Effects of Mechanically Shredding Utah Juniper on Fuel Characteristics

Kert Young and Bruce Roundy

Outline

1. Introduce SageSTEP
2. Ecological Concerns
3. Experimental Design
4. Fuel Measurement Methods
5. Objectives
6. Results
7. Conclusions
8. Implications

SageSTEP

Sagebrush Steppe Treatment Evaluation Project

Sagebrush Steppe
SageSTEP
Treatment Evaluation Project

Joint
Fire Science
Program

A collaborative research project among:

Oregon State University OSU

BYU Brigham Young University

University of Idaho

Utah State University

University of Nevada, Reno

U.S. Department of the Interior Bureau of Land Management

Forest Service U.S. Department of Agriculture

USGS science for a changing world

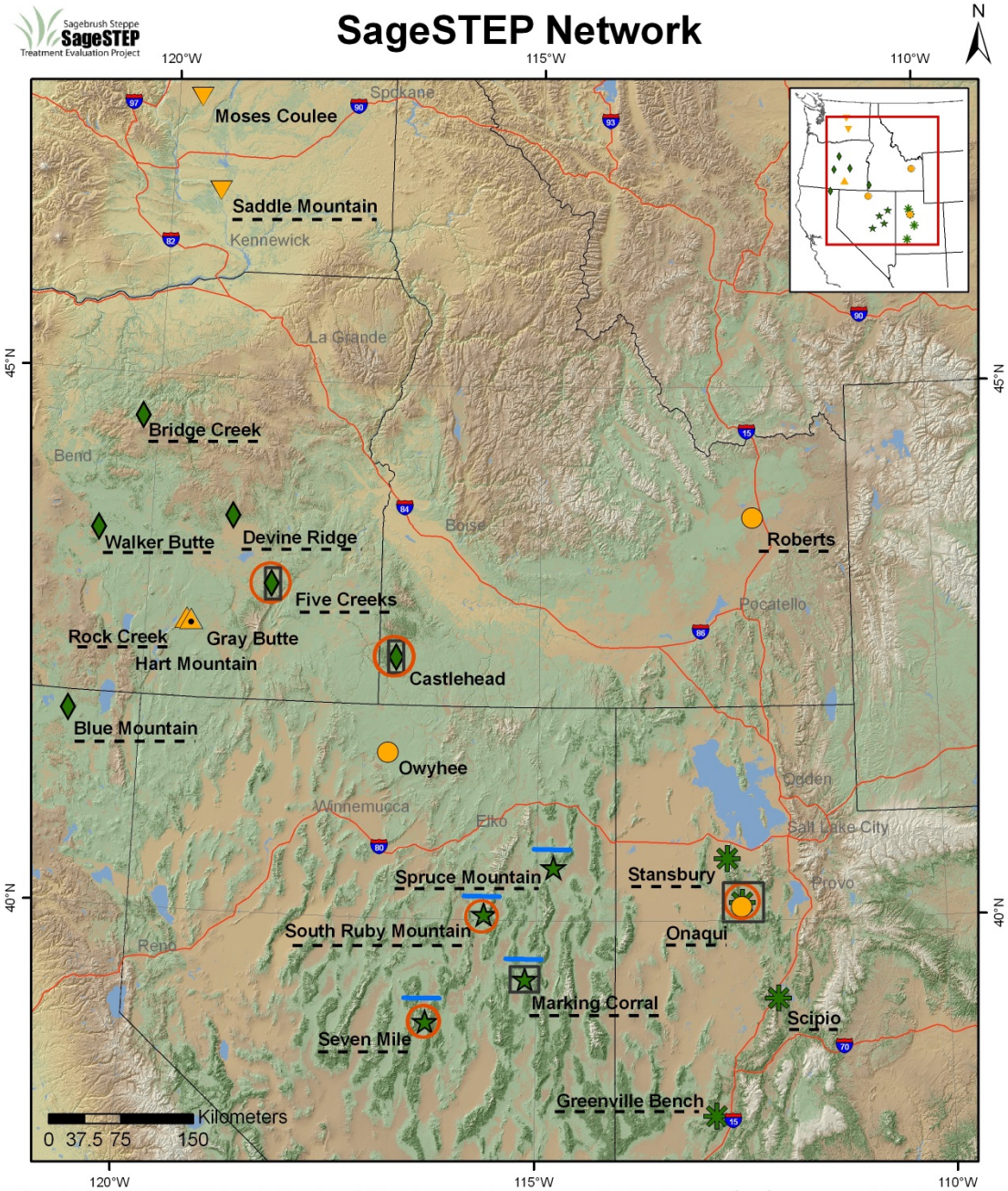
U. S. Department of the Interior Bureau of Reclamation

USDA ARS

U.S. Fish & Wildlife Service Department of the Interior

The Nature Conservancy Saving the last great places on earth

SageSTEP Network



Sagebrush/Woodland Network
- Pinyon-Juniper
- Utah Juniper
- Western Juniper

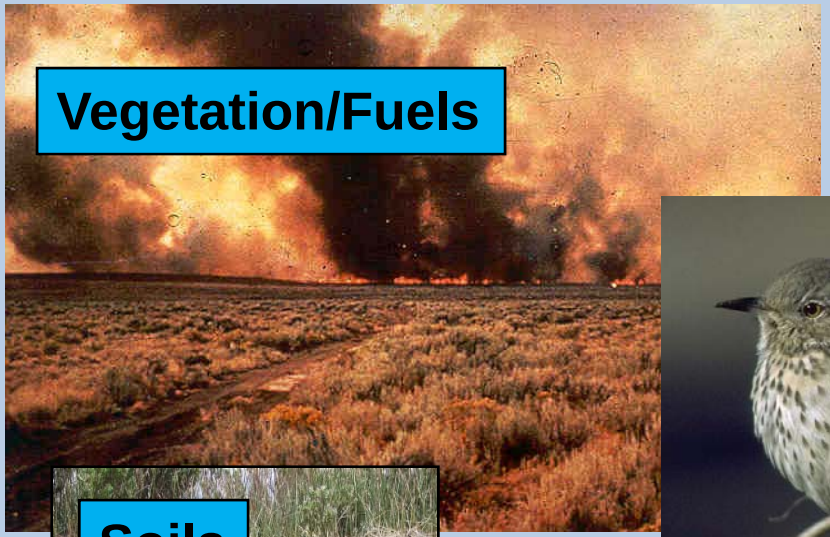
Sagebrush/Cheatgrass Network
- High Desert
- Humboldt/Bonneville
- Low Desert

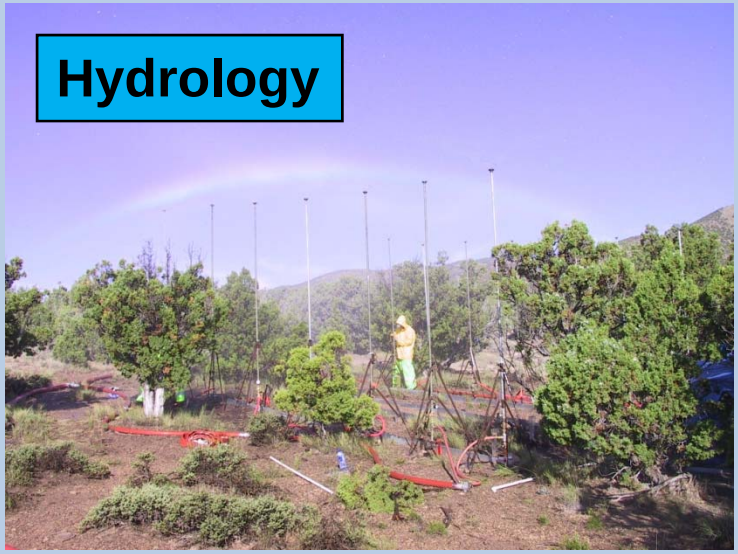
Intensive Studies
- Ant Spatial Work
- Hydrology
- Soil Moisture/Temp/ Nutrient Availability
- Wildlife

