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LOUISIANA LEVEL III CROPLAND AND PASTURE DELINEATION--A TEST AND
DEMONSTRATION PROJECT:

FINAL REPORT

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STATEMENT OF PROBLEM

U.S. Geological Survey (USGS) land use and land cover maps aggregate cropland and pasture areas into a single land use category--code 21, Cropland and Pasture. There is a need to differentiate agriculture lands into cropland and pasture. This need is demonstrated in a number of Federal programs including the Environmental Protection Agency's Section 208 Water Quality Management Program, and the United States Department of Agriculture, Rural Clean Water Program, Resource Conservation Act programs, and River Basin Studies Program. The differentiation of cropland from pasture allows the inference of many parameters of interest to people involved with these and other programs in Louisiana.

This test and demonstration project was undertaken to determine whether the land use and land cover compilation photography (high-altitude color infrared photography) could be used to differentiate cropland from pasture in three Louisiana parishes selected for their diversity and regional representativeness (see figure 1).

DEVELOPMENT OF THE WORK STATEMENT

Following the selection of the proposal as a test and demonstration project by the Advisory Panel to the Program for Technical Assistance, USGS and Soil Conservation Service (SCS) personnel met in Baton Rouge, Louisiana in April 1980 to develop a preliminary work statement for the project.

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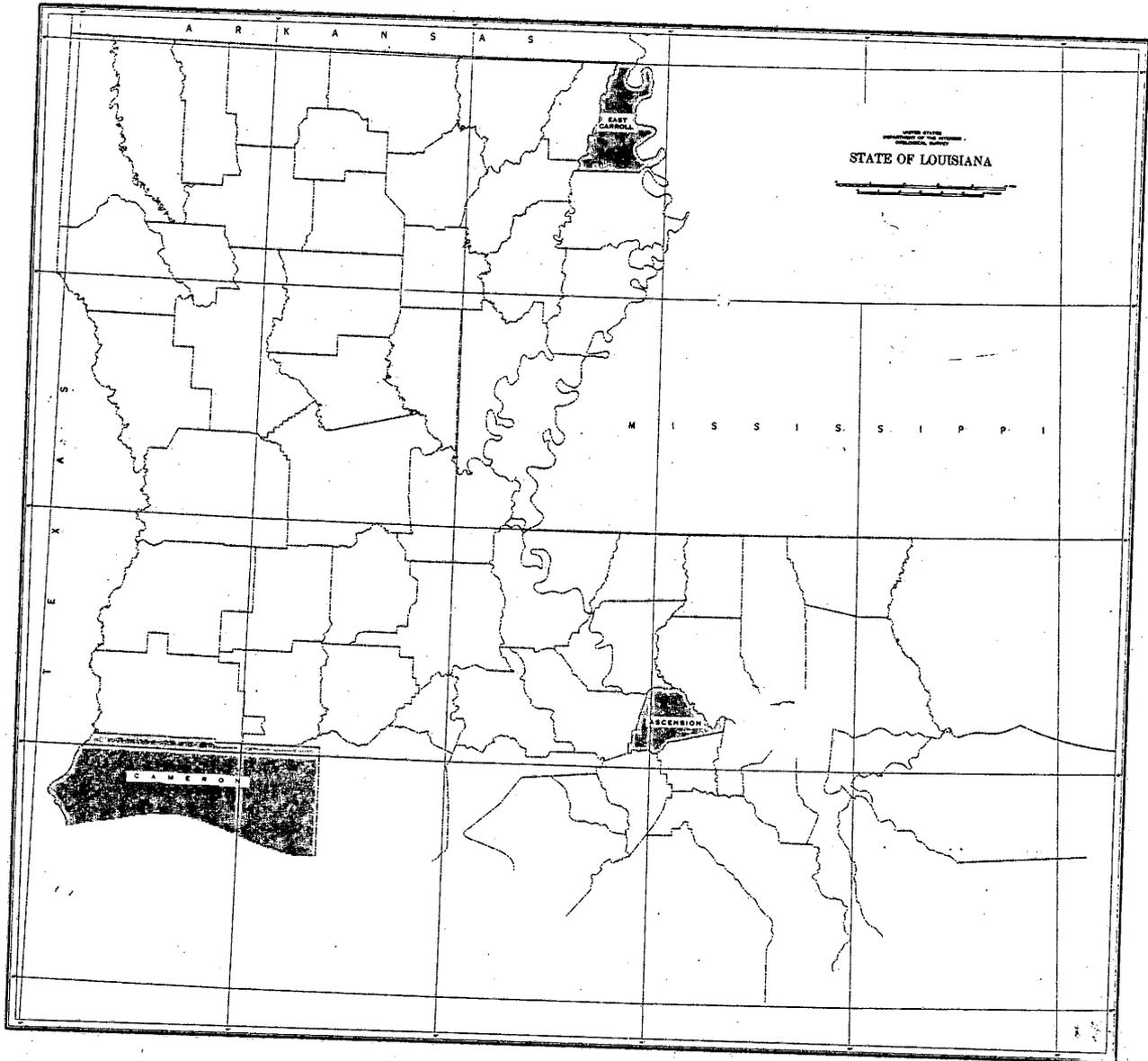


