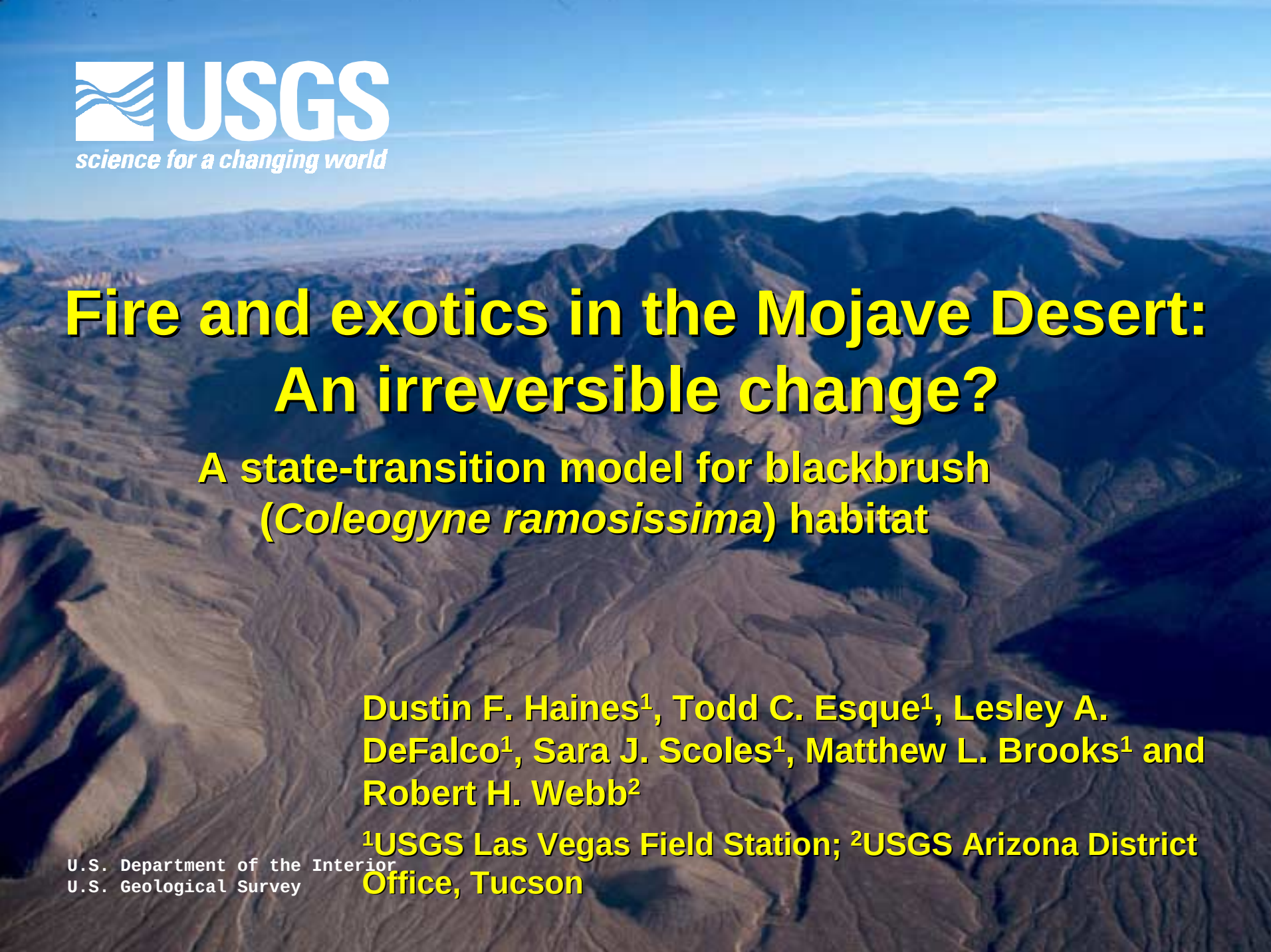

Fire and exotics in the Mojave Desert: An irreversible change?

A state-transition model for blackbrush (*Coleogyne ramosissima*) habitat

Dustin F. Haines[1], Todd C. Esque[1], Lesley A. DeFalco[1], Sara J. Scoles[1], Matthew L. Brooks[1] and Robert H. Webb[2]

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U.S. Department of the Interior
U.S. Geological Survey


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Fire in *Coleogyne* habitat at Joshua Tree National Park

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Tom Patterson, USFS


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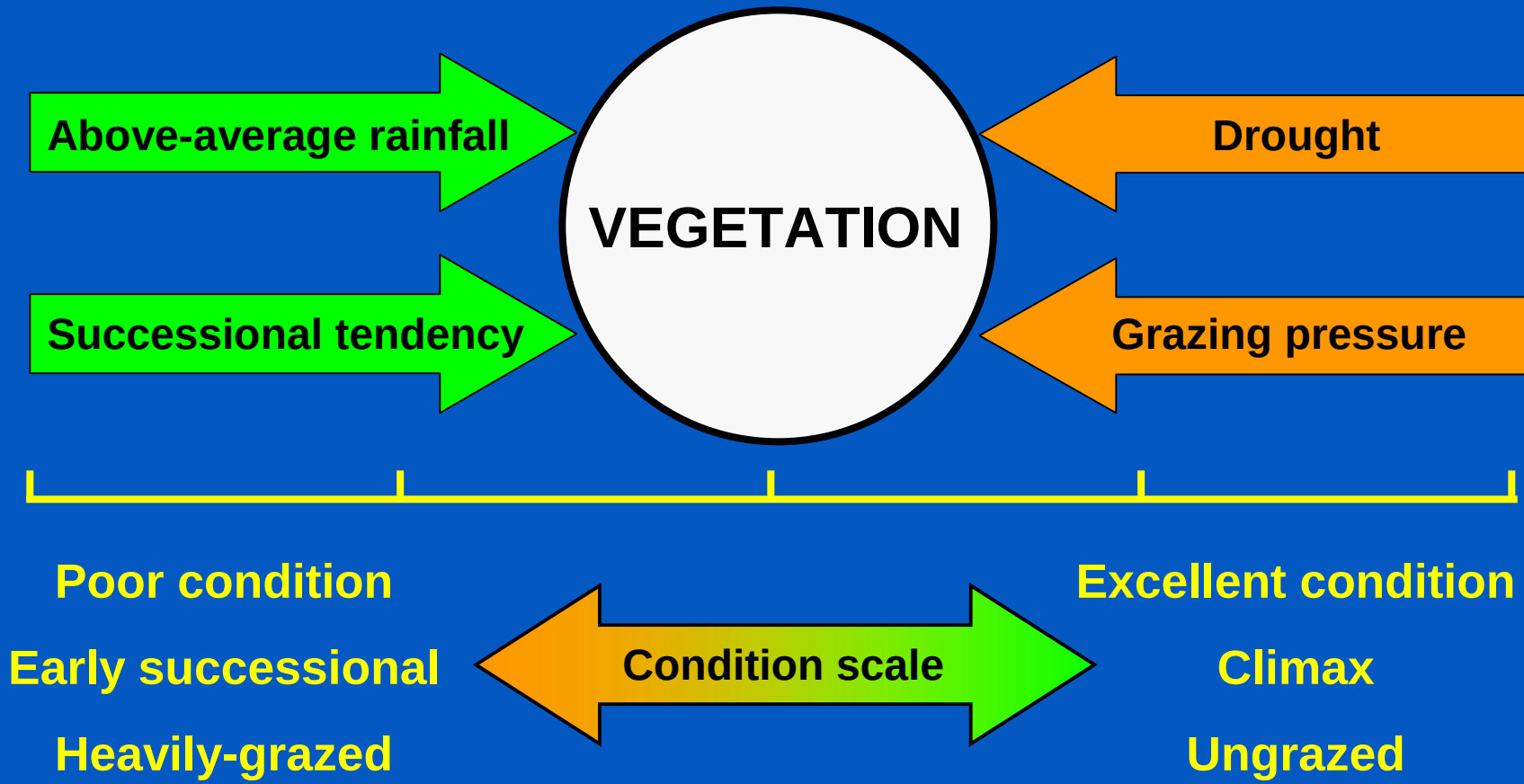
Range succession model



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from Westoby et al. 1989

Range succession models do not account for:

- Alternative stable states
- Discontinuous and irreversible transitions
- Nonequilibrium communities

But . . .

