

Regional to Local Patterns of Pinyon Mortality in the Southwest



Neil Cobb & Jesse Anderson



(Jeanine L. Paschke & FHM)



Drought Related Bark Beetle Outbreaks (1996-Present)

REGIONAL

Drought related mortality has occurred throughout Pinyon-Juniper woodlands on the Colorado Plateau.

Massive Pinyon mortality (*Ips confusus*), but little juniper mortality

LOCAL

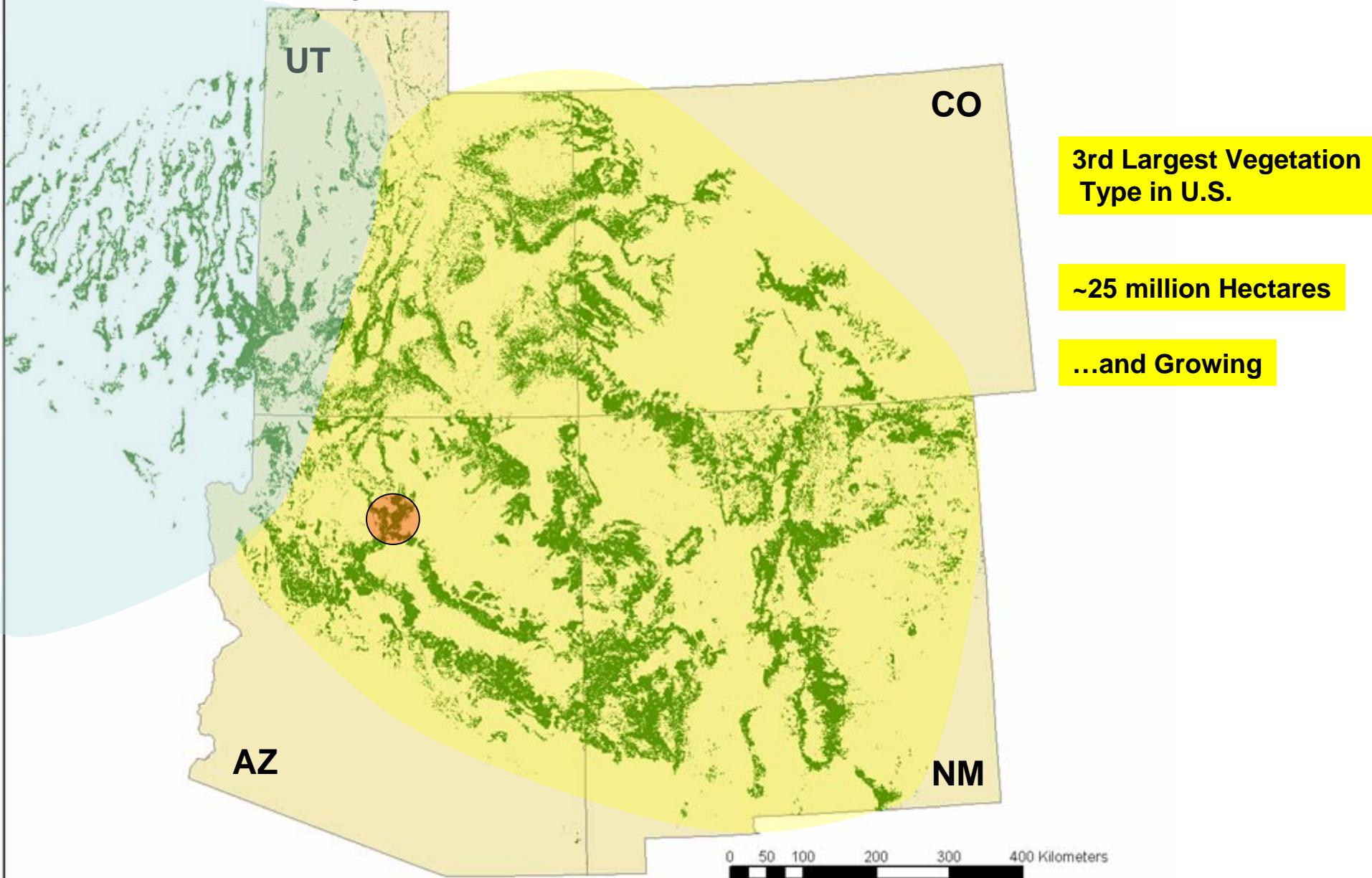
Patterns of Mortality (Transects & Satellite)

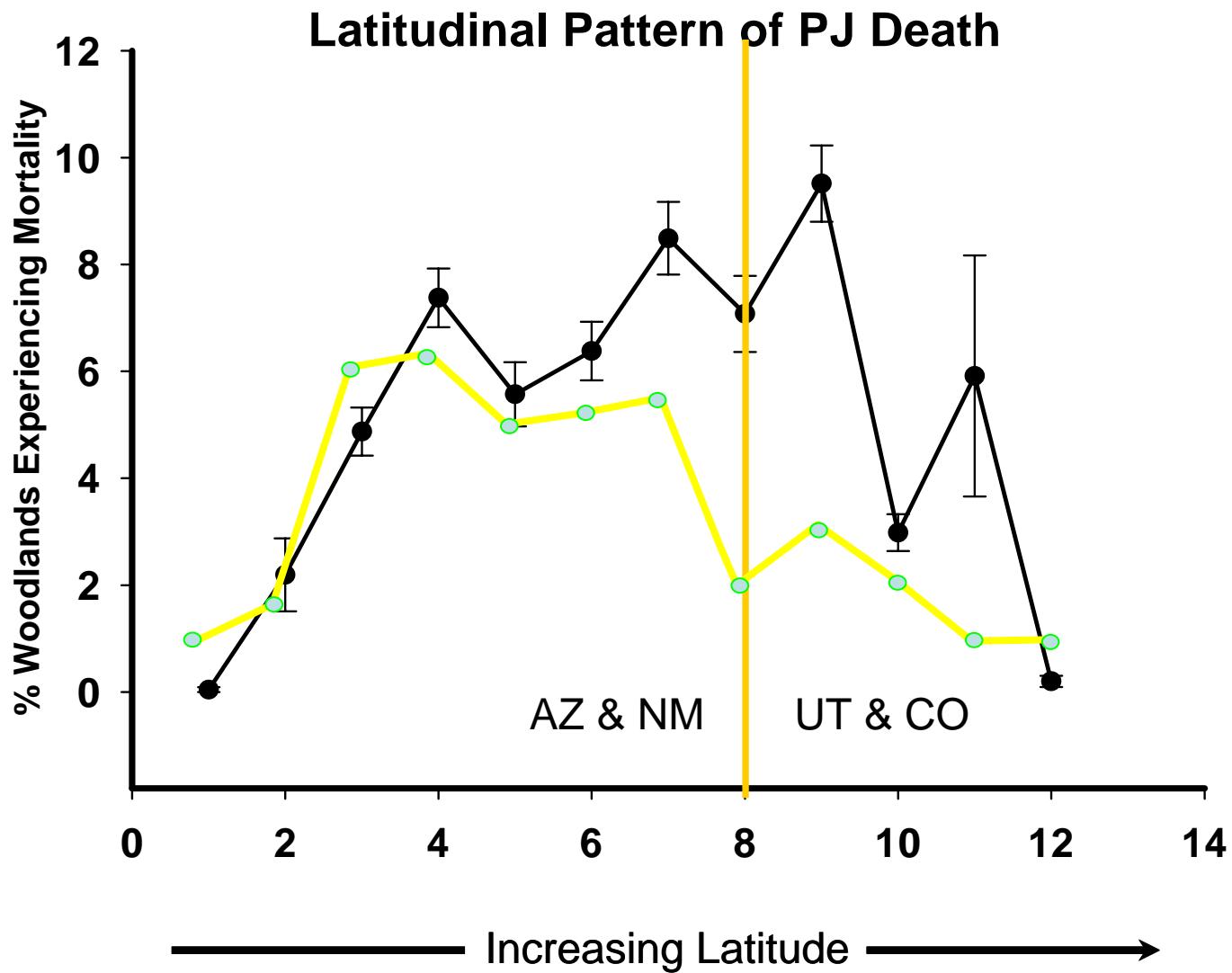
Drought/Beetles are Resetting Successional Clock

