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UNIVERSITY OF NEBRASKA - LINCOLN
Lincoln, Nebraska 68588

APPLICATIONS OF REMOTE SENSING IN RESOURCE MANAGEMENT IN NEBRASKA

Semiannual Progress Report, July-December, 1975

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Project Title

Application of Remote Sensing Technology to Accelerate Data Utilization and Graphic Product Distribution for the User Audience

Investigators

Dr. Rex M. Peterson, Remote Sensing Coordinator, Conservation and Survey Division, UNL.

Dr. Paul M. Seevers, Research Agronomist, Conservation and Survey Division, UNL.

Mr. Donald Buckwalter, Remote Sensing Analyst, Conservation and Survey Division, UNL.

Purpose of Investigation

To centralize the expertise, equipment and documentation becoming available through remote sensing investigations. This Remote Sensing Center will interface the research, Academic, and management agencies and will also serve as a data source for the general public.

Review of Activity

The Remote Sensing Center has approximately twice as much space as it had a few months ago as a result of moving into offices vacated by the U.S. Geological Survey in the east end of Nebraska Hall. The darkroom which serves the Conservation and Survey Division, as well as the Center, has been moved from the Nebraska Engineering Center into Nebraska Hall; copying and projection facilities are now adjacent to the processing rooms. Considerable equipment, such as enlargers, vacuum frames, and color processing apparatus, has been added. The following equipment has been added to the Center:

1. Lenses and light tables. The UN-L Geography Department purchased ten portable light tables and several hundred dollars' worth of lenses for the Remote Sensing Center. These light tables, with 15 others purchased by the Center, are used in workshops, the remote sensing class, and in daily work.

2. Bausch and Lomb Zoom Transfer Scope.

3. A Wild-Heerbruug microscope with camera lucida. As far as we know, this is the first application of this type microscope for viewing LANDSAT images. With dark and light field variable illumination, double irts control of light, and filters in the optical train, light can be controlled to maximize the detail visible in LANDSAT images. With the camera lucida, images can be superposed onto a map for annotation of maps.

4. Olympus camera system including two camera bodies and a wide variety of lenses and filters.

Remote sensing displays have been made to several audiences of various sizes. These range from two separate displays at the Nebraska State Fair to a display in the lobby of the CENGAS Building. The 10 by 16 foot LANDSAT mosaic of the conterminous United States, which is the center of many of the displays, is portable and available for short term loan. In addition to papers presented at scientific meetings, dozens of talks and presentations have been given to diverse groups.

A team assembled a slide presentation called "Ground Zero and Up." This package, which includes a casette narrative tape, 127 slides, and manual, is available from the University of Nebraska Instructional Media Center, Nebraska Hall, Lincoln, Nebraska 68588. The cost is $48.00. The slide set is designed to be the basis for a high school mini-course or a semester course can be structured around it. A set of five student workbooks, designed around the slide set, is available from the Nebraska State Department of Education.

The Remote Sensing Center has held several workshops to acquaint user groups with remote sensing data and its applications. Examples are workshops held for the Department of Roads, the Department of Water Resources, and the Natural Resources Commission. Workshops are planned for the Soil Conservation Service, the Department of Economic Development, and the State Office of Planning and Programming. A senior-graduate level course in remote sensing was taught during the spring semester and will be offered again when the spring semester begins in January. Of the 40 students enrolled in the class last spring, half were employed full time in federal or state agencies, or other units of the University. Because of the inter-disciplinary nature of the lectures, plus lab work specialized to disciplines, the course can be taken for credit in Geology (498/898), Geography (498/898), Agricultural Engineering (496/896) or Agronomy.

