

Task Order # 3--Service Agreement Between the Nebraska Department of Natural Resources and Board of Regents, University of Nebraska, Nebraska Water Center

TASK: "Delineation of 2005 Statewide Land Use Patterns for the State of Nebraska Department of Natural Resources" as outlined on Attachment 1.

Ann Bleed
Ann Bleed, Deputy Director and Task Order Coordinator

July 21, 2005
Date

Kyle D. Hoagland
Kyle Hoagland, Director Water Center and Project Manager

7/25/05
Date

Delineation of 2005 Statewide Land Use Patterns For The State of Nebraska Department of Natural Resources

A Proposal Submitted to the:

Nebraska Department of Natural Resources

c/o

Jim Cannia

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June 23, 2005

Period of Funding: 24 months from date of signature from sponsoring agency
Funds Requested: \$282,652

INTRODUCTION

The Nebraska Department of Natural Resources (NEDNR) seeks information on land use for the entire state beyond the area originally delineated by the previous work completed for The Platte River Cooperative Hydrology Study (COHYST). COHYST is a multi-agency effort that seeks to improve the understanding of the hydrological conditions in the Platte River watershed in Nebraska upstream of Columbus, NE. Current work at The Center for Advanced Land Management Information Technologies (CALMIT) is underway to identify land use patterns for the 2005 growing season within the COHYST study area. The NEDNR requires more information about land use patterns for the entire state of Nebraska, beyond the COHYST study area. Comprehensive and current information on land cover and land use, especially irrigation and crop patterns, are critical to NEDNR since hydrologic conditions change in relation to crop dynamics. CALMIT, a unit of the Conservation and Survey Division and the School of Natural Resource Sciences at the University of Nebraska – Lincoln, completed the development of two land cover databases for the COHYST region based on 1997 and 2001 Landsat satellite imagery and ancillary data. CALMIT herein proposes to develop a land cover and land use classification for the entire state of Nebraska, beyond the COHYST study area, using 2005 Landsat-5 and Landsat -7 satellite imagery as the primary data source.

OBJECTIVE

The principal objective of this project is to apply methodologies and skills developed in the 1997 and 2001 COHYST land cover research to develop an updated agricultural land cover classification for the 2005 growing season. By capitalizing on the seasonal dynamics of the agricultural crops and native plant communities, an accurate map land use and land cover will be developed for the entire state of Nebraska.

APPROACH

Landsat-5 and Landsat -7 satellite imagery will be utilized in this work. CALMIT personnel will be responsible for image selection in order to assure that the imagery purchased is appropriate to meet the project specifications. In the event that Landsat-5 data would not be available, other commercial satellite data will be used to supplement the image classification. If this is the case, the cost for satellite imagery for this project will be larger than the current estimated budget. In November 2005 CALMIT will re-evaluate the satellite images collected and assess if new imagery is required. If new imagery is required from different satellites this contract will be amended to account for increases in imagery costs.

For each Landsat Path/Row location within the study area, three dates of imagery (representing spring, summer, and fall growing conditions) will need to be acquired, georeferenced, co-registered, and processed into a land use/ land cover classification. Three dates of imagery at each Landsat Path/Row locations will be collect to cover nearly all of the study area. The total number of Landsat 5 scenes required will be 30 scenes total.

The following output classes are the target of our land cover classification:

<u>CODE</u>	<u>CLASS NAME</u>
1	Irrigated Corn
2	Irrigated Sugar Beets
3	Irrigated Soybeans
4	Irrigated Sorghum (Milo, Sudan)
5	Irrigated Dry Edible Beans
6	Irrigated Potatoes
7	Irrigated Alfalfa
8	Irrigated Small Grains
9	Range/Pasture/Grass (Brome, Hay, CRP)
10	Urban Land
11	Open Water
12	Riparian Forest and Woodlands
13	Wetlands
14	Other Agricultural Lands (Farmsteads, Feedlots,etc.)
15	Irrigated Sunflower
16	Summer Fallow
17	Roads
18	Dryland Corn
19	Dryland Soybeans
20	Dryland Sorghum
21	Dryland Dry Edible Beans
22	Dryland Alfalfa
23	Dryland Small Grains
24	Dryland Sunflower
25	Blowouts