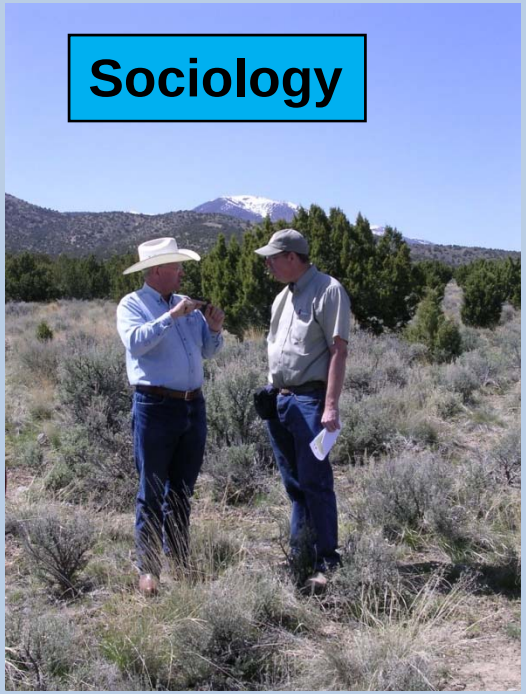
Land cover
- Sagebrush
- Pinyon/Juniper
- Water

Elevation
- High : 4409
- Low : -83

Fully Interdisciplinary Approach







Pinyon-Juniper Encroachment

1973

Shoshone Mountains,
Nevada
Photos by R. Tausch

2005

Land Management Treatments: Woodland Experiment

Prescribed fire

Chainsaw Cutting

Shred
(Utah only)

Untreated
Control

Wildfire

Treatment

Shred

"The Concern"

Degradation Pathway

Restoration Pathway

Invasive Grasses

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Native Grasses

©C. Kelley / WA Plant Materials Center

Hypothesis

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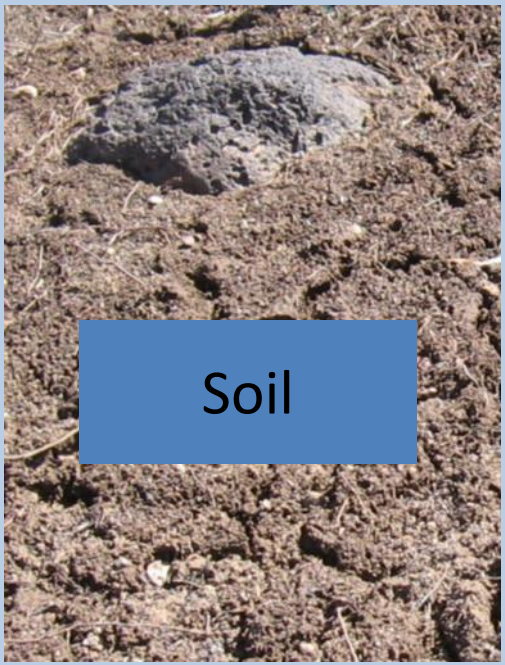


Increased
- Soil Organic C
- Soil C:N ratio

Increased
- Decomposition by soil microorganisms

Decreased
- Soil N availability

Decreased
- Cheatgrass success

Literature

- Cheatgrass invasion into PJ helps to enable crown fires and convert many PJ woodlands into annual grasslands (Billings 1994, West 2000)
- Cheatgrass dominance after severe wildfire leads to shorter fire return intervals excluding many perennial plant species (Billings 1994, West and Young 2000, Young 1991, Young and Evans 1973)
- High density PJ woodlands are expected to increase to 75% within the next 50 years (Johnson and Miller 2006, Miller et al. 2008)
- Canopy cover of 35% or greater is capable of supporting crown fire (Bryant et al. 1983)

Experimental Design

- 4 research locations
  - Stansbury, Onaqui, Scipio, Greenville
- 15 subplots
  - 30 x 33 m^2
- Tree Dominance
  - Tree cover / perennial cover
  - Low: Herbs & shrubs dominant
  - High: Trees dominant
  - Covariate
- Statistics
  - Mixed Model Analysis of Covariance
    (SAS Institute Inc., version 9.2, Cary, NC)

Tree Dominance

Succession Without Natural Fire Frequency

Northern Great Basin sagebrush steppe

- High
  - Dominated by trees

Succession without natural fire cycle

- Low
  - Dominated by grass and shrubs

High – Tree Cover Ratio

Mechanical Shredding and Sampling Dates

Location	Pretreatment	Treatment	Posttreatment
Onaqui	2006	Nov 2006	Summer 2007
Greenville, Scipio, Stansbury	2006	Nov 2007	Summer 2008

Tree Species
Utah Juniper - all locations
Two-needle Pinyon - Greenville

Pre-treatment Standing Tree Fuel Measurements

- Tree allometry
  - pre-treatment
  - standing trees
    - tree height
    - base canopy height
    - widest diameter
    - perpendicular diameter

Tausch, R. J. 2009. A structurally based analytic model for estimation of biomass and fuel loads of woodland trees.

Post-treatment Surface Tree Fuel Measurements

Planar-intersect

(Brown 1974, Brown et al. 1982)