The Remote Sensing Center has imagery from spacecraft and aircraft, including Department of Agriculture photography, housed in a central library with space and equipment available for the public. Areas covered by high altitude color infrared photography are generally by natural resource districts (NRD's), each of which includes several counties, or portions of several counties. A block of three natural resource districts has been flown at 42,000 feet by Air National Guard RF-4C Phantoms, using a KA-55 panoramic camera with a 12 inch focal length (with the exception of the June, 1973 flight over the Lower Platte South NRD on which a KS-72 framing camera with a six inch lens was used). Separate early and late summer missions were flown over each NRD. These flights were as follows:

1. Lower Platte South NRD--Lancaster and Cass Counties with small portions of Saunders, Seward, and Dodge Counties. Flown in 1973.

2. Papio NRD--Sarpy, Douglas, and Washington Counties. Flown in 1974.

3. Lower Platte North NRD--Portions of several counties. Flown in 1975.

NASA WB-57 and U-2 aircraft have flown several NRD's at 60,000 and 70,000 feet, using framing cameras with six inch focal lengths. The fall flight over the Lower Niobrara NRD was at 25,000 feet. Color infrared positive transparencies are available for each district flown. The coverage is as follows:

1. Central Platte NRD--Flown in early summer, 1974 and again in late summer, 1974.

2. Lower Niobrara NRD. Flown in early summer, 1975, at high altitude and in early October, 1975, by a NASA P-3 at 25,000 feet.

3. Lower Platte North NRD--Portions of several counties. Flown in 1975.

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1. Central Platte NRD--Flown in early summer, 1974 and again in late summer, 1974.

2. Lower Niobrara NRD. Flown in early summer, 1975, at high altitude and in early October, 1975, by a NASA P-3 at 25,000 feet.

3. Upper Niobrara-White NRD--Flown in early summer and early October, 1975, by high altitude NASA aircraft.

4. Upper Republican NRD (Dundy, Chase, and Perkins Counties) plus Keith County. Flown in early summer, 1975, by high altitude NASA aircraft.

In addition to the high altitude aircraft photography listed above, the Remote Sensing Center has all the ERTS-LANDSAT imagery of Nebraska that is significantly cloud-free, plus all Skylab coverage of the state.

The Remote Sensing Center has been cooperating with the CENGAS Corp. in a heat loss inventory of Lincoln, Beatrice, Columbus, and Norfolk, Nebraska,

and Sioux Falls, South Dakota. CENGAS contracted with South Dakota State University's Remote Sensing Institute to acquire 70 mm thermal imagery during February and March, 1975. The Nebraska Remote Sensing Center made six-times enlargements of the film to produce 16 by 20 inch thermograms. Over 800 of these were required to cover the five cities. More than 20,000 people have gone into CENGAS offices to view thermograms of their neighborhoods and get an idea of how much heat was escaping from their houses last winter. Only a few minutes is needed for a homeowner to check a city map, find the number of the thermogram of his eight block area, and find his own house. A gray scale for comparison with the graytone of buildings shows how severe, moderate or slight heat loss is.

Project Title

Application of Remote Sensing to an Inventory of Irrigated Land in Nebraska.

Investigators

Donald M. Edwards, Ph.D., Project Leader, Associated Dean, College of Engineering and Technology, University of Nebraska, Lincoln, Nebraska 68588.

Richard O. Hoffman, Ph.D., Co-Project Leader, Associate Professor, Department of Industrial and Management Systems Engineering, University of Nebraska, Lincoln, Nebraska 68588.

Purpose of Investigation

To evaluate use of aircraft and satellite imagery in detecting and estimating the acreage of irrigated land in Nebraska.

Review of Activity

There has been mapped 6,676 center pivot irrigation systems in Nebraska using 1972, 1973, and 1974 LANDSAT imagery. A computer map showing the location of the pivots has been prepared and distributed. A list of the numbers of center pivots in each of Nebraska's 93 counties for 1972, 1973, and 1974 is included. The number of acres irrigated in Nebraska in 1973 has been estimated at 5.1 million, using LANDSAT imagery. Because of the difficulty and cost of obtaining estimates of irrigated acreage, our estimates from LANDSAT data are becoming the standard.

