RangeSAT

Satellite-based Assessment Tools for Rangeland Management

Jen Hinds
University of Idaho

Vincent Jansen
University of Idaho

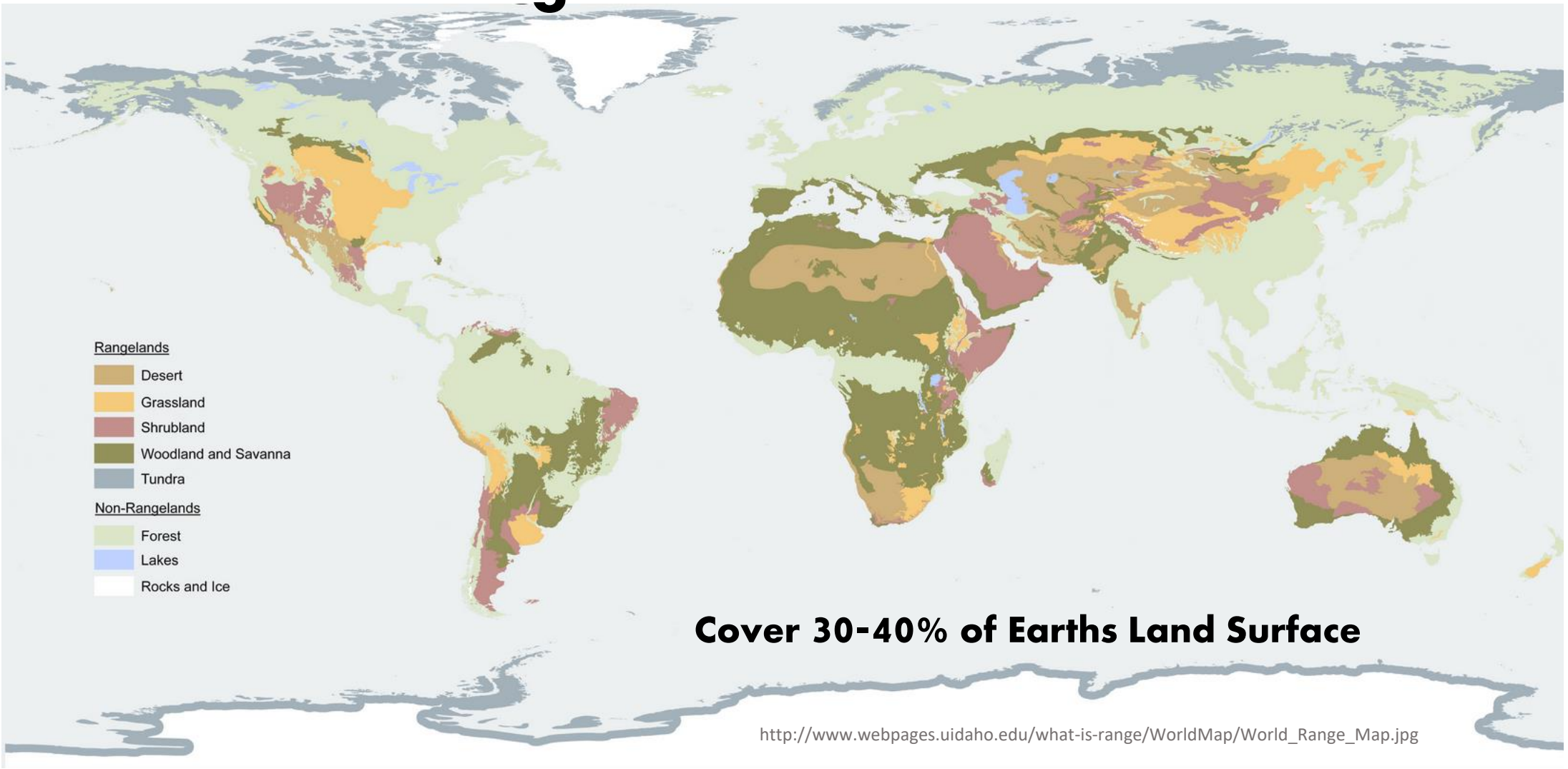
Jason Karl
University of Idaho

Roger Lew
University of Idaho

Chloe Wardropper
University of Idaho

Also thanks to our land management and rancher partners!