- Treatments
  - -- Untreated, Cut-and-drop, Burn

vs

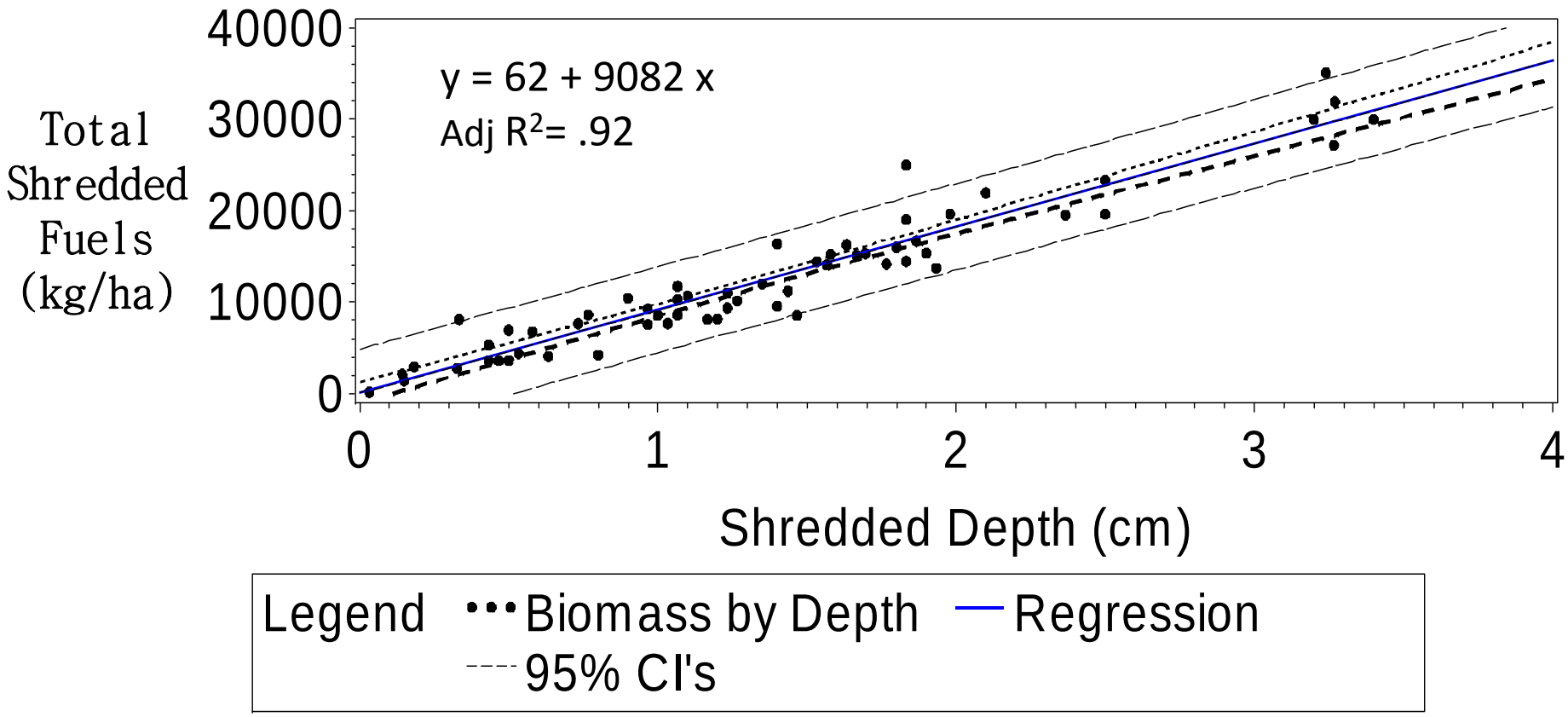
Quadrat

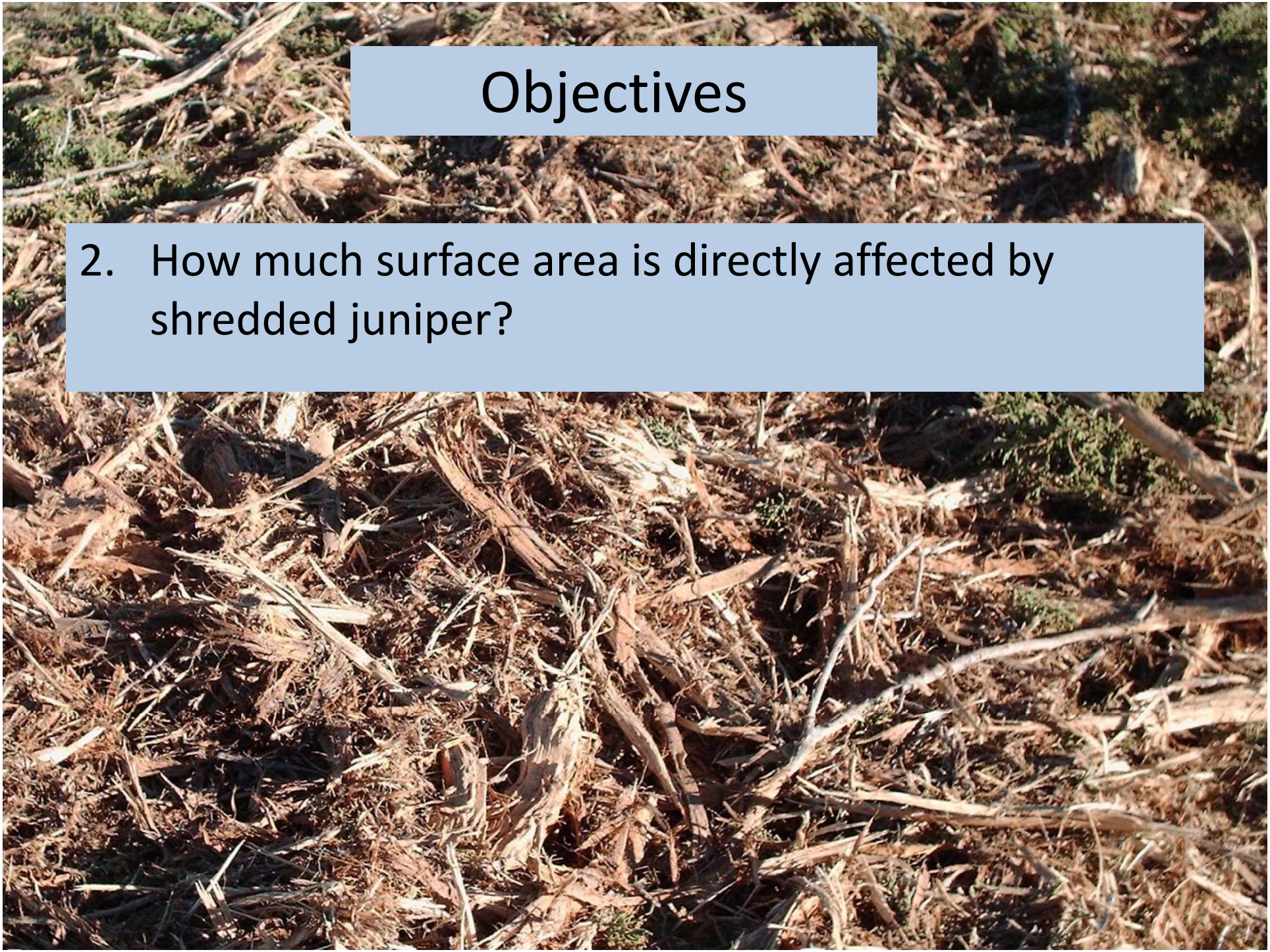
- Treatment
  - -- Shred

Objectives

1. Can shredded fuel depth estimate fuel loads using the quadrat method?
   - Save field time while maintaining accuracy?