TABLE 1 CENTER PIVOTS OBSERVED USING SATELLITE IMAGERY 1974

ENGINEERING RESEARCH CENTER
W181 NEBRASKA HALL
UNIVERSITY OF NEBRASKA
LINCOLN, NE. 68508
402-472-3181

DONALD M. EDWARDS
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DAVID D. PAPE
AUGUST 29, 1975
402-472-3405

COUNTY NUMBER	COUNTY NAME	NUMBER IN YEAR 1972	1973	1974	PERCENT INCREASE 72/3	74/3
14	ADAMS	19	19	45	0	137
26	ANTELOPE	171	222	334	30	50
91	ARTHUR	1	15	15	1400	0
85	BANNER	13	44	65	238	48
86	BLAINE	3	24	37	700	54
23	BOONE	27	32	43	19	34
65	BOX BUTTE	29	105	178	262	70
63	BOYD	2	2	3	0	50
75	BROWN	108	125	175	16	40
9	BUFFALO	36	42	120	17	186
31	BURT	3	3	4	0	33
25	BUTLER	4	9	30	125	233
20	CASS	0	0	0	N/A	N/A
13	CEDAR	7	7	11	0	57
72	CHASE	113	372	542	229	46
66	CHERRY	45	88	186	96	111
39	CHEYENNE	11	32	49	191	53
30	CLAY	35	45	88	29	96
43	COLFAX	14	19	28	36	47
24	CUMING	12	12	19	0	58
4	CUSTER	65	121	172	86	42
70	DAKOTA	2	2	4	0	100
69	DAWES	0	5	11	N/A	120
18	DAWSON	26	48	82	85	71
78	DEUEL	2	15	30	700	88
35	DIXON	2	2	2	0	0
5	DODGE	3	10	20	233	100
1	DOUGLAS	5	6	11	20	83
76	DUNDY	58	156	229	169	47
34	FILLMORE	25	34	69	36	103
50	FRANKLIN	4	4	6	0	50
60	FRONTIER	26	30	45	15	50
38	FURNAS	17	18	21	6	17
3	GAGE	2	2	23	0	1050
77	GARDEN	8	38	85	375	124
83	GARFIELD	4	5	9	25	80
73	GOSPHER	9	10	15	11	50
92	GRANT	1	2	3	100	50
62	GREELEY	13	21	38	62	81
8	HALL	6	7	41	17	486
28	HAMILTON	31	35	144	13	311
51	HARLAN	8	8	10	0	25
79	HAYES	17	39	55	129	41
67	HITCHCOCK	7	8	14	14	75
36	HOLT	708	847	1024	20	21
93	HOOKER	0	3	13	N/A	333
49	HOWARD	11	12	39	9	225
33	JEFFERSON	2	2	28	0	1300
57	JOHNSON	0	0	3	N/A	N/A
52	KEARNEY	80	80	104	0	30
68	KEITH	27	33	75	96	42
82	KEYA PAHA	28	33	66	18	100

TABLE 1 CENTER PIVOTS OBSERVED USING SATELLITE IMAGERY (CONT.)

