Type I Progress Report No. 1.

a. Inventory and Monitoring of Natural Vegetation and Related Resources in an Arid Environment by the Use of ERTS-A Imagery (Proposal No. 311).

b. GSFC I.D. UN 618.

c. Few problems exist which have impeded the progress of the investigation. Those existing problems have been organizational and pertain to the accessioning of ERTS-1 data in our laboratory files. Time has been spent developing a storage and retrieval filing system which we think will provide ready access not only for project investigators, but also for visitors not familiar with the ERTS system and its products. Maps have been prepared showing ERTS-1 ground traces. Each scene of ERTS-1 imagery has been given a place name imaged in it. By viewing the map for his area of interest, an investigator or visitor can easily go to the proper section of the file to find the data of interest. Each 9"x9" transparency is being mounted in individual transparent envelope sleeves and labeled with the ground location name, date of acquisition, and MSS band number. Seventy mm positive and negative transparencies are also being similarly filed.

We also recognize the need to keep a summary tabulation of all ERTS imagery received. Receipt of partial orders from GSFC imposes part of the need for this summary; we need the ability to quickly ascertain the status of accumulative standing orders. The form used for this purpose is exhibited as Figure 1. This summary also provides a record of retrospective orders received. Because it is organized in the same manner as the accessioning file system described above, this summary tabulation gives a quick assessment of imagery acquired for a specified location.

These accessioning efforts are being accomplished in cooperation with the Environmental Remote Sensing Applications Laboratory, Oregon State University.

Now that the accessioning system and summarization activities have been organized, those jobs have been assigned to technicians and the jobs are accomplished routinely.

Figure 1.
ERTS 1 CATALOGUE OF IMAGERY RECEIVED

FRAME NAME MESA AREA NAME OR NUMBER NASA TEST SITE 29

REGION OR STATE ARIZONA GROUND TRACE M

| DATE OF IMAGERY | CLOUD COVER % | QUALITY | POSITIVE TRANSPARENCY | | | | | | | | | | | | | NEGATIVE | | | | | | | | | | | | | Print |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 70mm | | | 9x9 | | | 70mm | | | | 9x9 | | | 70mm | | | 9x9 | | | | 70mm | | | | 9x9 | | | 9x9 |
| | | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 4 | 5 | 6 | 7 | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 4 | 5 | 6 | 5 |
| 5 AUG '72 | 40+ | FAIR | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | | | | | | | | | | | | | | |
| 23 AUG | 0 | EXC | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | 1 | | 3 |
| 10 SEP | 5 | GOOD | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | |
| 28 SEP | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 OCT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 NOV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 NOV | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 DEC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 DEC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 JAN '73 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 FEB | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19 FEB | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 MAR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 MAR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 APR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 MAY | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 MAY | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 JUN | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25 JUN | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 JUL | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 31 JUL | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18 AUG | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 SEP | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23 SEP | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

d. Accomplishments have been made primarily in Objectives 2 and 7 and in work preparatory to Objectives 2, 4, and 6. The preparatory work has advanced our vegetation legend development to near completion. This legend contains vegetation classifications and descriptions which depend strongly on physiognomy of plant communities and plant species prominence within those communities for characteristic and identifying features. Objective 2, geomorphic-vegetation relationships, has been partially accomplished with the establishment of the existence of definite relationships between selected plant species and some physical features of the landscape. Vegetation types chosen from our legend have also been shown to exhibit positive relationships with some of these landscape features. Approach to Objective 7, automatic data processing, was begun with a three day visit to the facilities of the Forestry Remote Sensing Laboratory (FRSL), Univ. of California, Berkeley. Our investigator will achieve the goals of Objective 7 primarily through the facilities of that laboratory. During the visit, personnel of FRSL educated our investigator with regard to the capabilities, hardware, and software available. In addition to working on Objective 7, our investigator is working with his counterparts on Task 2 of Contract NAS 5-21831 to effect a transfer of technology from the FRSL to Oregon State University. When that is accomplished we will then have the capability of automatic data processing of ERTS data in our own facilities.

e. Discussion of significant results - see separate page.

f. Abstract of presentation: "Landform-Vegetation Relationships in Southern Arizona" - a paper to be presented November 9, 1972 at the International Conference on Remote Sensing in Arid Lands, University of Arizona, Tucson. By David A. Mouat.