Shredded Fuels Depth to Fuel Loads

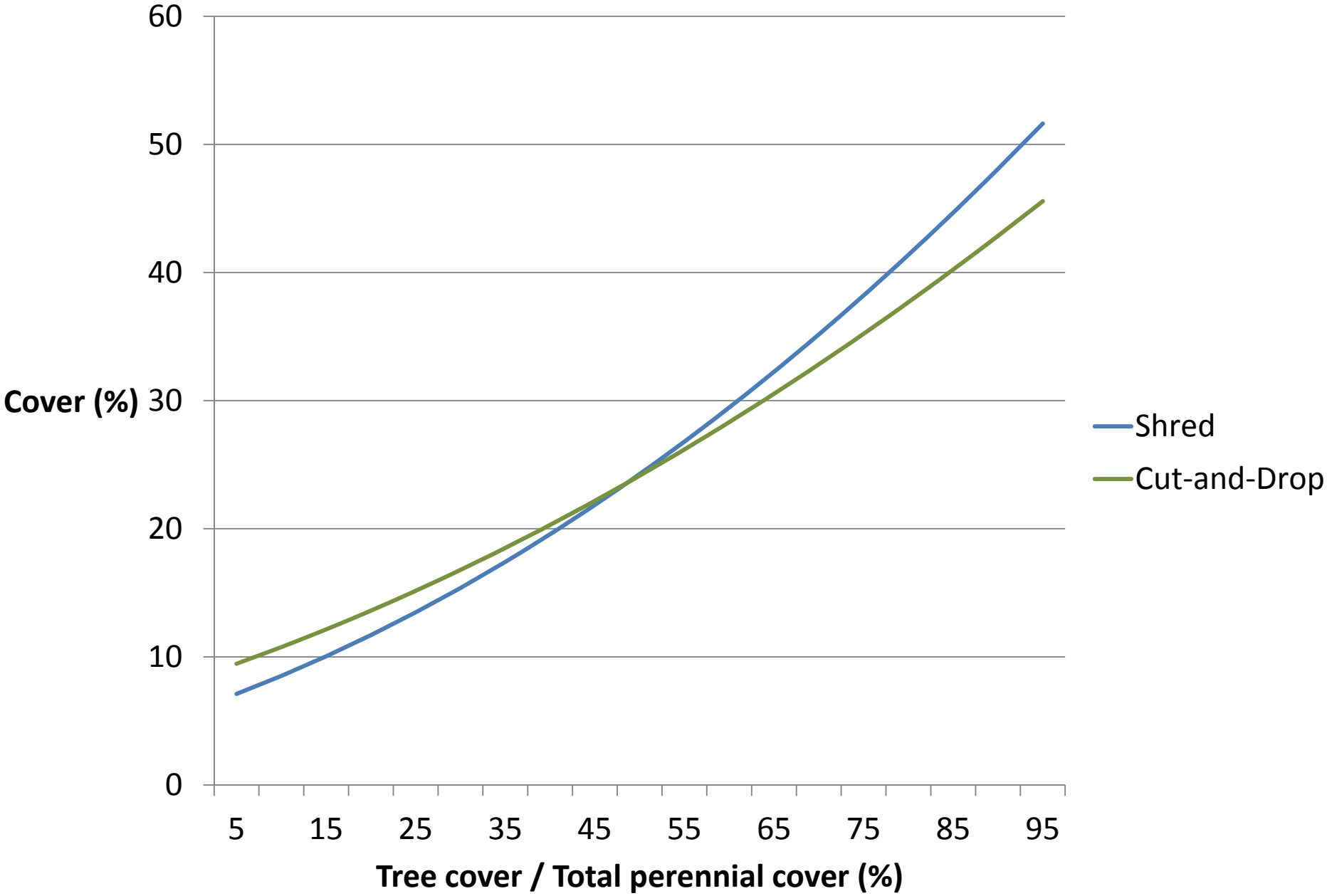




Objectives

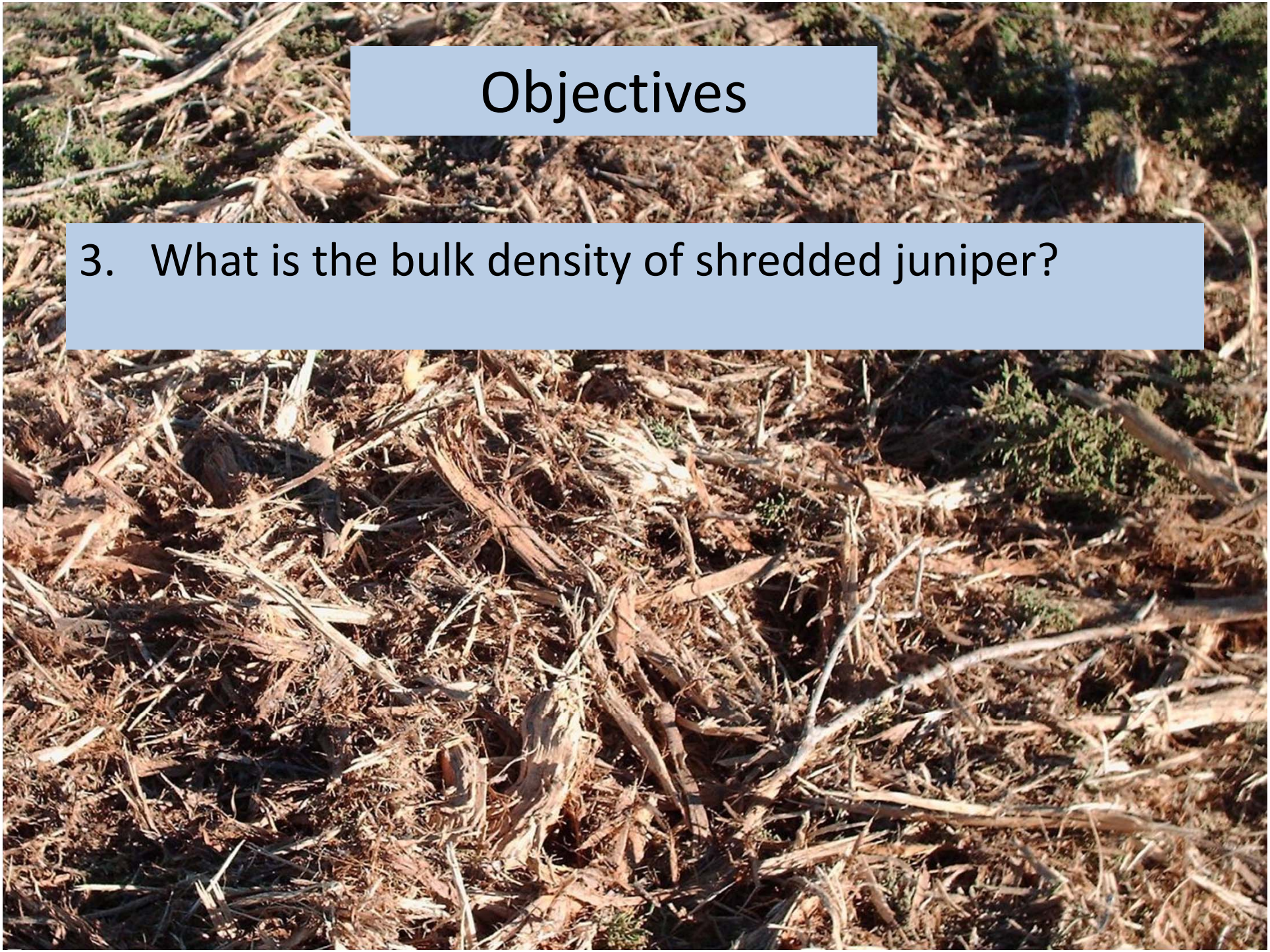
2. How much surface area is directly affected by shredded juniper?

