What's data got to do with it? *Connecting the dots between research and practical applications*

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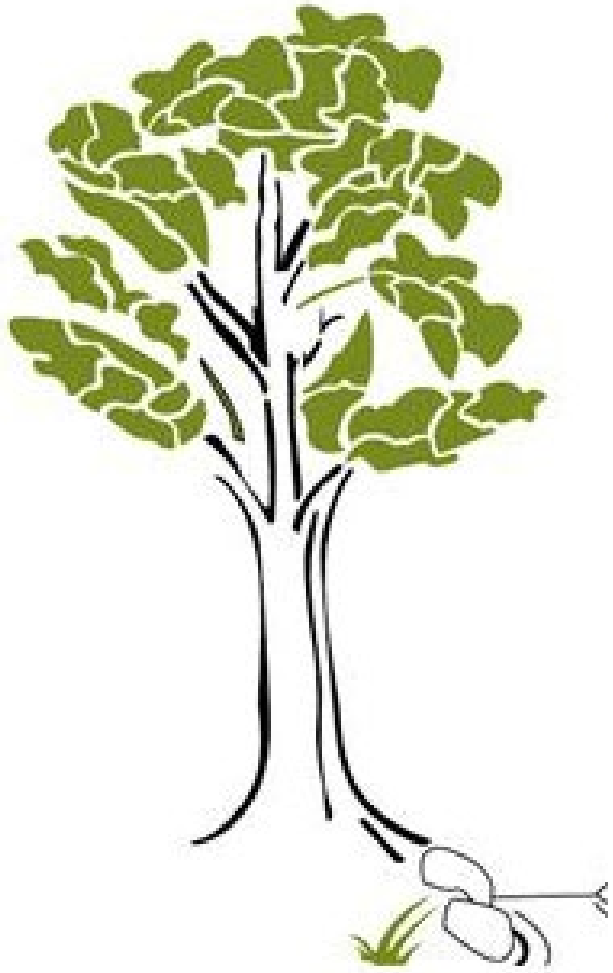
First, acknowledgements

The Sher Lab

Dr. Eduardo González

Thank You!


NATIONAL SCIENCE FOUNDATION
RiversEdge West
RESTORE + CONNECT + INNOVATE
DOLORES RIVER RESTORATION PARTNERSHIP
A PUBLIC - PRIVATE COLLABORATION
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Colorado State FOREST SERVICE
The Nature Conservancy
Protecting nature. Preserving life.
MARIE CURIE ACTIONS
SEVENTH FRAMEWORK PROGRAMME
USGS
DENVER BOTANIC GARDENS
U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR
NRCS



