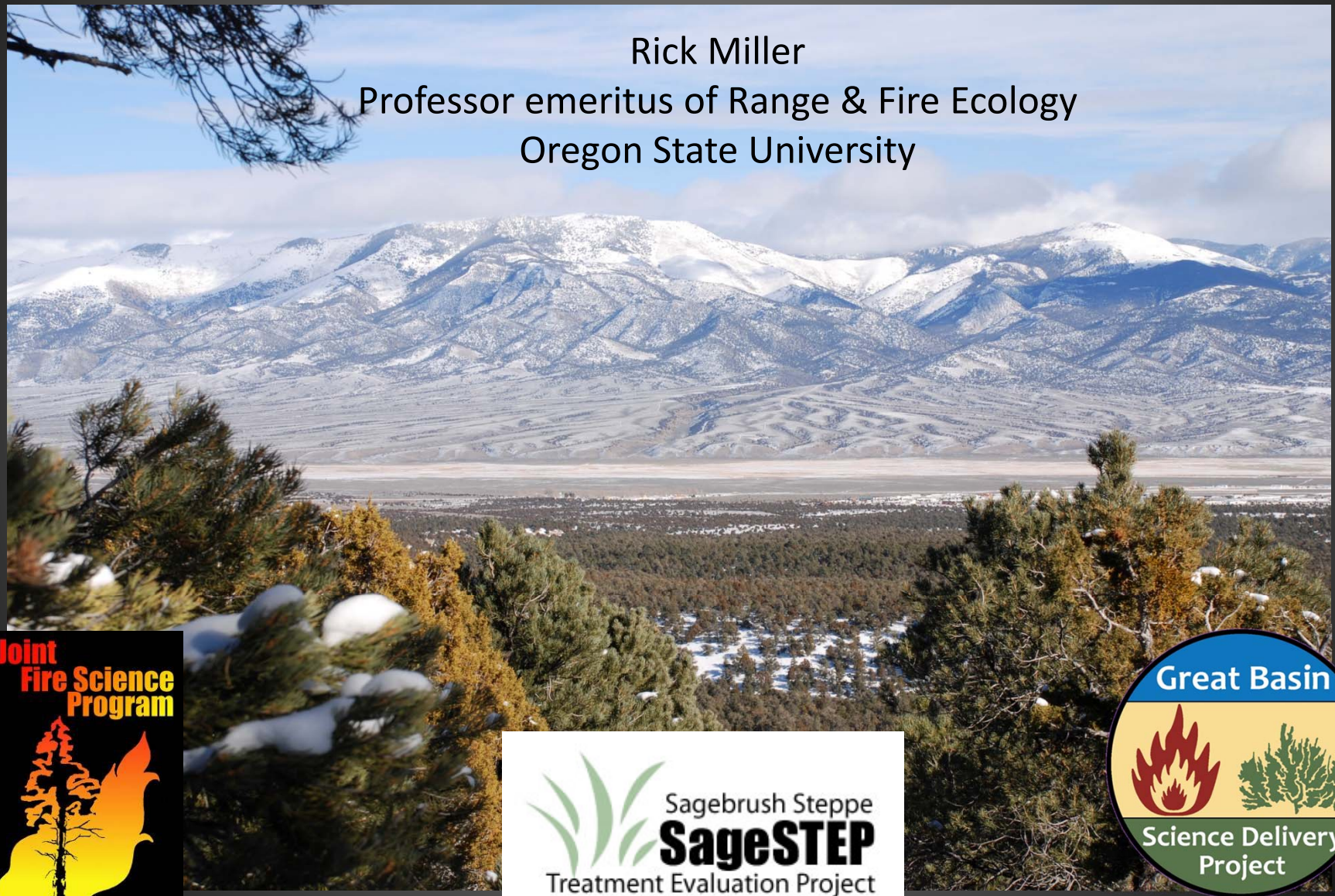
Pinyon & Juniper Woodlands: Expansion, causes, & consequences

