Sustain What? Regime Change for New Mexico Watersheds

Melinda Harm Benson
Geography & Environmental Studies
University of New Mexico

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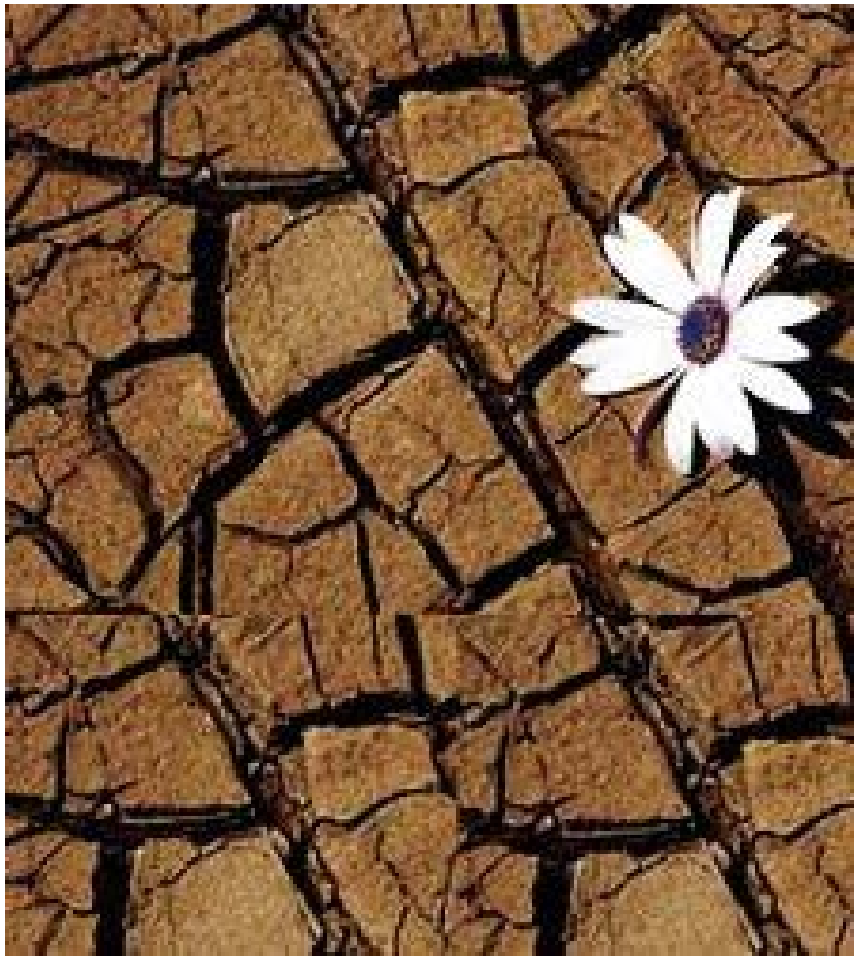
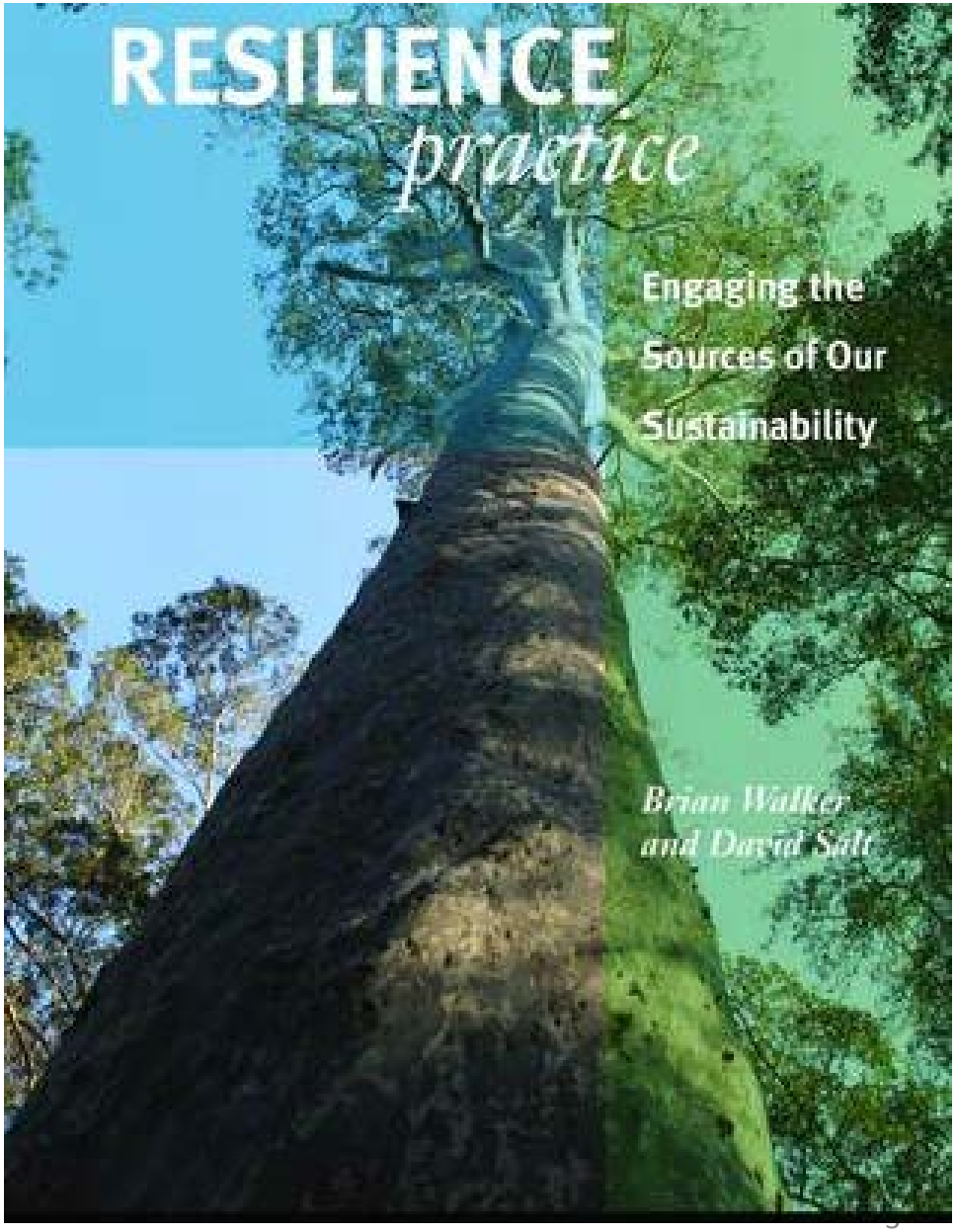
Overview