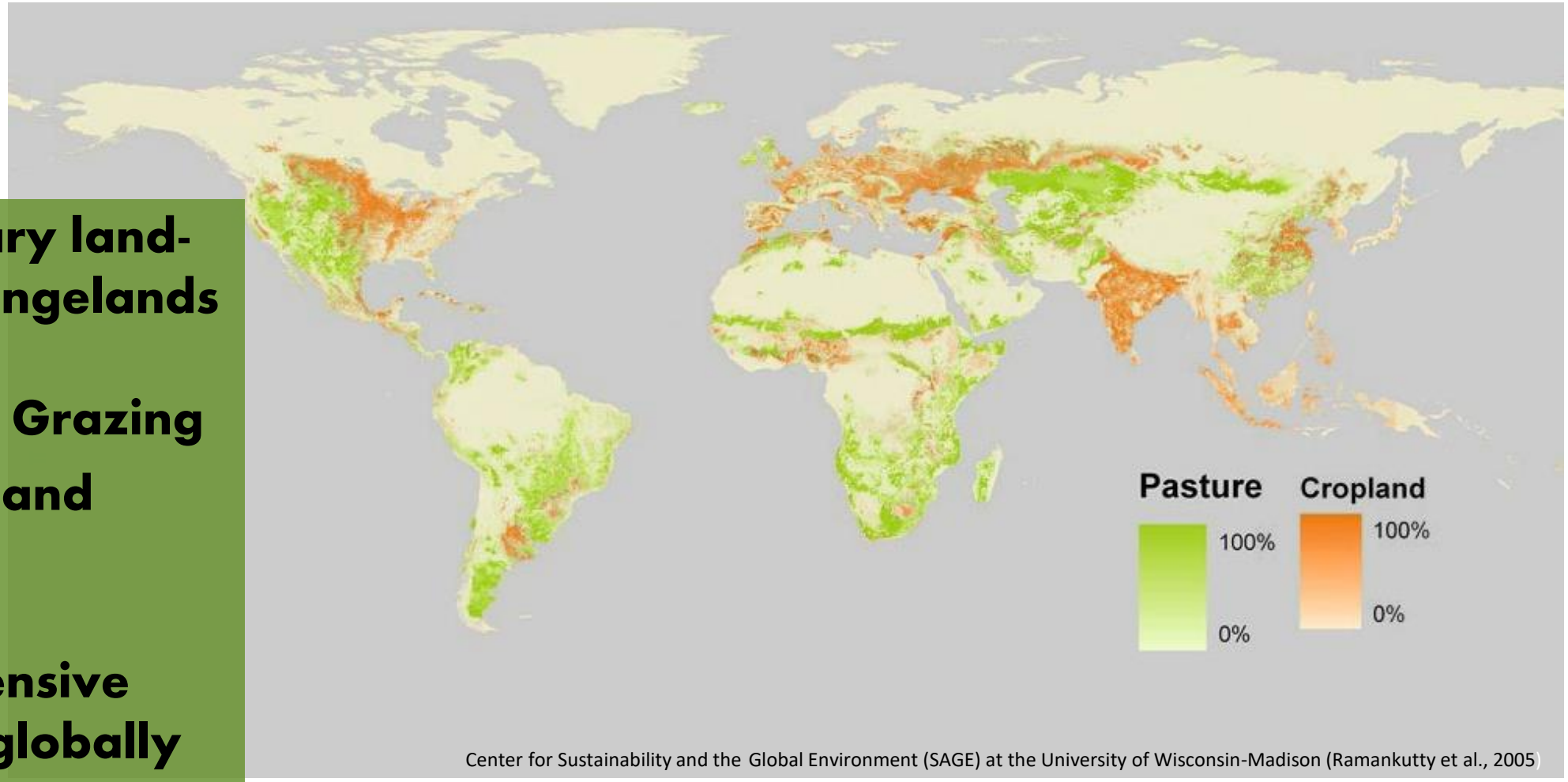
Rangelands of the World



"Land on which the indigenous vegetation is predominantly grasses, grass-like plants, forbs, or shrubs and is managed as a natural ecosystem." – Society of Rangeland Management (1998)

Grazing on Rangelands

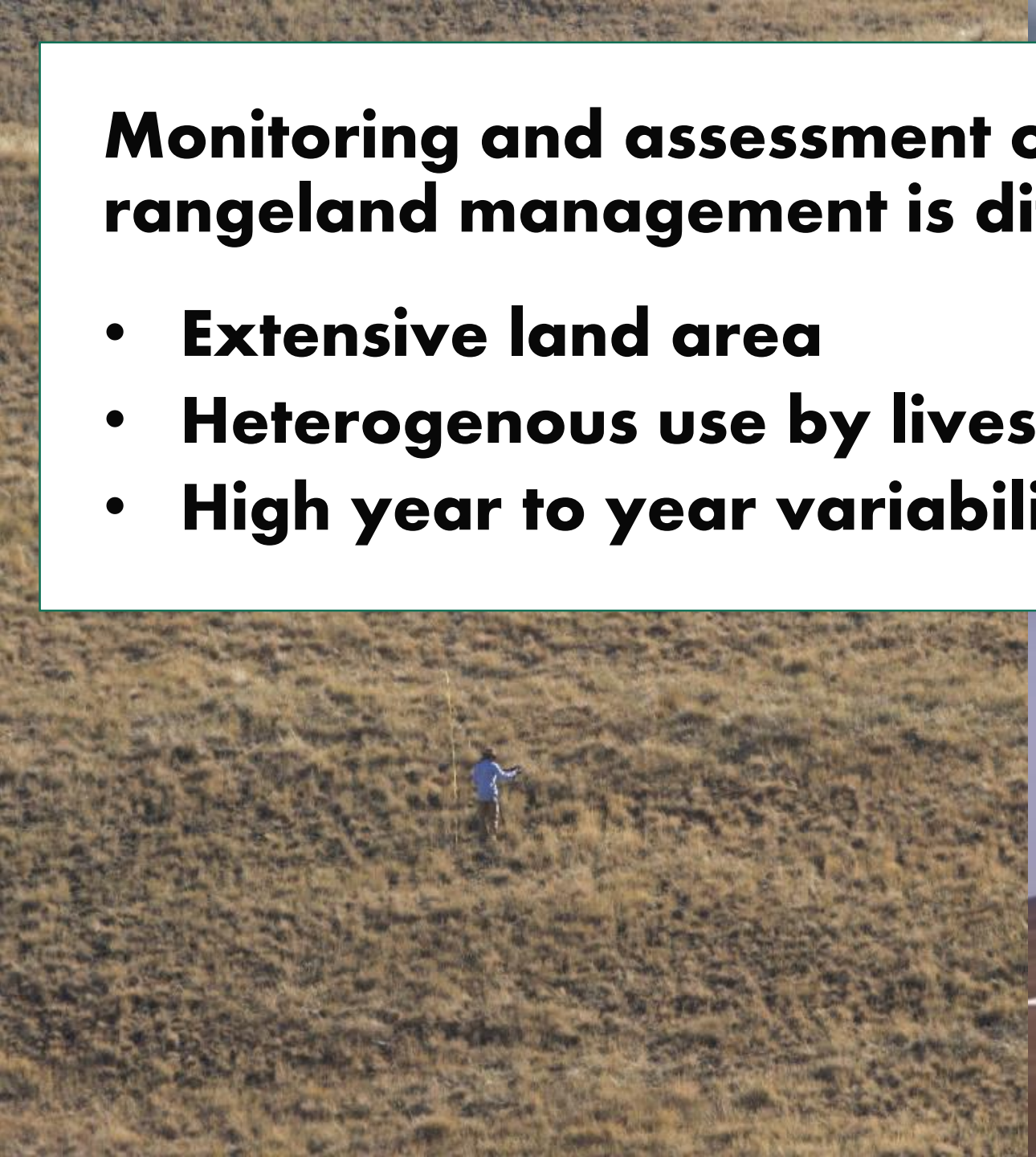
- **The primary land-use on Rangelands**
- **Managed Grazing = 25% of land surface**
- **Most extensive land-use globally**

