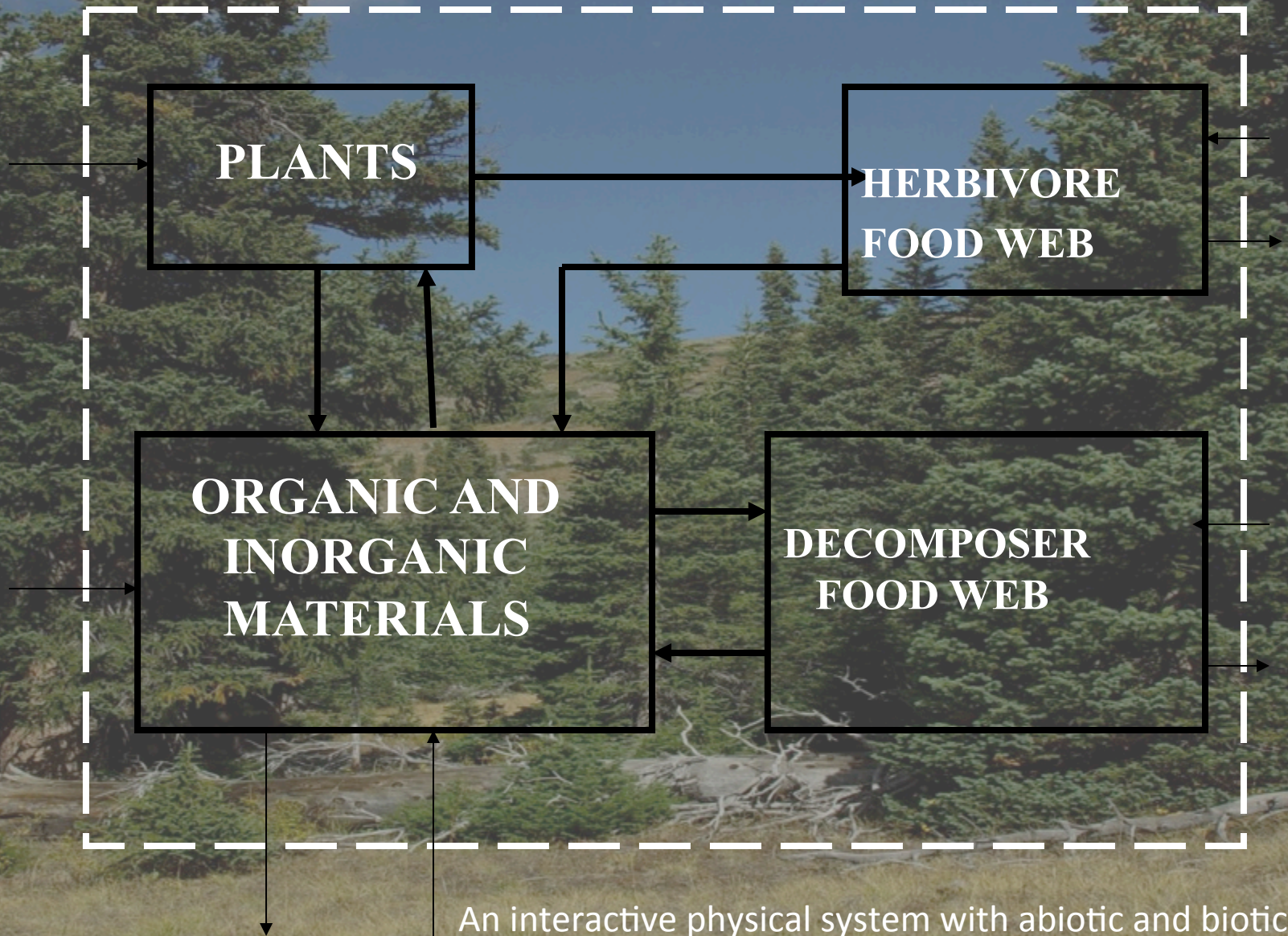


The Novel Ecosystem Debate Reframed for Land Managers: An ecologist's perspective

T.R. Seastedt, Oct. 4th, 2013



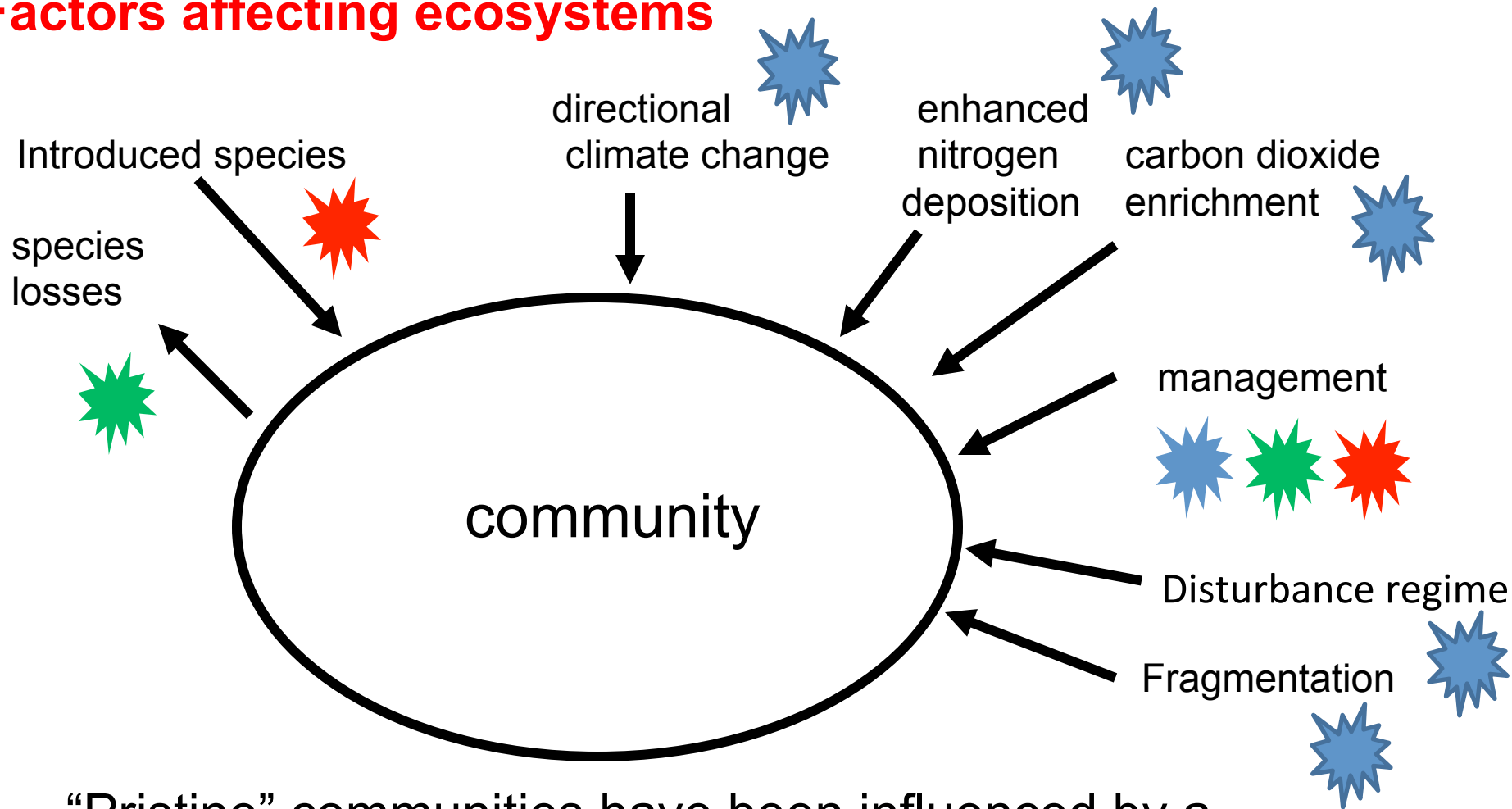





An interactive physical system with abiotic and biotic parts



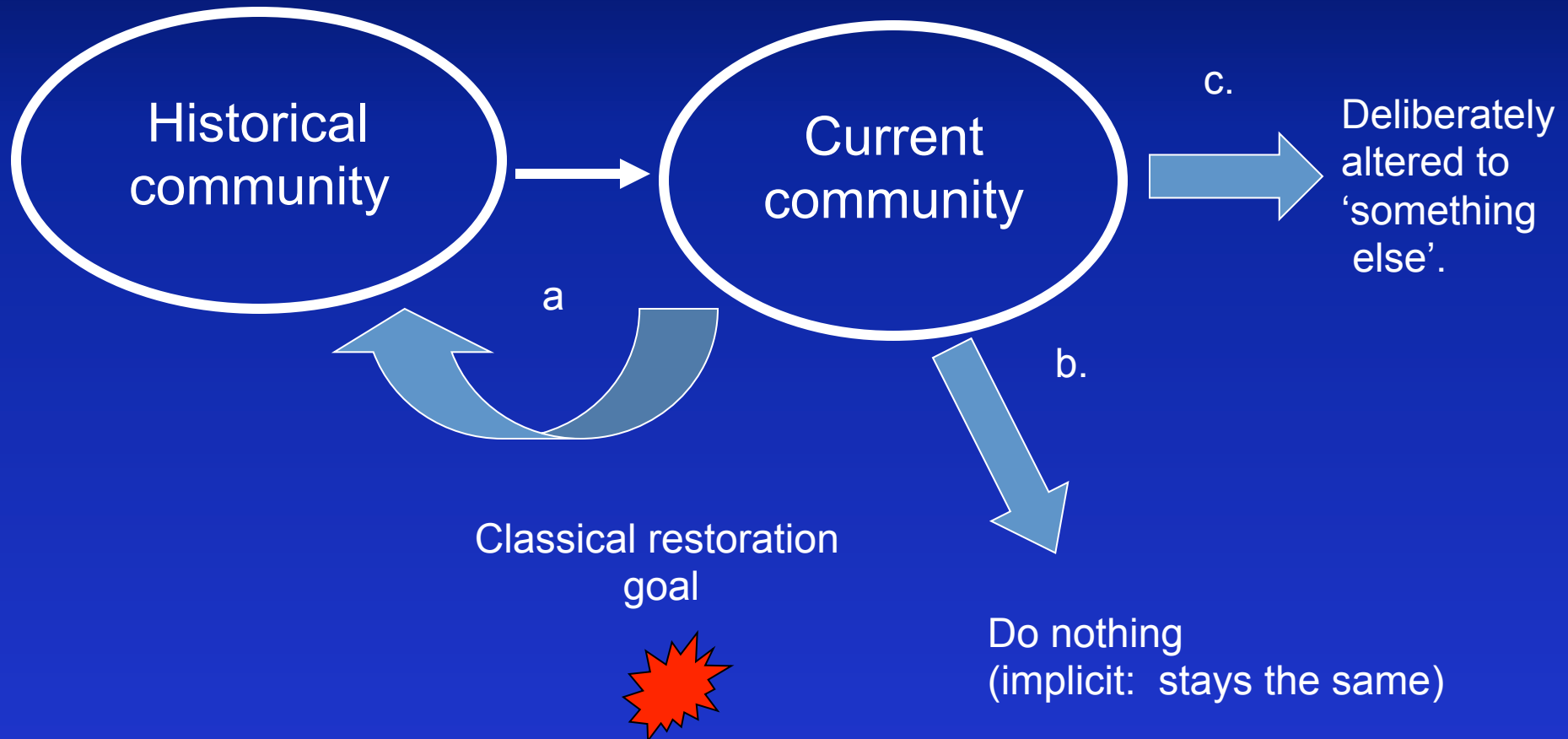
Factors affecting ecosystems



“Pristine” communities have been influenced by a number of anthropogenic factors for multiple decades.