State-transition models do

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Coleogyne:

- Upper elevations in Mojave Desert (>1000 m)
- Majority of cover is *Coleogyne* (30-50% cover)
- Shrubs closely spaced
- Few annuals

Bare ground:

- Most shrubs burned to ground level
- Minimal perennial cover (<10%)
- Shortly after fire (~0-10 years)
- No *Coleogyne* or unburned islands

Fire (natural and human causes)

P = Unknown

Root crown resprout (low intensity fire?)

P = Low

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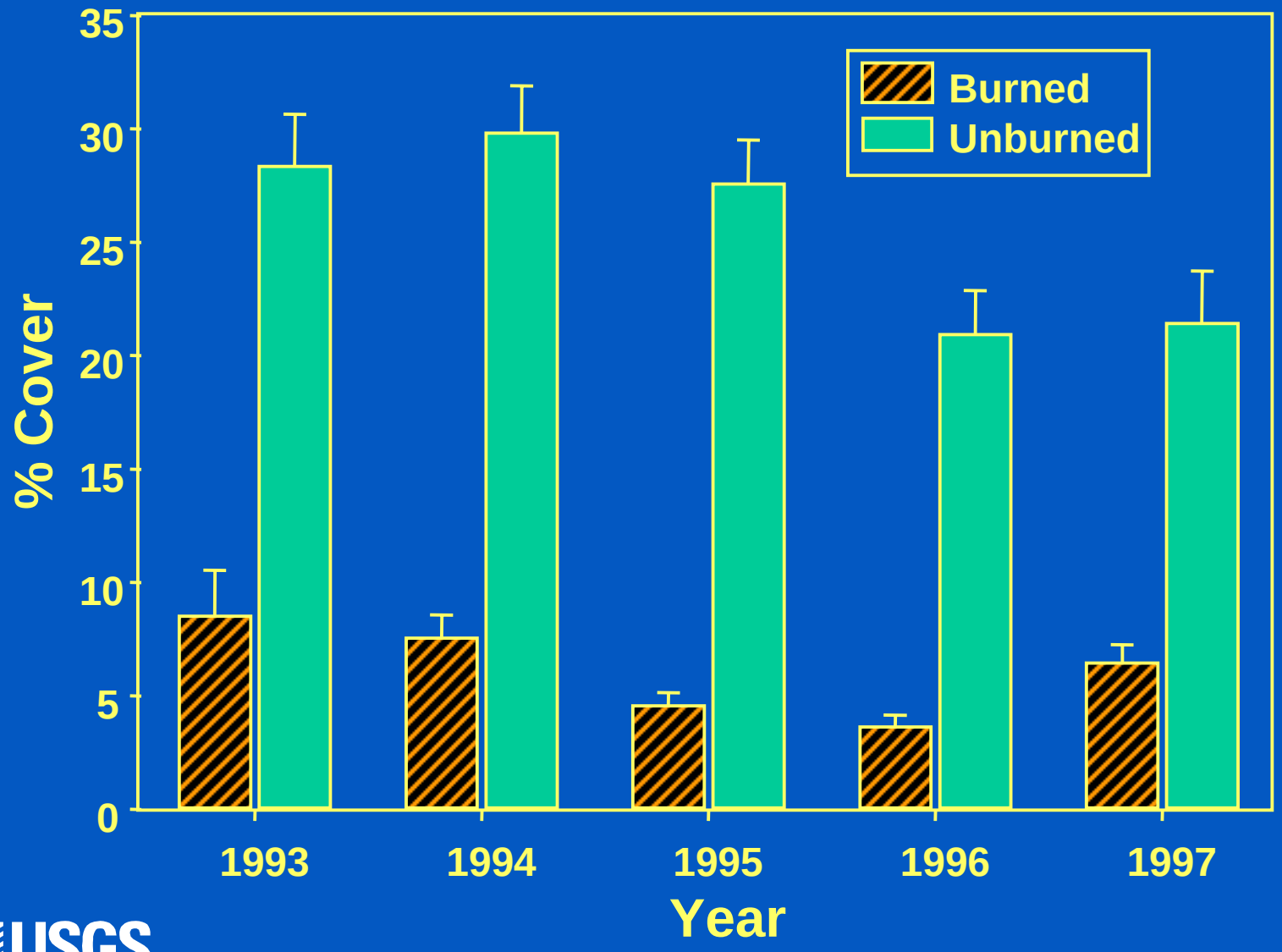
Perennial cover in Bulldog Canyon (burned 1993)



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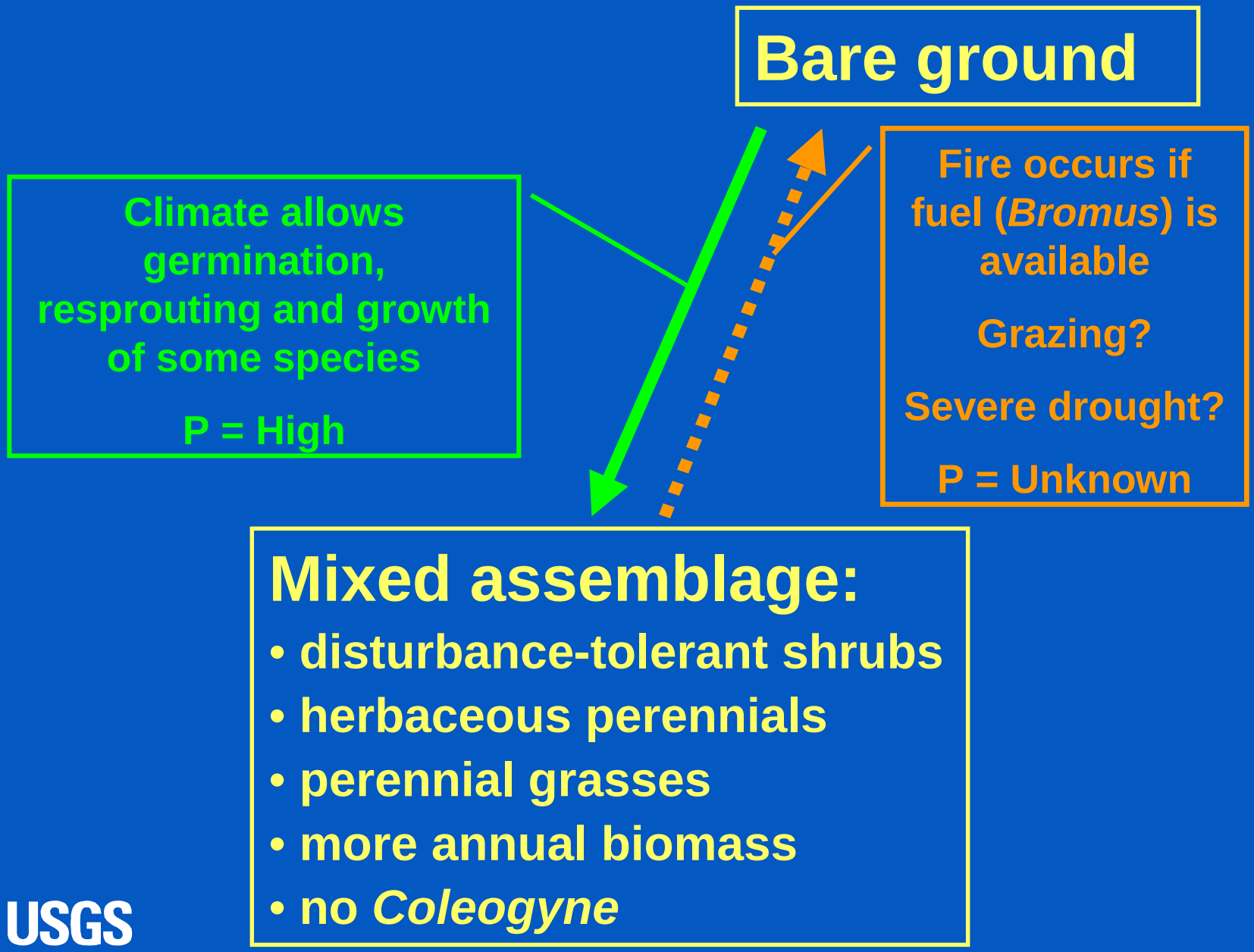
Esque & Eckert, unpublished data


