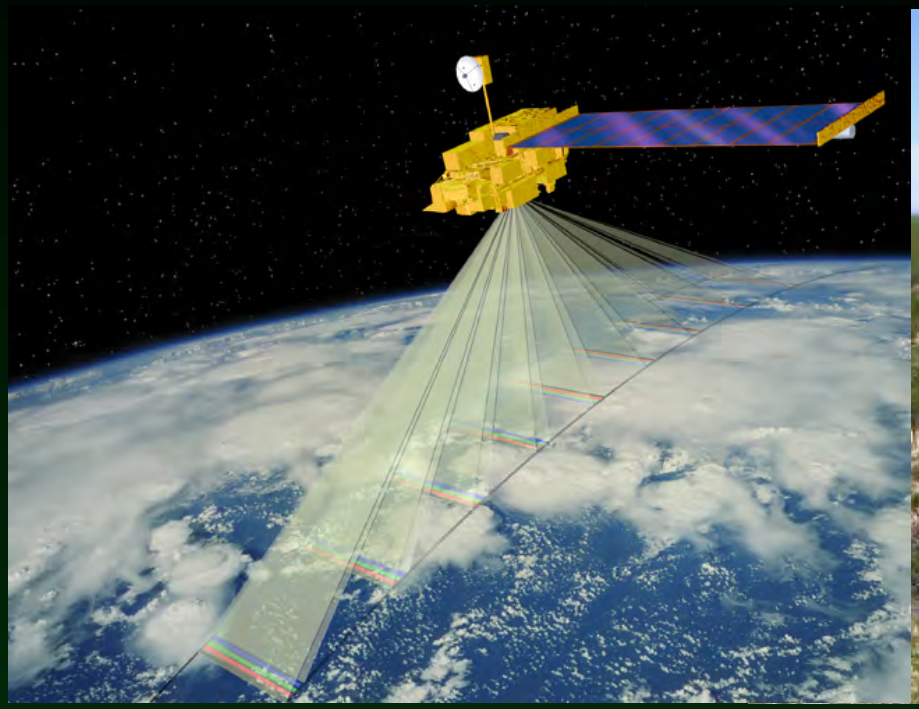
Update on MISR applications to Shrub Abundance Mapping in Desert Grasslands



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3 March 2006

Structure: A Strength of Multiangle Remote Sensing

- Multi-angle sampling provides sensitivity to vegetation canopy structure, even for low density canopies such as those encountered in the desert grasslands of the southwest US

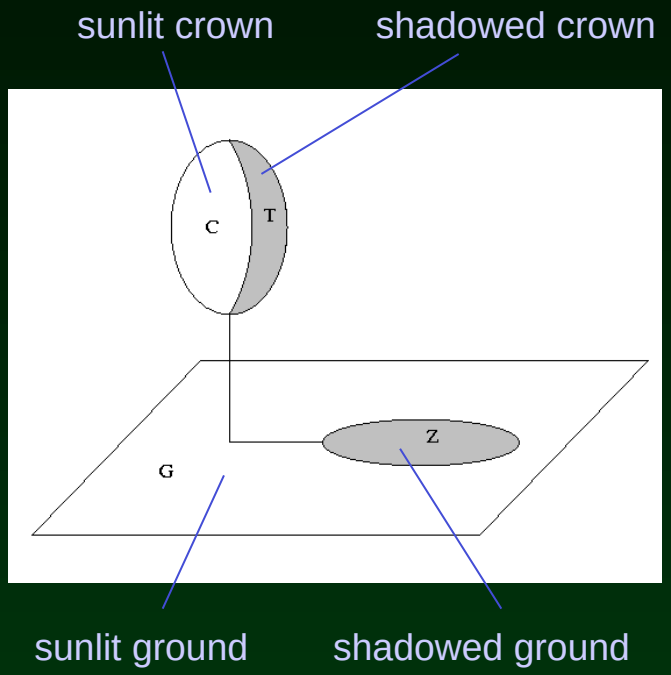
- Canopy structure can be inferred through various approaches, including **geometric-optical modeling**

