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# Modeling Forest Succession and Disturbance on the Kenai Peninsula, Alaska, Using the Fire Effects Tradeoff Model

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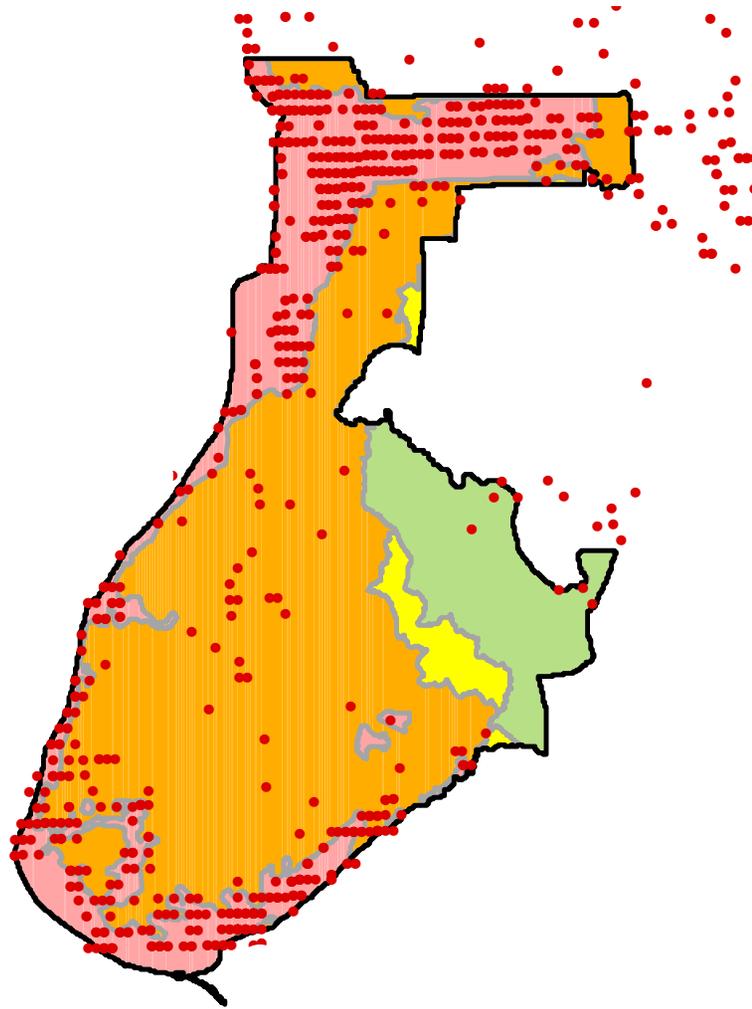
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# Introduction

- Study to evaluate the effects of alternative fuels treatment options on wildfire acres, smoke emissions, and landscape composition, on the Kenai Peninsula, Alaska
- Part of PSW Research Station's "Risk-Based Comparison of Potential Fuel Treatment Tradeoff Models"

