EVALUATION OF SPATIAL PRODUCTIVITY PATTERNS IN AN ANNUAL GRASSLAND DURING AN AVIRIS OVERFLIGHT*

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1. BACKGROUND

In May, 1991, coincident with an AVIRIS overflight, we completed a ground-based study covering 9 hectares of an annual grassland. There were two goals to this ground study:

1) Obtain ecologically and physiologically meaningful data for relating AVIRIS images to canopy structure, biochemistry and physiology.

2) Evaluate the suitability of the 20-m AVIRIS pixel size for depicting detailed spatial patterns of productivity.

2. MATERIALS AND METHODS

A 9-hectare annual grassland at Stanford University's Jasper Ridge Biological Preserve was sampled every 20 m for biomass, leaf area index (LAI), intercepted photosynthetically active radiation (PAR), chlorophyll, nitrogen, surface temperature and spectral reflectance. These measurements coincided with the May 14 and 15, 1991, AVIRIS overflights, providing a basis for biological interpretations of the AVIRIS images. Measurements of photosynthetic fluxes by eddy correlation were also completed during the overflight.

Three 20x20 m pixels were chosen for detailed ground sampling (every 5-m). The goal was to evaluate the 20-m AVIRIS pixel size by examining the semivariance in productivity estimates as a function of between-sample distance.

3. RESULTS

Images derived from ground-based measurements at the 20-m scale depict the influence of topography, soil and vegetation type on productivity in the grassland (Fig. 1). Preliminary geostatistical tests of the ground data also indicate that the 20-m between-sample distance (comparable to the AVIRIS pixel size) is suitable for studying spatial productivity patterns in this relatively uniform grassland. Different results might have been obtained if the study had been conducted on adjacent chaparral and woodland,

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composed of complex mosaics of individual canopies 1-10 meters in diameter.

Good correlations were obtained between ground-based reflectance indices (SR and NDVI) and several ecologically or physiologically significant indicators of productivity, including biomass, LAI, canopy chlorophyll and nitrogen content (Fig. 2). Ground data will be compared with endmember and residual images derived from mixture models to estimate productivity patterns from AVIRIS images (Ustin et al., this volume).

Results from this study will be compared with AVIRIS images obtained at other dates and at other sites and will be compared to CO_2 flux measurements that were made concurrently with the overflight. These studies should assist in development and validation of ecological and physiological models for AVIRIS image interpretation.

4. ACKNOWLEDGEMENTS

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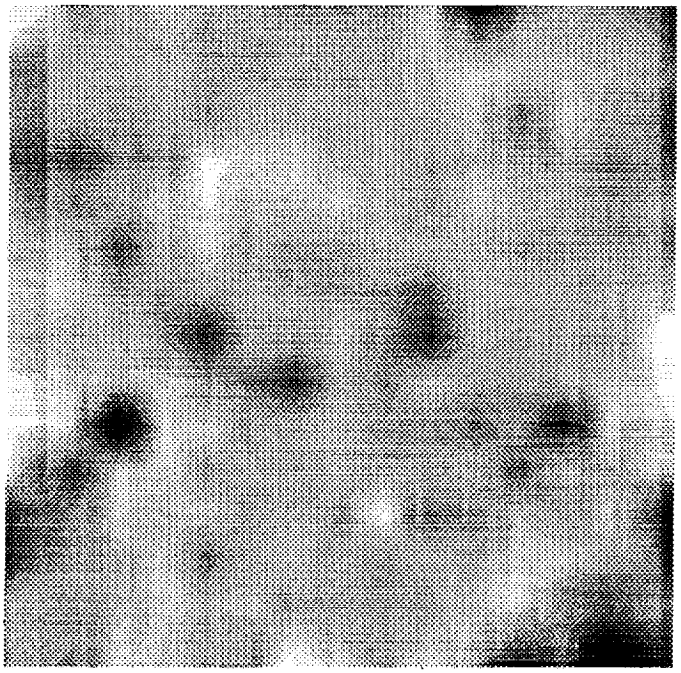

Fig. 1.

Interpolated image derived from ground-based LAI measurements of 9 hectares of the Jasper Ridge grassland at a 20-m sampling distance. LAI values ranged from 0.1 (light) to 3.5 (dark). Low-productivity areas are either hilltops or regions of serpentine-derived soil. High productivity areas are valley bottoms or patches with perennial vegetation.

