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FIFTH BI-MONTHLY PROGRESS REPORT
UNIVERSITY OF ALASKA
ERTS PROJECT 110-3
May 31, 1973

(E73-10634) IDENTIFICATION, DEFINITION AND MAPPING OF TERRESTRIAL ECOSYSTEMS IN INTERIOR ALASKA Bimonthly Progress Report (Alaska Univ., Fairbanks.) 11 p HC $3.00 CSCL 08B G3/13 N73-24393 Unclas 00634

A. TITLE OF INVESTIGATION: Identification, definition and mapping of terrestrial ecosystems in interior Alaska

B. PRINCIPAL INVESTIGATOR: J. H. Anderson. 592

C. PROBLEMS IMPEDING INVESTIGATION:

1. The color display unit, for the use of digital data, hasn't been installed according to schedule.

2. A simulated color-IR scene (Product Type B; Scene 1029-20381), ordered from NASA on January 7, has not arrived, nor has there been any explanation of the delay.

3. A reconstituted, simulated color-IR print of this same scene, enlarged to 1:500,000, was ordered from Project No. 1. The photo lab people found that bands 4, 5 and 7 could not be registered.

PROGRESS REPORT:

1. Accomplishments during the reporting period

a. A vegetation map of a 48 X 64 km area just west of Fairbanks was drawn using a simulated color-IR print made with bands 4, 5 and 7 of scene 1033-21011. This area includes Test Area No. 5. A report on the preparation and interpretation of this map will be submitted as an interim scientific report in the near future.

b. All images received to date were examined. Scenes 1247-20505 and 1247-20511 were selected for detailed study, including attempts to distinguish vegetation types in winter aspect.

2. Plans for next reporting period

a. The principal investigator will learn to use the digital CDU and its associated VP-8 image analyzer, now scheduled for installation during the week of June 18.

b. As soon as recently ordered tapes arrive, CRT displays will be studied for the three test areas now of chief concern, Nos. 5, 6 and 8 (tapes were not ordered early because of delays in CDU installation).

c. We will select additional scenes for intensive study, order digital tapes for these, etc. It is hoped that coverage for test areas for which suitable growing season coverage is not yet available will be obtained.

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DISCIPLINE: Environment

SUBDISCIPLINE: Other: vegetation analysis, mapping and phenology

SUMMARY OF SIGNIFICANT RESULTS:

A reconstituted, simulated color-infrared print, enlarged to a scale of 1:250,000, was used to make a vegetation map of a 3,110 km^2 area just west of Fairbanks, Alaska. This area centers on Test Area No. 5, including the Bonanza Creek Experimental Forest. Information was traced from the print, which comprised the southeastern part of ERTS-1 scene 1033-21011, onto a transparent acetate overlay. A 1:1,000,000 scale color-infrared transparency of this scene, obtained from NASA, was used along side the print as an aid in recognizing colors, color intensities and blends and mosaics of different colors. Although only one-quarter the scale of the print, the NASA product provided substantially more information. The print was used primarily as a device for making a map at the desired scale.

Color units on the transparency and print were identified according to vegetation types using NASA air photos, U.S. Forest Service air photos and experience of the principal investigator.

Information from the acetate overlay was transferred, using a light table, onto a regular U.S. Geological Survey topographic map (Fairbanks and Livengood sheets).

Five more or less pure colors (to the investigator's eye) were identified and associated with vegetation types. These colors are designated here according to their appearances on the print; on the NASA transparency they were somewhat different.

Orange - forest vegetation dominated by broad-leaved trees

The species involved in this type are *Populus balsamifera* (balsam poplar), *P. tremuloides* (aspen), *Betula papyrifera* (paper birch) and a few species of *Salix* (willow). It was not possible to distinguish large and more or less pure stands of single species on the imagery.

Gray - forest vegetation dominated by needle-leaved trees

The species involved are *Picea glauca* (white spruce) and *P. mariana* (black spruce). Stands comprizing chiefly *P. glauca*, on the one hand, and *P. mariana*, on the other, could be distinguished with what is considered reasonable confidence, though not on the basis of spectral characteristics. Instead, it is well known that the former species prefers relatively well-drained upland sites, more or less south slopes, and river bottom floodplain sites where the ground water is mobile. It also is the needle-leaved species occurring at the highest elevations. The latter species prefers, or is limited to lowland, poorly drained sites. In these sites a third needle-leaved species, *Larix laricina*, sometimes occurs, but it was not possible to distinguish this species from *P. mariana*. The latter species also occurs on north slopes, where *P. glauca* is infrequent. Thus areas of gray were identified according to vegetation types dominated by these two major species on the basis of topographic position, slope and elevation. However, it is known that *P. mariana* sometimes occurs in upland, level or south slope stands and that *P. glauca* may grow in sites normally occupied by the other species. Also, more or less even mixtures of these species are known. Ground data, particularly in the literature, indicates that the distinctions made in this study should be valid in a majority of cases. However, the probability of correct determinations has yet to be determined.