Bare ground
Climate allows germination, resprouting and growth of some species
P = High
Fire occurs if fuel (*Bromus*) is available
Grazing?
Severe drought?
P = Unknown
Mixed assemblage:
• disturbance-tolerant shrubs
• herbaceous perennials
• perennial grasses
• more annual biomass
• no *Coleogyne*

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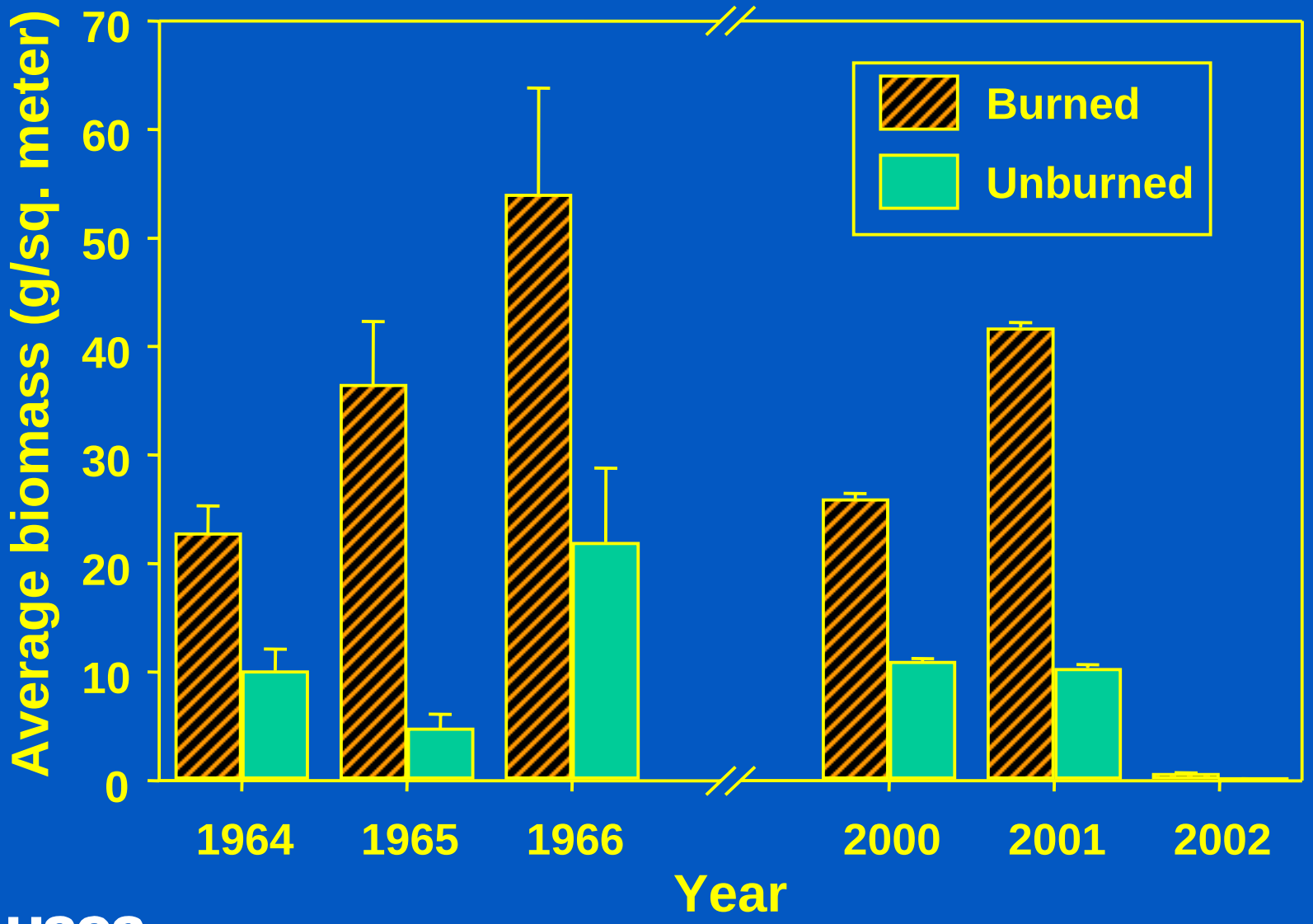
Annual biomass on Beatley plots



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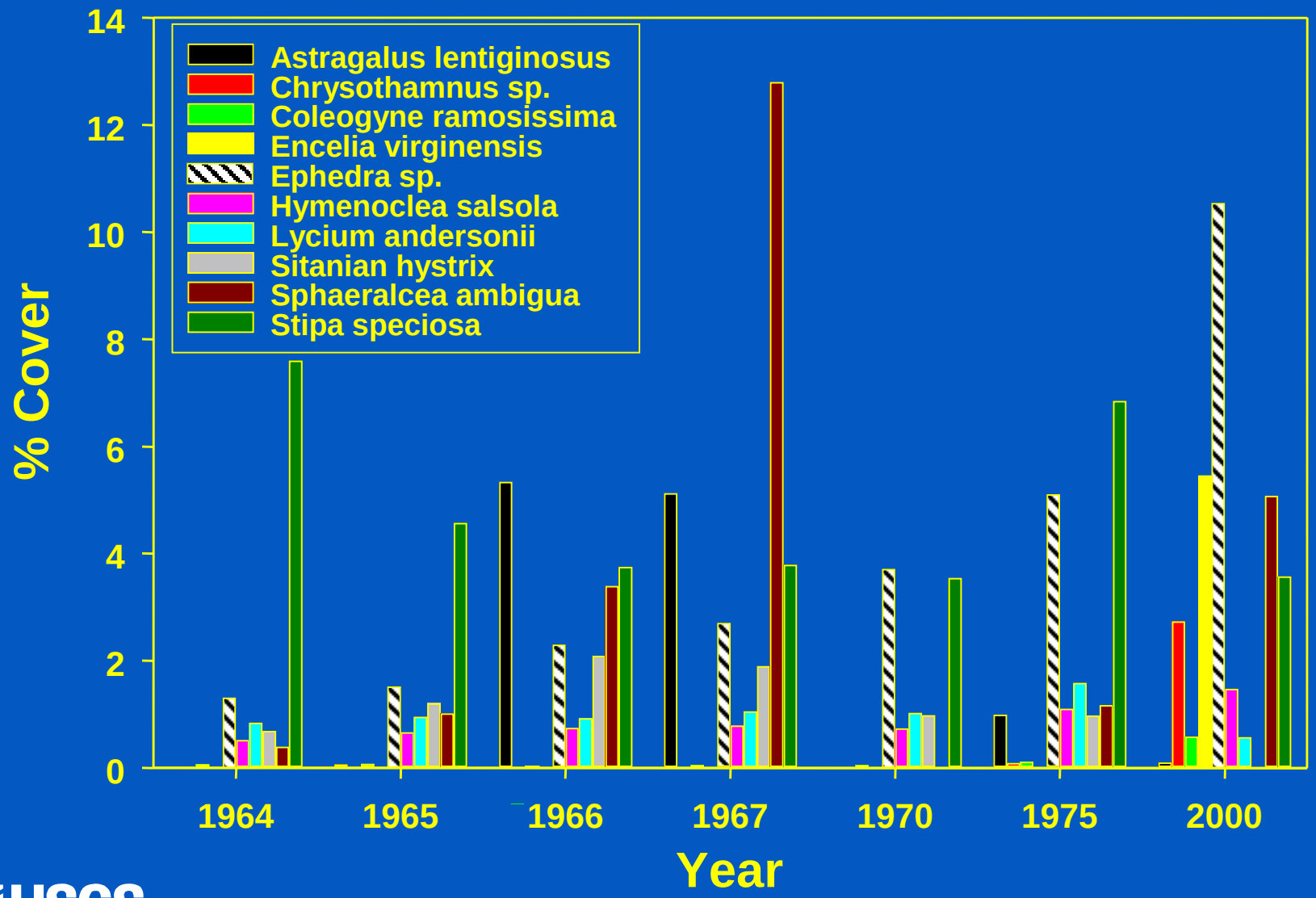
DeFalco et al., unpublished data

