

# IDAHO & OREGON AGRICULTURE

Monitoring Vegetation Impacts of Livestock  
Management Practices Used to  
Reduce Predator Conflicts on Idaho  
and Oregon Grazing Allotments

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Garret Weichel  
Aarushi Jhatro

Jack Hagenbuch  
Hannah Willis



Colorado – Fort Collins | Spring 2024



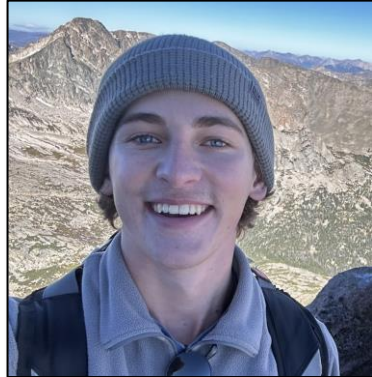
# Introductions

## DEVELOP Team

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**Garret Weichel**  
(Team Lead)



**Jack Hagenbuch**



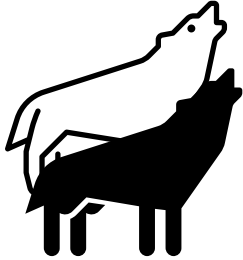
**Aarushi Jhatro**



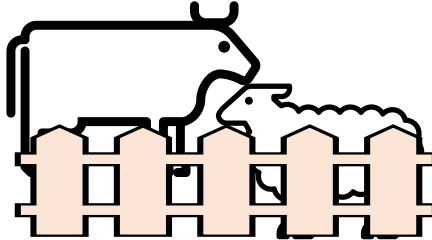
**Hannah Willis**

# Community Concerns

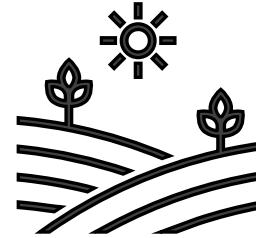
*Reduce Predation  
via Night Penning*



WOLF PREDATION



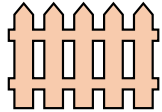
NIGHT PEN



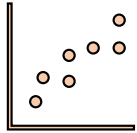
IMPACTS ON RANGELAND VEGETATION

*Understand the Impacts of Night  
Penning on Rangeland  
Vegetation*

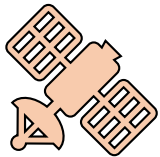
# Project Background



Night penning **could result** in conditions **detrimental to vegetation** growth.



**No evidence** that night pens have any significant effect on biomass production or vegetation community composition.



This project serves as a use case for Rangeland Analysis Platform. This dataset can **help inform** rangeland **managers**, **research**, and **conservation** objectives.