Violet - scrub vegetation, dominated by shrub species

The chief species involved are members of the genera *Alnus*, *Betula* and *Salix*. Although these could not be distinguished on the basis of spectral characteristics, physical site features recognizable on the imagery, in conjunction with ground and aircraft data, permitted more or less pure stands of these genera to be distinguished. Thus *Alnus* spp. (alder), where it forms stands large enough to be detected by the ERTS system, occurs near major streams on floodplains. *Betula* spp., including *B. glandulosa* and *B. nana* (shrub birches) sometimes occurs as a dominant in the lowland, flat muskeg areas and in the shrub tundra above timberline. *Salix* spp. (willows) occur in all of these situations, though usually as a secondary admixture. More or less pure and large stands of *Salix* spp. occur in upland riparian sites and, particularly, in areas where former forest vegetation had been destroyed by fire: certain species of *Salix* are major components of the earlier stages of post-fire vegetation succession. Thus upland areas appearing otherwise suitable for forest vegetation could be identified as possible locations of fires which occurred within the past few decades.

Light violet - herbaceous tundra vegetation

This color was of limited distribution in the area studied, occurring only at and in the vicinity of the highest summit, Murphy Dome. (Another high summit was cloud covered.) The vegetation here is known to be a tundra, characterized by sedges, herbaceous dicots, several species of low-growing woody plants, lichens, ~~XXX~~ mosses and occasional more or less bare rocky areas.

Dull violet - muskeg vegetation, characterized by muskeg plants

This color was extensive in the broad, permafrost-underlain "flats" south of the Tanana River in the southern XXX part of the area. This color is believed to represent muskeg vegetation wherein trees are scattered or absent. Here the dominant plants are species of *Sphagnum* and several other moss genera; *Carex*; *Eriophorum*, often forming tussocks; and a number of low-growing shrubs.

These five colors occurred individually as units large enough to map in only a few cases, except for orange, which is relatively widespread. Usually they could be feasibly mapped at the 1:250,000 scale only as components of mosaics or, in many cases, as blends, e.g. orange-gray (mixedwood forest) and dull violet-gray (black spruce muskeg). For this reason an additional 18 map units were established, some comprising two and others three colors. These mosaics and blends were identified according to vegetation type, where the type which appeared most important in terms of aerial distribution in the mosaics or contribution to the overall color in the blends was listed first. On the map, botanical names were used instead of color names. Thus an orange-gray, map unit B-N (broad-leaved trees/needle-leaved trees), represents broad-leaved forest vegetation with a major admixture of needle-leaved trees, either more or less evenly scattered (blend) or as scattered relatively pure stands (mosaic); and dull violet-gray-orange (muskeg plants-etc.), represents vegetation characterized by a muskeg matrix, with a relatively low density black spruce component and scattered stands of birch and/or aspen, particularly along water courses and on raised areas.

The major aspects of significance of this map and the work leading up to it seem to be:

(1) It tends to confirm a conclusion from our earlier study and mapping of vegetation on the western Seward Peninsula, involving mostly different vegetation types, that the use of ERTS imagery can enable the inventory and mapping of broadly defined vegetation types over large areas more efficiently than by conventional means.

(2) It shows that a similar, larger map for much of interior Alaska could be produced in a few weeks, given availability of comparable imagery for the area.

(3) Although not a detailed map, the present one is more detailed in terms of the XXXX areal distribution of types than any existing published map. Also, a significantly larger number of types is shown on the new map.

(4) The areas of the different vegetation types could be measured with a planimeter. Then, using factors developed from ground data, including published volume tables, etc., timber biomass could be calculated for larger areas.

d. The possibility of transferring vegetation and ecosystem information on ERTS images directly to 1:1,000,000 scale maps will be explored. It is believed that this might be a suitable scale at which to depict vegetation for all of Alaska in a single map.

e. Further working meetings with Project No. 2 personnel will be held. The next one is scheduled for June 12.

f. In mountainous areas, as in Test Area No. 6, major spectral differences occur between north and south slopes, sometimes where the actual landscapes are similar. This is a result of the lower angle of incidence of solar radiation on the north slopes and of shadows on the steeper north slopes. In an attempt to develop a technique for identifying similar and dissimilar landscapes under these circumstances, we will experiment with determining interband ratios and, given adequate sequential imagery, signature change relations, using digital data and the CDU.