DIREnet

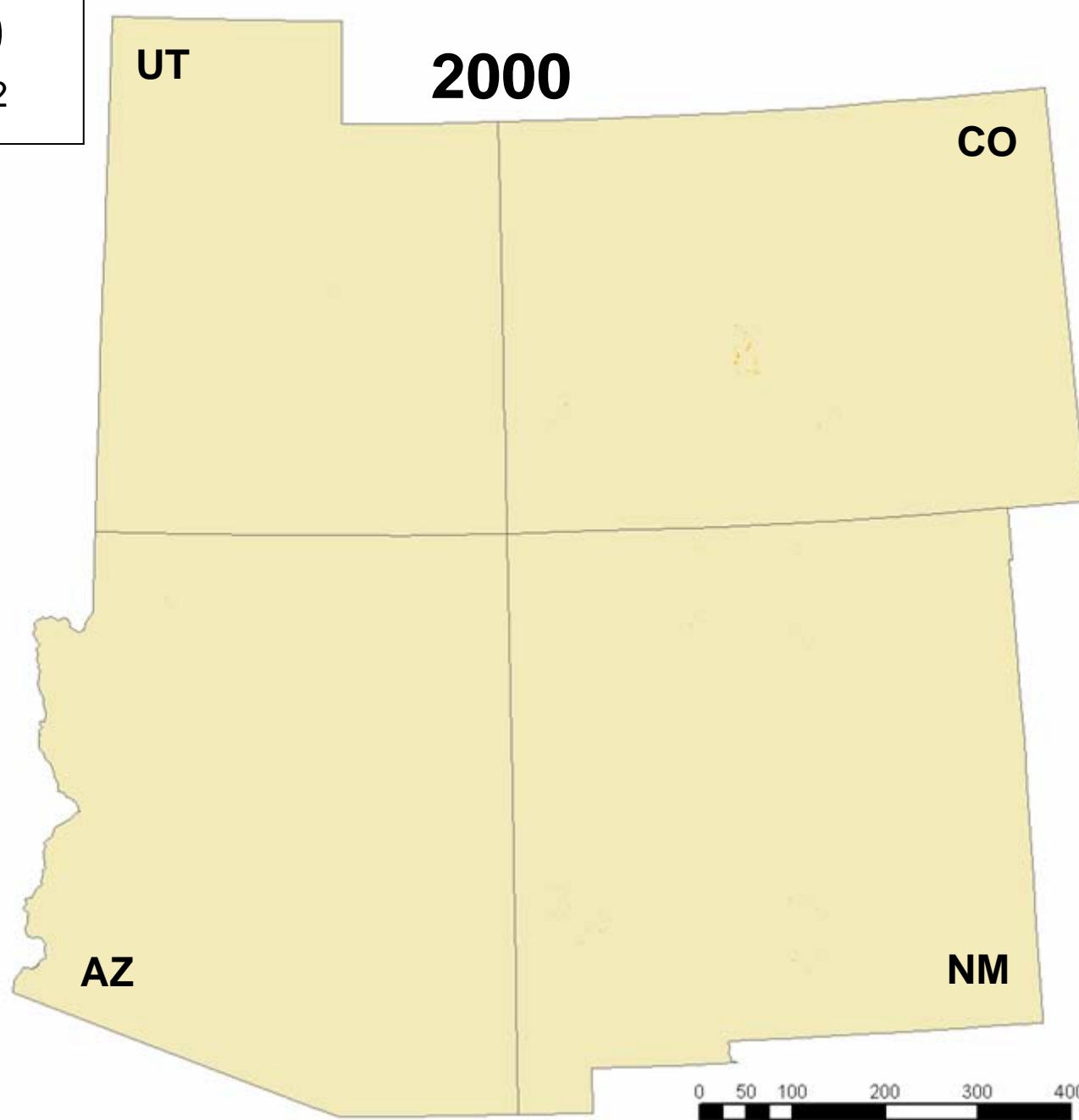
Drought Impacts Network: DIREnet

Pinyon-Juniper Woodlands





2000
75 km²



0 50 100 200 300 400 Kilometers

2000

75 km²

2001

332 km²

UT

2001

CO

AZ

NM

0 50 100 200 300 400 Kilometers

2000

75 km²

2001

332 km²

2002

1,377 km²

UT

2002

CO

AZ

NM

0 50 100 200 300 400 Kilometers

2000

75 km²

2001

332 km²

2002

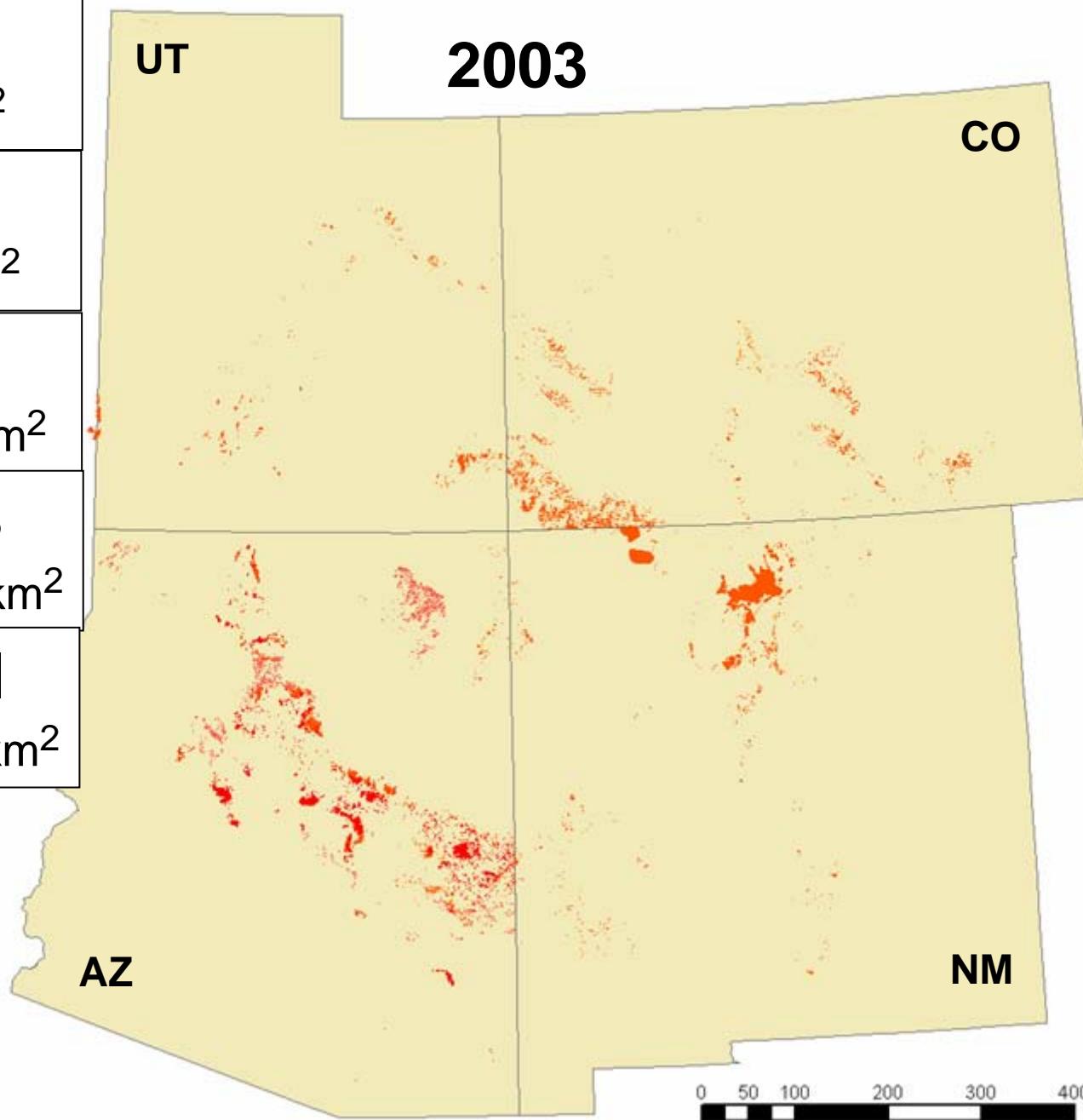
1,377 km²

2003

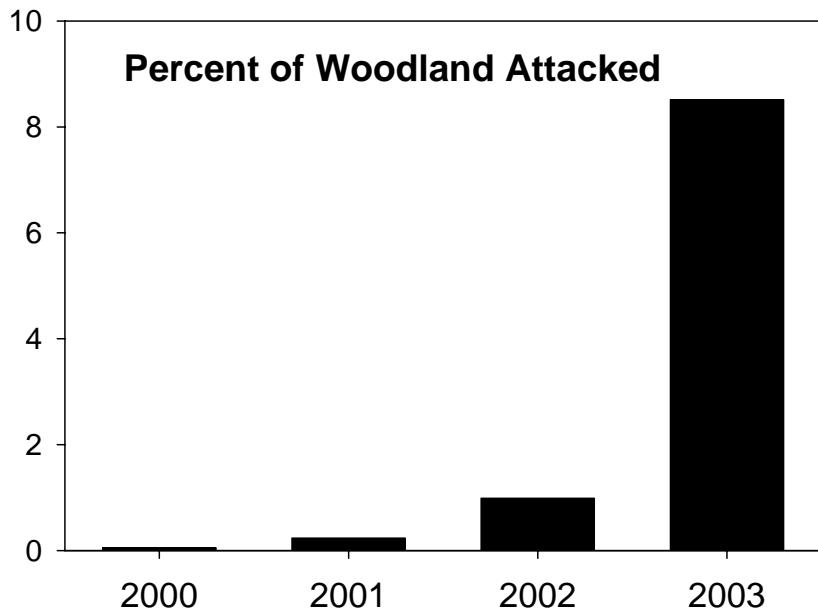
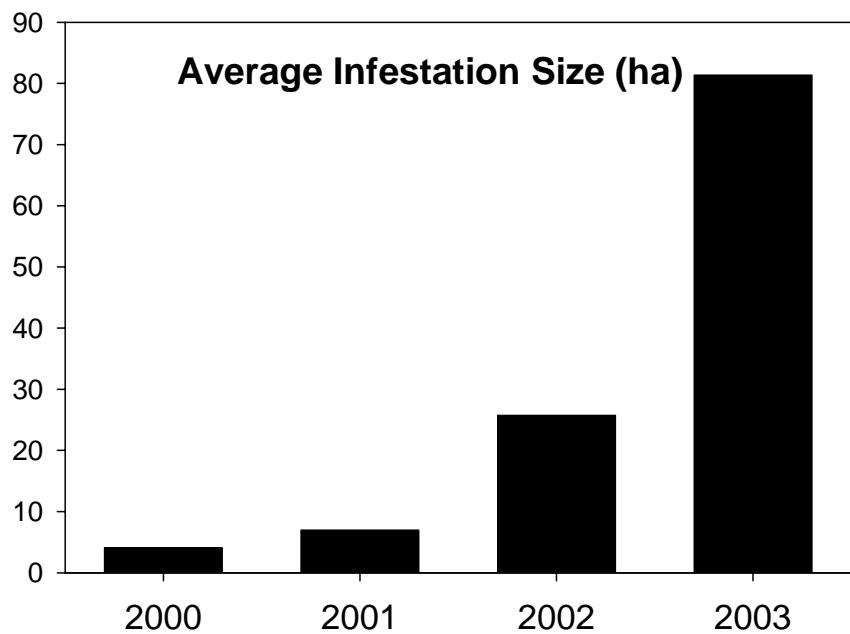
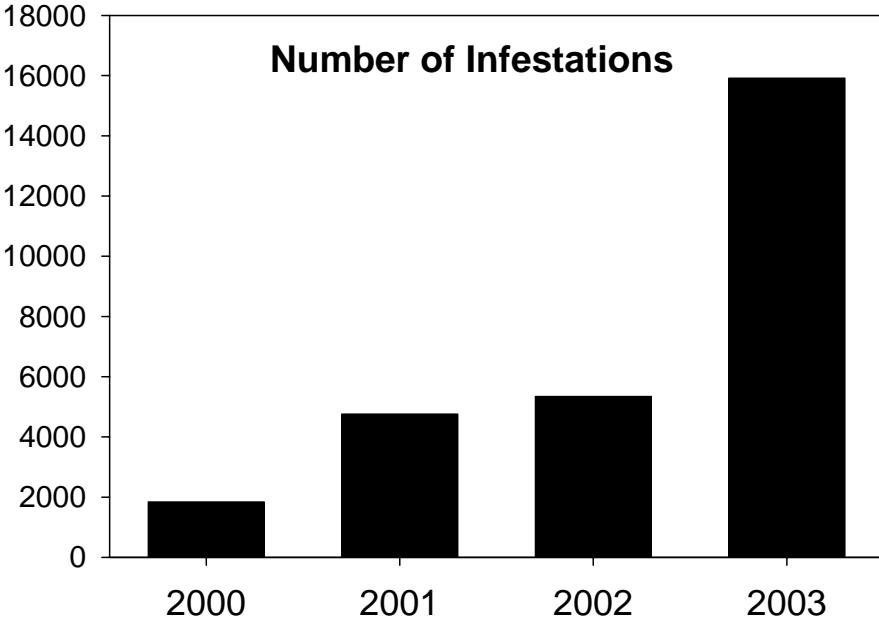
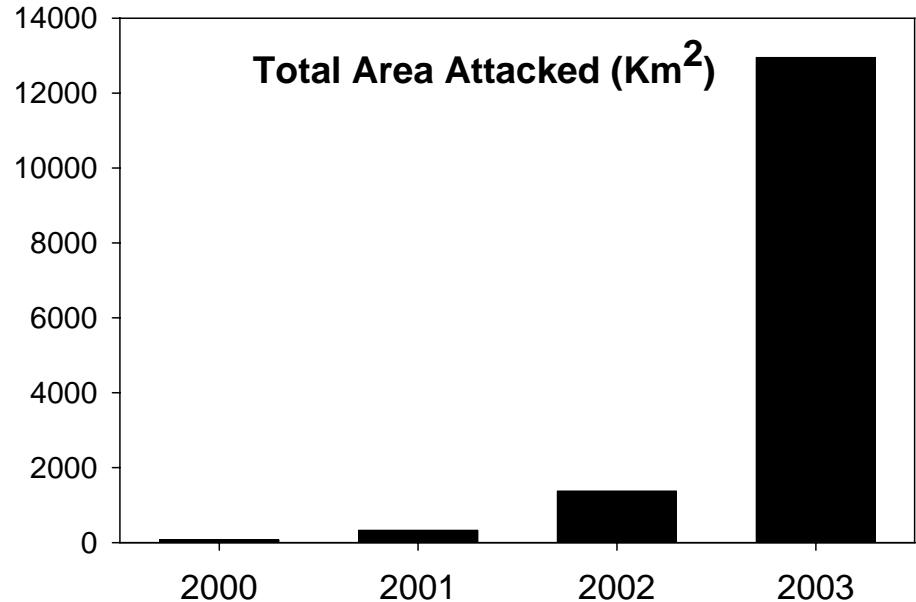
10,406 km²

