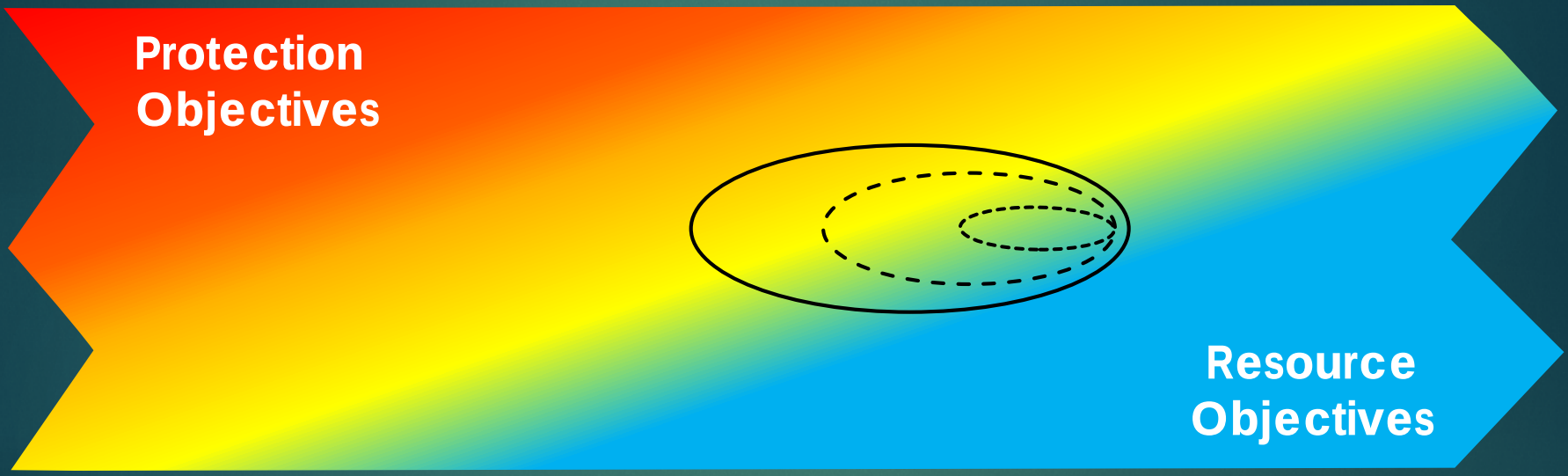
Fire Growth & Evolving Objectives



Thompson et al. 2016

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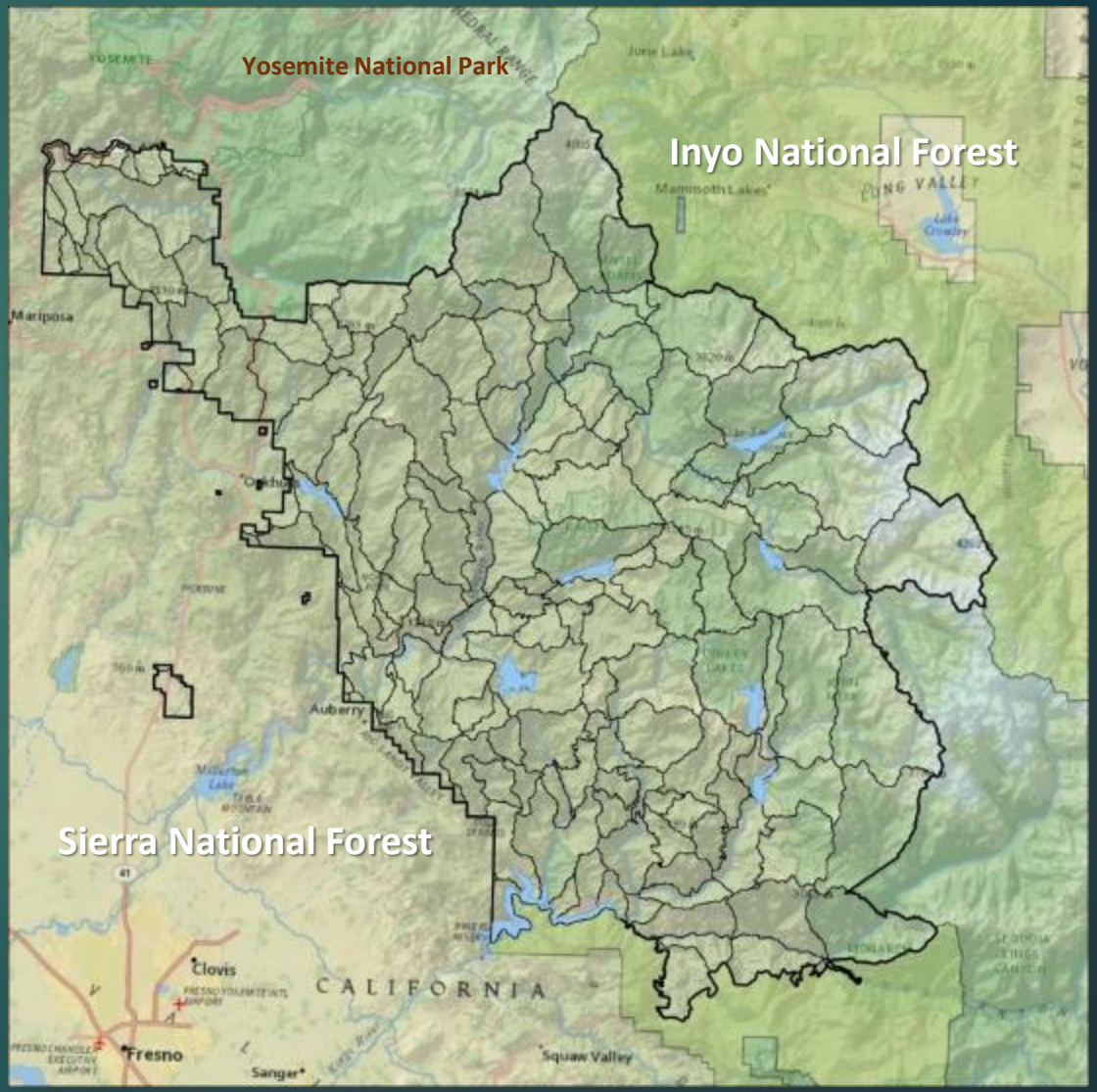
Potential wildfire Operation Delineations (POD)

The Creation of PODs is essential to summarizing risk assessment outputs in a useful fire management context.



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What is a POD?

- Spatial fire-related summary units that are used for summarizing data from a wildfire risk assessment
- PODs are bounded by real fire management features such as roads, rivers, major ridges, barren areas, waterbodies, elevation changes, major fuel changes, etc.
- PODs are mapped by local wildland fire management specialists
- PODs are the initial spatial basis for Strategic Wildfire Management Zones
- PODs are *not* Fire Management Units (FMU)