Perennial cover by species on burned Beatley plots



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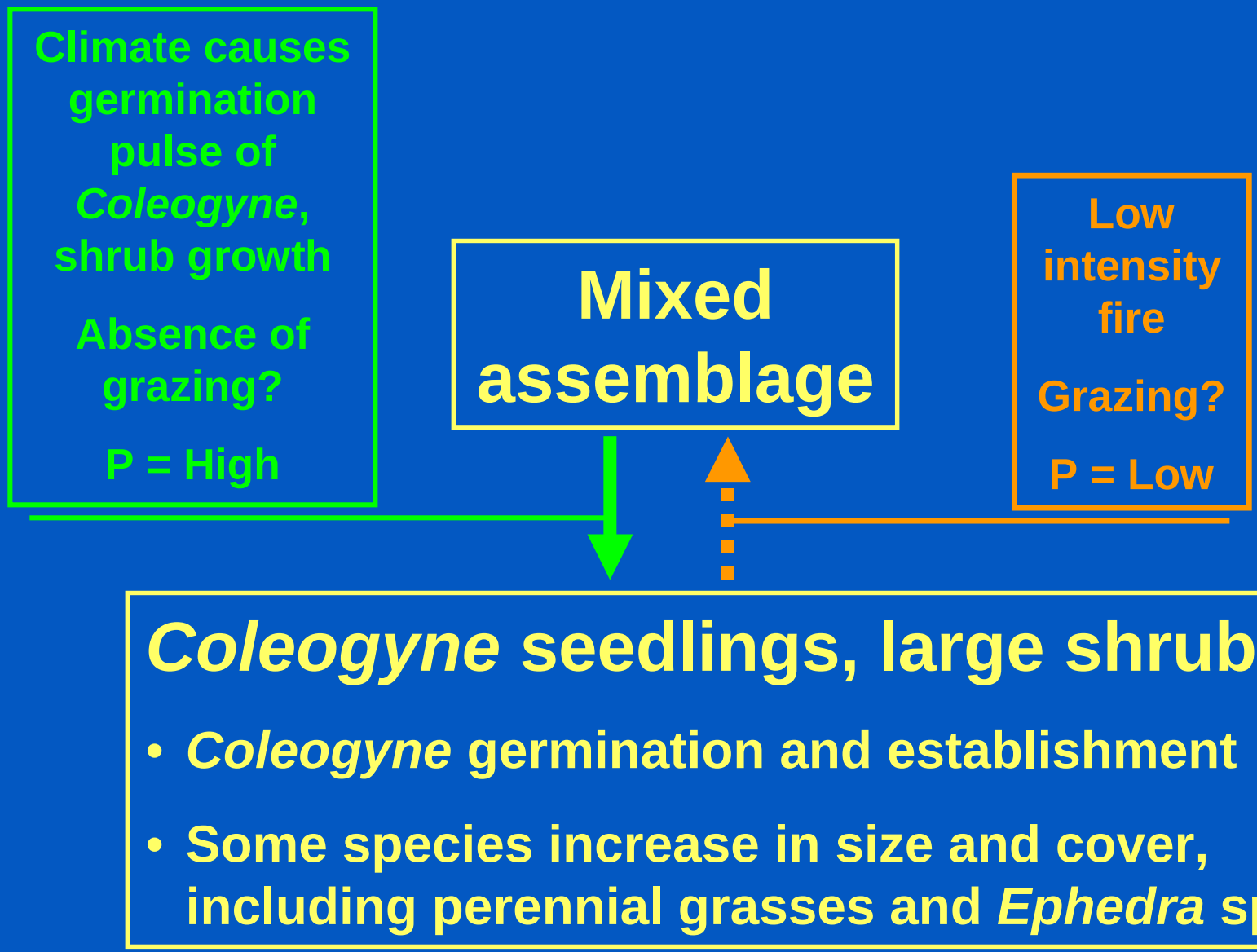
Webb, unpublished data


Climate causes germination pulse of *Coleogyne*, shrub growth
Absence of grazing?
P = High
Mixed assemblage
Low intensity fire
Grazing?
P = Low
Coleogyne seedlings, large shrubs
• *Coleogyne* germination and establishment
• Some species increase in size and cover, including perennial grasses and *Ephedra* sp.