g. There are no recommendations to be made at this time.

h. No changes in standing order forms have been made.

i. ERTS Image Descriptor Form - see separate page.

j. No Data Request Forms have been submitted.

k. During the next reporting period we expect to complete the vegetation legend applicable to our southern Arizona test site. Additional study of geomorphic-plant species relationships (Obj. 2) will be made. With the completion of the legend, more geomorphic-vegetation relationship evaluations may also be possible. Initial analyses for the detection of plant phenological influences on ERTS imagery (Obj. 4) may also be started as well as work on multistage sampling of vegetation within the test site (Obj. 6).

Inventory and Monitoring of Natural Vegetation and Related Resources in an Arid Environment by the Use of ERTS-A Imagery (Proposal No. 311)

Type I Progress Report No. 1 - Discussion of significant results.

Our southern Arizona test site includes vegetation representing shrub types of the Sonoran and Chihuahuan Deserts and Arizona chaparral. Also represented are grassland types of the desert grassland, juniper and oak woodland types, and coniferous forest types. The vegetation legend contains groups classified primarily on the basis of plant community structure (physiognomy) and species prominence. This legend has been completed for Chihuahuan Desert and most Sonoran Desert shrub types, most grassland and coniferous forest types, several chaparral, and juniper and oak woodland types.

Relationships between plant species and selected terrain features are given in Figure 2. The terrain feature classes used for the analyses are given in Figure 3. The purpose for determining the degree to which such relationships exist is to develop a body of knowledge to constitute the associated evidence that a photointerpreter may consult when interpreting vegetation subjects on small scale imagery. Imagery of this scale class (such as that reconstituted from ERTS-1 MSS data) contains little image detail which can be interpreted directly in terms of vegetation. On the other hand, some terrain features are the most salient features of that same imagery. Exploitation of those features for vegetation identification, inventory, and analysis can be accomplished only after establishing the existence of ecological relationships as indicated in Figure 1, and it is these relationships that are currently being identified.

Figure 2. Degree of species-terrain feature relationships. Numerical entries 1 through 5 correspond respectively to values of poor, fair, moderate, good, and excellent relationships.

| Species | Elevation | Parent Material | Aspect | Slope Angle | Solar Radiation | Landform | Macrorelief | Drainage Density |
|---|---|---|---|---|---|---|---|---|
| Acacia constricta | 2 | 2 | 3 | 3 | 1 | 3 | 1 | 1 |
| Agave palmeri and/or parryi | 4 | 4 | 1 | 5 | 1 | 4 | 5 | 2 |
| Agave schottii | 5 | 4 | 3 | 5 | 2 | 5 | 5 | 1 |
| Aloysia wrightii | 3 | 4 | 1 | 5 | 1 | 4 | 5 | 3 |
| Arctostaphylos pungens | 4 | 4 | 2 | 4 | 1 | 3 | 4 | 2 |
| Brickellia spp. | 4 | 4 | 3 | 4 | 3 | 4 | 4 | 3 |
| Calliandra eriophylla | 3 | 1 | 3 | 3 | 3 | 2 | 3 | 2 |
| Cercocarpus breviflorus | 5 | 5 | 4 | 5 | 4 | 5 | 5 | 4 |
| Cercidium microphyllum | 5 | 2 | 5 | 2 | 4 | 3 | 1 | 5 |
| Ferocactus wislizenii | 3 | 2 | 5 | 3 | 3 | 2 | 2 | 2 |
| Mimosa dysocarpa | 4 | 1 | 4 | 5 | 3 | 4 | 4 | 4 |
| Mortonia scabrella | 4 | 5 | 3 | 5 | 4 | 5 | 5 | 4 |
| Parthenium incanum | 4 | 2 | 3 | 3 | 3 | 2 | 4 | 1 |
| Prosopis juliflora | 2 | 1 | 1 | 3 | 1 | 2 | 1 | 1 |
| Quercus emoryi | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 4 |
| Rhus choriophylla | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 4 |
| Yucca elata | 3 | 5 | 1 | 4 | 4 | 3 | 4 | 1 |
| Bouteloua curtipendula | 3 | 4 | 3 | 3 | 1 | 3 | 3 | 3 |
| Bouteloua rothrockii | 2 | 3 | 2 | 3 | 1 | 1 | 2 | 1 |
| Hilaria mutica | 3 | 4 | 3 | 4 | 4 | 4 | 4 | 4 |

Figure 3. Terrain feature classes.