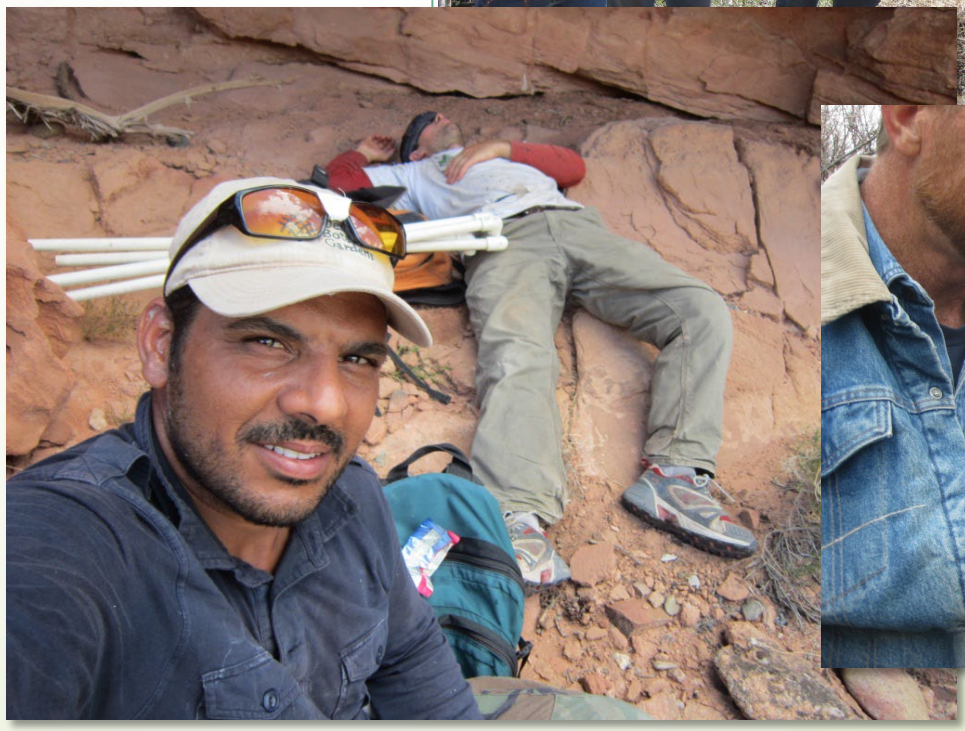
RiversEdge West

RESTORE + CONNECT + INNOVATE

How do you identify?

- Student?
- Researcher?
- Land or Resource Manager?
- Multiple roles?
- Something else?

Please introduce yourself to someone new, particularly someone with a different "conference identity"



The goals of this talk

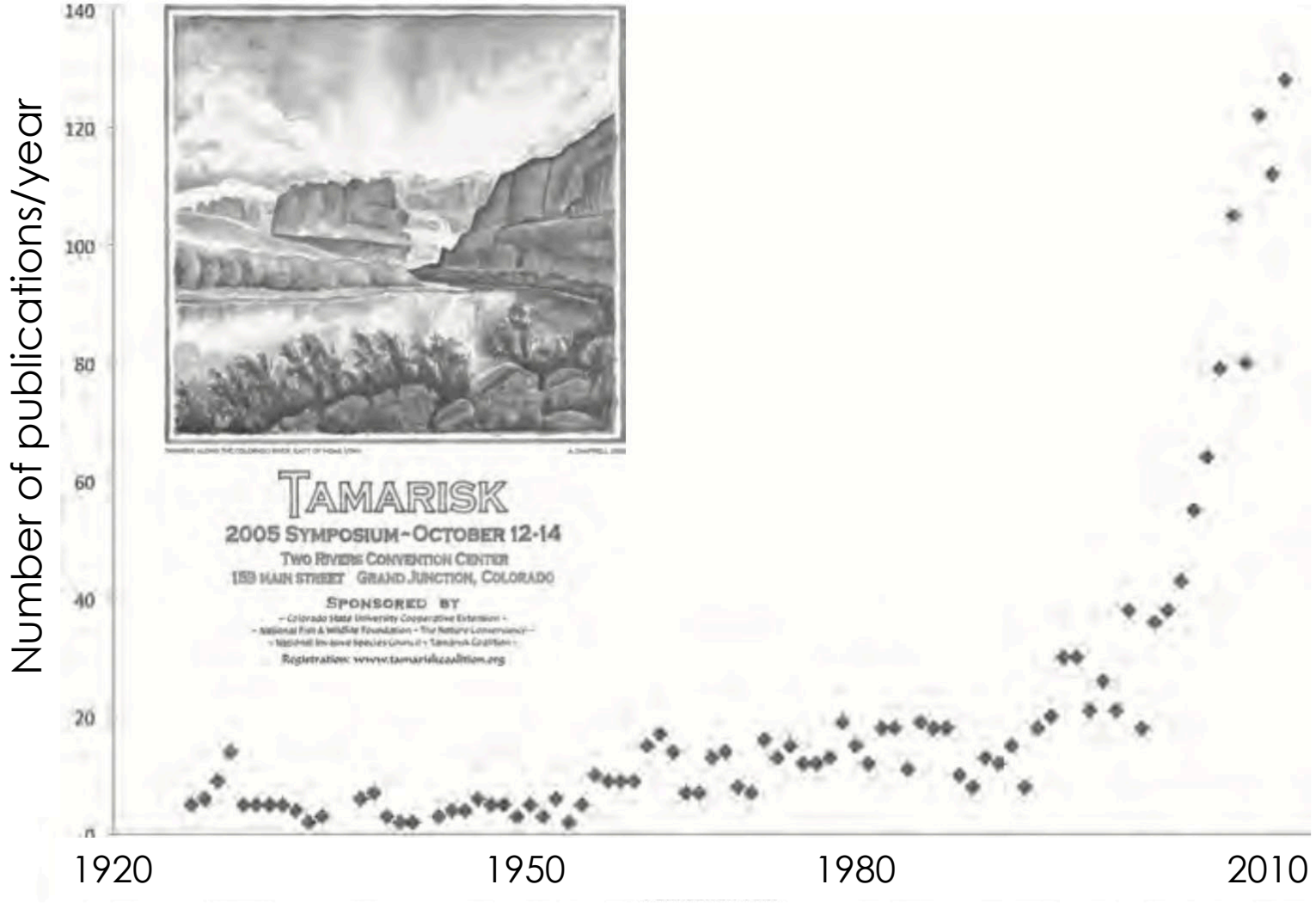
- Get to know each other better
- Illustrate how we evaluate what we know
- Reflect on specific learnings regarding the human element
- Get you excited about this conference!

