

# Planned Shrub Removal Experiments on Instrumented Watersheds: Opportunities for Collaboration

Steve Archer (on behalf of a bunch of others)

School of Natural Resources and the Environment

The University of Arizona

11<sup>th</sup> Annual Research Insights in Semiarid Ecosystems Symposium

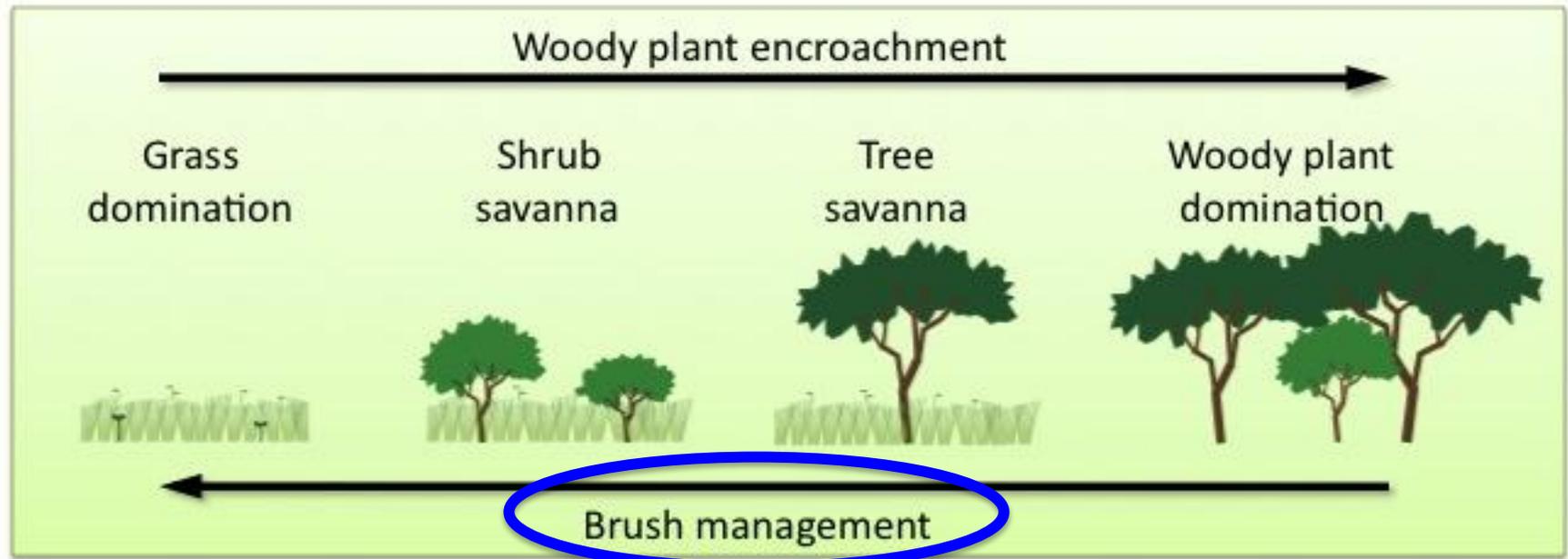
October 17, 2014

## Traditional Considerations

- Livestock production
  - health
  - handling
  - forage production
- Hydrology
  - Stream flow
  - groundwater recharge
- Wildlife
  - game management

## Emerging Considerations

- Primary production
- Land surface-atmosphere interactions
- Carbon sequestration
- Trace gas fluxes
- Biological diversity
- Non-methane hydrocarbon emissions





Brush Management – widely practiced since 1940s:

- Prescribed fire
- Herbicides
- Mechanical treatments
- Biological control (goats, insects)



## Conservation Effects Assessment Project (CEAP)

CEAP is a multi-agency effort to quantify the environmental effects of conservation practices and programs and develop the science base for managing the agricultural landscape for environmental quality. Project findings will be used to guide USDA conservation policy and program development and help conservationists, farmers and ranchers make more informed conservation decisions.

