

In the interest of early and wide dissemination of Earth Resources Survey Program information and without liability for any use made thereof."

E73 10474

CR-131284

CENTER FOR RESEARCH, INC.  
UNIVERSITY OF KANSAS  
ERTS DETAILED IMAGE INTERPRETATION REPORT

CRINC  
DIIR No. 2264-3  
Date  
Prepared 11 Jan 73

Subject: Land Use Map, Finney County, Kansas

Subject Geographic Coordinates 38-05N/100-45W NASA Test Site No. 76

NASA Image Descriptors: Agriculture, Geography, Urban Area, Rangeland, Irrigation

Report Summary: Methods for the mapping of land use in agricultural regions are developed and applied to preparation of a land use map of Finney County, Kansas. Six land use categories were identified from an MSS-5 image. These categories are (1) large field irrigation, (2) small field irrigation, (3) dryland cultivation, (4) rangeland, (5) cultural features, and (6) riverine land. The map is composed of basically homogeneous regions with definable mixtures of the six categories. Each region is bounded by an ocularly evident change in land use.

Imagery References		Subject Image Coordinates		Cloud Cover	Image Quality
CRINC Image No.	NASA Image ID Block	X	Y		
MP00330	E-1024-16511-5	(9.5) 34	56	0	Good

(E73-10474) LAND USE MAP, FINNEY COUNTY, KANSAS (Kansas Univ./Center for Research, Inc.) 8 p HC \$3.00 CSCL 08B

N73-21311

G3/13 Unclass 00474

Map References: USGS NJ14-4, NJ14-7, Scale 1:250,000

Digital Data Used Yes  No

Image Analyst Donald L. Williams  
Jerry C. Coiner

Principal Investigator Donald L. Williams  
for S.A. Morain

NASA Contract No. NAS 5-21822

User ID No. U664

## REPORT

During interpretation of ERTS-1 imagery of Finney County, it became apparent that six basic types of land use, four of which were directly associated with agriculture, were detectable. These types were observed to occur with varying degrees of intermixing throughout the county. Using the mixture of agricultural land uses expressed as fractional codes, it was possible to map the land use of Finney County into basically homogeneous regions of definable mixtures (see map).

Although images of all four MSS bands were inspected prior to the land use categorization, all categories were defined in terms of one band, MSS-5, for one date, 16 August 72. This band was selected because it provides maximum scene contrast for areas not involving surface water bodies. The August date was selected because of the cloudfree condition of the subframe area of interest. This date was the only acquisition date through the end of November which was clear in subframe of interest.

### Land Use Categories

The six land use categories were defined in terms of tone and pattern on the image. These categories are:

- A. large field irrigated areas,
- B. small field irrigated areas,
- C. dryland cultivation areas,
- D. rangeland,
- E. cultural features, and
- F. riverine features.

Each category is discussed in the following essay key.

Large field irrigation is characterized by fields which are about 160 acres in size. Some of the fields are irrigated by flooding, but most are irrigated by center pivot sprinkler systems (Williams and Barker, 1972). If a crop is in the field, the field appears dark gray to black on the film positive. Bare soil images near white. Such fields are rare in August in the more intensively irrigated areas. The primary crops grown in these fields are corn and grain sorghum.

Small field irrigation is a more intensive agricultural system and has been in existence for about 60 years (originally based on the construction of the now abandoned Great Western Sugar Company mill in Garden City). Although now primarily dependent on wells, the system was

originally based on an extensive network of canals from the Arkansas River. These canals continue to be used. Irrigation is exclusively by the flooding method. Except for the pattern of smaller fields, these areas exhibit the same image characteristics as the large field irrigation areas. The crop assemblage in this irrigation system is much more diverse. Sugar beets and alfalfa, both of which require high labor intensities, are very important. Corn, grain sorghum, winter wheat, and a variety of minor crops are also cultivated in this area.

Dryland cultivation in this semiarid area is based on land extensive cropping and summer fallowing. The fields are large but often stripcropped (to prevent wind erosion) creating narrow east-west tonal bands across the image. Image tones are medium to light gray in August. The only crop in the fields in August is grain sorghum. All other fields contain wheat stubble or are nearly bare in preparation for the fall wheat planting. This area also includes pastures as large rectangular fields.

Extensive areas of rangeland occur on the sand dunes south of the Arkansas River and on steep and broken land of the headwaters of the Pawnee River (northeastern part of the county). These areas of native short and mid grasses image as medium gray with gradual variations in tone associated with exact topographic position and range management practices (Drew, 1972). Gullies and areas of unstabilized dunes image white and are small and irregular in shape.