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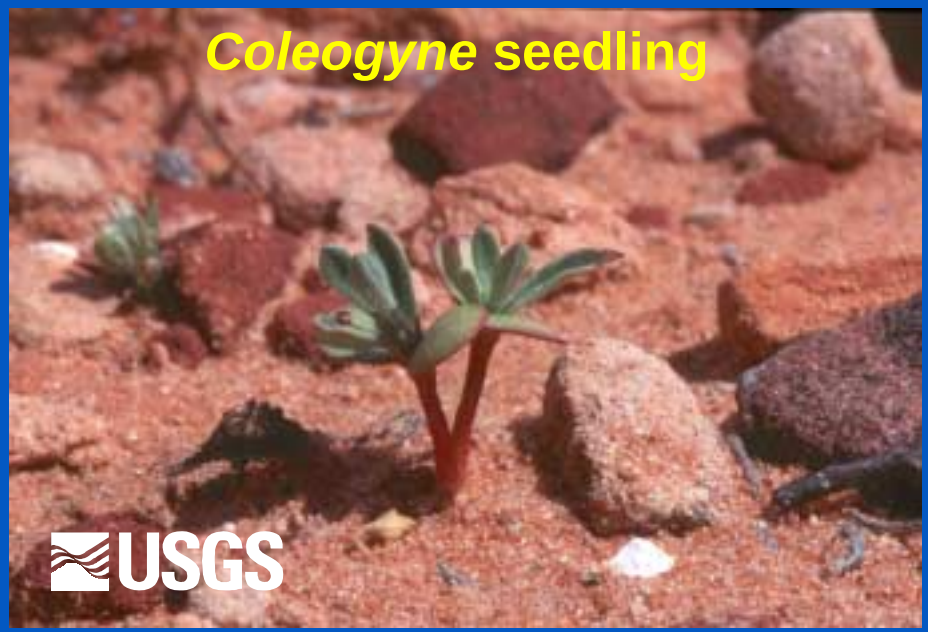
Coleogyne seedling
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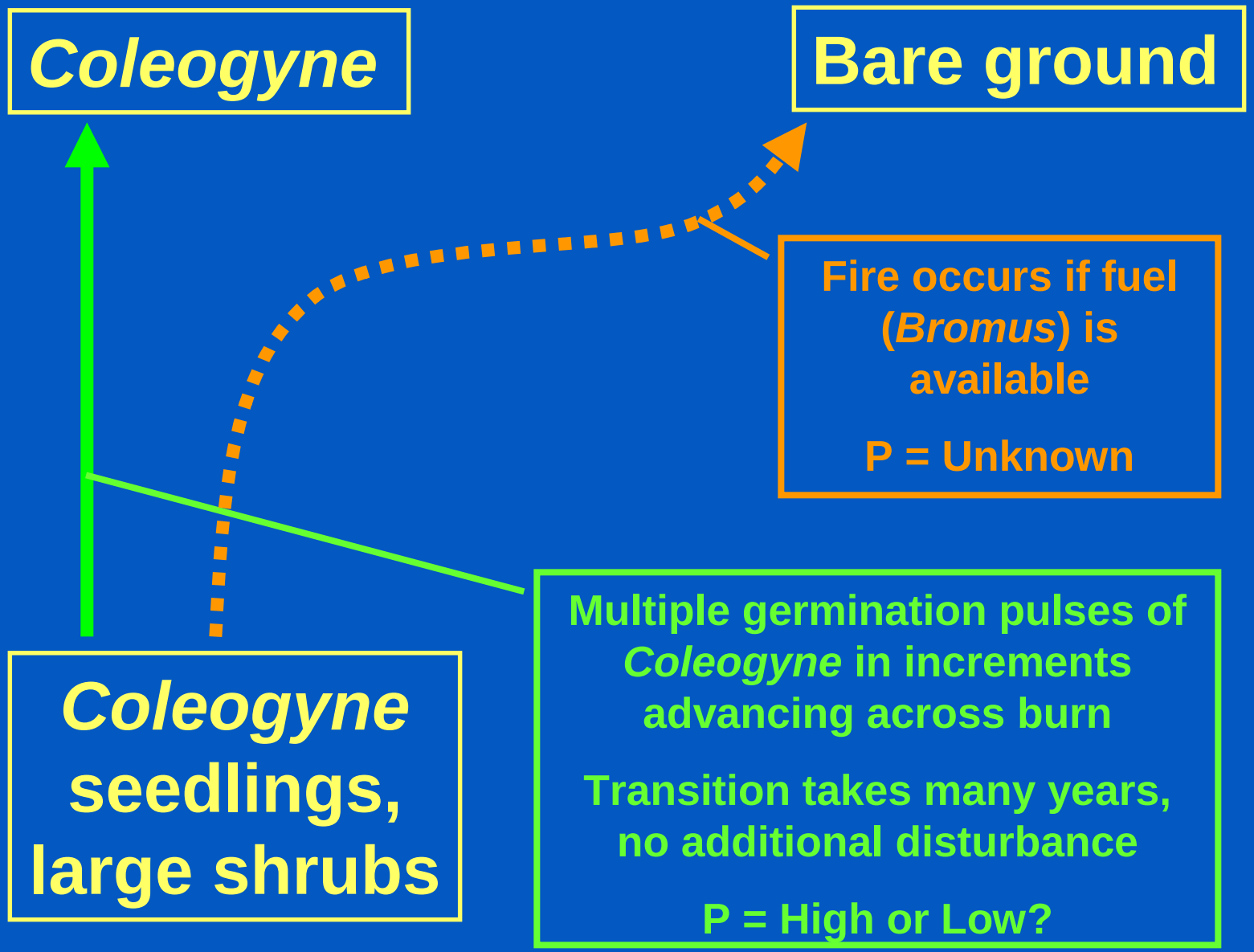
Young *Coleogyne*


Coleogyne
Bare ground
Fire occurs if fuel (*Bromus*) is available
P = Unknown
Multiple germination pulses of *Coleogyne* in increments advancing across burn
Transition takes many years, no additional disturbance
P = High or Low?
Coleogyne seedlings, large shrubs

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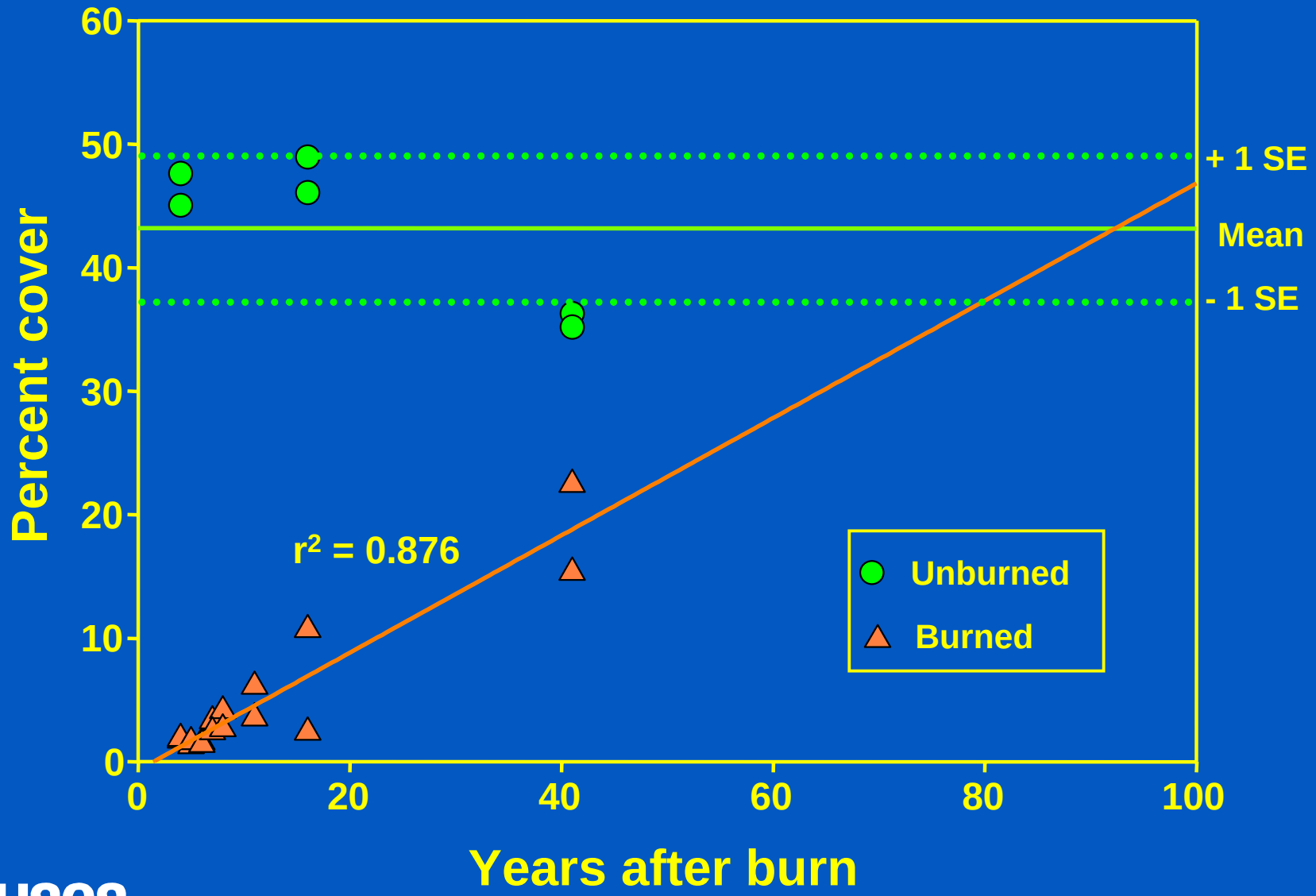
Total perennial cover on Beatley plots