Source: Garrett Weichel



# Project Partners

## **Alderspring Ranch**

Glenn Elzinga  
Rancher, Ecologist

## **Krebs Livestock**

Cameron Krebs  
Rancher

## **USDA A.P.H.I.S.**

Stuart Breck  
Wildlife Biologist



Source: Melanie Elzinga



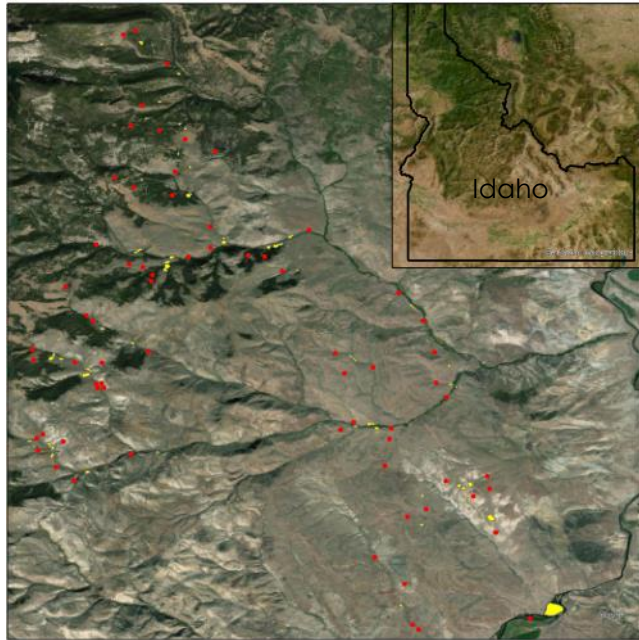
Source: Krebs Livestock



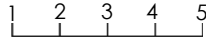
Source: USDA APHIS

# Study Area

## ▲ Alderspring Ranch

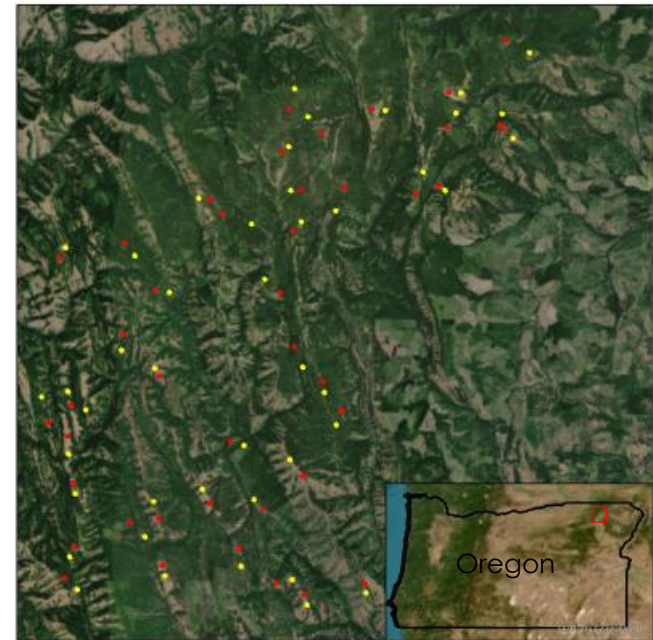


- Alderspring Control Points
- Alderspring Night Pens

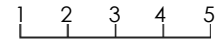


**Study Period:**  
2000 – 2023

## ▲ Krebs Livestock



- Krebs Night Pens
- Krebs Control Points



# Project Objectives

1. **Select control sites** that capture topographic characteristics of night pen sites.

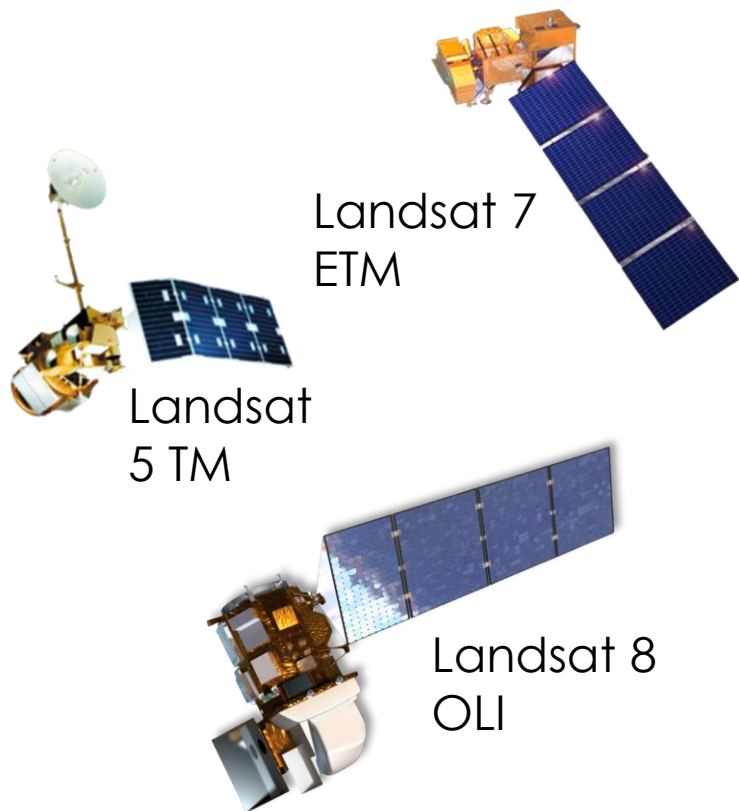


2. **Quantify** and **compare** changes in vegetation characteristics between **night pen** and **control sites**.