- Resilience
- Transformation
- Resilience v. Sustainability
- Example: New Mexico Forests

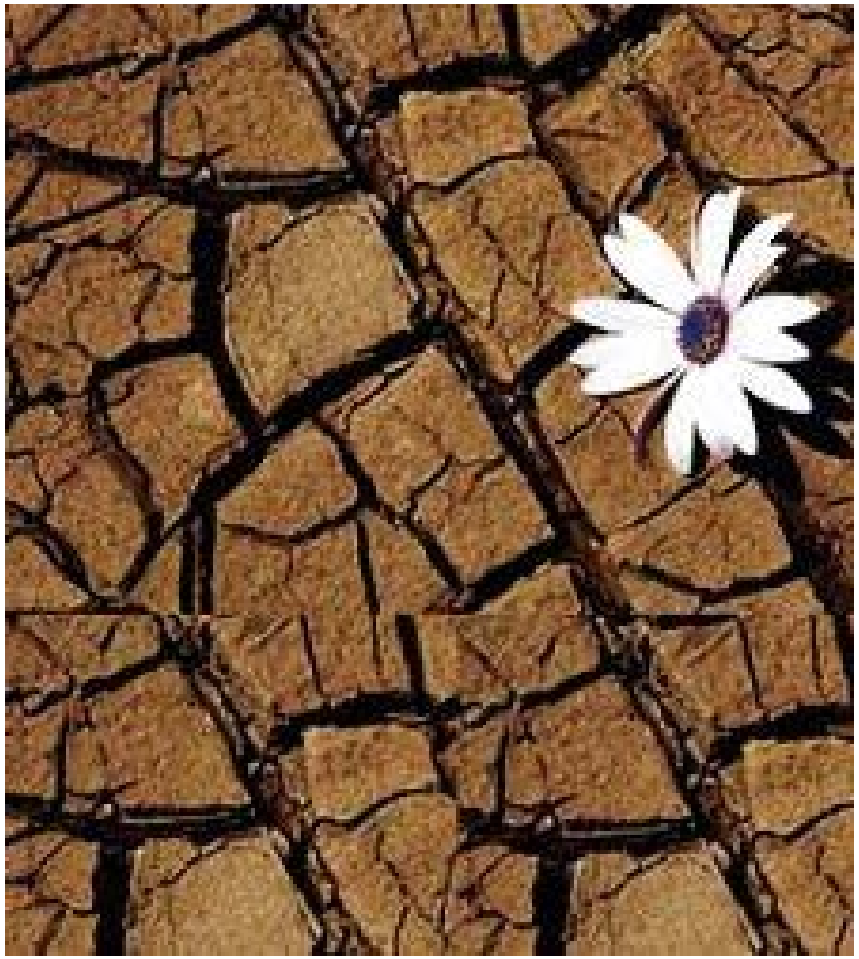


The capacity of a system to absorb a spectrum of disturbances and reorganize so as to retain essentially the same function, structure, and feedbacks—to have the same identity (Walker and Salt 2012).



Transformability

- The capacity to reconceptualize and create a fundamentally new system with different characteristics (Walker and Salt 2012)