Total

12,191 km²



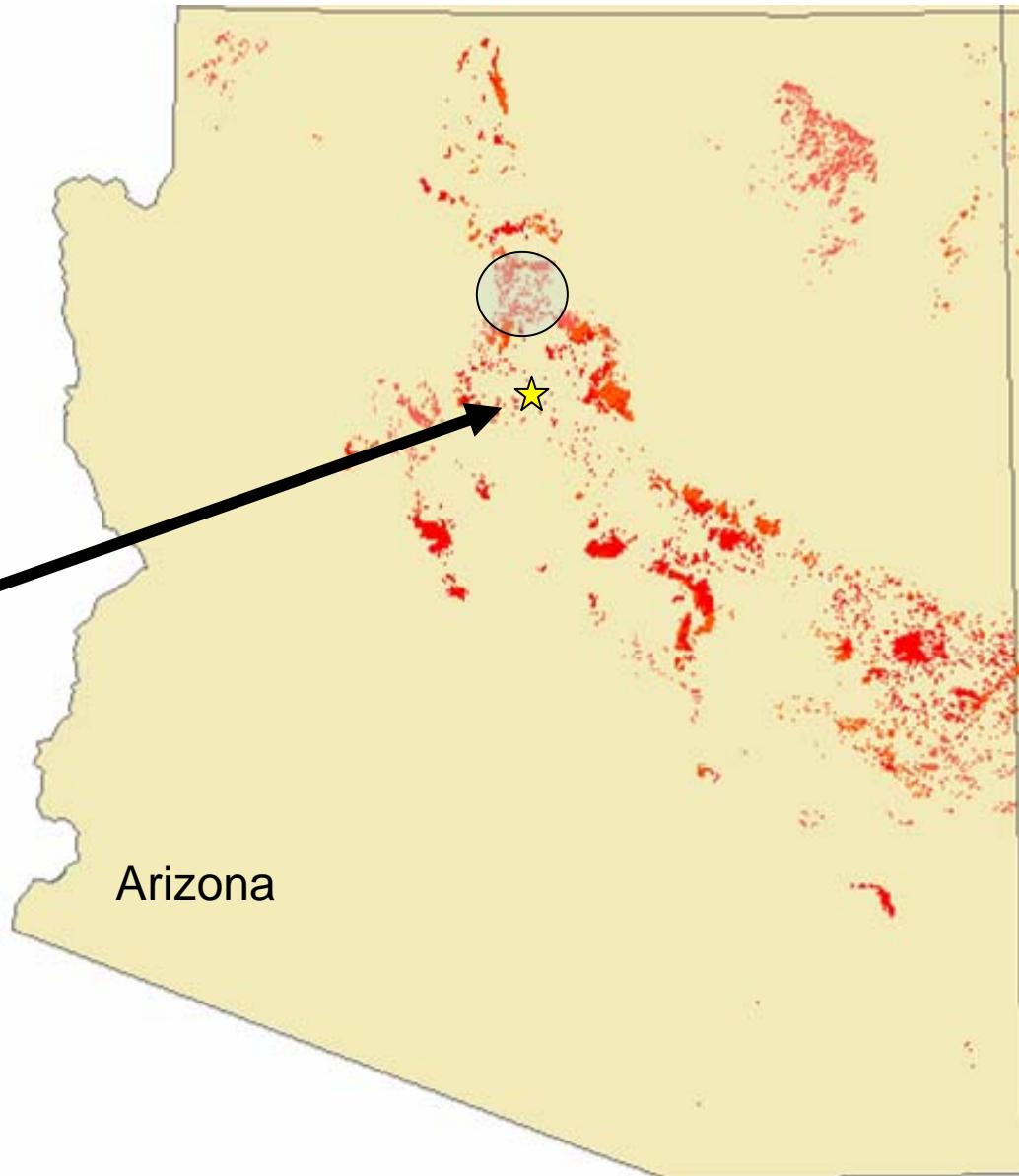
Four States - Pinyon / Juniper



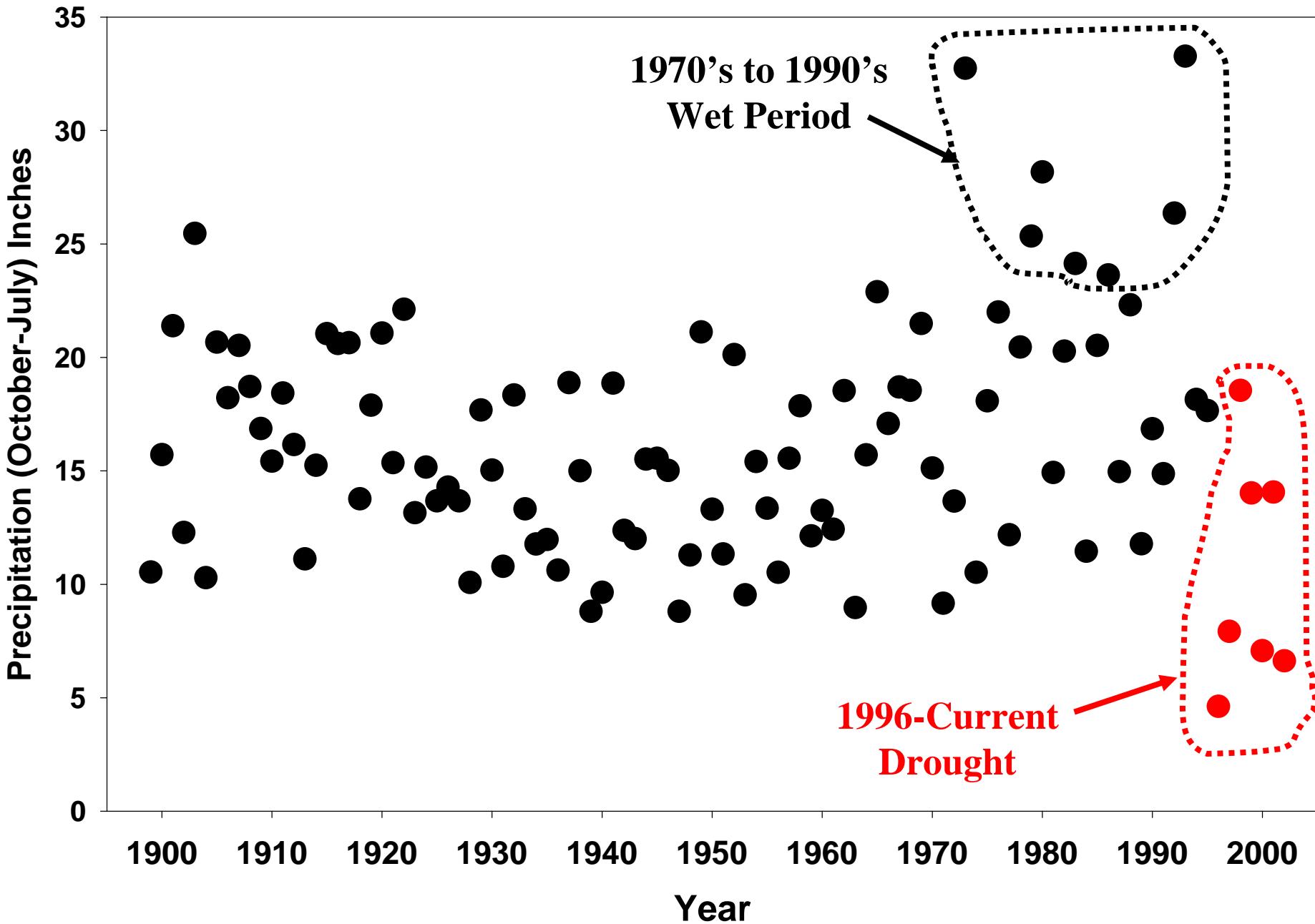
Local Patterns of mortality in Pinyon-Juniper Woodlands