COUNTY NUMBER	COUNTY NAME	NUMBER IN YEAR 1972	1973	1974	PERCENT INCREASES 72/3	74/3
71	KIMBALL	12	31	43	158	39
12	KNOX	38	43	63	13	47
2	LANCASTER	2	2	4	0	100
15	LINCOLN	103	129	226	25	75
87	LOGAN	4	21	26	425	24
88	LOUP	8	16	22	100	38
90	MC PHERSON	3	14	23	367	64
7	MADISON	35	43	79	23	84
46	MERRICK	68	88	134	29	52
64	MORRILL	12	95	135	692	42
58	NANCE	12	15	23	25	53
44	NEMAHA	0	0	0	N/A	N/A
42	NUCKOLLS	2	2	10	0	400
11	OTOE	2	2	5	0	150
54	PAWNEE	0	0	1	N/A	N/A
74	PERKINS	94	180	297	91	65
37	PHELPS	55	71	83	29	17
40	PIERCE	80	88	133	10	51
10	PLATTE	40	45	73	13	62
41	POLK	5	5	17	0	240
48	RED WILLOW	16	23	37	44	61
19	RICHARDSON	0	0	3	N/A	N/A
81	ROCK	131	165	205	26	24
22	SALINE	2	2	19	0	850
59	SARPY	0	0	4	N/A	N/A
6	SAUNDERS	6	6	15	0	150
21	SCOTTS BLUFF	0	3	5	N/A	67
16	SEWARD	17	17	57	0	235
61	SHERIDAN	14	51	97	264	90
56	SHERMAN	14	17	40	21	135
80	SIOUX	0	17	34	N/A	100
53	STANTON	3	4	8	33	100
32	THAYER	14	14	73	0	421
89	THOMAS	0	6	11	N/A	83
55	THURSTON	1	1	2	0	100
47	VALLEY	11	24	41	118	71
29	WASHINGTON	0	0	0	N/A	N/A
27	WAYNE	6	6	7	0	17
45	WEBSTER	9	9	21	0	133
84	WHEELER	54	79	102	46	29
17	YORK	10	10	35	0	250
	NEBRASKA	2733	4218	6676	54	58
	ESTIMATED ACRES IRRIGATED BY CENTER PIVOT IRRIGATION SYSTEMS, THOUSANDS	383	591	935	54	58

The Nebraska State Office of Petroleum Allocation uses this information in allocating emergency fuel supplies for counties. Valmont Industries, the largest manufacturer of center pivot systems in the United States, used our data for the location of a future plant and expansion of their present plant. Valmont has consulted with us regarding equipment, imagery, and techniques for counting center pivot systems in 30 U.S. states and several countries. LANDSAT imagery showed an average 303% growth of center pivot irrigation systems in the three counties of the Upper Republican NRD between 1972 and 1974. which caused considerable concern about the lowering of ground water levels. The LANDSAT imagery and data encouraged the Nebraska Legislature to pass LB 577, which allows the definition and regulation of critical ground water areas.

Project Title

Application of Remote Sensing in Estimating Evapotranspiration in the Platte River Basin.

Investigators

Blaine L. Blad, Assistant Professor of Agricultural Meteorology, Department of Horticulture, University of Nebraska.

Norman J. Rosenberg, Professor of Agricultural Meteorology, Department of Horticulture, University of Nebraska.

Purpose of Investigation

Primary objectives of this study area: (1) to develop and test evapotranspiration (ET) models based on crop temperature and (2) to determine the feasibility of using remotely sensed thermal imagery to supply data on crop temperature for use with these models.

Review of Activity

Blaine L. Blad, Asst. Prof. of Agricultural Meteorology completed analysis of 1972 and 1973 data and submitted reports for publication. Crop temperatures have been measured with leaf thermocouples, infrared thermometers near the surface, and thermal scanners. The thermal imagery obtained in 1974 is superior to that of 1972-1973, so that it is possible to use the imagery for quantitative estimates of crop temperature, if adjustments are made for atmospheric attenuation of thermal radiation and for crop emissivity effects.

Earlier findings in this study have been verified to show that alfalfa behaves as a potential evaporator, thereby consuming more water than pasture,

corn, and many other crops. This information is useful for devising methods for scheduling irrigation. It may be possible to use thermal data from satellites, in the future, to estimate evapotranspiration for large regions and use those estimates for irrigation scheduling and in the application of hydrologic models to watershed water balance.

Project Title

Application of Remote Sensing in the Delineation of Major Tectonic Lineaments.

Investigators

Dr. Rex M. Peterson, Remote Sensing Coordinator, Conservation and Survey Division, UNL.