# Study Areas :



## 1- Coastal Area

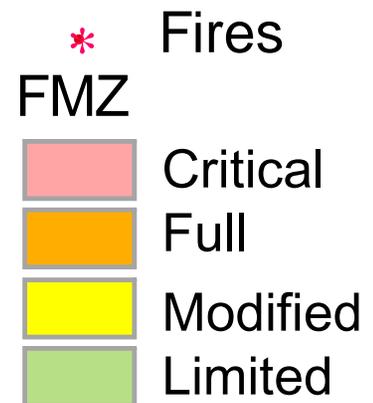
Critical Fire Management Zone

26 fire starts per year

## 2- Interior Area

Full/Modified/Limited FMZs

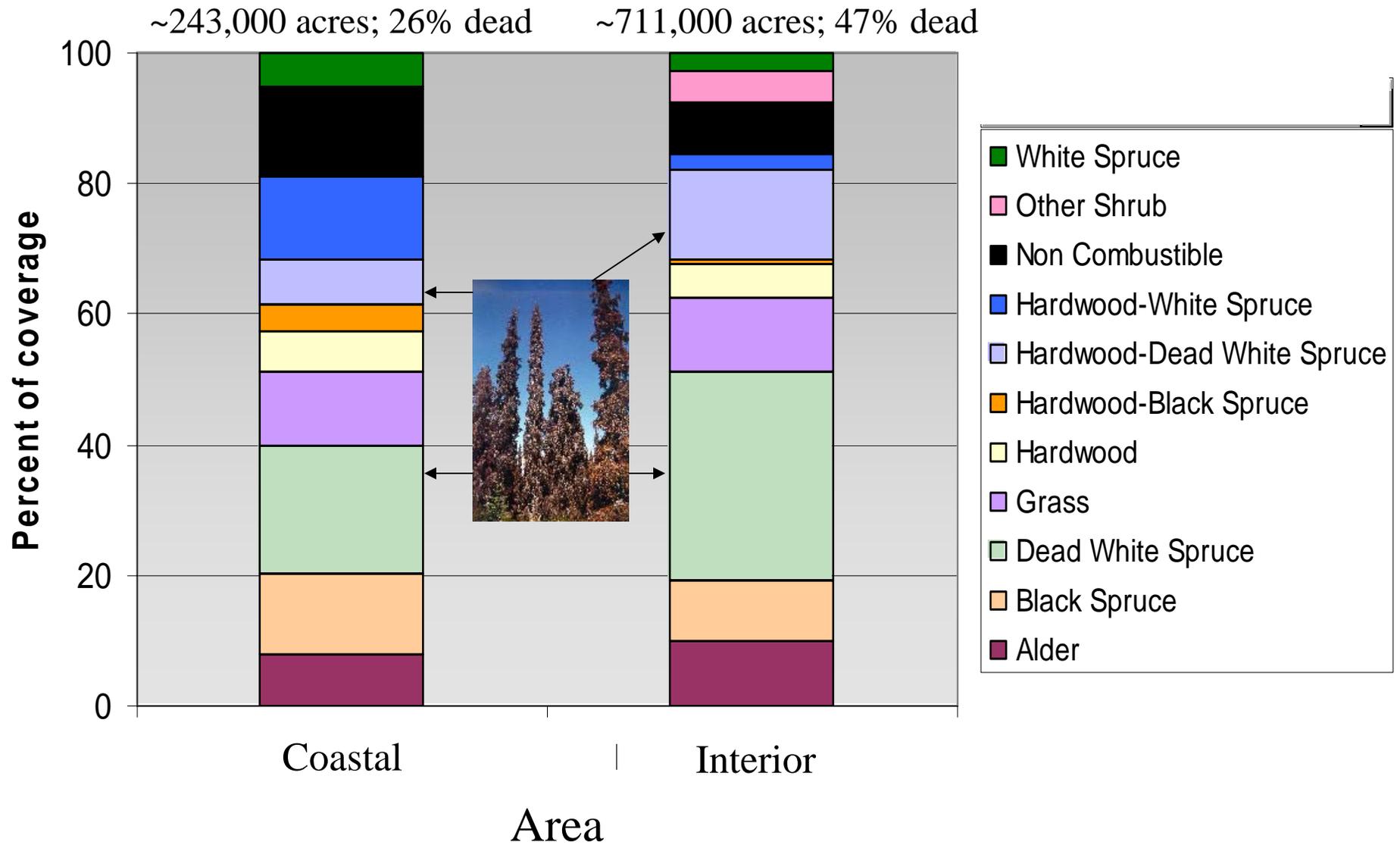
6 fire starts per year



0 20 Miles



# Initial Vegetation Distribution





White  
Spruce  
Stand

- 60ft high

Source: Natural Fuels  
Photo Series, Volume  
II, Spruce types in  
Alaska, NFES 2581



Mixed White  
Spruce and  
Hardwood

- 49ft high

Source: Natural Fuels  
Photo Series, Volume  
IIa, Spruce types in  
Alaska, NFES 2668

# Spruce bark beetle kill in white spruce



Source: <http://www.borough.kenai.ak.us/sprucebeetle/New/photos.htm>

# Surface fuels after spruce bark beetle kill



Source: <http://www.borough.kenai.ak.us/sprucebeetle/New/photos.htm>

# Research Question

- What are the short and long term effects of different fuels treatment options targeting beetle killed white spruce?
- Effects measured in terms of:
  - 1) Wildfire acres
  - 2) Smoke emissions
  - 3) Landscape composition

# Fuels Treatment Types

- CCWR-plant
  - Clear cut with reserve trees, followed by re-planting with spruce
- CCWR
  - Clear cut with reserve trees
- Rx
  - Prescribed fire

# Treatment Alternatives

Scenario	Treatment Acres (thousands)			
	TOTAL (% of area)	CCWR-Plant Acres	CCWR Acres	Rx-fire Acres
1- Coastal Interior				
2- Coastal Interior	6 (9%) 52 (16%)	6 52		
3- Coastal Interior	20 (30%) 175 (52%)	6 52	9 82	5 41
4- Coastal Interior	15 (23%) 134 (41%)	6 52	9 82	
5- Coastal Interior	6 (9%) 52 (16%)	6 52		

# Fire Effects Tradeoff Model

- Ecosystem disturbance model
  - Natural disturbances
  - Management activities
- Stochastic, dynamic, non spatial
- Emphasis on fire behavior and effects
- Variable temporal and spatial scales
- Development funded by Joint Fire Science Program

