Title: Quantifying Changes in Carbon Pools with Shrub Invasion of Desert Grasslands using Multi-Angle Data from EOS Terra and Aqua

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Goals: Our research addresses new approaches to exploiting data from the NASA Earth Observing System Multi-angle Imaging Spectro-Radiometer (MISR) and Moderate Resolution Imaging Spectroradiometer (MODIS) for mapping woody plants in arid and semi-arid regions. We are working to improve regional carbon pool estimates: woody plant encroachment of invasive shrubs is the second largest source of uncertainty in carbon flux estimates after forest. Approaches: community type mapping and geometric-optical (GO) canopy reflectance models.

Data: • MISR level 1B2 MI1B2T terrain-projected product • MISR Level 1B2 MI1B2GEOP geometric parameters • Ikonos 1 m panchromatic imagery • SRTM Digital Elevation Model • MISR Level 2 MIL2ASAE aerosol product • MOD09 Surface Reflectance product • MODIS Vegetation Continuous Fields • Jornada/Sevilleta LTER Vegetation Maps

Recent Progress: In desert grasslands we have found that fractional woody shrub cover can be mapped down to about 0.05 (typical range 0.00 - 0.28) with a MISR/GO approach – including shrubs that are growing in grass-dominated areas as well as more established stands over sparse understories (Chopping et al., 2006). This approach has also allowed us to map woody plant cover, canopy height, and biomass at 250 m over large parts (>200,000 km²) of Arizona and New Mexico (Chopping et al., 2007), with the potential to also provide estimates of understory density. Results over forest from a random sample of 576 points showed compatibility with U.S. Forest Service predictions over the same area. All relationships were significant at the 99% level and could not have occurred by chance. This is the first time that canopy height has been estimated using explicit GO modeling with moderate resolution data from a passive NASA EOS instrument with a high revisit capability.

We also performed research on the use of support vector machine (SVM) algorithms for classification of MISR and MODIS data sets to 19 often subtly differing community types in the Jornada Experimental Range and the Sevilleta National Wildlife Refuge, New Mexico. We obtained important improvements using multi-angle observations and BRDF model anisotropy patterns. With a maximum likelihood classifier the overall classification accuracy increased from 45.4% for nadir observations to 67.5% using anisotropy patterns: an increase of 22.1%. Using a non-parametric SVM algorithm we were able to further raise the classification accuracy to 76.7% (Su et al., 2007a), and including topographic and soils data did not improve on this. More information, including recent publications: http://csam.montclair.edu/~chopping/wood