Southern Rockies Western Slopes Agriculture

Identifying Drivers of Rangeland Production for Drought Planning on the Western Slope of the Southern Rockies

Abstract

Over the last decade, the southern Rocky Mountains of the United States have experienced increasingly severe and variable drought. Local ranchers and landowners have reported strain on their operations, citing decreasing forage production for their cattle and a need to adjust their business models, even considering abandoning their businesses altogether. The study identified Major Land Resource Area-48 (MLRA-48) and northwestern Colorado as the key region for analysis. NASA DEVELOP partnered with the BLM Colorado River Field Office, Colorado State University Extension, USDA Forest Service, and the National Drought Mitigation Center to address stakeholder concerns of the efficacy of existing remotely sensed rangeland production estimation platforms and explore possible early warning climatic indicators of drought. The study identified two key rangeland platforms, The Rangeland Production Monitoring Service (RPMS) and Rangeland Analysis Platform (RAP) and used in-situ data to statistically validate their efficacy. RAP outperformed RPMS in estimating in-situ biomass and was therefore used in our climate modeling. Our study performed a random forest analysis, sampling 1500 points across the study area, comparing monthly RAP biomass estimates to a variety of climatic variables, including mean precipitation, temperature, palmer drought severity index, snow water equivalent, wind speed and direction, and vapor pressure deficit. After analysis, our study determined that vapor pressure deficit is a key indicator in predicting forage production in MLRA-48. Our study recommends the use of RAP in estimating potential forage, with caution for its tendency to overestimate. Our climate analysis provided our partners with greater understanding of the influence of various climatic factors in determining forage production and allows them to assist landowners in planning for future drought.

Project Partners

- National Drought Mitigation Center
- Colorado State University Extension
- USDA Forest Service
- Bureau of Land Management – Colorado River Valley Field Office

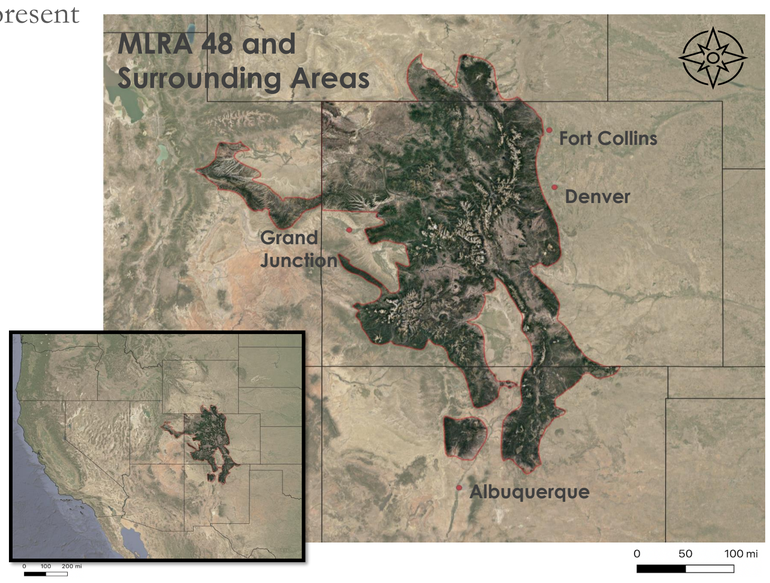
Objectives

- **Produce** ground truth rangeland models that quantify the reliability of the Rangeland Analysis Platform (RAP) and Rangeland Production Monitoring Service (RMPS) remote sensing products.
- **Create** a forage production analysis of the relationship between production and multiple meteorological factors in the region.

Earth Observations

Study Area & Period

- MLRA 48A & B span across Colorado, Wyoming, Utah, and New Mexico
- Over 70% of MLRA 48 is federally owned
- Land usage comprises grazing, recreation, forestry, and irrigated farming
- 1986-present



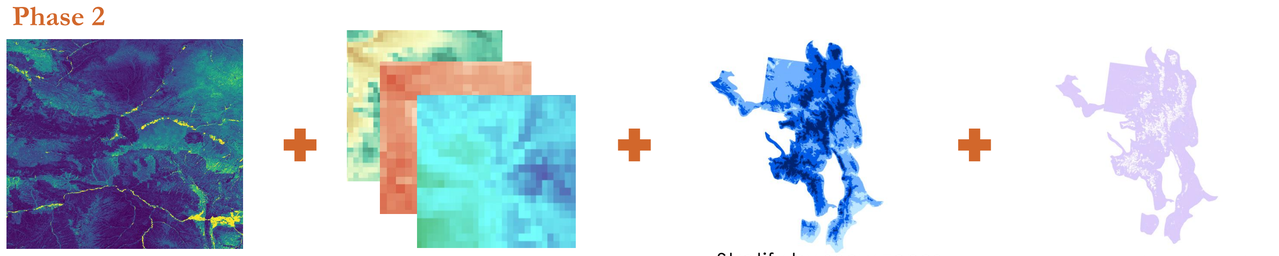
Methodology

Phase 1

Lat	Long	Date	Herb	Location	Plot ID
40.93118	-108.534	7/1/2014	157	West Moffat	BLMLT1
40.94323	-108.752	7/4/2014	25	West Moffat	Ref1Mat
40.9286	-108.75	7/5/2014	41	West Moffat	Ref1w