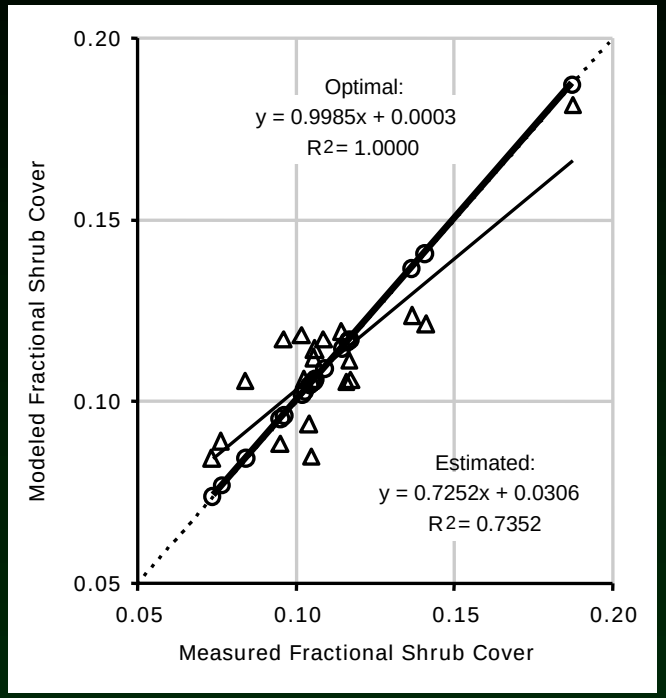
- A major prerequisite for GO modeling is the ability to estimate the relative contributions of the upper canopy (i.e., shrubs) and the soil-understory component (exposed soil, grasses, sub-shrubs, and forbs)

Geometric-Optical Modeling of Vegetation

GOAL: to obtain areally-weighted proportions of background (soil, understory) and upper canopy components. Geometric-Optical (GO) models provide one method of understanding the sensitivities of passive multi-angle sensing to canopy structure parameters of practical significance to ecosystem modeling:

- woody shrub cover
- mean shrub crown shape and radius
- shrub number density
- canopy height
- soil/understory brightness and anisotropy

