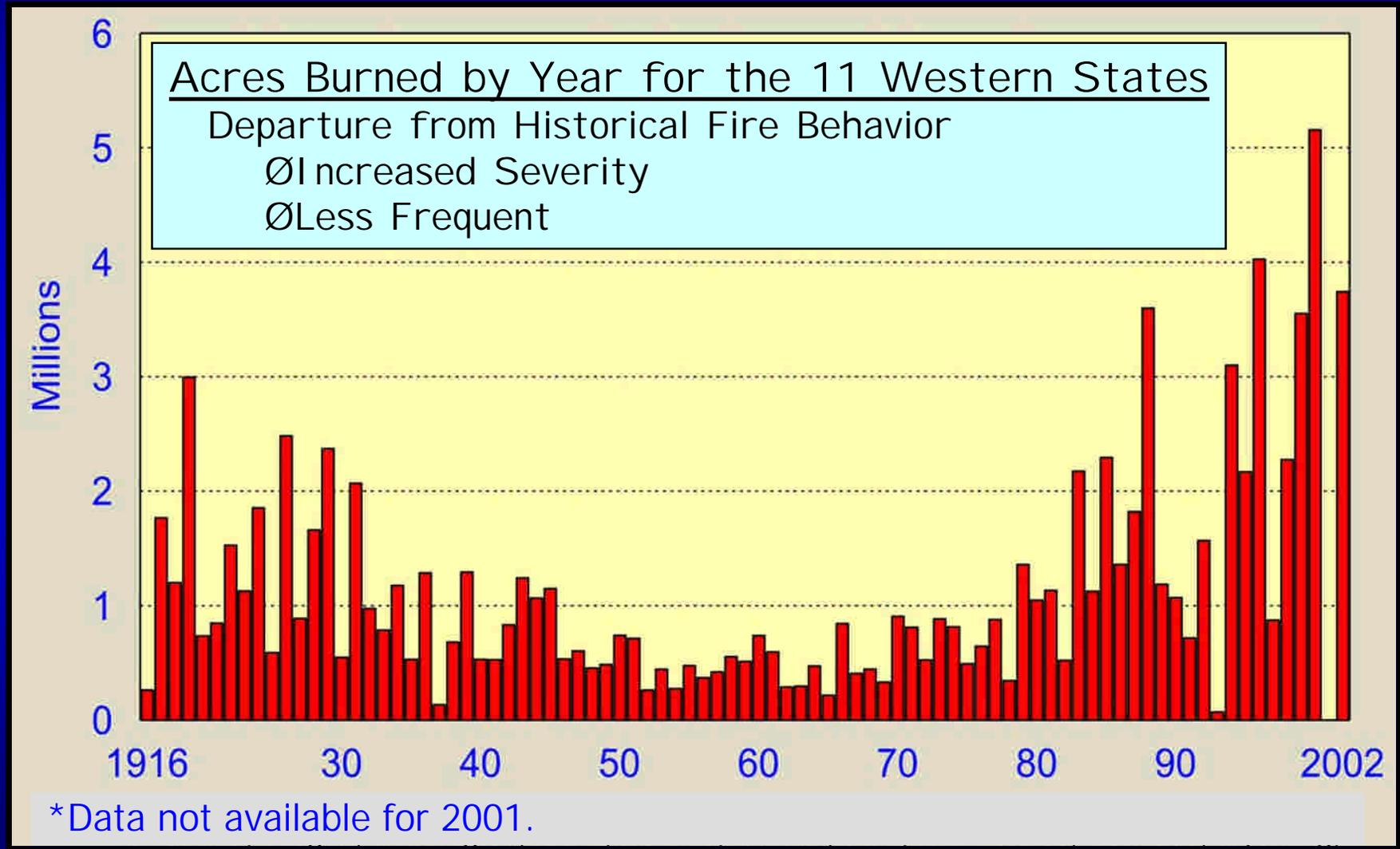


Coarse Scale Fire Regime Mapping, LANDFIRE, & Project Level FRCC: How it fits together

Presenter: Jim Menakis
Workshop: FRCC Guide Book
Place: Tucson, AZ
Date: March 17-21, 2003



Increased Acres Burned by Wildfires



Shifting Demographics

More People are
Moving into the
Wildland Interface...

With little Understanding
of their Environment...

And...

Sometimes resulting
in Catastrophic
Consequences...



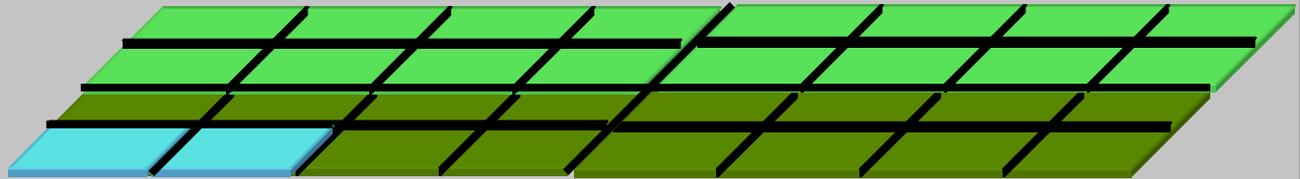
Hi Meadow Fire (2000): Pine Valley, Colorado
Photo by Andrea Booher/FEMA News Photo

Scale – Mapping and Field

Coarse Scale



LANDFIRE



Field Data



Coarse Scale

Scale and Accuracy

Pixel Size: 1 square kilometer (247.1 acres)

Map Scale: 1:10 million

Appropriate Scale for

Data Summaries: Several western states

Accuracy: 60 to 80 % – when summarized over a Forest Service region or a couple of western States

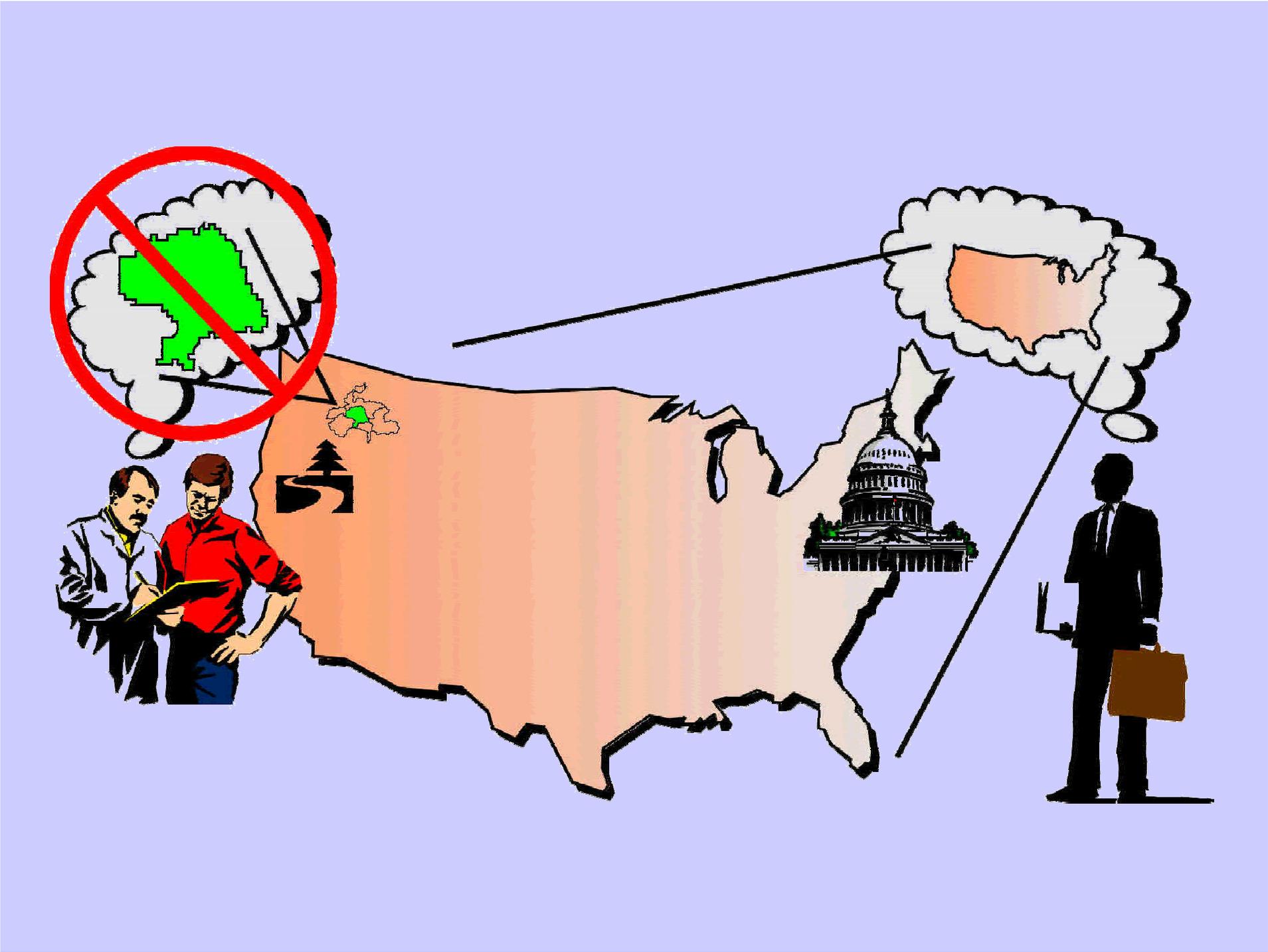
Ground Truth: Expert Opinion & Comparison to finer scale data

Use of Information:

- National Program Strategy
- Region/State Prioritization

Coarse Scale Objectives

To provide information that will be used to prioritize areas where prescribe fire can be applied to the landscape.