# Methodology

Collect Data



Parameterize FETM



Define Scenarios



Run Model



Evaluate Results

# Methodology

Collect Data



Parameterize FETM



Define Scenarios

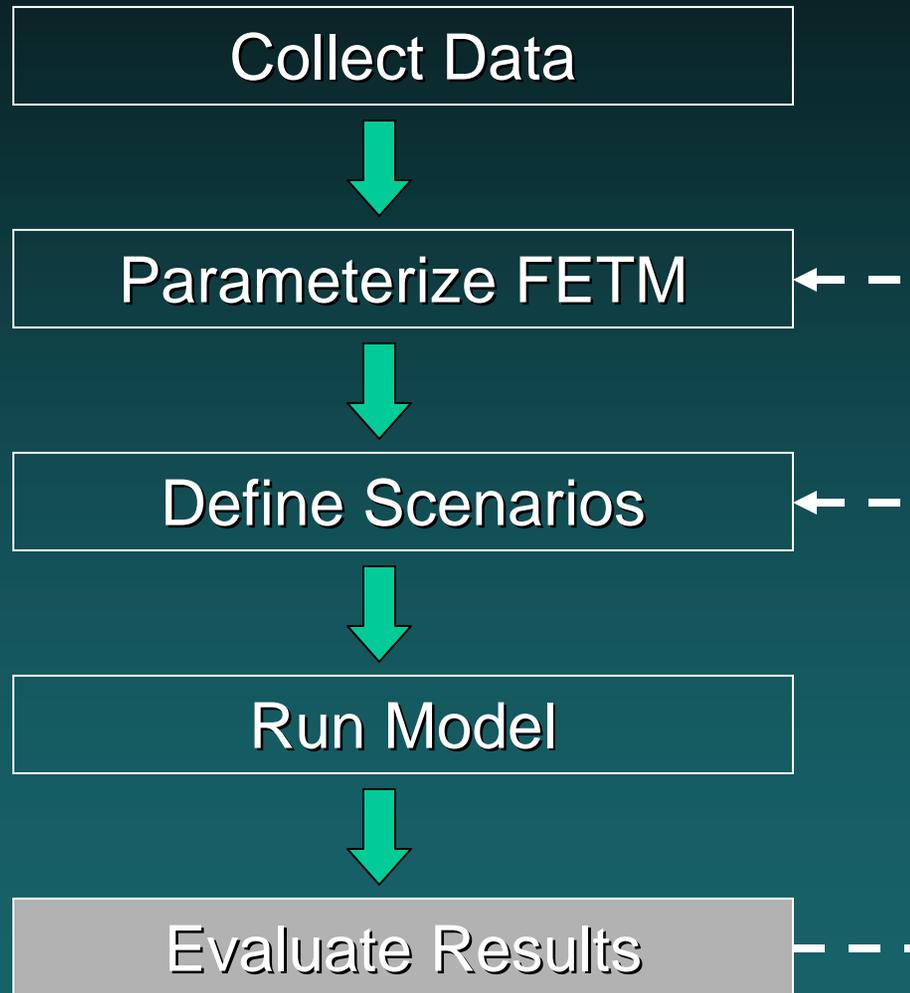


Run Model