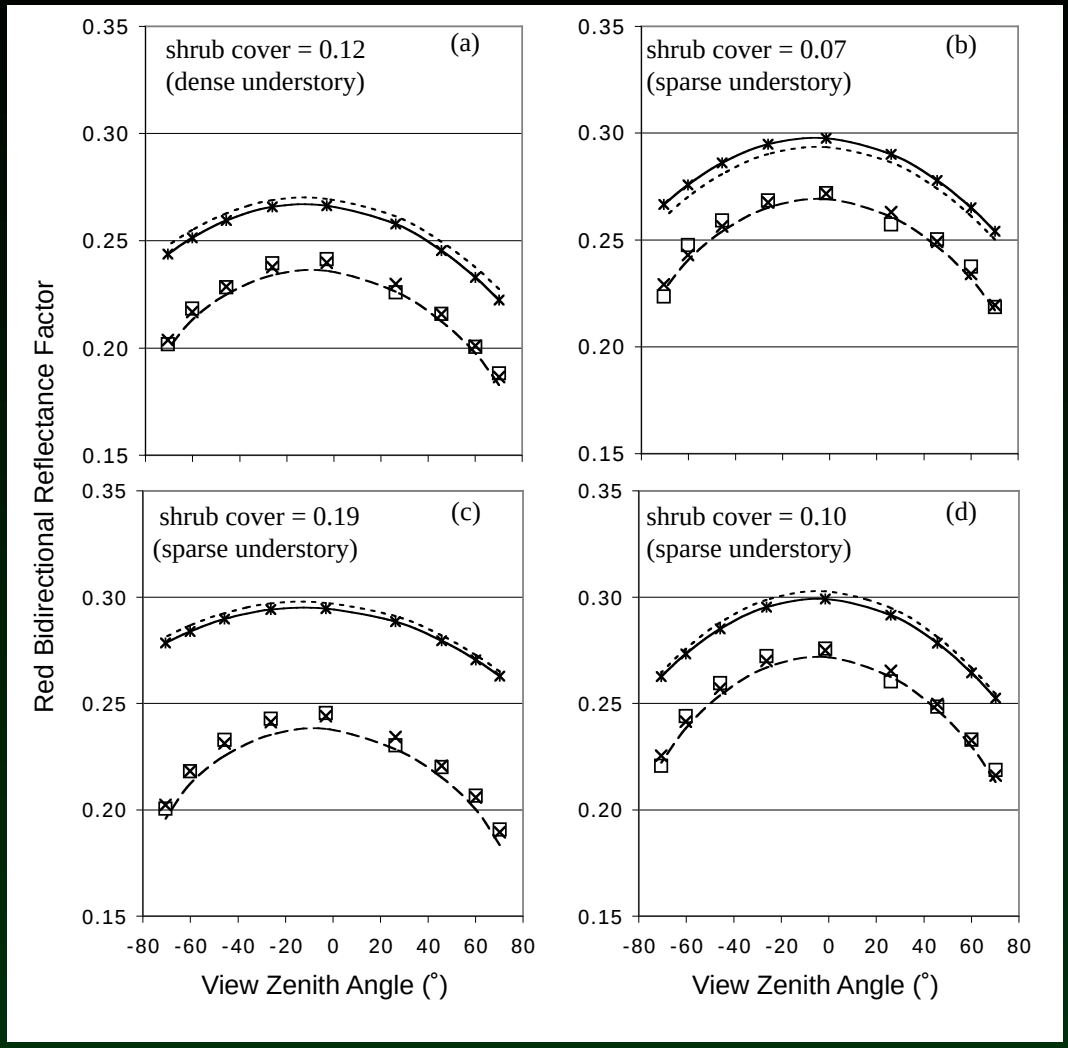




The impact of using *estimated* (Δ) over *optimal* (O) background BRDFs for 19 cases covering a wide range of shrub cover/size and understory configurations. The background contribution is the most important source of error in modeling canopy-level reflectance at the landscape scale

Simulations of MISR BRFs in the red band and at nine viewing angles

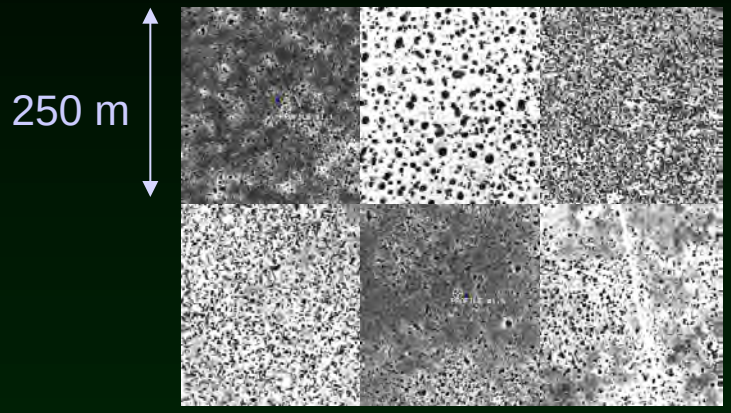
A good match is obtained between modeled and observed BRFs from MISR 275 m red band data.
GO model: Simple Geometric Model (SGM), using the Walthall model to represent the soil-understory contribution. Shrub crown radii and number density were measured using IKONOS 1 m panchromatic imagery.