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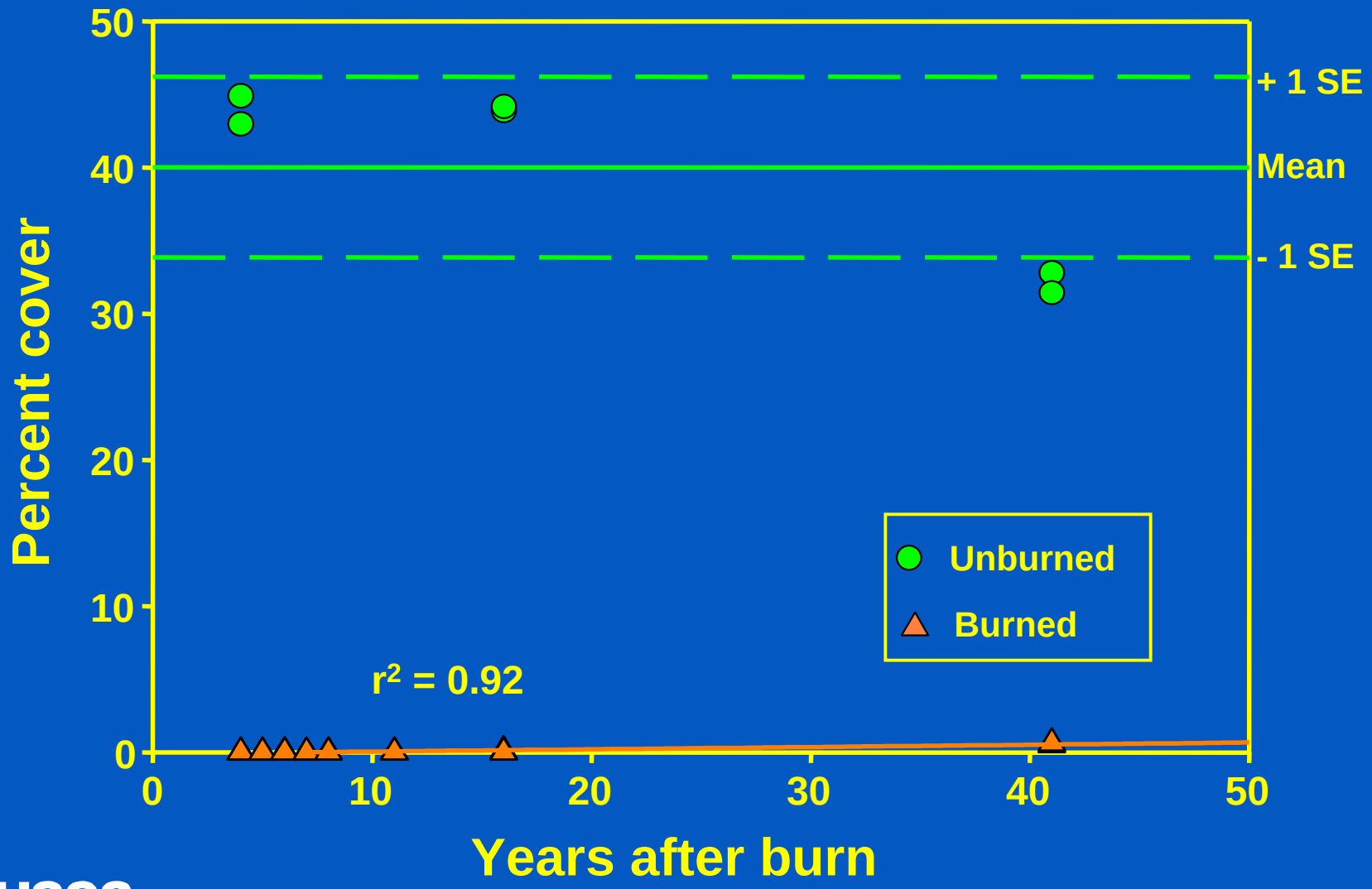
Webb, unpublished data

Coleogyne cover on Beatley plots



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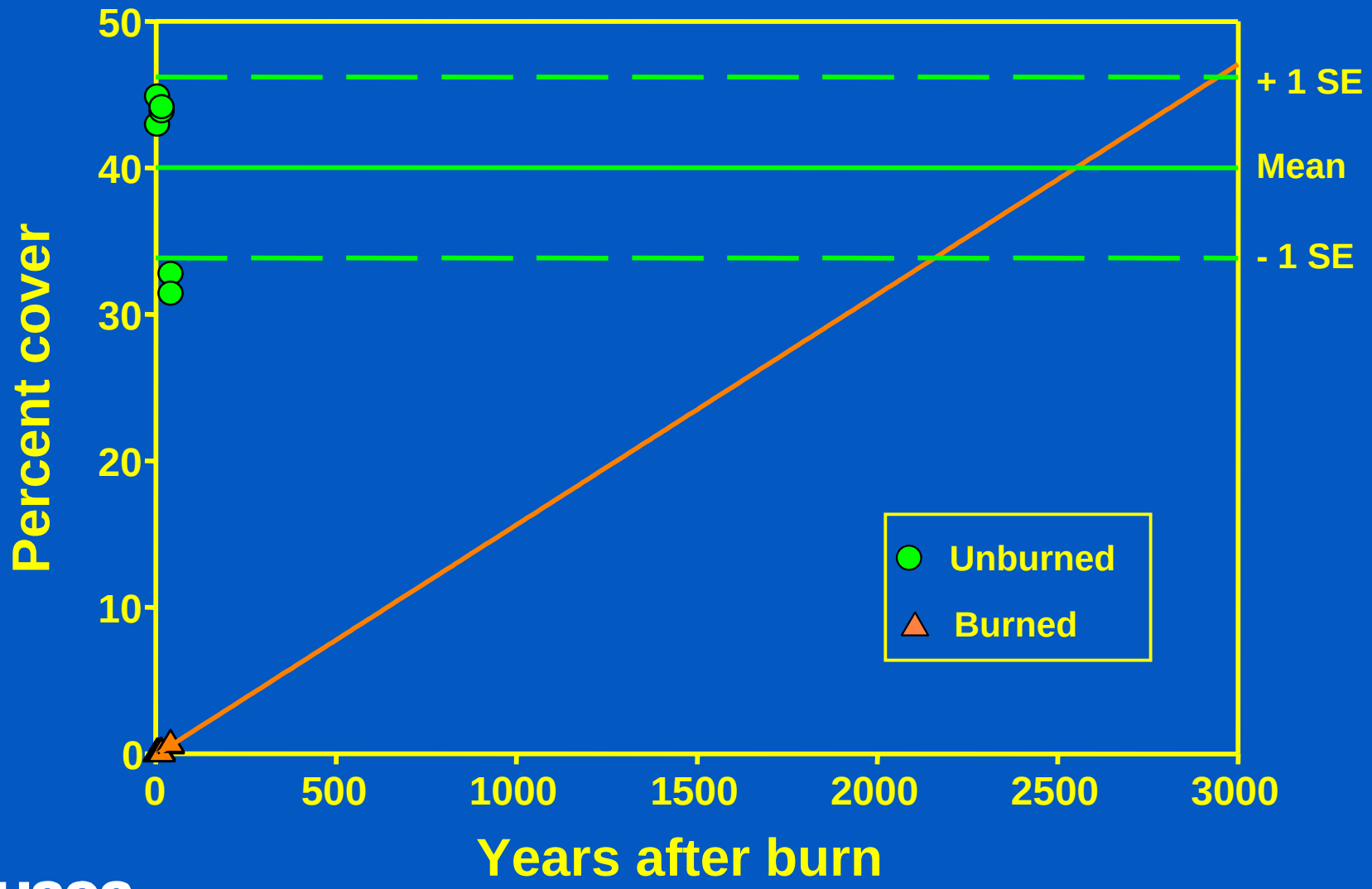
Webb, unpublished data