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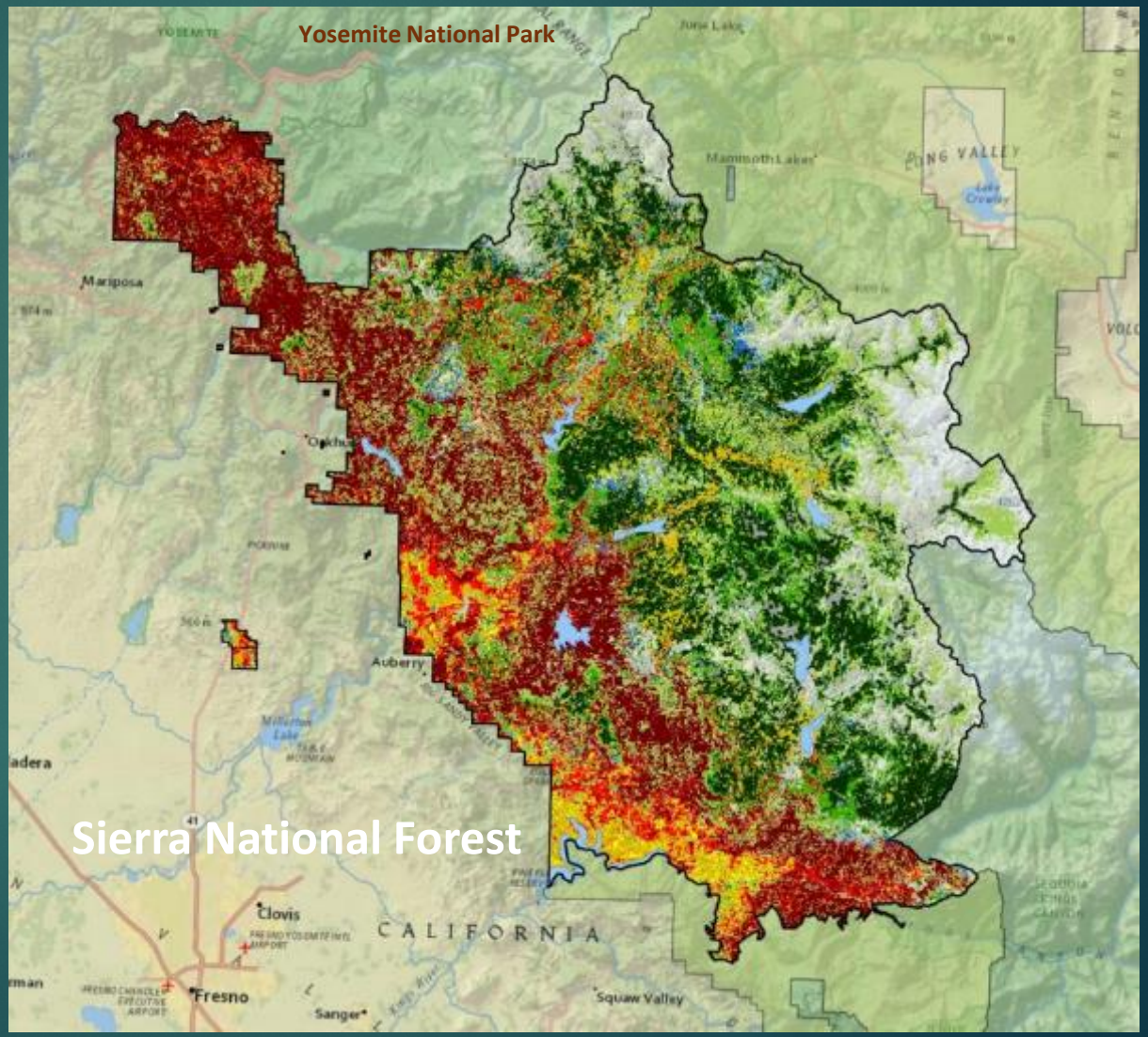
Results from Risk Assessment

Relative Risk Matrix
for Large Fires
(90m pixels)