 Abiotic site characteristics  Biotic site characteristics  introduced impacts

Restoration Options



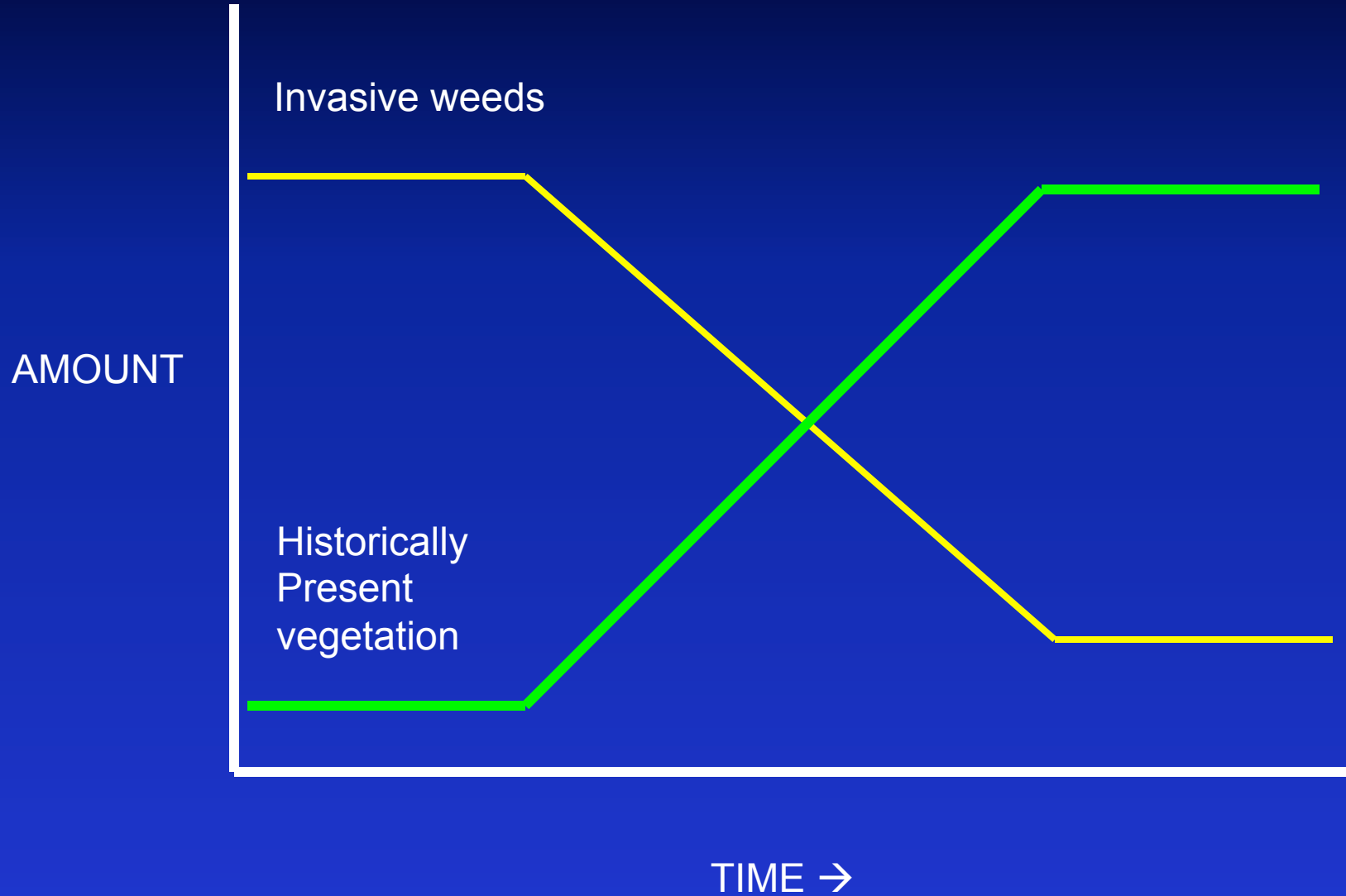
The local/regional textbook example:

1990s: Control of diffuse knapweed (*Centaurea diffusa*):