Major cultural features in Finney County are Garden City and Garden City Airport. The city is a complex feature with irregular, vague boundaries distinct from the surrounding rectangular fields. The airport is detectable by the runway pattern.

Riverine features are irregular, very dark toned features associated with streams. The tone represents high water availability to the adjoining vegetation. Areas of lighter tones associated with streambeds and water are also present. This area was mapped only along the Arkansas River. Areas of this type along the Pawnee River are detectable on the image, but were not mappable at the scale used.

### Map Construction

Mapping of the land use in Finney County was conducted in two simultaneous phases: (1) delimitation of boundaries between distinctive areas and (2) formulation of the fractional code for each area delimited.

An enlargement to mapping scale was prepared using a mosaic 3.16X Polaroid enlargement.

from that portion of the image containing Finney County. After the county boundaries had been plotted on an overlay, the land use boundaries were delimited by study of the original transparency under variable (2 to 10X) magnification. The first interpreter drew a boundary wherever he believed a detectable change in land use had occurred. The second interpreter examined the same area and drew his boundary. Conflicts were resolved by further study of the image until a mutually satisfactory boundary was drawn on the overlay.

A fractional code was formulated for each area as it was bounded. This code was based on independent estimates by each interpreter of the percentage of bounded area belonging to each land use category. Estimates were made to the nearest ten percent. Again, conflicts were resolved by discussion and further study of the image.

### Extent of Categories

The area enclosed by each boundary was measured directly from the map with a Hewlett-Packard HP9200B digitizer/calculator. Where mixtures occurred, the areas were distributed among the categories according to the proportions already assigned. The total measured area of Finney County was  $1318 \text{ mi}^2 \pm 3 \text{ mi}^2$ , which compares to an actual area of  $1308 \text{ mi}^2$  (these measurement techniques are discussed in detail in DIIR 2262-2).

The primary land use category, in terms of area, is dryland cultivation, which occupies  $651 \text{ mi}^2$  (see Table 1). Rangeland is the second most important category, occupying  $350 \text{ mi}^2$ . A total of  $297 \text{ mi}^2$  of land is irrigated, with  $194 \text{ mi}^2$  in large field systems and  $103 \text{ mi}^2$  in small field systems. Only  $8 \text{ mi}^2$  is detectable as cultural land (omitting several small towns, populations less than 400, and rural point economic functions) while  $12 \text{ mi}^2$  are mappable as riverine land.

### Spatial Organization of Categories

The distribution and mixing of the land use categories is strongly related to the distribution of soil types and irrigation water availability (U.S.D.A. Soil Conservation Service, 1965; Latta, 1944).

Dryland cultivation is concentrated in the northern part of the county and is usually (mixing ratio = 71%)<sup>1</sup> mixed with one or more other uses, principally large field irrigation.

<sup>1</sup>Mixing ratio is the percentage of area of one category which is impure. That is, the percentage which occurs in map units which have multiple part fractional codes.

TABLE 1. Areas and mixing ratios for each land use category in Finney County, Kansas.

<u>Category</u>	<u>Area (mi<sup>2</sup>)</u>	<u>Mixing Ratio (%)</u>
Large field irrigation	194	86
Small field irrigation	103	99
Dryland cultivation	651	71
Rangeland	350	37
Cultural features	8	0
Riverine land	12	0

Rangeland is concentrated in two parts of the county: (1) the sand dunes south of the Arkansas River and (2) the rougher terrain areas of the Pawnee River basin in northeastern Finney County. Rangeland is relatively pure (mixing ratio = 37%). Most of the mixing is with dryland cultivation in the Pawnee River basin.

Irrigated areas are almost never pure (large field irrigation mixing ratio = 86%; small field irrigation mixing ratio = 99%). Small field irrigation is concentrated in the traditionally irrigated area of level clayey soils northwest of Garden City. Large field irrigation diffuses into the dryland cultivation around the periphery of this traditional area and is extensively used on the sandy soils of southern Finney County.

### Costs

Direct costs of preparation of this report were 38 hours interpreter time, 8 hours drafting time, and \$6.56 nonexpendable supplies. Interpreter time included (1) derivation of the categories, (2) preparation of the mosaic, (3) mapping, (4) assignment of fractional codes, (5) mensuration, and (6) report writing.