P1	N1
P2	N2
P3	N3
P4	N4

No Data / No Risk



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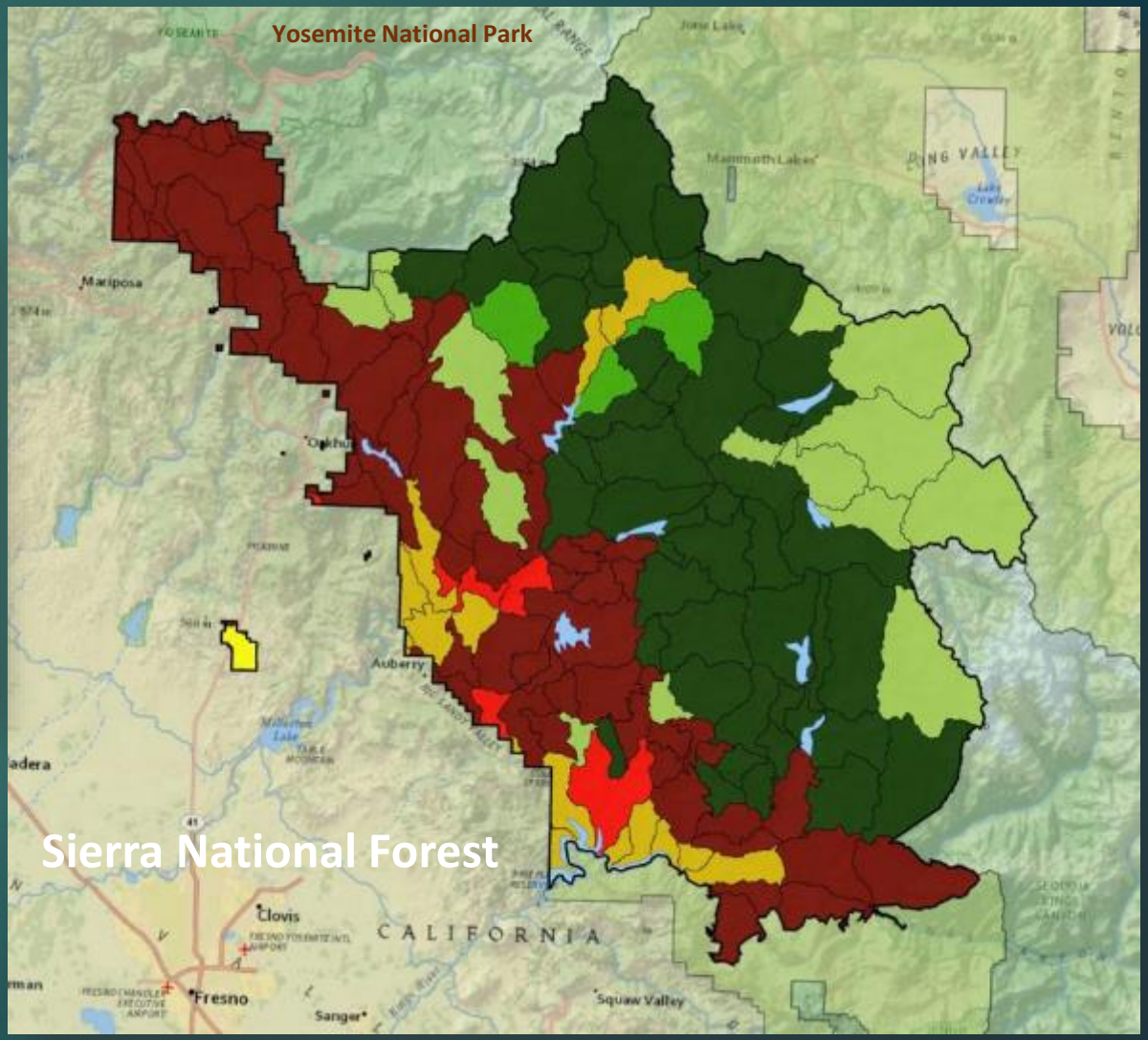
Relative Risk Map – by POD

Relative Risk Majority Summary
for Large Fires
(summary units based on
fire management features)

Top Priority:	P1	N1
High Priority:	P2	N2
Moderate Priority:	P3	N3
Lowest Priority:	P4	N4