Coarse Scale Data Layers

Fire Modeling Institute, Fire Science Lab, RMRS

1) Current Cover Types



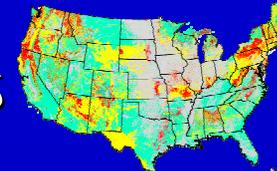
2) Historical Natural Fire Regimes



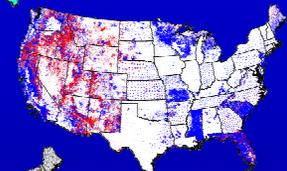
3) Potential Natural Vegetation Groups



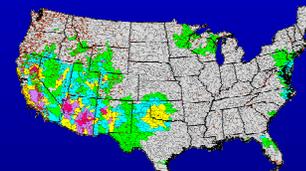
4) Fire Regime Condition Classes



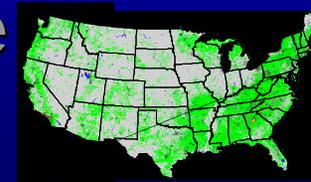
5) National Fire Occurrence Map Data



6) Potential Fire Characteristics



7) Wildland Fire Risk to Flammable Structures



Integrated Ecological Approach

- Ø Based on ecological processes
- Ø Spans many map scales
- Ø Extensively documented in the literature
- Ø Used in several projects:
 - Interior Columbia Basin Ecosystem Management Project
 - Historic Fire Regimes -- Version 2.0 (western states)
 - Selway-Bitterroot Wilderness Fuels Mapping Project
 - Gila National Forest Fuels Mapping Project

Kuchler Potential Natural Vegetation Biophysical Classification

Ø Describes long term environmental conditions across the landscape, such as:

- Weather
- Soils
- Topography

Ø Groups similar ecosystems properties and dynamics.

Ø Maps the Lower 48 States.

Kuchler Potential Natural Vegetation

Terrain Corrected

The modal Kuchler PNV for each combination of:

✓ **Watersheds (4th Code HUC)**

✓ **Elevation Classes (500 m² DEM):**

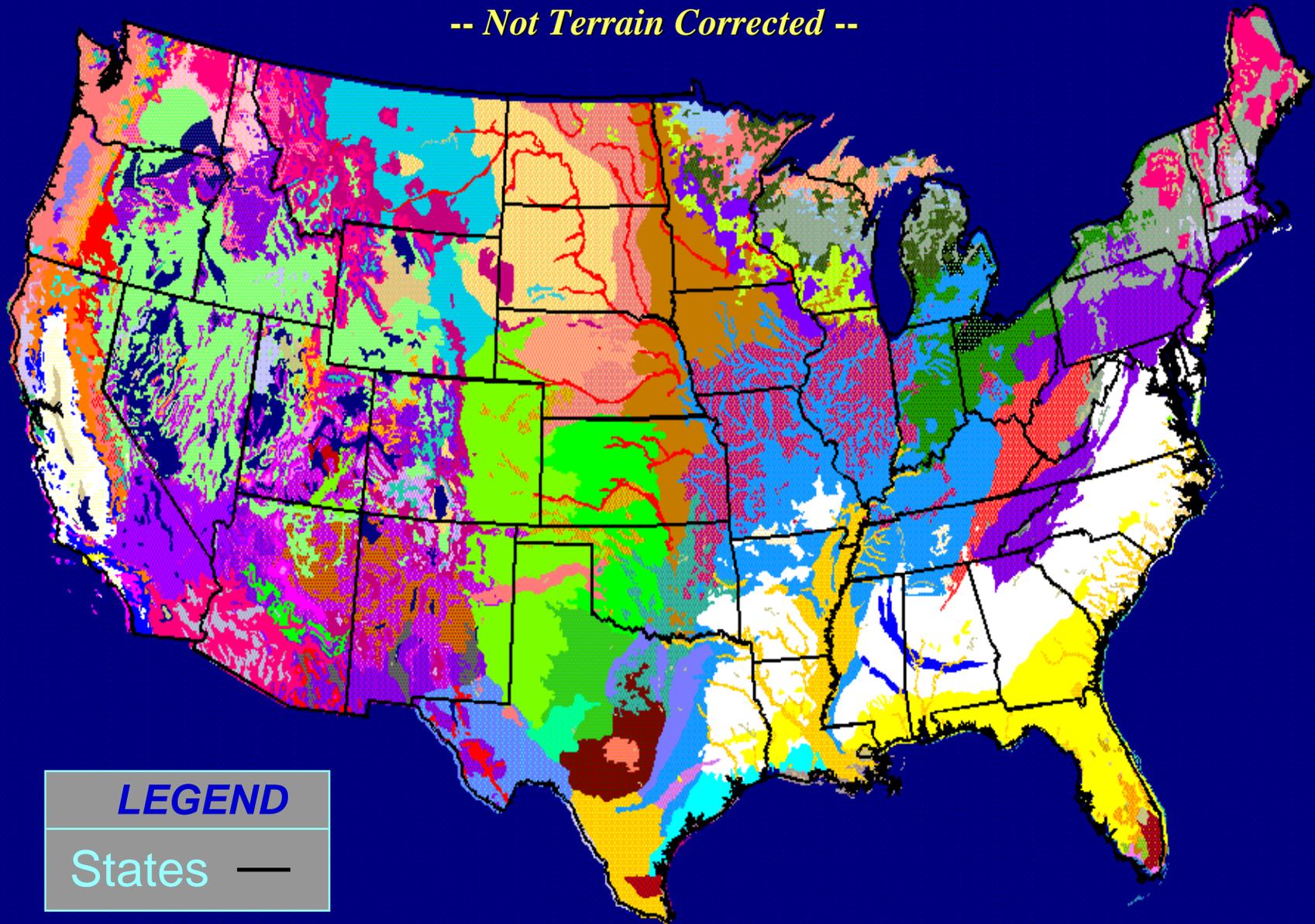
- 50 meters classes (western states)
- 10 meters classes (eastern states)

✓ **Slope Classes (500 m² DEM):**

- Less than or equal to 5 percent slope
- Greater than 5 percent slope

Kuchler Potential Natural Vegetation

-- Not Terrain Corrected --



LEGEND

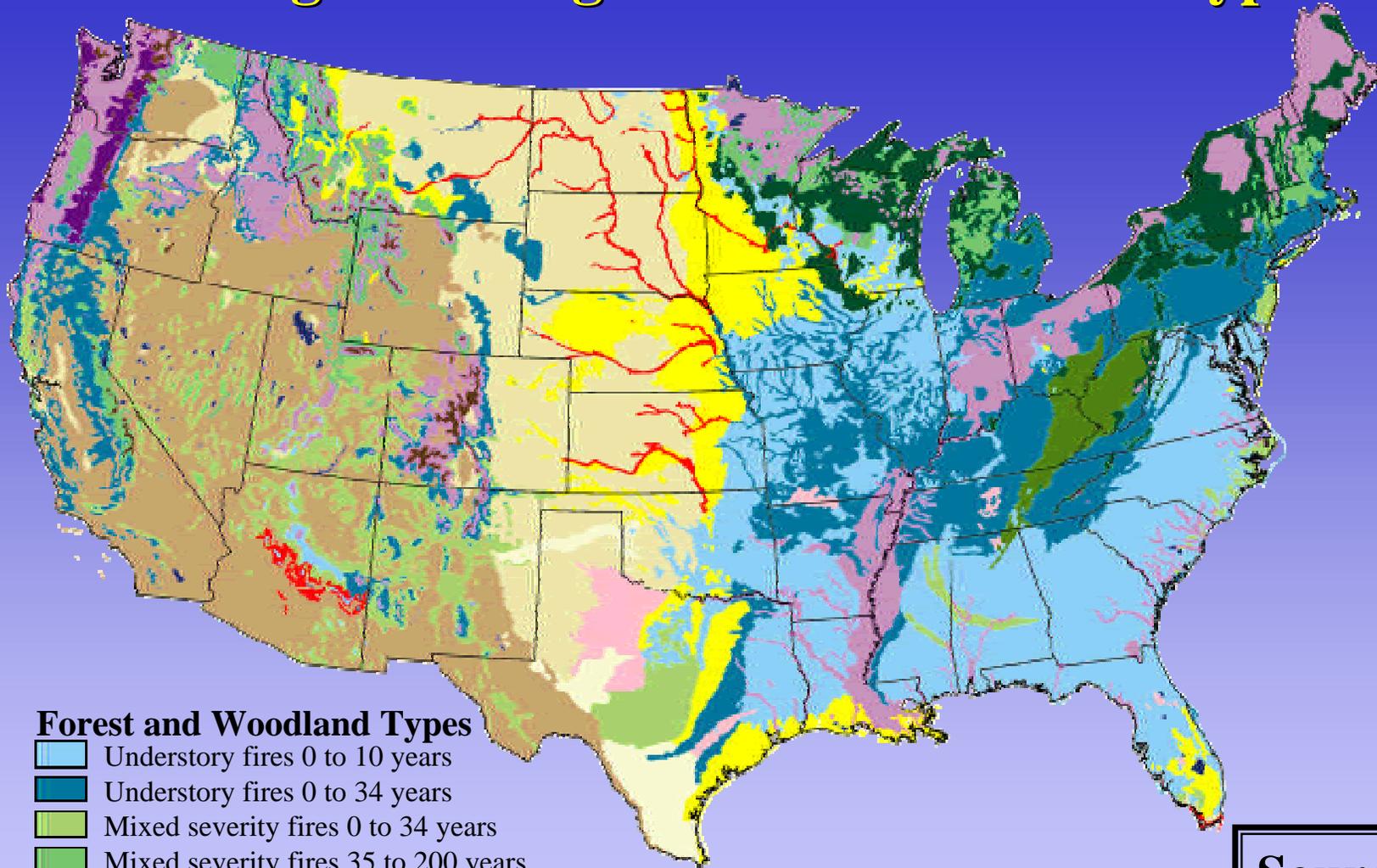
States —

Historical Natural Fire Regimes

Mapped using Kuchler Potential Natural Vegetation

- Ø Strong relationship between Potential Vegetation Types and Fire Regimes
- Ø Linked to the FEIS Database
- Ø Used in the Rainbow Series
 - A series of publications describing the effects of fire on soil, water, air, flora, fauna, and fuels.