You are Here

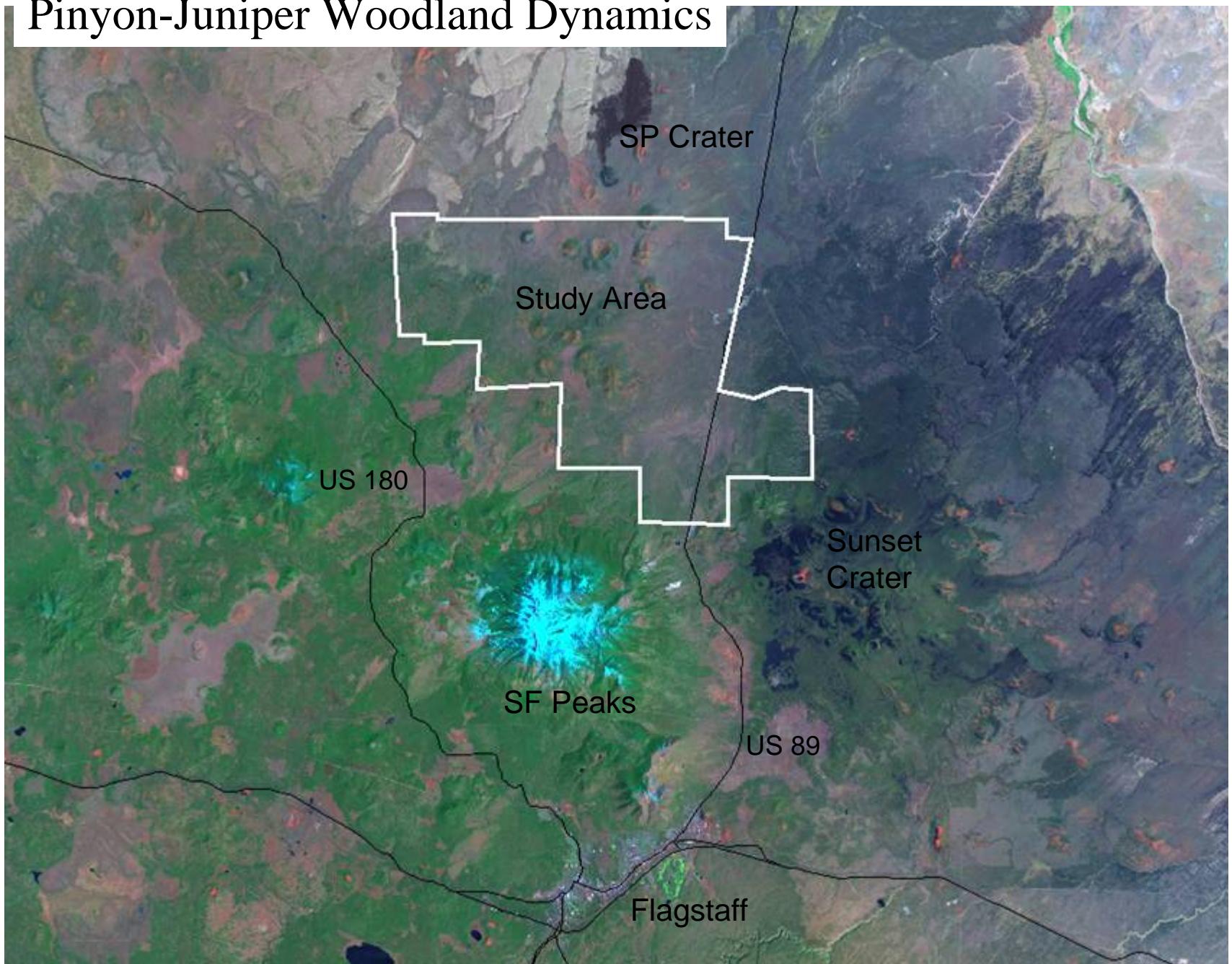
 Mortality

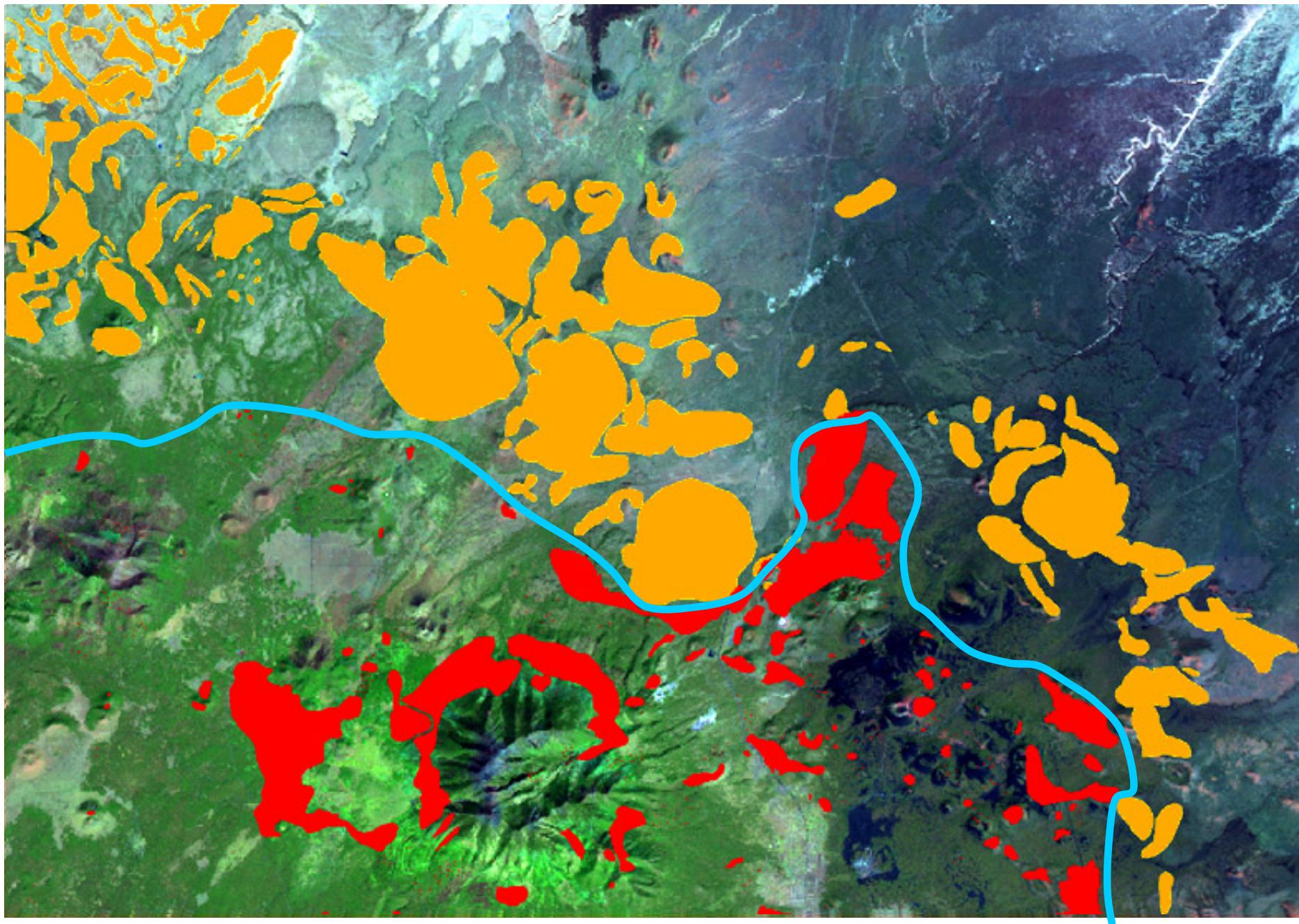


102 Years of Flagstaff Precipitation

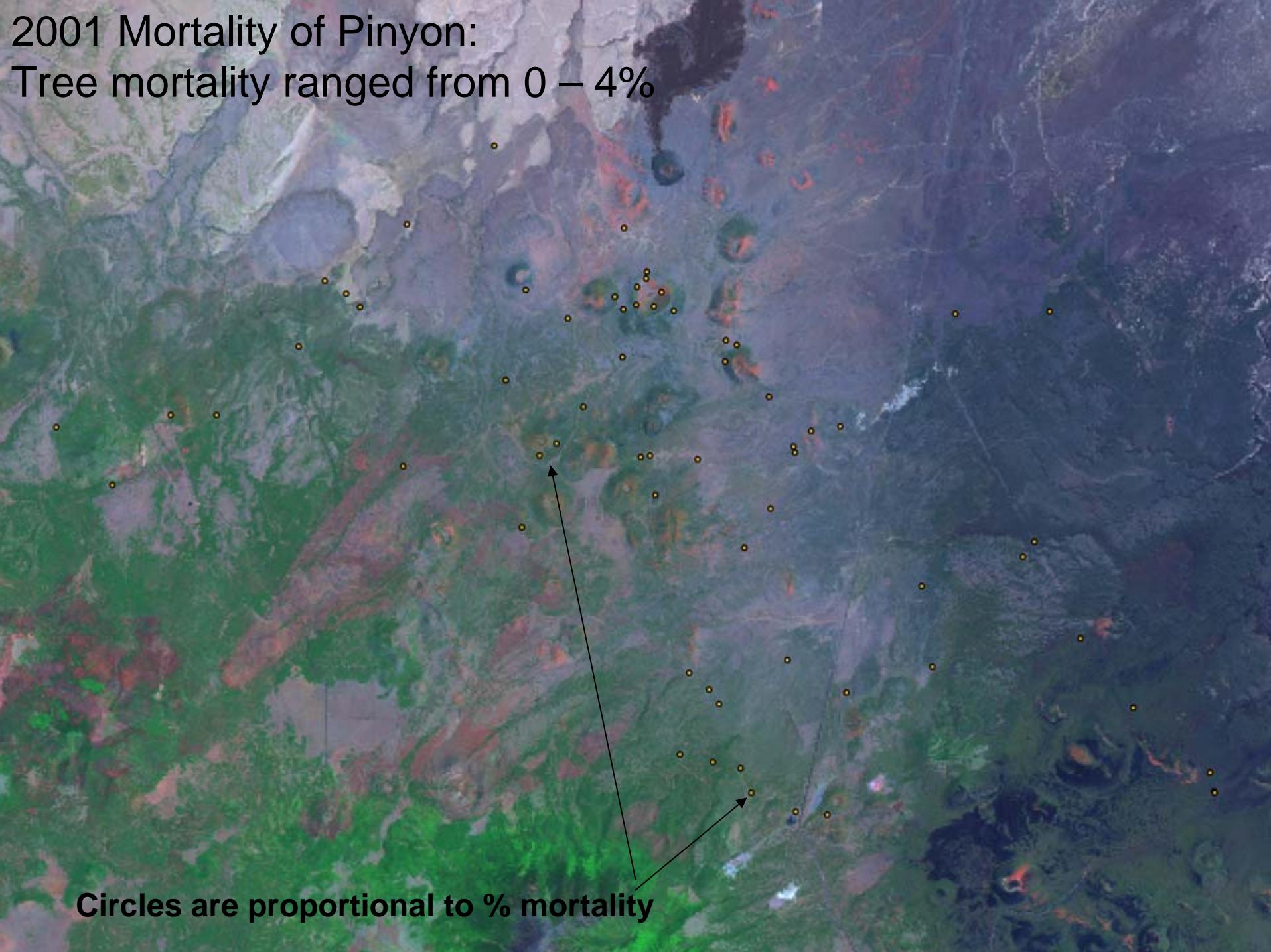


Pinyon-Juniper Woodland Dynamics

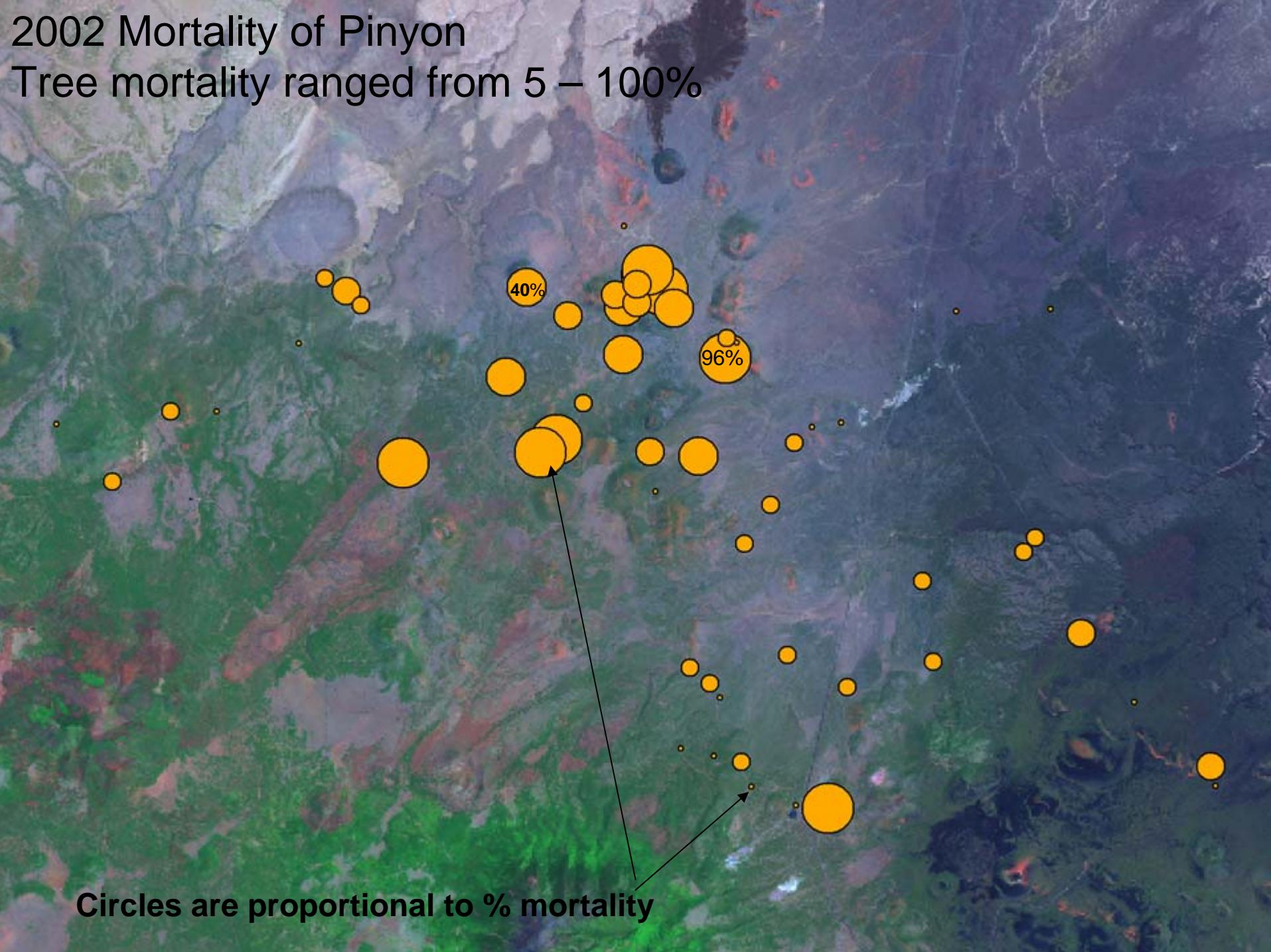




2001 Mortality of Pinyon:
Tree mortality ranged from 0 – 4%



2002 Mortality of Pinyon
Tree mortality ranged from 5 – 100%



