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REMOTE SENSING FOR INVENTORY OF DESERT SHRUB VEGETATION IN SOUTHEASTERN ARIZONA

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Problem:

Sampling native vegetation is never an easy undertaking and it becomes particularly complex in shrub communities. Techniques have been fairly well developed for use in grassland communities using various sizes and shapes of plots which can be laid down over the vegetation. In forested lands, the so-called plotless techniques were developed but many of them depend on an individual having a single well defined trunk or main stem. The major causes of difficulty in utilizing these techniques in a shrub community are probably related to life form of the shrub species and spacing of individuals which creates physical problems in laying out plots of a sufficient size to obtain a desired level of precision. The variations in size or density of individuals may necessitate several plot sizes for adequate sampling precision.

Objective:

The purpose of this study was to determine the feasibility of using remote sensing techniques to facilitate vegetative sampling in shrub communities.

Study Area:

This study was conducted in a mesquite-paloverde community in southeastern Arizona. The site is located on the Santa Rita Experimental Range at approximately 3200 feet elevation.

** Slides 14, 18, 21

These slides show the area in March of 1970. The topography is generally sloping towards the northwest. Micro-relief is less than 30 feet. The area is more or less disected by dry washes, which flow into the Santa Cruz River.

Procedures:

The following types of imagery were obtained over the study site.

(1) Black and white panchromatic prints in March 1970; scale 1:6000; complete coverage.

(2) Ektachrome color infra-red transparencies in March and July 1970; Scale 1:6000; complete coverage.

(3) Ektachrome color infra-red transparencies in March and July, 1970; Scale 1:600; selected transects (approximately 5 percent coverage).

A key question in using imagery to sample vegetation is: "Can species be accurately identified and by what means?" We found that multi-seasonal color infra-red imagery at a scale of 1:600 permitted identification of the major shrub and cacti species. The exact size at which a young individual becomes recognizable seems to depend on each species individually. Many individuals and species can be seen at this scale but are not of a sufficient size for accurate identification. This is particularly true in the case of burroweed Aplopappus tenuisectus; zinnea, Zinnia pumila and young staghorn cacti, Opuntia versicolor.

Lantern Slides #2, and #3

These slides are from a braided channel type and illustrate the effectiveness of multi-seasonal imagery as an aide to species identification. The first was obtained in March during a relatively dormant stage of growth; the second was taken in July after full leaf development had occurred on Mesquite, Prosopis juliflora.

Annotated individuals:

1.	Paloverde	Cercidium microphyllum
2.	Catclaw	Acacia greggi
3.	Mesquite	Prosopis juliflora
4.	Hackberry	Celtis pallida
5.	Barrel cactus	Ferocactus Wislizeni

The community was stratified into an upland type and a braided channel type. This stratification was accomplished using the 1:6000 scale color infra-red transparencies and the black and white panchromatic prints.

**Lantern Slide #1

This slide is a 70mm color infra-red frame at a scale of 1:6000 and illustrates the upland and braided channel types. While it is possible to see individual plants at this scale it is not possible to accurately identify them by species.

Following stratification a number of "transect" locations were established in each type for sampling purposes. The ends of the transects were marked with 8 foot panels for making scale determinations from the imagery and to assist the pilot in flying. Certain individuals were marked on the ground and identified as a check on imagery identification.

Imagery sampling was done using a 100 square grid superimposed on each frame. Stereo pairs were used in the interpretation, however we will illustrate using only one frame here. The number of individuals by species occurring in each square of the grid was recorded for density and frequency sampling. Cover determinations were made by recording the "hits" at the grid corners for 100 points on each frame.

On 1:600 scale imagery a typical "frame" plot is approximately 30 meters on a side or a one-third acre plot. The precision estimates obtained would indicate that this plot size is a minimum for adequate sampling.

** Lantern Slide #4 Slide 13

A typical upland frame and the grid for interpretation would look like this slide. As the interpreter reads off each grid square a recorder tallies the results on a grid format. This recording system also allows for analysis of pattern and dispersal of species and association analysis, if desired. A ground view of the frame looks like this.

Ground truth sampling for cover estimates was obtained by sampling five 30 meter line intercept transects at each photo transect. Along the center line of each transect a one meter wide belt transect was defined for ground data on density of primarily the low vegetation such as burroweed, although all woody species were recorded. These transects were satisfactory for the most common smaller species but they were not of an adequate size or number for good estimates on the larger species. They can be used to give an indication of the size and number of plots required for adequate sampling of the larger species.

Results

** Acetate Overlays -#1 and #2

(1) This table indicates the density and cover results for species which could be identified on the imagery for the upland type.

(2) These values are estimates obtained by ground sampling. The results are based on 42 ground locations and 15 photo frame samples.

The generally higher density estimates obtained by the ground sampling may possibly be due to the failure to detect small or young individuals on the imagery. The estimates for cover agree more closely indicating that these smaller individuals probably do not contribute a large proportion of the total cover. We know particularly for staghorn cholla that we failed to detect a rather large number of young plants on some photos.

Conclusion:

In conclusion we feel that the imagery technique is useful where it is desired to obtain information on large shrubs. Photos will have to be supplemented with ground transects or quadrats if information on young plants or small species is required. A multi-stage sampling scheme utilizing imagery and ground plots should be utilized in such cases.

To obtain equal precision for the larger species with ground sampling would require several times the expenditure in time and effort as compared to the photo technique.

IMAGERY RESULTS

SPECIES	DENSITY/ACRE	STD	% COVER	STD
MESQUITE	12.4	7.2	8.2	4.9
PALOVERDE	2.4	3.1	0.8	1.1
CATCLAW	4.8	7.0	0.7	1.2
HACKBERRY	4.0	5.8	1.1	1.5
CHAIN CHOLLA	48.6	36.1	1.9	2.0
STAGHORN CHOLLA	14.8	8.4	0.5	0.8
PRICKLY PEAR	5.9	6.6	0.3	0.5
EPHEDRA	0.7	2.0	0.1	0.4
BARREL CACTUS	3.2	4.2	0.1	0.3

Overlay #1

GROUND TRANSECT RESULTS

SPECIES	DENSITY/ACRE	STD	% COVER	STD
MESQUITE	289	56.1	4.2	7.6
PALOVERDE	3.2	20.9	1.1	3.8
CATCLAW	19.3	87.8	0.9	3.1
HACKBERRY	16.1	85.4	0.4	1.8
CHAIN CHOLLA	38.6	74.8	1.2	2.3
STAGHORN CHOLLA	138.2	196.6	1.0	1.8
PRICKLY PEAR	16.1	53.4	0.4	1.4
EPHEDRA	22.5	59.0	0.1	0.5
BARREL CACTUS	22.5	50.9	---	---

Overlay #2