

Beyond traditional ecological restoration and reclamation on the Colorado Plateau



JULY/AUGUST 1985
VOL. 35 NO. 7

BioScience

Publisher

American Institute of Biological Sciences
730 11th St., NW, Washington, DC 20001-4584
Charles M. Chambers, Executive Director

Editorial Staff

Editor: Ellen W. Chu
Features and News Editor: Laura Tangle
Assistant Editor: Erica Gordon Sorohan
Production Manager: Anne S. Meltzer
Book Review Editor: Judith S. Weis
Technology Editor: David M. Coder
Business Manager: John G. Peyton
Institutional Subscriptions: Louise Salmon
Membership: Louise Salmon

Editorial Board

Agriculture: Edward G. Buss, Sylvan H. Wittwer
Animal Behavior: Jeanne Altmann
Biochemistry: Fred C. Hartman
Biology and Industry: Ernest G. Jaworski

Opinion

JOHN D. ABER
*Department of Forestry
University of Wisconsin
Madison, WI 53706*

WILLIAM R. JORDAN, III
*University of Wisconsin Arboretum
Madison, WI 53706*

RESTORATION ECOLOGY: AN ENVIRONMENTAL MIDDLE GROUND

An impoverished *Imperata* grassland in the Philippines, a high-elevation conifer forest in Germany undergoing *Waldshaden* (forest death), degraded farmland in the American Midwest: What do these three have in common? They are creations of human activity that have come to occupy significant amounts of the earth's land surface. Might they also represent a scientific opportunity and a chance to alter our approach to environmental management?

The prevailing view in our society is that nature exists only where human activity is not in evidence. This view is apparent in the emphasis society gives to preserving remaining wild areas. In the ecological sciences, it is apparent in the preponderance of research done in undisturbed ecosystems. Basing our knowledge of ecosystems on these areas is much like studying human physiology using only healthy subjects. Such a study includes only a small subset of possible reactions and mechanisms; it also provides little information on methods to cure the sick. Although the degradation of ecosystems continues to accelerate, there is as yet no real "science of land health" such as envisioned by Aldo Leopold some 40 years ago.

RESTORATION ECOLOGY: The State of an Emerging Field

John Cairns, Jr.
Department of Biology
Blacksburg, Virginia

KEY WORDS: ecology
repair

The field of restoration
theory and conservation
ecology can be viewed

The Recent Double Paradigm Shift in Restoration Ecology

Vicky M.

Restoration Ecology
THE JOURNAL OF THE SOCIETY FOR ECOLOGICAL RESTORATION

Abstract

The fields of ecology and restoration
enormous practical resour-
information. practical resour-
situated in a world of
lent opportunities for
restoration ecology
have recently
call for such a
level, as we move
restoration projects
neglected so

REVIEW ARTICLE

Evaluating Ecology of the Literature

Liana Wortley,^{1,2} Jean-Marc

Abstract

Assessing the success of ecological
critical to justify the use of restoration
management and to improve best practices
are extensive discussions surrounding
that define and measure success
monitoring or evaluation of projects
thought to have lagged behind. We
future review to determine trends in
restoration projects and identify key know

Conversion of
into degraded
a great threat to
powerful suite
restoration ecology
as a way of in-
standing of how
with natural re-
future of the ei

Anc

Hopes for the Future: Restoration Ecology and Conservation Biology

Copyright © 2005 by the author(s). Published here under license by the Resilience Alliance.
Hilderbrand, R. H., A. C. Watts, and A. M. Randle 2005. The myths of restoration ecology. *Ecology and Society* 10(1): 19. [online] URL: <http://www.ecologyandsociety.org/vol10/iss1/art19/>

Perspective

The Myths of Restoration Ecology

Robert H. Hilderbrand¹, Adam C. Watts², and April M. Randle³

Key Words: carbon copy; command and control; cookbook; ecological restoration; fast forward; field of dreams; myths; resilience; restoration ecology; Sisyphus complex



Restoration Success: How Is It Being Measured?