Fire Regimes Assigned to Kuchler PNV Types



Forest and Woodland Types

- Understory fires 0 to 10 years
- Understory fires 0 to 34 years
- Mixed severity fires 0 to 34 years
- Mixed severity fires 35 to 200 years
- Mixed severity fires 201 to 500 years
- Mixed severity fires 500+ years
- Stand replacement fires 0 to 34 years
- Stand replacement fires 35 to 200 years
- Stand replacement fires 201 to 500 years
- Stand replacement fires 500+ years

Grass and Shrub Types

- Mixed severity fires 0 to 34 years
- Stand replacement fires 0 to 10 years
- Stand replacement fires 0 to 34 years
- Stand replacement fires 35 to 100 years
- Stand replacement fires 101 to 500 years

Other

- Water

**Source:
Rainbow
Series**

Regional Experts

Assigned Historical Natural Fire Regimes to Kuchler PNV Groups

+ Ecological Regions

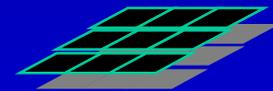
↑ Watersheds (4th Code HUC)

↑ Bailey's ECOMAP – Sections

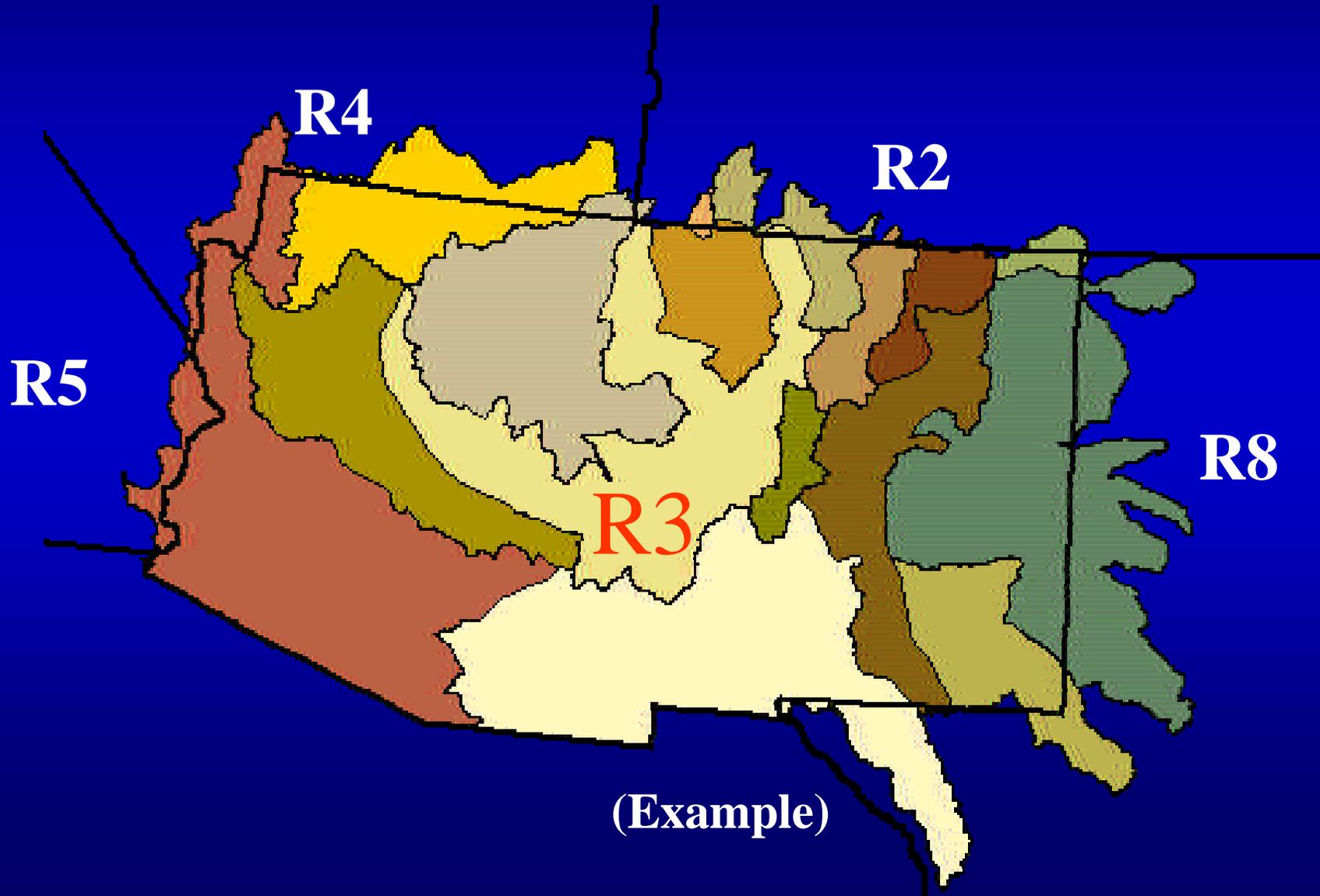
↑ Forest Service Regions

+ Kuchler Potential Natural Vegetation Groups

= Historic Fire Regimes

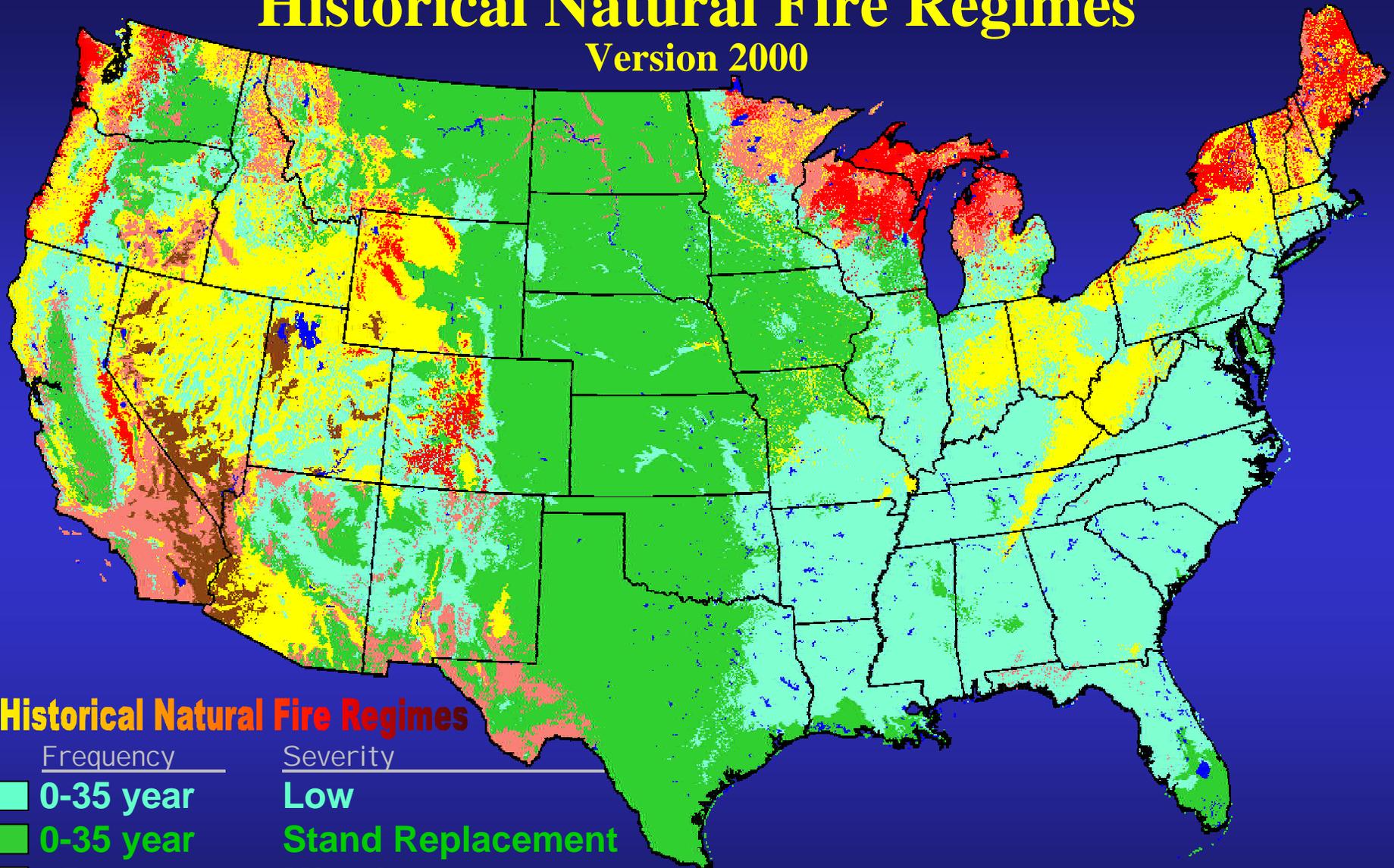


Ecological Forest Service Regional Boundaries -- All Lands



Historical Natural Fire Regimes

Version 2000



Historical Natural Fire Regimes

Frequency

- 0-35 year
- 0-35 year
- 35-100 year
- 35-100 year
- 200+ year

Severity

- Low
- Stand Replacement
- Mixed
- Stand Replacement
- Stand Replacement

- Barren
- Water

Fire Regime Condition Classes

Ecological Attribute

f { **Departure from Historic Fire Regimes.**
Defined by the number of missed fire return intervals, or increased fire frequency because of exotics.

RESULTING IN CHANGES IN:

- **Canopy closure**
- **Stand structure**
- **Stand Age**
- **Species Composition**

Fire Regime Condition Classes

A Departure from Historical Natural Fire Regime

Fire Regime Condition Class	Changes in species composition & structure	Fire Regime Changes	
		Return interval (Increase or Decrease)	Size, intensity, severity, & landscape patterns
1	Largely intact	Little to none	Little to none
2	Moderately altered	One or more	Moderate
3	Significantly altered	Multiple	Dramatic

Fire Regime Condition Classes

Mapping It

Fire History (Sequoia & Kings Canyon National Parks)

- Ø Intensive field collection
- Ø Need good fire history records.

Successional Pathways (Fire Modeling Inst.)