1-yr Post-treatment surface tree fuel cover

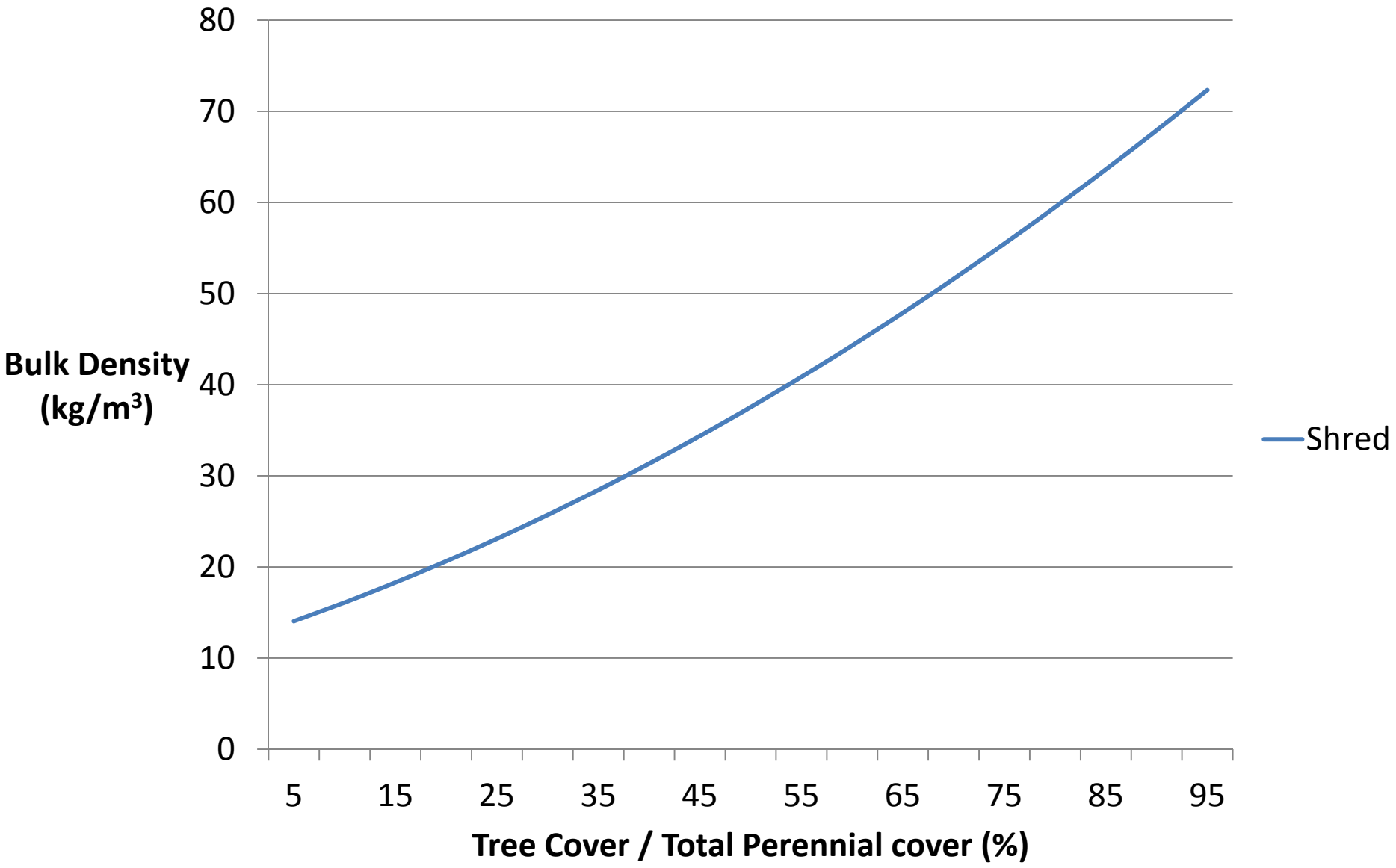


Objectives

3. What is the bulk density of shredded juniper?



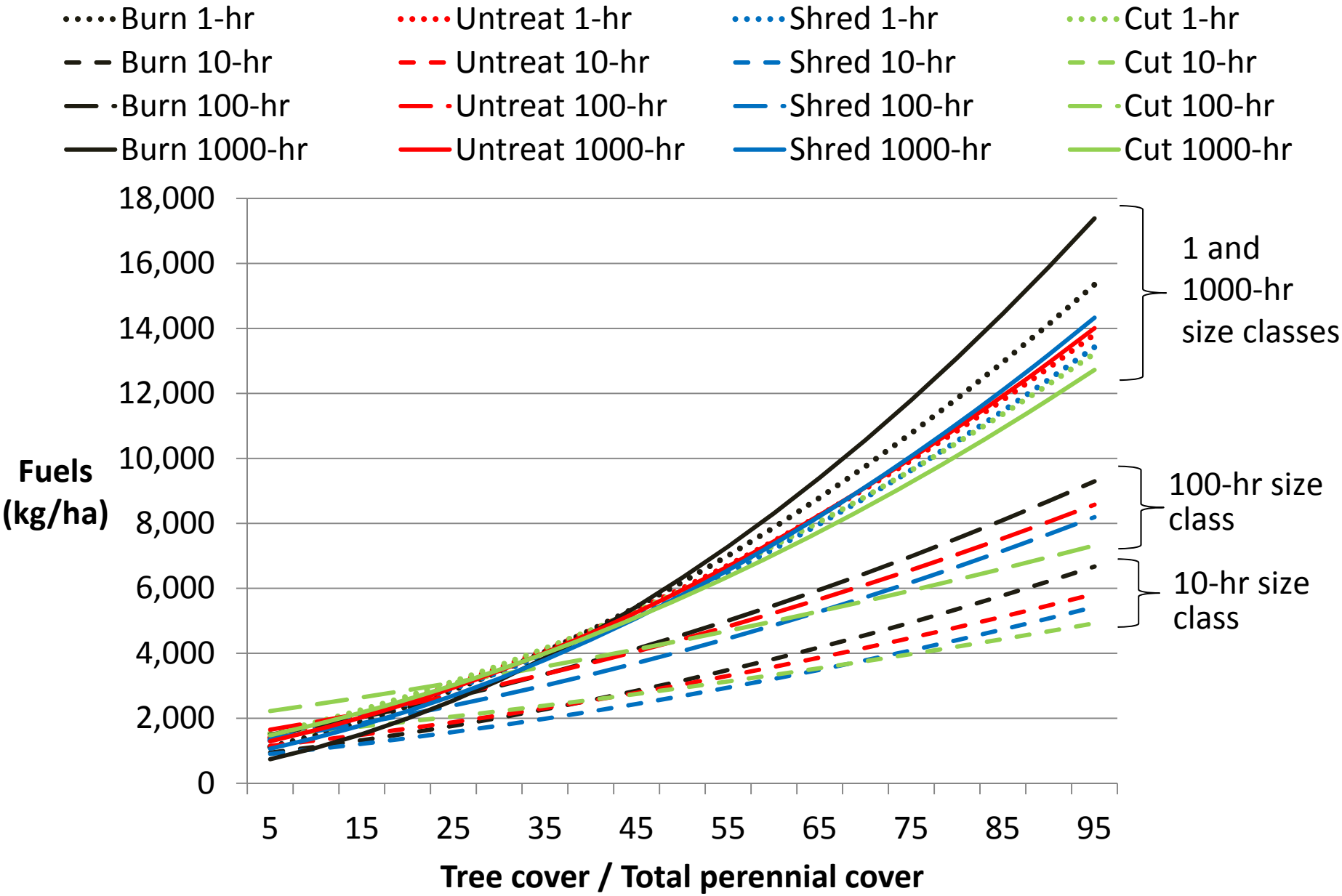
1-yr post-treatment shredded juniper bulk density