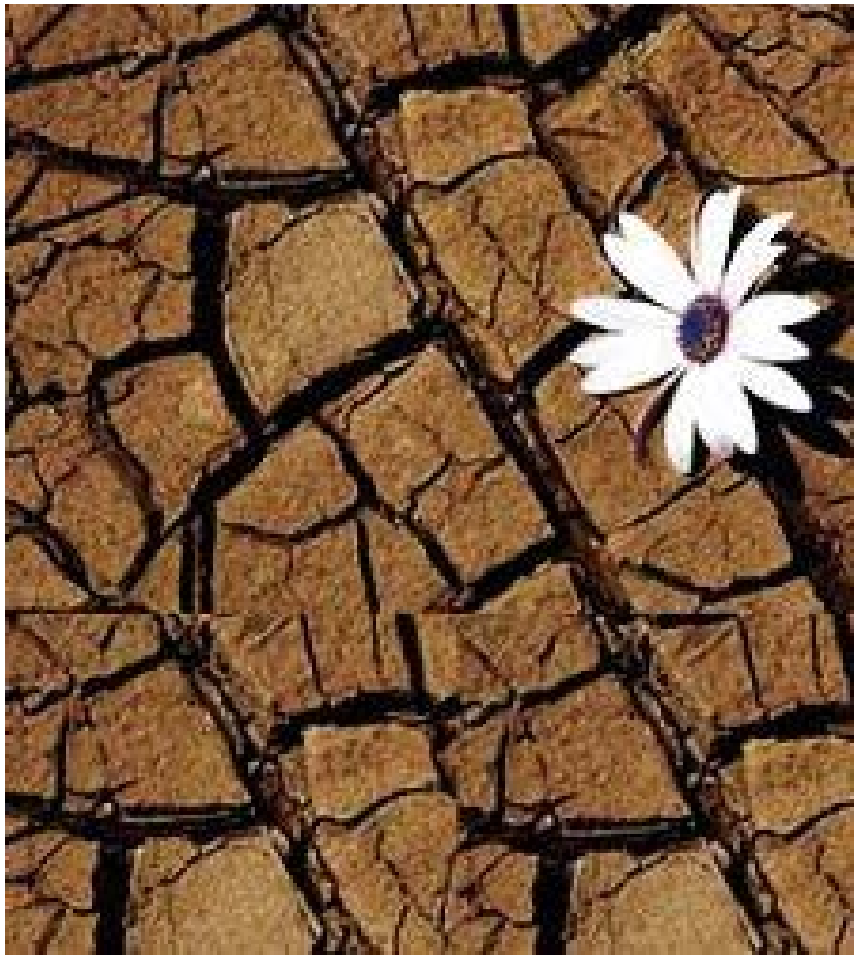


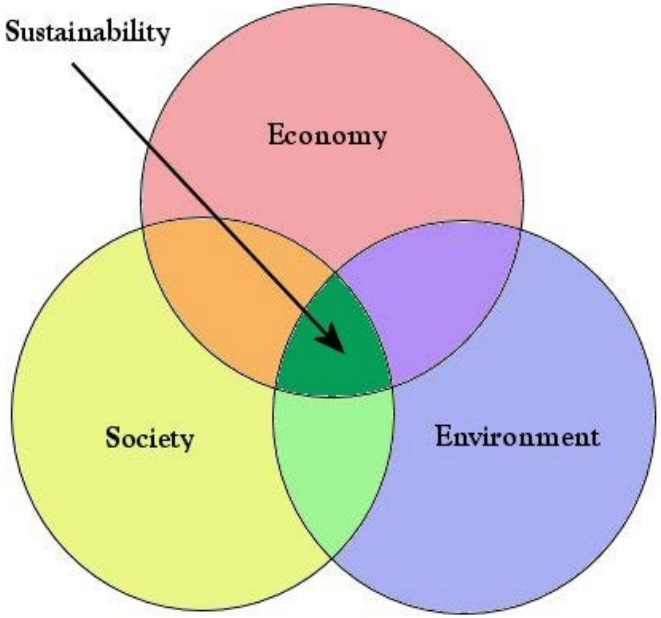
Elements for Transformation

- Preparedness to change (as opposed to state of denial)
- Having the options for change (possible new trajectories)
- The capacity to change (ability to make choices among trajectories)

Resilience v. Sustainability

"sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."




Sustainability
Economy
Society
Environment


SUSTAINABILITY
ENVIRONMENTAL
SOCIAL
ECONOMIC


RIO+20

"if current patterns of production and consumption of natural resources prevail and cannot be reversed and 'decoupled,' then governments will preside over unprecedented levels of damage and degradation"

-- U.N. Environment Programme Global, Environmental Outlook 5

Benson and Craig (2014)

- Sustainability goals for natural resources & the environment are based on an assumption of stationarity.
- Climate change is eliminating our ability to rely on stationarity.
- Therefore, we need a new paradigm for a world of continual change.

New Mexico Forest Systems

- Drought
- Bark Beetle
- Wildfire

ARTICLES
PUBLISHED ONLINE: 30 SEPTEMBER 2012 | DOI: 10.1038/NCLIMATE1693
nature climate change

Temperature as a potent driver of regional forest drought stress and tree mortality

A. Park Williams[1]*, Craig D. Allen[2], Alison K. Macalady[3,4], Daniel Griffin[3,4], Connie A. Woodhouse[3,4], David M. Meko[4], Thomas W. Swetnam[4], Sara A. Rauscher[5], Richard Seager[6], Henri D. Grissino-Mayer[7], Jeffrey S. Dean[4], Edward R. Cook[6], Chandana Gangodagamage[1], Michael Cai[8] and Nate G. McDowell[1]