- Ø Ecological Processes
- Ø Stand composition and structure.
- Ø Data layers available for the lower 48 states

Succession Pathway

A Simple Dry Douglas-fir Pathway

PATHWAY

Cover Type

Density Classes
(Canopy Cover)

Grass

None

Ponderosa
Pine

Low

Ponderosa
Pine

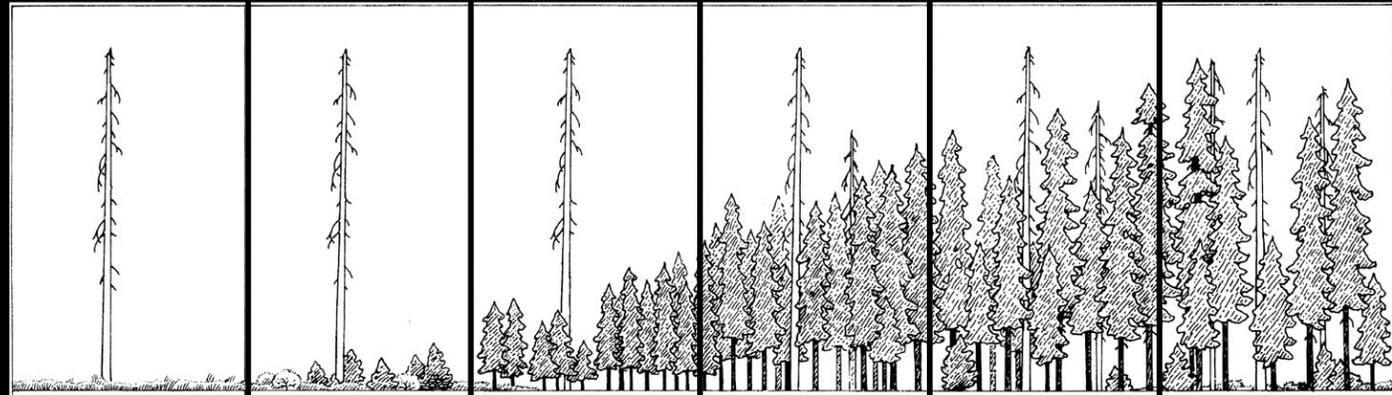
High

Douglas-fir

Moderate

Douglas-fir

High





After Thinning

1909



1938

361706



1948

452647



1979



1989

Developing Succession Diagrams

+ Ecological Regions



+ Kuchler PNV Groups



+ Historical Fire Regimes



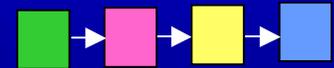
+ Cover Type



+ Stand Density

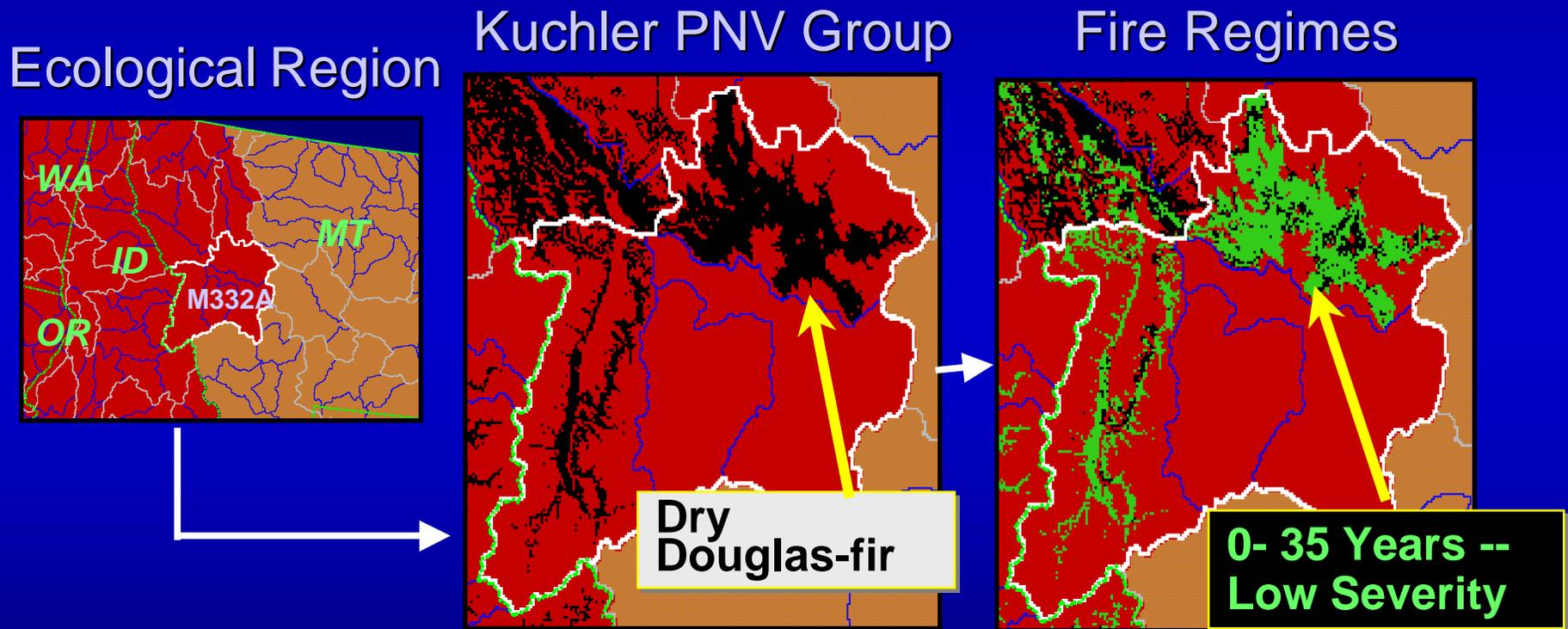


= Successional Diagrams



Successional Diagrams

Example -- Strata



Layers Used In Successional Boxes Cover Types and Stand Density

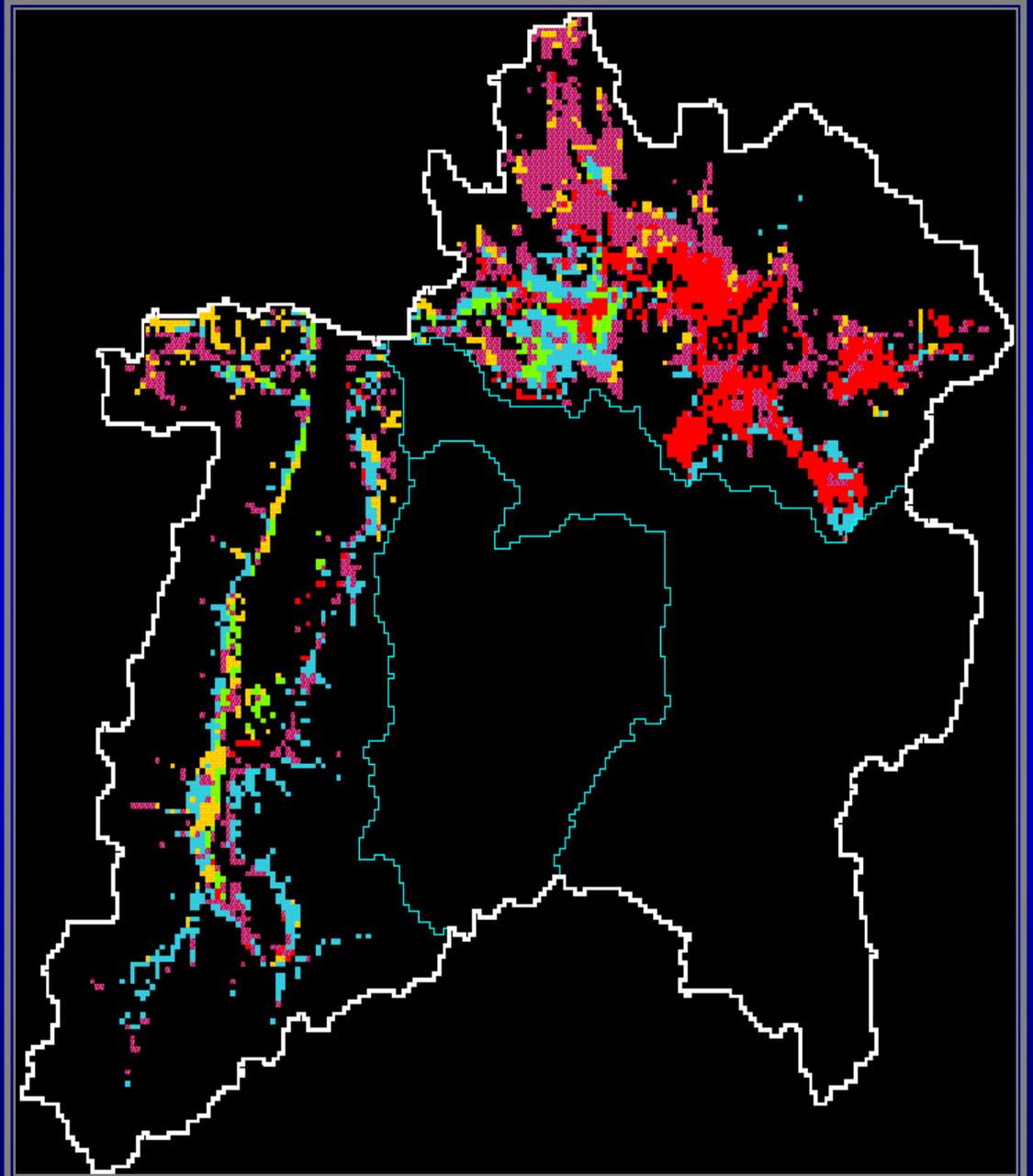
STRATA

Ecological Region
Kuchler PNV: Dry Douglas-fir
Fire Regime: 0-35 Yr- Low Sev.

LEGEND

Cover Type / Density Class

-  Grass
-  Ponderosa Pine -- Low
-  Ponderosa Pine -- High
-  Douglas-fir -- Moderate
-  Douglas-fir -- High



Successional Diagram

STRATA

Pathway Development	Ecological Region Kuchler PNV Group: Dry Douglas-fir Fire Regimes: 0-35 years; Low Severity
----------------------------	--

PATHWAY

Successional Boxes Created From GIS Layers

Cover Type

Grass

**Ponderosa
Pine**

**Ponderosa
Pine**

Douglas-fir

Douglas-fir

**Density
Classes**

None

Low

High

Moderate

High

(Canopy Cover)

Fire Regime Condition Classes

Mapping Conditions

f { **Departure from Historic Fire Regimes.**

Defined by the number of missed fire return intervals, or increased fire frequency because of exotics.