No Data / No Risk



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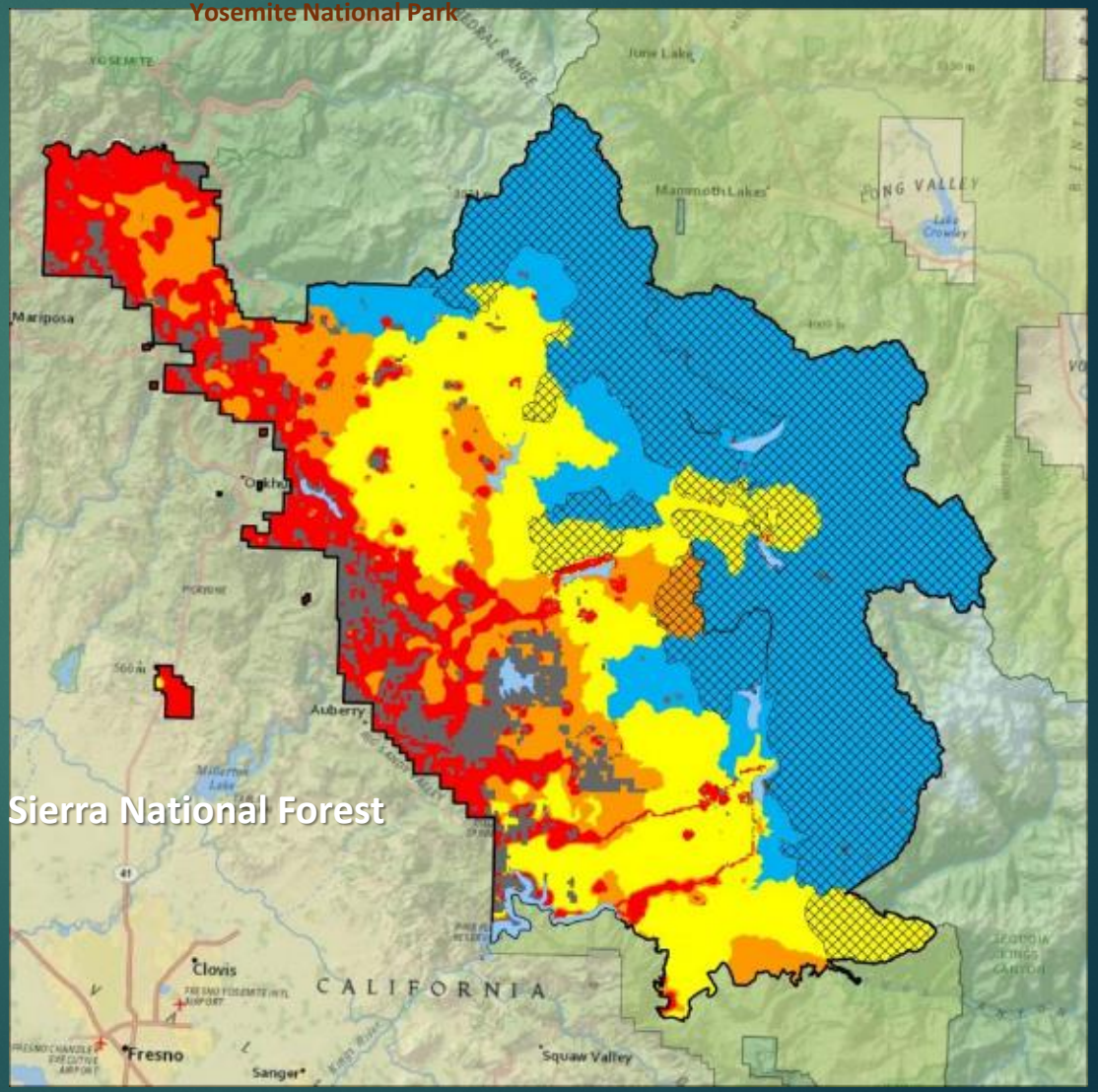
Step 4: Strategic Wildfire Management Zones: Sierra National Forest



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Step 4: Strategic Wildfire Management Zones: LMP Objectives

Strategic wildfire management areas	Wildfire risk	Can wildfire meet resource management objectives?	Replaces old LRMP areas
P1 **Community Wildfire Protection**	**Very High** Community Assets	**Yes** Opportunities will be very limited due to risk to communities.	WUI defense zones. Areas where assets are threatened.
P2 **General Wildfire Protection**	**High** Resources & Ignition Threat to Communities	**Yes** Opportunities will be limited due to risk to assets and natural resources.	WUI threat zones. Area where natural resources and assets are threatened.
R **Wildfire Restoration**	**Moderate** Resources	**Yes** Opportunities are far less limited than the protection zones. Some risks to natural resources.	This area is new.
M **Wildfire Maintenance**	**LOW** Likely benefits To Resources	**Yes** Opportunities are good under a wide range of conditions. Wildfire should be used but always commensurate with values at risk.	This area is new.