# Sensors



Spectral Indices  
(Red, Green & Blue)

Continuous  
Vegetation Cover

Net Primary  
Productivity (NPP)



# Software

## ArcGIS

### Data Inputs:

- DEM (Digital Elevation Model)

### Outputs:

- CTI (Compound Topographic Index)
- HLI (Heat Load Index)

## RAP

### Data Inputs:

- Landsat 5-8 Data

### Outputs:

- Net Primary Productivity (NPP)

## GEE

### Data Inputs:

- Night-pen Site Polygons
- NPP Dataset
- CTI, HLI, Aspect
- NAIP Imagery

### Outputs:

- Average NPP for night-penning sites
- Control Sites

## R

### Data Inputs:

- Outputs from GEE

### Outputs:

- Time series
- Data distribution of vegetation response

# Methodology

## Input Data

*Night Pen  
Polygons*

*NAIP*

*CTI, HLI*

*RAP*

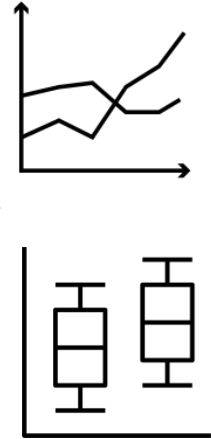
## Data Processing

*Validate Night  
Pen Locations*

*Identify Control  
Site Locations*

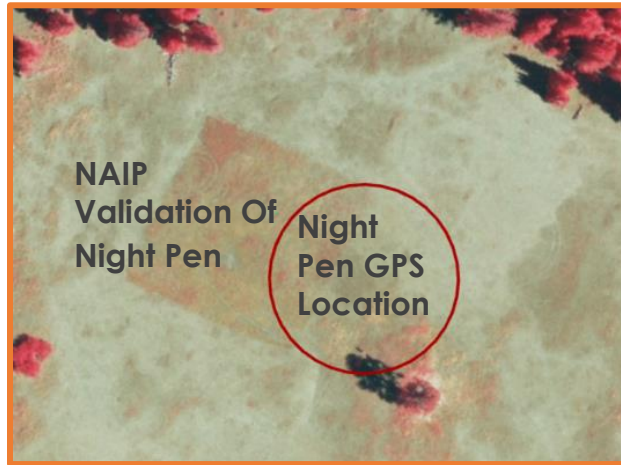
*Summarize  
NPP Data*

## Data Analysis



# Night Pen Site Validation

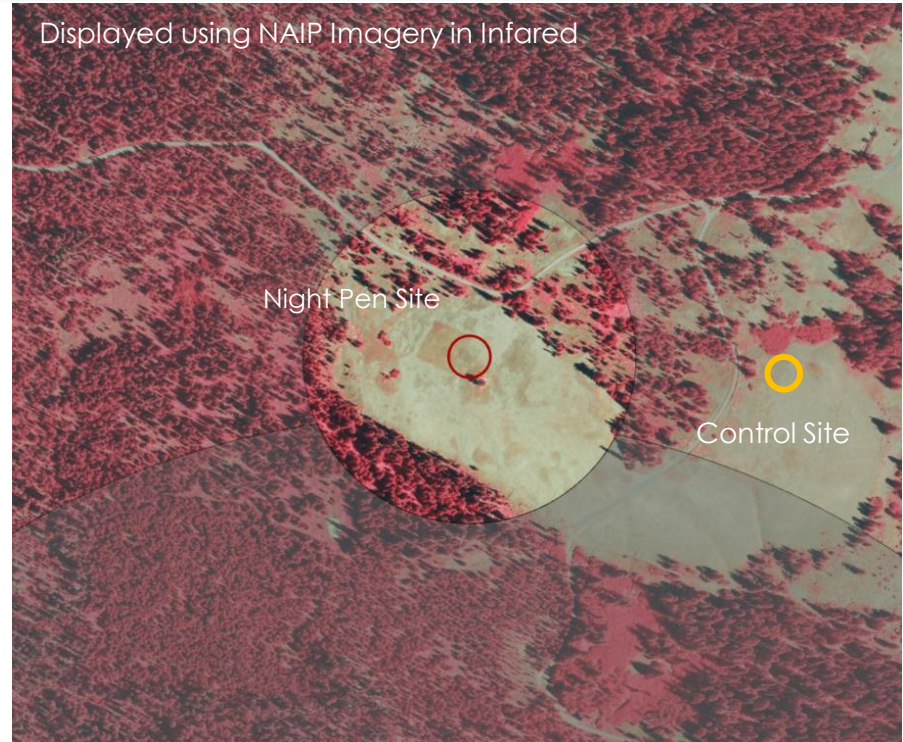
Night pen locations were co-validated with partners using NAIP imagery.