Circles are proportional to % mortality

May 17, 2003 North of San Francisco Peaks

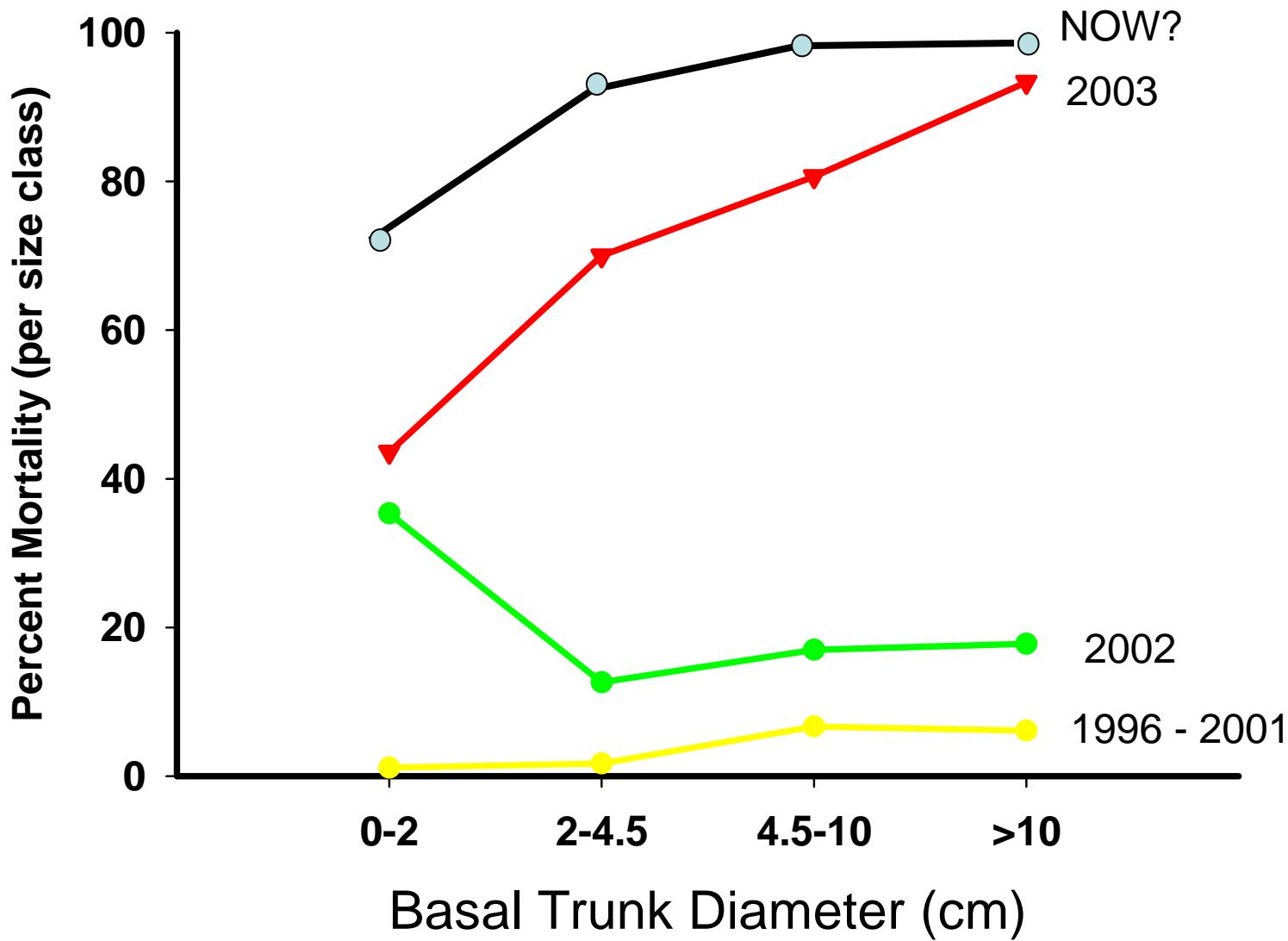


September 20, 2003 North of San Francisco Peaks

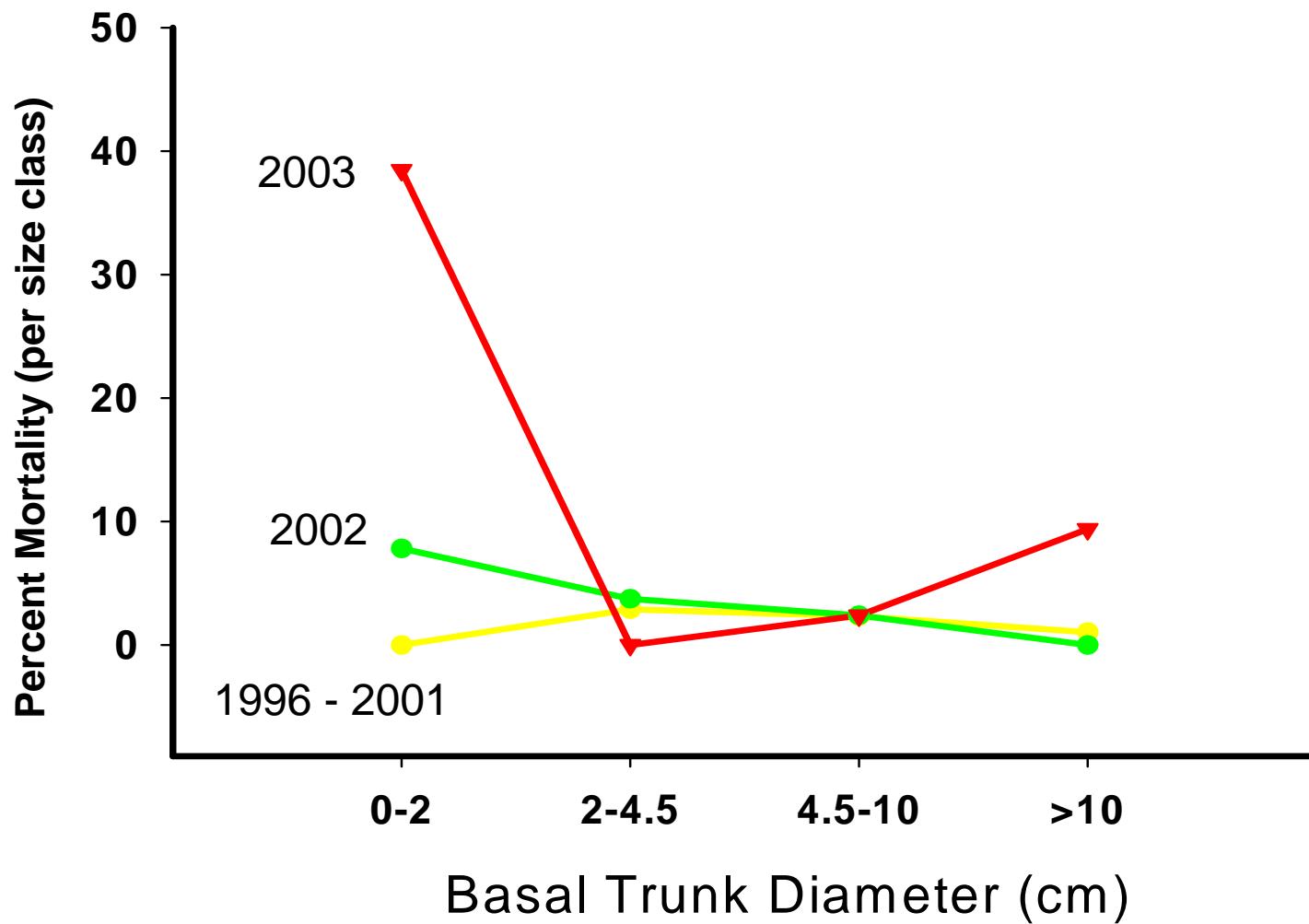


PJ Woodland —————→ Juniper Woodland

Pinyon Death Across Years and Size Classes



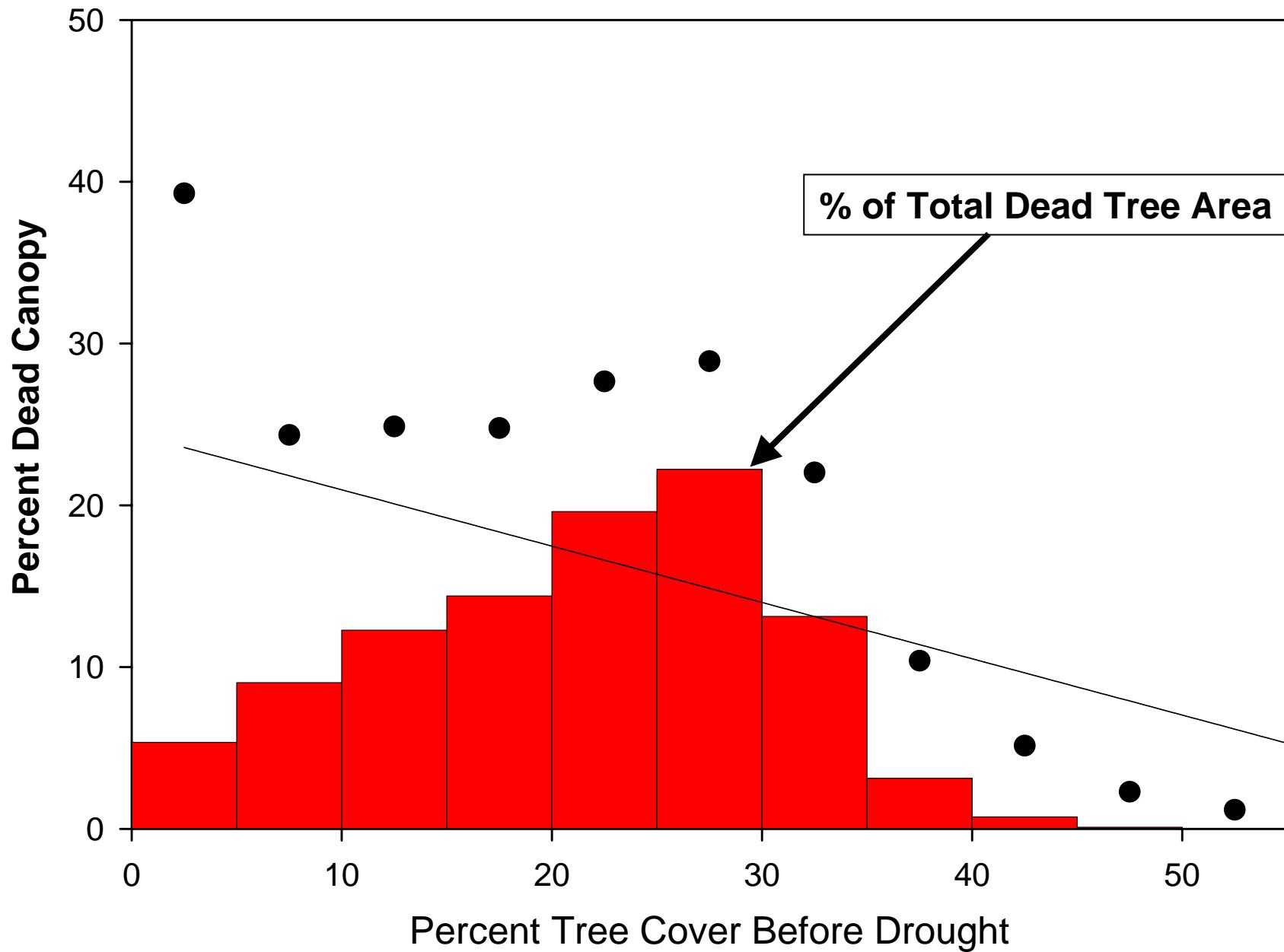
Juniper Death Across Years and Size Classes