We all have been collecting data for a long time…

… mostly so that the data can be used to improve practices!

- From: Sher, A. Introduction to the Paradox Plant. 2013. P 1-20 in *Tamarix*: A Case Study of Ecological Change in the American West. A. Sher and M. F. Quigley, eds. Oxford University Press.

Introduction to the Paradox Plant



Bias is real

Hence, the need for:

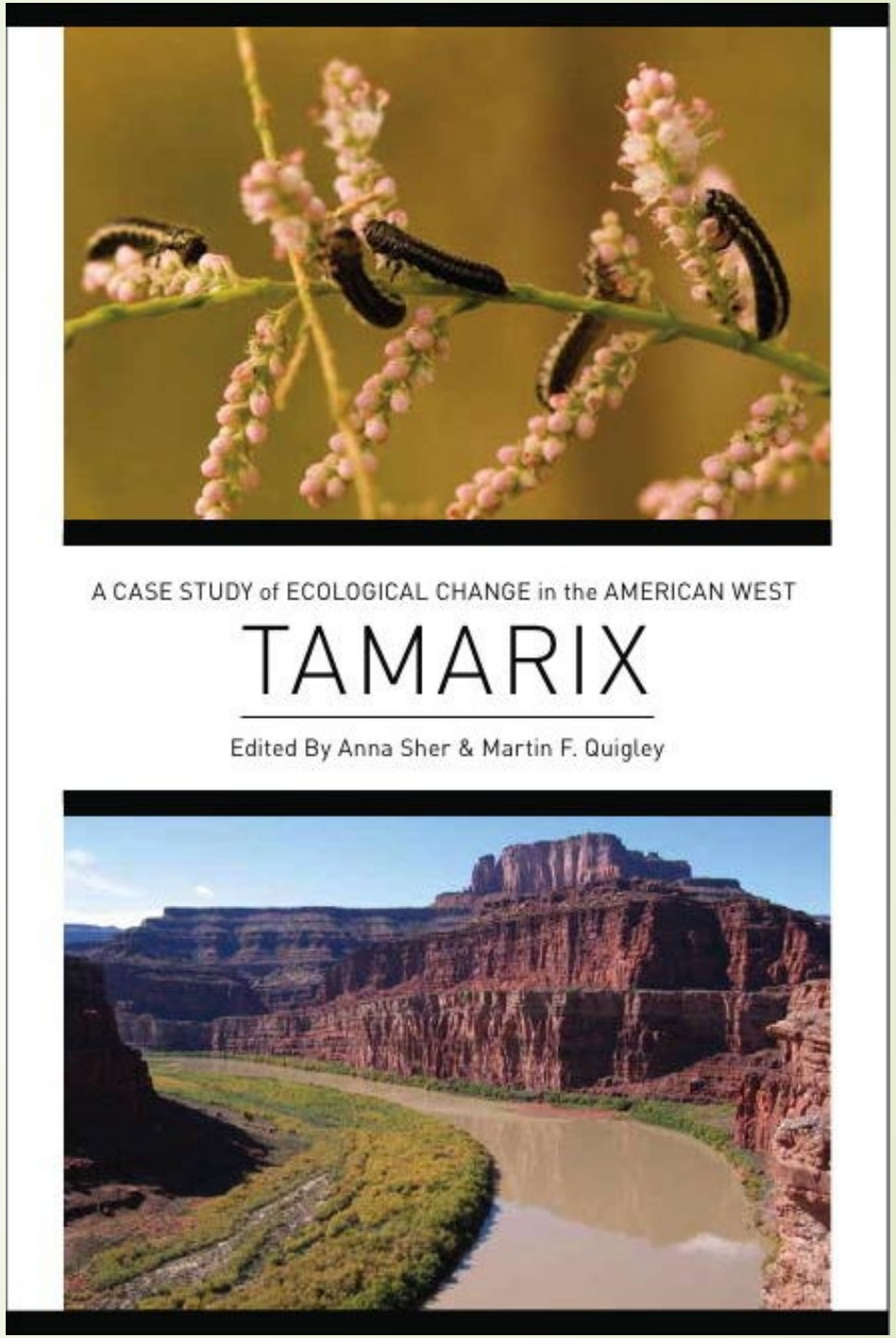
- Good science practice
- Listening to others with different experiences & backgrounds
- Objective ways to summarize findings