Land cover classes may be modified or expanded subject to mutual agreement between CALMIT and NENDR personnel. Land cover mapping will be done using a variety of image processing techniques including image classification, image differencing, and GIS modeling. The techniques will be similar to the methods used in the 1997 and 2001 COHYST land cover mapping projects (Dappen, P. & M. Tooze, 2001, Dappen, P. & J. Merchant 2003). Ancillary data layers such as the USDA Farm Service Agency (FSA) reporting records, Digital Ortho-photo Quarter Quadrangles (DOQQ's), National Wetlands Inventory (NWI), and SSURGO and STATSGO soils data will be used as needed to assist in the mapping process. The majority of field data will come from FSA reporting records or crop field location information provided by Natural Resource Districts. These records will be gathered by NEDNR personnel and provided to CALMIT. Additional fieldwork may be necessary to provide accurate crop and irrigation

information across the study area. NEDNR cooperators and personnel will be responsible for gathering most of the field data.

Classification accuracy will be determined by comparisons with existing crop information for 2005 gathered by NEDNR personnel or cooperators. The target will be 80% accuracy for each class mapped. This may not always be possible, however. We will be able to delineate some classes above the 80% target accuracy yet some land cover types will be so spectrally and temporally similar that we may not be able to reach 80%. Accuracy will be reported for each land cover class. For classes with lower accuracy, information on the nature of the inaccuracy will be provided so that the data managers can determine how it may affect the hydrologic model outputs.

DELIVERABLES

1. A land use/land cover map of the study area for the 2005 growing season. This will be provided to NEDNR data managers in ERDAS Imagine and ArcInfo GRID format in a NAD 83 State Plane Coordinate projection. Maps will also be provided in the form of E size color plots, with format and content consistent with NEDNR needs and standards.
2. An inventory of center pivot locations for the entire state based on 2005 Landsat imagery.
3. A surface irrigation coverage for the entire state. NEDNR cooperators and personnel will be responsible for providing crop information and irrigation rights maps to develop irrigation layer datasets.
4. Summary statistics on total acres within each land use/land cover category, both for the study area.
5. A report of the methods used in the development of the land use/land cover map and statistics. This will include documentation on the map accuracy and assessment procedures.
6. Metadata for any data layers delivered will be provided in a format consistent with NEDNR needs and standards.
7. An internet mapping site will be developed for the 2005 land use classification to allow users beyond NEDNR to view the data. All datasets and metadata will be available for download from the web site.

PERIOD OF PERFORMANCE

Because of the large spatial area and the level of detail involved in this mapping project, the mapping process will require 24 months from signature of final proposal, or delivery of Landsat data (whichever occurs last). The proposed schedule could also be affected by delays in field data delivery, satellite imagery availability, and may be subject to change.

COPY

Amendment #1
To

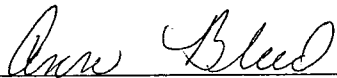
Task Order #3 *Delineation of Statewide Land Use Patterns for the State of Nebraska*
Department of Natural Resources

Task Order #3 *Delineation of Statewide Land Use Patterns for the State of Nebraska*
Department of Natural Resources was agreed upon under the *Service Agreement Between*
the Nebraska Department of Natural Resources and the Board of Regents of the
University of Nebraska, Nebraska Water Center and is hereby amended.

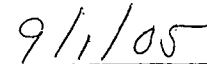
The first sentence under the heading "Period of Record" shall be changed to remove the words "or delivery of Landsat data (whichever occurs last)" and end after the word "proposal".

All other amendments are on the final page (entitled "Budget") of the Task Order. Those amendments are as follows:

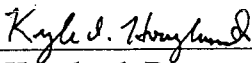
1. On line 3 the words "(3% of FTE for 24 months)" shall be changed to "(3% of FTE for 23 months)".
2. On line 5 the words "(80% FTE in 24 months)" shall be changed to "(83.4% FTE in 23 months)".
3. On line 7 the words "(\$36,750 each for 24 months)" shall be changed to "(\$36,750 each for 23 months)".