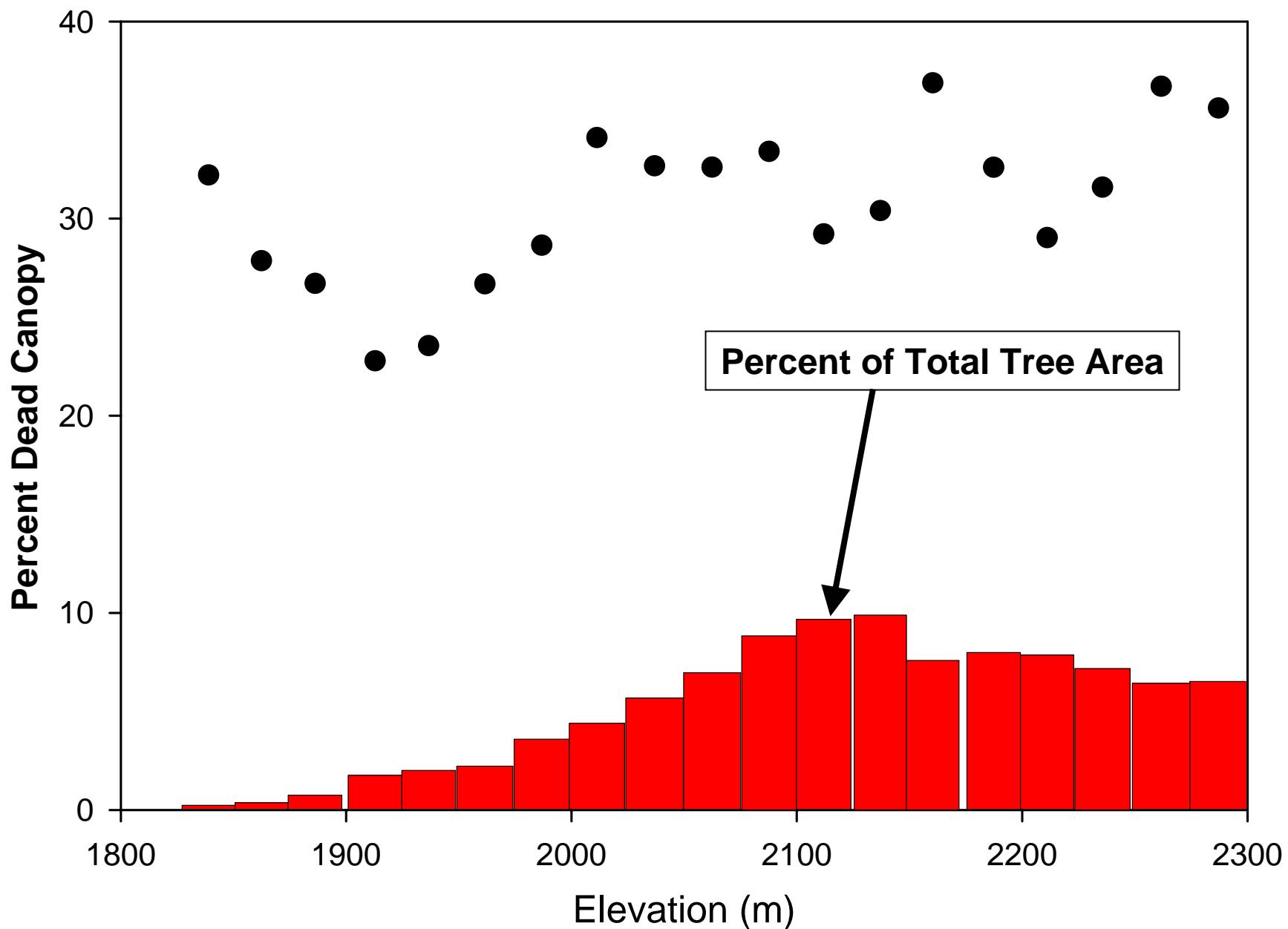


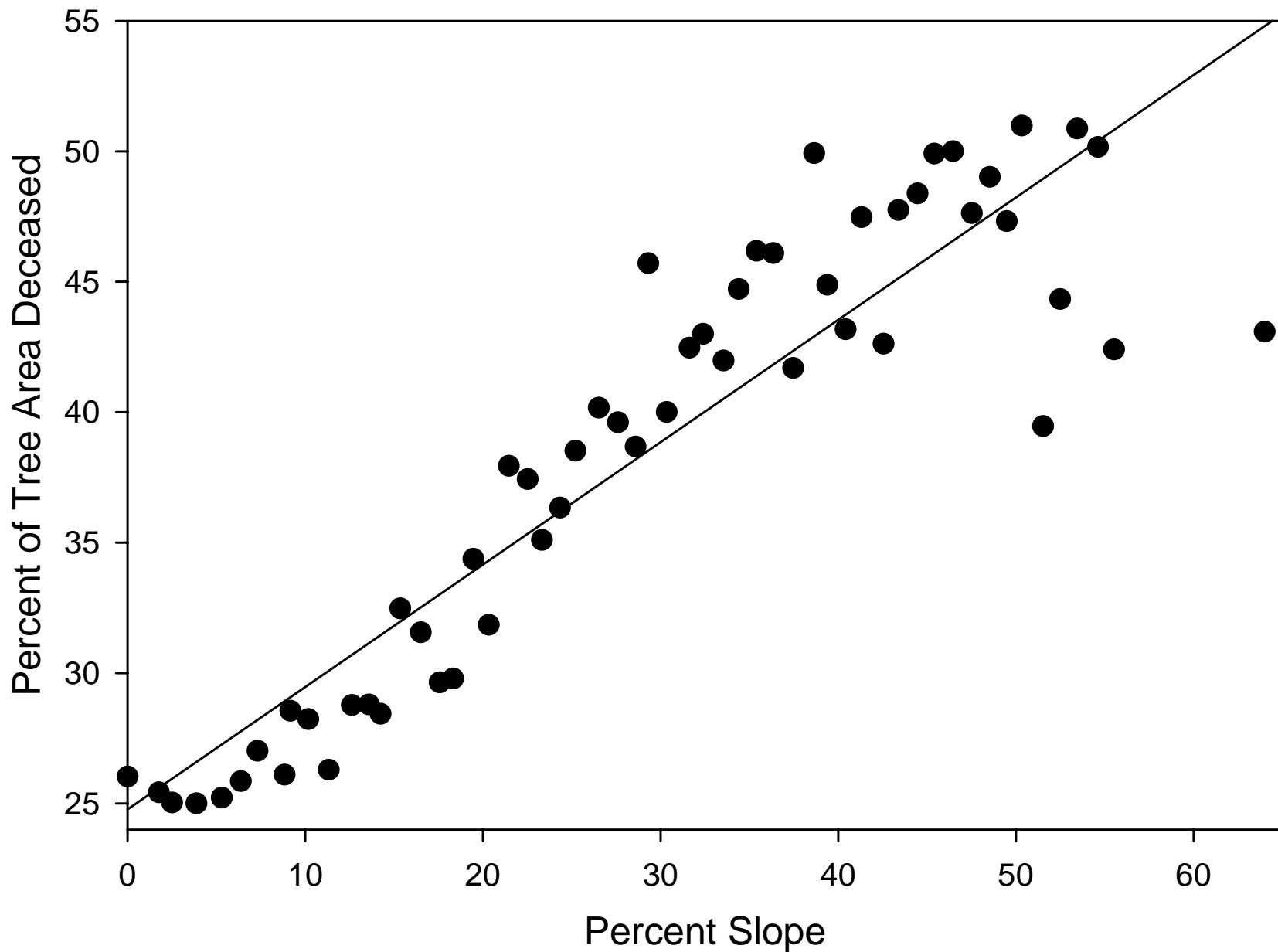
Quickbird Satellite Data (0.6m) delineating one ha plots