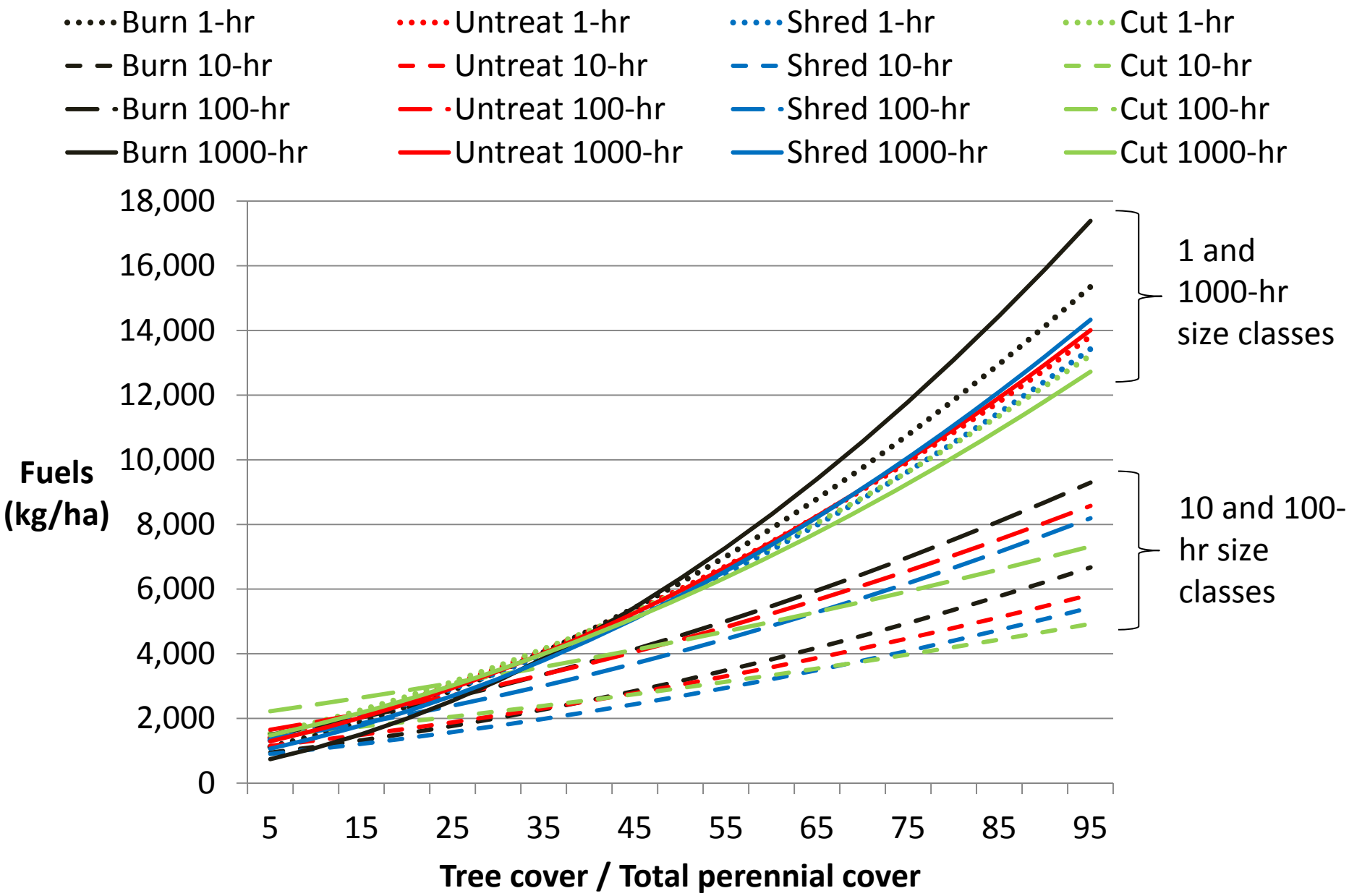
Objectives

4. How does treatment alter fuel loads by size class?

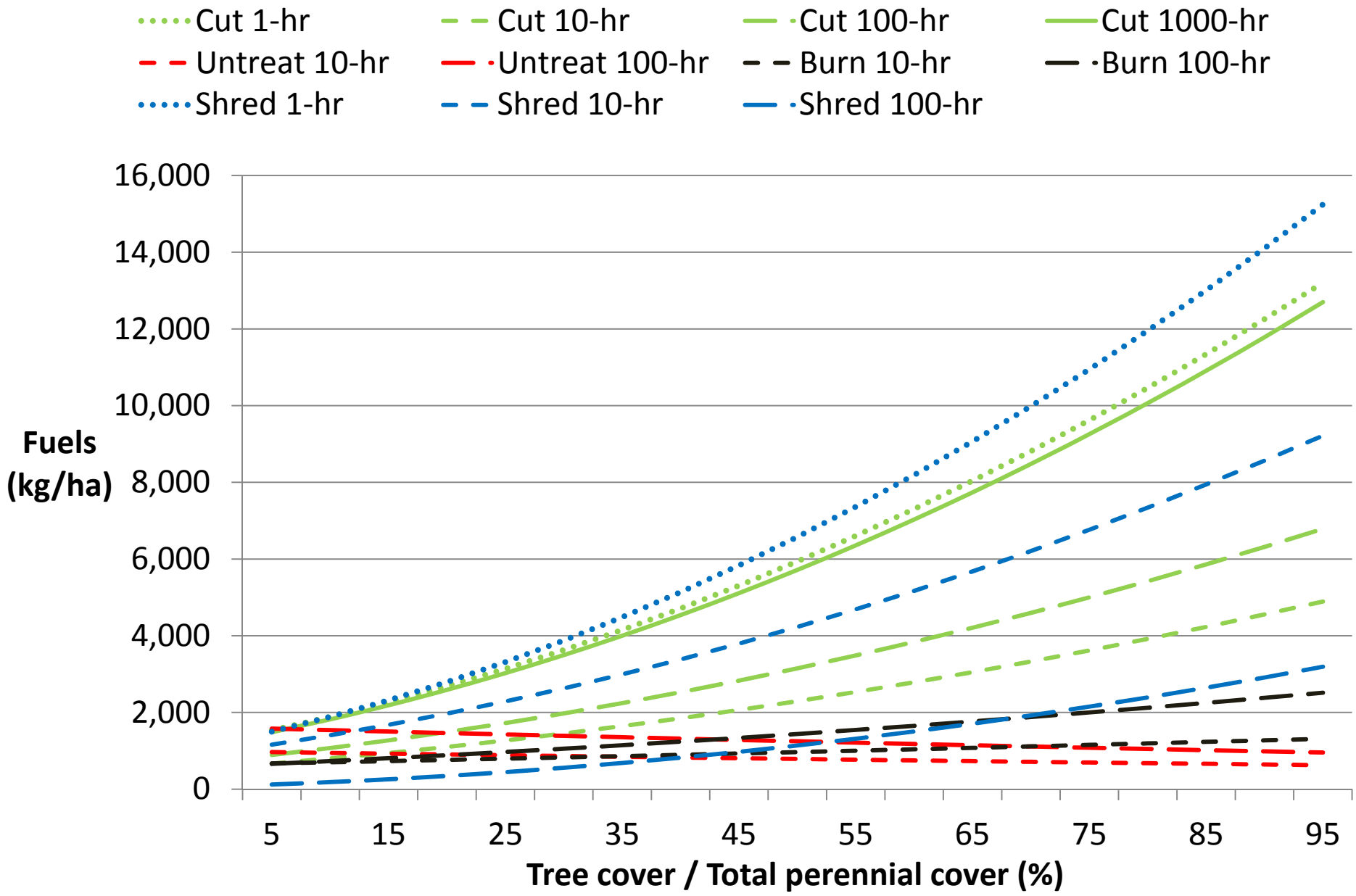
Pre-treatment standing and surface juniper fuels
Comparing size classes within treatment



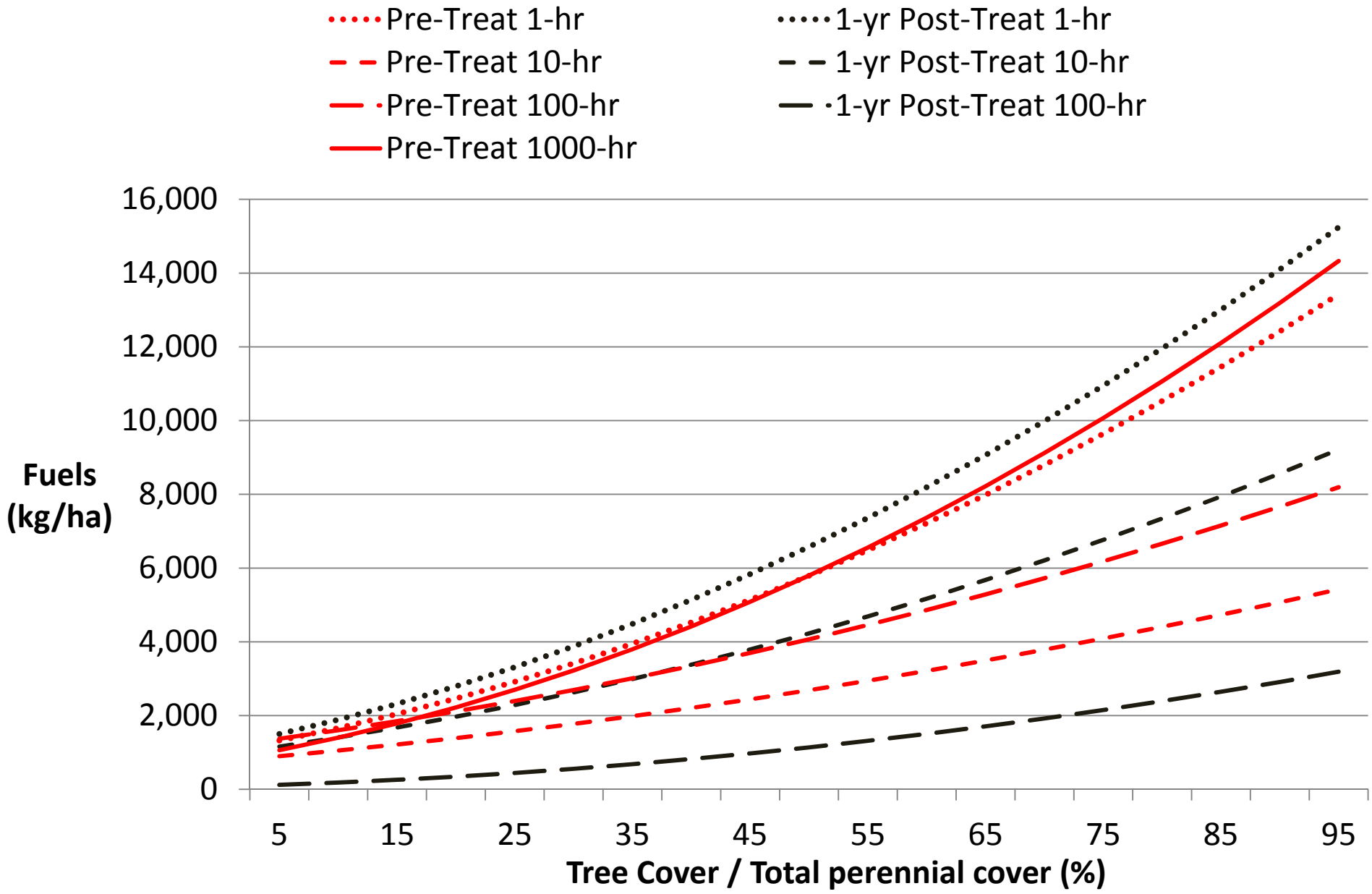
Pre-treatment standing and surface juniper
Comparing size classes across treatments