Coleogyne cover on Beatley plots



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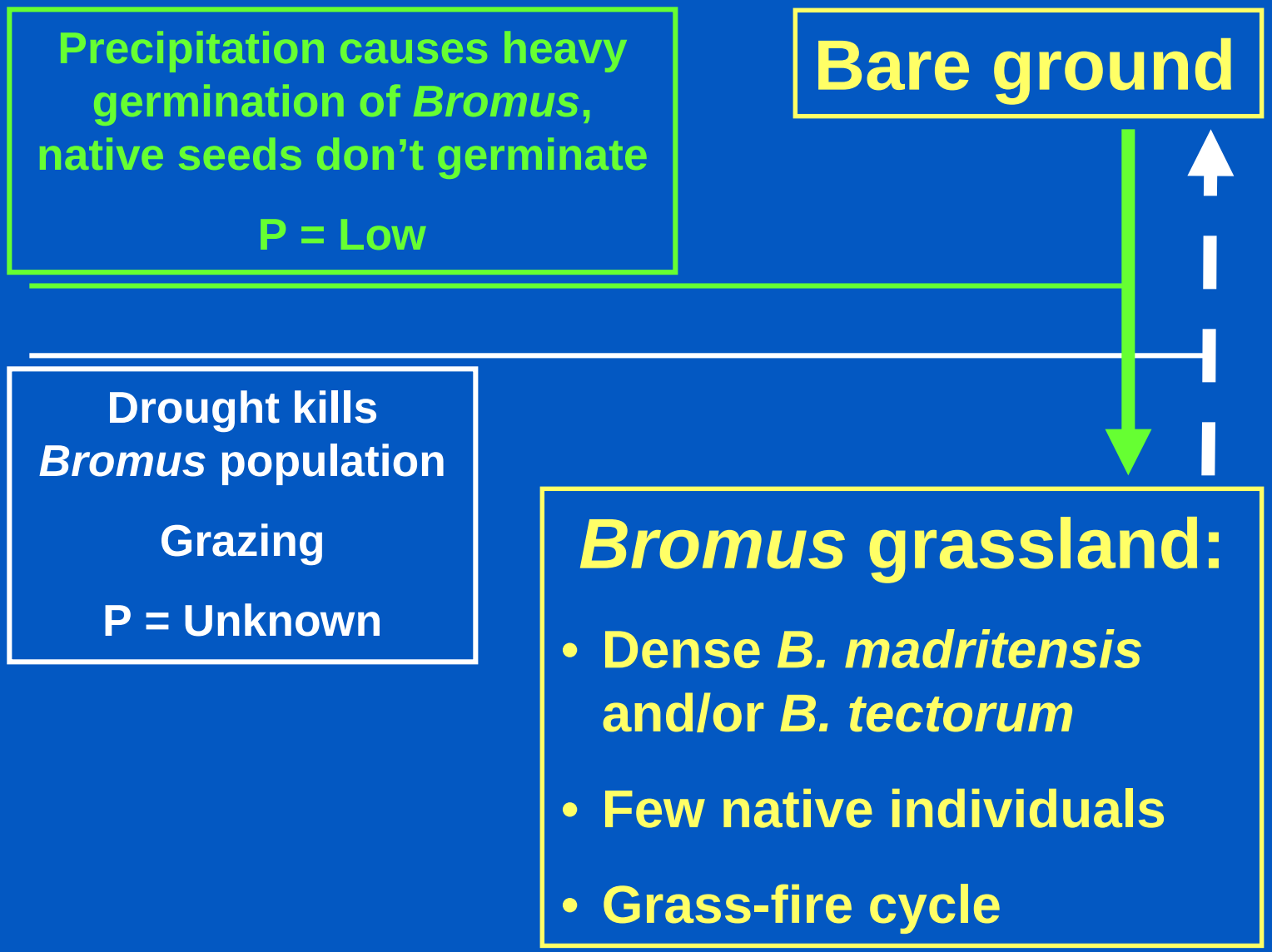
Webb, unpublished data


Precipitation causes heavy germination of *Bromus*, native seeds don't germinate
P = Low
Bare ground
Drought kills *Bromus* population
Grazing
P = Unknown
Bromus grassland:
• Dense *B. madritensis* and/or *B. tectorum*
• Few native individuals
• Grass-fire cycle

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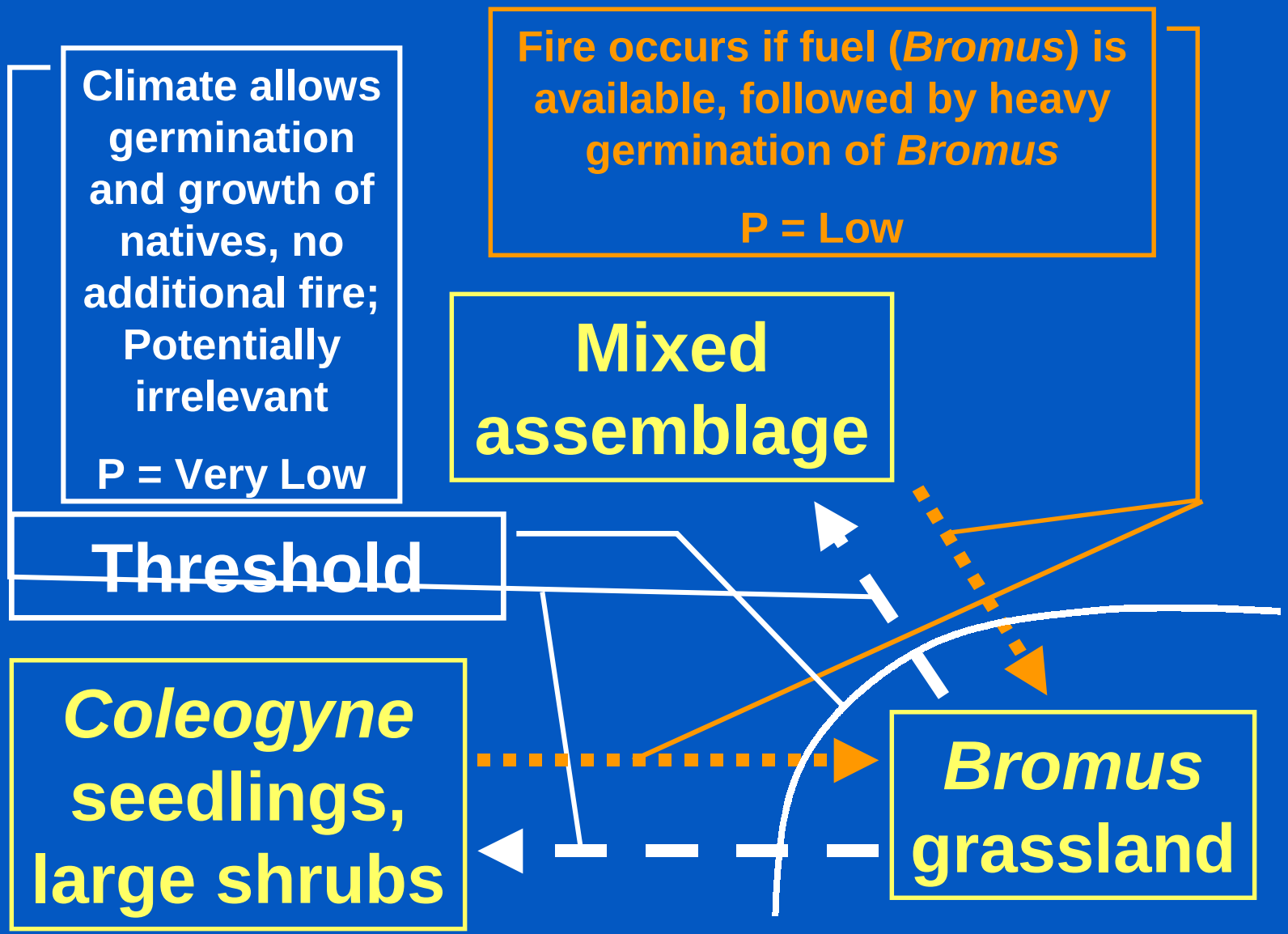
Climate allows germination and growth of natives, no additional fire; Potentially irrelevant
P = Very Low
Fire occurs if fuel (*Bromus*) is available, followed by heavy germination of *Bromus*
P = Low
Mixed assemblage
Threshold
Coleogyne seedlings, large shrubs
Bromus grassland