Maria C. Ruiz-Jaen^{1,2} and T. Mitchell Aide²

Abstract

The criteria o
lished to eval
ety of Ecolo
produced a P
should be con
To determine
in restoration
Restoration
addressed the
ecosystem att
measures used
has measured

“How Local Is Local?”—A Review of Practical and Conceptual Issues in the Genetics of Restoration

John K. M

Abstract

In plant con
reestablishme
is a valuable
restoration el
genes and ger
used are not
important be
populations t
tions. Here
ongoing rest

Setting Effective and Realistic Restoration Goals: Key Directions for Research

Richard J. Hobbs^{1,2}

Abstract

Restoration ecology has made significant ac
past few decades and stands to make signifi
tions both to the practical repair of damag
and the development of broader ecological
lighted four main areas where progress in
assist with this. First, we need to enhance
of recent advances in our understanding of
landscape dynamics into the conceptual
frameworks for restoration. Second, we nee
the development of an ability to correctly
system damage, identify restoration thresh

Restoration Ecology to the Future: A Call for New Paradigm

Young D. Choi^{1,2}

Abstract

The discipline of restoration ecology has grown remarka
ably in the past decades, providing new ideas and opportu
nities for conserving biological diversity, managing
ecosystems, and testing ecological theories. On the other
side, its past-oriented, static, and idealistic approach has
been criticized for subjectivity in determining restoration
goals, inapplicability to dynamic ecosystems, and inability
for restoring certain irreversible losses. Moreover, unpre
dictable sustainability of the restored ecosystems, which
were modeled after its historical fidelity, adds our skepti
cism under the changing environment. This paper calls for
a new paradigm of ecological restoration to the future. A

future-oriented restoration should (1) establish the eco
systems that are able to sustain in the future, not the past,
environment; (2) have multiple alternative goals and
trajectories for unpredictable endpoints; (3) focus on re
habilitation of ecosystem functions rather than recom
position of species or cosmetics of landscape surface; and
(4) acknowledge its identity as a “value-laden” applied
science within economically and socially acceptable frame
work. Applicability of ecological theories to restoration
practice is also discussed in this paper.

Key words: ecology, future, paradigm, rehabilitation, res
toration, sustainability.

The Future of *Restoration Ecology*: Challenges and



ANNUAL
REVIEWS **Further**

Click here for quick links to
Annual Reviews content online,
inclu

- Oth
- Top
- Top
- Our

Commentary

Toward an Era of Restoration
in Ecology: Successes, Failures,

Towards a Conceptual Framework for Restoration Ecology

Restoration Ecology

THE JOURNAL OF THE SOCIETY FOR ECOLOGICAL RESTORATION

OPINION ARTICLE

Degraded or just different? Perceptions and value judgements in restoration

Richard J. Hobbs^{1,2}

An underlying premise of ecological restoration is that i
apparently straightforward aim, there is in fact consider
assessed. In addition, there is a notable subjective compo
this often relates to the values and goals being considered.
where damage and loss of valued characteristics are evid
mixed benefits and disbenefits, the decision on whether the

REVIEWS REVIEWS REVIEWS

The changing role of history in restoration ecology

Eric Higgs^{1*}, Donald A Falk², Anita Guerrini³, Marcus Hall⁴, Jim Harris⁵, Richard J Hobbs⁶,
Stephen T Jackson^{7†}, Jeanine M Rhemtulla⁸, and William Throop⁹

In the face of rapid environmental and cultural change, orthodox concepts in restoration ecology such as histor-
ical fidelity are being challenged. Here we re-examine the diverse roles played by historical knowledge in restora-
tion, and argue that these roles remain vitally important. As such, historical knowledge will be critical in shaping
restoration ecology in the future. Perhaps the most crucial role in shifting from the present version of restoration
ecology ("v1.0") to a newer formulation ("v2.0") is the value of historical knowledge in guiding scientific inter-
pretation, recognizing key ecological legacies, and influencing the choices available to practitioners of ecosystem
intervention under conditions of open-ended and rapid change.

Restoration ecology is a mess!

*...such a unique and
challenging scientific field!*

Overview

- Changing definitions
- The Colorado Plateau today
- Novel ecosystems and a changing climate
- Let's get local!
- Values and objectives