Assessments in CEAP  
**cropland, grazing la**  
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**bibliographies and**  
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data collection, outrea  
CEAP science into pra

### Natural Resources Assessment

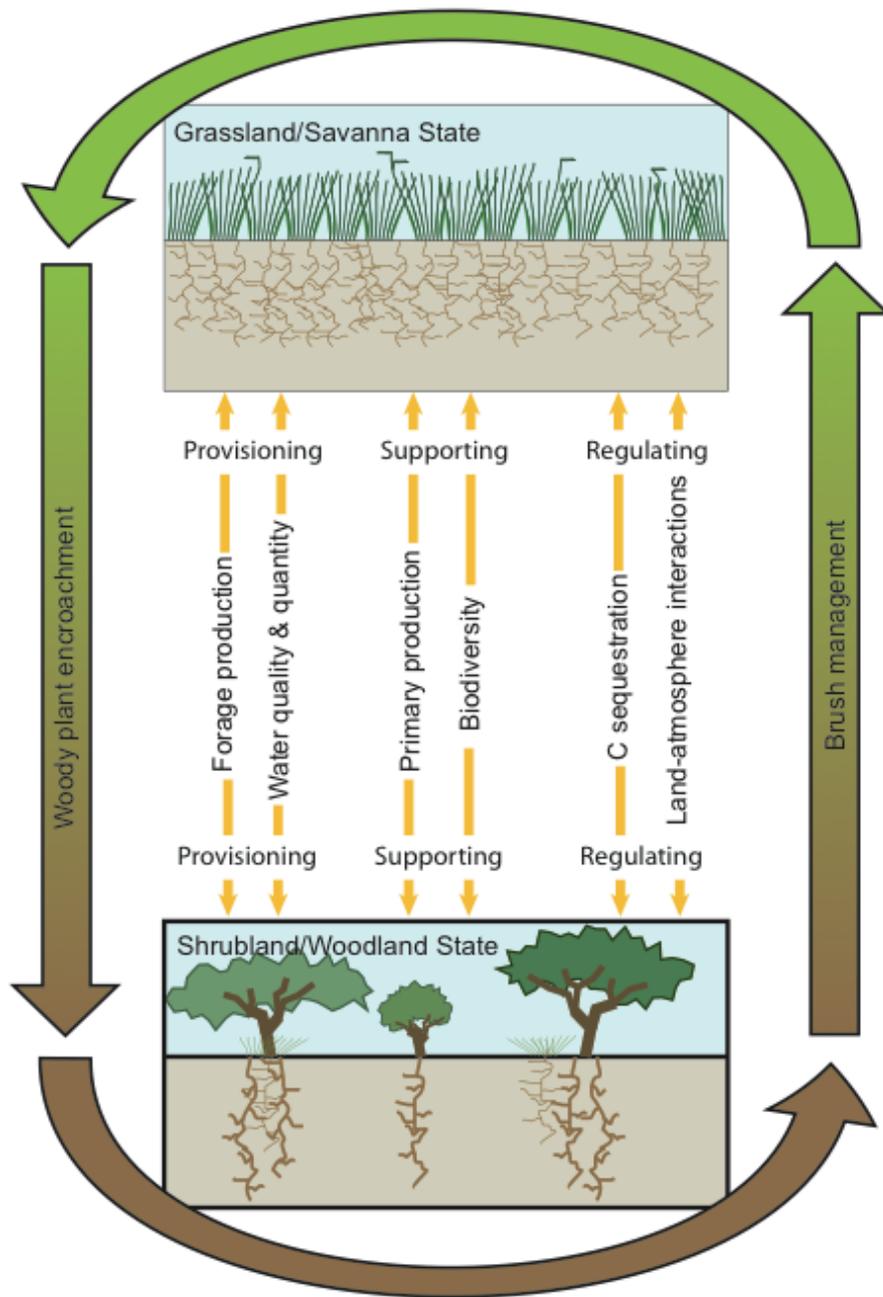
- o Cultural Resources
- o National Resources Inventory
- o Conservation Effects Assessment Project (CEAP)