Dr. M. P. Carlson, Assistant Director and Principal Geologist, Conservation and Survey Division, UNL.

Mr. J. B. Swinehart, Research Geologist, Conservation and Survey Division, UNL.

Purpose

To test and evaluate ERTS imagery in the delineation of major tectonic lineaments within the State of Nebraska and to predict the extent of their economic and environmental significance.

Review of Activity

Significant advances have been made in the classification and ranking of tectonic lineaments. At the recent remote sensing symposium for geologists, in Sioux Falls, sponsored by the American Mining Congress, many speakers noted that what is needed most in lineament studies is a classification of lineaments, so important lineaments can be separated from insignificant ones. It would seem that a method for ranking lineaments in relative importance has been developed at Nebraska.

The key to the method is to map a sufficient number of many-sided polygons (which can be generalized to circles on small scale images). The polygons are visible by changes in graytones on images, which correspond

to a combination of landscape features such as drainage, soil differences, vegetation, topography, and land use. However, by exercising the lenses and filters mentioned plus some patience (and eyestrain), it is possible to fill an image with polygons (circles) in a hierarchy of sizes and in a grid-like pattern.

When a grid pattern of polygons in a wide variety of sizes is developed on an image, it becomes apparent that what was considered an anomaly is really part of a landscape pattern. Circular landforms still have to be considered, but in the context of geologic associations, scale, and distribution. The explanation of a universal grid-like pattern of circular features in over a dozen sizes has many loose ends, to say the least. Using models that treat the features as interference folds is encouraging and is being tried for Red Willow County, one of Nebraska's more important oil-producing counties. It is apparent that some of the circular features relate to fracture patterns in certain ways and it is this relationship that makes possible the ranking of lineaments. The importance of lineaments decreases in proportion to the size of the circular features with which they are associated.

A comparison of lineaments mapped from polygons drawn on LANDSAT imagery with aeromagnetic lineaments in southeastern Nebraska shows a very good correlation. Geology students in the Center have mapped polygons on LANDSAT imagery of the Paradox basin, Utah. A map showing our lineaments interpreted from polygons, have been sent to S. Parker Gay, Consulting Geophysicist and President of the American Stereo Map Co., who will compare our lineaments with those on his 3-D aeromagnetic maps.

A map showing major lineaments interpreted by the polygon method for a LANDSAT frame in southwestern Nebraska, and adjacent parts of Kansas, shows that known oil fields tend to lie at the intersections of the major lineaments. Hundreds of wells drilled away from those intersections have been dry holes.

The intriguing feature is that there has been no drilling at several intersections. If other geologic conditions are favorable, such as porosity, thickness of reservoir formations, and presence of source beds, these intersections might be favorable prospect sites for oil exploration.

Further discussion of this method of mapping and ranking lineaments is presented in a preprint of a paper presented at the recent annual meeting of the Society of Exploration Geophysicists.

Project Title

Application of Remote Sensing in the Determination of Water Quality in Nebraska Reservoirs.

Investigators

Dr. Gary L. Hergenrader, Chairman, School of Life Sciences, UNL.

Mr. Kelly White, Graduate Assistant, School of Life Sciences, UNL.

Purpose

The purpose of this research is to determine the feasibility of measuring selected aspects of water quality in Nebraska reservoirs by remote sensing. Specifically, to what extent can concentrations of chlorophyll and inorganic turbidities be quantified by remote means? Is it possible to differentiate from reflectance characteristics, between the major classes of phytoplankton that occur in our reservoirs? If it is possible to determine water quality by remote sensing, then the characterization of the trophic state of these reservoirs should also be possible.