RESULTING IN CHANGES IN:

- Canopy closure
- Stand Age
- Stand structure
- Species Composition

Mapped To Successional Diagrams

Successional Diagram

Assigning Relative Departure

STRATA

Ecological Region

Kuchler PNV Group: Dry Douglas-fir

Fire Regimes: 0-35 years; Low Severity

PATHWAY

Cover Type

Grass

**Ponderosa
Pine**

**Ponderosa
Pine**

Douglas-fir

Douglas-fir

**Density Classes
(Canopy Cover)**

None

Low

High

Moderate

High

Ecological Attributes

Relative Departure

0

0

1

2

3

Successional Diagram

Assigning Condition Classes

STRATA

Ecological Region

Kuchler PNV Group: Dry Douglas-fir

Fire Regimes: 0-35 years; Low Severity

PATHWAY

Cover Type

Grass

Ponderosa
Pine

Ponderosa
Pine

Douglas-fir

Douglas-fir

Density Classes
(Canopy Cover)

None

Low

High

Moderate

High

Ecological Attributes

Relative Departure

0

0

1

2

3

Fire Regime

Condition Classes

1

1

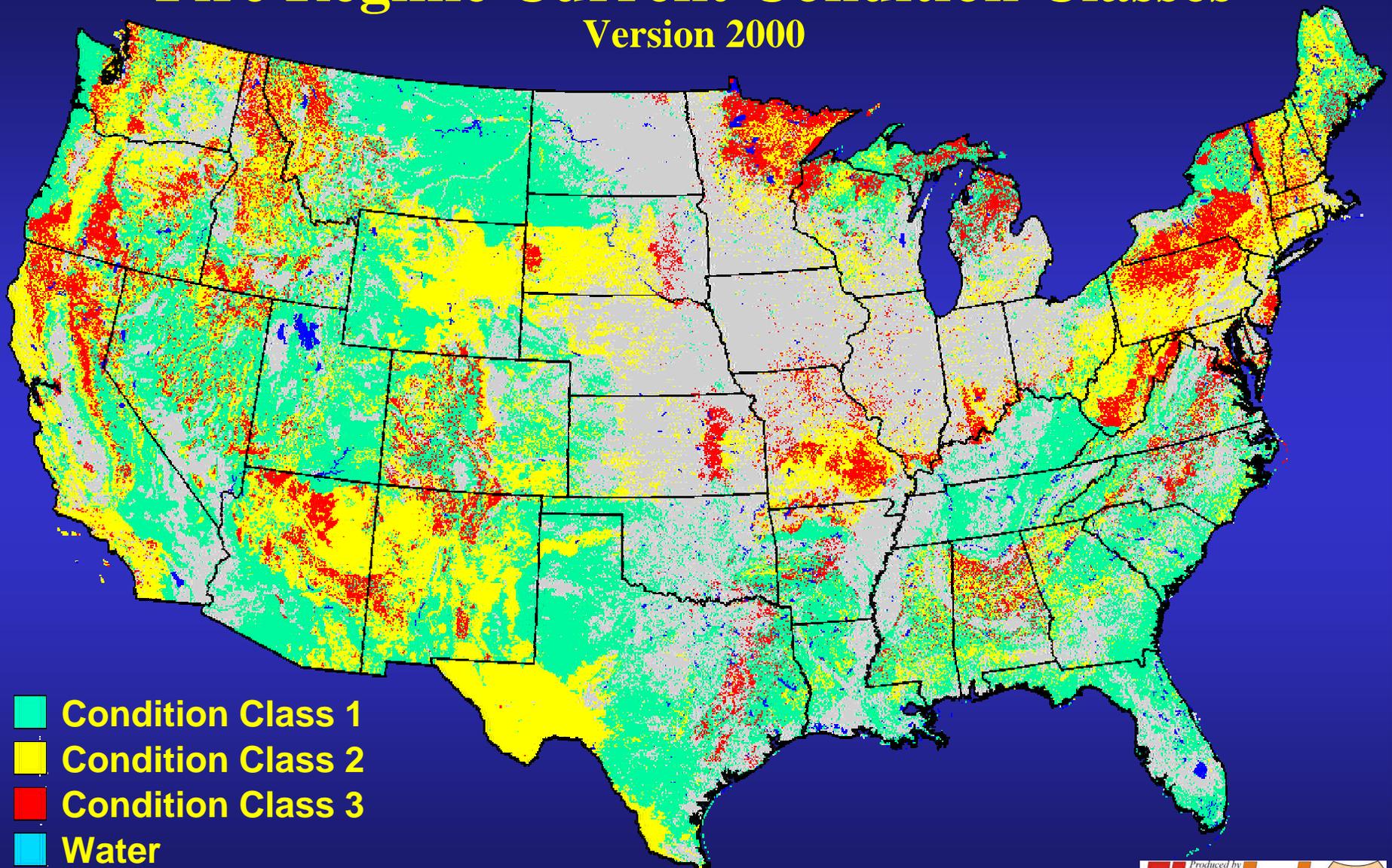
2

2

3

Fire Regime Current Condition Classes

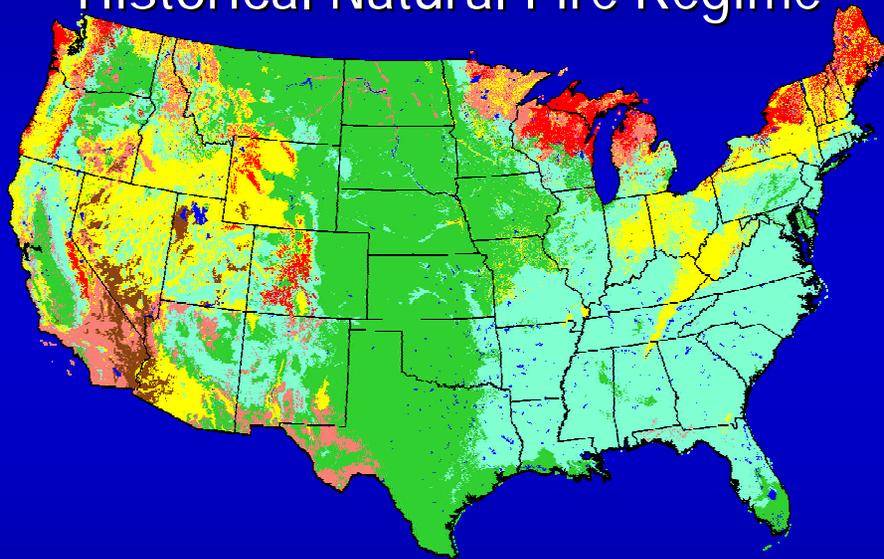
Version 2000



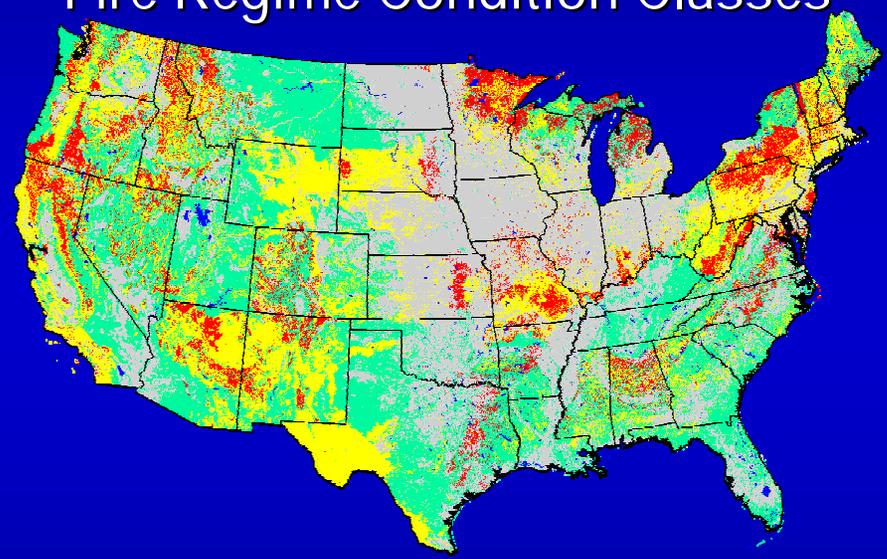
- Condition Class 1
- Condition Class 2
- Condition Class 3
- Water
- Agriculture & Non-Vegetative areas

1999 – FIRELAB Develops the Coarse Scale Data Layers To help address the GAO Report.

Historical Natural Fire Regime



Fire Regime Condition Classes



Frequency

0-35 year

0-35 year

35-100+ year

35-100+ year

200+ year

Severity

Low

Stand Replacement

Mixed

Stand Replacement

Stand Replacement

Fire Regime Condition Class 1

Fire Regime Condition Class 2

Fire Regime Condition Class 3

Water

Ag & Non Vegetative Areas

What about Rangelands?

Today



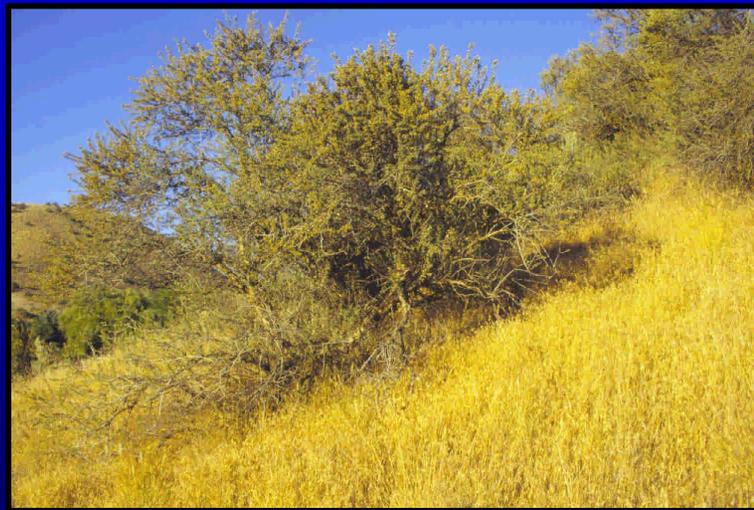
**Mapping
Departure from
Historical Natural
Fire Regime
Caused by
Cheatgrass in the
Great Basin**



A PRAIRIE FIRE

Departure from Historical Natural Fire Regimes Created by Cheatgrass

- Invasive – Outcompetes native seedlings
- Changes Fire Behavior
- Increases Fire Frequency



Fire Regime Condition Classes

f { **Departure from Historic Fire Regimes.**
Defined by the number of missed fire return intervals, or increased fire frequency because of **exotics**.