- □ MISR observations
- × Modeled (simple geometric model)
- ····· optimal background
- ---*--- estimated background
- - - without shrubs ($G.k_G$)

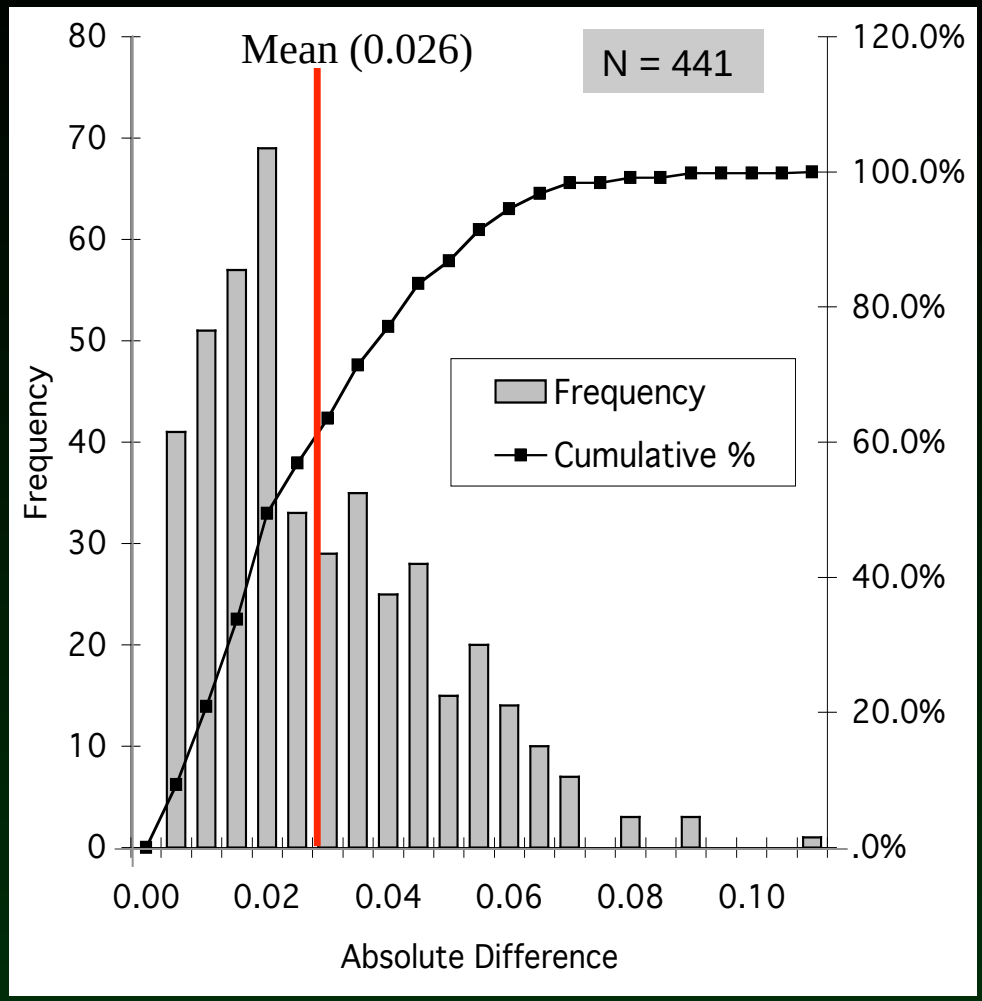
Retrieval of woody shrub cover at landscape scales

Shrub cover was measured using IKONOS panchromatic imagery for a 5 km^2 area in a Chihuahuan Desert grassland with varying degrees of shrub encroachment.



80% of retrieved shrub cover values using MISR data were within 0.05 of the measured value