Rick Miller
Professor emeritus of Range & Fire Ecology
Oregon State University

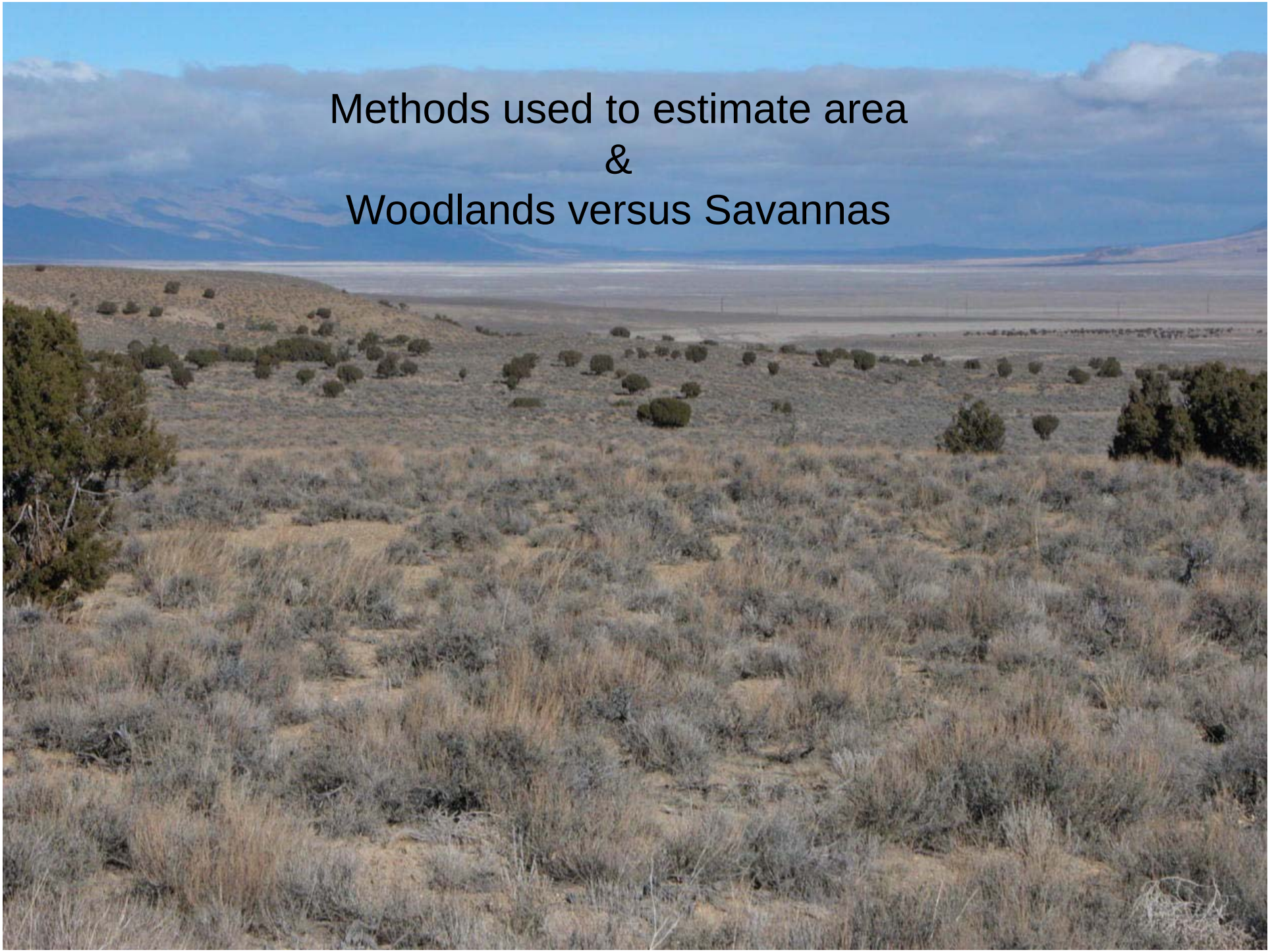


Joint Fire Science Program

Sagebrush Steppe SageSTEP Treatment Evaluation Project

Great Basin Science Delivery Project

Area in the Intermountain West: 40 to 100 million acres


Methods used to estimate area
&
Woodlands versus Savannas

Great Basin
Pinyon Juniper Woodlands
17.6 million acres

from Tueller et al. 1979

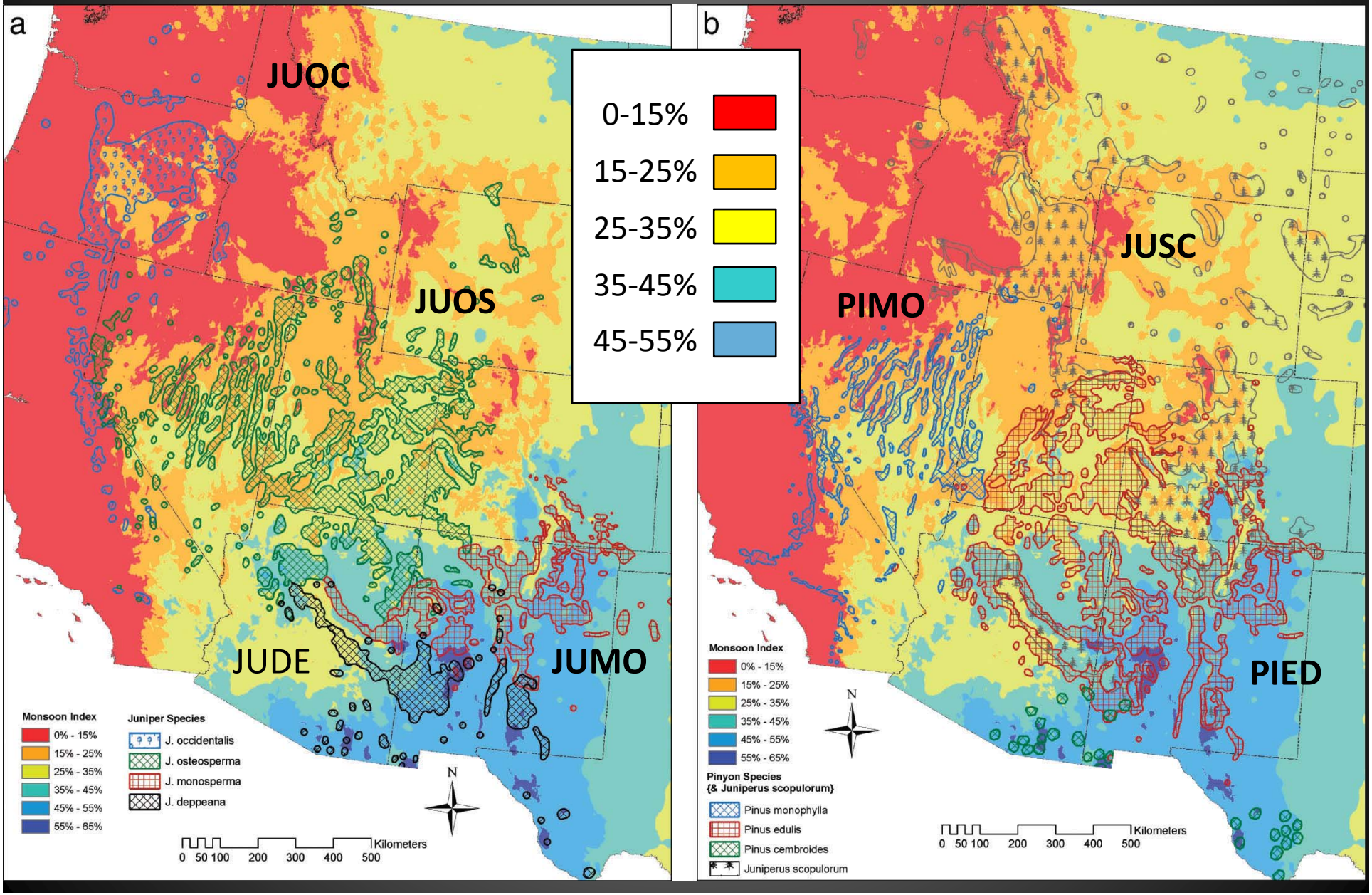
Acres of Pinyon and Juniper in the Intermountain West

State	Species	Area (ac)	Reference
Arizona	JUOS-Pinyon	11,641,999	Springfield 1976
California	JUOC	1,283,999	Bolsinger 1989
	JUOC savanna	796,999	Bolsinger 1989
	JUOS-JUCA	1,089,000	Bolsinger 1989
Colorado	JUOS-PIED	5,937,880	estimated from Powell et al. 1994
Idaho	JUOC	617,500	Chojnacky 1995
	JUOS	137,001	Teuller et al. 1979
New Mexico	JUOS-PIED	3,081,999	Springfield 1976
Nevada	JUOS-PIMO	7,155,970	O'Brien and Woudenberg 1999
	JUOS	1,683,566	O'Brien and Woudenberg 1999
	JUOC	100,000	estimated Miller et al. 2005
Oregon	JUOC	2,239,000	Gedney et al. 1999
	JUOC savanna	2,818,000	Gedney et al. 1999
Utah	JUOS-Pinyon	7,766,307	O'Brien and Woudenberg 1999
	JUOS	148,400	O'Brien and Woudenberg 1999
Wyoming	JUOS-PIED	202,999	Powell et al. 1994
Total		**46,683,125**	

JUOS = *Juniperus osteosperma*; JUOC = *J. occidentalis* var. *occidentalis*, JUCA = *J. californica*, PIMO = *Pinus monophylla*, PIED= *P. edulis*

Environmental characteristics of the Pinyon-Juniper woodlands

Percent of summer precipitation of total annual



Geology?

Soils

Utah & Nevada
Predominantly shallow and/or skeletal

Nevada Singleleaf pinyon and Utah juniper Forestland Soils Identification

Paul W. Blackburn, John B. Fisher, Edward W. Blake, Brien K. Park, Mathew P. Cole, Steven Herriman, Erin V. Hourihan*, Douglas J. Merkler

Nevada Soil Scientists and Ecological Site Specialist*, National Cooperative Soil Survey

s developed to aid Nevada
angeland professionals in
f pinyon and Utah juniper
l sites on the landscape in
-juniper trees are known to
land areas. Due to the tran-
etative communities a more
as needed to differentiate
ferent types of ecological
soil mapping on BLM and
ber of soil criteria were
ns to differentiate between
ite types in questionable

s developed using tacit
asoned Nevada soil scien-
scriptions from multiple
ern Nevada, and laboratory
samples collected in 2009
aboratory characterization of
soils throughout northern

ic features (1) identified for
ngeland from forestland
presence or absence of a
llic epipedon thickness, and
restrictive layer. These soil
n with landscape position,
rock outcrop, and estab-
n-Juniper Forestland criteria
guidance to future pinyon-
entification on the Basin
pe.

Forestland site and soil

Pedon 09NV613112MPC

Turba series
Loamy-skeletal, mixed, superactive, mesic, shallow Vitritorrandic Argiustolls

Ecological site: PIMO-JUOS/ARTRV-AMUT-QUERC, F029XY078NV: singleleaf pinyon pine - Utah juniper / mountain big sagebrush - Utah serviceberry (Pinus monophylla - Juniperus osteosperma / Artemisia tridentata var. vaseyana - Amelanchier utahensis Quercus)

Rangeland site and soil

Pedon 09NV613051MPC

Schoolmarm series
Ashy-skeletal, glassy, frigid, Aridic Lithic Argixeriolls

Ecological site: Cobbly Claypan 12-14", R028AY126NV: low sagebrush - antelope bitter-