Evaluate Results

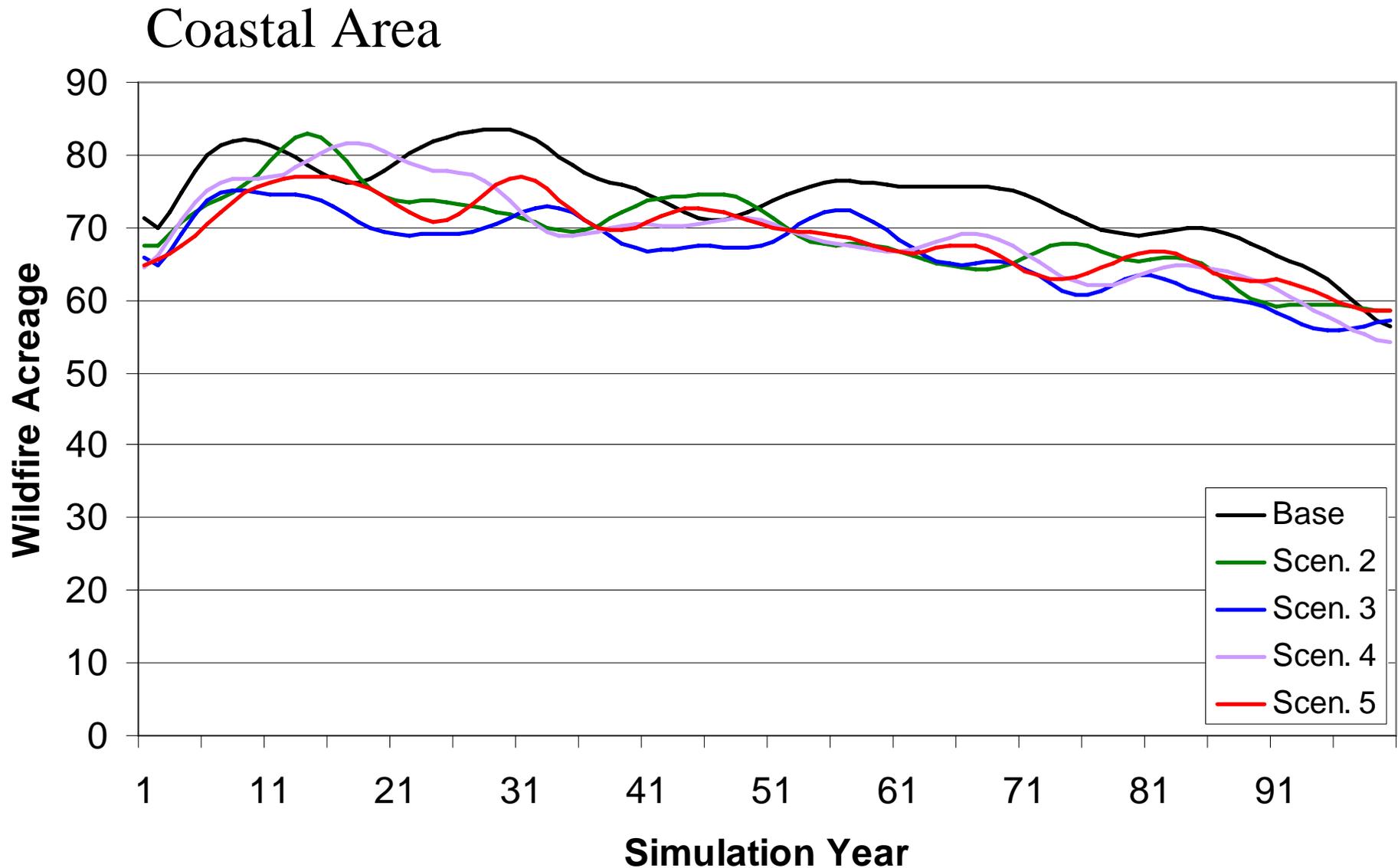
# Methodology



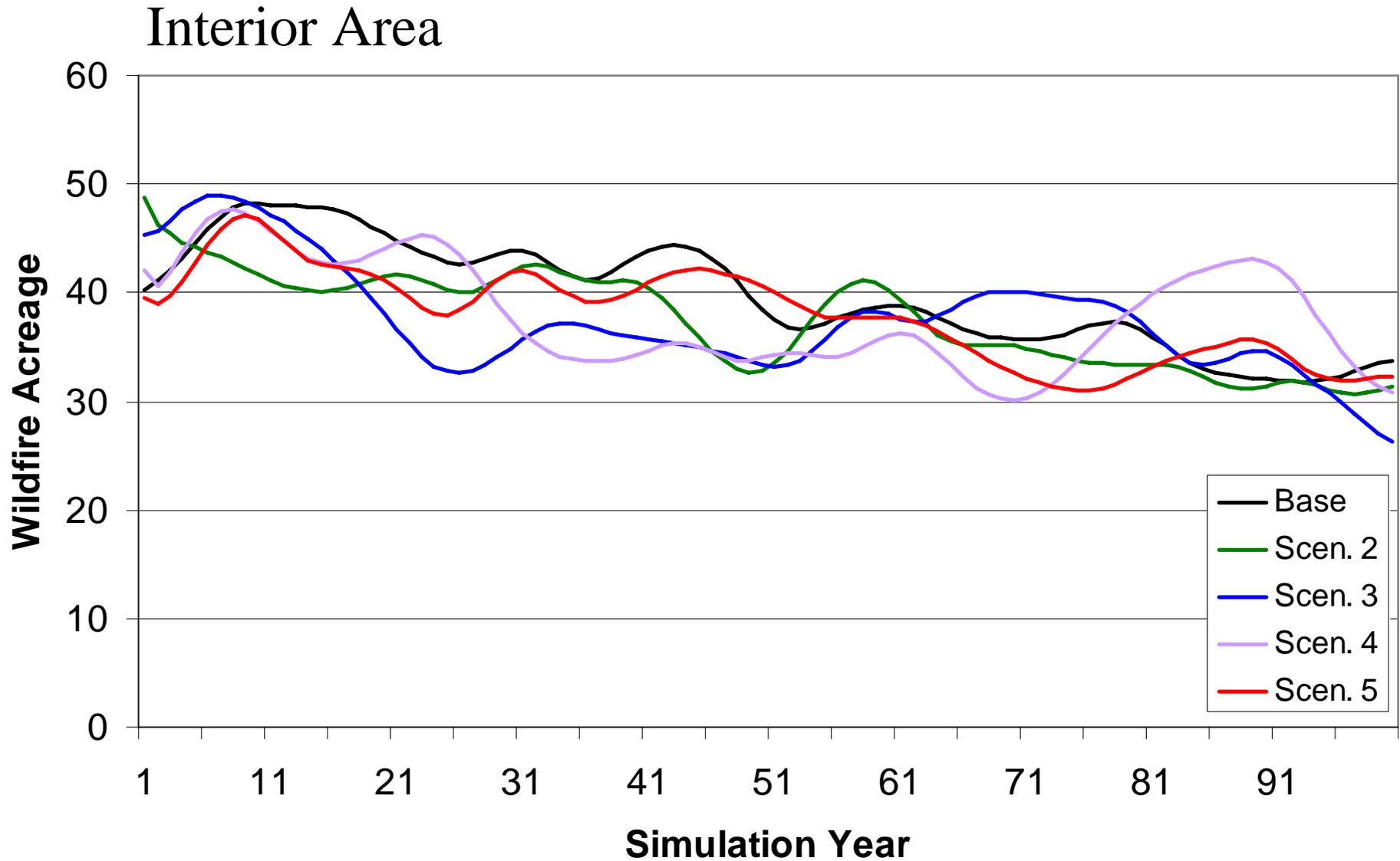
# Study Outputs

- Acres burned by wildfire
- $PM_{10}$  Emissions
  - Wildfire
  - Prescribed Fire
- Landscape Composition