Stand Density and Death

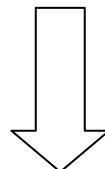






Drought as a Key Factor in Woodland Dynamics

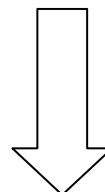
Low-Density Pre-Settlement



Woody Biomass

**Fire Suppression
Heavy Grazing
Climate Change**

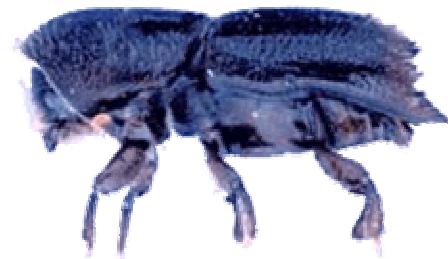
Dense Tree Stands



Mortality

**Drought
Bark Beetles**

Reset Successional Clock



1892

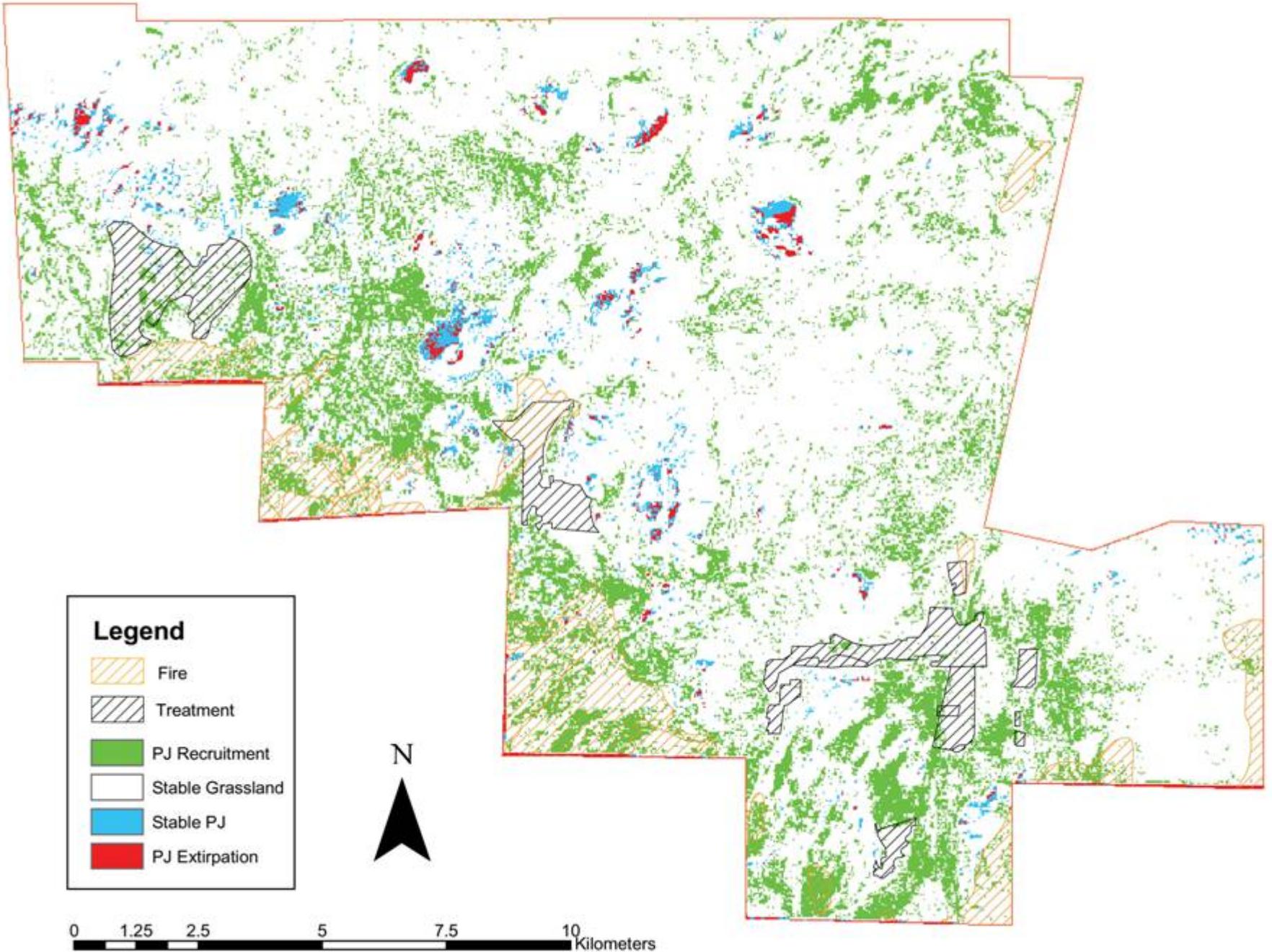


2001

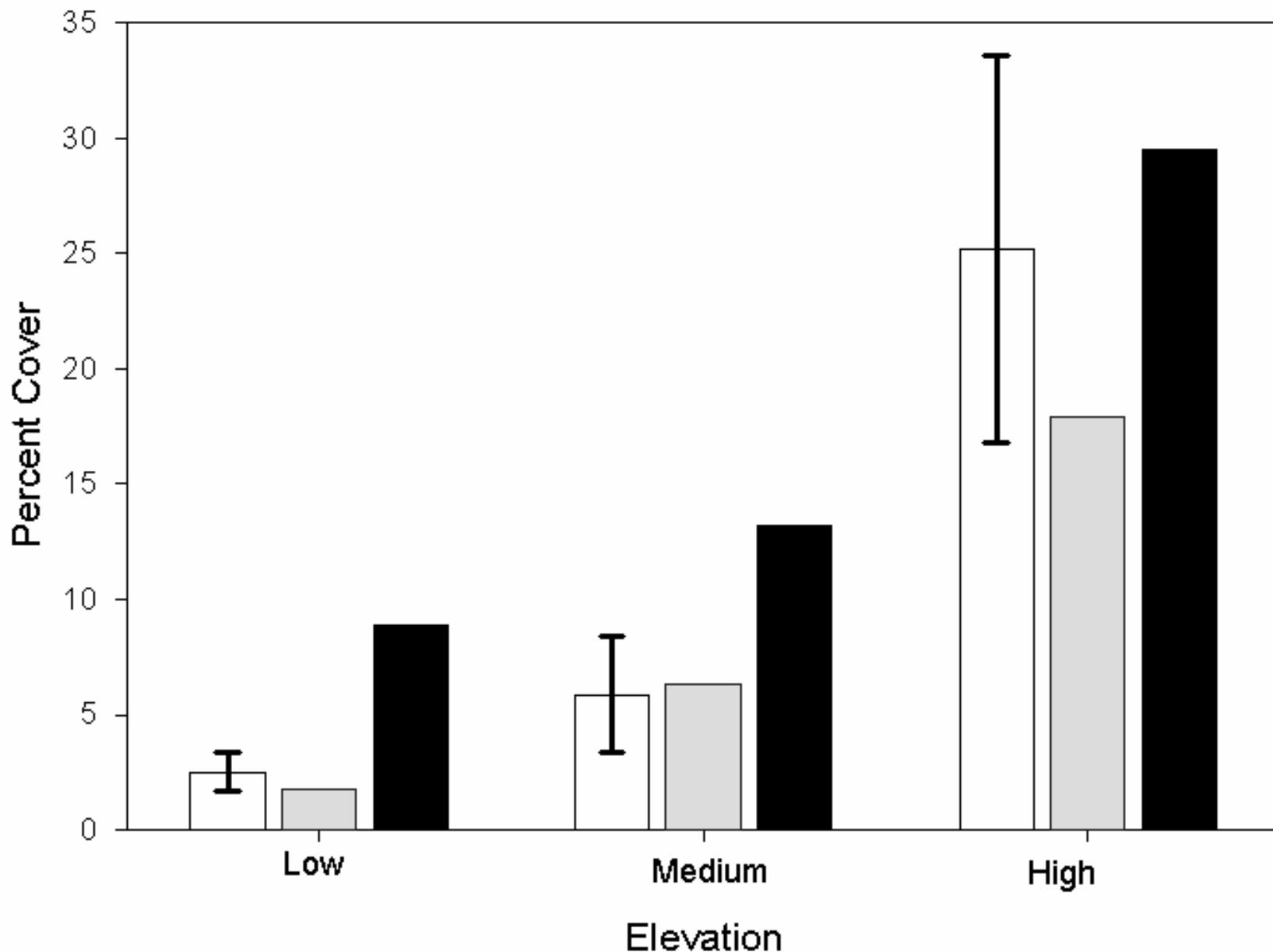


2003

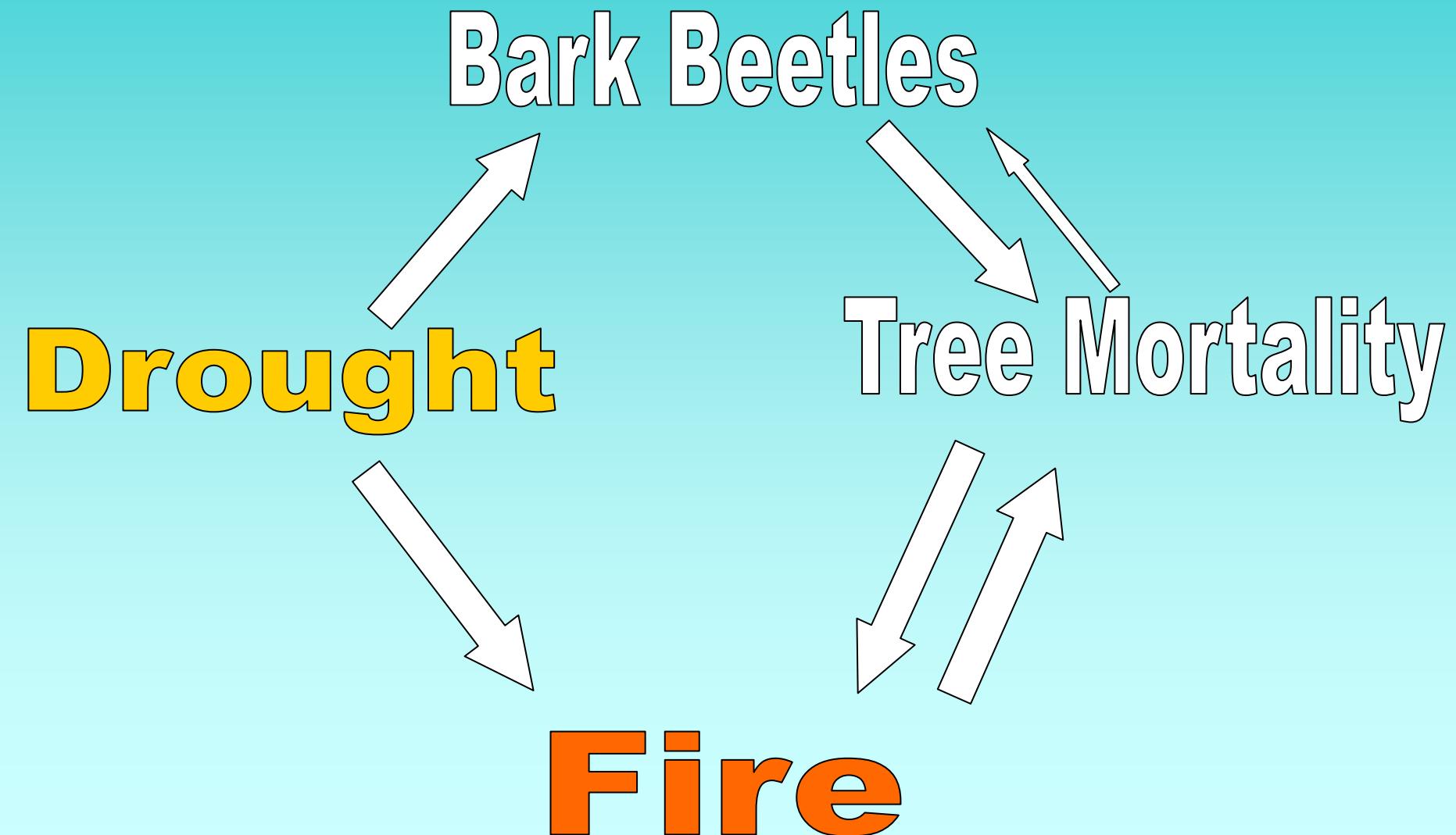




Percent Cover from 1883-1997



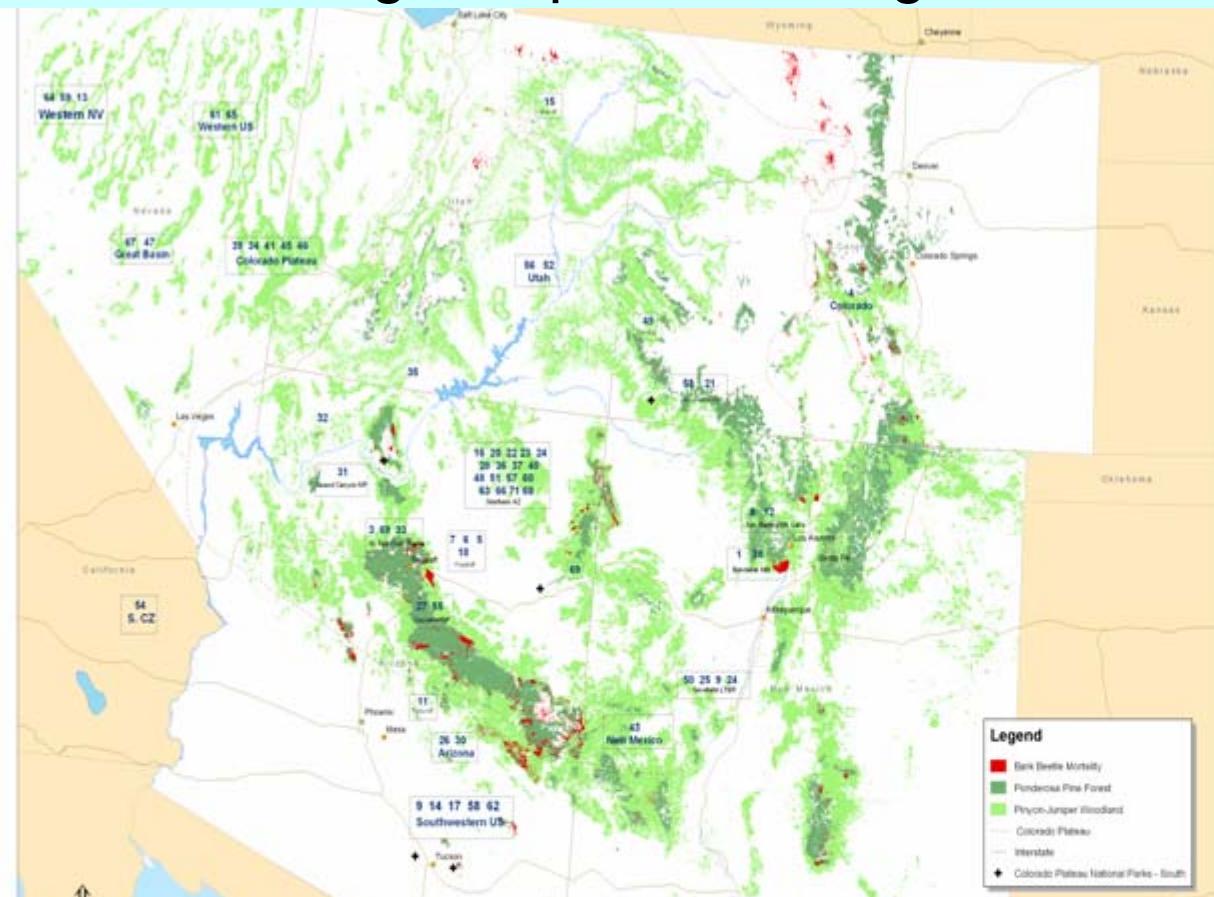
Drought Mediated Tree Population Dynamics