How do we summarize findings?

…especially when they are contradictory?

Method 1: Literature review

Tamarix Book



40 experts on:
- Biology
- Ecology
- Management
- And more!

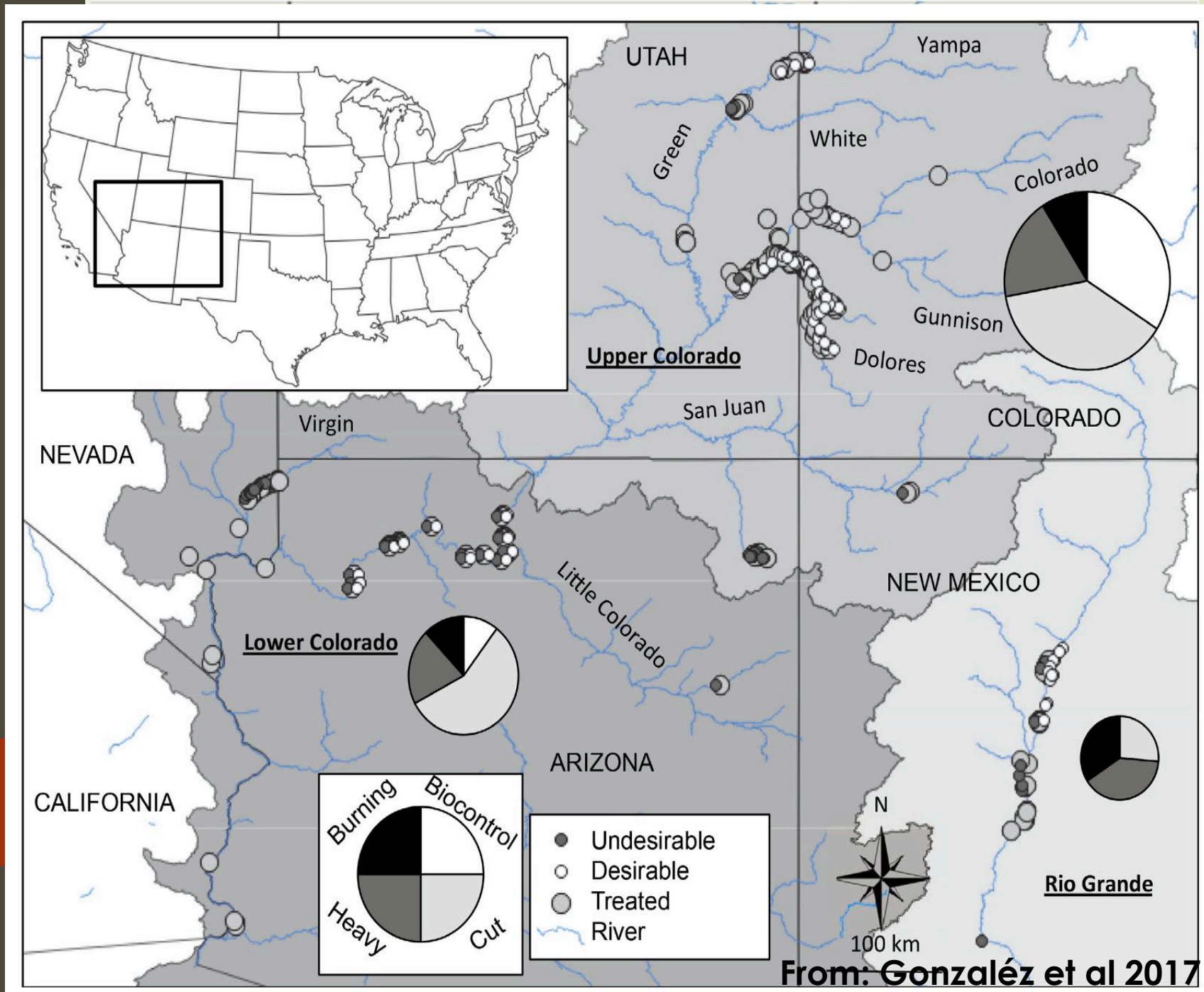
2013 Oxford University Press

limitations of traditional literature review

- Difficult to be objective
- How to weigh conflicting findings?

Method #2: analyze all the data together

"Chorus Data"



From: Gonzaléz et al 2017

Ecological Applications, 27(6), 2017, pp. 1789–1804

Vegetation response to invasive *Tamarix* control in southwestern U.S. rivers: a collaborative study including 416 sites

Eduardo González,[1,2] Anna A. Sher,[2,18] Robert M. Anderson,[2] Robin F. Bay,[2] Daniel W. Bean,[3] Gabriel J. Bissonnete,[4] Bérenger Bourgeois,[5,6] David J. Cooper,[7] Kara Dohrenwend,[8] Kim D. Eichhorst,[9] Hisham El Waer,[2] Deborah K. Kennard,[10] Rebecca Harms-Weissinger,[11] Annie L. Henry,[2] Lori J. Makarick,[12,17] Steven M. Ostoja,[13] Lindsay V. Reynolds,[14] W. Wright Robinson,[15] and Patrick B. Shafroth[16]

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[2]*Department of Biological Sciences, University of Denver, F. W. Olin Hall, 2190 E Iliff Avenue, Denver, Colorado 80208 USA*
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[4]*U.S. Bureau of Land Management, 82 East Dogwood, Moab, Utah 84532 USA*