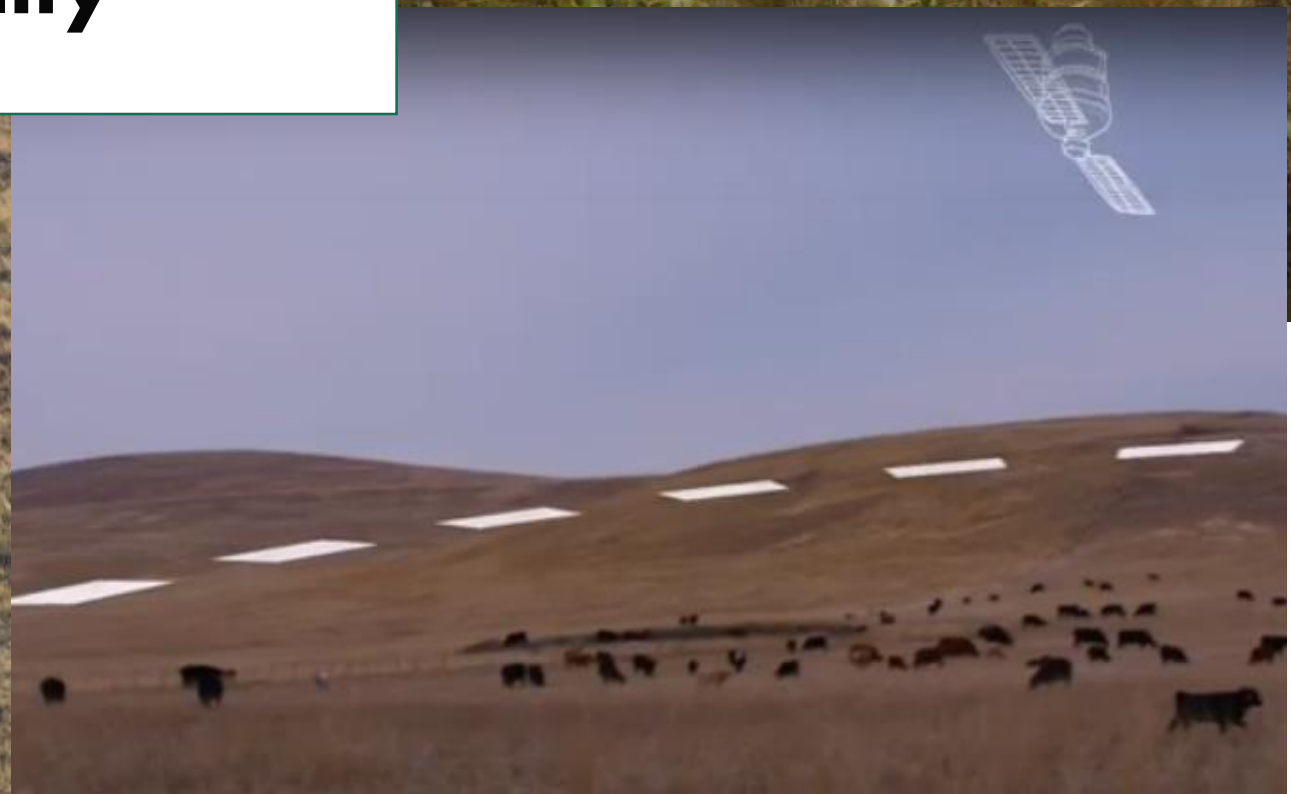


Center for Sustainability and the Global Environment (SAGE) at the University of Wisconsin-Madison (Ramankutty et al., 2005)