Drought Impacts on Regional Ecosystems Network

DIREnet Collaborators

STUDY ID	STUDY LOCATION	STUDY	STUDY	AFFILIATION	STUDY HABITAT	STUDY OBJECTIVE
1	Western NV	Bark Beetle Mortality	1	University of Nevada, Reno	Ponderosa Pine Forest	Document tree mortality and impacts
2	Western US	Ponderosa Pine Forest	2	USFS, Northern Rockies	Ponderosa Pine Forest	Document tree mortality and impacts
3	Western US	Pinyon-Juniper Woodland	3	USFS, Northern Rockies	Pinyon-Juniper Woodland	Document tree mortality and impacts
4	Western US	Colorado Plateau	4	USFS, Northern Rockies	Colorado Plateau	Document tree mortality and impacts
5	Western US	Cross-Pollination in Pinyon-Juniper	5	USFS, Northern Rockies	Pinyon-Juniper Woodland	Document tree mortality and impacts
6	Western US	Colorado Plateau National Parks - South	6	USFS, Northern Rockies	Cross-Pollination in Pinyon-Juniper	Document tree mortality and impacts
7	Western US	Colorado Plateau National Parks - North	7	USFS, Northern Rockies	Cross-Pollination in Pinyon-Juniper	Document tree mortality and impacts
8	Western US	Colorado Plateau National Parks - West	8	USFS, Northern Rockies	Cross-Pollination in Pinyon-Juniper	Document tree mortality and impacts
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Drought Impacts on Regional Ecosystems Network

Coordinating Drought Studies on Southwest Ecosystems

Background Information

Climate

Ponderosa Pine

Pinyon-Juniper

Sagebrush

DIRENET Information

[DIREnet Home](#)

[DIREnet Associates \(SERF\)](#)

2003 Drought Summit

2003 Drought Symposium

Drought Research

ForestEra

Los Alamos

Mesa Verde

San Francisco Peaks

MPCER



The Drought Impacts on Regional Ecosystems Network (DIREnet) is an association of researchers and land managers interested in documenting impacts on major ecosystems of the western United States resulting from drought related processes. The research network is currently focused on Ponderosa Pine Forests and Pinyon-Juniper Woodlands in the Southwest. A severe regional drought has gripped the Southwest in recent years, and is rapidly and dramatically altering forest, woodland and shrubland ecosystems. The drought has become a catalyst in bringing researchers and land managers together to assess the impacts of the drought.

DIREnet will promote research needed to address specific questions that could not be addressed otherwise. For example, how does tree mortality change over regional environmental gradients and to what degree does climate variability explain ecosystem dynamics? DIREnet will implement two mechanisms to foster collaborations of researchers from academia and land management agencies: **Southwest Ecological Research Forum (SERF)**, will be a sophisticated online information archive and community forum which will serve as a globally accessible clearinghouse and provide an effective forum for discussion and communication **Cross-Pollination in Research and Education**. The organization of conferences and workshops will foster new research, and complement SERF activities by establishing new collaborations and strengthening existing relationships. In combination, these efforts will greatly aid understanding of how major ecosystems function and respond to climatic perturbations.

Drought in Southwest: Southwest arid and semi-arid ecosystems may be particularly sensitive to climate changes (Risser 1995, Swetnam and Betancourt 1988). The primary production of these ecosystems is limited by water, making the consequences of changes in temperature and precipitation more extreme. Also, human populations have increased up to 40% in the Southwest during the last decade (US Census Bureau, Census 2000) exacerbating drought impacts due to increased risk of fires. We are focusing our network coordination activities on research carried out in the Southwest.

Google: DIRENET

Latest Updates

Letter to EPA & DOI

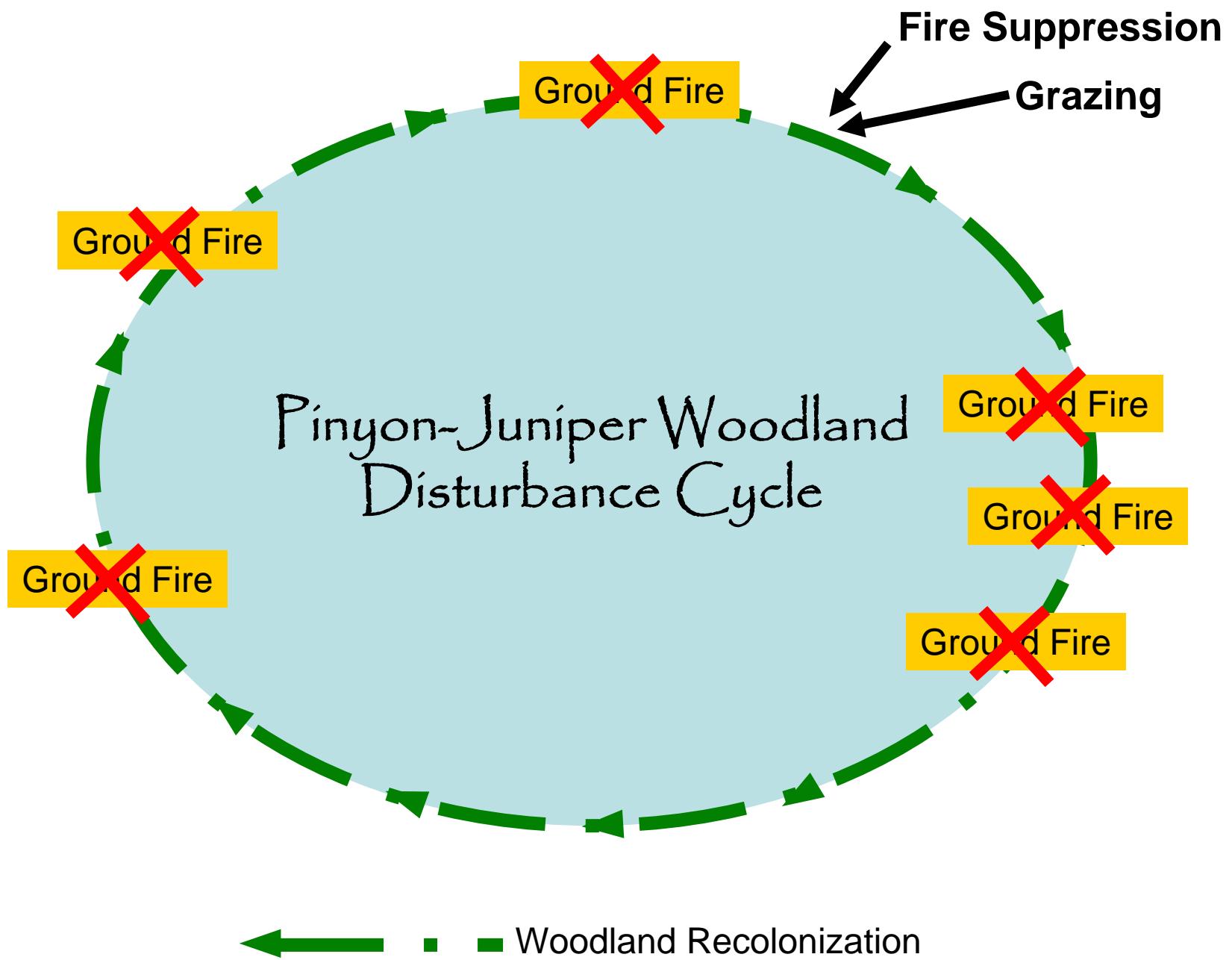
Bill Romme (Colorado State University) is leading an effort to inform policy makers about the ecological and economic implications of land management decisions in dealing with dead trees in Pinyon-Juniper woodlands. [full story...](#)

Responses to Letter

The above letter was printed in the Santa Fe New Mexican recently. Read current responses from the public [here](#).

Apache-Sitgreaves NF

The latest map of tree mortality in one of the southwest's hardest hit areas. [Mortality Maps](#)

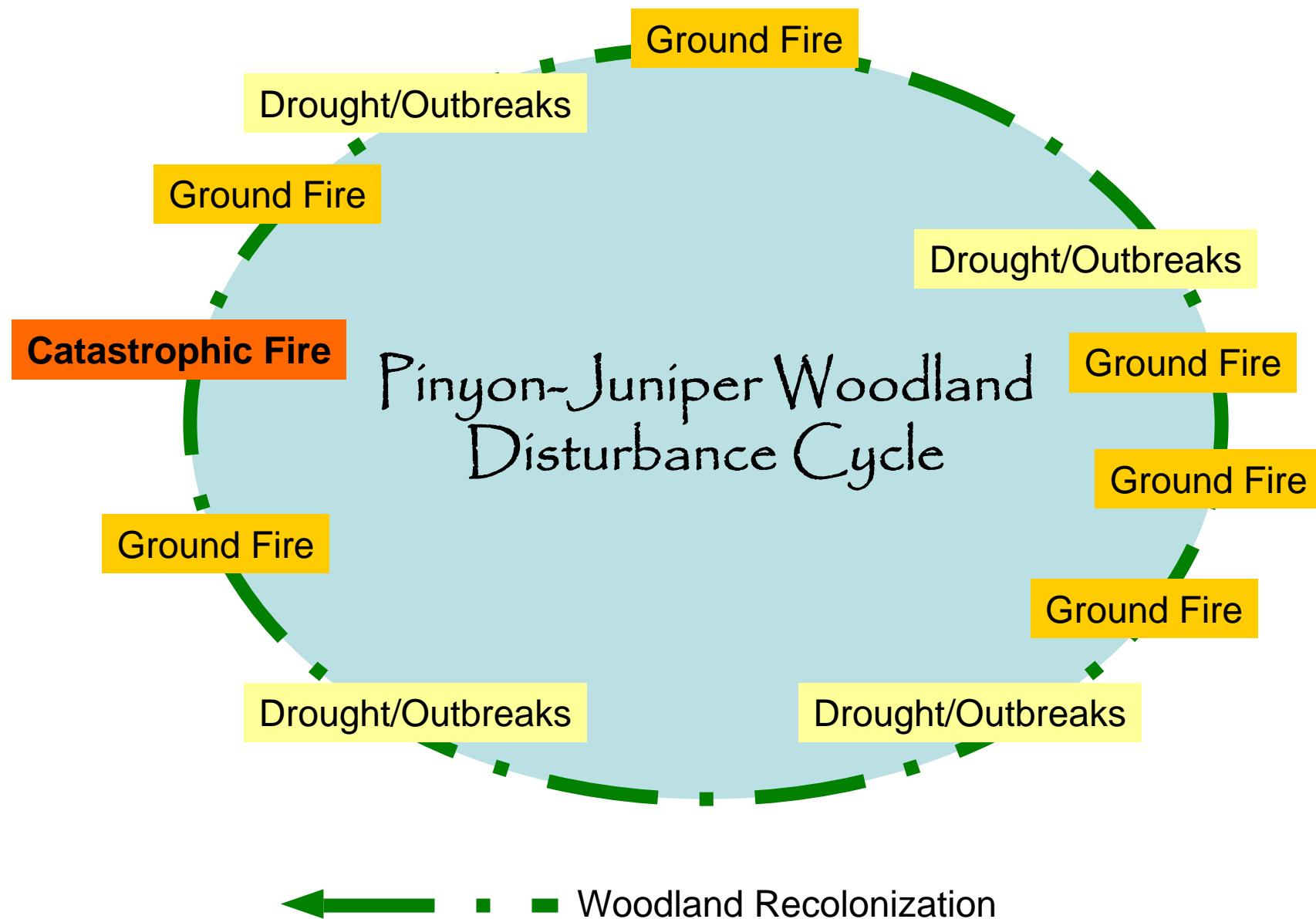


Catastrophic Fire

= 450 years

Drought/Outbreaks

= 100 years



Model of Beetle Dynamics