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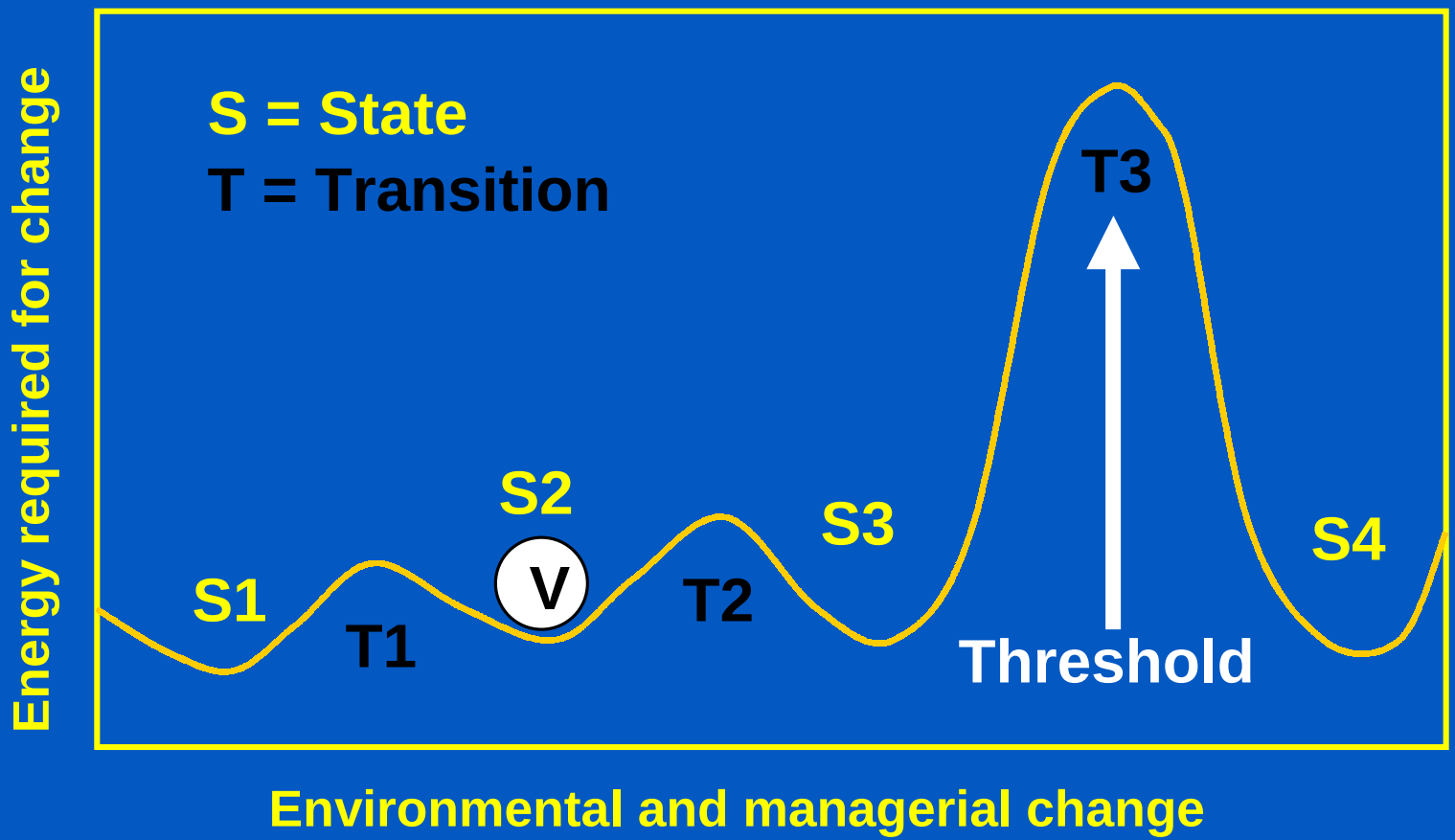
Ball and trough analogy



USGS

from George et al. 1992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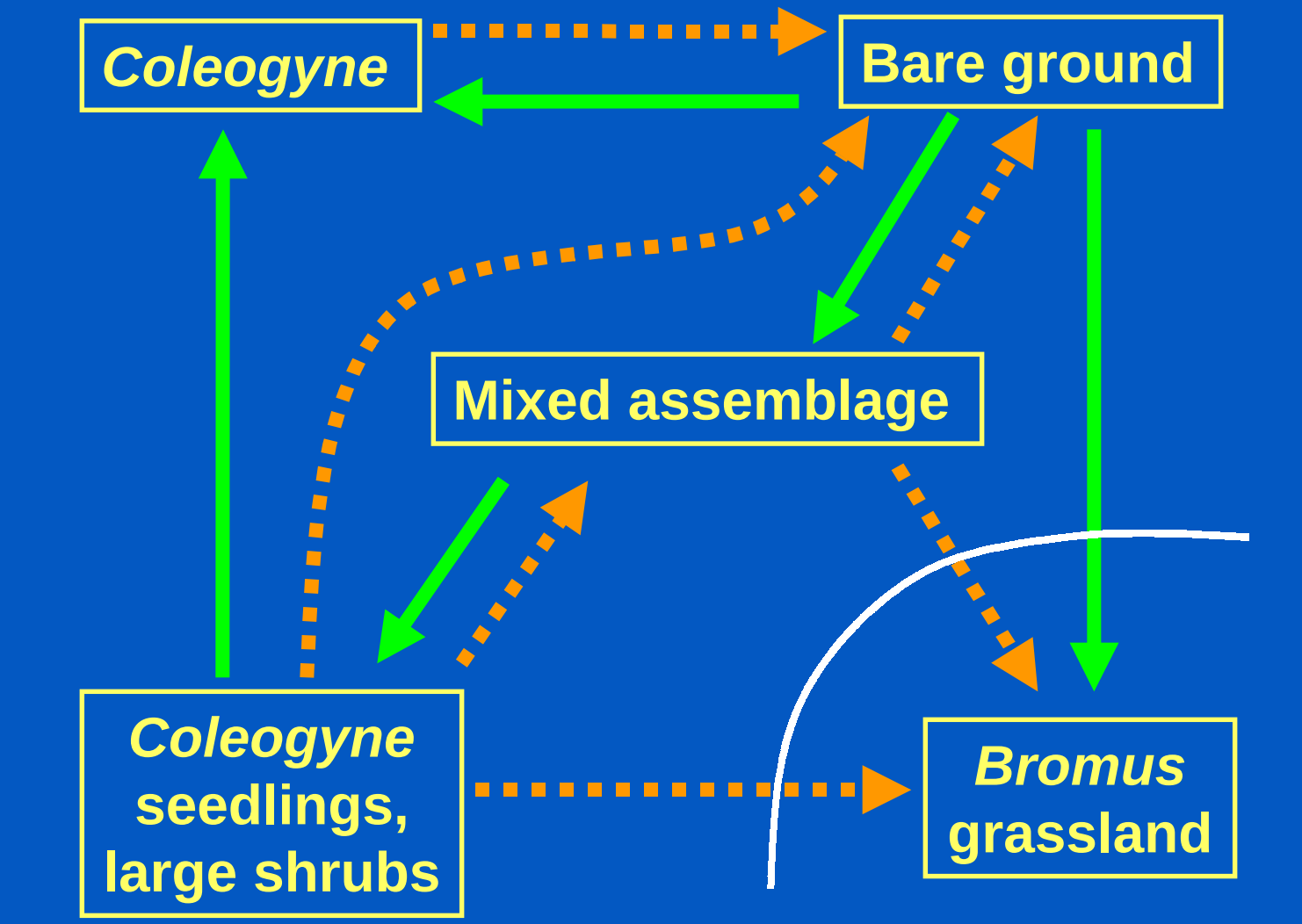
Coleogyne
Bare ground
Mixed assemblage
Coleogyne seedlings, large shrubs
Bromus grassland
= Resprouting, Germination, Growth (Climate responses)
= Fire, Grazing
= Threshold

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Summary

- Fire can occur in *Coleogyne* w/o fuel from exotic annuals
- *Coleogyne* may return after multiple germination pulses, many years
- Transition to *Bromus* grassland is uncommon, but probably irreversible

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Management considerations

- **Fire suppression is important in both unburned and previously burned habitat**

- **Natural recovery could take millenia, so alternative strategies to encourage *Coleogyne* germination, establishment and growth should be considered**

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Acknowledgements

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