Review of Activity

The Masters thesis entitled "The Remote Sensing of Water Quality Parameters of the Salt Valley Reservoirs" by Mr. Kelly White described in the last reporting period indicated that the water quality parameters of interest could be determined with the smallest statistical confidence intervals from CCT's provided by Landsat-1. However, because ground truth was available for only one date it was unknown how reliably CCT's would provide accurate data. Consequently, ground truth was collected on six different sampling dates in June, July and August from Lake McConaughy,

a 35,000 acre reservoir in western Nebraska. These dates coincided with overflights of Landsat-1 and Landsat-2. Water samples were analyzed for Secchi depth, turbidity, suspended solids, and chlorophyll. These data will provide ground truth which will be used to verify the correlations observed with the use of CCT. However, data from only three of the sampling dates can be used because it turns out that the satellites were inoperative on three of our six sampling dates.

The CCT's recently received will be run on the computer and radiance values from our sampling sites in the four spectral bands will be extracted. These values will be compared to our ground truth values by the statistical analyses we developed earlier in the research. These analyses will allow us to determine whether the strong correlations we obtained earlier from the CCT were due to chance or whether in fact the CCT's are the best format for accurate determination of water quality in Nebraska reservoirs.

Project Title

Application of Remote Sensing in Land Use Classification and Inventory and in the Delineation of Critical Environmental Areas.

Investigators

Dr. Marvin P. Carlson, Assistant Director and Principal Geologist, Conservation and Survey Division, UNL.

Mr. James Barr, Natural Resource Coordinator, State Office of Planning and Programming.

Dr. Paul M. Seevers, Research Agronomist, Conservation and Survey Division, UNL.

Dr. James V. Drew, Dean for Graduate Studies and Professor of Agronomy, UNL.

Purpose

To test and evaluate ERTS imagery in obtaining Level II land use data and in defining and monitoring critical environmental areas in conjunction with data derived from underflights and ground truth.

Review of Activity.

The following Nebraska land use maps have been published:

1. Generalized Land Use of Nebraska. 1:1,000,000 scale, level 1, seven colors, from Landsat imagery.

2. Lancaster County. 1,62,500 level 2, 15 colors, ten acre cells, from color infrared film acquired in early summer and again in late summer by a Nebraska Air National Guard RF-4C from 42,000 feet.

3. Lower Platte South Natural Resource District. 1:125,000 scale, level 2, 15 colors, ten acre cells, from Air National Guard early and late summer color, infrared photography.

4. Dawson County. 1:125,000 scale, eight colors, level 1 plus; from Landsat and aircraft imagery.

5. Phelps County. Approximately 1:125,000 scale, level 1 plus; from Landsat and aircraft imagery.

Land use maps for other natural resource districts (NRD's) are in various stages of preparation as listed below:

1. Papio NRD. Color separations for Sarpy, Douglas, and Washington Counties are nearing completion in the Conservation and Survey drafting room. This map will be similar to the Lancaster County and Lower Platte South NRD maps with dominant land use of each ten acre parcel shown in 15 colors. The inventory was prepared from color infrared panoramic photography flown in early and late summer, 1974, by a Nebraska Air National Guard RF-4C.

2. Central Platte Natural Resource District. In early and late summer, 1974, high altitude color infrared photography was flown for this area by NASA. Mapping is still in the inventory stage.

3. Lower Platte North NRD. Color infrared photography was flown in early and late summer, 1975, by the Nebraska Air National Guard and the inventory is underway.

4. Lower Niobrara NRD. This area in north-central Nebraska was photographed in early summer and early fall 1975, by NASA aircraft. Inventory is in the beginning stages.

5. Upper Niobrara-White NRD. NASA aircraft photographed this NRD in early summer and in early October, 1975. The inventory has just begun.