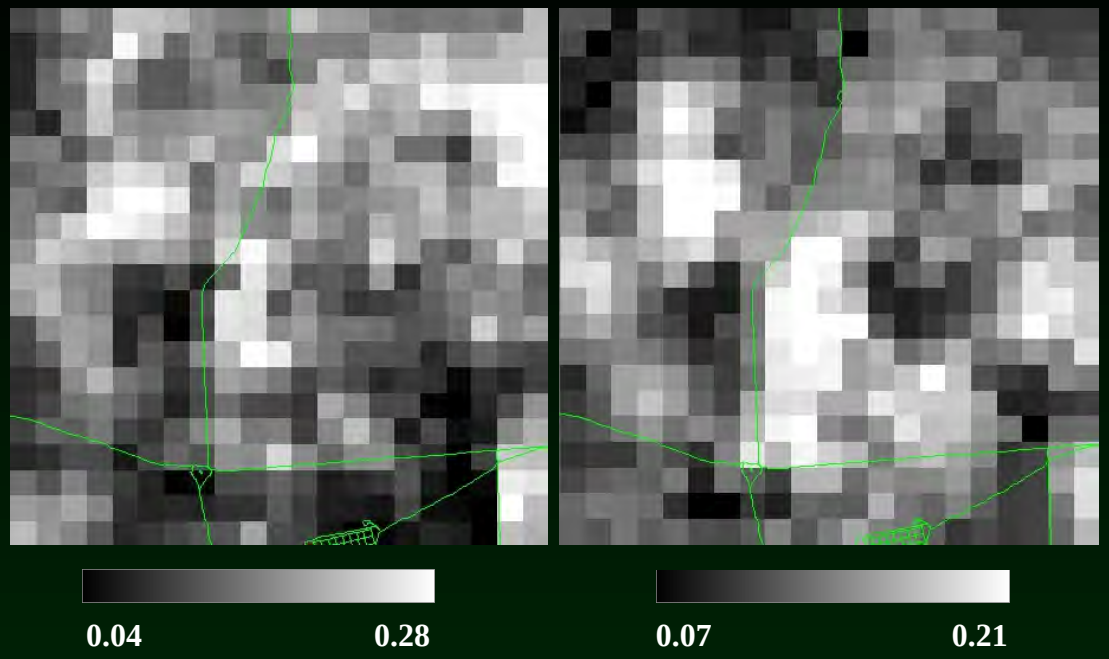
This is the first time that fractional woody shrub cover has been mapped using medium resolution Earth Observation data