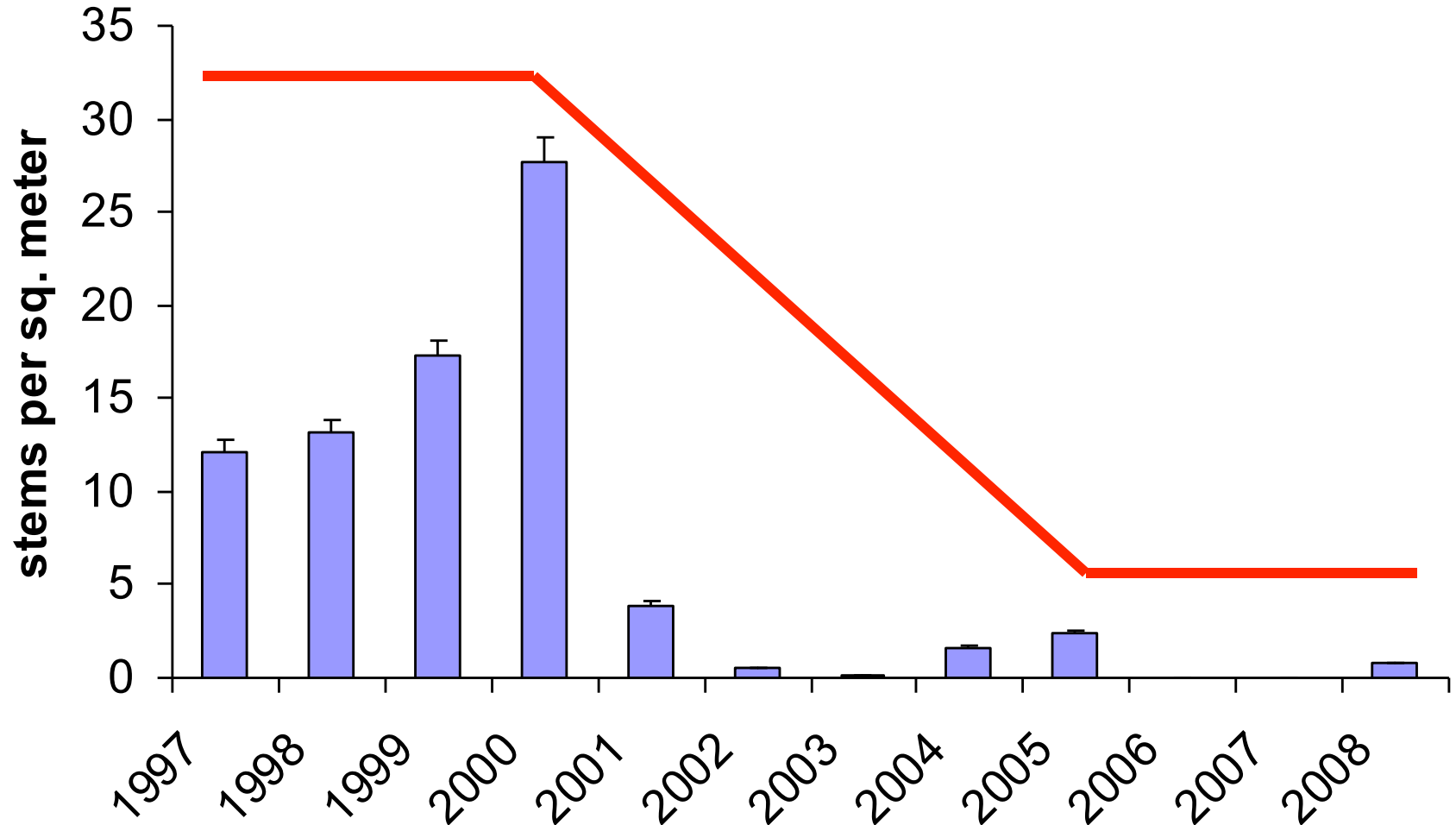
Classical restoration model

Sustainable management solution

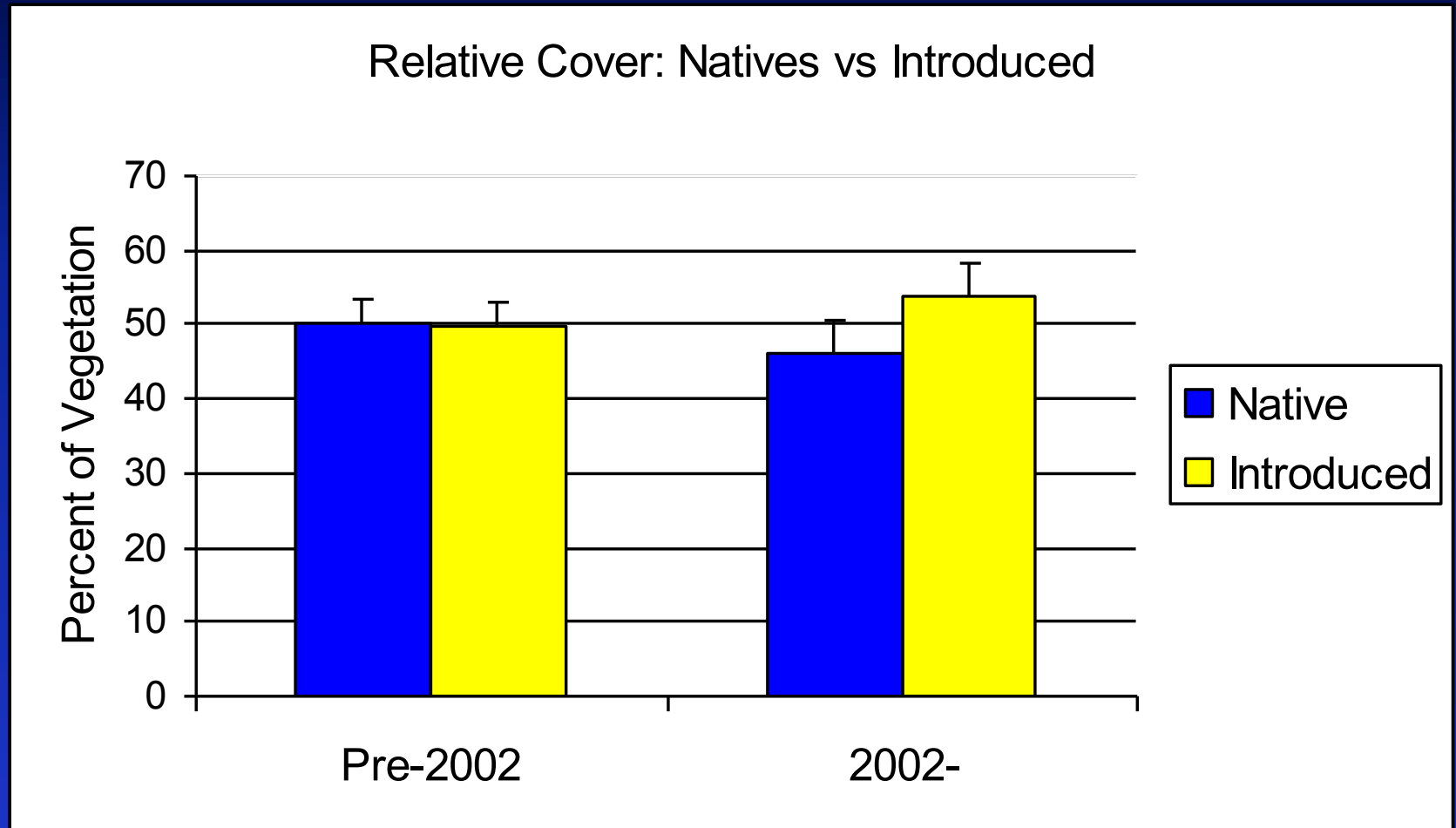


Demise of knapweed on eastern Boulder grassland:

knapweed flowering stems



But the demise of knapweed was exploited by other introduced species... Why?



We got rid of what we don't want...why won't the system go back to it's historical configuration?

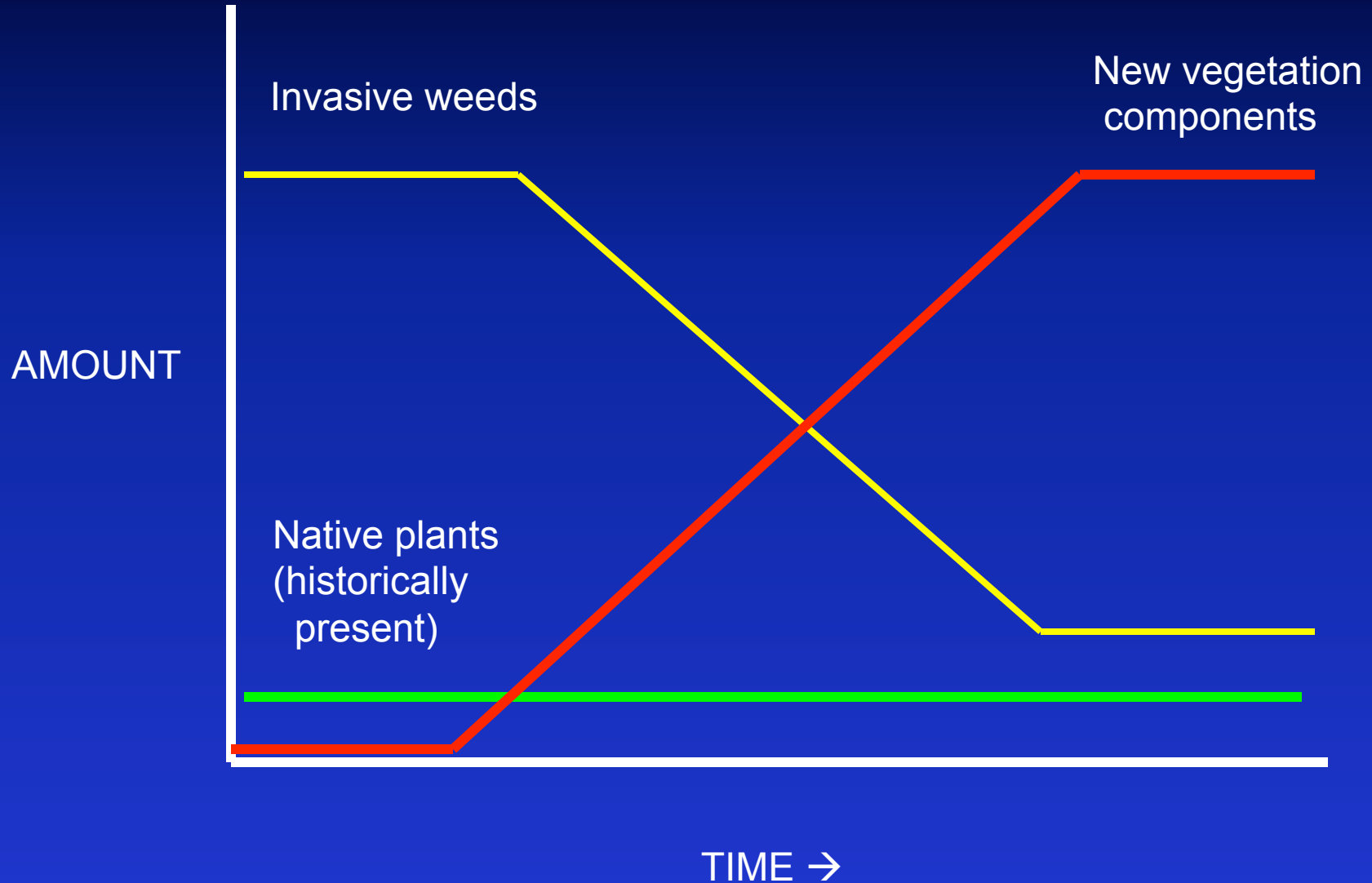
Possibilities (not exhaustive):

Passive restoration efforts produce new systems because:

- a) Longer growing season (favors 'winter species')
- b) Wetter winters but no overall increase in precipitation
- c) Higher CO₂ and atmospheric nitrogen deposition makes some plants better competitors.
- d) Altered (suppressed) fire regimes favor different species
- e) Fragmentation effects on microhabitats & source-sink relationships
- f) Recently introduced species better matched to changes.

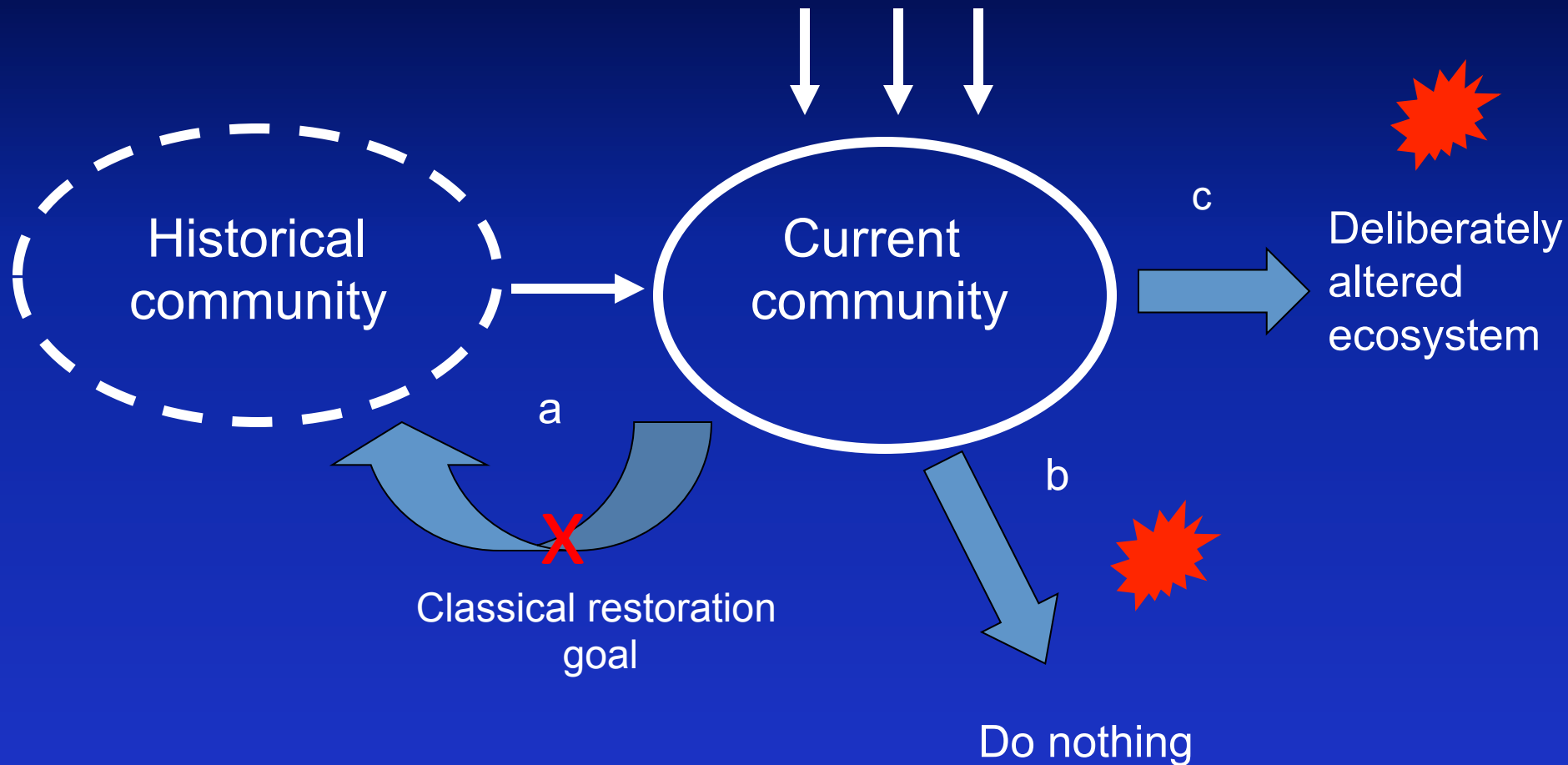
The current reality:

Sustainable management solution



(Recovery
Extremely unlikely)

New species, climate, N deposition, etc



Getting rid of what you don't want under the 'new rules' only facilitates additional changes...