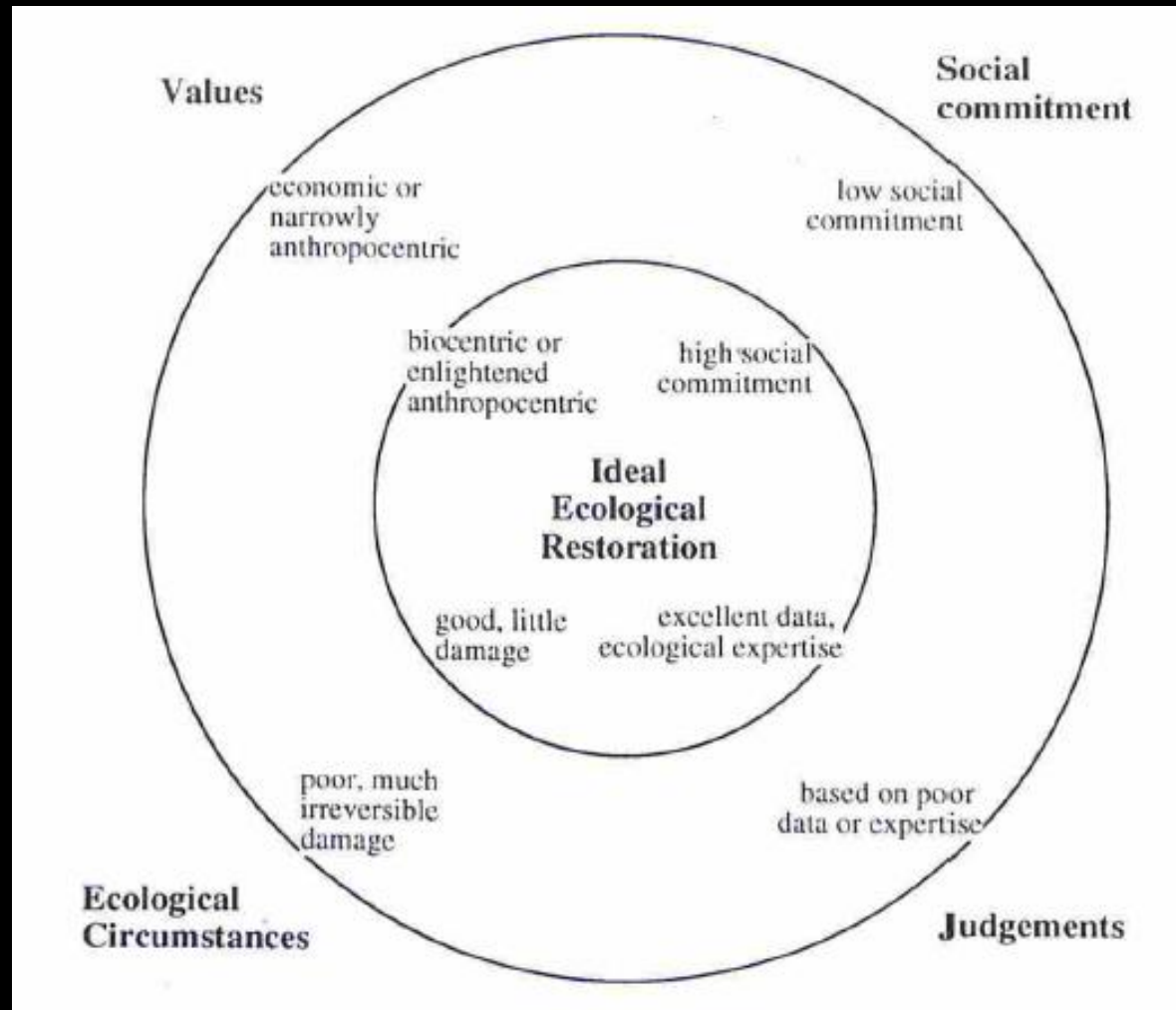


Changing definitions

- “Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed”
(SER 2002; Martin 2017)

At the same time, restoration ecology is a subject of skepticism. The discipline of restoration ecology has grown astoundingly in the past decades, providing new ideas and opportunities (Choi 2004; Davis & Slobodkin 2004a, 2004b). It has been regarded as a new strategy for conserving biological diversity (Jordan et al. 1988) and ecosystem integrity (Cairns & Heckman 1996), a litmus test for applicability of ecological theories to practice (Bradshaw 1983, 1987, 2002), and a hope for the future (Dobson et al. 1997). It is also a response to certain irreplaceable losses (e.g., keystone species).