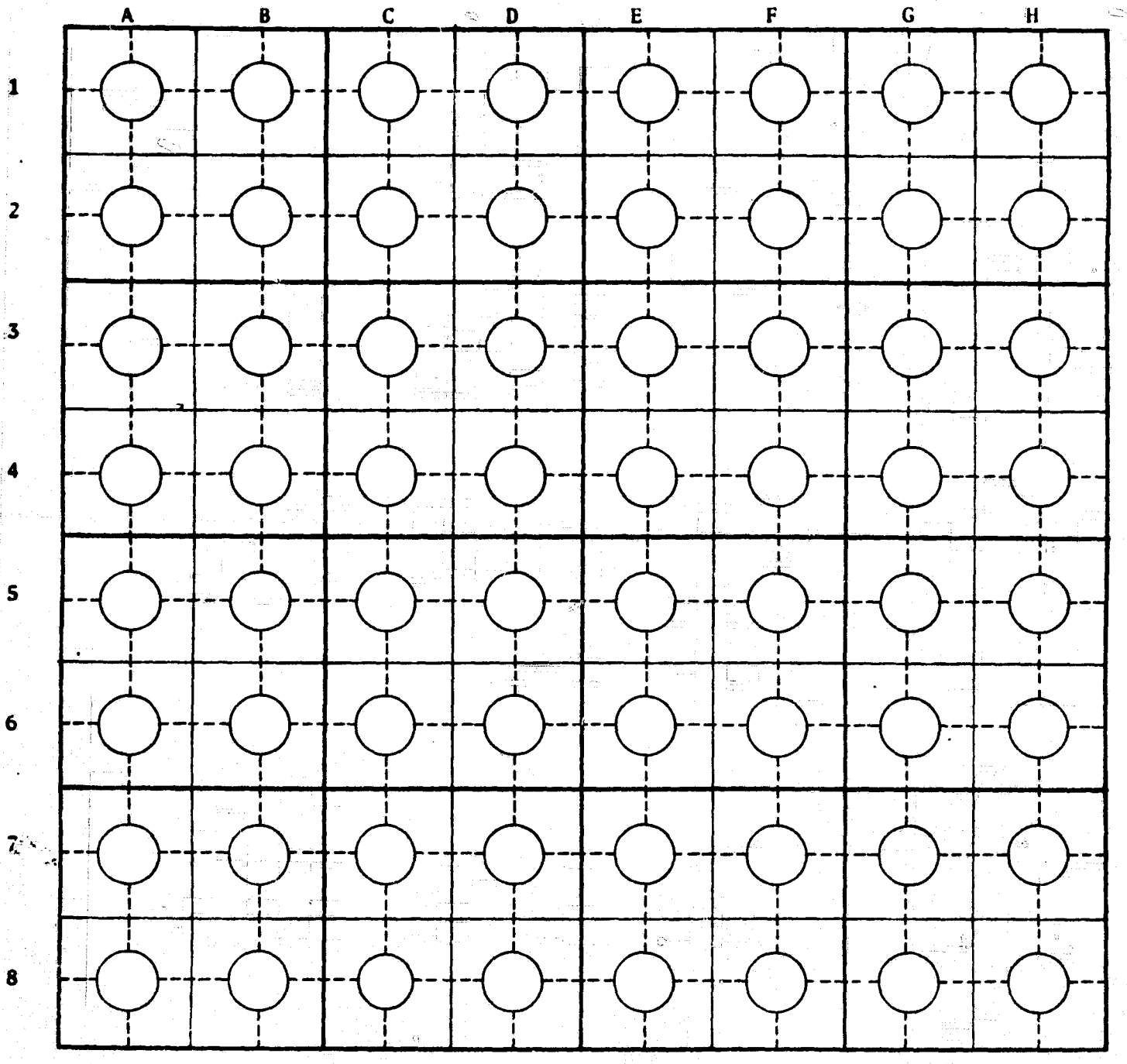
Regarding the process of inventorying level 2 land use, our photo-interpreters place frames of early and late summer imagery of the same area side by side on a light table. After viewing a ten-acre legal subdivision with magnification they enter the symbol for the appropriate land use on a data sheet. A data sheet (sample included) covers one 640 acre