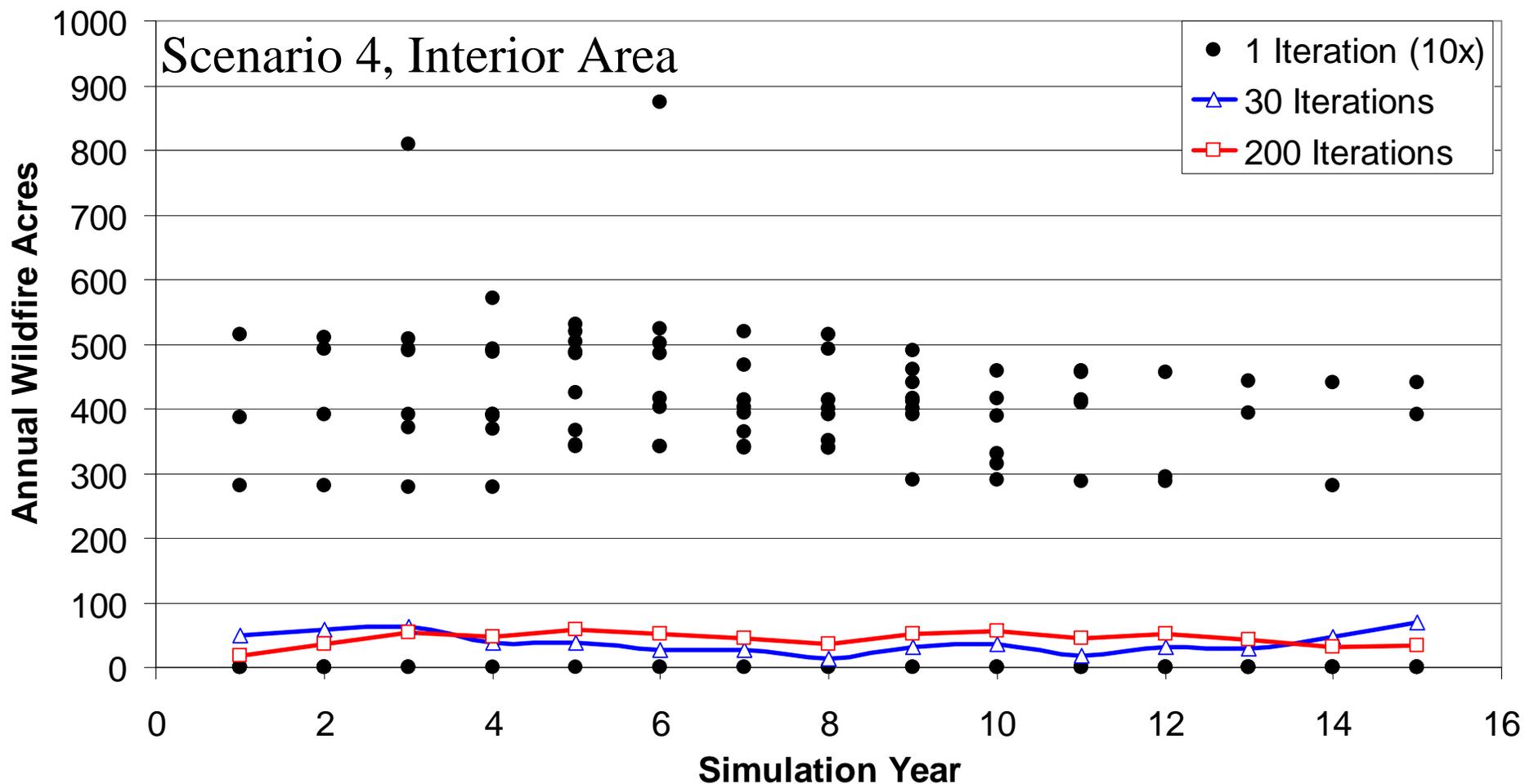
# Results—Mean Wildfire Acres



# Results—Mean Wildfire Acres

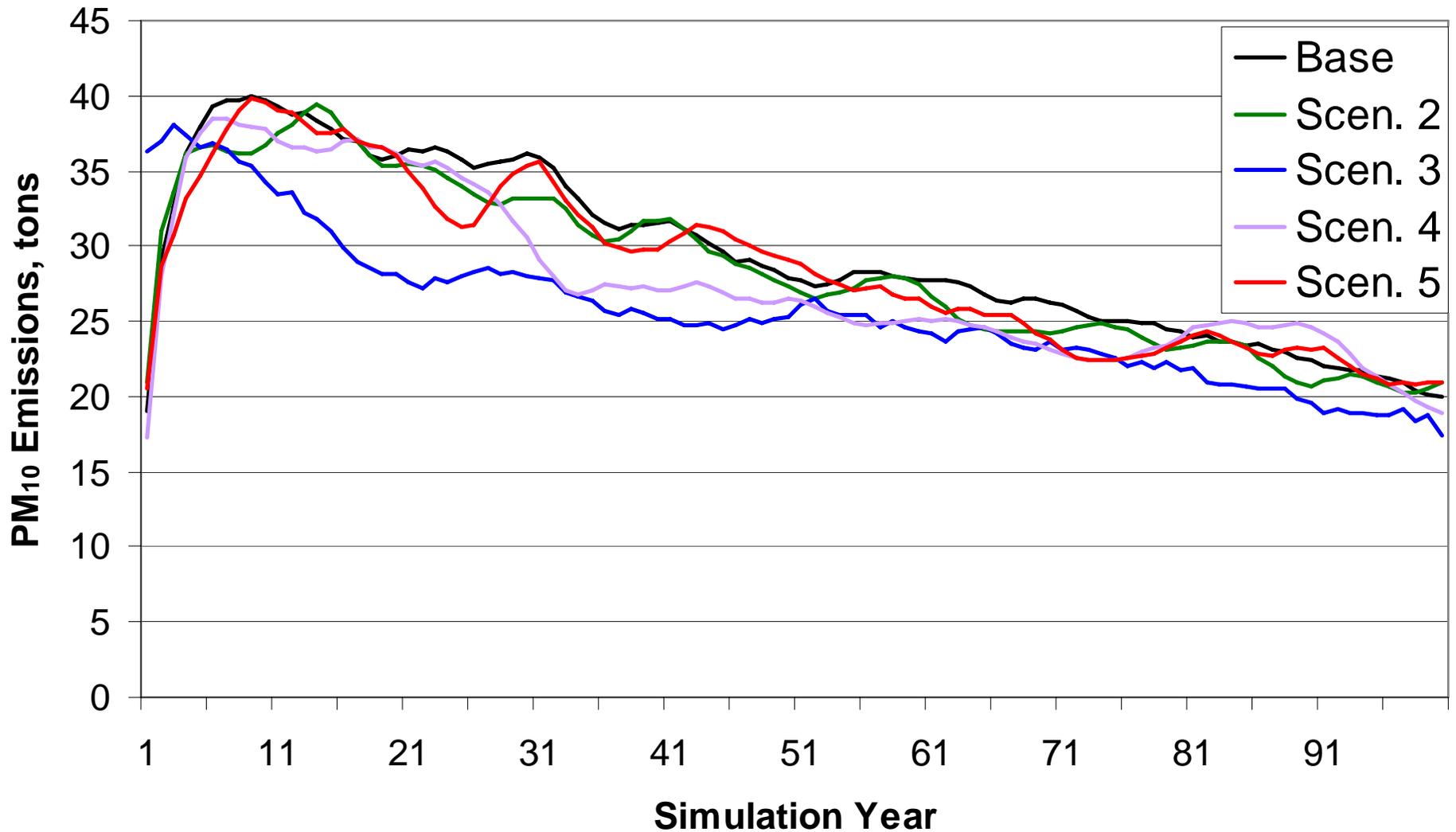