Soils Guide for Nevada P/J Forestland

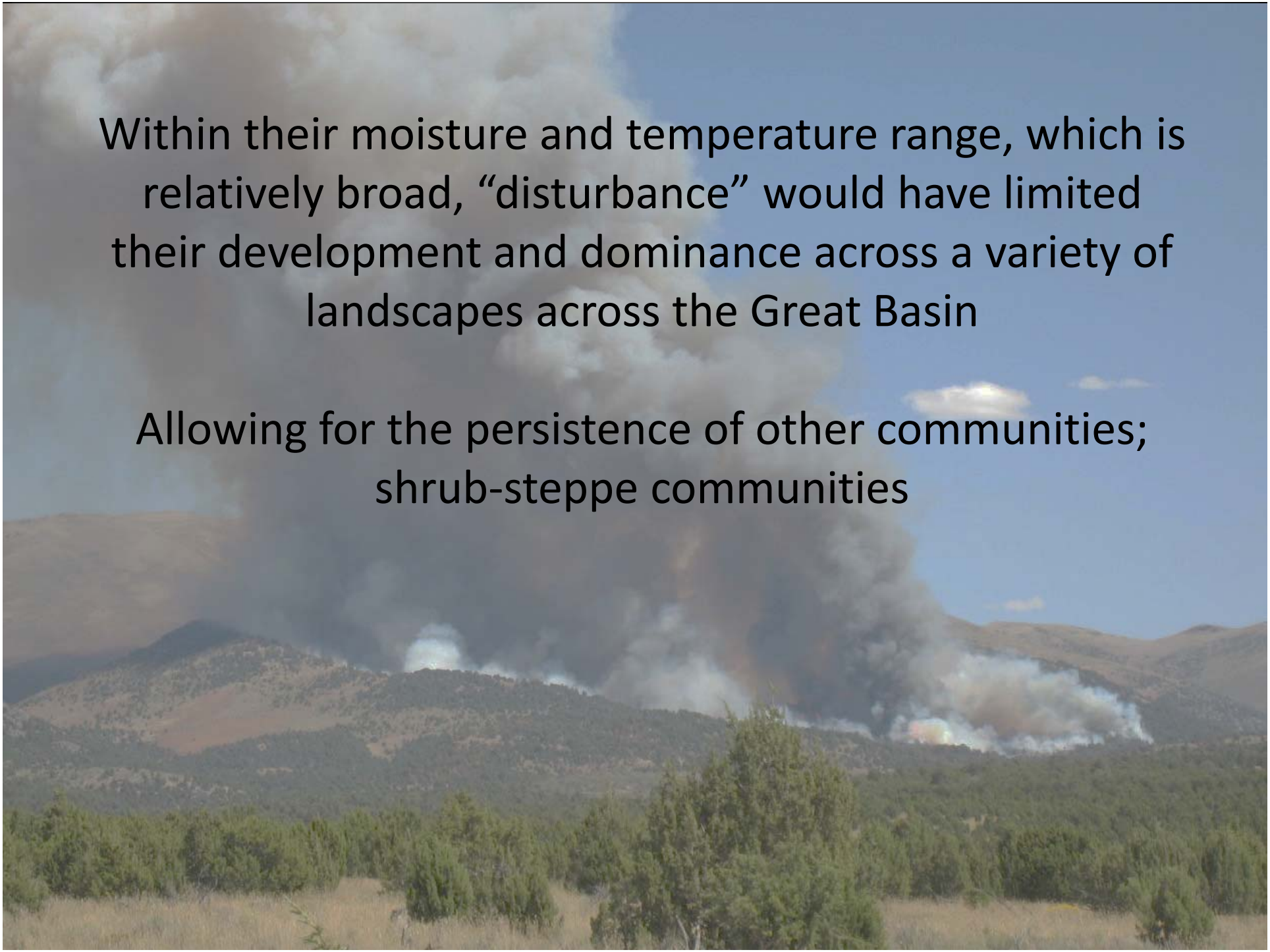
Use of this table is based on the following conditions pres
1. Singleleaf pinyon and Utah juniper are present on the site. (1
tation)
2. Application of forestland criteria does not provide a satisfact
soil/ecological site correlation.
3. Soil depth is typically <50 cm but may as thick as 100 cm to b
4. If bedrock truncates epipedon thickness identified below , th
still apply.

Epipedon Kind	Epipedon Thickness*	Soil Color Value dry/moist	Ra
Ochric epipedon	any	>5 dry / >3 moist	
Mollic epipedon	≤ 18 cm	5 dry / 3 moist	
Mollic epipedon	18 - 36 cm	5 dry / 3 moist	
Mollic epipedon (dark throughout)	18-36 cm	< 3 or 4 dry / <2 moist throughout	
Mollic epipedon	>36 cm	< 4 dry / <2 moist upper part	
		5 dry / 3 moist lower part	
Mollic epipedon (eroded surface)	18-36 cm	6 dry / 4 moist near surface	
		5 dry / 3 moist below surface	
Mollic epipedon (eroded surface)	36 to ≥50 cm	6 dry / 4 moist near surface	
		5 dry / 3 moist below surface	

References: (1) Soil Survey Staff, 2010, Keys to Soil Taxon

Utah juniper and western juniper

carbon assimilation and water use



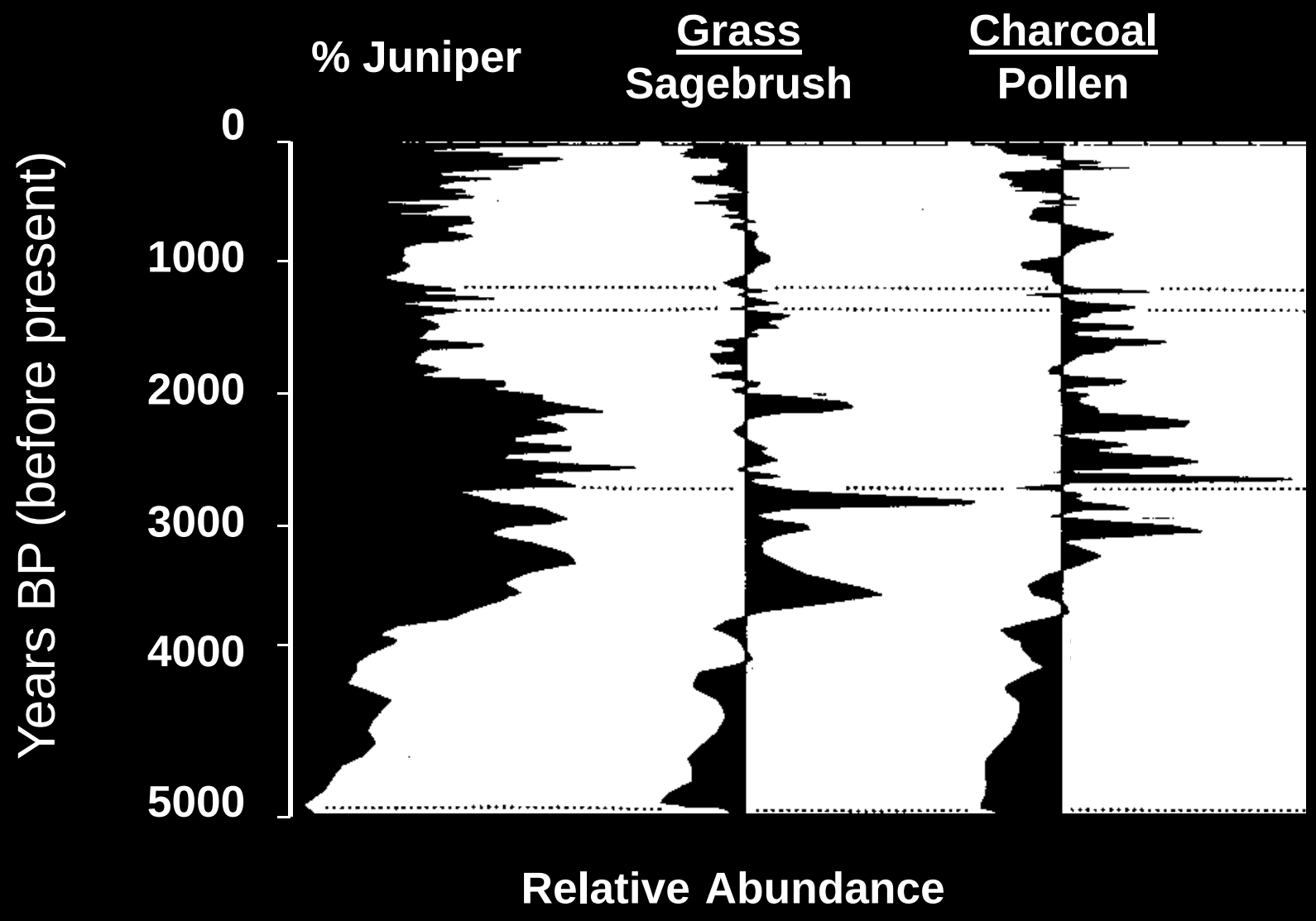
Within their moisture and temperature range, which is relatively broad, “disturbance” would have limited their development and dominance across a variety of landscapes across the Great Basin