Figure 1.--Louisiana Level III Cropland and Pasture delineation - project parishes.

After a few revisions, a detailed work statement (Appendix A) was mutually agreed upon. The work statement outlined the following seven tasks:

1. USGS would acquire existing National Aeronautics and Space Administration (NASA) high-altitude photography for the three parishes.
2. USGS would enlarge updated land use and land cover maps to the scale of the aerial photography.
3. SCS would send a representative to the Mid-Continent Mapping Center Building in Rolla, Missouri, to brief the USGS compilers on cropland and pasture photographic signatures.
4. USGS personnel would interpret the aerial photography and delineate cropland and pasture areas on tracing-film overlays. Completed overlays would be forwarded to the SCS.
5. SCS personnel would conduct extensive field validation of the overlays.
6. USGS would review field validation comments and revise the overlays as appropriate.
7. USGS and SCS personnel would prepare a final report describing the techniques and procedures for differentiating cropland and pasture and the accuracy levels obtained using the procedures.

METHOD AND RESULTS

Following the initiation of a cooperative funding agreement (September 1979) between the State of Louisiana and the USGS, the latter has had under preparation statewide Level II land use and land cover maps. The photographic source used for preparing the land use overlays is high-altitude NASA color infrared imagery--1:129,000-scale photography (November 1979) for areas north of Alexandria, Louisiana and 1:66,000-scale photography (October 1978) for areas south of Alexandria. The USGS obtained copies of the photographs for the three parishes. NASA flight number 79-164 (November 12, 1979) photography was used for East Carroll Parish while flight numbers 78-148 (October 15, 1978) and 78-144 (October 9, 1978) photography were used for Ascension and Cameron Parishes respectively.

Following the acquisition of the above photographs, the preliminary Level II land use and land cover overlays were enlarged to the scale of the photography onto matte film (a frosted base film conducive to annotations). The matte film enlargements were placed in register over the photographs and a piece of tracing film laid directly over them. Existing Level II Cropland and Pasture polygons were further delineated into cropland or pasture polygons based on their photographic signatures.⁴ Areas smaller than 20 acres or less than 660 feet in width were not delineated.

⁴A SCS soil scientist spent 2 days in Rolla, Missouri, acquainting the USGS photo land use compiler with the type and extent of agricultural practices of the three parishes. He also provided suggestions and guidance on the photographic signature characteristics for cropland and pasture in the parishes; particularly the frequent occurrence of scattered trees in pasture areas.

Following completion of the Level III Cropland and Pasture land use overlays, the overlay materials were forwarded to the SCS in Alexandria, Louisiana for field validation. The SCS personnel inspected 26 sites in East Carroll Parish, 40 sites in Ascension Parish, and 50 sites in Cameron Parish. Data sheets were provided for Cameron and East Carroll Parishes listing points that were verified for land use photointerpretations. The data sheets listed the 1980 land use and, when available, the 1979 and 1978 land uses. Ascension Parish discrepancies were noted directly on the original Level III Cropland and Pasture land use overlay.