Choi 2007. *Restoration Ecology*



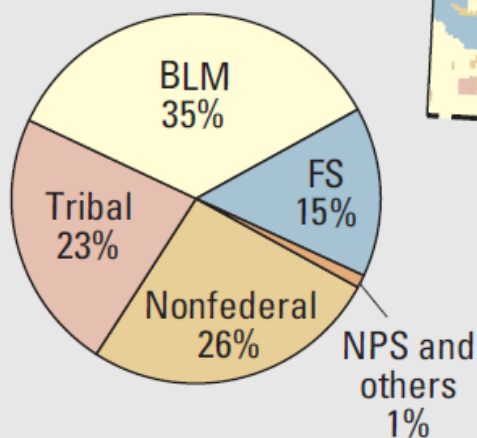
Jackson et al. 1995. *Restoration Ecology*

The Colorado Plateau today

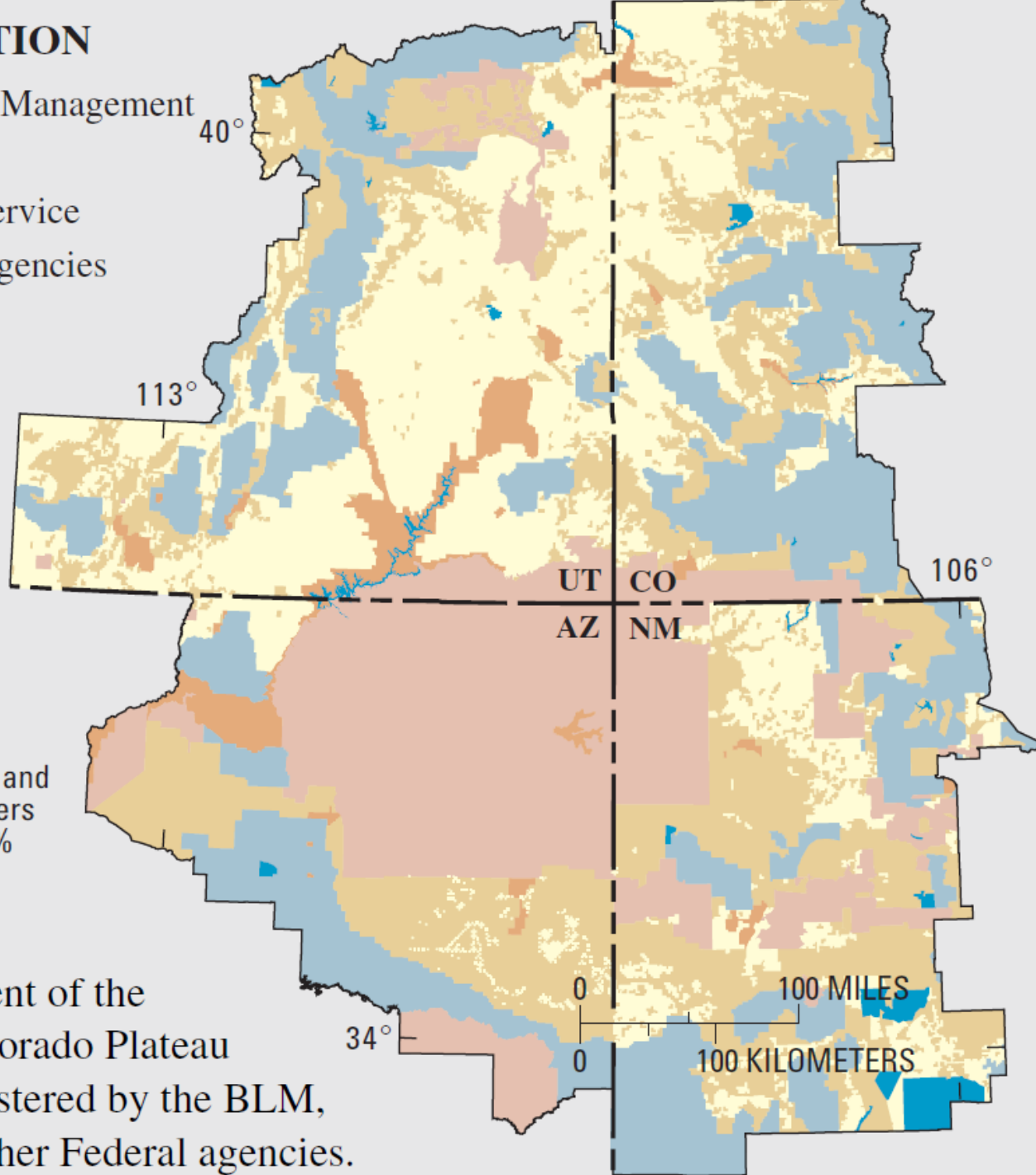
- 340,000 km²
- Multiple agencies
- Novel changes on CP, aridification and land-use interactions, impacting local economies (Copeland et al. 2017)