section of land. The ten acre squares on the data sheet are arranged in the same way they are on a map, aerial photo, and the land. One letter symbol per ten acre square, plus identification data shown on top of the data sheet can all be entered on one IBM punch card. Because we have had numerous inquiries concerning locations and numbers of farmsteads, rural houses, and terraced fields, the interpreters enter this information with point symbols in appropriate squares. The data on location and numbers of terraced fields, houses, and farmsteads doesn't appear on our standard keypunch entries or maps, but it is available on the inventory sheets and can be added to computer programs and maps. A computer program has been developed in the Center for plotting land use data in map format at various scales. Level 2 inventory data for each legal section in Sarpy County, Nebraska, was placed on punch cards, then magnetic tape, and displayed in map format by computer plots at a scale of one inch to the mile. A composite plot was prepared showing all the categories on the data sheet, plus separate maps for each subcategory such as agriculture, urban, and water. These computer plots can be used as a direct guide for drafting color separations in preparation for publication of color maps, or the computer maps can be used as preliminary maps.

There has been considerable interest in an historic land use inventory of Lancaster County, Nebraska, the county in which Lincoln is situated. Data for 1973 was available on early and late summer Air Guard color infrared photography, but data for previous years had to be interpreted from black and white U.S. Department of Agriculture photos. Photographs for 1949, 1959, and 1965 were interpreted with the use of the same ten-acre cell data sheets used on our other land use inventories. Because some of the Department of Agriculture photographs were taken in the fall, and because they are black and white, the level of confidence of interpretation is lower than with the color infrared, multitemporal photography. Nevertheless, by using some

COUNTY _____ IMAGERY(19) _____ DATE _____

SEC _____ TWN _____ N RNG _____ E/W INTERPRETER _____ DATE _____



1. URBAN
   - A-Residential
   - B-Commercial
   - C-Industrial
   - D-Transportation
   - E-Institutional
   - F-Recreational
   - G-Strip & Clustered
   - H-Mixed
   - I-Open & Other
2. AGRICULTURAL
   - J-Row Crop
   - K-Small Grain
   - L-Pasture
   - M-Fallow
   - N-Horticultural
   - O-Farmstead
   - P-Feeding Operation
   - Q-Other
3. RANGELAND
   - R-Rangeland
4. FOREST LAND
   - S-Deciduous
   - T-Evergreen
5. WATER
   - U-Streams
   - V-Lakes
   - W-Reservoirs
   - X-Other
6. NONFORESTED WETLAND
   - Y-Nonforested Wetland
7. BARREN LAND
   - Z-Barren Land
   - ●-Extractive

_____ Terraced △ House □ Farmstead

surrogates for interpretation (such as furrows in row crop fields, or trails and ponds in pastures) interpretations were possible, so that we have data for use of each ten acre piece of land in Lancaster County for four slices in time over a period of a quarter century. The data is being analyzed by such agencies as the Nebraska State Office of Planning and Programming. Many changes in amounts of land used for various categories of agriculture, urban, and wetlands are apparent and measurable by this technique. At this time the historic land use data is summarized only on computer printouts, but if there were sufficient interest and demand we could use our computer program to translate the magnetic tape data into maps, similar to those prepared for current land use in Sarpy County.

The Remote Sensing Center is conducting a pilot study for Basin Electric Cooperative, Bismarck, North Dakota, for the purpose of selecting new routes for high voltage transmission lines. The approach is to use only optical, photographic, and electronic enhancement (but no computer manipulation) of LANDSAT imagery for land use mapping of 100 mile-wide corridors through which transmission lines could be routed. One or more ten mile-wide corridors would be selected after analysis of LANDSAT data. Aircraft photography would be acquired for those strips, and more detailed land use inventories would be made. Level 2 or 3 land use information and additional information, such as land valuations, soils, presence of ground water, and slopes, would be considered in selection of routes for the power line.