CHAPTER 3

3

# Brush Management as a Rangeland Conservation Strategy: A Critical Evaluation

Steven R. Archer<sup>1</sup> (lead), Kirk W. Davies<sup>2</sup>, Timothy E. Fulbright<sup>3</sup>, Kirk C. McDaniel<sup>4</sup>,  
Bradford P. Wilcox<sup>5</sup>, and Katharine I. Predick<sup>1</sup>



# **SRER: Uniquely poised to address shrub encroachment – brush management effects on ecosystem services**

1975: Eight experimental watersheds (1.1 to 4.0 ha ) established

- All with 2<sup>nd</sup> and 3<sup>rd</sup> order channel networks
- Elevation range: 970 m to 11160 m = different bioclimatic settings
- Mesquite in 4 watersheds treated in w/ diesel
- Rotational or continuous livestock grazing

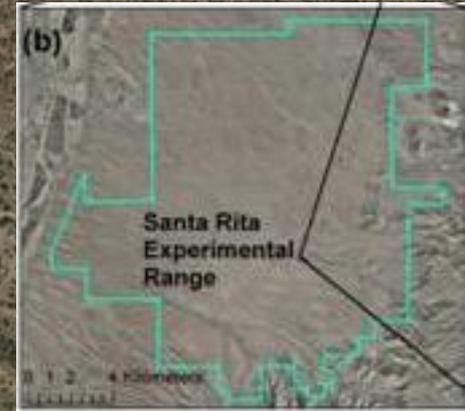
Instrumented for

- Precipitation
- Runoff
- Sediment Yield

Plant cover data 1974-1986

Results summarized in Martin and Morton 1993 & Polyakov et al. 2010