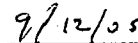
Ann Bleed, Acting Director and Task Force Coordinator
Nebraska Department of Natural Resources



Date



Kyle Hoagland, Director Water Center and Project Manager



Date

TASK	DURATION
Image selection, ordering and receiving / Ancillary data collection	3 months
Initial image processing and classification	6 months
Development of irrigation base layer	6 months
Field checking and planning refinements	2 months
Refinement of classification	3 months
Accuracy assessment and change analysis	2 months
Final reporting and documenting of results	2 months

References Cited

Dappen, Patti and Marcus Tooze. "Delineation of (1997) Land Use Patterns for the Cooperative Hydrology Study in the Central Platte River Basin: Final Report." January, 2001.

http://www.calmit.unl.edu/cohyst/1997/media/documents/cohyst_finalreport_1997.pdf

Dappen, Patti and James Merchant. "Delineation of 2001 Land Use Patterns for the Cooperative Hydrology Study in the Central Platte River Basin: Final Report."

September, 2003. http://www.calmit.unl.edu/cohyst/2001/data/2001_cohyst_report.pdf

PRINCIPAL INVESTIGATORS

Patti R. Dappen has worked as a Research Specialist with the Center for Advanced Land Management Information Technologies (CALMIT), University of Nebraska-Lincoln since 1999. Ms. Dappen has worked with remote sensing and Geographic Information System (GIS) technologies for the past 7 years. Her past current research includes (1) developing agricultural and land cover maps of the Central Platte River basin (COHYST) using satellite imagery, and (2) GIS database development for the Rainwater Basin Joint Venture.

James W. Merchant is Professor in the School of Natural Resource Sciences and the Conservation and Survey Division (CSD), Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln (UNL), Lincoln, Nebraska. He is Associate Director of UNL's Center for Advanced Land Management Information Technologies (CALMIT). Dr. Merchant holds a Ph.D. in Geography from the University of Kansas. He has been engaged in basic and applied research in remote sensing and GIS since 1971. His research, funded by NASA, NSF, USDA, EPA, USGS, and various state agencies, is currently focused upon (1) development of strategies for large-area land cover characterization using digital multispectral satellite data, (2) spatial and contextual analysis of digital images, and (3) the design of spatial models that can be employed in geographic information systems to aid in management of natural resources. Dr. Merchant was the recipient of the 1999 Outstanding Contributions Award presented by the Nebraska GIS/LIS Association and the 1998 Outstanding Contributions Award, Association of American Geographers Remote Sensing Specialty Group. In 1997 he was honored with the John

Wesley Powell Award for significant contributions to the research mission of the U.S. Geological Survey, and in 1990 he was recipient of the Alan Gordon Memorial Award presented by the American Society for Photogrammetry and Remote Sensing (ASPRS) to recognize career achievements in remote sensing and GIS.

FACILITIES AND EQUIPMENT

The Center for Advanced Land Management Information Technologies (CALMIT) was established in 1986 by the Board of Regents of the University of Nebraska to enhance and expand research and instructional activities in remote sensing, GIS, automated cartography and image processing. CALMIT maintains a broad selection of hardware including 15 UNIX workstations and 45 Windows XP workstations, all equipped with software for image analysis (e.g., ERDAS Imagine, ENVI) and GIS (e.g., ArcInfo, ArcView, ArcGIS) processing, and nearly a terabyte of disk storage. These are complemented by large-format color plotting and scanning capabilities, several CD-R and DVD mastering devices, and other peripherals.

Budget

Staff

Principal Investigator - Merchant (3% FTE for 24 months)	6,300
Project Manager – (Dappen or Other) (80% FTE for 24 months)	87,150
2 Full Time Staff Members (\$36,750 each for 24 months)	73,500
1 Hourly Employee (\$800 per month for 12 months)	9,600
Fringe benefits for PI – Merchant (26%)	1,638
Fringe benefits for PI – Dappen (26%)	22,659
Fringe benefits for 2 Staff Members (26%)	19,110
TOTAL SALARIES	219,957

Satellite Imagery

(30 Landsat images @ \$500 each) 15,000

Laboratory Operating Expense 19,000

Travel 2,000

Supplies and Materials

(CD-ROMs, media etc.) 1,000

TOTAL DIRECT COSTS 256,957

FACILITIES AND ADMINISTRATIVE (F&A) COSTS

(10%) 25,695

TOTAL COSTS **282,652**