As the climate changes, drought may reduce tree productivity and survival across many forest ecosystems; however, the relative influence of specific climate parameters on forest decline is poorly understood. We derive a forest drought-stress index (FDSI) for the southwestern United States using a comprehensive tree-ring data set representing AD 1000–2007. The FDSI is approximately equally influenced by the warm-season vapour-pressure deficit (largely controlled by temperature) and cold-season precipitation, together explaining 82% of the FDSI variability. Correspondence between the FDSI and measures of forest productivity, mortality, bark-beetle outbreak and wildfire validate the FDSI as a holistic forest-vigour indicator. If the vapour-pressure deficit continues increasing as projected by climate models, the mean forest drought-stress by the 2050s will exceed that of the most severe droughts in the past 1,000 years. Collectively, the results foreshadow twenty-first-century changes in forest structures and compositions, with transition of forests in the southwestern United States, and perhaps water-limited forests globally, towards distributions unfamiliar to modern civilization.

New Mexico's Top 10 by acres burned.

Rank	Name	Start	Acres
1	Whitewater-Baldy	05/09/12	297,845
2	Las Conchas	06/26/11	156,593
3	Donaldson	06/28/11	101,563
4	Dry Lakes	5/30/03	94,580
5	Pasco	06/10/09	93,029
6	McDonald	3/12/06	92,390
7	Ponil	6/2/02	92,194
8	Miller	04/28/11	88,835
9	Black Range Complex	5/28/05	80,502
10	Stiles Complex	03/14/08	67,008

Let’s keep going, the rest of the Top 20.