# Results–Potential Wildfire Acres



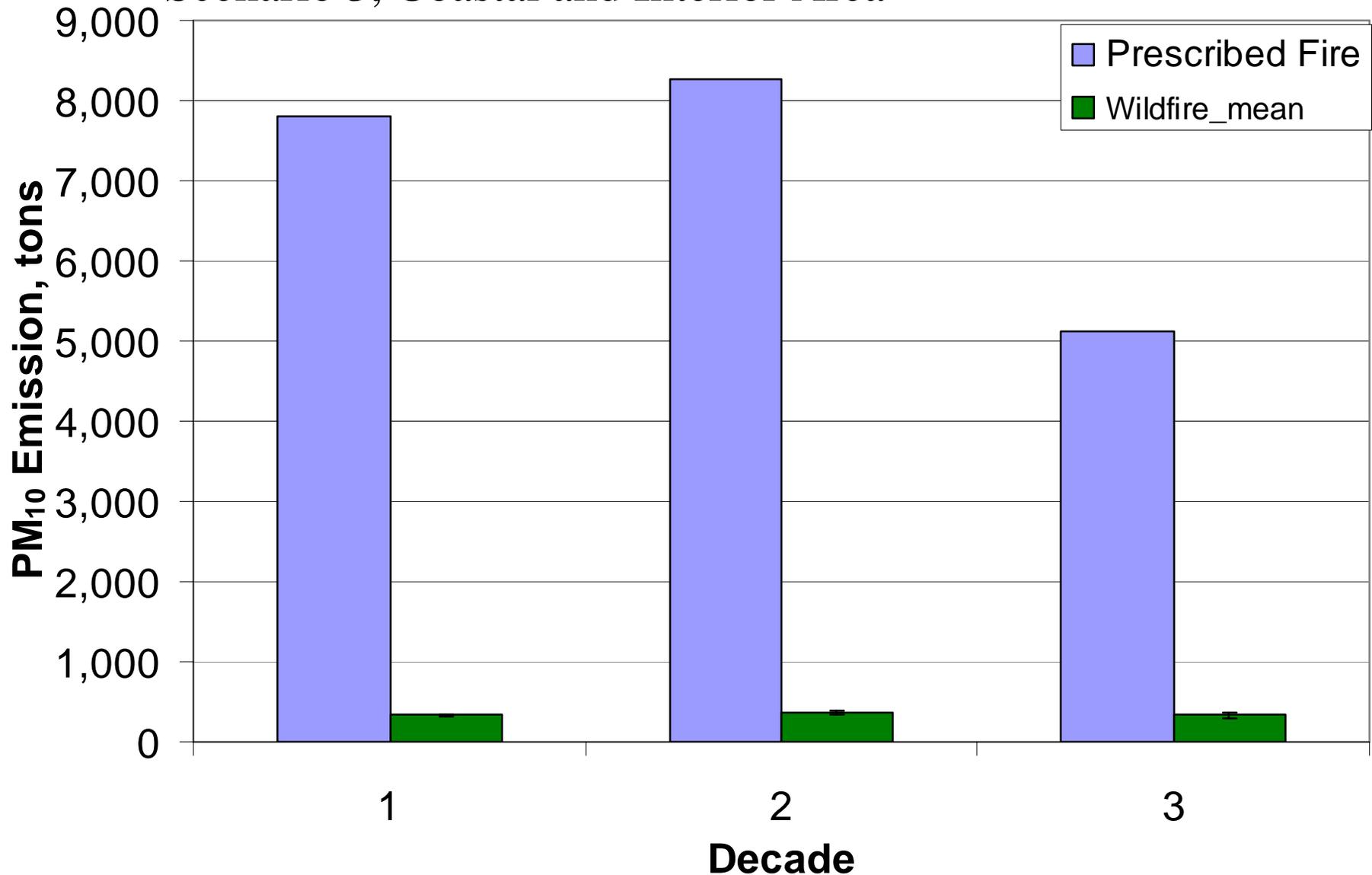
# Results—Wildfire PM<sub>10</sub> Emissions