Allowing for the persistence of other communities; shrub-steppe communities

Broad range of ecological site characteristics = broad range of resilience and resistance


Long term dynamics
Climate
Short term shifts (decades)
Drought & pests
Fire

Diamond Craters, OR

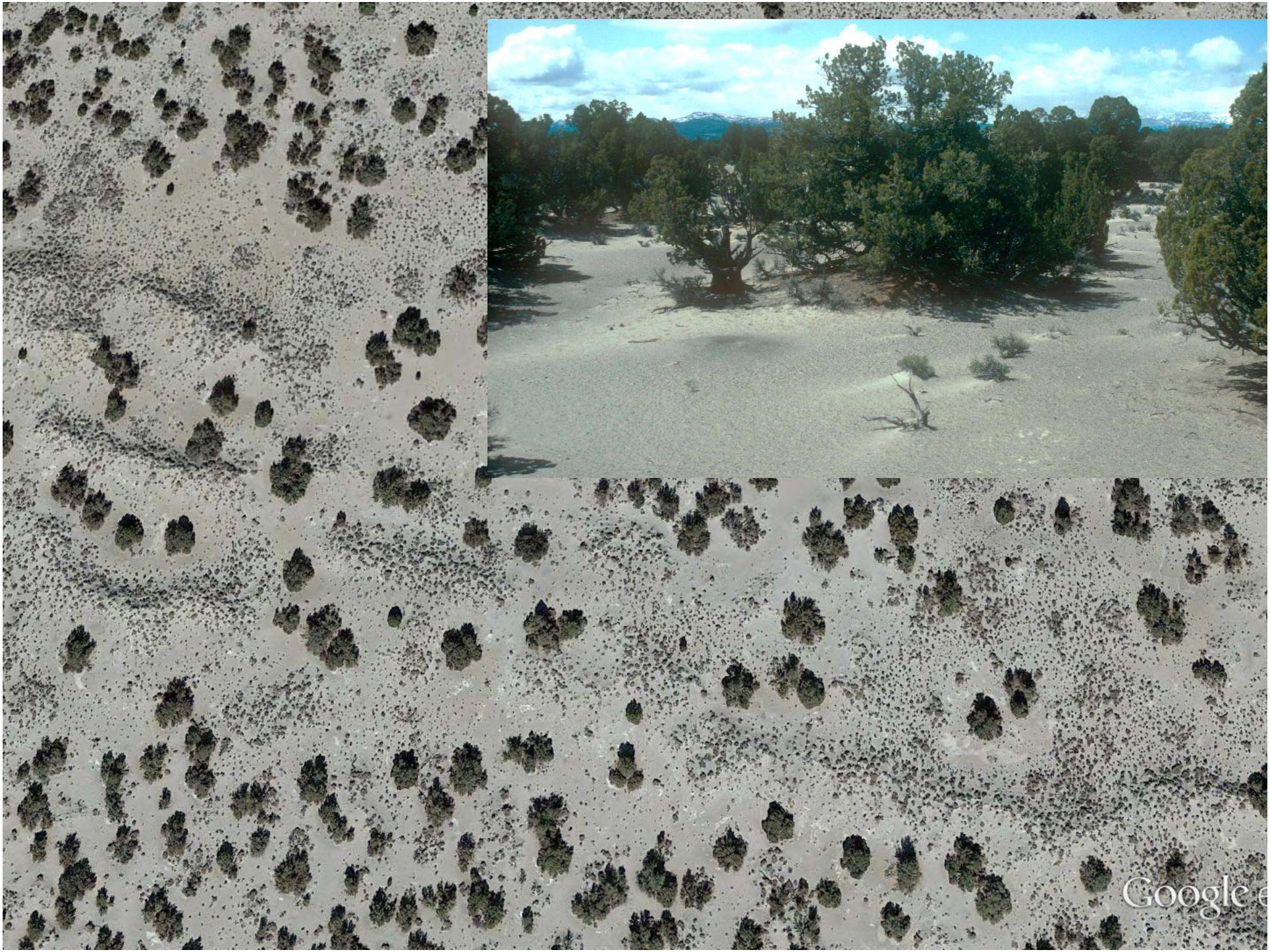