NAIP Imagery showing night pen site based on field coordinates (red circle), and actual Night-Pen Site (square).

# Control Site Selection

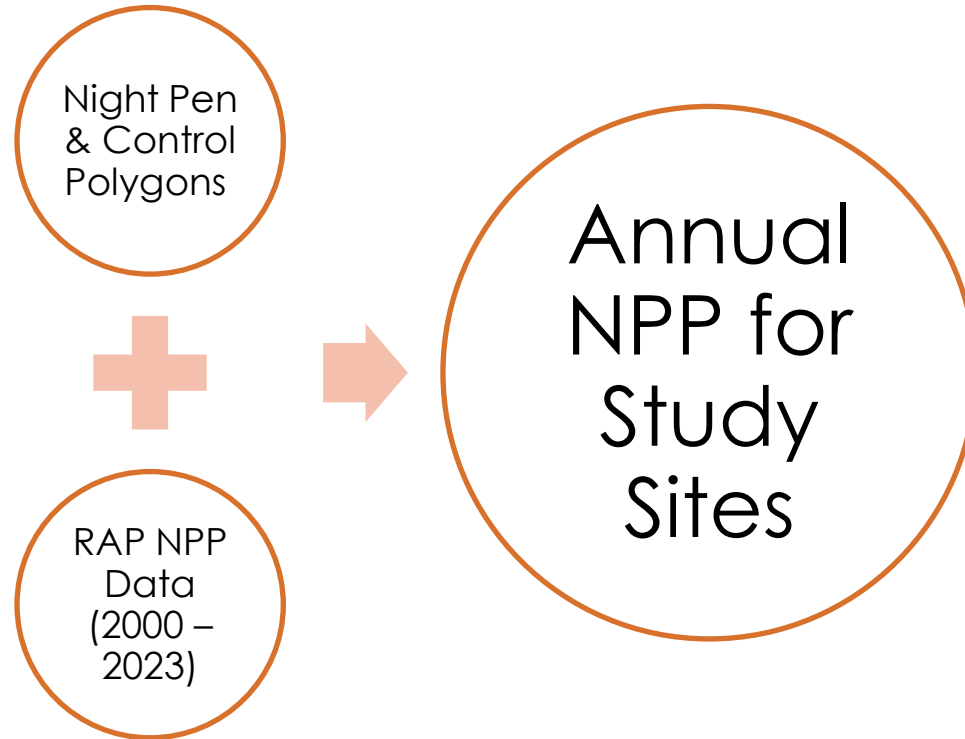
1. Control sites were identified using topographic indices and NAIP imagery.
2. Partners provided ground truthing of selected control sites.