Monitoring and assessment of rangeland management is difficult

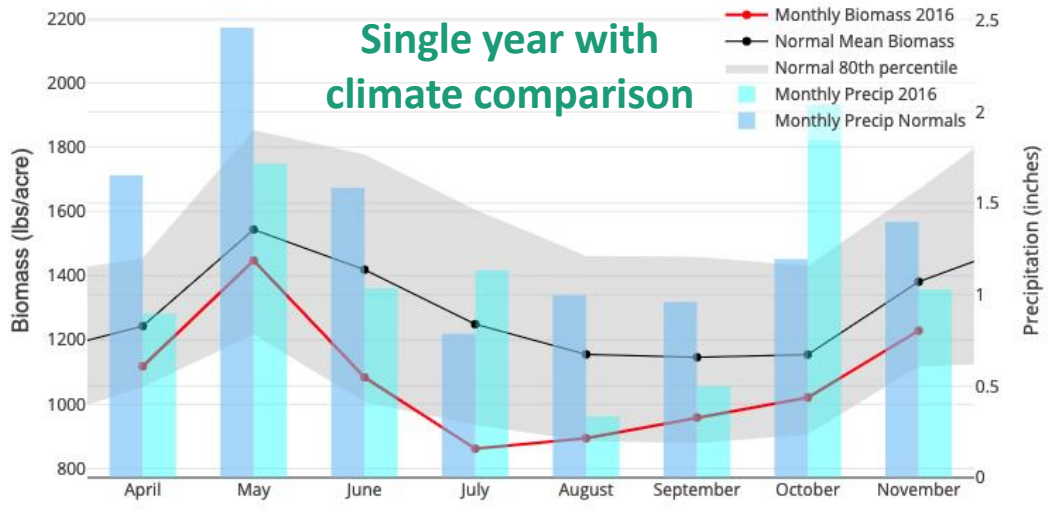
- Extensive land area
- Heterogenous use by livestock
- High year to year variability



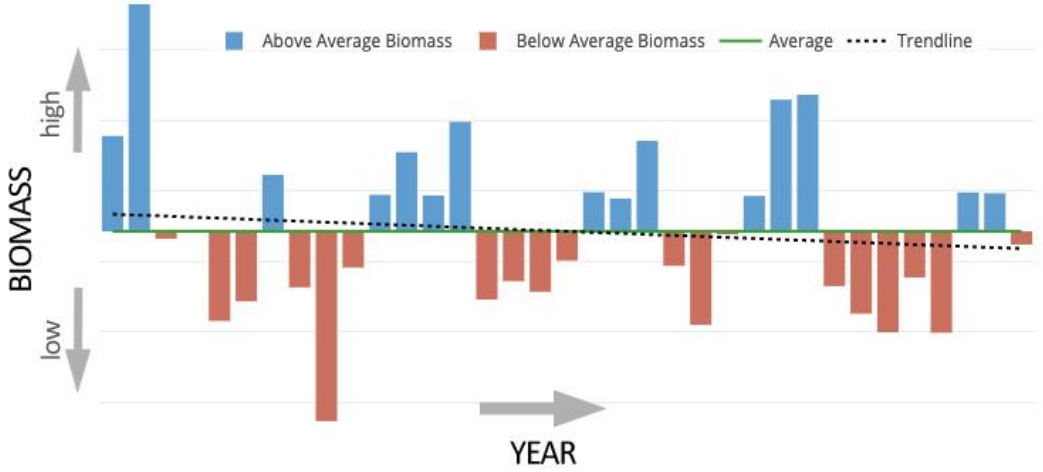


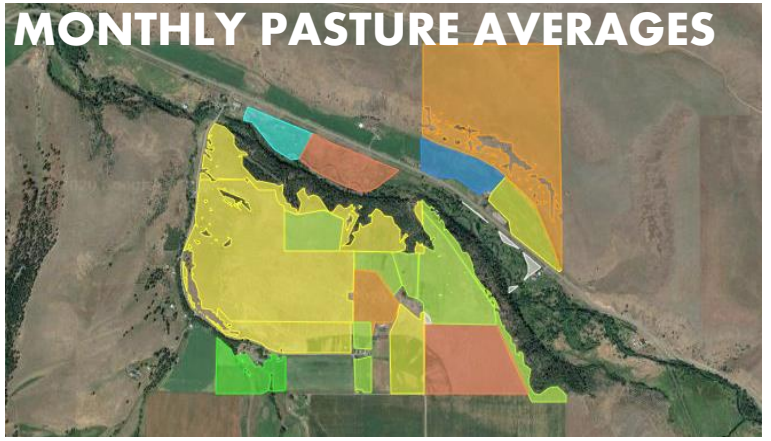
RangeSAT Web Tools

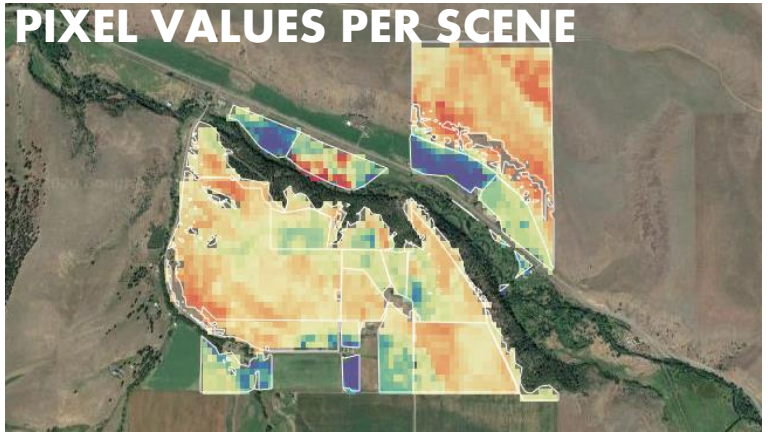
SINGLE PASTURE ANALYSIS:

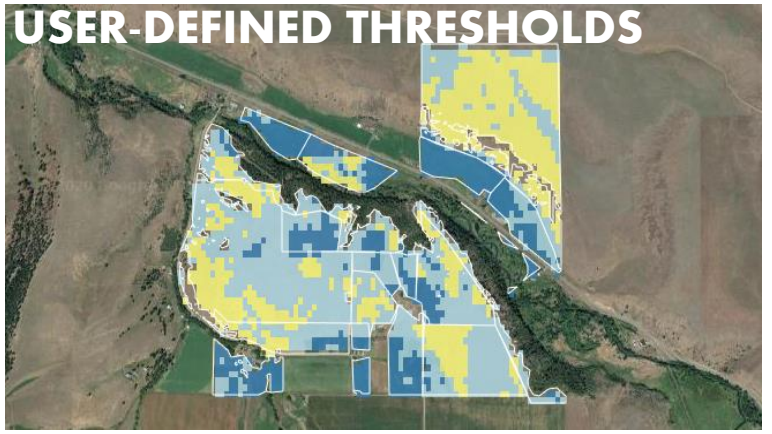


MULTIPLE YEAR ANALYSIS:



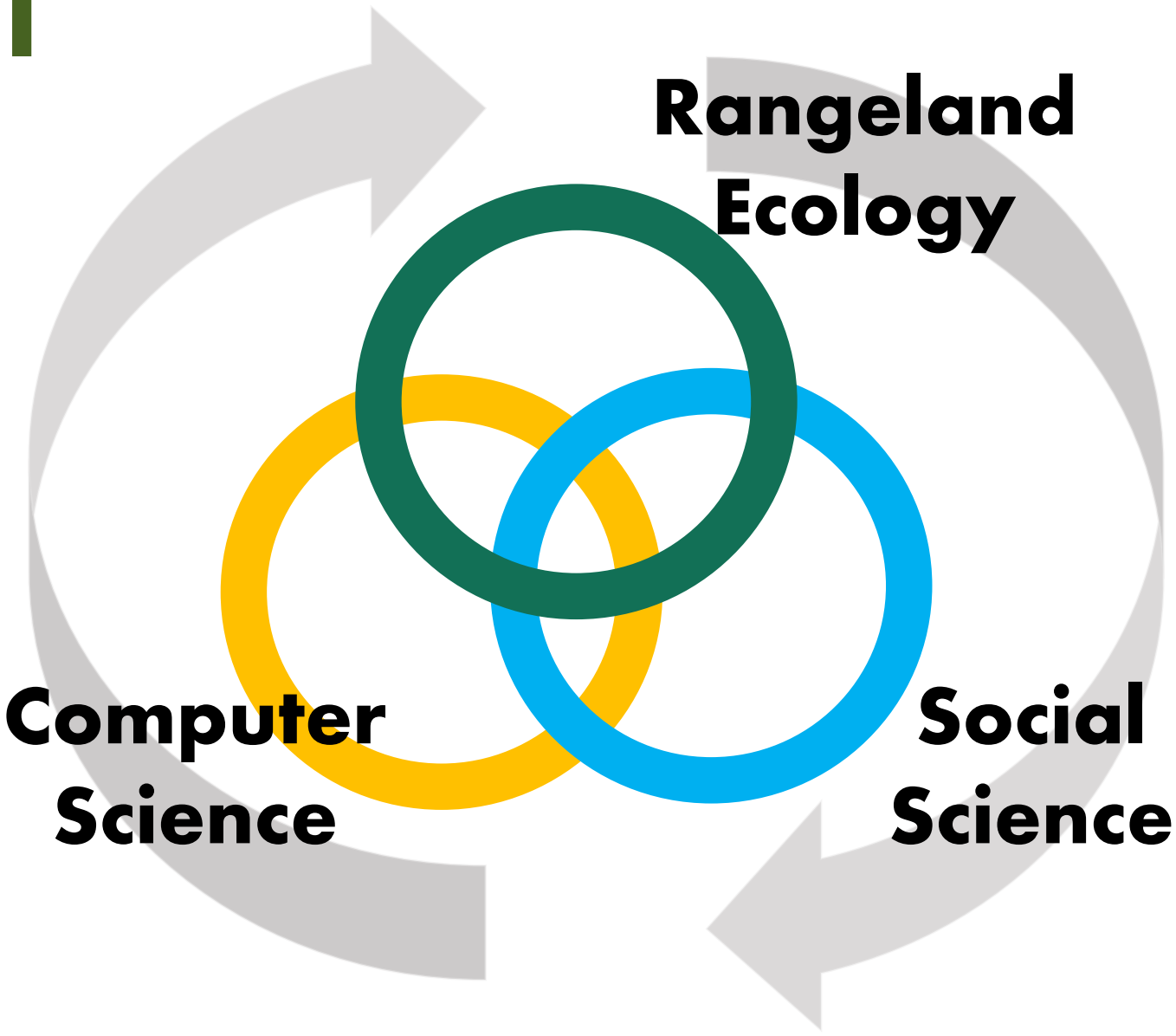






Building RangeSAT

- RangeSAT is a collaborative effort
  - Ranchers
  - Land managers
  - Scientists
    - Rangeland ecology
    - Sociology
    - Computer scientists