[5]*Département de Phytologie, Faculté des Sciences de l'Agriculture et de l'Alimentation, Université Laval, 2425 rue de l'agriculture, Quebec City, Quebec G1V 0A6 Canada*
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[7]*Department of Forest and Rangeland Stewardship, Colorado State University, Fort Collins, Colorado 80523 USA*
[8]*Rim to Rim Restoration, P.O. Box 297, Moab, Utah 84532 USA*
[9]*Department of Biology, Bosque Ecosystem Monitoring Program (BEMP), University of New Mexico, MSC 03 2020, Albuquerque, New Mexico 87131 USA*
[10]*Department of Physical and Environmental Sciences, Colorado Mesa University, Grand Junction, Colorado 81501 USA*
[11]*Northern Colorado Plateau Network, National Park Service, Moab, Utah 84532 USA*
[12]*Grand Canyon National Park, 1824 S, Thompson Street, Suite 200, Flagstaff, Arizona 86001 USA*
[13]*USDA California Climate Hub, Agricultural Research Service, University of California, Davis, California 95616 USA*
[14]*Department of Biology, Colorado State University, Fort Collins, Colorado 80523 USA*
[15]*Grand County Weed Department, 125 East Center Street, Moab, Utah 84532 USA*
[16]*U.S. Geological Survey, Fort Collins Science Center, 2150 Centre Avenue, Building C, Fort Collins, Colorado 80526 USA*

Conservation 213:100-114.González E.*, **A.A. Sher**, and 17 others. 2017. Vegetation Response to Control of Invasive *Tamarix* in Southwestern US Rivers: A Collaborative Study Including 416 Sites. Ecological Applications. DOI: 10.1002/eap.1566