g. It is increasingly apparent that most of the ground data needed for interpreting ERTS imagery and meeting the objectives of this project may be obtained from aerial photographs. The NASA-Houston air photos are of primary importance, but coverage is limited to a single flight line through the test areas or, in the case of Test Areas 1, 2 and 5, two or three flight lines. Other agencies possess air photos of various dates, spectral characteristics and quality covering the test areas. The Institute of Northern Forestry of the U.S. Forest Service on campus, for example, has a set of color photos for the entire Bonanza Creek Experimental Forest and adjacent areas in Test Area No. 5 which we have consulted. Therefore we will make a systematic search for additional photography and will catalog and study that which is of value to the project. It appears that this will permit a significant reduction in the amount of field work anticipated earlier.

h. As the Alaskan field season is now beginning, some field work for ground data acquisition will be conducted during the next reporting period. This will be in accordance with the multistage sampling strategy, i.e. only sites bearing vegetation and related landscape features not adequately identifiable on NASA and other air photos will be visited on the ground. Although most of the ERTS signatures can be identified at the air photo level, certain locations will have to be field checked. During the next reporting period such checking will be done in Test Areas 5 and 6. As soon as growing season imagery is obtained for other test areas, it will be examined and compared with air photos, and sites for possible ground checking here will be identified and visited.

E. SIGNIFICANT RESULTS

A reconstituted, simulated color-infrared print, enlarged to a scale of 1:250,000, was used to make a vegetation map of a 3,110 km^2 area just west of Fairbanks, Alaska. This area centers on Test Area No. 5, including the Bonanza Creek Experimental Forest. Information was traced from the print, which comprised the southeastern part of ERTS-1 scene 1033-21011, onto a transparent acetate overlay. A 1:1,000,000 scale color-infrared transparency of this scene, obtained from NASA, was used along side the print as an aid in recognizing colors, color intensities and blends and mosaics of different colors. Although only one-quarter the scale of the print, the NASA product provided substantially more information. The print was used primarily as a device for making a map at the desired scale.

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(5) This study has shown, through close examirations of the NASA transparency, which contains a remarkable amount of information, that much more detailed vegetation, landscape or ecosystem maps could be produced, if only (a) spectral signatures (tones or colors, etc.) could be consistently and reliably recognized across a given scene, which is difficult by visual study and (b) the information could be transferred to a map of suitable scale reasonably efficiently. For item (a), electronic data processing will be begun in the near future with the hope that intensity slicing and other manipulations will increase our capabilities in this area. Item (b) will be handled through continued experimentation with enlarged photographic products, use of a zoom transfer scope and automated, computer plotting with digital tapes.

It is clear from this study that, were all the information on the ERTS image mapped at a scale of, say, 1:63,360, a very crowded map would result.

F. PUBLICATIONS

a. In preparation

Anderson, J. H. Mapping vegetation in interior Alaska using ERTS imagery. To submitted to NASA as an interim scientific report.

Anderson, J. H. Boreal forest vegetation map of an area near Fairbanks, Alaska, based on ERTS-1 imagery. In preparation for Photo-Interpretation. (To be submitted only after report processed by NASA)

b. In press

Anderson, J. H., L. Shapiro and A. E. Belon. 1973. Vegetative and geologic mapping of the western Seward Peninsula, Alaska, based on ERTS-1 imagery. Proceedings of the Symposium on Significant Results Obtained from ERTS-1, NASA/Goddard Space Flight Center, March 5-9, 1973.

c. Published

Anderson, J. H. and A. E. Belon. 1973. A new vegetation map of the western Seward Peninsula, Alaska, based on ERTS-1 imagery. Interim Scientific Report to NASA on Contract NAS5-21833; Available as No. E73-10305 from the National Technical Information Service. 20 p.

Note: Material from the paper by Anderson, Shapiro and Belon (1973) was used in the following paper: Maugh, T. H. III. 1973. ERTS (II): A new way of viewing the earth. Science 180: 171-173.

G. RECOMMENDATIONS

None

H. REVISED STANDING ORDERS

A revised standing order, date May 4, 1973, was submitted. No word regarding its approval or rejection has been received.

I. ERTS IMAGE DESCRIPTORS FORM

See attached.

J. DATA REQUESTS

Data requests dated May 31 and June 8 were submitted. No word regarding their approval or rejection has been received.

ERTS IMAGE DESCRIPTOR FORM

(See Instructions on Back)

DATE May 31, 1973

PRINCIPAL INVESTIGATOR J. H. Anderson

GSFC 592

ORGANIZATION University of Alaska

NDPF USE ONLY

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ID

PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1247-20505 and 1247-20511 Bulk b & w 70 mm pos. transparencies and 240 mm paper prints, bands 4-7.				Aerial imagery used Braided stream Brush Conifer Deciduous Forest Ground truth used Hardwood forest Highway Lake Mature vegetation Meander Muskeg River Timberline Tundra Urban area Vegetation

*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).

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301-982-5406

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