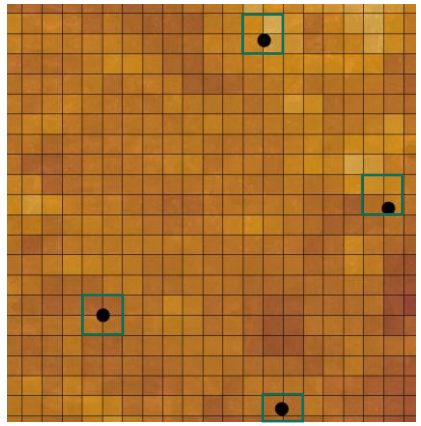
Co-development with End Users

- Initial Project surveys
  - What monitoring data or information do ranchers use to make management decisions?
- Presented a tool mock-up for feedback
- Feedback guides tool creation

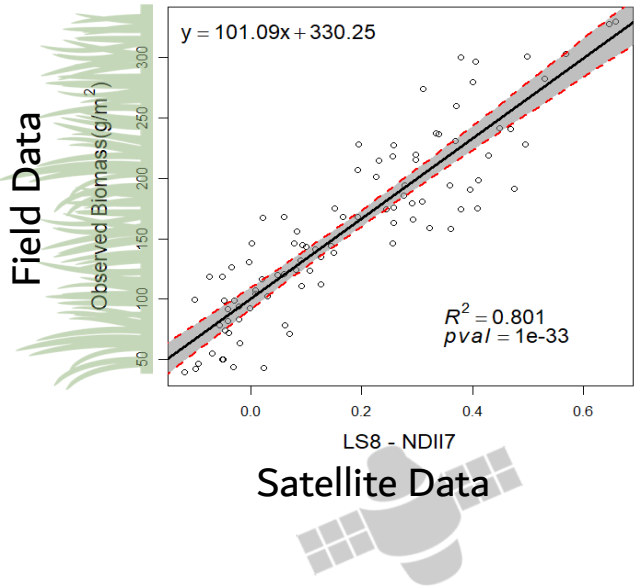
Mapping Vegetation Amount

Field Data

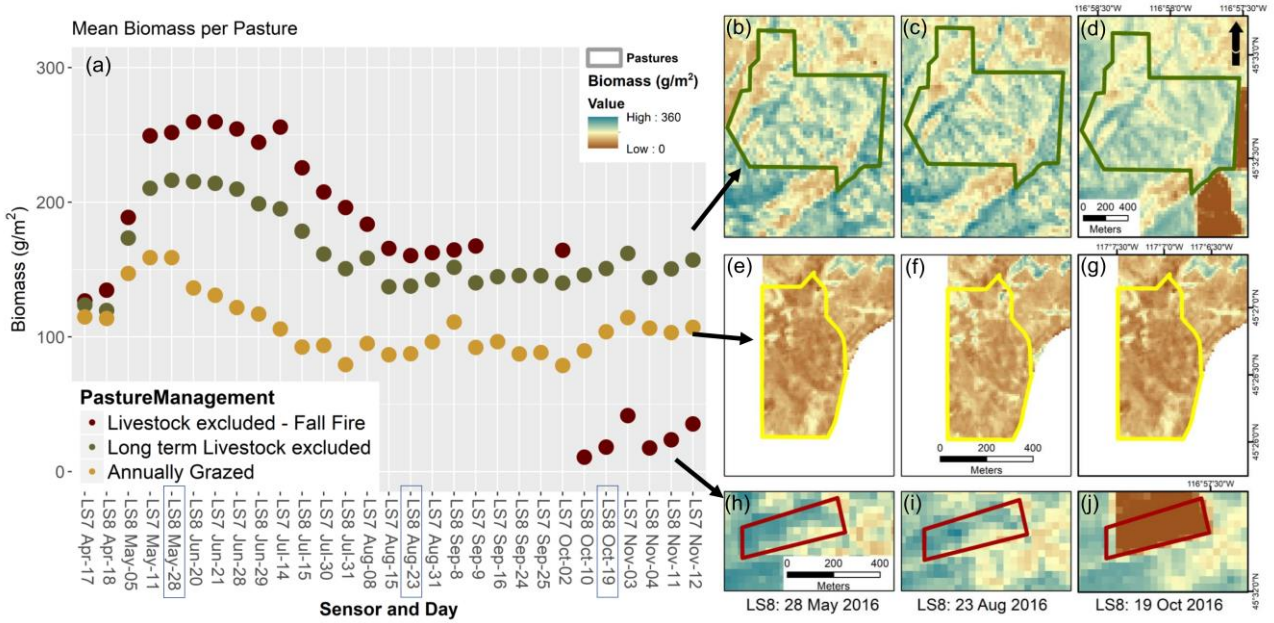
Satellite Data



Statistical model



Results



Jansen VS, Kolden CA, Schmalz HJ. The Development of Near Real-Time Biomass and Cover Estimates for Adaptive Rangeland Management Using Landsat 7 and Landsat 8 Surface Reflectance Products. *Remote Sensing*. 2018; 10(7):1057.

https://www.mdpi.com/2072-4292/10/7/1057

Delivering Geospatial Data to End Users

Server side / Back End

USGS science for a changing world

1. Order and acquire Landsat Scenes (LS)

crontab 0 0 * * * python3 order_scenes.py
crontab 6 0 * * * python3 download_scenes.py
Code at: https://github.com/rogerlew/rangesat-biomass