Rank	Name	Start	Acres
11	Enterprise	02/27/11	64,936
12	Peppin	5/15/04	64,488
13	Boiler	4/17/03	58,413
14	Cato	06/10/09	55,080
15	Last Chance	04/24/11	53,342
16	Bear	6/19/06	51,307
17	Grande Complex	3/7/00	50,000
18	Rocky	06/18/08	49,132
19	McKnight	4/15/51	48,052
20	Cerro Grande	5/5/00	47,650

Las Conchas fire, Sunday, June 26, 3 PM
(Cliff Dahm: view from Placitas)

- Started June 26, 2011
- Tree fell on a power line
- Burned 43,000 acres on day 1
- 156,593 acres total
- Destroyed 63 residences
- Threatened LANL

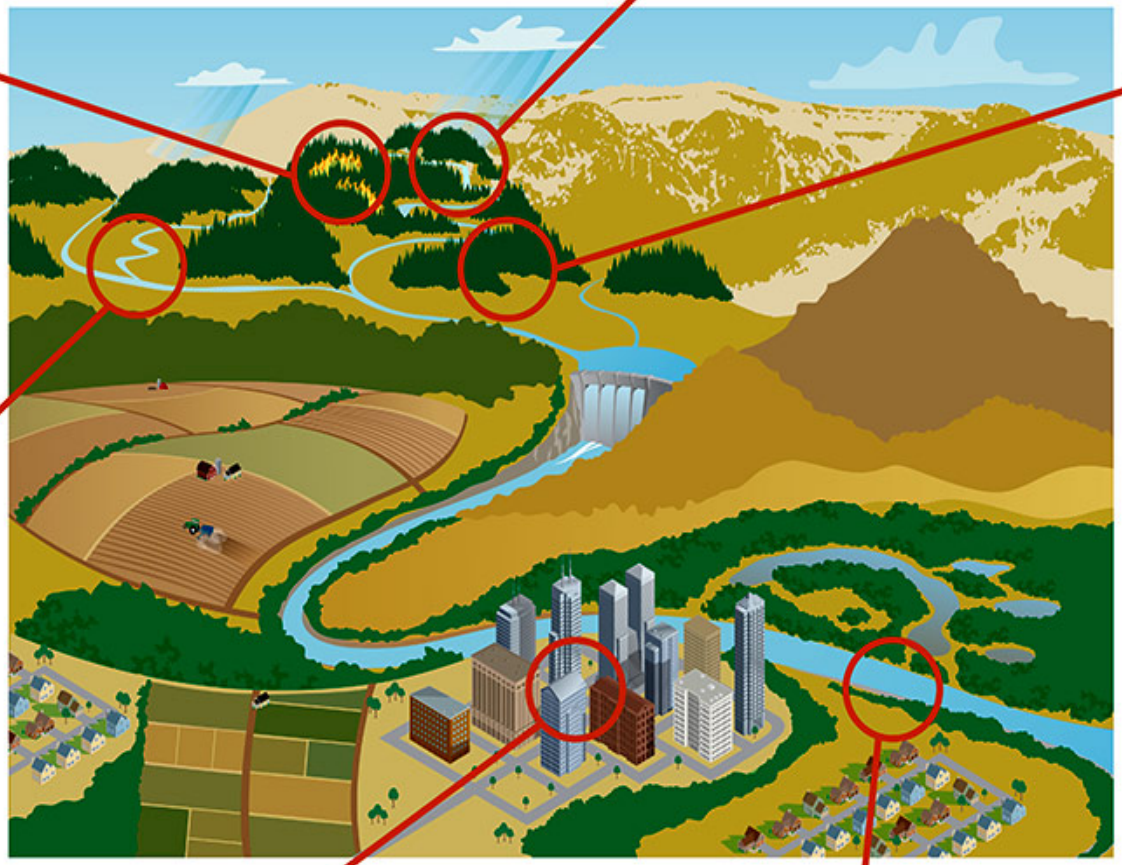
High-severity burn – Las Conchas

Sterilized and Hydrophobic Soils – Las Conchas Fire


Post Fire Floods – Las Conchas Fire
Indios Creek, 1 PM, July 29, 2011

New Mexico | Rio Grande Water Fund

Restoring essential forested lands upstream will ensure a continuous supply of clean water downstream



Healthy forests store more snowpack and release more water to streams, leading to **more resilient forests** and possibly increased stream flows.

Frequent, **high-severity wildfires and subsequent post-fire flooding** increasingly threaten the Rio Grande's water security and cause extensive soil erosion and debris flows that degrade water quality for communities downstream.

A sustainable supply of trees removed by forest thinning could be used to generate electricity, heat buildings and produce liquid fuels–**creating new jobs and uses** for New Mexico's abundant, overgrown trees.

Healthy forests and streams provide **habitat for fish and wildlife** and protect them from damaging wildfire, flooding and ash-flows that often follow high-severity burns.