Est. 2004  
Santa Rita Mesquite Flux Tower



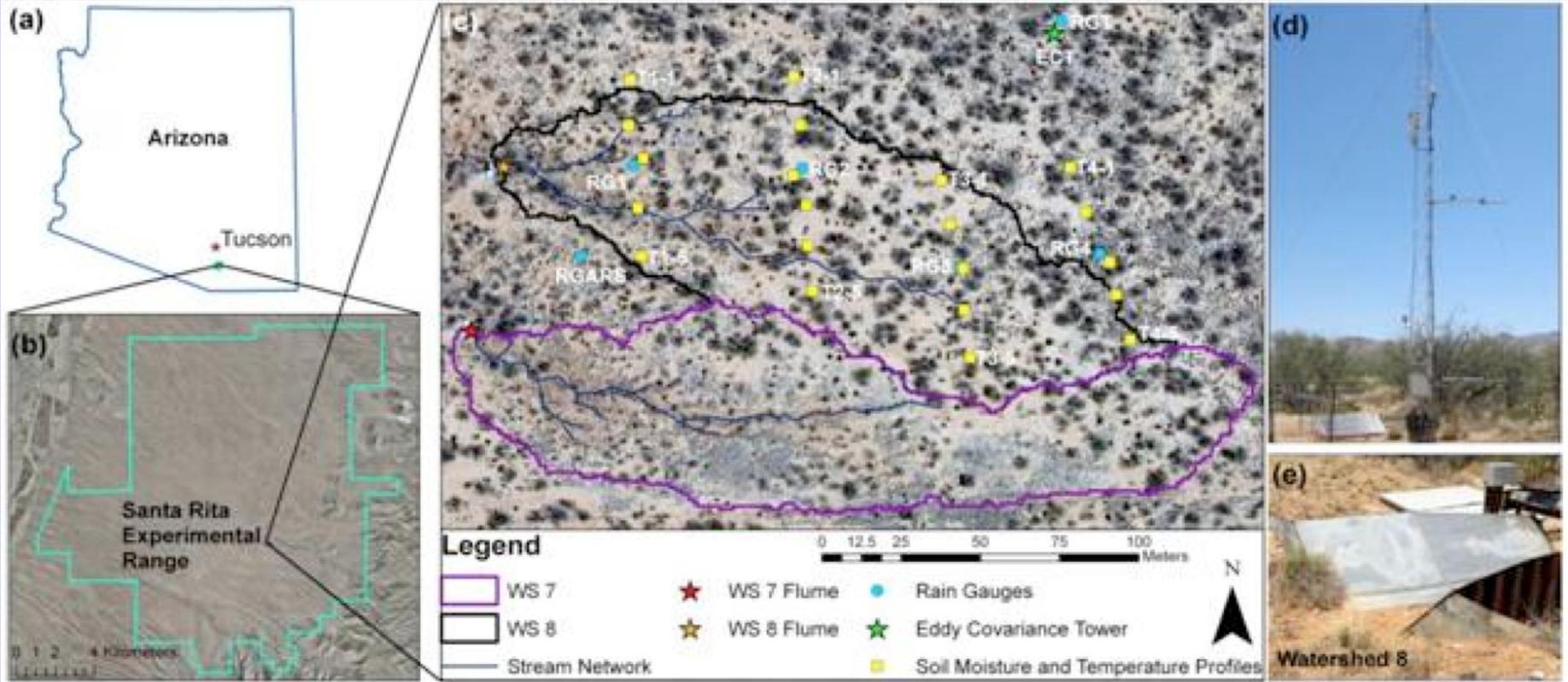
Approximate Treatment Area ~16 ha

486  
413

Watershed Outlets

ASU Flux Tower  
Est. 2011

**The Plan: flux towers on newly cleared and nearby control areas**



ASU Flux Tower Footprint



# GOAL

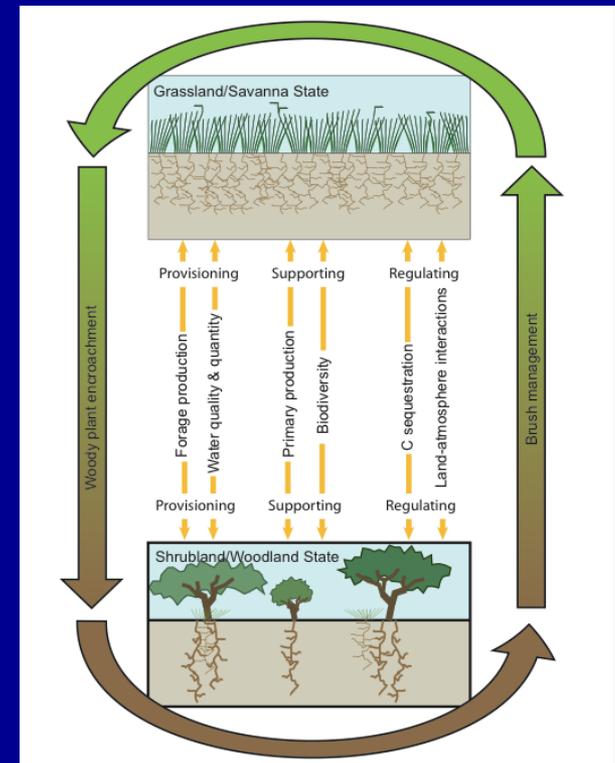
Quantify/assess trade-offs between woody plant encroachment and brush management

# Objective

Compare and contrast the provision of a portfolio of ESs on instrumented watersheds with intact and cleared woody vegetation

# ESs to be quantified (spatially explicit w/i watersheds):

- Provisioning
  - Forage production
  - Water yield
  - Runoff/Erosion/Sediment yield
- Supporting
  - Ecosystem [woody + herbaceous] ANPP
  - Herbaceous diversity
  - ET and NEE
- Regulating
  - C sequestration
  - Peak flows & sediment yield
  - Land surface-atmosphere interactions

