

Postfire shrub dynamics determined from very large scale aerial (VLSA) imagery

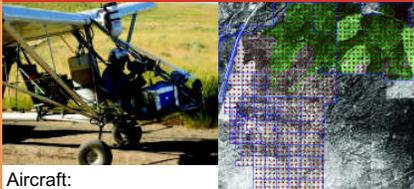
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Introduction

The true location of very large scale aerial (VLSA) images have been >40 m from where the navigation system reported the location, making it difficult to validate VLSA image-based measurements. Before VLSA imagery can be generally recommended as a tool for measuring shrub cover, it should be validated.

We georeferenced VLSA images, made paired ground- and image-based shrub cover measurements, and quantified agreement between methods. We then measured cover from VLSA images to determine postfire shrub canopy cover dynamics for antelope bitterbrush, sagebrush, and spineless horsebrush.

Materials and Methods



Aircraft:

- Light piloted fixed-wing aircraft
- 250 m AGL at 23.2 m s⁻¹

Cameras:

- 11.1 MP – Canon EOS 1Ds
- 16.7 MP – Canon EOS 1Ds Mark II

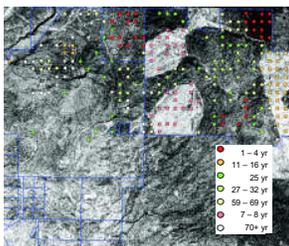
Navigation system:

- DGPS, Laser Altimeter, Tracker Software

Image locations and sampling:

- US Sheep Experiment Station VLSA survey
- 1134 locations on a 300-m grid were imaged in 5.2 hr of flight
- 457 locations in mountain big sagebrush community
- 210 locations sampled for postfire shrub dynamics analysis
- 30 images (2.3 mm GSD) from each of the 7 years-since-last-burn classes were measured.

Sample locations within the mountain big sagebrush community. Within each of the 7 years-since-last-burn classes, there are 30 samples. The background is a 2002 panchromatic QuickBird image.



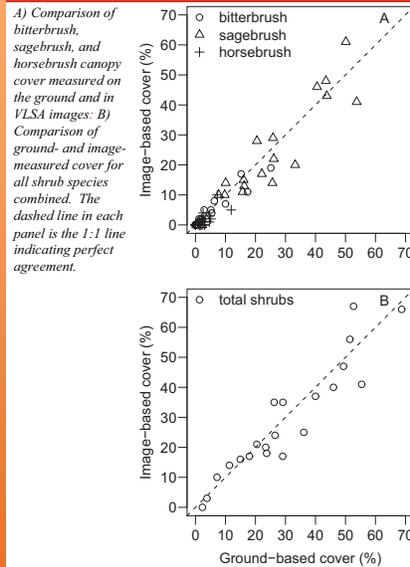
Validation:

- 21 paired images and ground plots
- 3 images from each of the 7 years-since-last-burn classes
- Image measurements – 100 random pixels (point intercept)
- Ground measurements – 100 m of line intercept (20 lines from plot center)
- Images were georeferenced using QuickBird as the base imagery and 11.1 MP VLSA images (24 mm GSD) as an intermediate.
- Limit of Agreement analysis was used to quantify agreement between methods

Example VLSA image



Validation



Shrub type	Mean A - B ^a	Intercept	Slope	R ²
Bitterbrush	0.67	0.03	1.16	0.92
Horsebrush	1.20*	1.44*	0.84	0.51
Sagebrush	1.10	3.59	0.88	0.87
All	1.28	3.85	0.91	0.87

^a A = ground-measured cover; B = image-measured cover.
 * Significantly different from 0 ($\alpha = 0.05$).

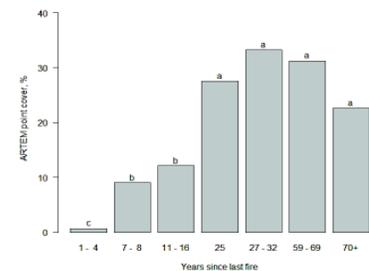
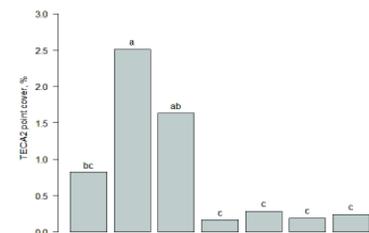
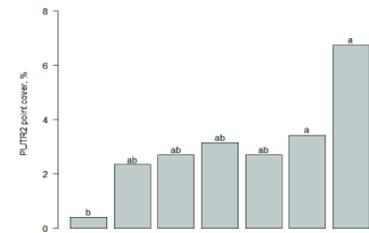
The mean difference in bitterbrush, sagebrush, and all brush species was not different from 0. Horsebrush cover measured on the ground was, on average, 1.2% greater than measured in VLSA imagery.

Regardless of shrub type, ground-based method repeatability is equivalent to the ½ LoA width between methods.

Shrub type	Ground Measurement		VLSA	
	Min	Max	Repeat-ability	½ LoA ¹ Width
Bitterbrush	0.0	25.1	3.8	3.6
Horsebrush	0.0	11.9	2.3	3.6
Sagebrush	0.3	53.7	11.8	12.2
All	2.3	68.7	11.8	13.2

¹ LoA = Limit of Agreement

Postfire shrub dynamics



After burning, bitterbrush (PUTR2) and sagebrush (ARTEM) cover were significantly reduced and horsebrush (TECA2) cover remained low. Between 7 and 16 yr after a burn, horsebrush cover peaked. By 7 to 8 yr after a burn, bitterbrush cover was restored. By 7 to 8 yr after a burn, sagebrush cover was significantly greater than it was 1 to 4 years after a burn. Sagebrush cover did not reach preburn levels until 25 years after a burn.

Conclusions

Antelope bitterbrush, spineless horsebrush, and sagebrush canopy cover measurements made with VLSA and ground methods were equivalent. Thus, VLSA imagery is an efficient method for estimating cover of these and is an efficient tool for addressing landscape scale questions about these important shrub species in mountain big sagebrush communities.

References

- Moffet, C.A. 2009. Agreement Between Measurements of Shrub Cover Using Ground-Based Methods and Very Large Scale Aerial Imagery. Rangeland Ecology and Management. (In Press).
- Booth, D.T. and S.E. Cox. 2006. Very large scale aerial photography for rangeland monitoring. Geocarto International 21:27-34.