2. Process scenes for location

for each scene
extract to a ramdisk
crop LS to location and store on NAS
build biomass rasters using model
for each ranch
for each pasture
calc biomass statistics
store in db

SQLite

3. API for Front End

Flask web development, one drop at a time

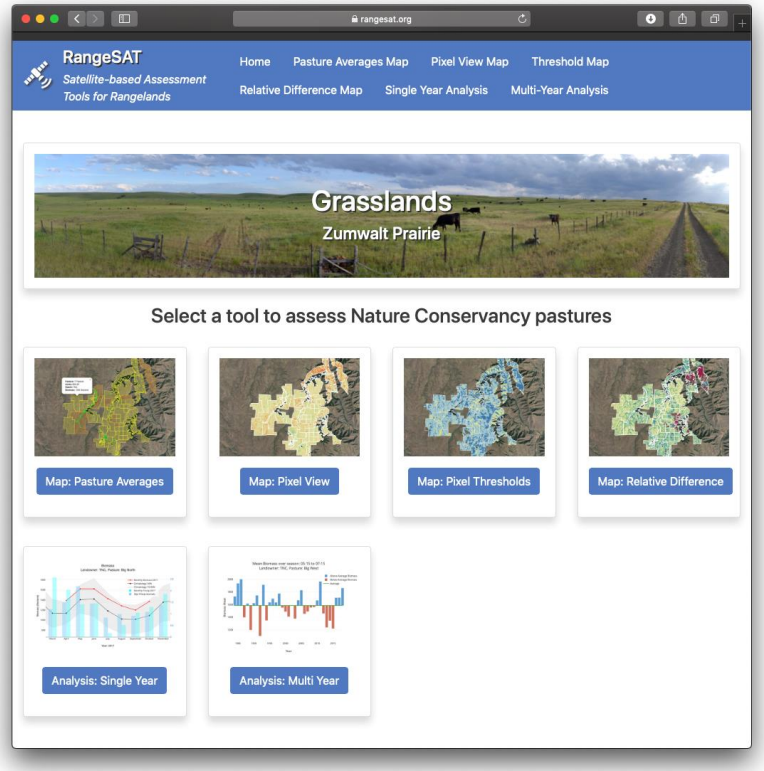
query available scenes
obtain rasters w/ on-the-fly masking of ranches
raster processing (e.g. difference maps)
vector maps of ranches/pastures
query pasture statistics with on-the-fly aggregation
(e.g. average from May to June)

Client Side / Front End

4. Query API

Drupal™ jQuery write less, do more. Leaflet plotly

query API to:
display rasters,
generate thematic maps by pasture,
graph time series data



Testing, validating and improving RangeSAT and livestock use (utilization) monitoring