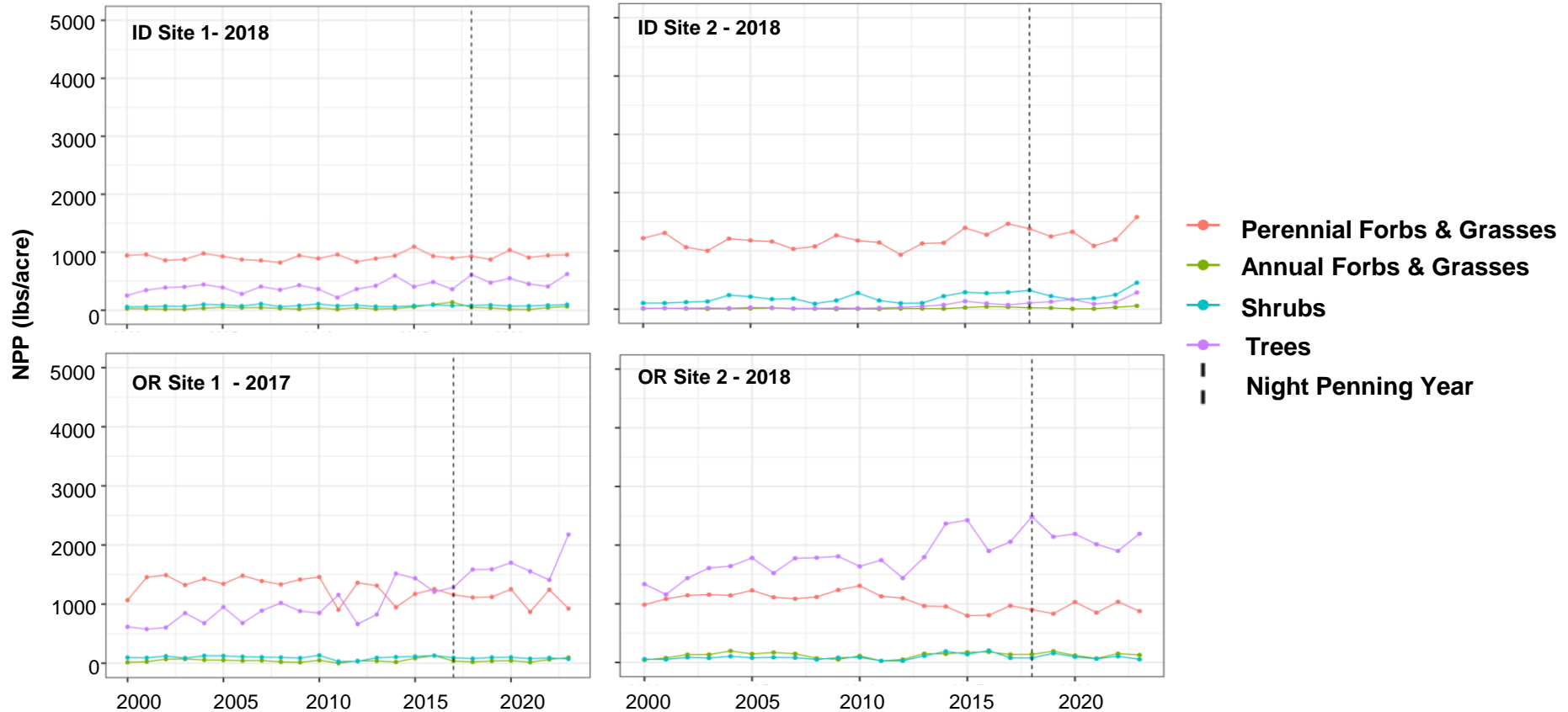
NAIP Imagery showing night pen site (red circle) and corresponding control site (yellow circle). The darker gray areas indicate the buffer zone (200- 1000m) used for initial control site selection.