EXPLANATION



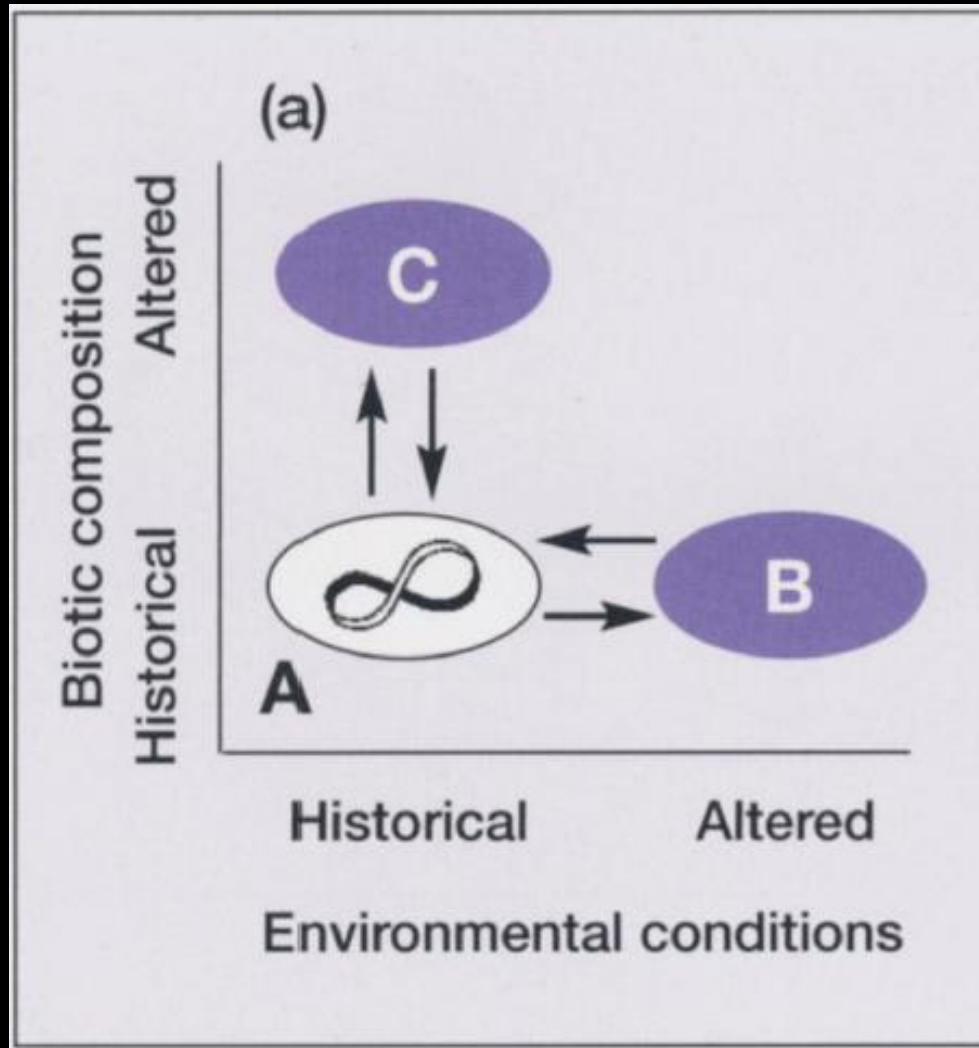
About 50 percent of the surface of the Colorado Plateau Region is administered by the BLM, USFS, NPS, or other Federal agencies.