Learn More or Donate

Laura McCarthy
Director of Conservation
lmccarthy@tnc.org
(505) 946-2024

Jacquelyn Hall
Philanthropy Director
jacquelyn_hall@tnc.org
(505) 946-2021

nature.org/riogrande

The Rio Grande and its tributaries **supply water to nearly half of New Mexico's population**, including Albuquerque, Santa Fe, Pueblos and other communities.

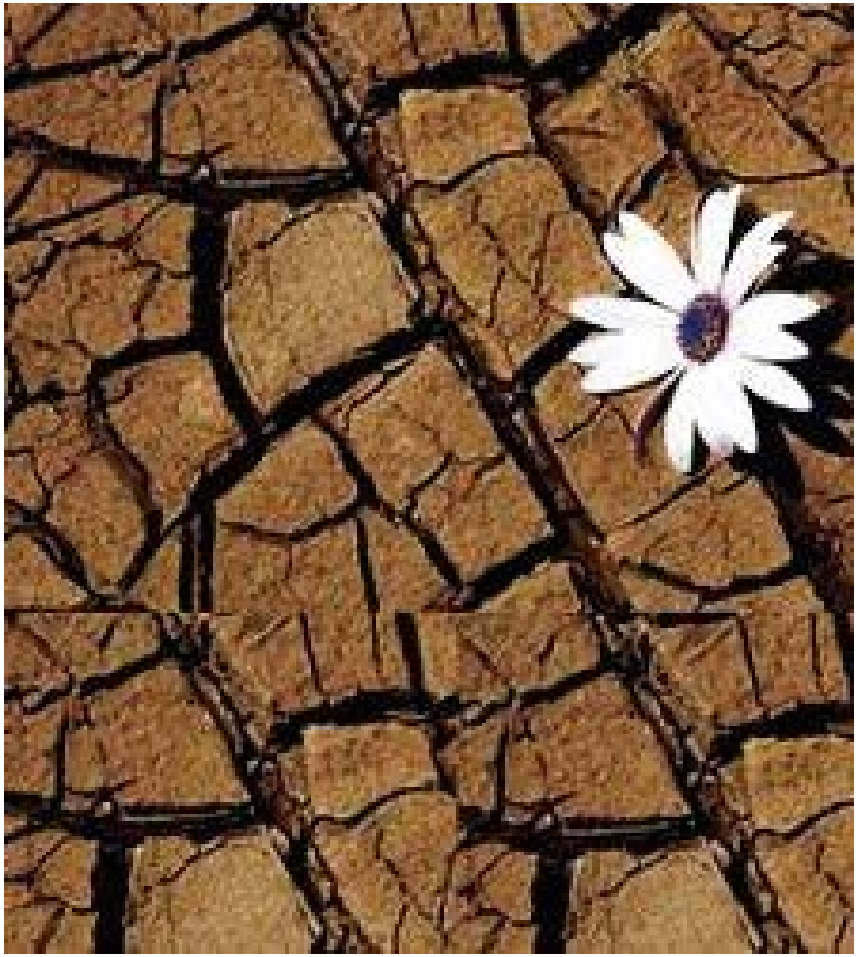
Healthy and scenic rivers, forests and mountains benefit New Mexico's **tourism and recreation economy** by attracting visitors who seek to experience the state's beautiful outdoors.

The Nature Conservancy
Protecting nature. Preserving life.™

RIO GRANDE WATER FUND
A Wildfire and Water Source Protection Project

Transformational Change?

- Preparedness to change or denial?
- Options for change? New Trajectories?
- Capacity to change? Choice?



Contact

- Melinda Harm Benson
  Associate Professor
  Department of Geography & Environmental Studies
  University of New Mexico
  mhbenson@unm.edu

- **View my research on my SSRN Author page: http://ssrn.com/author=1225638**

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National Science Foundation
WHERE DISCOVERIES BEGIN

References

- Benson, M.H. and R.K. Craig. 2014 “The end of sustainability,” Society & Natural Resources: An International Journal, 27:7, 777-782, http://dx.doi.org/10.1080/08941920.2014.901467
- Folke C., J. Colding, and F. Berkes, 2002. Building resilience for adaptive capacity in social-ecological systems. In: Berkes F., J. Colding, and C. Folke (eds). Navigating Social-Ecological Systems: Building Resilience for Complexity and Change. Cambridge University Press, Cambridge, UK.
- Milly, P. C. D. *et al*. 2008. “Stationarity Is Dead: Whither Water Management?” *Science.* 319: 573–574.
- Walker B. and D. Salt. 2012. *Resilience Practice* (Island Press).