In situ data + RMPS data + RAP data + Stratify by snow zones

Phase 2



Results: Phase 1

Snow Zone 1 (Low)

	R^2 (%)	RMSE	Mean Bias	*P*-value
RAP	30.84	62.33	-189.75	0.44
RPMS	4.43	122.17	-275.50	0.79

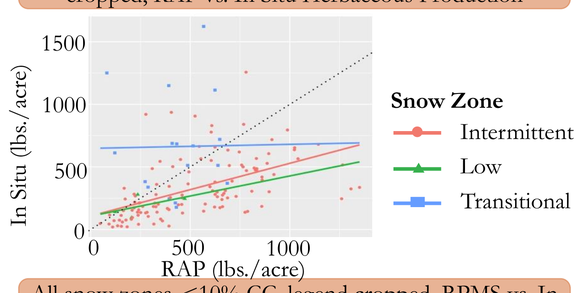
Snow Zone 2 (Intermittent)

	R^2 (%)	RMSE	Mean Bias	*P*-value
RAP	27.45	204.16	-329.78	<0.001
RPMS	0.01	264.94	-285.52	0.95

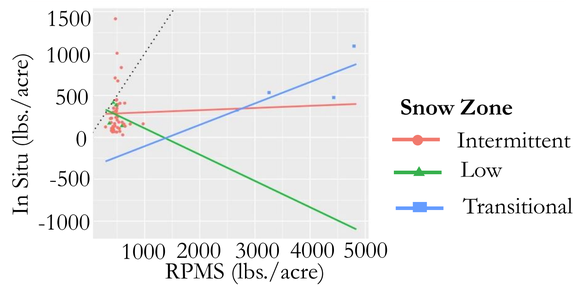
Snow Zone 3 (Transitional)

	R^2 (%)	RMSE	Mean Bias	*P*-value
RAP	0.51	388.63	-633.94	0.79
RPMS	57.54	188.30	-606.00	0.24

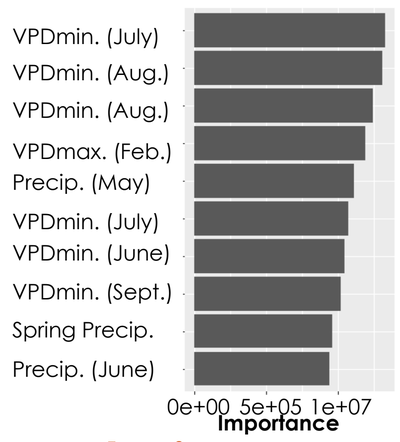
All snow zones, <10% forest canopy cover, legend cropped, RAP vs. In Situ Herbaceous Production

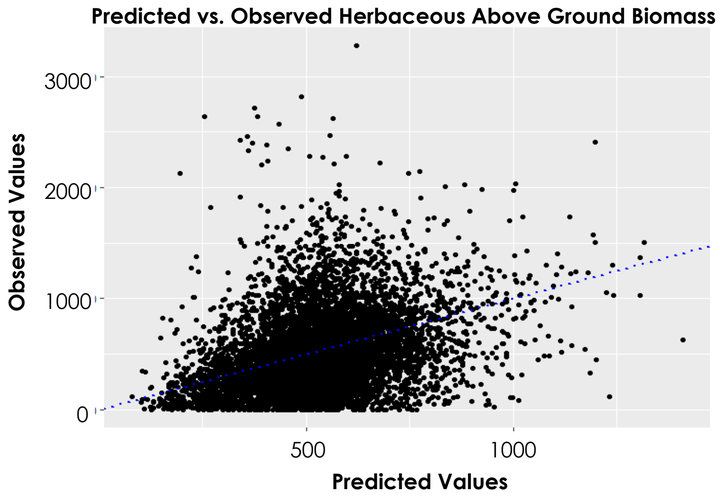


All snow zones, <10% CC, legend cropped, RPMS vs. In Situ Total Production



Results: Phase 2





Conclusions

Phase 1

- RAP overpredicts production, but as in situ values increase so do RAP values.
- Based on our regression, RAP has a closer relationship with the in situ data than RPMS does.

Phase 2

- The relationship between RAP and the In Situ data in our study indicates that RAP is more accurate than RPMS for calculating rangeland production.
- Vapor Pressure Deficit minimum and precipitation had the largest apparent influence on rangeland production

Team Members

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