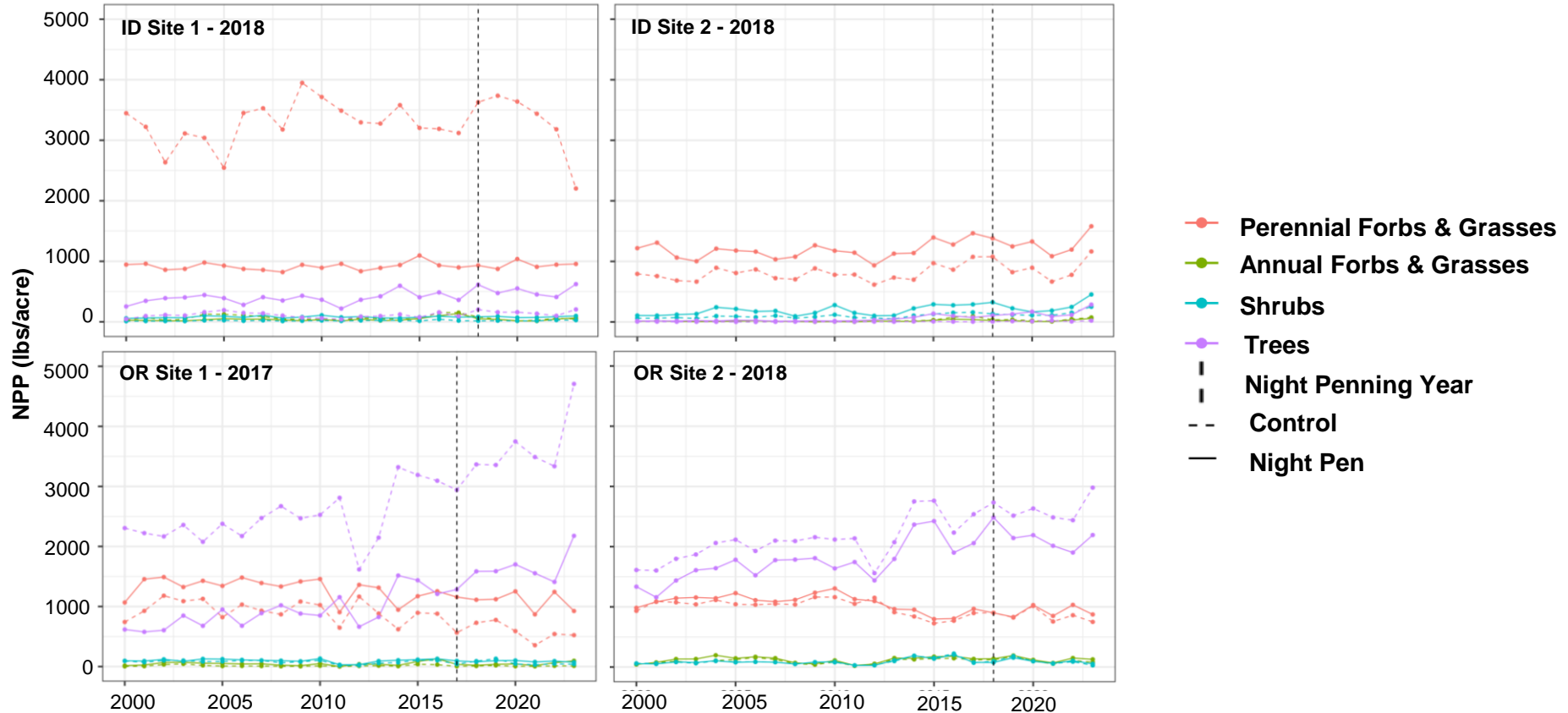
# Data Analysis



# Result: NPP Timeseries



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# Data Analysis

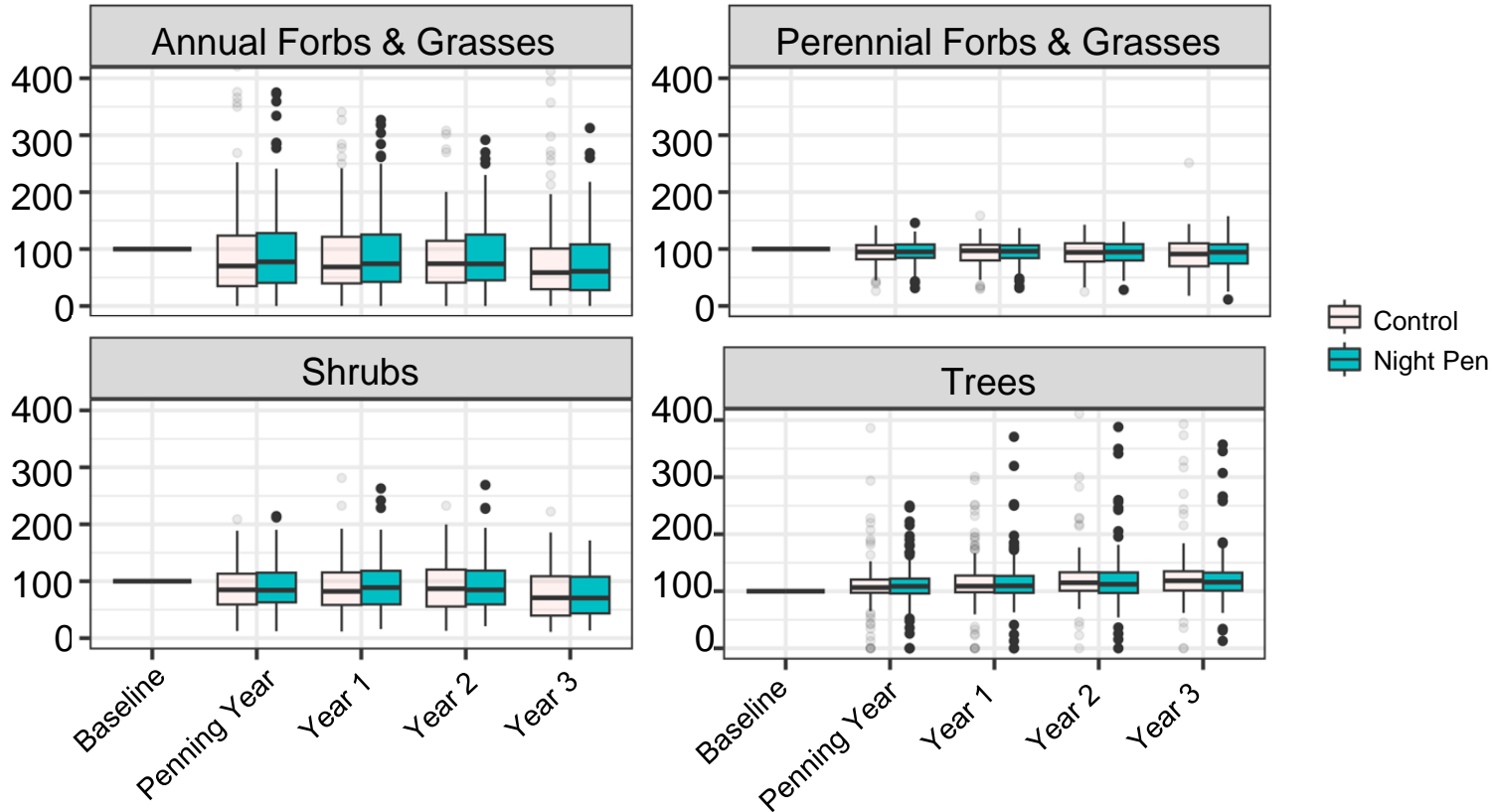
## Analysis Timeframes



$$\frac{\text{NPP (Response Year)}}{\text{NPP (Baseline Year)}} \times 100$$