Pete Mehringer

Old-Growth Stand Structure

Presettlement Woodlands


Image Landsat
Google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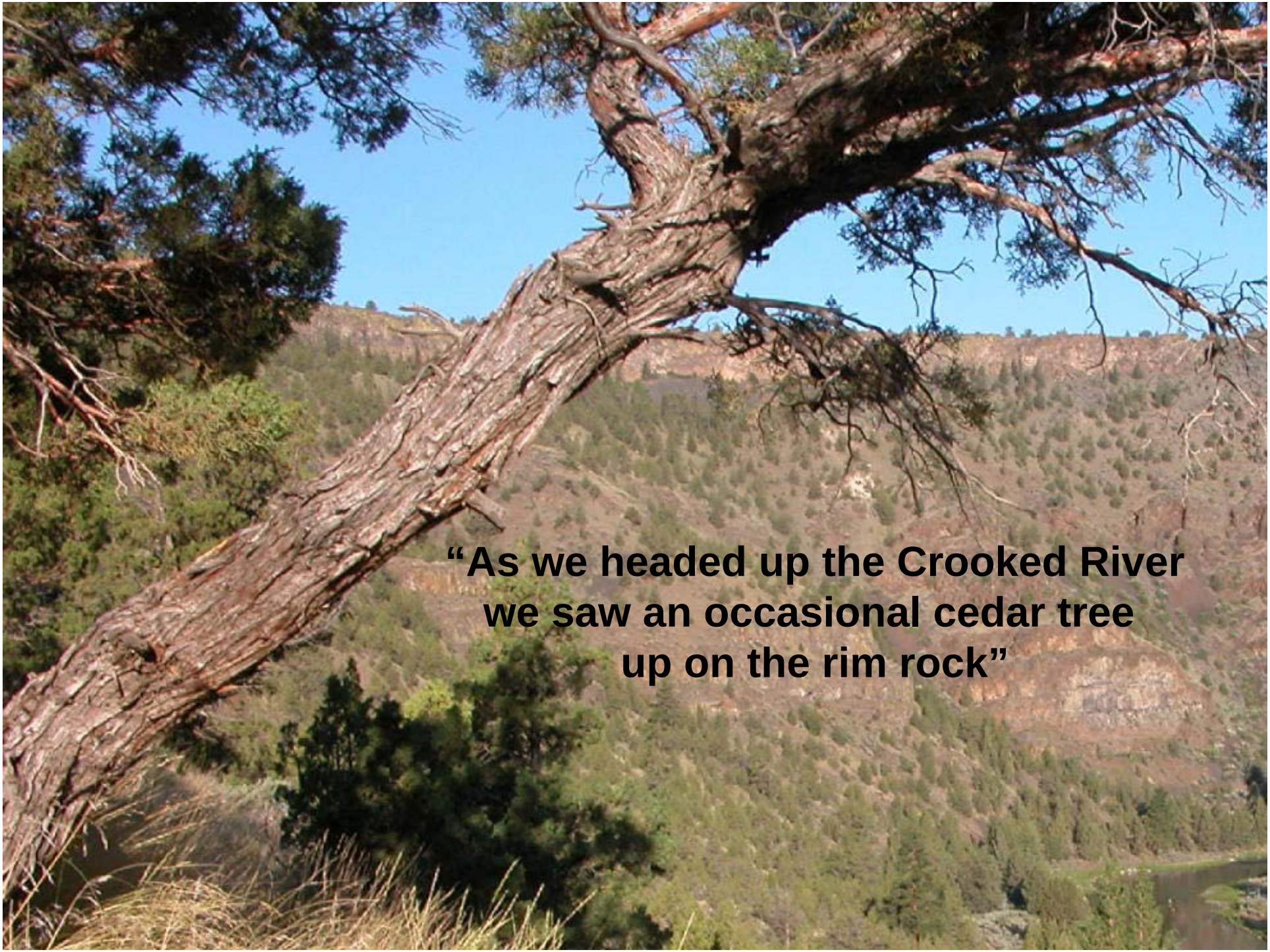
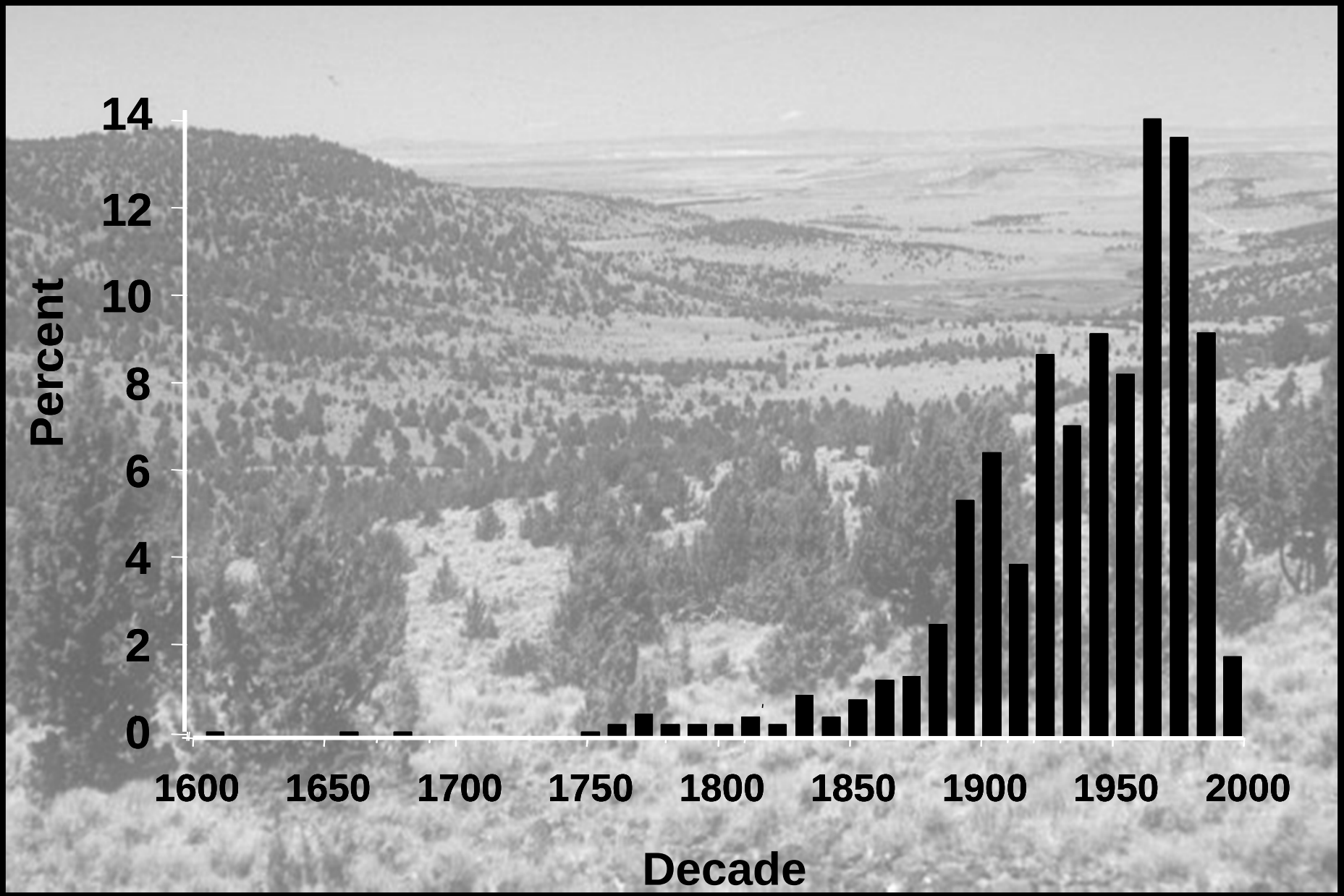
Post-Settlement Expansion?

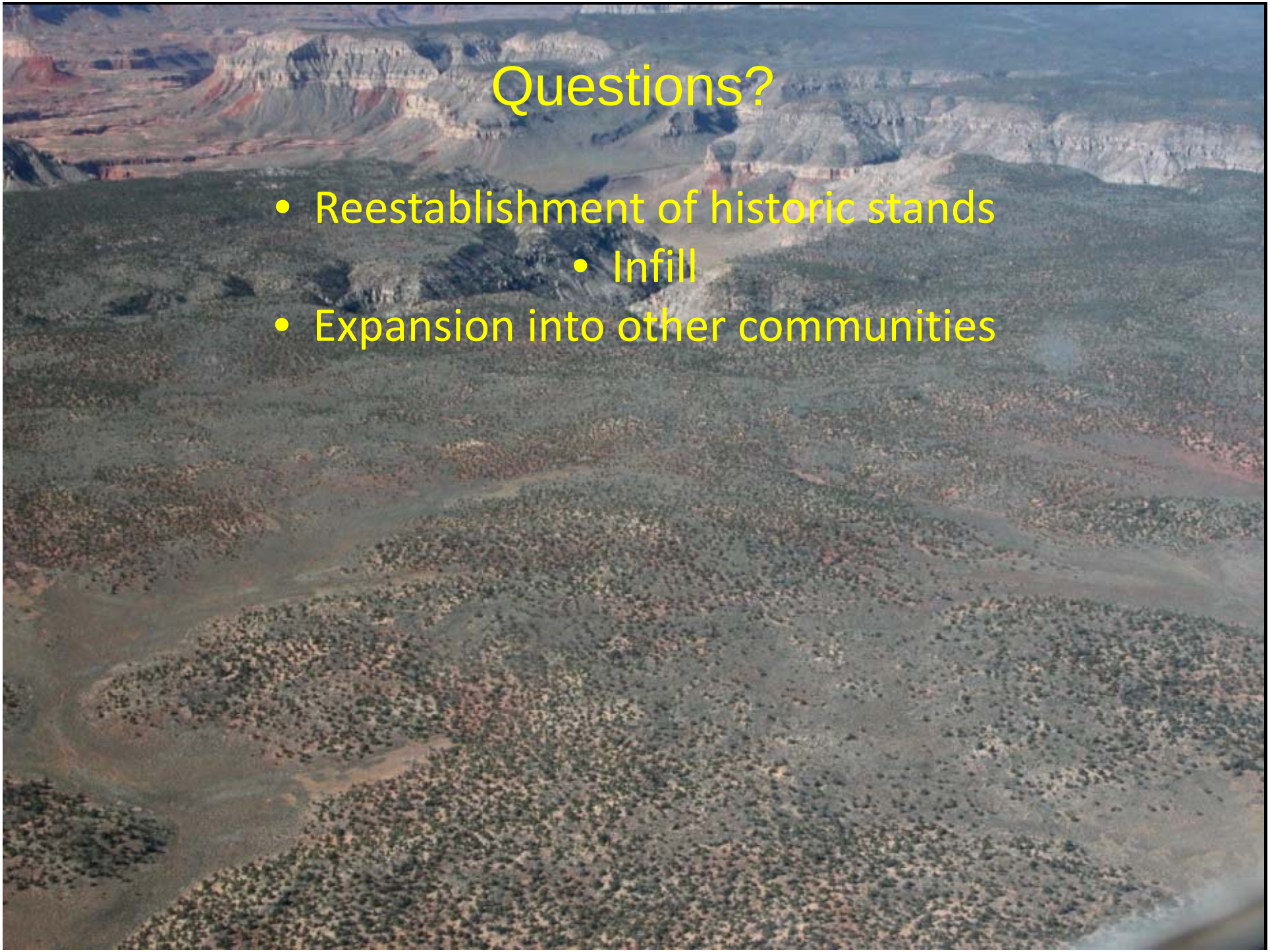
Post-Settlement Expansion?