Elevation Classes

< 3000'
3000'-3500'
3500'-4000'
4000'-4500'
4500'-5000'
> 5000'

Aspect

1 - northeast
2 - north
3 - east
4 - northwest
5 - level
6 - southeast
7 - west
8 - south
9 - southwest

Solar Radiation Index

< 51 - low
51-54 - medium
> 54 - high



Landform Type

00 - landforms developed upon non-consolidated materials
01 - swale
02 - floodplain
03 - narrow floodplain
04 - alluvial terrace
05 - valley fill
06 - dissected valley fill
07 - lacustrine plain
08 - sand dunes
10 - undifferentiated bajada - non-dissected
11 - upper bajada
12 - lower bajada
13 - undifferentiated dissected bajada
14 - convex slope of dissected bajada
15 - midslope of dissected bajada
16 - interfluve
20 - landforms developed upon consolidated materials
21 - convex hillslopes
22 - upper middle hillslope
23 - middle hillslope
24 - lower middle hillslope
25 - concave hillslope
26 - interfluve
27 - drainageway
28 - pediment

Parent Materials

1 - alluvium
2 - sedimentary not incl. limestone
3 - limestone
4 - intrusive volcanics
5 - volcanics

Slope Angle

1 - < 1 1/2%
2 - 1 1/2 to 3%
3 - 3 1/2 to 10%
4 - 11 to 25%
5 - 26 to 50%
6 - > 50%

Drainage Density

< 5.0 - low
5.0-7.2 - medium
> 7.2 - high

based upon length of streams in miles in plots averaging 3.14 miles$^2$

Macrorelief

1.0 - Flat lands (regional slope < 10%)
1.1 - nondissected
1.2 - dissected (local relief < 10%)
2.0 - Rolling (slopes 10-25%) and moderately dissected lands
2.1 - rolling (regional slope not apparent)
2.2 - dissected (local relief 10' to 100', regional slope apparent)
3.0 - Hilly lands (local relief > 100', slopes > 25%)
4.0 - Mountainous lands (local relief > 1000', slopes > 25%)

# ERTS IMAGE DESCRIPTOR FORM

(See Instructions on Back)

NDPF USE ONLY
D
N
ID

DATE 9 November 1972

PRINCIPAL INVESTIGATOR Barry J. Schrumpf

GSFC UN 618

ORGANIZATION Oregon State University

| PRODUCT ID (INCLUDE BAND AND PRODUCT) | FREQUENTLY USED DESCRIPTORS* | | | DESCRIPTORS |
|---|---|---|---|---|
| | Basin & Range | Cropland | Desert | |
| 1032-17382M | ✓ | ✓ | ✓ | Parallel drainage, bajada, mountain, arroyo, flood plain, lake, metropolitan area, rangeland, pediment, grassland, brush, alluvial fan. |
| 1031-17325M | ✓ | ✓ | ✓ | Parallel drainage, bajada, mountain, arroyo, flood plain, lake, metropolitan area, rangeland, pediment, brush, alluvial fan, open pit mines, irrigation canal. |
| 1048-17272M | ✓ | ✓ | ✓ | Parallel drainage, bajada, mountain, arroyo, flood plain, metropolitan area, rangeland, pediment, grassland, brush, alluvial fan, open pit mines, forest, playa, lake, pasture, orographic clouds |

*FOR DESCRIPTORS WHICH WILL OCCUR FREQUENTLY, WRITE THE DESCRIPTOR TERMS IN THESE COLUMN HEADING SPACES NOW AND USE A CHECK (✓) MARK IN THE APPROPRIATE PRODUCT ID LINES. (FOR OTHER DESCRIPTORS, WRITE THE TERM UNDER THE DESCRIPTORS COLUMN).

MAIL TO ERTS USER SERVICES
CODE 563
BLDG 23 ROOM E413
NASA GSFC
GREENBELT, MD. 20771
301-982-5406

GSFC 37-2 (7/72)