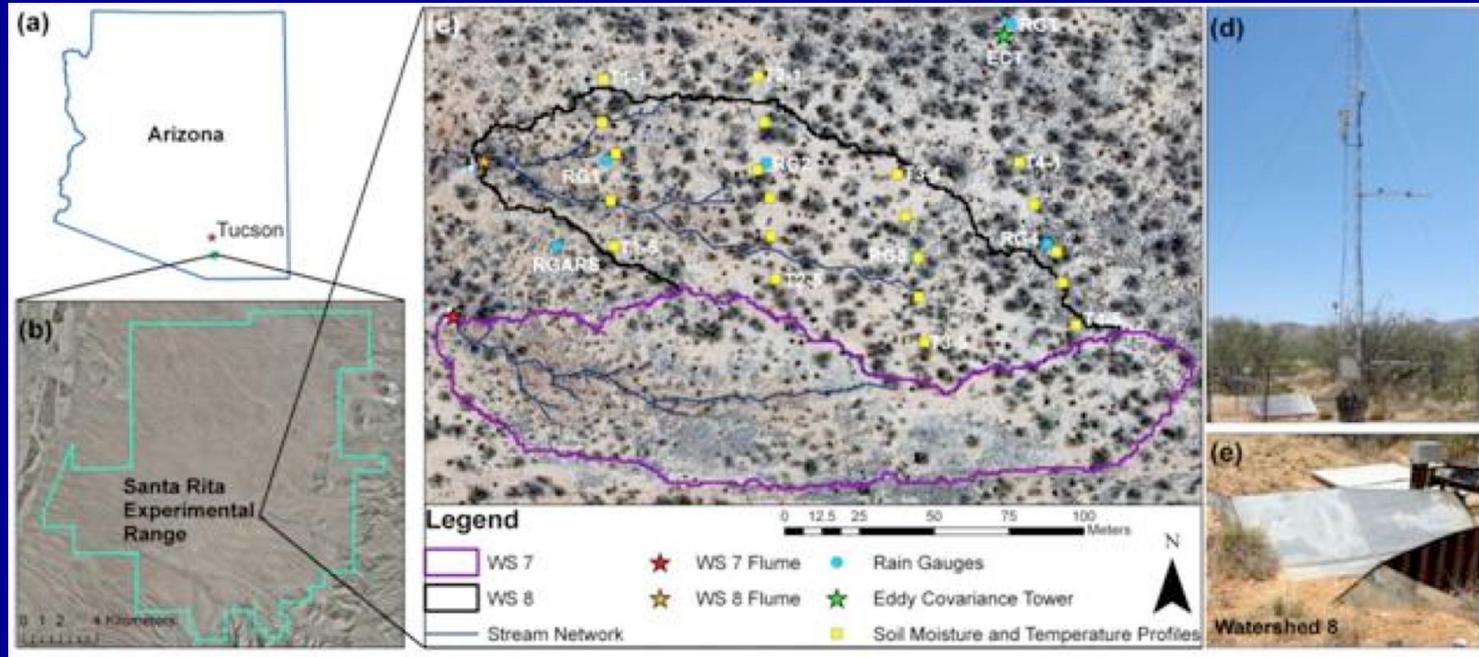


## APPROACH

- Traditional field work
- High resolution remote sensing
- Flux towers (*Scott, Vivoni*)
- Decisions Support Tools & Economics (*Heilman*)