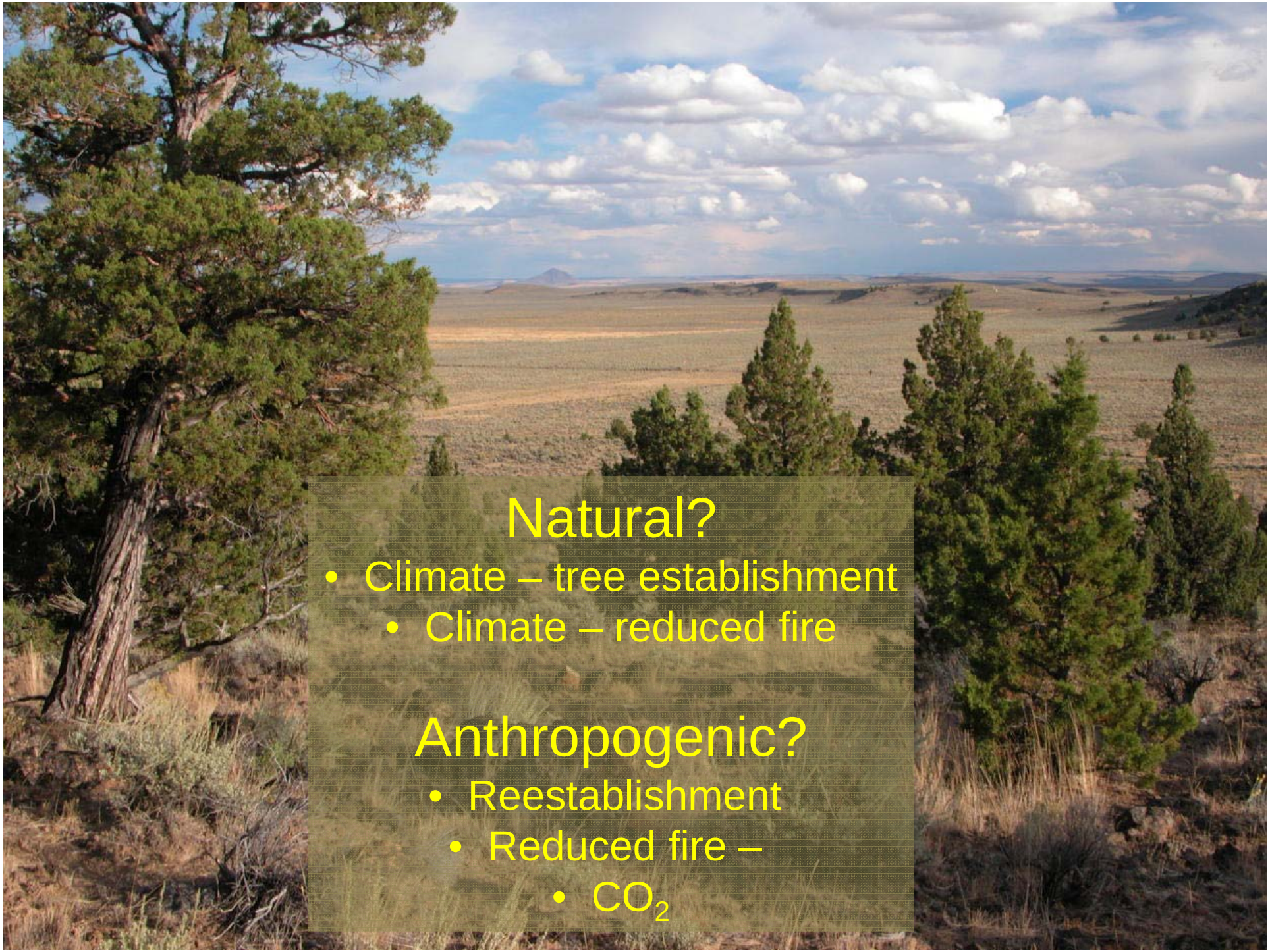
Photos by Robin Tausch


“As we headed up the Crooked River
we saw an occasional cedar tree
up on the rim rock”

Woodland Age Structure

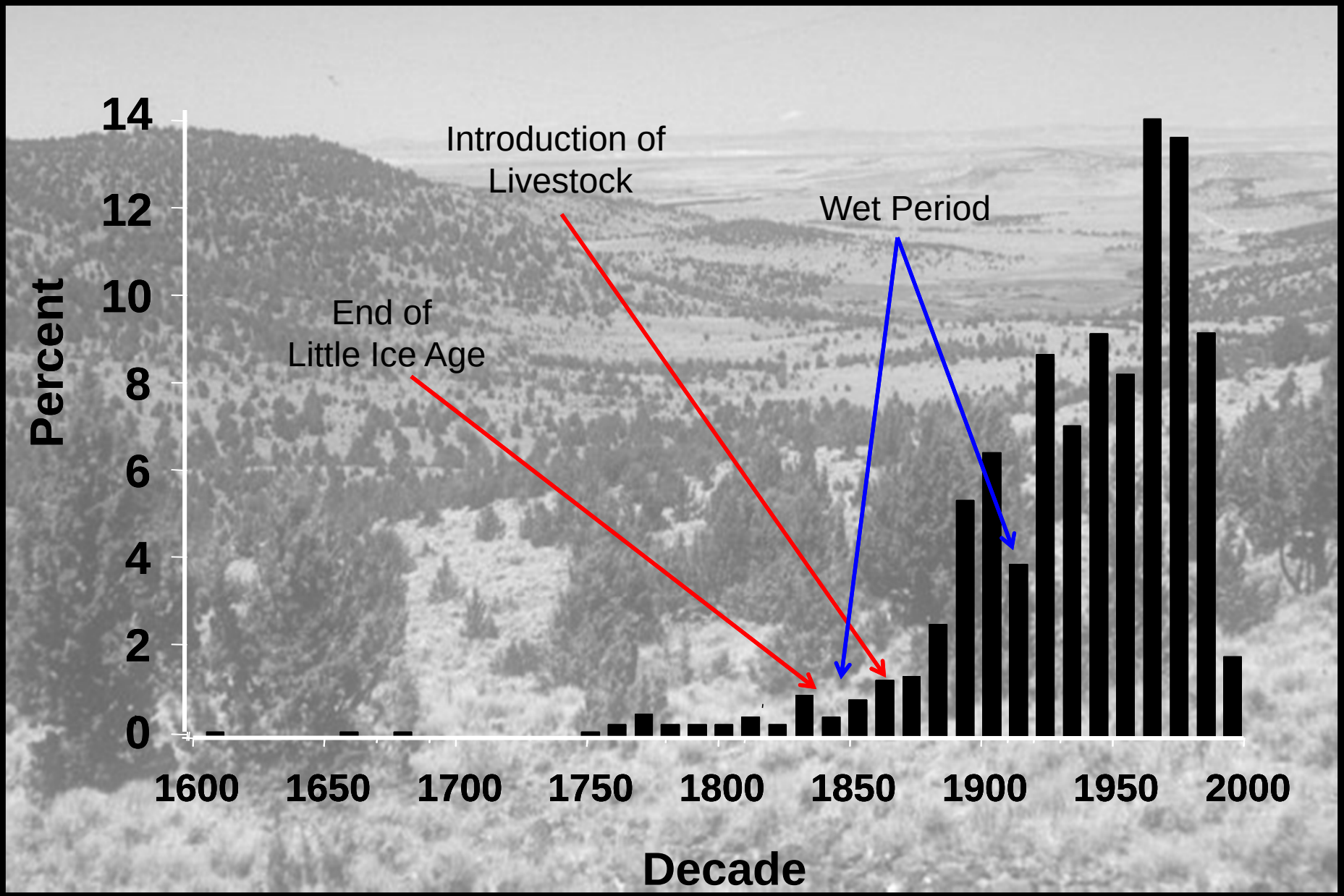



Questions?
• Reestablishment of historic stands
• Infill
• Expansion into other communities


Natural?
• Climate – tree establishment
• Climate – reduced fire
Anthropogenic?
• Reestablishment
• Reduced fire –
• CO_2

The Role of Fire?