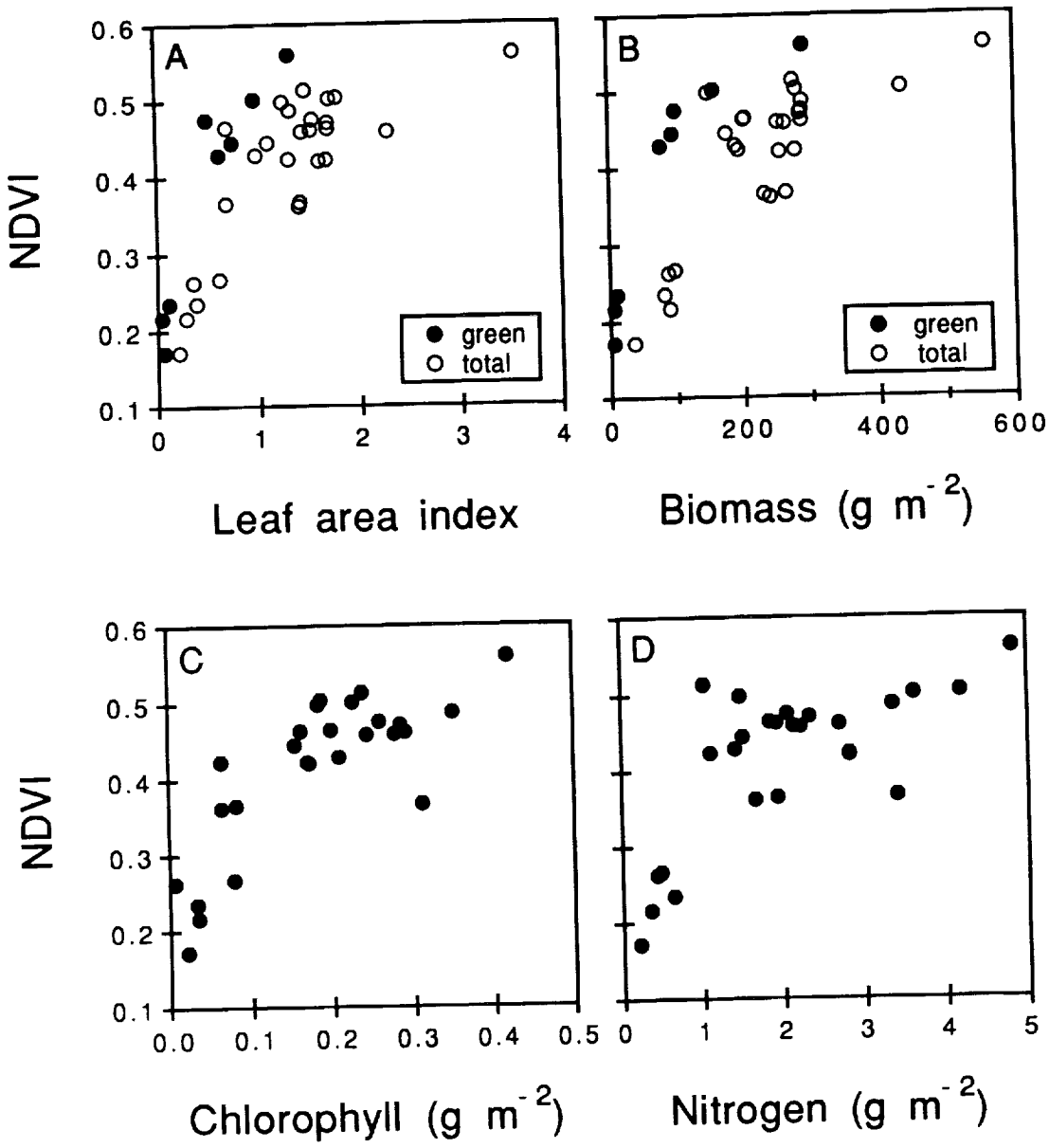

Fig. 2.

Relationships between NDVI and indicators of canopy structure (A and B) or total canopy chlorophyll (C) and nitrogen (D). Correcting for canopy "greenness" improves the correlations (A and B) and indicates the presence of standing dead biomass.