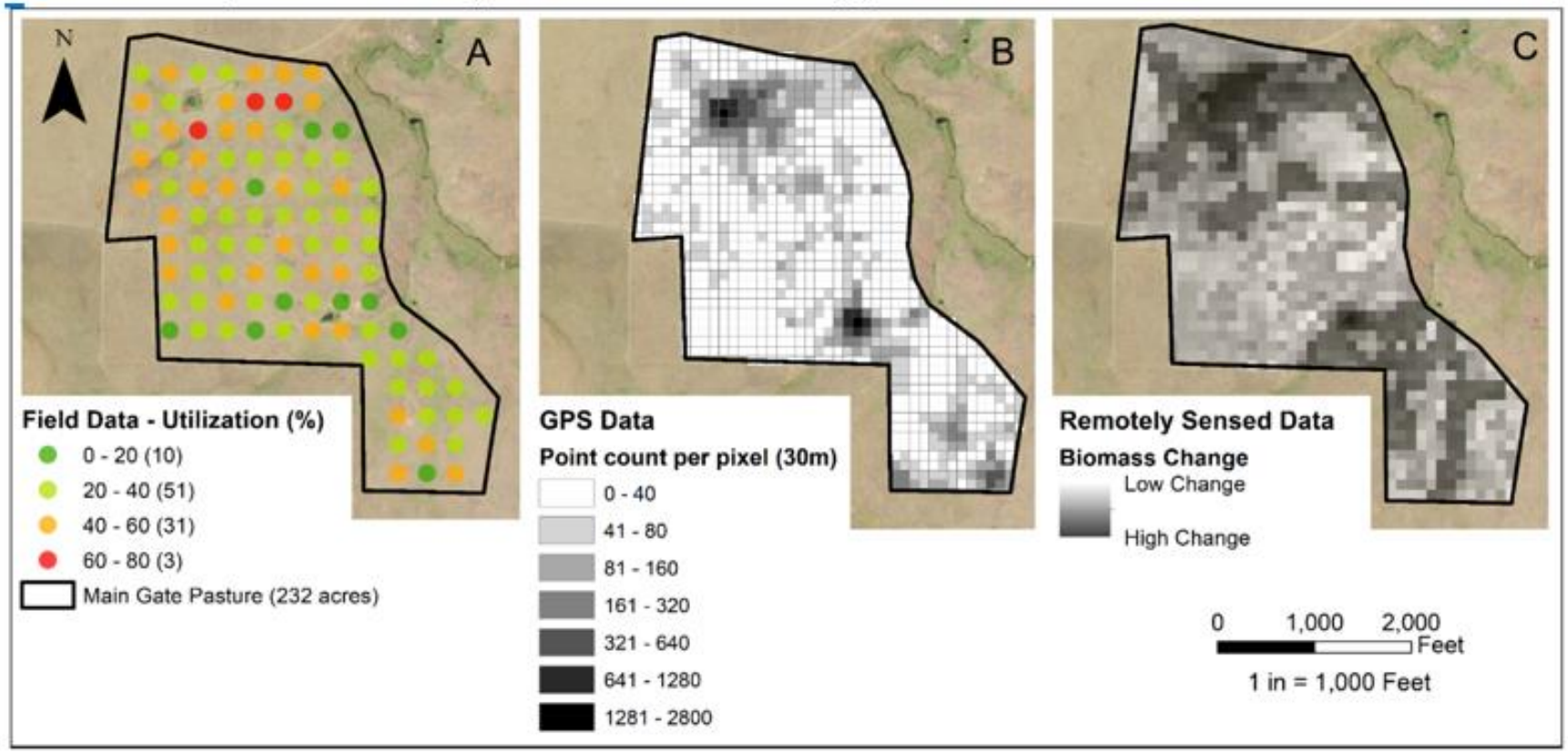
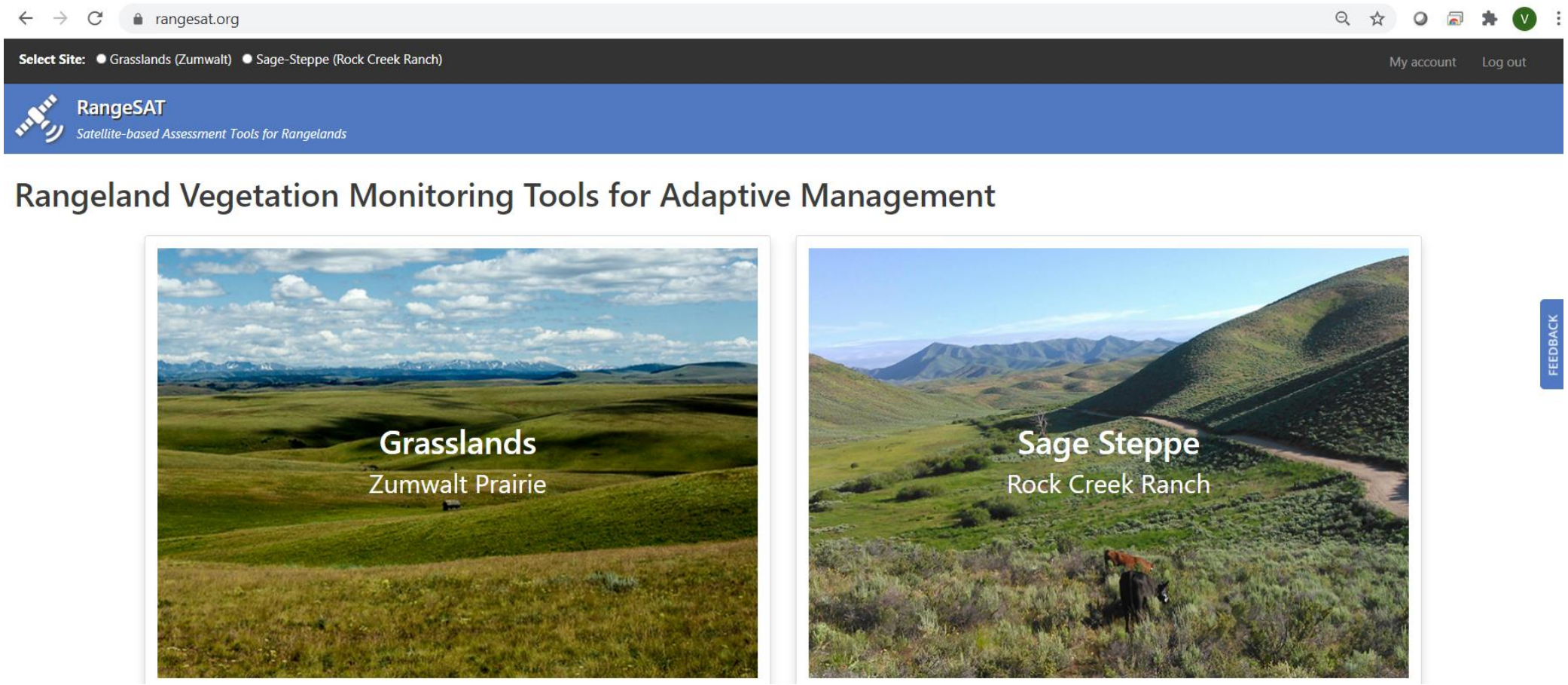


Fig. 5. (A) Map of field base utilization data using NRCS Key Forage Method. (B) Map of GPS point data per 30 m pixel, displayed as the number of points per pixel. (C) Map of the relative difference in biomass using pre grazing (July 26th, 2020) and post grazing (August 11th, 2020) biomass maps derived from remotely sensed imagery.

Jansen and Traynor et al., in review. Rangelands

Thank you



University of Idaho

USDA Northwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

The Nature Conservancy

NRCS
Natural Resources Conservation Service

USDA NRCS
This material is based upon work supported by the Natural Resources Conservation Service, U.S. Department of Agriculture, under a Conservation Innovation Grant (CIG), agreement number NR193A750008G005

Northwest Climate Hub
Funding provided under agreement number 17-JV11261944-073