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4-11-2011

To Eat or Not to Eat? Developing Biomarkers for Diet Selection by Herbivores

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Abstract

A major goal in conservation biology is to explain habitat use by animals. Remote sensing has been used for landscape-scale analysis of habitat features. However, studies that directly link specific parameters of habitat quality to selection by wildlife are needed at the microsite-scale before landscape-scale mapping can be validated. We used the sagebrush-pygmy rabbit system to develop spectral biomarkers that can predict how the quality of food influences habitat use.

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To eat or not to eat? Developing biomarkers for diet selection by herbivores

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Background

A major goal in conservation biology is to explain habitat use by animals. Remote sensing has been used for landscape-scale analysis of habitat features. However, studies that directly link specific parameters of habitat quality to selection by wildlife are needed at the microsite-scale before landscape-scale mapping can be validated. We used the sagebrush-pygmy rabbit system (**Fig. 1**) to develop spectral biomarkers that can predict how the quality of food influences habitat use.

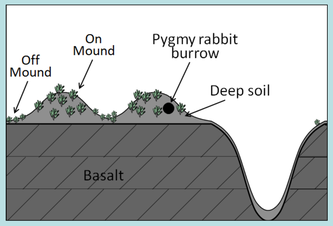

Figure 1. Diagram (left) showing the sagebrush-pygmy rabbit system. The deeper soil provides both a burrow habitat for the rabbits (pictured, right) and produces higher quality sagebrush.

Objectives

Objective 1: Compare dietary quality of sagebrush on-mounds and off-mounds.
Objective 2: Show that high-browsed plants are higher in crude protein than low-browsed plants.
Objective 3: Develop a spectral biomarker that can predict crude protein and thus diet selection by pygmy rabbits.

Methods

•We quantified crude protein of sagebrush on- (n=27) and off-mounds (n=27) and from plants high- (n=30) and low-browsed (n=30) by pygmy rabbits.
•We then used a spectrophotometer to scan these same samples.

Figure 2. The contact probe (left) used to scan samples and the spectrophoto-meter (right).

Plants differ within landscapes

•Crude protein was higher in sagebrush taken on-mound than off-mound (**Fig. 3**, P<0.0001).
•Crude protein was higher in plants highly browsed than plants less browsed by pygmy rabbits (**Fig. 4**, P=0.05).

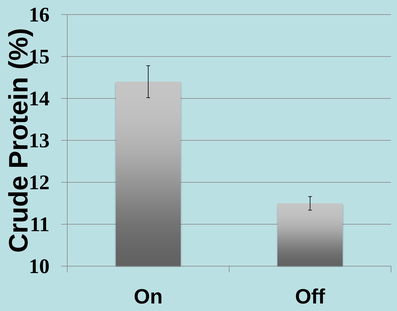

Figure 3. Mean percent crude protein for sagebrush taken from on and off mounds (P<0.0001).

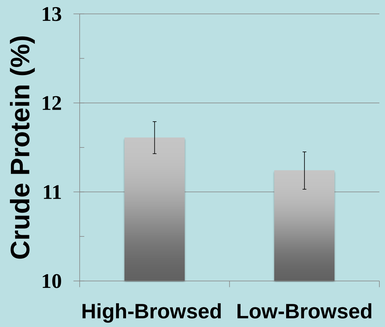

Figure 4. Mean percent crude protein for high-browsed and low-browsed sagebrush (P=.05).

Each plant has a unique spectrum

•Preliminary data shows the spectra of sagebrush taken from on- and off-mounds are different at several wavelengths (**Fig. 5**).

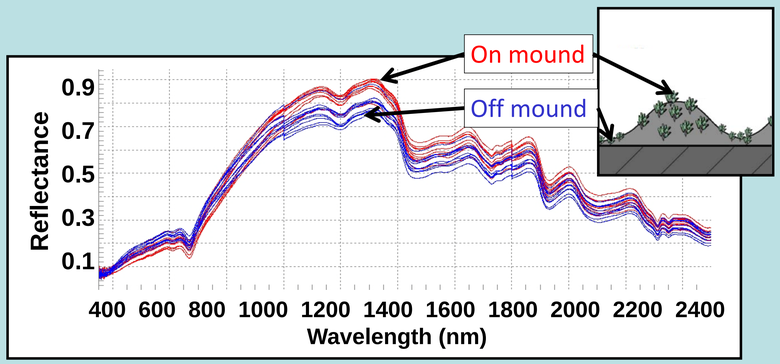

Figure 5. Reflectance spectra comparing a subsample of sagebrush on mound (red, n=10) and off mound (blue, n=10).

Conclusions

•Variation exists: higher quality sagebrush closer to burrows
•Rabbits choose to browse plants with higher crude protein
•Preliminary spectral differences can be used to develop biomarkers
•Spectral biomarkers could provide a tool for the rapid assessment of quality food across landscapes (**Fig. 6**)
•Agencies armed with this tool would be able to better identify and conserve quality habitat for pygmy rabbits

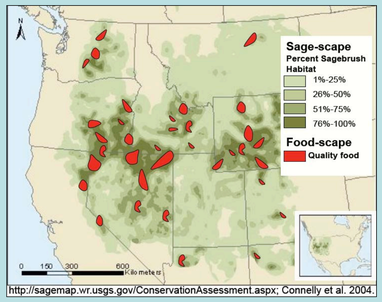

Figure 6. Theoretical food-scape showing a possible distribution of quality sagebrush as food for an herbivore across the landscape. The map is adapted from Connelly et al. 2004.

Literature Cited

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Acknowledgements

This project was supported in part by NSF award number EPS-0814387 from the NSF Idaho EPSCoR Program and by the BLM CCS L09AC16253 grant awarded to J. Forbey.