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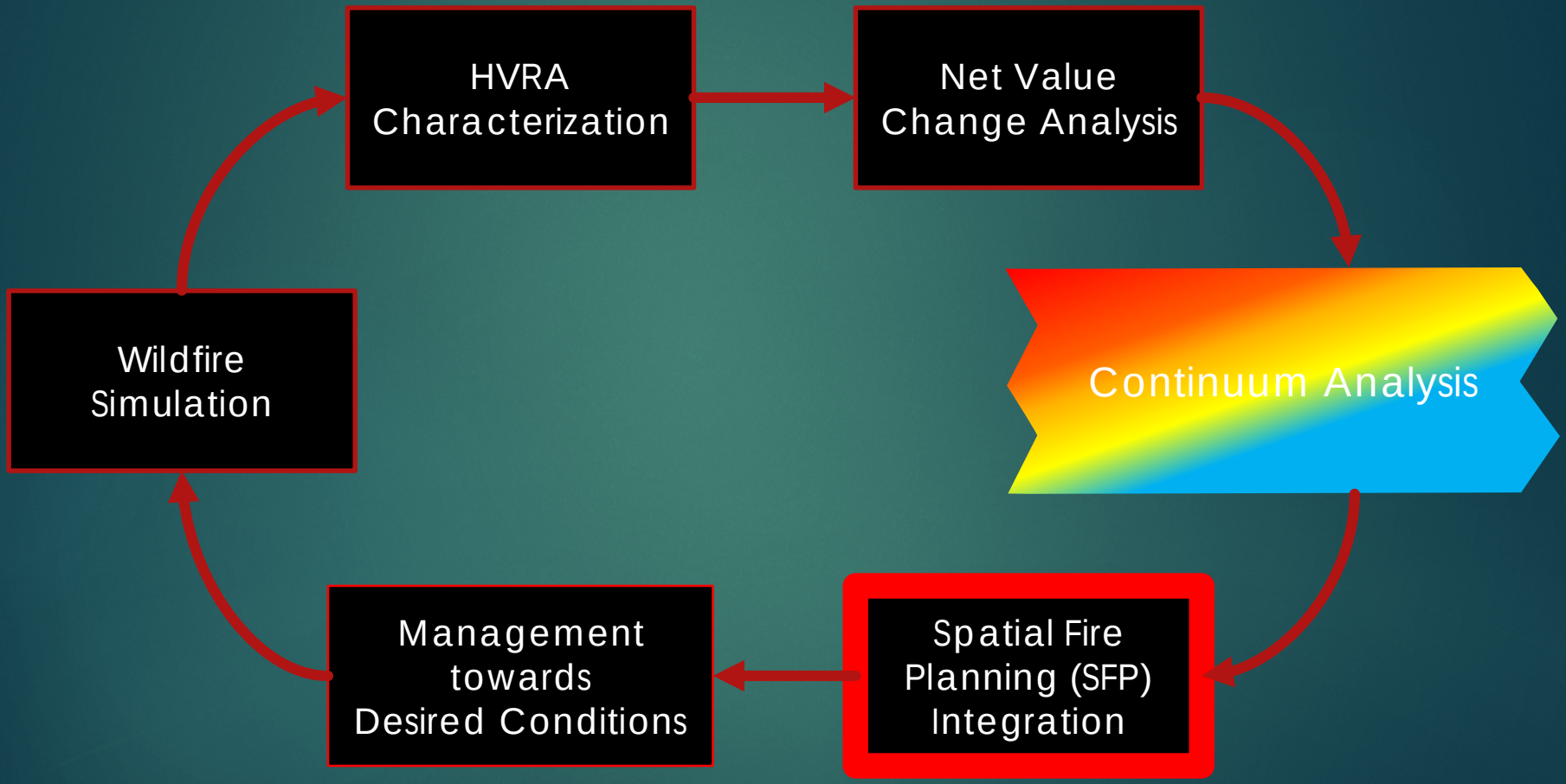
Risk-Based Fire Management Cycle