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sturbance. Biological

Limitations of analyzing the data together

- Treats all measurements the same
- Aren't using the individual study's "controls"
- Could over or under-estimate impact

Method #3: Meta-analysis

- A way to summarize data, by taking into account:
  - How big the effect was of the treatment
  - How rigorous the study was

The latest from the Sher Lab:

NeoBiota 91: 67–98 (2024)
doi: 10.3897/neobiota.91.111628
https://neobiota.pensoft.net

REVIEW ARTICLE

A peer-reviewed open-access journal
NeoBiota
Advancing research on alien species and biological invasions

Outcomes of control and monitoring of a widespread riparian invader (*Tamarix* spp.): a comparison of synthesis approaches

Alexander R. B. Goetz[1,2], Eduardo González-Sargas[3,4], Mayra C. Vidal[5], Patrick B. Shafroth[4], Annie L. Henry[1], Anna A. Sher[1]

1 *Department of Biological Sciences, University of Denver, Denver, CO, USA* **2** *Current affiliation: Department of Ecology and Evolutionary Biology, University of California, Los Angeles, CA, USA* **3** *Department of Biology, Colorado State University, Fort Collins, CO, USA* **4** *U.S. Geological Survey, Fort Collins Science Center, Fort Collins, CO, USA* **5** *Department of Biology, University of Massachusetts Boston, Boston, MA, USA*

Corresponding author: Alexander R. B. Goetz (arbgoetz@ucla.edu)

Meta-analysis: How has the ecosystem responded to removal of *Tamarix* throughout the Southwest?

- Search of all papers published on this
  - 266 papers-->52 papers
    - Must have sample size, a control, effect size, variance
  - N=777 effect sizes

Goetz, A. R.*, González-Sargas, E., Vidal, M. C., Shafroth, P. B., Henry, A. L.*, Sher, A. A. 2024. Control of invasive *Tamarix* in the American Southwest

Method #4: Automated Content Analysis

- Using AI to summarize themes in published literature
- Ability to review hundreds of papers
- Too soon to report results!

González et al. 2017a, 2017b

Image source: USGS

What have we learned?

Removal efforts do reduce *Tamarix* cover

- Herbicide especially helpful

Overall understory vegetation shows a small improvement

- And increases over time

Fauna are sometimes negatively affected by *Tamarix* removal

- Need more data on non-vegetation responses!

The goals of this talk (revisited)

- Get to know each other better
- Illustrate how we evaluate what we know
- Reflect on specific learnings regarding the human element
- Get you excited about this conference!

Why is this conference so important?

The human element

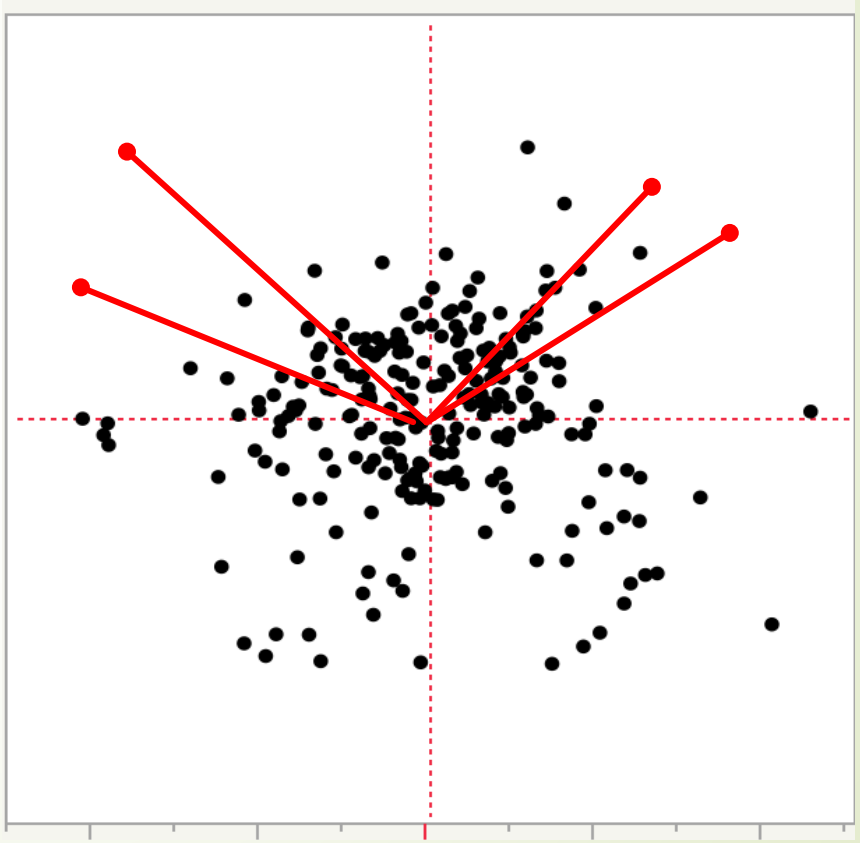
- Are scientists and managers communicating in this system?
- What human behaviors are associated with restoration success?