Tropical Conservation Science – Special Issue Vol.6:
325-337, 2013

Novel tropical forests: Nature's response to global change

Ariel E. Lugo

“Novel forests include native tree and animal species as well as significant numbers of introduced and naturalized species. **These introduced species dominate forest stands,** and their dominance is not incompatible with the regeneration of native species.”

Lugo's findings are a potential paradigm buster:

The introduced (now dominant) species may be neutral or even positive with respect to the presence of the historically present species.

Novel forests will function similarly to current native forests in their delivery of vital ecological services to people.

Historical communities are unlikely to replace novel communities ...because the environmental conditions continue to change and the historic conditions that favored traditional native species are not likely to prevail.

Dr. Lugo's findings are only one outcome....
But, his finding may be widespread...

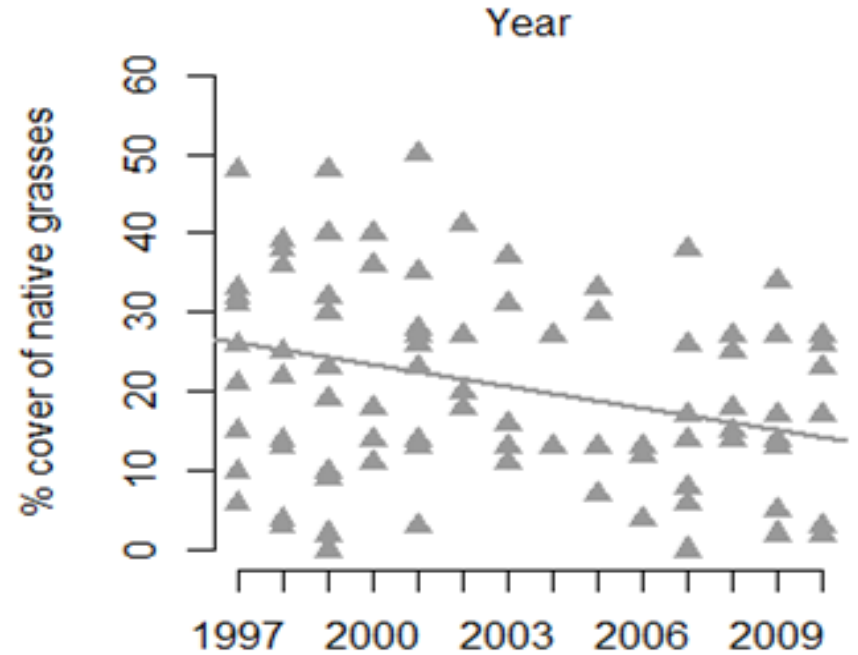
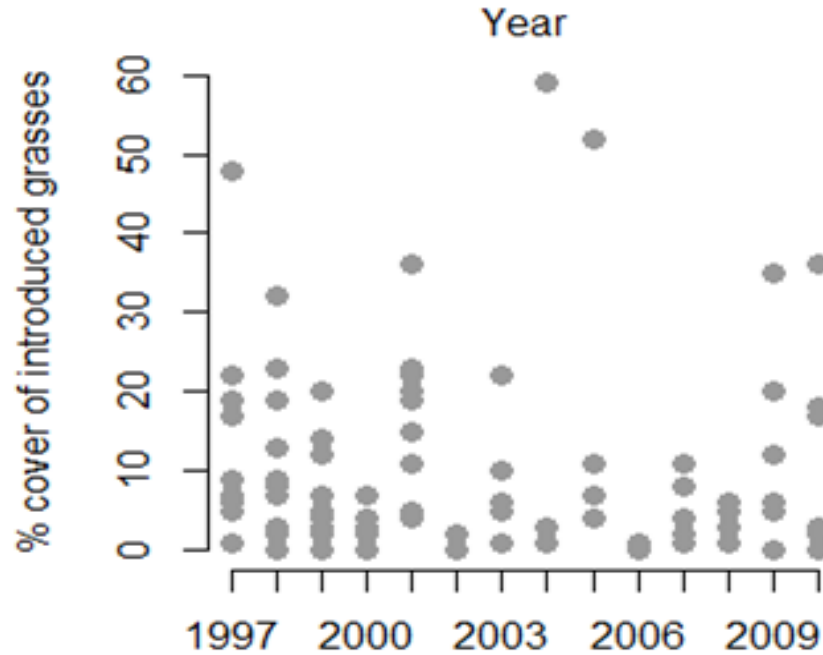
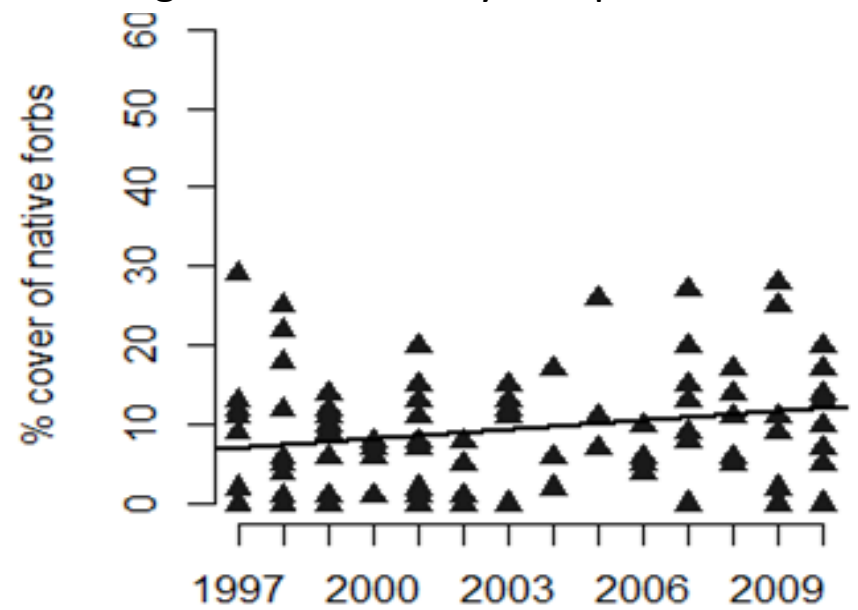
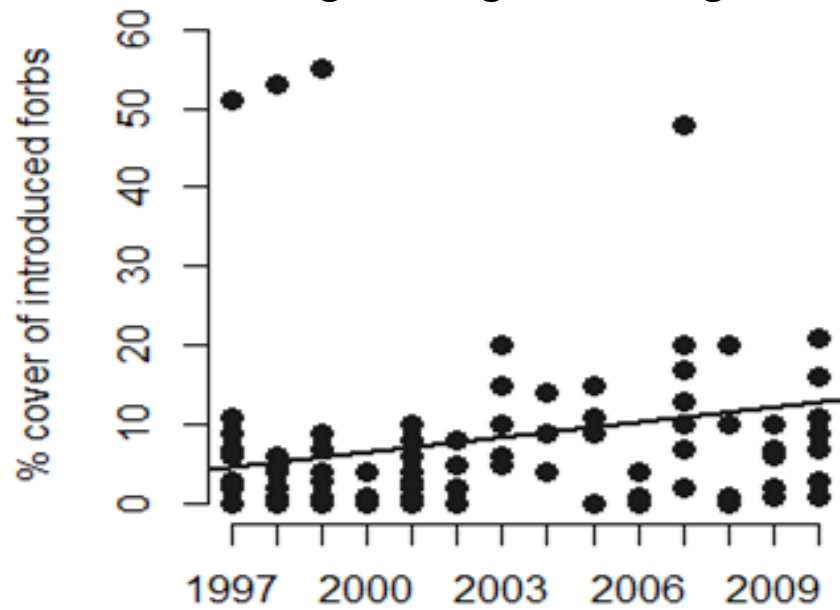
But, there will be other outcomes where
'doing nothing' is probably less desirable.

Example.... Boulder Open Space “natural areas”

Vegetation monitored since 1997.....

look at results from ‘undisturbed’ sites lacking prairie
dog colonies..... (plot data from about 8000 acres)

Doing nothing is resulting in directional changes in community composition...

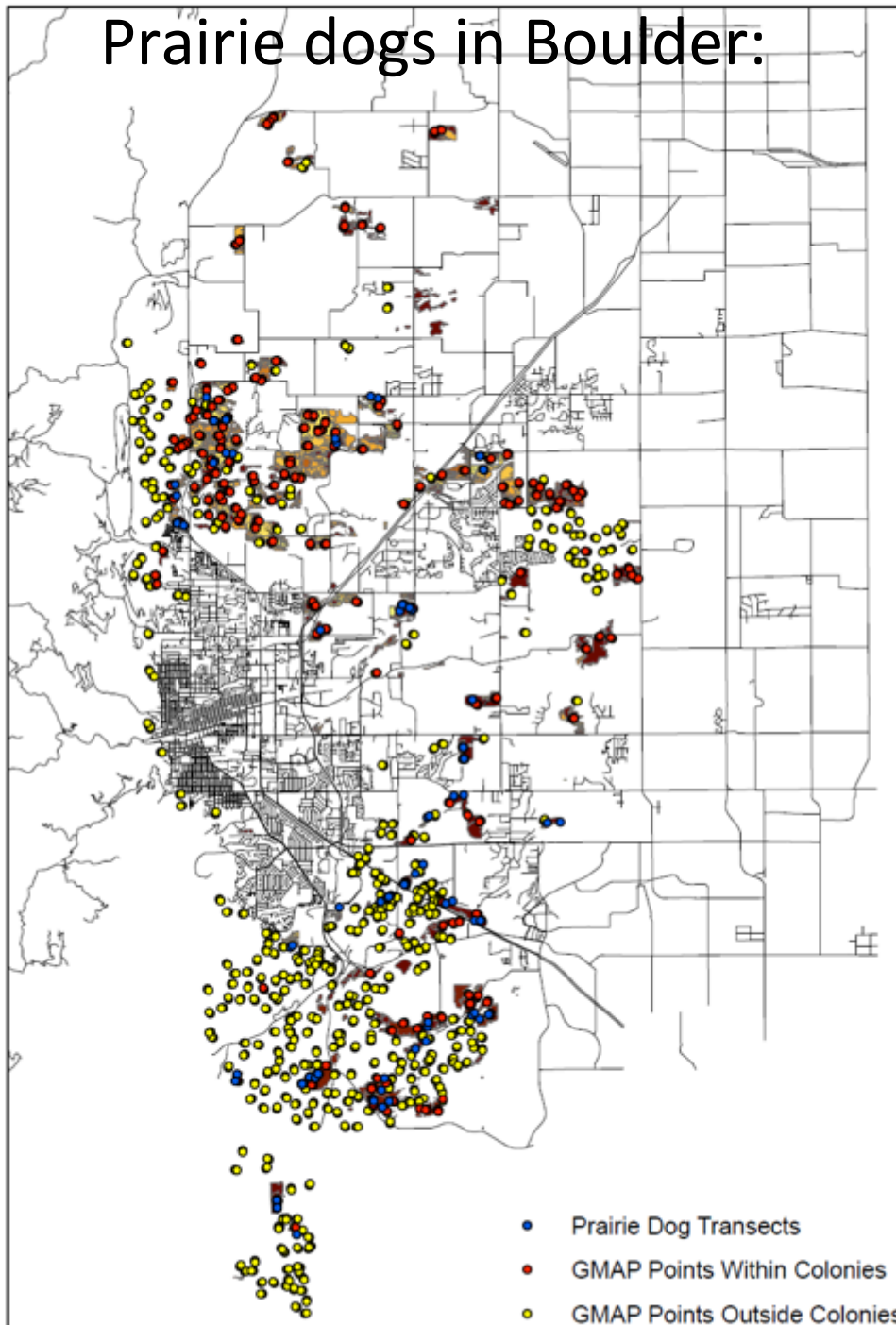


Directional changes:

Expanded growing season
without additional rainfall
means suppression of
species caught in the middle?



Prairie dogs in Boulder:



Pawnee Grassland Prairie Dog community:
Classic keystone species role: attracting other,
desired species to area.



Boulder prairie dog colony, September



Boulder County Prairie dog colony, March : Prairie dogs consume dominant, introduced forb.



**Dust from prairie dog town
endangers traffic**



Photo by Richard Reynolds



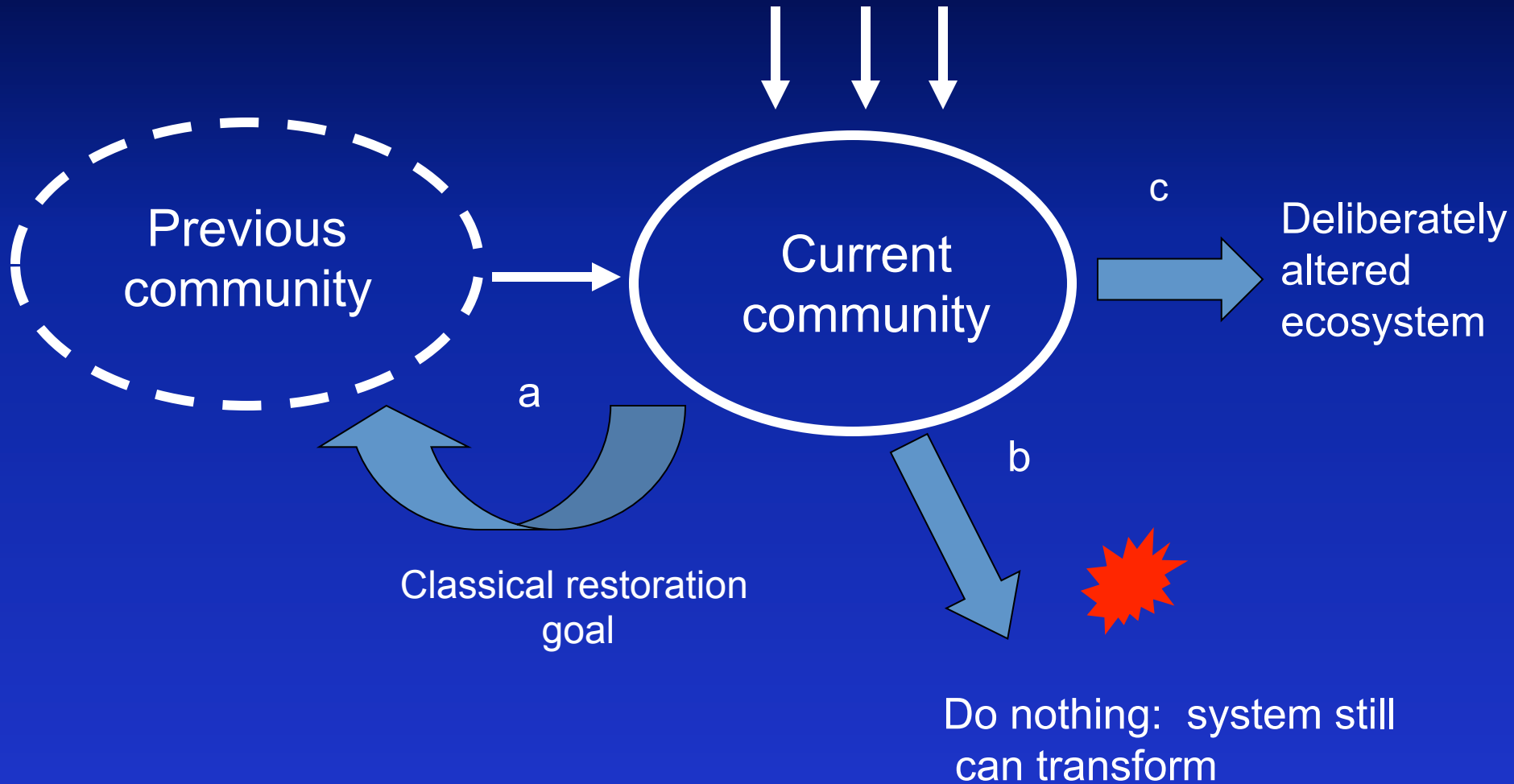
Prairie dogs on longer growing season now 'farming' introduced plant species?
Consequences of farming result in bare soil in late winter/early spring.

Prairie dogs interact with new climate & plant species to destabilize landscapes: “keystone species” status?



(Recovery
Extremely unlikely)

New species, climate, N deposition, etc



Human activities have also altered 'extreme events':

- * Changes in fire frequencies and intensities
(deliberate fire suppression activities + climate change)
- * Changes in storm frequencies and intensities.