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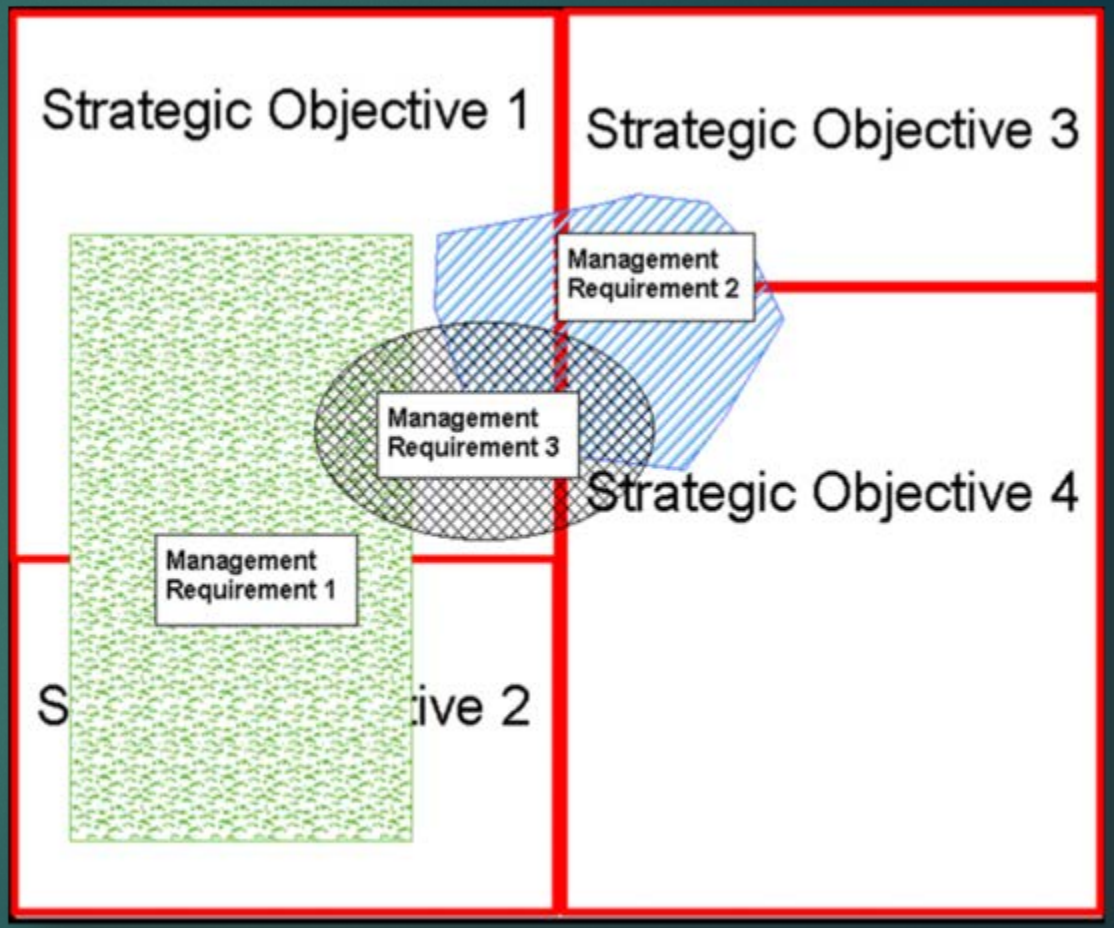
Step 5: Spatial Fire Planning Integration

Strategic objectives and management requirements are represented by GIS shapes in WFDSS



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Step 6: Managing Towards Desired Conditions

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Other Assessment Uses

- Fuels treatment prioritization
- Wildfire response (multiple ignitions)
- Fire prevention prioritization
- Pre-planning

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Article

Application of Wildfire Risk Assessment Results to Wildfire Response Planning in the Southern Sierra Nevada, California, USA

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Abstract: How wildfires are managed is a key determinant of long-term socioecological resiliency and the ability to live with fire. Safe and effective response to fire requires effective pre-fire planning, which is the main focus of this paper. We review general principles of effective federal fire management planning in the U.S., and introduce a framework for incident response planning consistent with these principles. We contextualize this framework in relation to a wildland fire management continuum based on federal fire management policy in the U.S. The framework leverages recent advancements in spatial wildfire risk assessment—notably the joint concepts of *in situ* risk and source risk—and integrates assessment results with additional geospatial information to develop and map strategic response zones. We operationalize this framework in a geographic information system (GIS) environment based on landscape attributes relevant to fire operations, and define Potential wildland fire Operational Delineations (PODs) as the spatial unit of analysis for strategic response. Using results from a recent risk assessment performed on several National Forests in the Southern Sierra Nevada area of California, USA, we illustrate how POD-level summaries of risk metrics can reduce uncertainty surrounding potential losses and benefits given large fire occurrence, and lend themselves naturally to design of fire and fuel management strategies. To conclude we identify gaps, limitations, and uncertainties, and prioritize future work to support safe and effective incident response.

Keywords: risk-informed decision making; effects analysis; fire management planning; incident management

1. Introduction

In the western U.S. and elsewhere, new paradigms are emerging that recognize a need to deemphasize fire exclusion, expand application of prescribed and managed natural fire, and foster resilience and adaptation to fire [1–4]. The National Cohesive Wildland Fire Management Strategy in the U.S. focuses on making meaningful progress towards attainment of resilient landscapes, fire adapted communities, and safe and effective response to fire [5]. Our focus here is the goal of safe and effective response to fire, and is based on the premise that how fires are managed—not just how landscapes are managed and communities respond before and after fires occur—is a key determinant of long-term socioecological resiliency and the ability to "live with fire" [6–8].

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Questions?
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