# Result: Relative NPP Distribution



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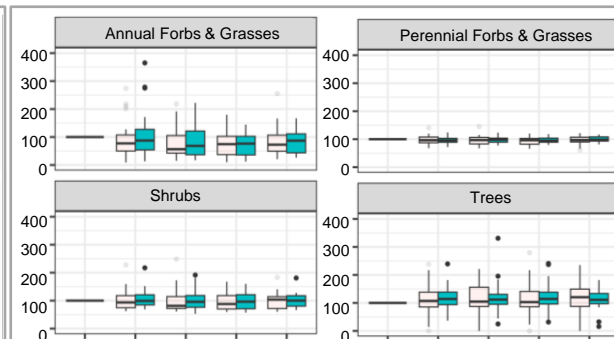
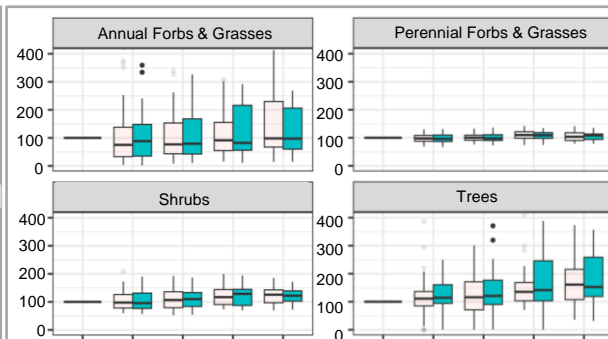
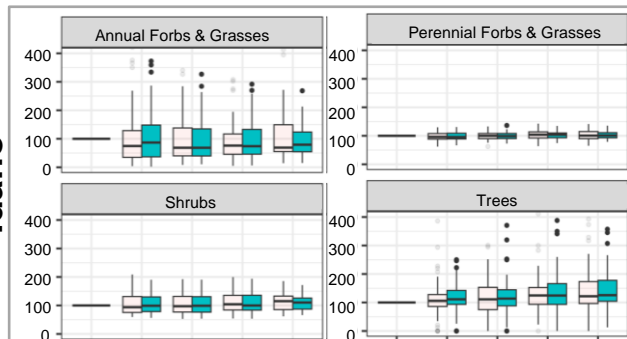
Control  
Night Pen