Jan, 2009



Oct, 2010



Sept, 2010



March, 2011



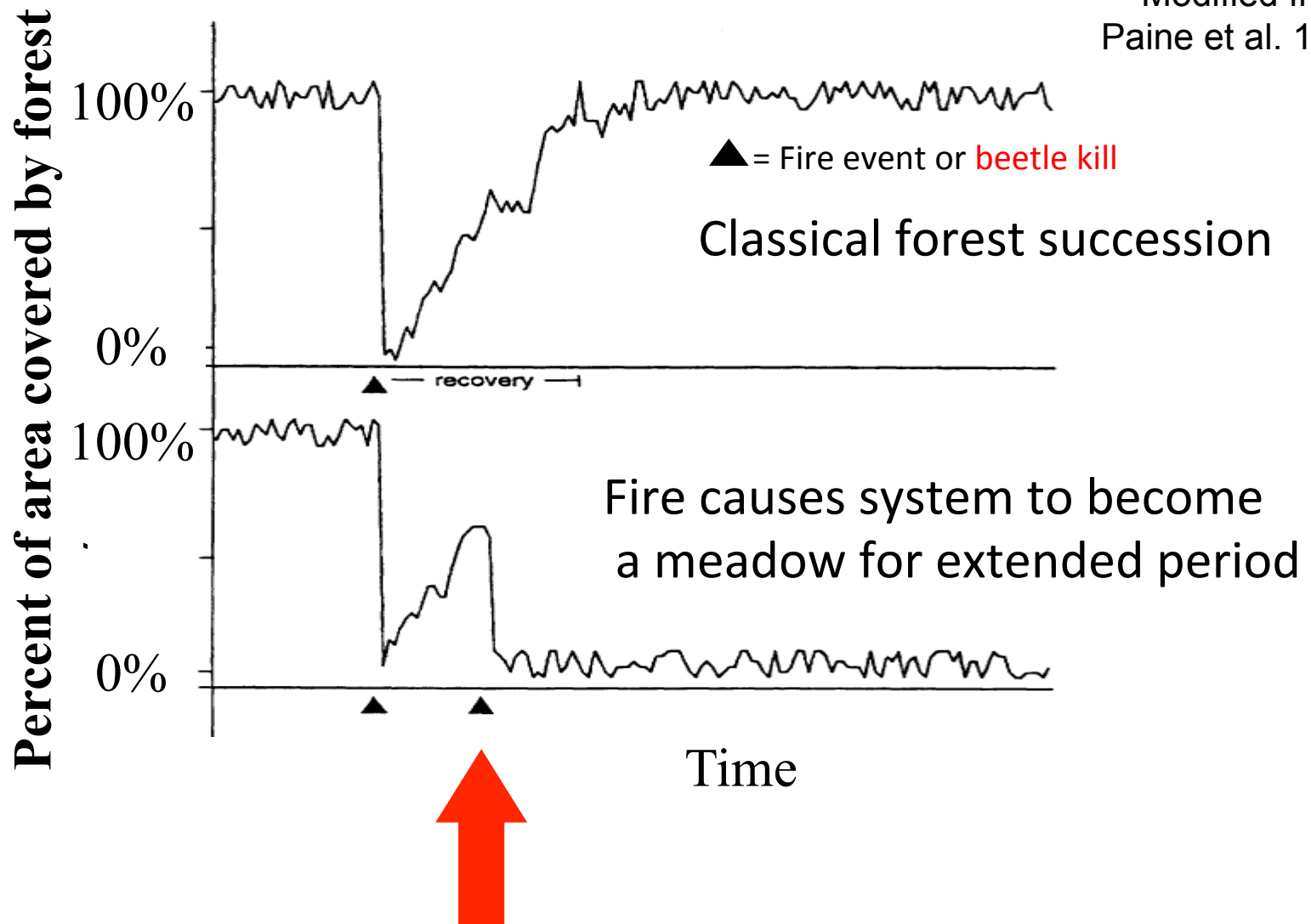
June, 2012



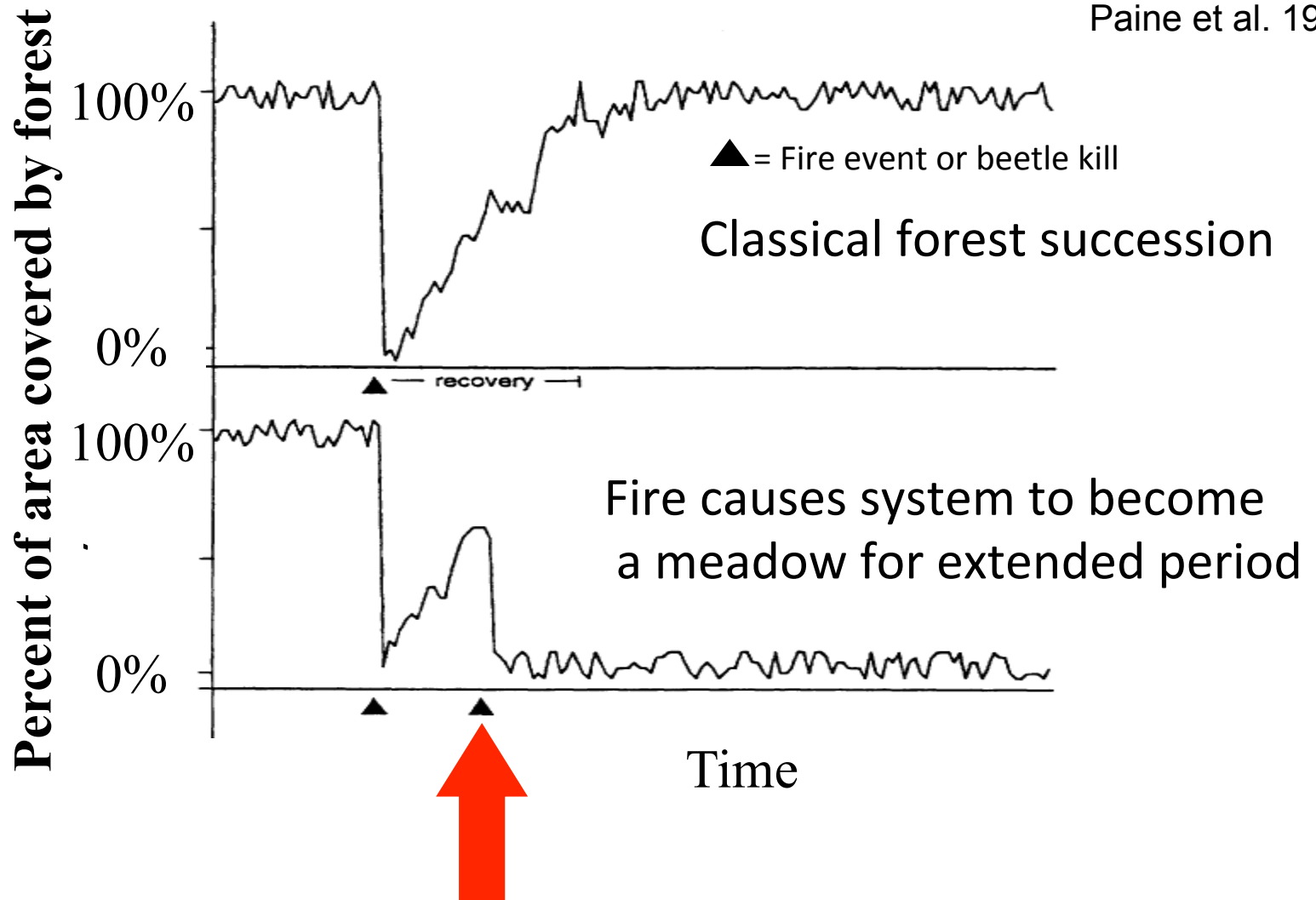
Colorado Springs, June 2012: Colorado joins Southern California in demonstrating that structures generate 'canopy fires'..

The four most expensive fires in Colorado history have all occurred since 2010 (Boulder, Ft. Collins, Colorado Springs) Fire has moved to where people live, and people have moved into a high fire frequency zone.





Second disturbance prior to tree seed production,
can create long-term meadow habitats



Since the entire region will be largely in regrowth mode, seed source for a regrowth forest becomes much less common...

Also, seedling survivorship inhibited by hotter, drier climate!

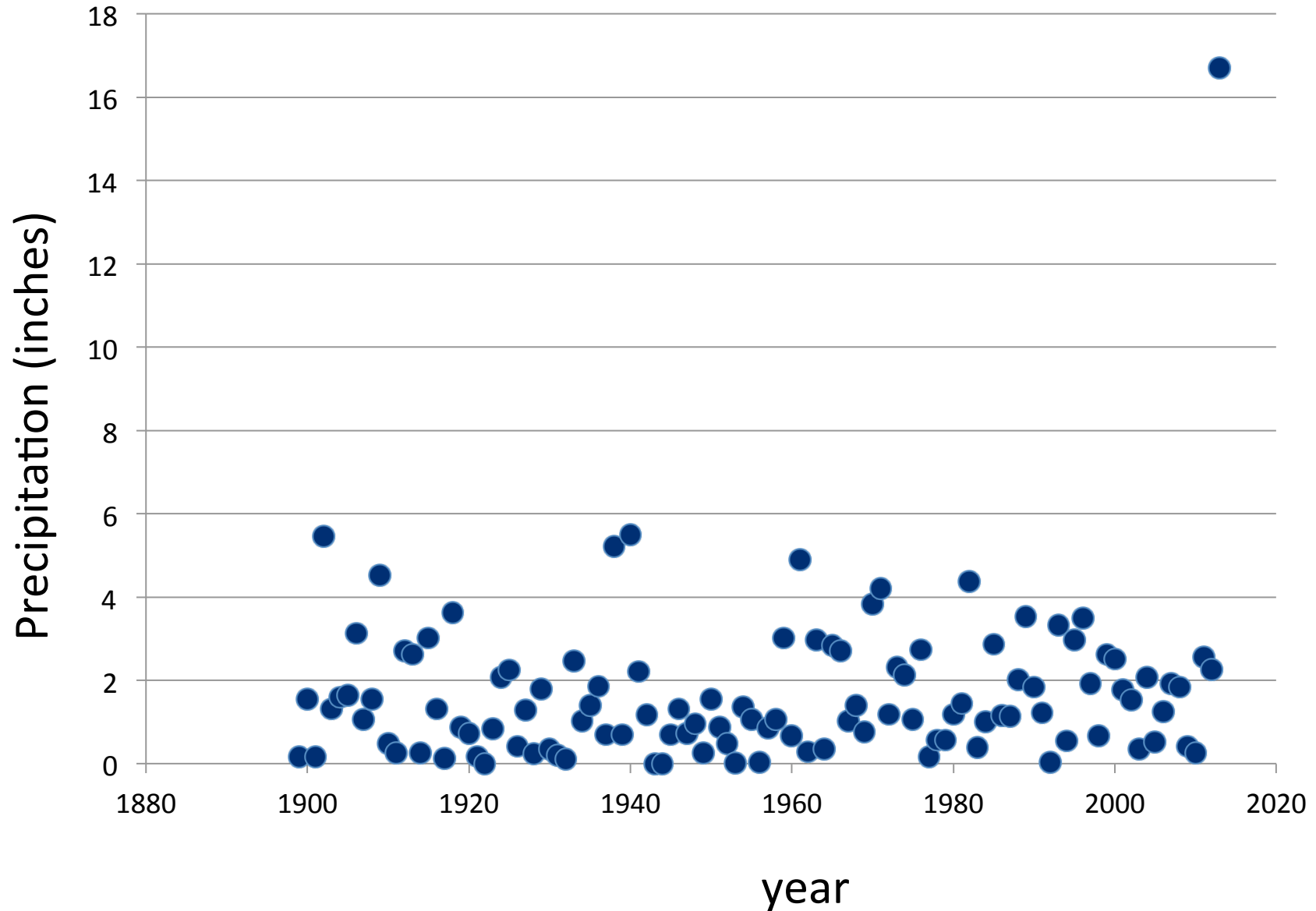
The Rockies will be composed of a much larger percentage of 'mountain meadows' and savannas than occurred in last century (landscape generated by 0-3 fires since 1988)



Photo by David Knochel

Boulder Precipitation in September, 1899-2013

(highest previous monthly record for ANY month was 9.59 inches)

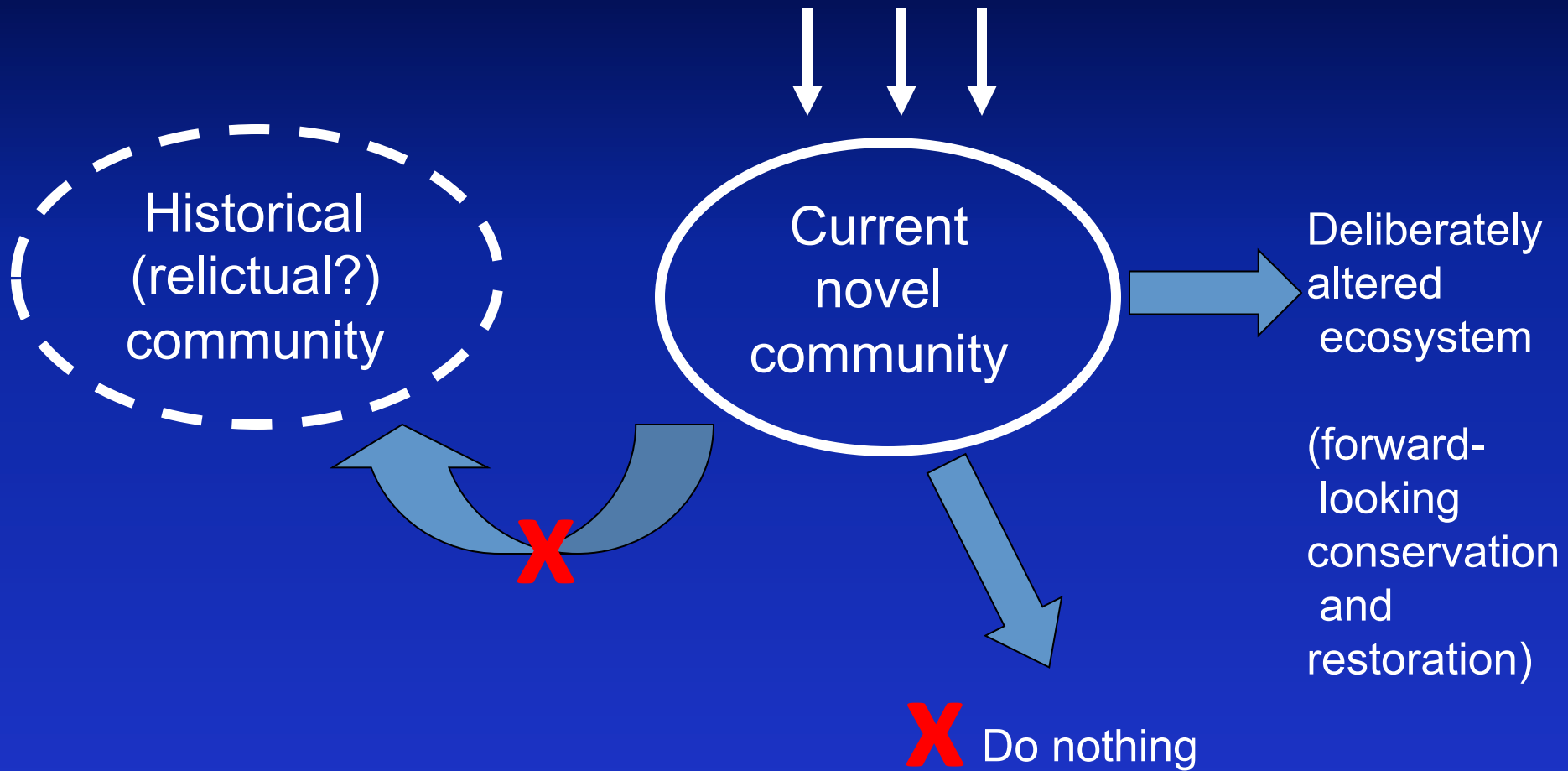






(Recovery
Extremely unlikely)