CP unknowns/
research needs

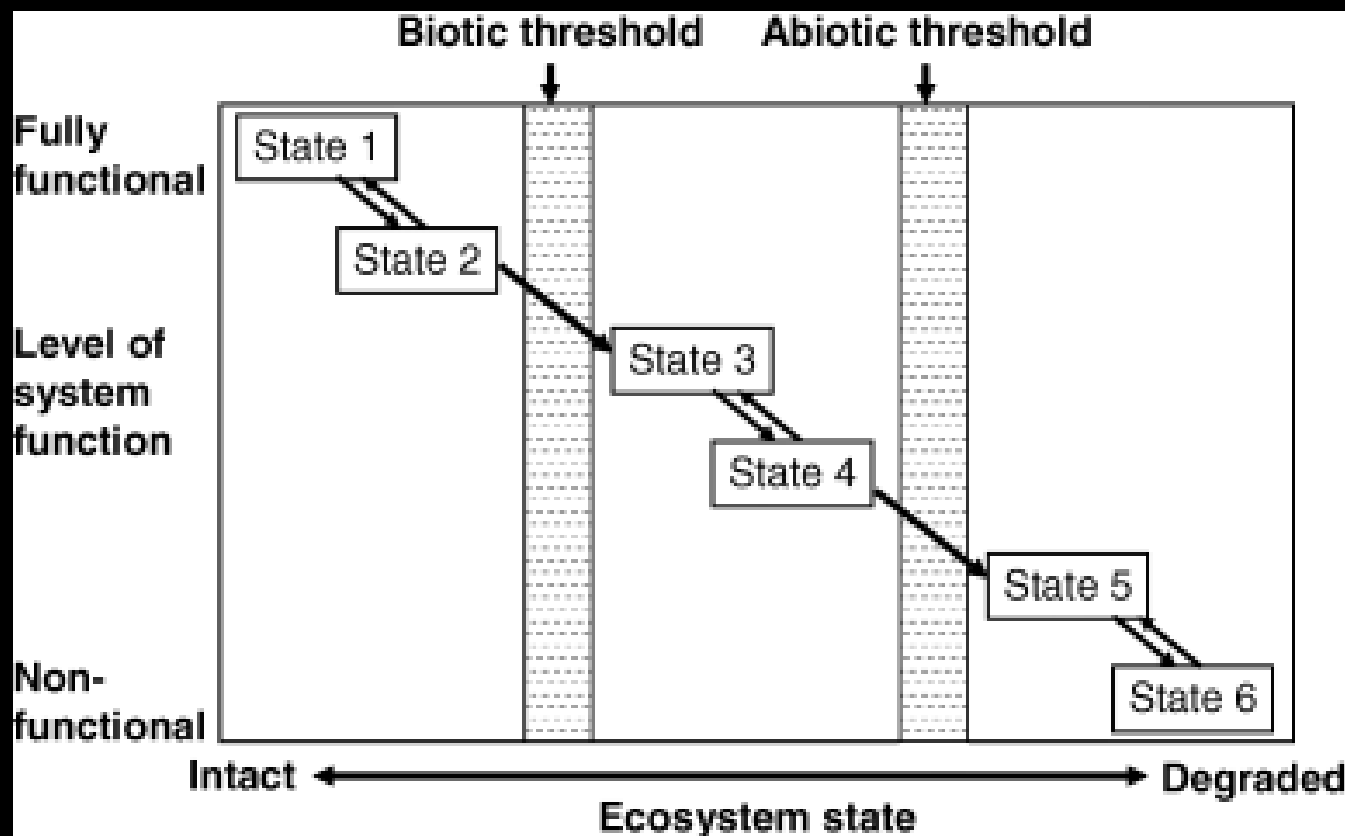
- Biocrusts
- Salvaging topsoil
- Seed banks
- Varying agency needs
- Dynamics of pulse-driven system
- Futures...

Novel ecosystems and a changing climate



Seastedt et al. 2008. *Frontiers in Eco Environ*

Climate change/land use leads to novel systems?



Hobbs 2007. *Restoration Ecology*

- Little is known about what thresholds are
- Can we move from state 3 to state 2?
- State 6 to state 1?

Let's get local!

We're getting local by:

- utilizing genomics to identify suitable seed (Havens et al. 2015)
- Testing native responses to simulated change (Butterfield and Wood 2016, Hoover et al. 2015, 2017)
- Considering alternative states (Butterfield et al. 2017, Doherty et al. 2017)
- Identifying local stakeholders needs/wants (Peppin et al. 2010)
- BLM priority: **Work with partners to develop and implement priority habitat monitoring and improvement projects**



Values and objectives

- Social and cultural objectives are important to consider
- Application of successful methods need practice to test effectiveness
 - Seedbed modification on oil pads (Eldridge et al. 2012)
 - Con-mods as seed traps/nurses (Fick et al. 2016)
- Cooperative, large-scale restoration is near
 - Colorado Plateau Native Plant Program exists as a potential “boundary-spanner”
 - **Functioning native plant materials market to meet policy needs is underway!**



Poster session tonight!

Jessica DaBell et al. - Data Synthesis for Restoration Practitioners and Ecologists: Preliminary Plant Trait Database

Winkler et al. - Useable Science for Restoring Drylands: Synthesizing What is Already Known to Facilitate Applied Research on the Colorado Plateau

What is the biggest challenge to achieving restoration success on the Colorado Plateau?

Thank you! Daniel Winkler * dwinkler@usgs.gov