## Coastal and Interior Area

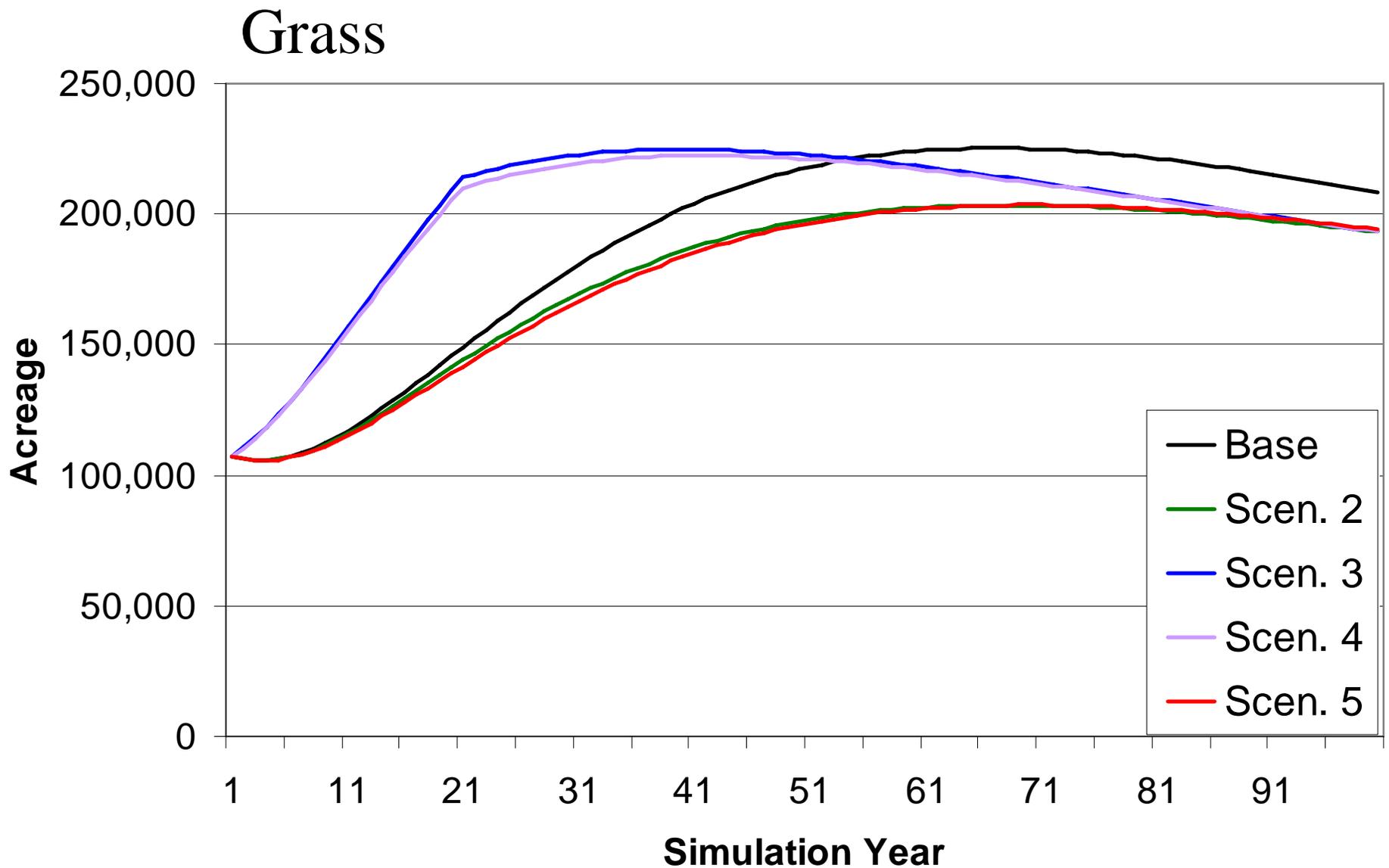


# Results– Total PM<sub>10</sub> Emissions

Scenario 3, Coastal and Interior Area

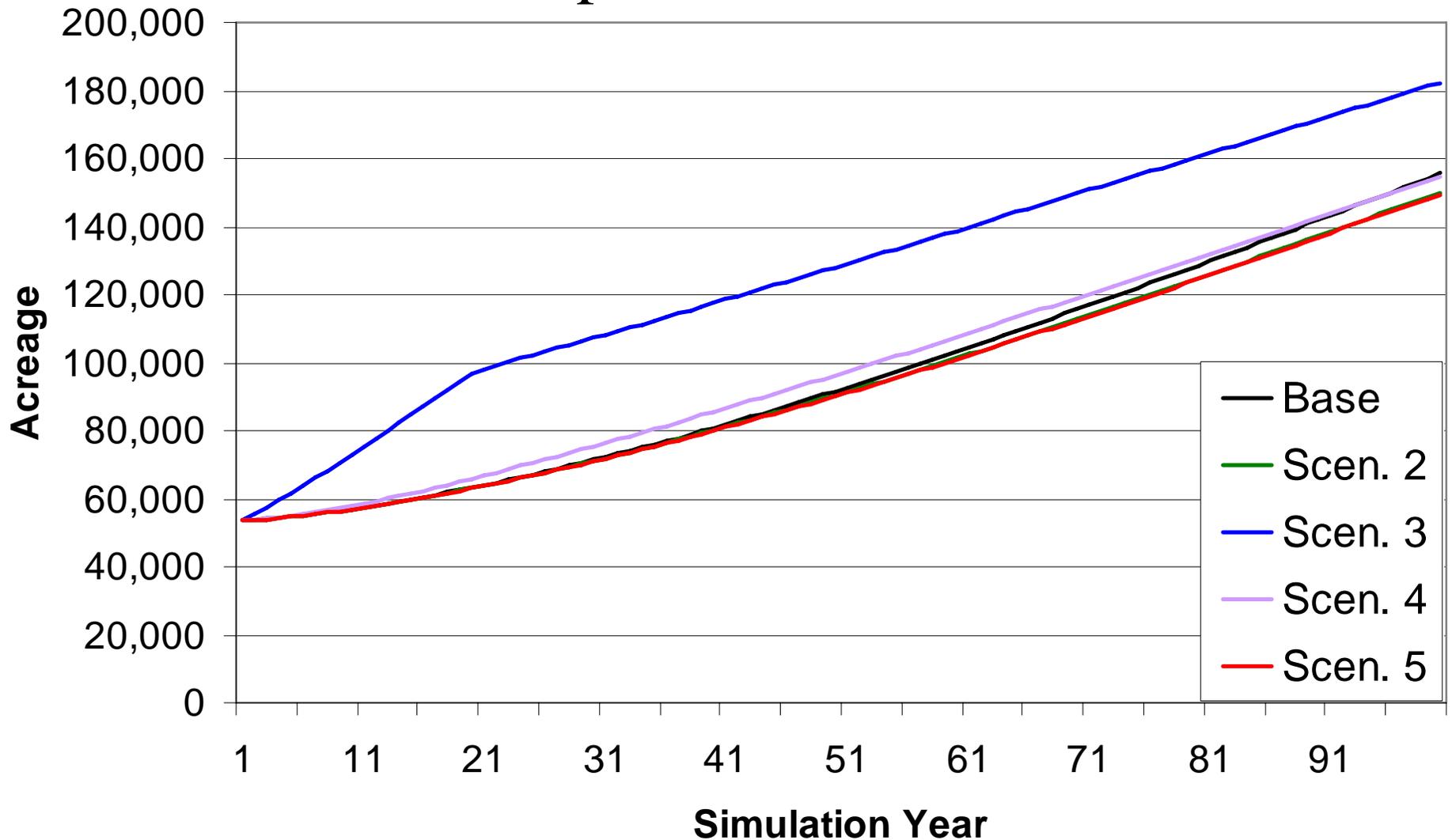


# Results– Landscape Composition

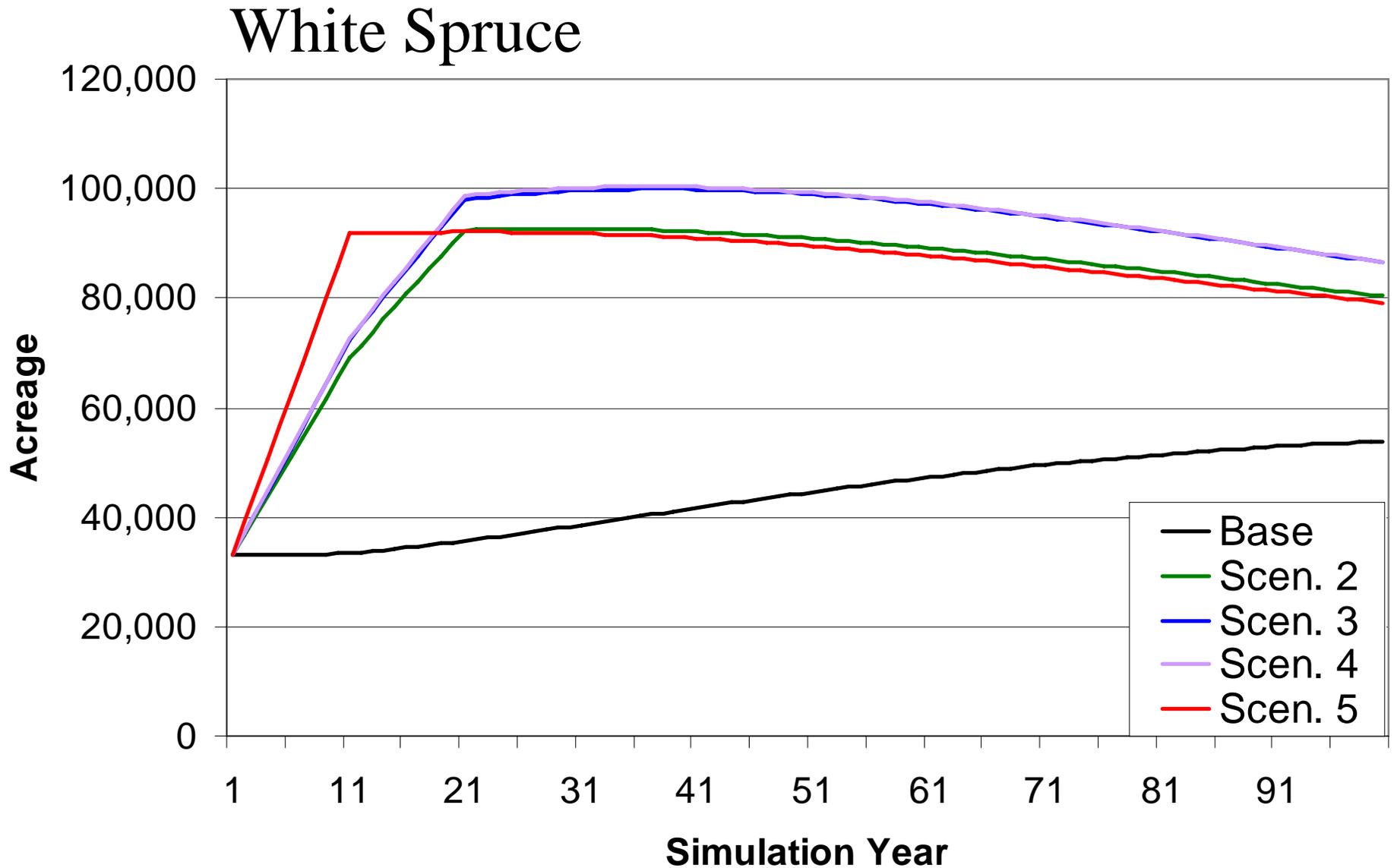


# Results– Landscape Composition

## Hardwood Species



# Results– Landscape Composition



# Discussion- Wildfire Acres

- Various fuel treatments had relatively little effect on mean wildfire acres.
- This was due to combination of:
  - Low number of fire starts
  - Effective fire suppression

## Discussion- $PM_{10}$ Emissions

- Various fuel treatments had relatively little effect on wildfire  $PM_{10}$  emissions.
- $PM_{10}$  emissions tended to be lower for scenario 3, due to prescribed burning.
- However, emissions from prescribed burning were much higher than those from mean wildfire.

# Discussion- Landscape Types

- As beetle killed white spruce coverage decreases, other vegetation types increase and stabilize over time.
- Fuel treatments affected vegetation coverage most during first 20-30 years.
- Fuel treatment critical in returning white spruce dominated stands to the landscape.

# Discussion- General

- Model results are sensitive to input:
  - Vegetation transitions
  - Beetle activity in the future?
  - Fire suppression program
- Model inputs defined based on a long distance approach.
- Model inputs need to be reviewed and refined by local land managers.