New species, climate, N deposition, etc



Introduction → Establishment → Outcome
(rare, common, dominant)

Abiotic and biotic 'filters'

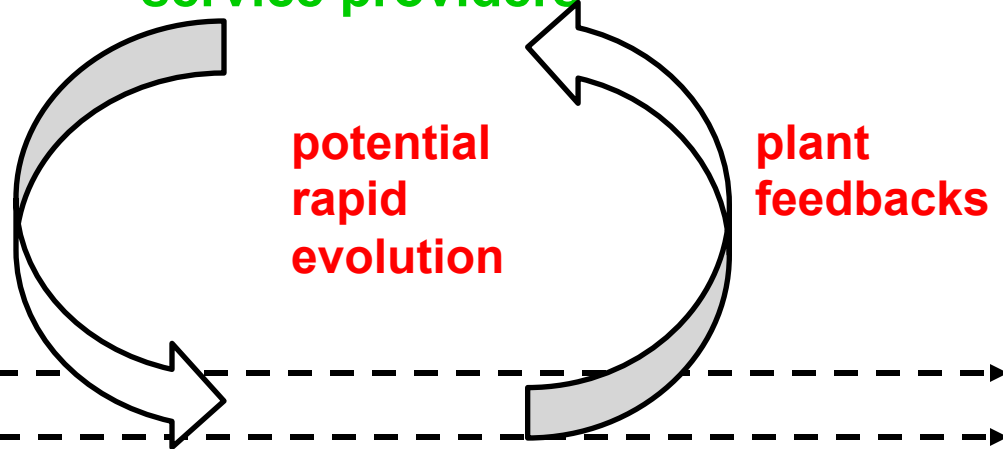
Climate filter - - - - -
Site Resource filter - - - - -
Disturbance filter - - - - -

Biotic filters (already present)

symbionts - - - - -
pathogens - - - - -
herbivores - - - - -
competitors - - - - -
service providers - - - - -

Introduced Plant characteristics

Niche difference - - - - -
Fitness - - - - -

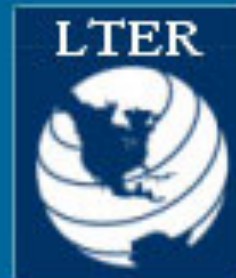


■ Abiotic site characteristics ■ Biotic site characteristics ■ invader traits

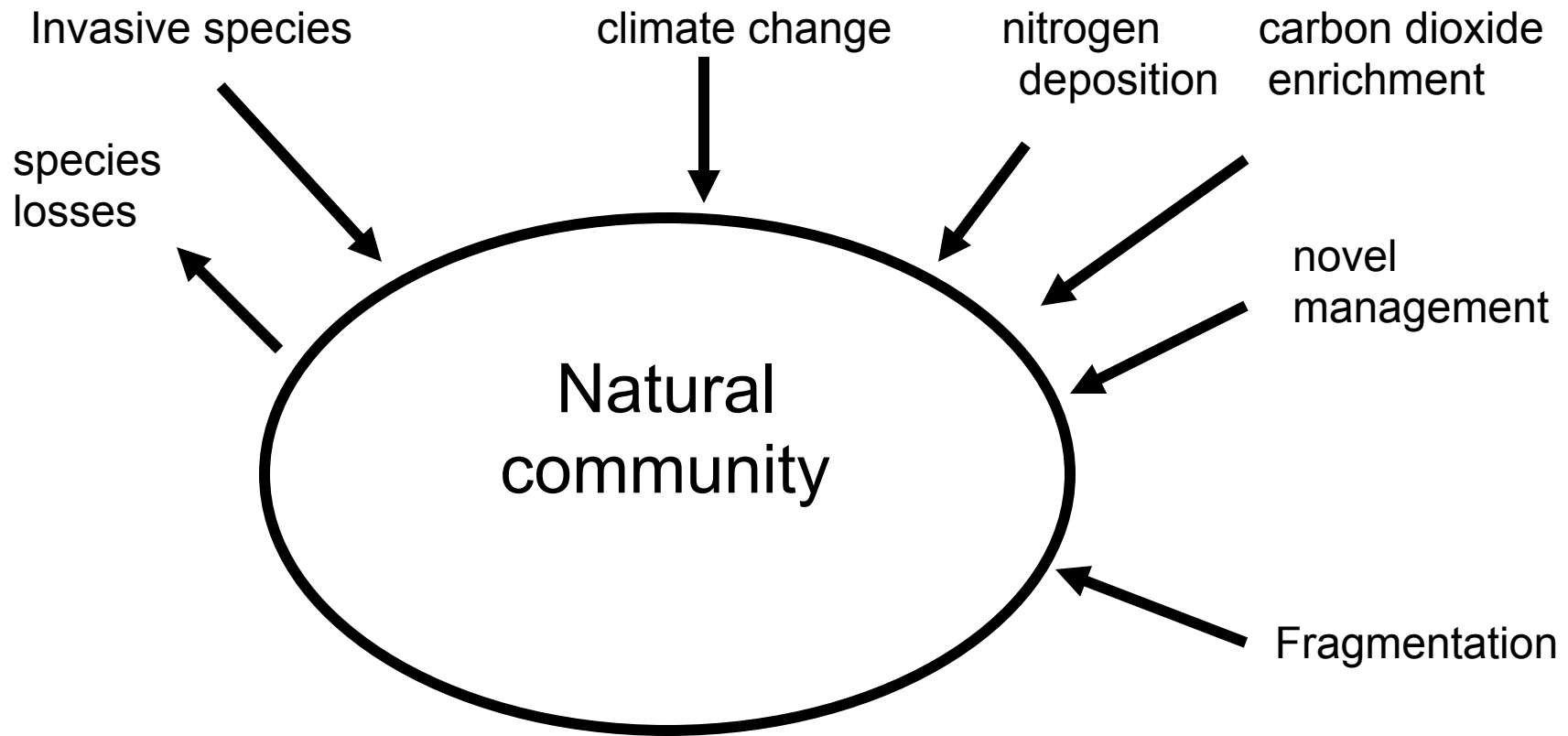
Thanks!



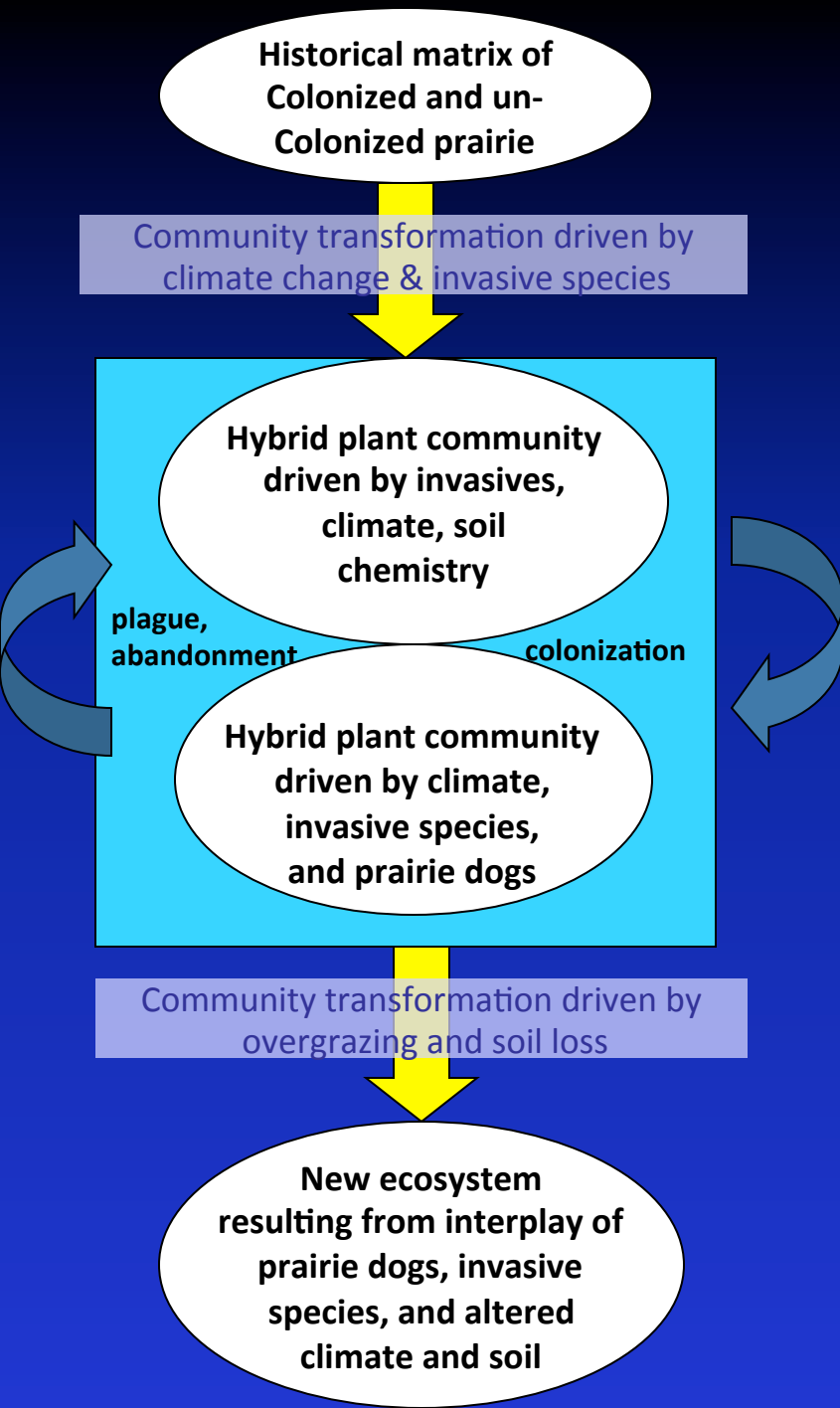
Ecology &
Evolutionary
Biology
University of CO, Boulder