Post-treatment surface juniper fuels by treatment and size class



Pre- vs Post-shredded juniper fuels by size class

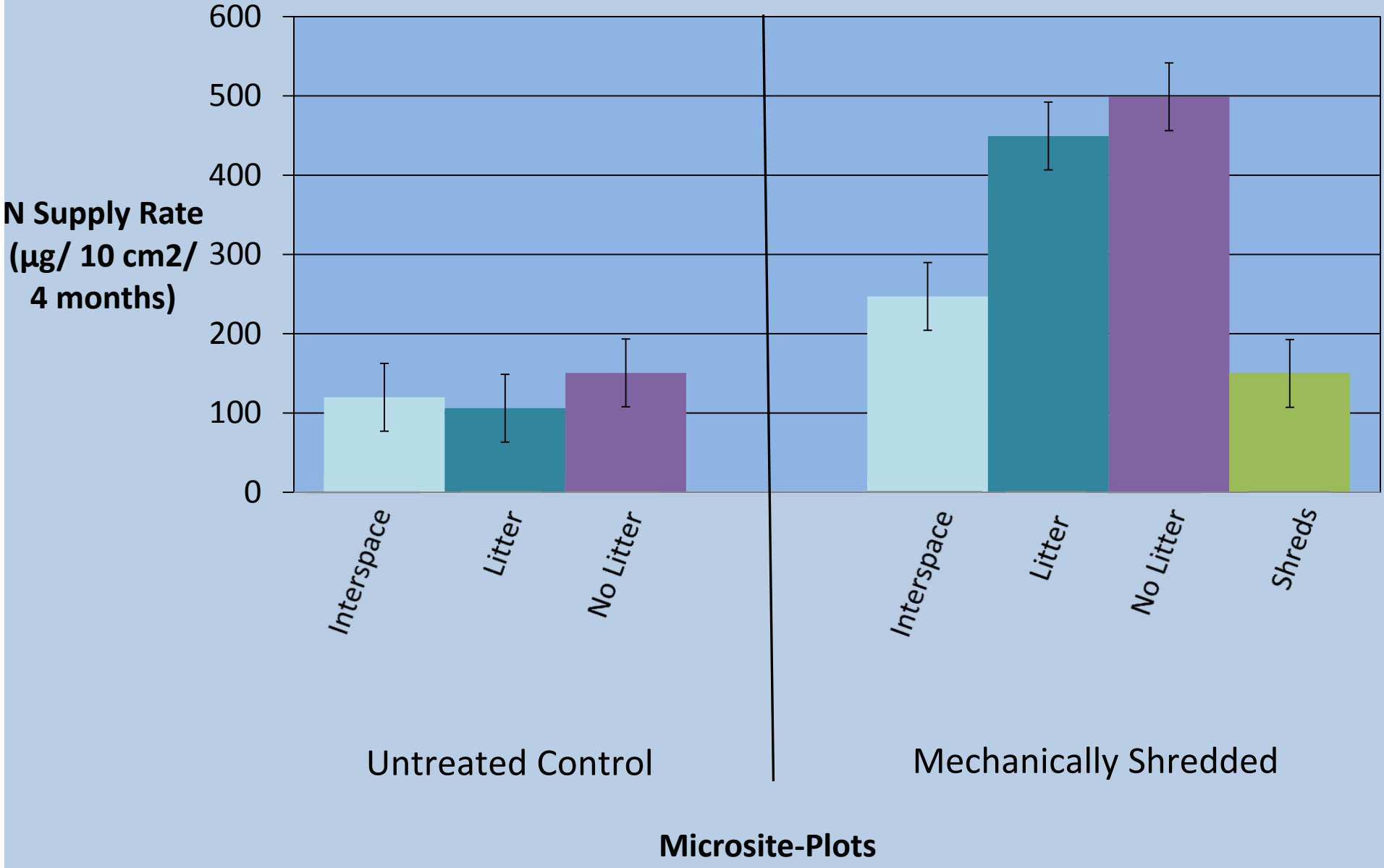


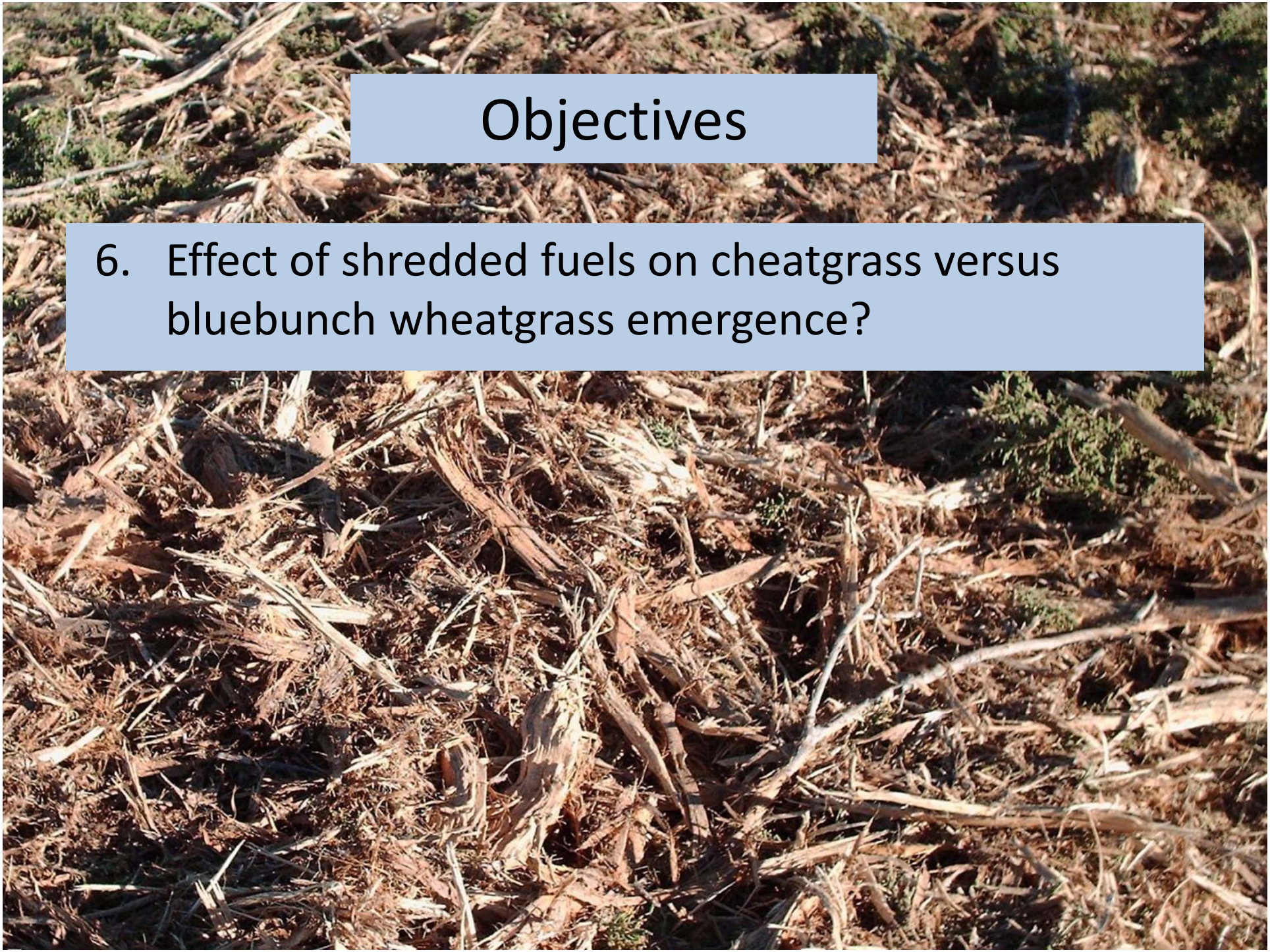
Objectives

5. Effect of shredded fuels on soil N availability?

Preliminary - Soil N Supply Rate - PRS Resins

Untreated versus Shredded Juniper



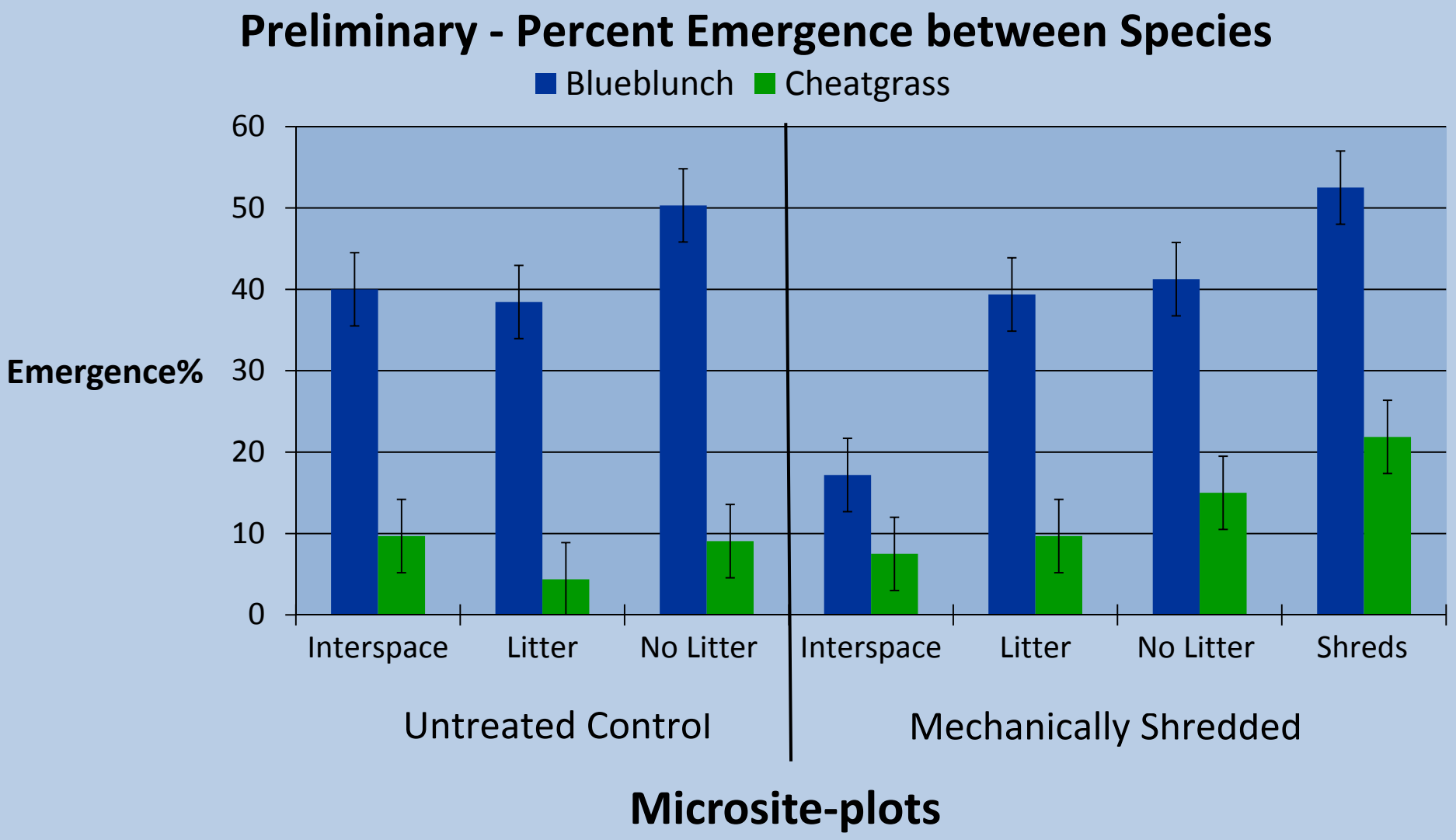


Objectives

6. Effect of shredded fuels on cheatgrass versus bluebunch wheatgrass emergence?

Response to "The Concern"

- Will invasive or native grasses dominate following mechanical shredding of juniper?



Response to Hypothesis

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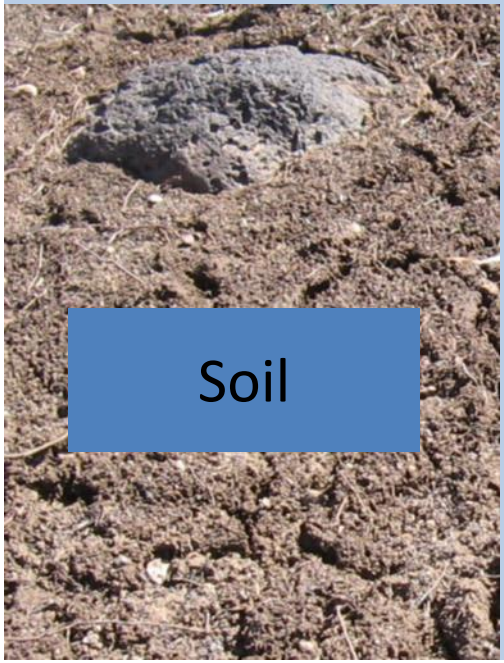

Increased
- Soil Organic C
- Soil C:N ratio

Increased
- Decomposition by soil microorganisms

Decreased
- Soil N availability
- Cheatgrass success

Conclusions

- Shredded juniper depth versus fuel load
  - Shredded fuel depth can estimate fuel loads
- Shredding juniper
  - Converts canopy fuels to surface fuels
  - Reduces fuel size
  - Fuels remain on site
- Cut-and-drop
  - Converts live fuels to dead fuels
  - No change in fuel loads or size classes
  - Fuels remain on site
- Burning
  - reduces fuel loads

Conclusions

- Soil and plant responses to shredding juniper (preliminary)
  - Interspace soil and soil under canopy litter
    - Increased soil N availability
  - Under shredded juniper alone
    - No significant reduction in soil N availability
  - Overall
    - Bluebunch (Anatone) had ~30% greater emergence than cheatgrass

Vegetation Implications

Degradation Pathway

Restoration Pathway

Invasive Grasses

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Native Grasses

©C. Kelley / WA Plant Materials Center

Shredding Juniper Implications

- Proactive juniper control is better than reactive fire suppression
- Control invasive species early before desired plants are weakened or lost
- Shredding juniper treatment
  - Hope for bluebunch
  - Surface fire is easier to control than crown fire
  - Optional – post-shredding, follow-up with cool season prescribed fire
  - Not enough reduction in soil N availability to stop cheatgrass

- Next step
  - Develop shredded juniper fire behavior models

For more information…

www.sagestep.org

Joint Fire Science Program

Sagebrush Steppe SageSTEP Treatment Evaluation Project