What is "restoration success"?

Take a moment to ask your new friend what it means to them

What is "restoration success"?

- PCA on difference in measures between:
- "Desirable"
  - Total native cover
  - Understory relative native cover
- "Undesirable"
  - *Tamarix* cover
  - Understory noxious cover

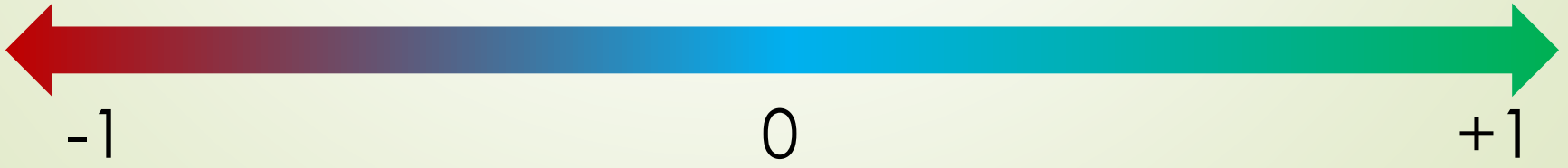


PCA1 explains 76%

PCA1= "success metric"

Increase in *Tamarix* and Noxious Understory

Increase in desirable species



Lisa Clark, MS

Surveys and Interviews covering 80 projects (45 managers)

Variables Measured

Manager Decisions

- Monitoring (types & frequency)
- Information Sources
- Types of goals
  - Plants
  - People
  - Water, Wildlife
- Organization
  - Number of collaborators
  - Employing agency

Manager Characteristics

- Number of management roles
- Manager's highest level of formal education
- Overall experience
- Local experience

Using combinations of these, we could explain as much as 78% of the variability in restoration success!