USGS personnel reviewed the SCS comments and photo-inspected each discrepancy. The results of the review revealed the following:

Ascension Parish

Number of sites inspected:	40
Number of discrepancies:	16
Number of discrepancies due to unfamiliar photographic pasture signature:	6
Number of sites classified as cropland which were actually idle cropland ⁵ (pasture) areas:	8
Number of sites classified as pasture which were actually cropland but missed due to poor photographic signatures:	1
Number of discrepancies due to photo-interpreter error:	1

Cameron Parish

Number of sites inspected:	50
Number of discrepancies:	12
Number of sites classified as pasture which were in cattle grazing at the time of the photography but were normally used for cropland: ⁶	8
Number of discrepancies due to poor photographic cropland signatures (probably areas recently converted to cropland):	4
Number of discrepancies due to photointerpreter error:	0

⁵Because of the dominance of grass vegetation during field checks idle land was classified as pasture land. Eight such areas in Ascension Parish which were formerly active cropland areas still exhibited photographic signatures characteristic of cropland.

⁶The Louisiana SCS considers temporary pasture to be cropland.

East Carroll Parish

Number of sites inspected:	26
Number of discrepancies:	10
Number of sites classified as pasture which were actually cropland but missed due to poor photographic signatures:	9
Number of discrepancies due to photo- interpreter error:	1

Two different accuracy statements can be derived from the above data depending upon whether the classifications are based on land use activity or on land cover. If the accuracy statement is based on land use activity, the accuracy level would be reported as 38 discrepancies among 116 sites visited--a 67.2 percent accuracy level. However, as noted, eight of the discrepancies identified in Cameron Parish were due to a difference in definition rather than photointerpretation error. The eight sites were probably being grazed at the time of the aerial photography.

Land use mapping from remote sensing source materials is typically based on land cover characteristics and not the most-frequent or highest-order activity. Therefore, if an accuracy statement was prepared from the point of view of a photointerpreter, the number of errors would be 30, not 38, and the corresponding accuracy level would be 74.1 percent (86 correct calls out of 116 sites visited).

The USGS requires an 85 percent photointerpretive accuracy level for its Level II land use and land cover maps--both the 67.2 percent accuracy level based on land use activity and the 74.1 percent accuracy level based on land cover fall significantly short of this requirement.⁷

ANALYSIS OF THE DISCREPANCIES

Analysis of the SCS field validation comments revealed five reasons for classification discrepancies. They were:

1. Fourteen sites which were recently converted to cropland (either from forest land or pasture) did not exhibit a clear photographic cropland signature. In most cases the areas were in a transition stage to cropland.

⁷SCS field validation was performed on an enumeration basis rather than on a systematic sampling basis. The SCS personnel were very familiar with their parishes and therefore inspected the land use overlays for all recognizable discrepancies. The site visits included all of the possible discrepancies plus sites en route. It can therefore be assumed that discrepancies noted during SCS field validation identified most, if not all, cropland/pasture classification discrepancies.

2. Eight sites in Ascension Parish classified as cropland areas were actually idle. For the purpose of improving drainage conditions the crops were planted on elevated rows. Even after 10 to 15 years, the characteristic row pattern of the idle cropland areas was easily identified on the high-altitude photographs. Only personal knowledge of the agricultural practices used in the area and/or field validation would ensure a proper Level III classification.
3. Eight sites in Cameron Parish were used for cattle grazing as part of a rotation cropping practice at the time of the photography. Although farmers would classify these sites as cropland, the proper photographic land use classification is pasture.
4. Six sites in Ascension Parish classified as cropland were actually pasture. These areas, dark gray on the color infrared photography, were surrounded by pasture areas (bright red areas on the photography). Had their photographic signature been pointed out prior to photographic interpretation and classification, these discrepancies might not have occurred.
5. Two sites, one in Ascension Parish and another in East Carroll Parish, were not delineated. In both cases the sites were small; barely meeting the minimum acreage mapping unit size of 20 acres.

If the high-altitude photography had been taken during the growing season the number of classification errors may have been reduced. However, the test and demonstration project was designed to investigate whether cropland could be differentiated from pasture areas utilizing the same photographic source material as used for Level II land use and land cover mapping.⁸

MANPOWER REQUIRED

The test and demonstration project required manpower resource commitments on the part of the USGS and SCS. The breakdown of these requirements was as follows:

- USGS - Level III cropland and pasture delineation from high-altitude photography:

Ascension Parish	- 10 hours
Cameron Parish	- 16 hours
East Carroll Parish	- <u>8 hours</u>
Total	34 hours

⁸Although this project used some NASA photography taken as part of a joint funding agreement, the USGS will, in the future, rely more heavily upon the National High-Altitude Photography (NHAP) program as its source material for land use and land cover mapping. Therefore, since HAP photography is flown under contract between January 15 and April 1 each year, it is unlikely that growing season high-altitude aerial photography will be generally available for the separation of cropland from pasture land.