RESULTING IN CHANGES IN:

- **Canopy closure**
- **Stand structure**
- **Stand Age**
- **Species Composition**

Cheatgrass in the Great Basin

National Science and Technology Center, BLM

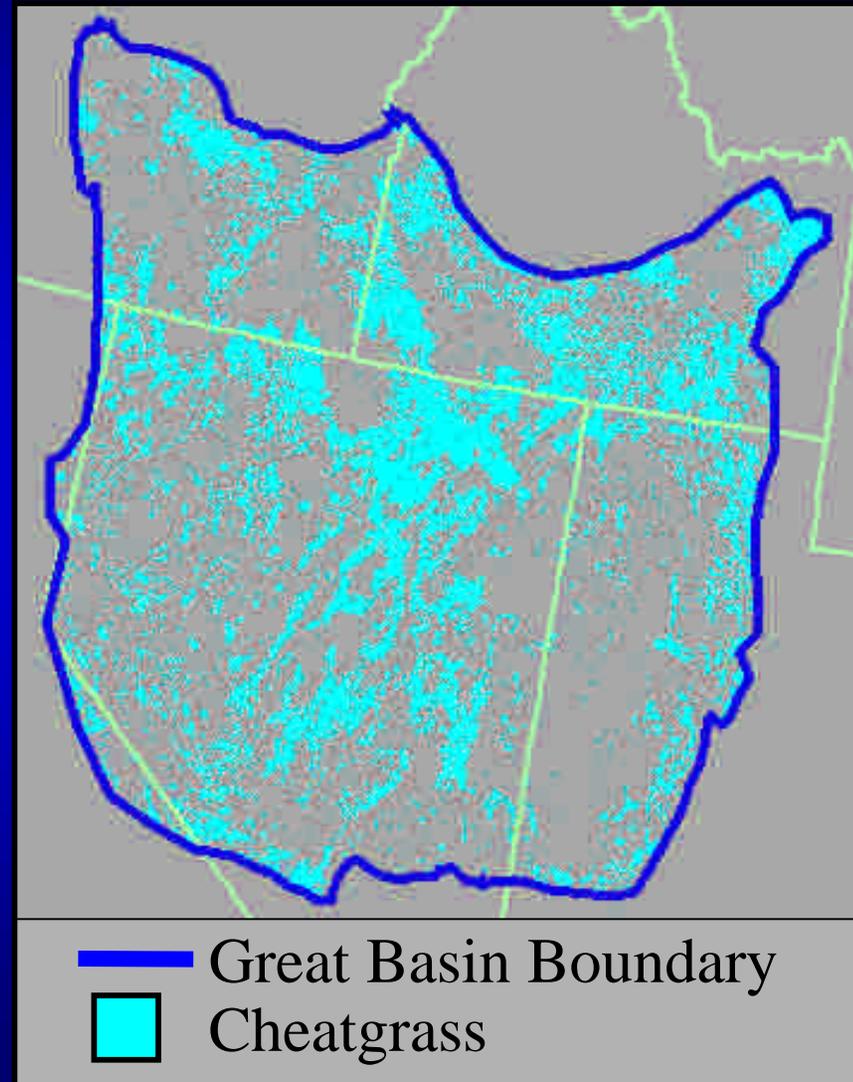


SOURCE INFO

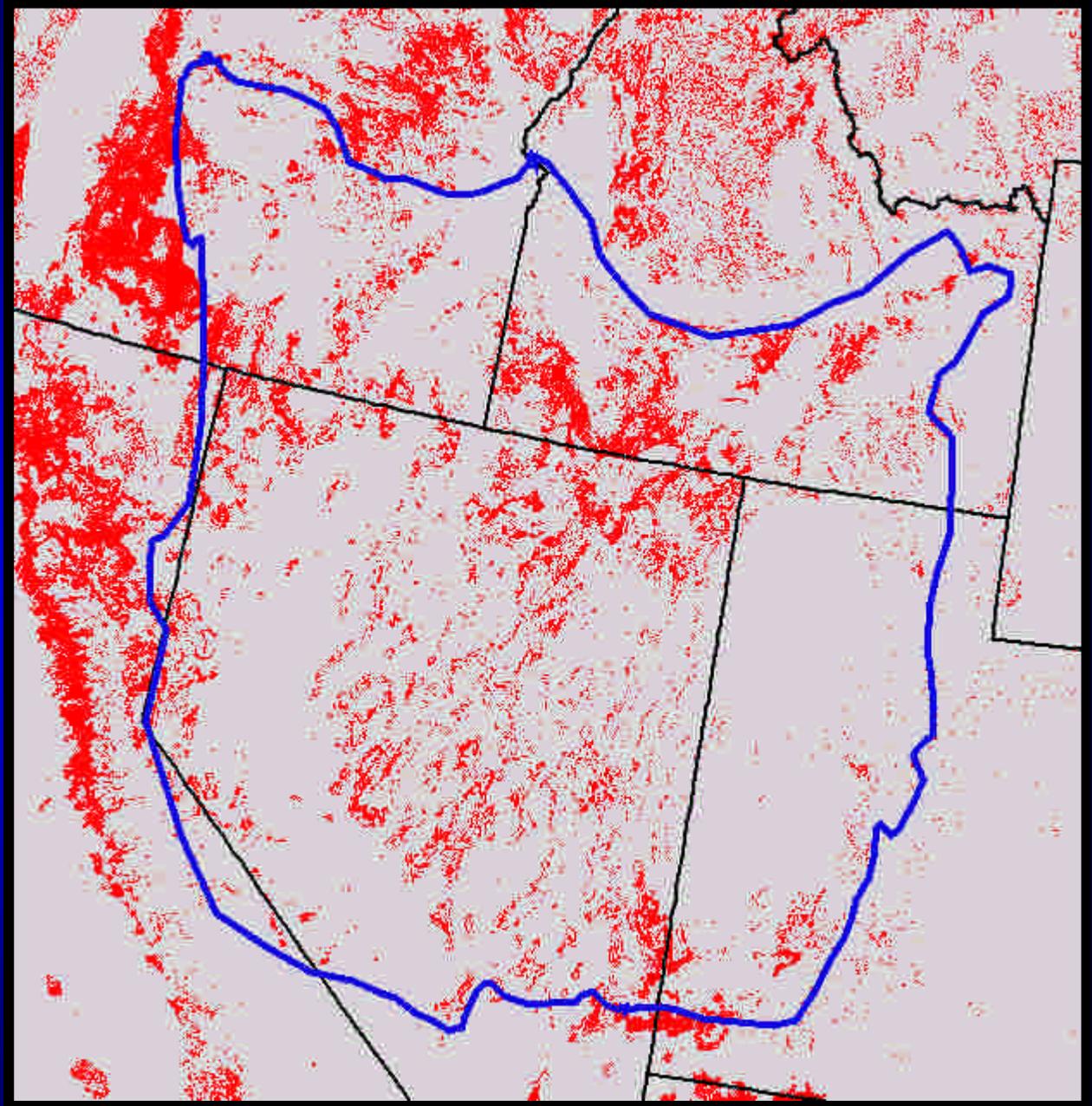
- AVHRR satellite images
- NDVI

Scene selection based on Cheatgrass phenology:

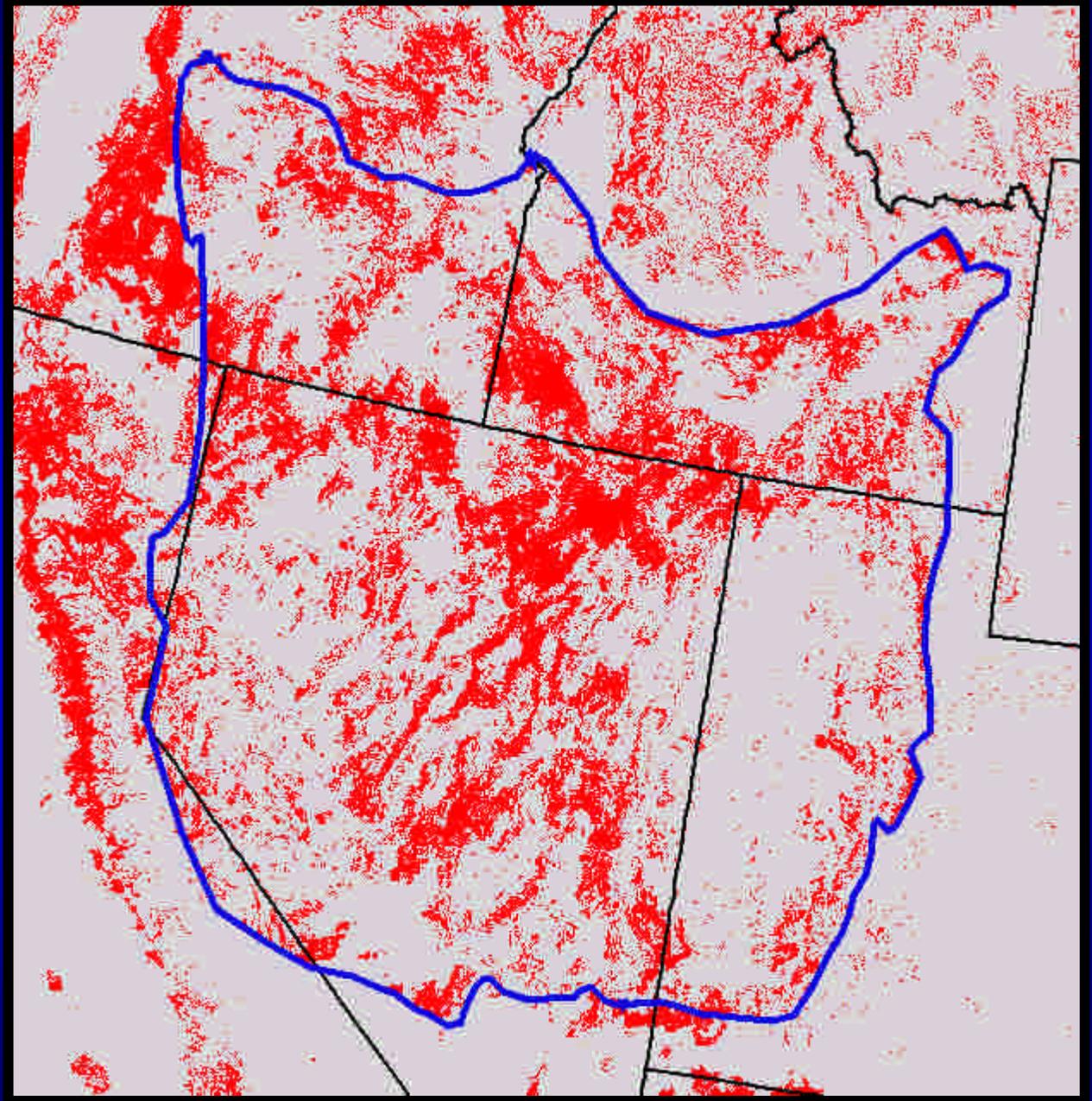
- Green-up scene
- Browning-out scene



**Fire
Regime
Condition
Class 3
Version
2000
In the
Great Basin**

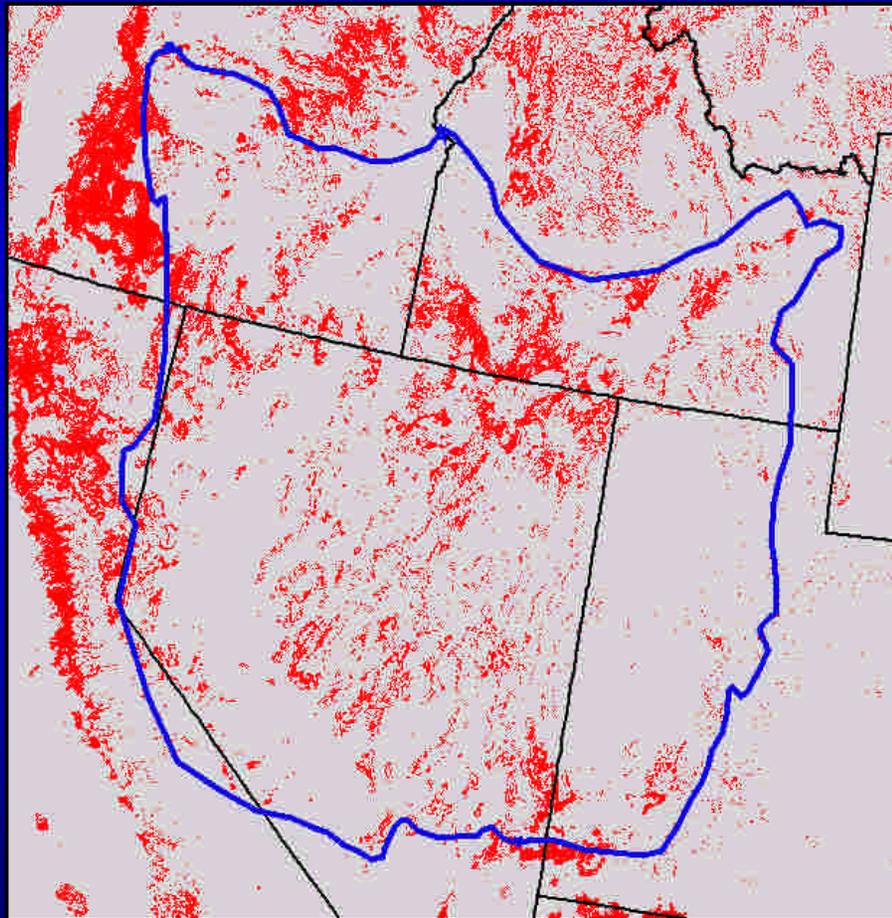


**Fire
Regime
Condition
Class 3
with
Cheatgrass
In the
Great Basin**

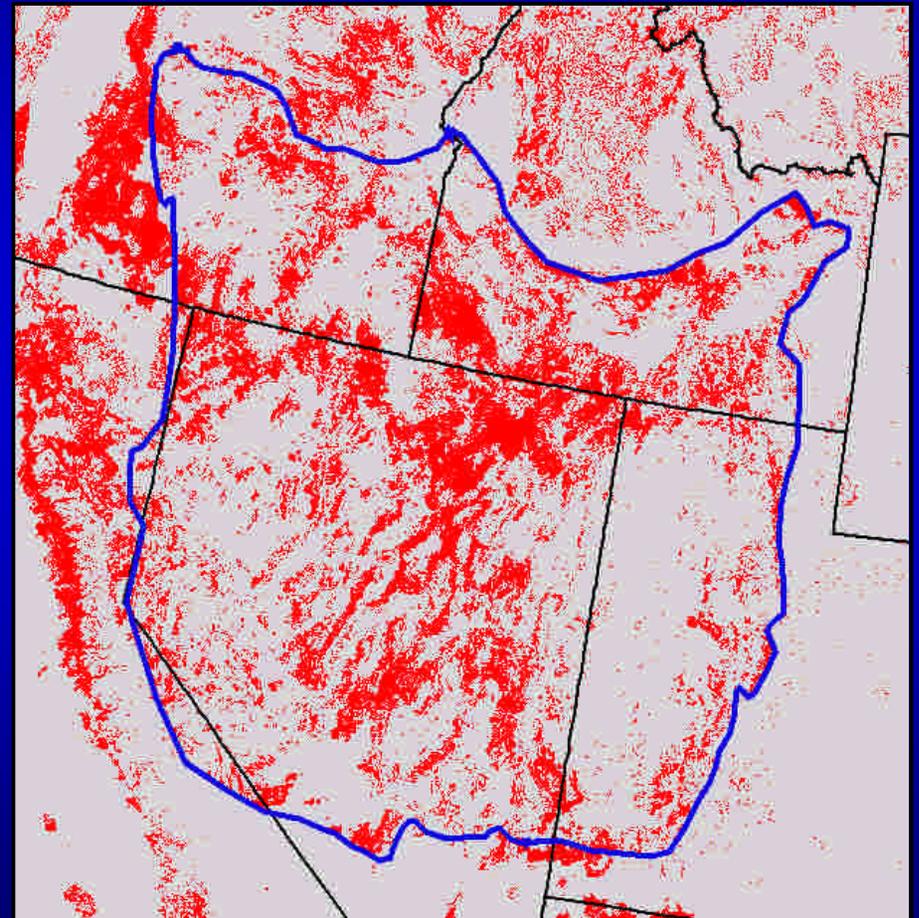


Fire Regime Condition Class 3 Comparison

Without Cheatgrass



With Cheatgrass



In the Great Basin

Results

Geographic Area (Conterminous US)	Fire Regime Condition Class 3		
	Square Kilometers		Percent Increase
	Version 2000	Cheatgrass	
All Lands	735,630	79,919	11
Federal Lands	301,892	60,522	20



Discussion/Thoughts

Coarse Scale

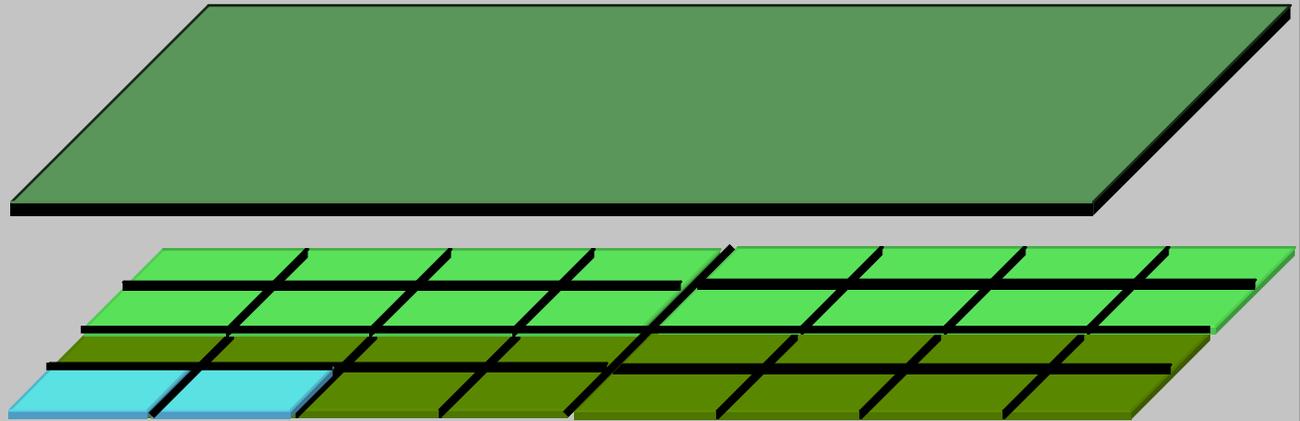
- Ø Fire Regime Condition Classes (Version 2000) underestimated the departure in Range and Shrublands
- Ø Difficult to extrapolate these numbers to the conterminous US
- Ø Need for finer scale data (LANDFIRE)

Scale – Mapping and Field

Coarse Scale
(1 km² Pixel Size)

LANDFIRE

Field Data



LANDFIRE

Scale and Accuracy

Pixel Size: 30 m² (0.2 acres)

Map Scale: 1:100,000 to 1:250,000

Appropriate Scale for Data Summaries: Watershed to sub-watershed level

Accuracy: 60 to 80 % – when summarized to the watershed to sub-watershed

Ground Truth: - Geo-referenced plot data
- Walk through evaluations of mapping polygon

Use of Information: - Fire Management Planning
- Forest or Resource Plan
- Project Prioritization

A Joint Forest Service-DOI Effort for National Fire Fuels Assessment



**Funding
Agencies**



**Project
Leads**



USDA Forest Service
Rocky Mountain Research Station
Fire Science Laboratory
Missoula, M.T.

DOI USGS
Earth Resources Observation Systems
(EROS) Data Center
Sioux Falls, S.D.

Why LANDFIRE

Yes or No

Do we know the total number of acres of Fire Regime Condition Class 3 there are in the nation?

NO

There is somewhere between 90 and 190 million acres on federal lands.

Do we know where they are? **NO**

At best, we have a coarse idea where they are.

Do we have the data needed to prioritize areas that need fuel treatments?

NO

Without scientifically sound (Consistent, Cohesive, and Continuous) national data, prioritization will be (at best) guess work subject to appeal.