Wetlands
https://doi.org/10.1007/s13157-020-01370-w

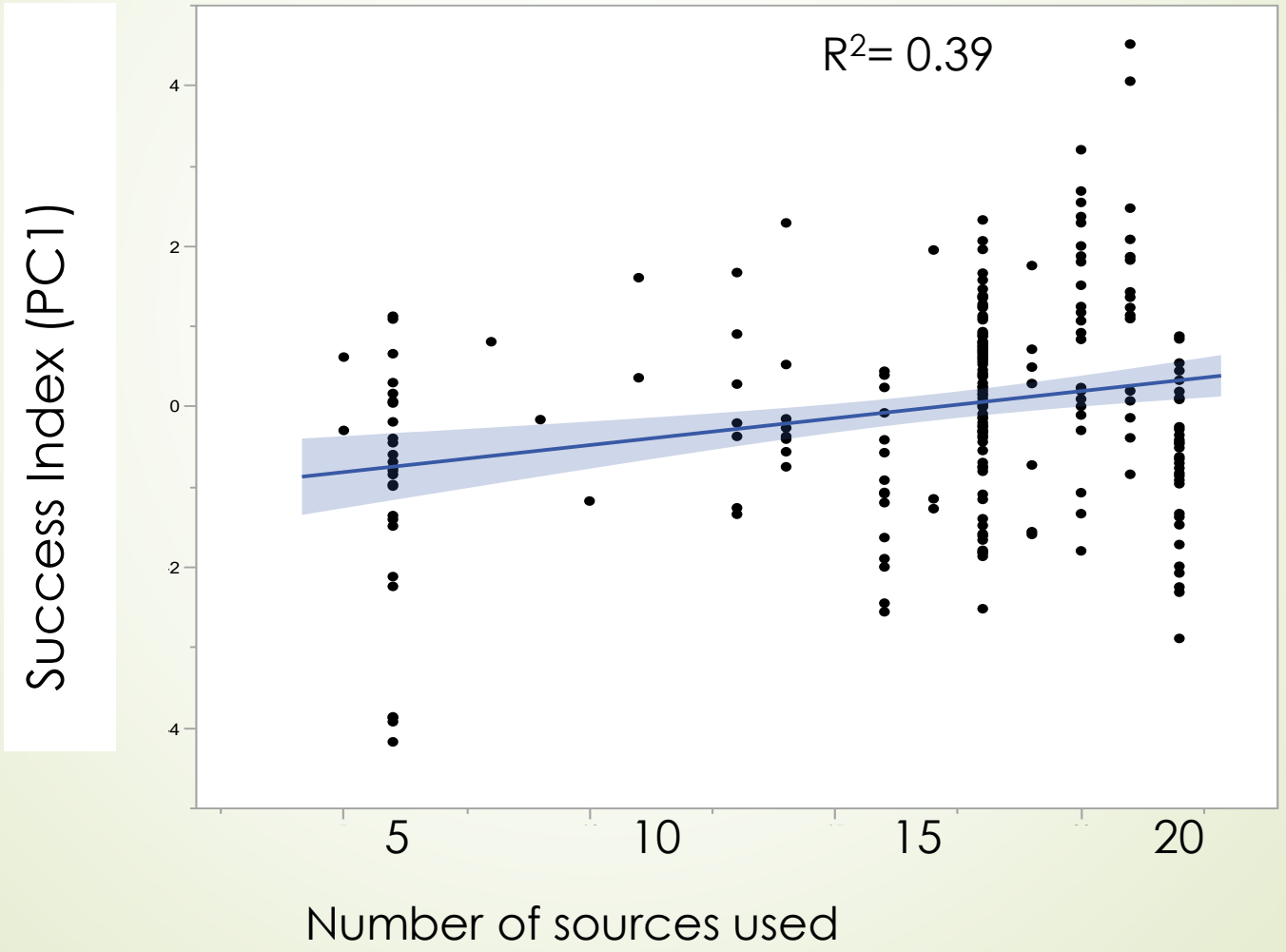
The Human Element of Restoration Success: Manager Characteristics Affect Vegetation Recovery Following Invasive *Tamarix* Control

Anna A. Sher[1] · Lisa Clark[1] · Annie L. Henry[1] · Alexander R. B. Goetz[1] · Eduardo González[2] · Anit Tyagi[1] · Isabelle Simpson[1] · Bérenger Bourgeois[3]

Worse outcomes when the manager had:

- more roles
- a fancier education

More success with more info sources used



More success with more collaborating agencies & organizations (including scientists!)

We also found:

RESTORATION ECOLOGY
The Journal of the Society for Ecological Restoration

SER SOCIETY FOR ECOLOGICAL RESTORATION

RESEARCH ARTICLE

Successful information exchange between restoration science and practice

Lisa B. Clark[1], Annie L. Henry[1], Rebecca Lave[2], Nathan F. Sayre[3], Eduardo González[1,4], Anna A. Sher[5]

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Managers

Scientists

What aspect of riparian restoration needs the help of science right now?

- Consult with your neighbor
- Email it to me: anna.sher@du.edu
- Or send anonymously to:
  - The Menti.com code **8692 5077**

The data show…

- There is good communication between scientists and managers
- This communication matters for restoration outcomes

Why is this conference so important?

Because:

Success happens when we do good science and talk to each other!

What aspect of riparian restoration needs the help of science right now?

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- Email it to me: anna.sher@du.edu
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