- SCS - Land use field validation (including travel to areas):

Ascension Parish	- 20 hours
Cameron Parish	- 36 hours
East Carroll Parish	- <u>24 hours</u>
Total	80 hours

- SCS - Preparation of field validation data sheets and overlays:

6 hours

- USGS - Review of field validation data sheets: 11 hours

- Preparation of final report:

USGS - 10 hours
SCS - 3 hours

SUMMARY AND RECOMMENDATIONS

The use of high-altitude photography taken at times other than the growing season reduces the ability of the photointerpreter to differentiate cropland from pasture land--particularly for idle cropland areas, areas employing rotation cropping practices (such as a rice, soybean, and pasture rotation), and croplands and pasture lands in transitional stages.

The SCS in Louisiana considers areas in temporary pasture to be cropland because the management and cultural practices are similar to those used on cropland areas. However, in land use and land cover mapping from aerial photographs, these areas are delineated primarily on the basis of cover and therefore they are classified as pasture land.

The results of this test and demonstration project suggests that the USGS should not, as a standard practice, delineate cropland from pasture from high-altitude photography; particularly when the photography has been obtained at times other than the growing season.

Even with proper seasonal photography, it will be rather difficult to delineate cropland from pasture land for areas in agricultural transition stages--areas recently converted to cropland or former cropland areas now in an idle state with a dominant grass vegetation.

Finally, the low interpretive accuracy level of 74 percent in this project further suggests that the USGS should not attempt to delineate cropland from pasture land on its standard Level II land use and land cover maps.

APPENDIX A

Louisiana Level III Cropland and Pasture Delineation Work Statement

This work statement describes the tasks and responsibilities for a test and demonstration project to be performed jointly by the U.S. Geological Survey's Program for Technical Assistance in the Analysis of Land Resources and the United States Department of Agriculture, Soil Conservation Service.

This project will provide the Soil Conservation Service (SCS) with a set of overlays depicting the areas of cropland or pasture for three parishes in the State of Louisiana. The source material to be used in the determination of these areas will consist of the high-altitude photography presently being used to compile the updated land use and land cover maps for Louisiana and the new updated land use bases being compiled. The test areas will consist of that portion of East Carroll Parish on the Jackson 1:250,000-scale map, Ascension Parish as shown on the Baton Rouge 1:250,000-scale map, and Cameron Parish as shown on the Port Arthur 1:250,000-scale map. Since the land use and land cover maps are presently in compilation, the base maps and photographs will only be available as compilation is completed. Work on this project will start as soon as the source materials are available, however, any work to be performed by the Program for Technical Assistance staff that is not completed by October 1, 1980, will terminate until this project has been reviewed with respect to the priorities and requirements of the new Geographic Investigations Office.

1. The Program for Technical Assistance will acquire the high-altitude photography needed to cover the project parishes. The photographs to be used will be the photographs used to compile the land use maps.
2. The Program for Technical Assistance will obtain the updated land use maps of the parish areas and enlarge them to the scale of the photographs.
3. The SCS office, located at 3737 Government Street, Alexandria, Louisiana 71301, will provide a person familiar with the area to brief the compiler in Rolla, Missouri. This will ensure the proper background for the compiler to ensure the best interpretation of the area.
4. The Program for Technical Assistance will interpret the photography and delineate the areas of cropland or pasture within the parishes on the land use sheets. To be delineated, the area of cropland or pasture must be a minimum of 20 acres with a minimum width of 660 feet.
5. The maps prepared by the Program for Technical Assistance for the parishes showing areas of cropland or pasture will be furnished to the SCS in Louisiana for field validation.
6. The maps will be returned to the Program for Technical Assistance with areas marked for review and correction where necessary. The maps will then be reduced to a scale of 1:250,000 and furnished to SCS in Louisiana.
7. A joint report will be prepared by the two offices, SCS and the Program for Technical Assistance, to describe the techniques and procedures for breakout of cropland and pasture for the remaining portions of the State.