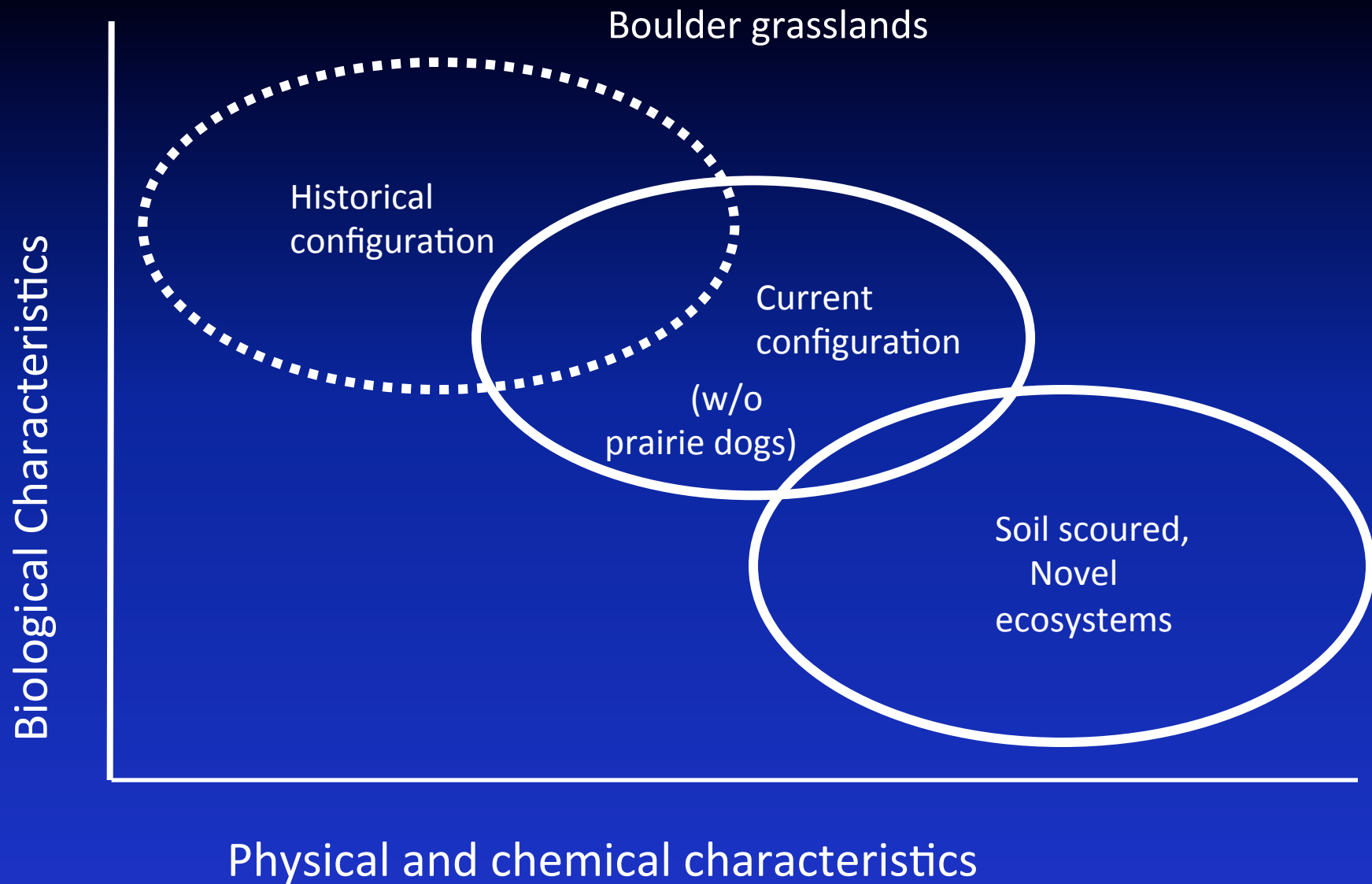
Factors affecting ecosystems



Even “Pristine” communities have been influenced by a number of anthropogenic factors for multiple decades.



The last step remains the 'prediction',
One affected by plague as well as
by climate.



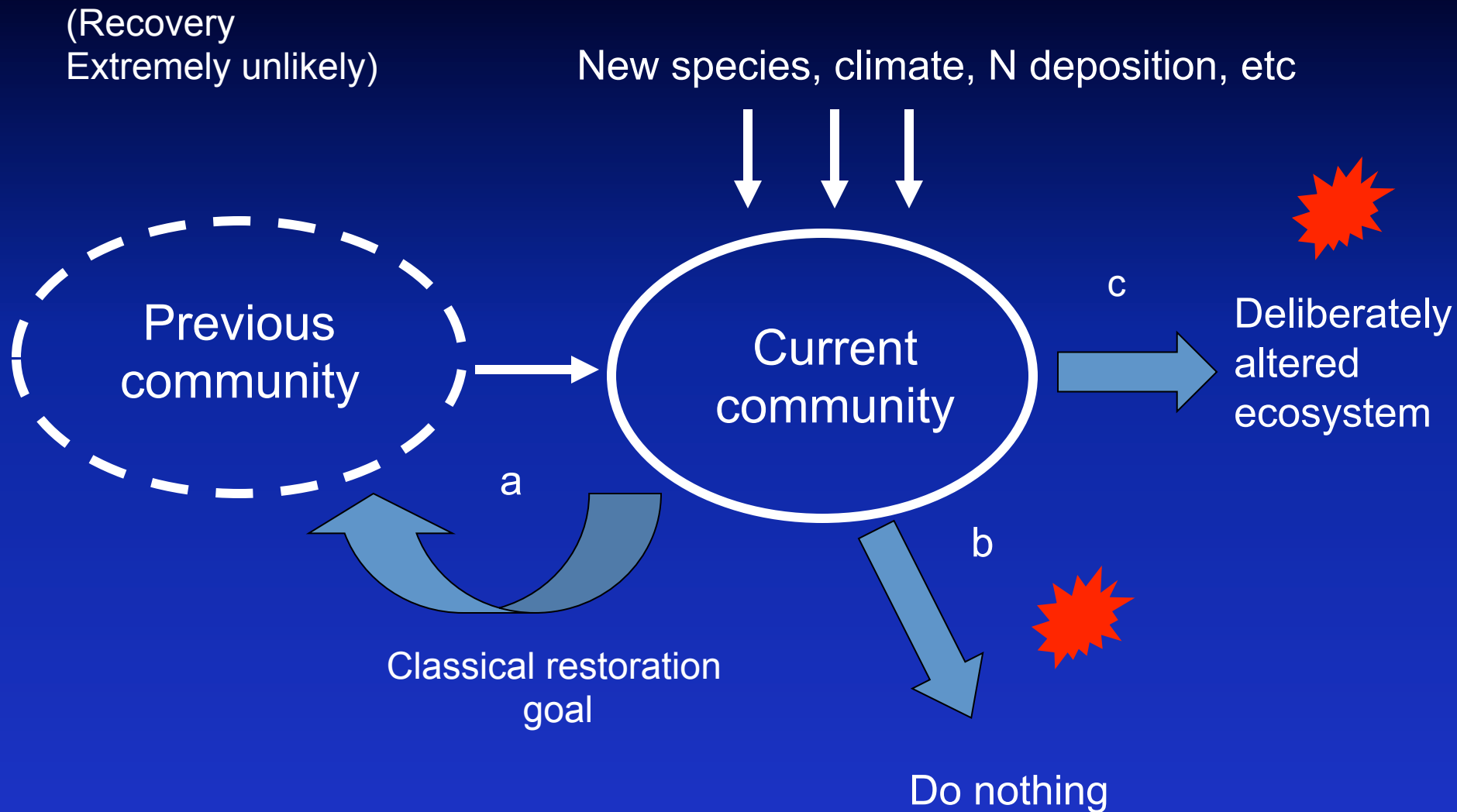
With the loss of topsoil and continued new environmental drivers...return to the historical composition of this prairie is highly unlikely.

Transformative events (wholesale conversion of one community type to another)

Under what circumstances are proactive efforts on invasive species the equivalent of rearranging the deck chairs of the Titanic?







Getting rid of what you don't want under the 'new rules' only facilitates additional changes...while doing nothing allows for uncontrolled change caused by directional 'drivers' like fire suppression and atmospheric chemistry!

Introduction → Establishment → Outcome
(rare, common, dominant)

Abiotic and biotic 'filters'

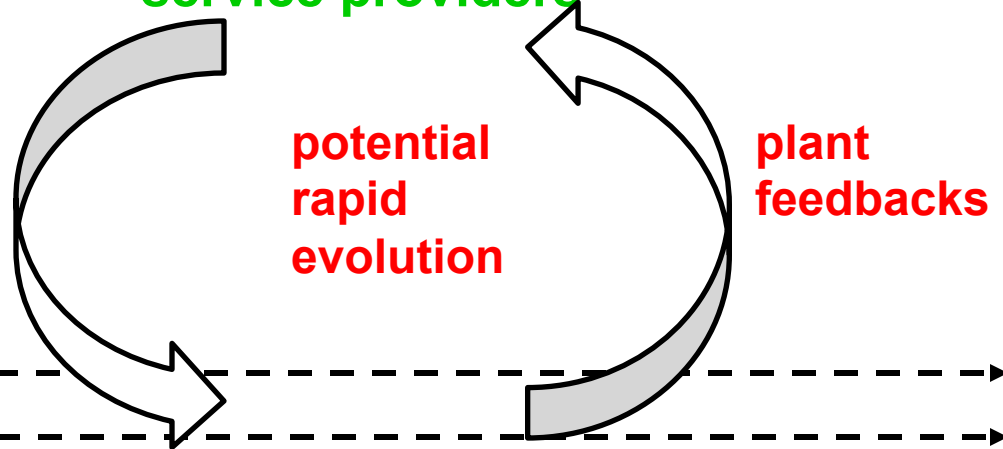
Climate filter - - - - -
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Introduced Plant characteristics

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■ Abiotic site characteristics ■ Biotic site characteristics ■ invader traits