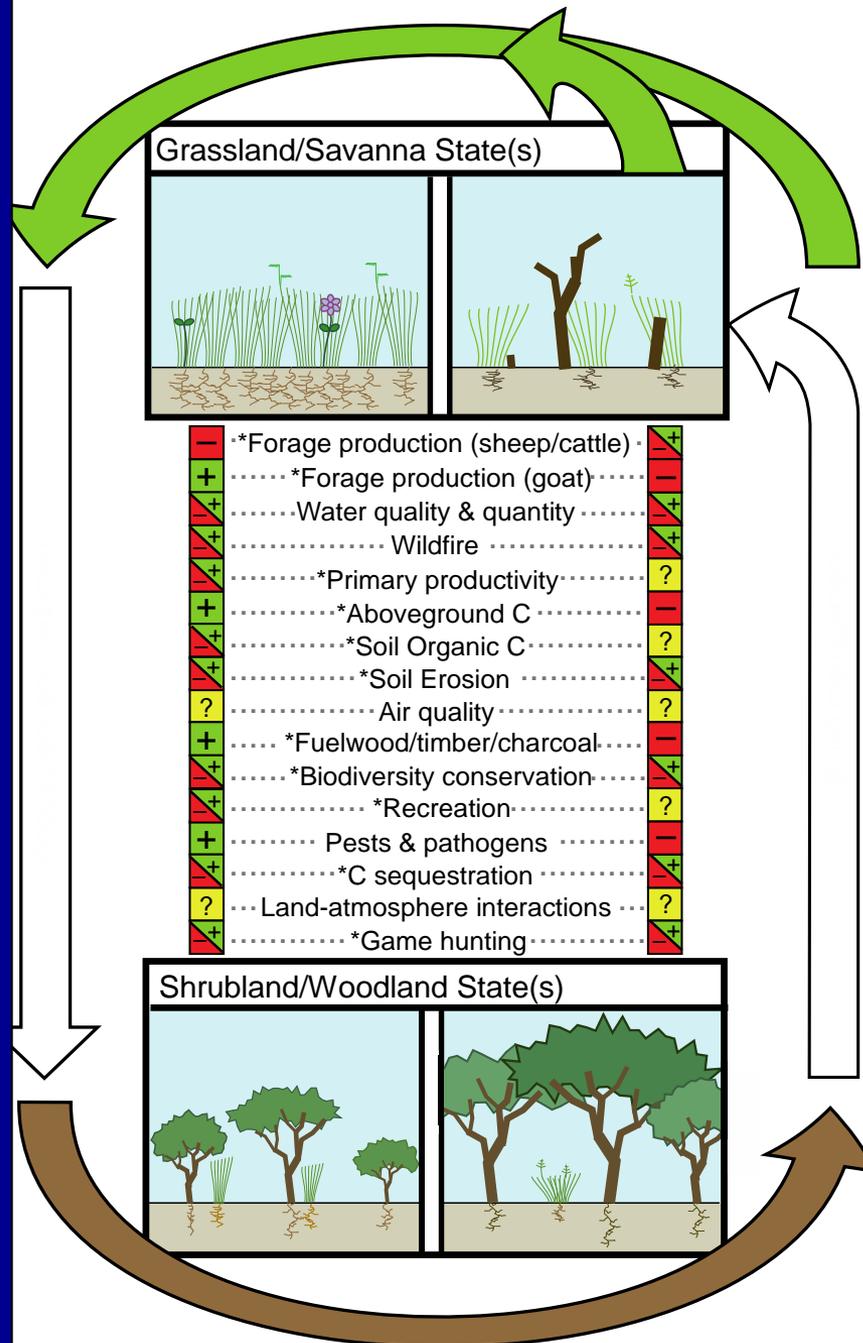
(Greg Barron-Gafford)



### Modeling:

- AGWA, Automated Geospatial Watershed Assessment tool with the RHEM-KINEROS2-OPUS models (*Guertin et al.*)
- tRIBS, TIN-based Real-time Integrated Basin Simulator (*Vivoni et al.*)
- CENTURY biogeochemical process model (*Throop & Archer*)

# Resolving Current Uncertainties



# PROPOSAL

## Brush management and ecosystem services: A quantification of trade-offs on Western rangelands

USDA AFRI Agroecosystems Management Program (submitted June 4th)

### Cast of Characters

- Steve Archer, Phil Guertin (SNRE) & Greg Barron-Gafford (Geog)
- Russ Scott & Phil Heilman (ARS – SWRC)
- Heather Throop (New Mexico State)
- Enrique Vivoni (ASU)

### Strategy:

If funded : get 1 y pre-treatment data on ANPP, SOC, diversity, etc. then spray

If not funded – curse reviewers, write nasty letter to program manager, call Raul Grijalva (?) and Ron Barber (?), Jeff Flake, John McCain: demand investigation, contemplate retirement....

Or: delay treatments, opportunistically get pre-treatment data; resubmit, pray we get enlightened reviewers