Woodland Age Structure

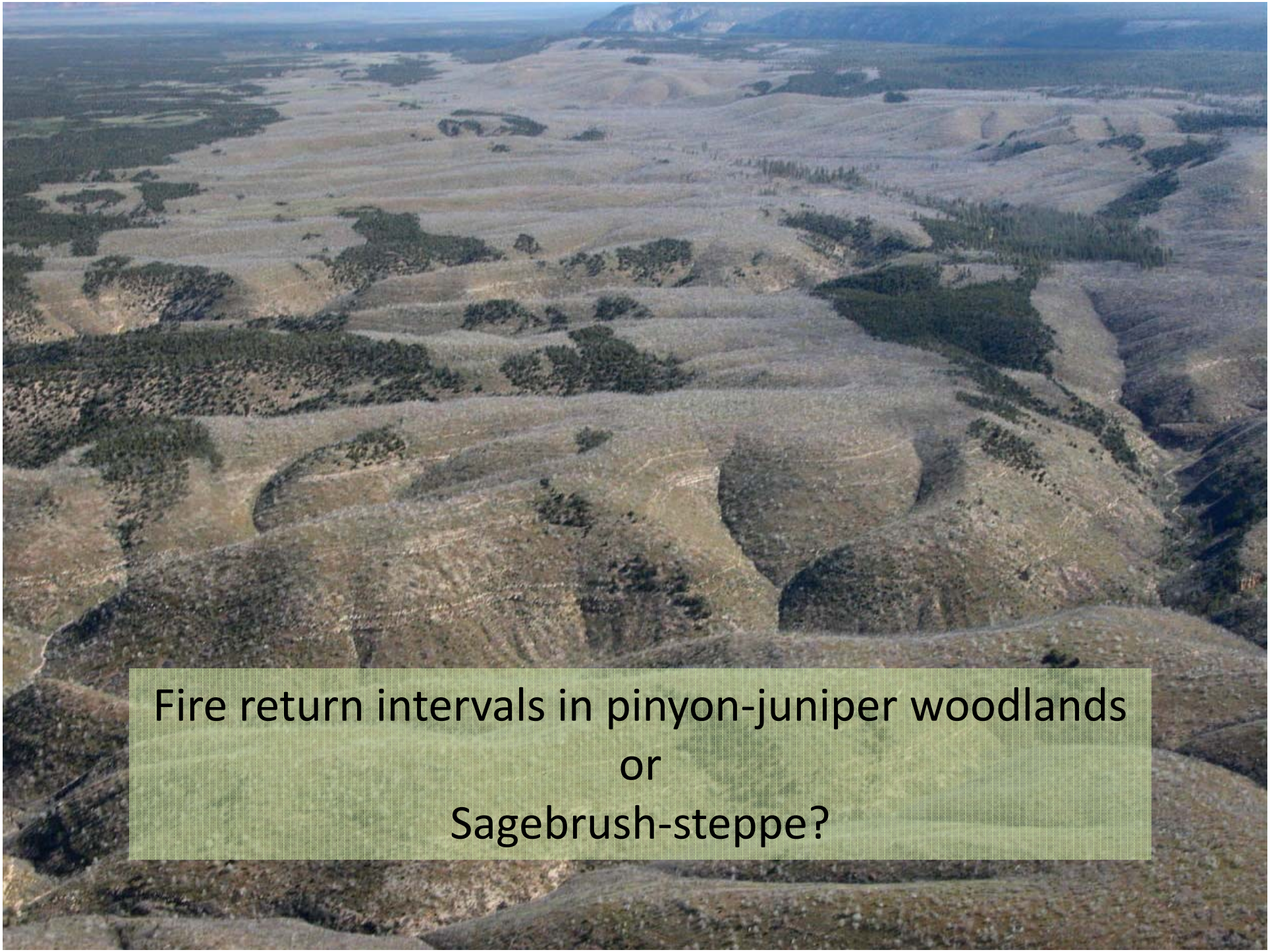


Limitations

Climate vs Fire

From Biondi et al. 2011

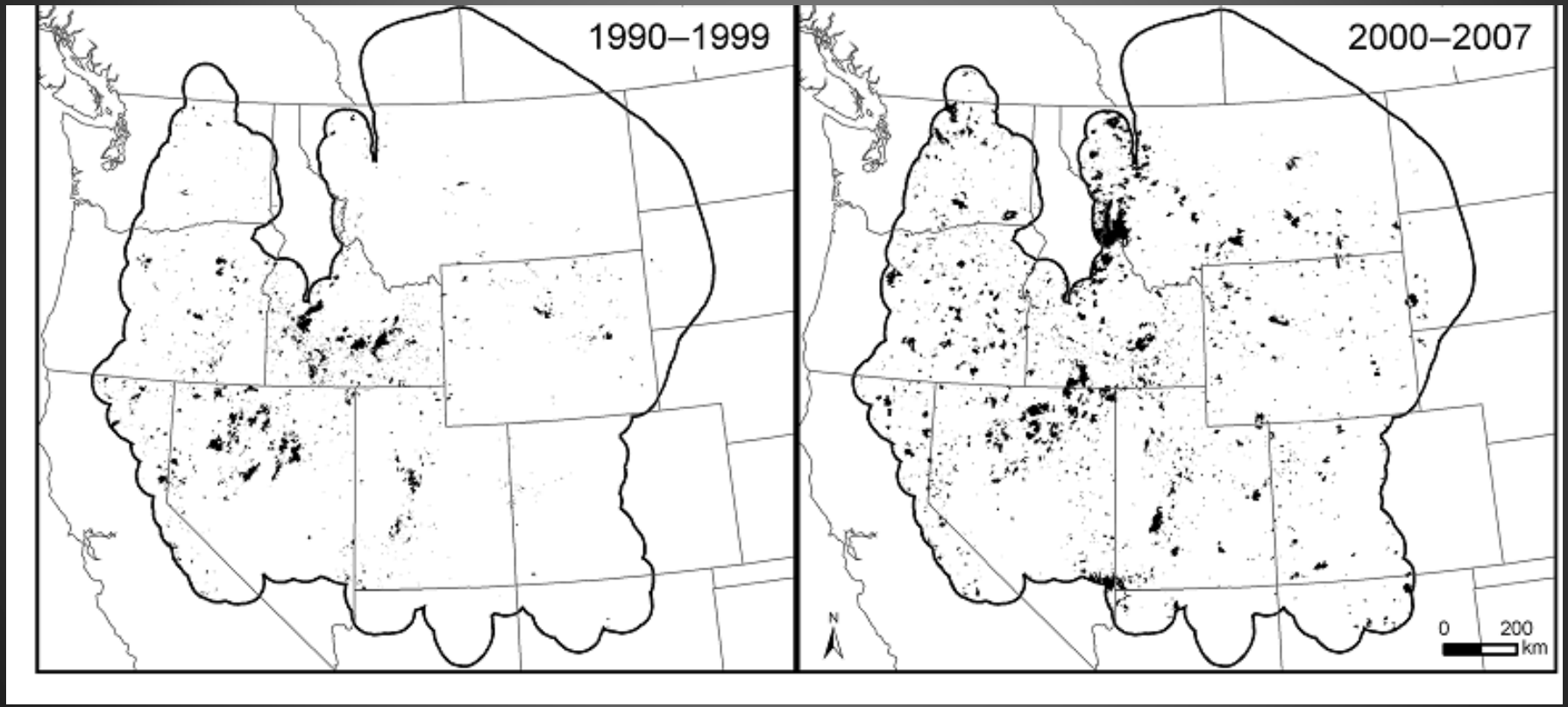
Climate


Fire return intervals in pinyon-juniper woodlands
or
Sagebrush-steppe?