## REFERENCES

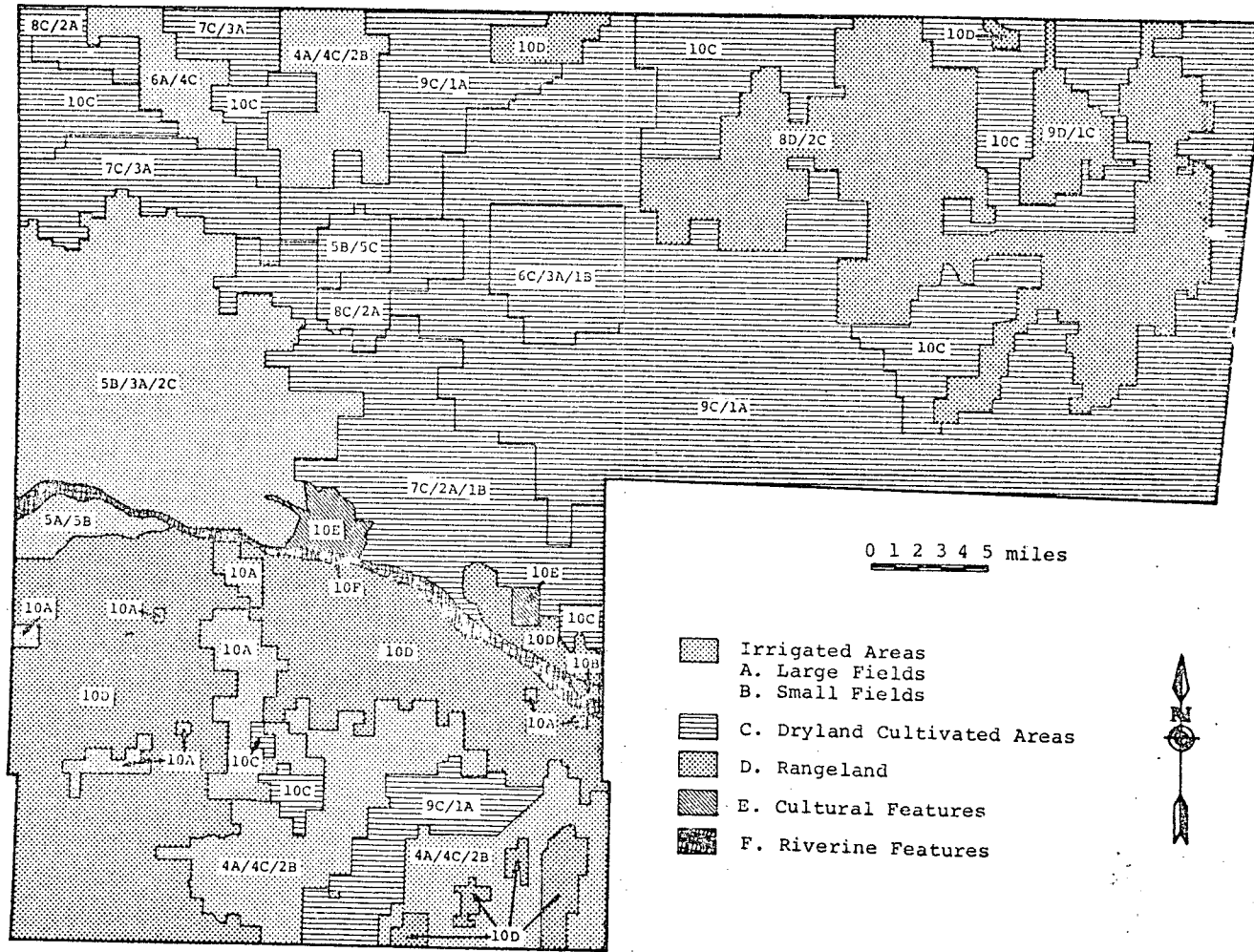
Drew, James V. 1972. Proposal to evaluate the use of ERTS-A imagery in mapping and managing soil and range resources in the Sand Hills region of Nebraska. NASA-CR-128412.

Latta, Bruce F. 1944. Geology and Ground-Water resources of Finney and Gray Counties, Kansas. State Geological Survey of Kansas Bulletin 55.

U.S.D.A. Soil Conservation Service. 1965. Soil Survey, Finney County, Kansas.

Williams, Donald L., and Bonnie Barker. 1972. Center pivot irrigation in Finney County, Kansas: an ERTS-1 interpretation procedure. CRINC Technical Report TR-2264-1.

# LAND USE FINNEY COUNTY, KANSAS



Compiled by J.C. Coiner and D.L. Williams  
 Drafted by B.L. Barker