LANDFIRE Objective

To provide **the spatial data and predictive models needed by land and fire managers** to prioritize, evaluate, plan, complete, and monitor fuel treatment and restoration projects, **essential to achieving the goals targeted in the Joint Cohesive Strategy and National Fire Plan.**



Deliverables

Digital Databases

- ✓ Historical Natural Fire Regimes
- ✓ Fire Regimes Condition Classes
- ✓ Biophysical Settings
- ✓ Potential Vegetation Types
- ✓ Cover Types
- ✓ Structural Stages
- ✓ FARSITE Data Layers
- ✓ Ecosystem Status
- ✓ Fire Hazard & Potential Status

Computer Models

- q Fire Potential Model (FIREHARM)
- q Landscape Simulation (LANDSUM)
- q Biogeochemical Model (LF-BGC)

Ancillary Utilities & Products

- Reference Database
- Scientific Publications
- Interactive WEB Site
- Tools allowing managers to scale the datasets
- Technology Transfer

Design Criteria

Ø Multi-Scale (Hierarchical)

National Level (Coarse Scale) to Local Level (Fine Scale)

Ø Map All Lands & Vegetative Communities

- Same level of Detail (Federal & Non-Federal)

- Forestlands, Shrublands, and Grasslands

Ø Designed to be Repeatable

Quickly and Affordable after all the models are built

Ø Target Map Accuracies:

60 to 80 Percent to the

Sub-Watershed level (10,000 Acres- 40,000 Acres)

Ø Consistent for the Nation

A piece of ground mapped red means the same thing in Florida as it does in Colorado

Ø Not a substitute for Fine Scale Data

Safety Net for Land Managers without data

LANDFIRE Schedule



4 Funds start in March 2002
4 Prototype area finished by Sept 2005

Project Sequence

Prototype



Western US

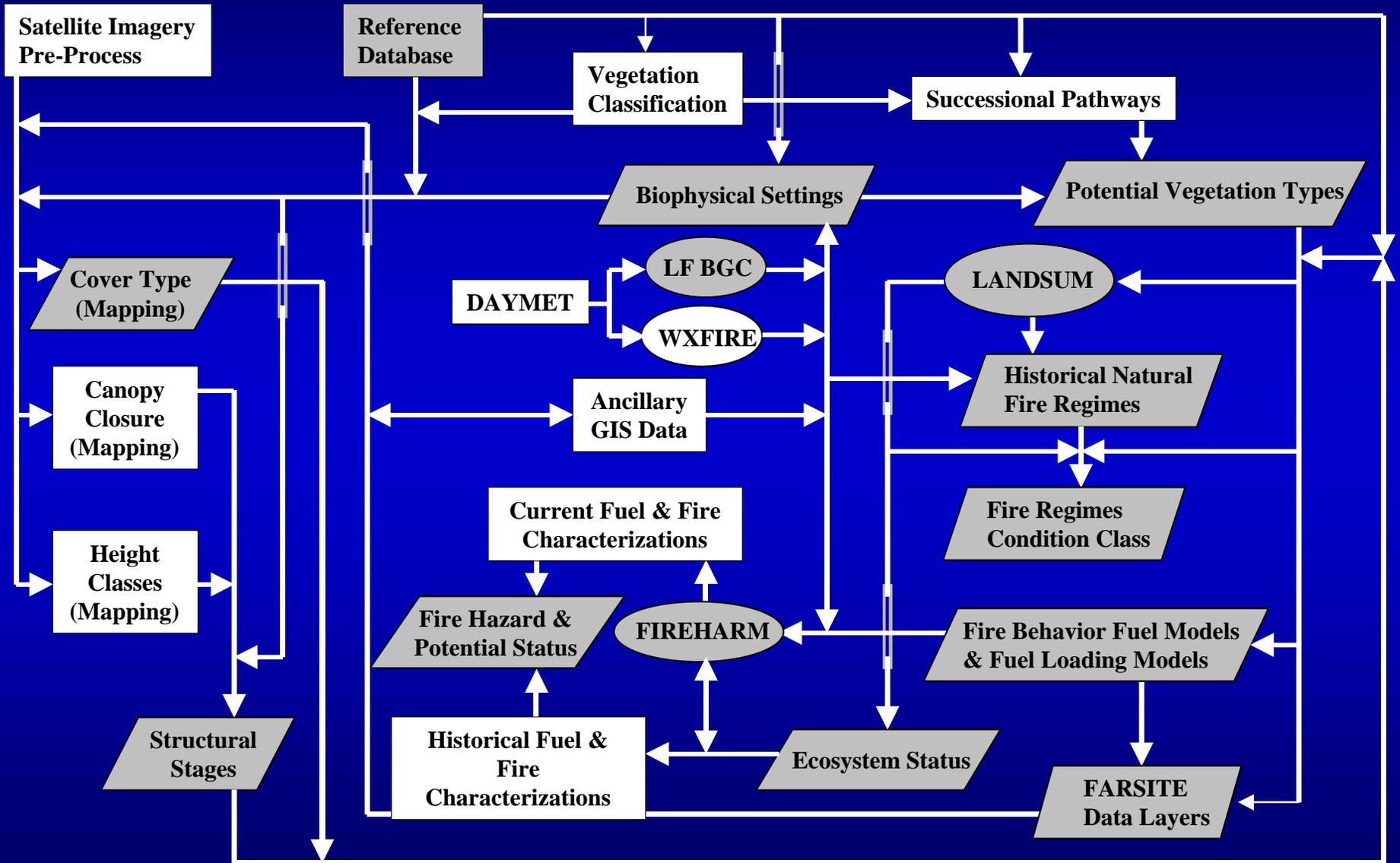


Alaska/Eastern US

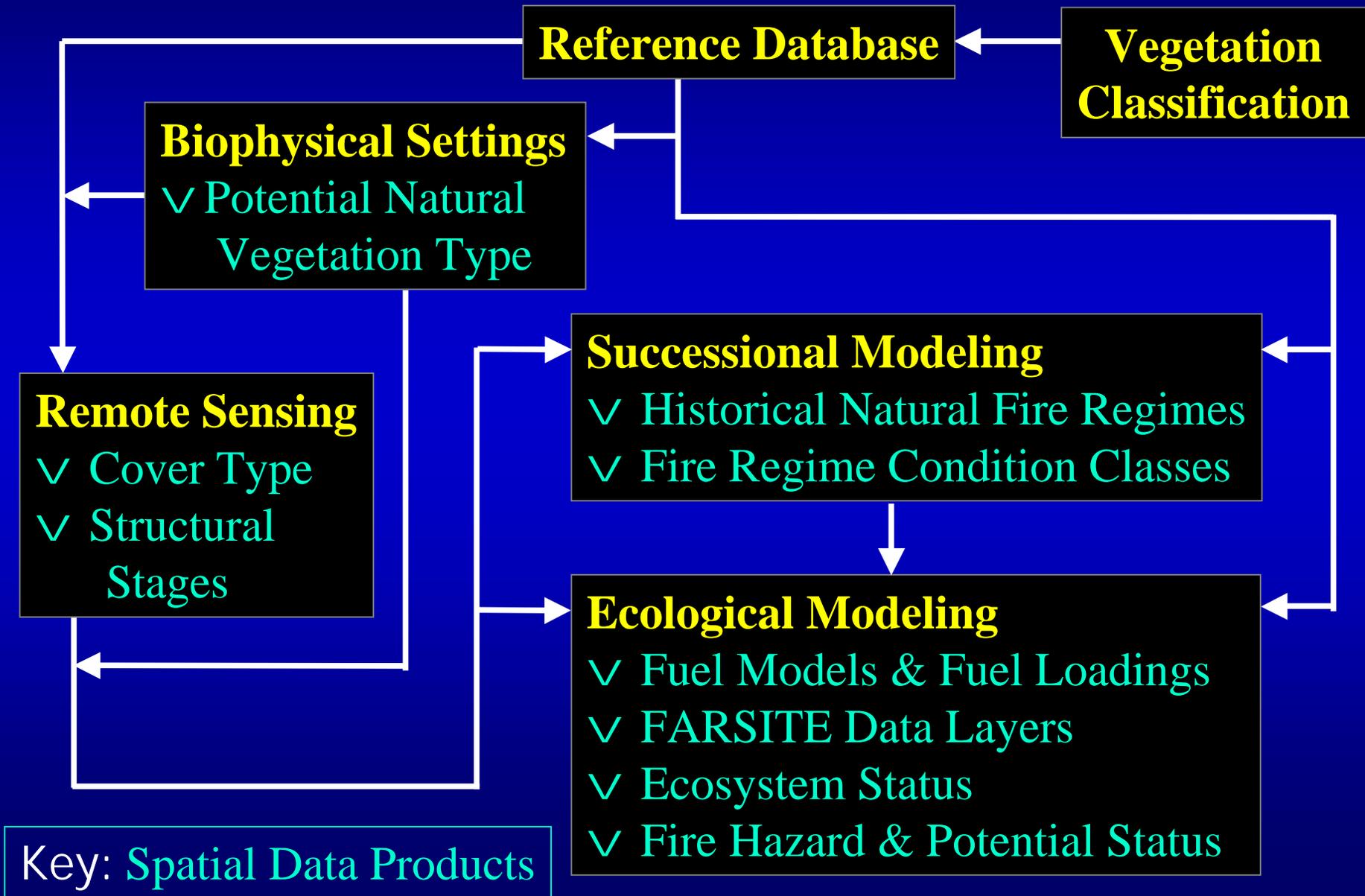
The Prototype does not have to be done to start the Western US.



Flow Diagram of Major Tasks & Products



Simplified Major Tasks / Flow Diagram

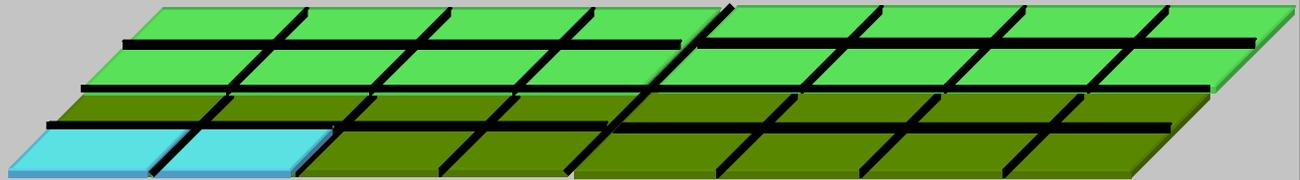


Scale – Mapping and Field

Coarse Scale
(1 km² Pixel Size)

LANDFIRE
(30m² Pixel Size)

Field Data



Fine/Project Scale

Scale and Accuracy

Pixel Size: 10 to 30 m² (0.02 to 0.2 acres)

Map Scale: 1:10,000 to 1:24,000

Appropriate Scale for Data Summaries: Sub-watershed to stand level

Accuracy: 60 to 80 % – when summarized to the sub-watershed or stand level

Ground Truth: - Geo-referenced plot data
- Walk through evaluations of mapping polygon

Use of Information: - Project Design
- Project Planning
- Project Monitoring
- Project Reporting

Questions?

Coarse Scale Data:

<http://www.fs.fed.us/fire/fuelman>

LANDFIRE:

<http://www.landfire.gov>