Fire Return Intervals in Shrub Steppe?

Regional differences in fire regimes?

Sage-grouse boundary
&
Fire perimeters



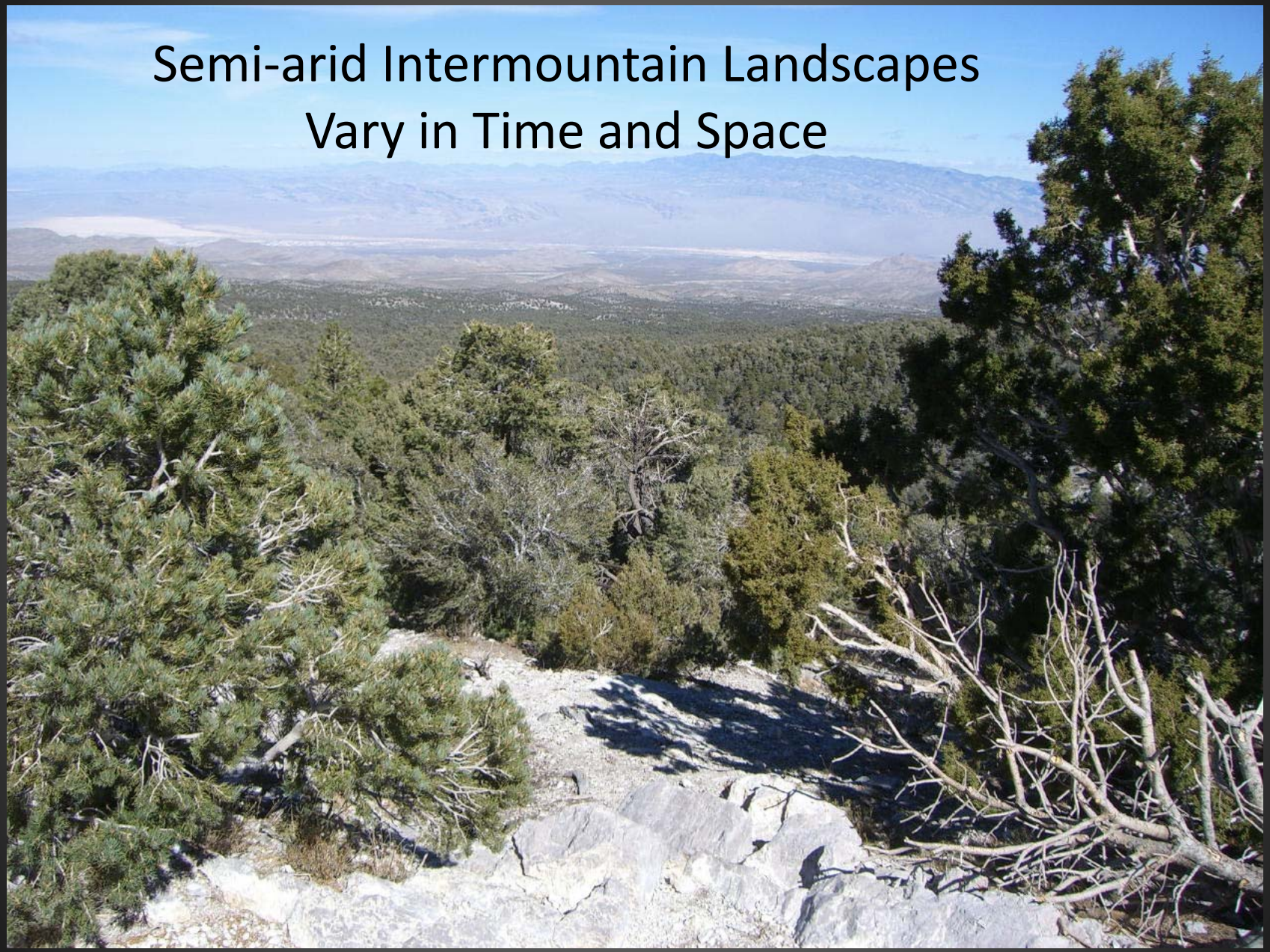
from Miller and others 2011

Since 1950: CO_2 & water-use efficiency

Biological inertia = CO_2, increased seed dissemination

Re-establishment

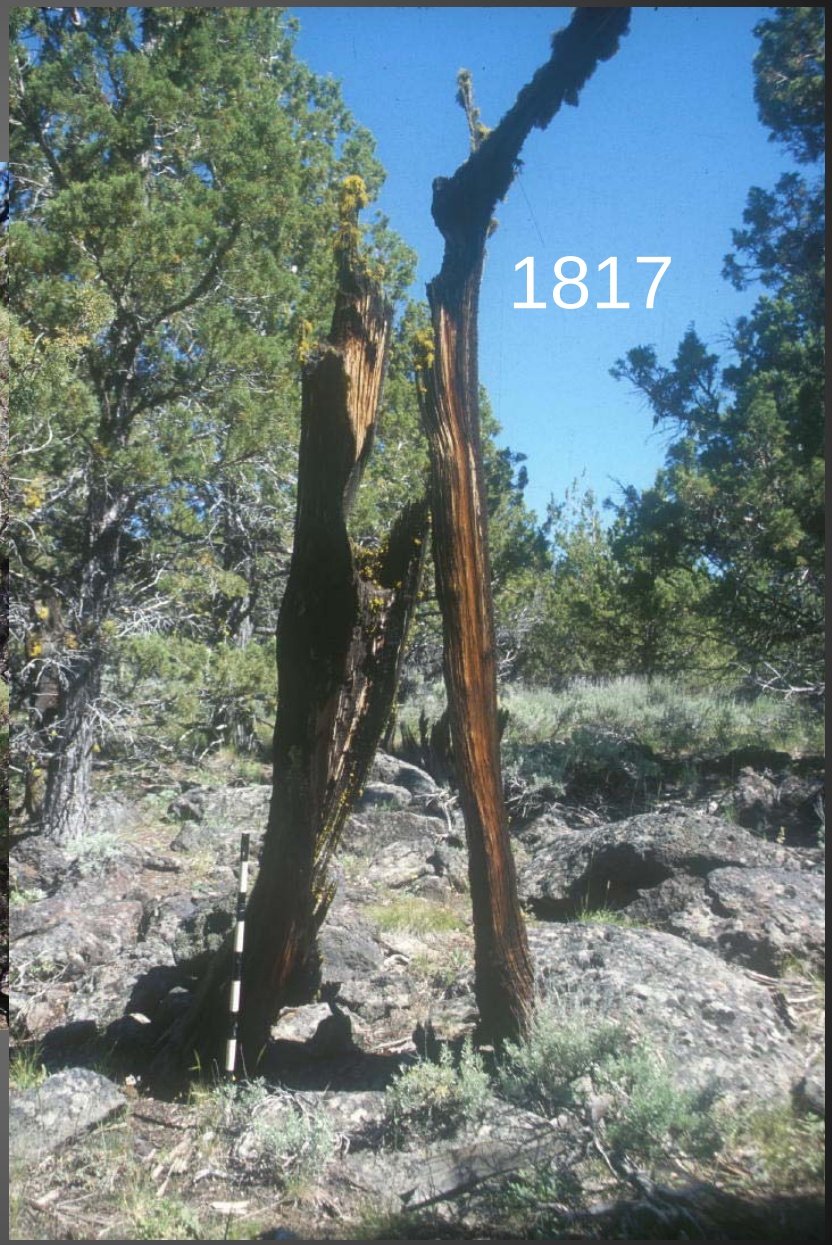
Where are the stumps?


Semi-arid Intermountain Landscapes
Vary in Time and Space

Old Growth Woodlands or Encroached Shrub Steppe?

Persistence of old wood

~ 1600 AD



Soils

Moderately deep Mollisols
frigid (cool)-xeric (moist) 12-16”PZ

Function and Process

How will they recover?

Succession
changing
Function and Process