Retrieval of woody shrub cover at landscape scales

Measured **Retrieved**

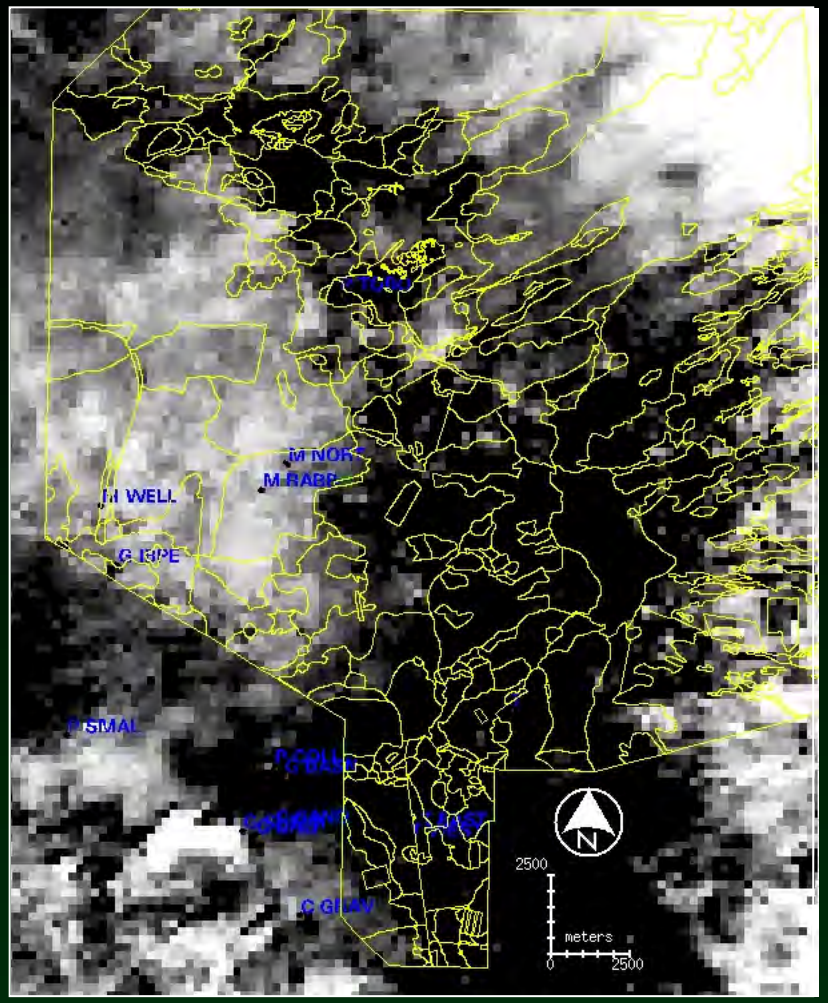
250 m^2 raster cells



There is broad agreement in the spatial distributions of the retrieved and reference data for fractional woody shrub cover in this Chihuahuan Desert grassland. 80% of retrieved shrub cover values retrieved using MISR data were within 0.05 of the measured value. To our knowledge, this is the first time that woody shrub cover has been mapped *over sparse and dense backgrounds* using medium resolution Earth Observation. Although there is some divergence between retrieved and measured distributions, there is also error in the reference data; these were obtained via thresholding IKONOS 1 m panchromatic imagery.

Woody shrub cover at landscape scales from MISR

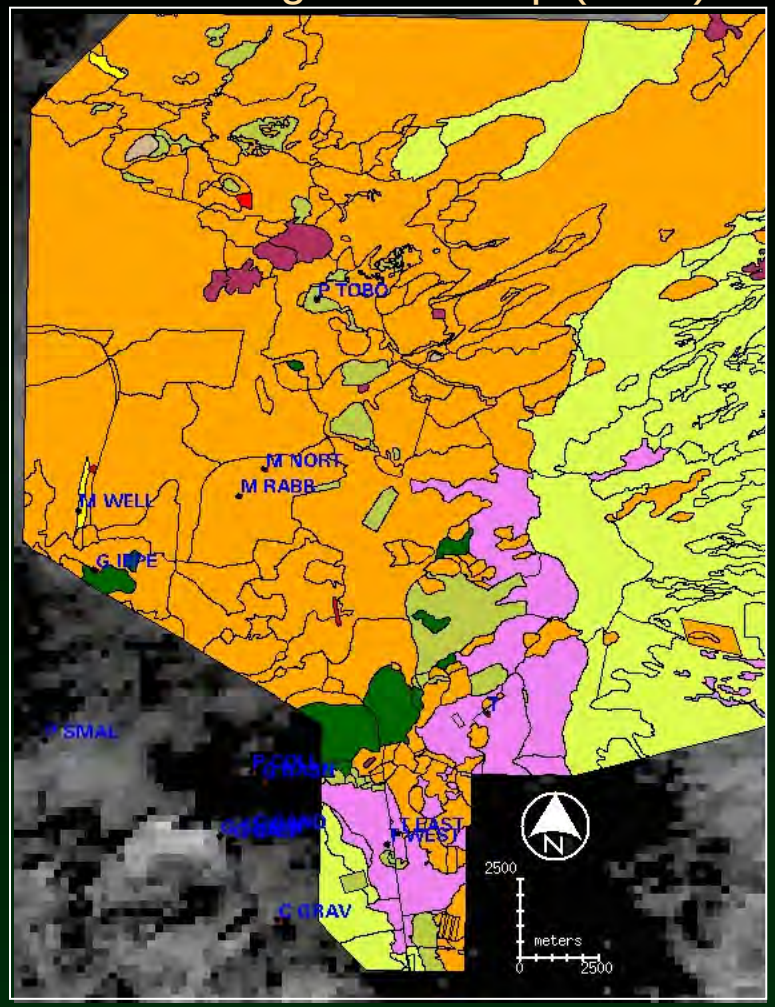
Fractional Woody Shrub Cover



M.Well, etc indicate Net primary produvity sampling sites:
M=mesquite T=tobosa P=playa C=cresosotebush G=grama grass. Boundaries of vegetation mapping units.

N.B. no corrections were applied for topographic effects on acquisition angles (affecting the E. part of the scene)

LTER Vegetation Map (1998)



mesquite
grasses:
creosotebush
yucca elata
upland
tarbush
snakeweed
playa
other shrubs