All Use

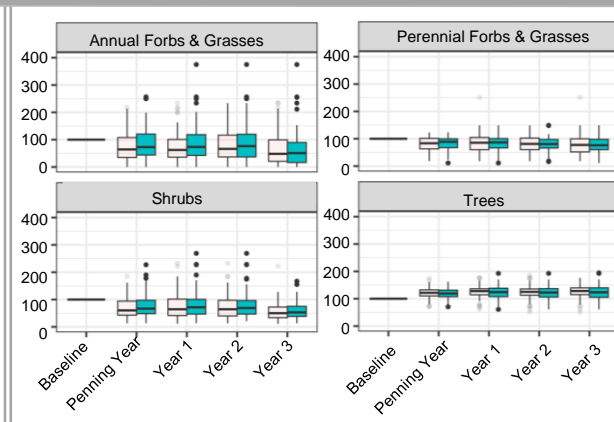
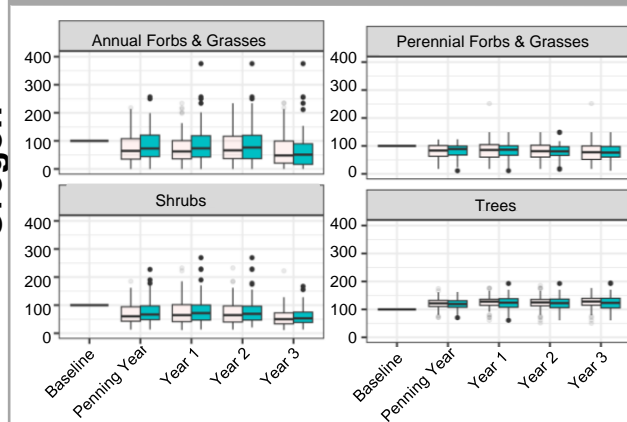
Single Year Use

Multi-Year Use

Idaho



Oregon



# Conclusions



The net primary productivity of Vegetation groups **responded differently** across different night pen sites.



However, **no significant differences** were observed between Night Pen and Control sites.



Using remote sensing to track vegetation response is **promising**, but **resolution limitations** need to be addressed.

# Uncertainties and Errors

Vegetation  
Mismatch

Uncertain  
Land Use

?

Night Pens  
Used Multiple  
Times

Data  
Summarization





# Future Work



**Validate** vegetation composition at sites through field work.



**Quantify** vegetation response on a finer temporal resolution.



**Assess** vegetation response through alternate parameters such as NDVI.

# Acknowledgments

## Fellow

- Truman Anarella

## Partners

- Glenn Elzinga (*Alderspring Ranch*)
- Cameron Krebs (*Krebs Livestock*)
- Stuart Breck (*U.S. Department of Agriculture, Animal & Plant Health Inspection Service, National Wildlife Research Center*)

## Science Advisors

- Nicholas Young
- Dr. Anthony Vorster
- Dr. Catherine Jarnevich
- Dr. Paul Evangelista
- Christopher Tsz Hin Choi



**SUPPORTING SLIDES:**

# Results

## Relative NPP Distribution With Outliers

