

Irrigated Acreage Assessment

Recommendation

June 2, 2010

Introduction

The North Platte Natural Resources District (NPNRD) is currently undergoing efforts to develop a surface water model in support of water resources planning and ground water modeling. One of the critical pieces of information used by the model is irrigated acreage data within the model study area. Irrigated acreage information necessary for the model includes the amount of irrigated acreage served by surface/ground water sources, crop type, and irrigation application type (flood/sprinkler) over the study period. In order to link irrigated acreage to their sources of water supply, mapping of ditch system service areas and well locations is needed. This resulting time series of information reflects the dynamic irrigation practices in the study area and will be used in the surface water, ground water and consumptive use (CropSim) modeling efforts.

In order to develop this time series of irrigated acreage information, the following tasks were identified in the Irrigated Acreage Scope Amendment, included as **Appendix A**:

- Compile Available Irrigated Acreage Information
- Recommendation of Current Sources
- Develop New Irrigated Acreage Information
- Spatial Irrigated Acreage Parcel Assignment
- Integrated Data for Surface Water Model

This report summarizes the results of the compilation of available irrigated acreage information recommendations of which sources to use in the modeling effort, and a recommended approach on how to develop new irrigated acreage information.

Note that the efforts discussed herein focus primarily on the irrigated acreage in the model study area. Subsequent phases of the assessment efforts will focus on the irrigated acreage in the South Platte NRD area and dryland crop acreage throughout the entire North Platte and South Platte NRD areas. A scope of services for the subsequent phases will need to be developed.

Study Area

The irrigated acreage assessment study area directly corresponds to the surface water model study area which encompasses the North Platte River valley between the Whalen diversion dam in Wyoming and Lewellan, Nebraska. The Nebraska portion of the study area is located within the North Platte NRD boundary. As requested by the North Platte NRD, irrigated acreage information and aerial imagery was also collected for the entire North Platte and South Platte NRD areas if available from the source. The

study areas referenced herein indicate either the North Platte River valley irrigated acreage area (surface water model area), the North Platte NRD area (NPNRD), or the South Platte NRD area (SPNRD).

Study Period

The study period for the surface water model begins in 1961; however publically available irrigated acreage information will be collected back to 1950 in support of the ground water model study period. Therefore all irrigated acreage information will be compiled over the 1950 to 2009 study period.

Compilation of Available Information

The first task in the Irrigated Acreage Assessment was to investigate, understand and compile publically available sources of irrigated acreage information based on the attributes needed for modeling efforts. Information was available in spatial and tabular formats, as well as reported or anecdotal in nature. The following summarizes the eight sources LRE identified as having useful irrigated acreage information:

1. USBR Information
2. NPNRRFM Model
3. USGS Land Use Information
4. National Agricultural Statistics Service (NASS)
5. Wyoming Framework Water Plan
6. COHYST/CALMIT
7. NPNRD Certified Acres
8. Recent Aerial Imagery

These sources were assessed based on the following attributes:

- **Years Available:** Time period over which the data is available.
- **Area Extent:** Extent of the source data, can include the surface water model study area, Wyoming portion, North Platte and/or South Platte NRD areas.
- **Parcel Boundaries:** Indicates whether the source data contains spatial polygons representing irrigated acreage parcel boundaries.
- **Water Source:** Indicates whether the source data contains an attribution of surface and/or ground water.
- **Structure Assignment:** Indicates whether the source data has been assigned to a specific surface or ground water structure.
- **Crop Types:** Indicates whether the source data contains an attribution of crop type.
- **Irrigation Method:** Indicates whether the source data contains an attribution of irrigation method; center pivot (sprinkler) or flood (other) irrigation.

Each source was evaluated based on the same general criteria and/or attributes and are summarized in detail in **Appendix B**. Note that some sources deemed unusable for the assessment are included in **Appendix B** however are not included in the main text.

1) USBR Information

The largest of the irrigation districts along the North Platte River are those that are under contract with the USBR and that receive irrigation water via the system of federal reservoirs located on the North Platte River ¹. For these irrigation districts, the USBR maintains annual records on the crops grown and the water diverted, both from natural flow and from the federal reservoirs. USBR information was compiled in two formats: USBR Crop Reports and spreadsheet summary as provided by the Nebraska DNR. Although the format of the USBR Crop Reports has changed over the years, in general the Crop Reports for each irrigation district include the annual acreage summary, crop value summary, farm/population count, and a crop type summary. The spreadsheet information provided by the DNR summarizes the total irrigated acreage by irrigation district.

Table 1: USBR Information Summary Table

	USBR Crop Reports	DNR Spreadsheet Summary
Years Available	1977, 1980, 1985, 1990, and 1995*	1946 through 2005
Area Extent	Model Study Area	NP and SP NRD Areas
Parcel Boundaries	No	No
Water Source	No	No
Structure Assignment	Yes	Yes
Crop Types	Yes	No
Irrigation Method	No	No

* Note that Crop Reports are reported by the USBR every year, however only these years were publically available as collected in support of the NPRRFM (see below).

Assessment Comments:

- Although limited in years available, the USBR Crop Reports contain valuable crop type information that allowed LRE to determine which crop acreage information *should* be included in the total irrigated acreage per district and verify that the spreadsheet summary information accurately reflects the total irrigated acreage.
- The DNR spreadsheet accurately summarizes the total irrigated acreage by district as reported by USBR Crop Reports and is the only publically available source that provides annual total acreage information over much of the study period.

¹Source: Wyoming State Water Plan, Platte River Basin Water Atlas

2) NPRRFM Model

The North Platte River Return Flow Model (NPRRFM), developed by BBA, is a surface water model that simulates the diversion of natural flow and storage releases to meet irrigation demands. The USBR Crop Reports served as the basis for the irrigated acreage information in the model for USBR project structures. Decisions were made during model development regarding which pieces of information (e.g. crop types, harvested crops) from the Crop Reports were included in the total irrigated acreage for each modeled system. Comparing the total modeled irrigated acreage to the Crop Reports allowed LRE to determine which pieces of information were used in the model and to determine the accuracy of the acreage in the model.

Modeled acreage information for irrigation districts not served or recorded by USBR was based on interviews with Nebraska and Wyoming Departments of Water Resources and information from *Post-Decree Changes in Water Supply and Irrigation Development in the North Platte River Valley* (Martin, 2000).

Table 2: NPRRFM Crop Acreage Information Summary Table

	NPRRFM Crop Information
Years Available	1977, 1980, 1985, 1990, and 1995
Area Extent	Model Study Area
Parcel Boundaries	No
Water Source	Yes
Structure Assignment	Yes
Crop Types	Yes
Irrigation Method	Yes

Assessment Comments:

- Based on review of the Crop Reports, the modeled acreage does not include acreage that was reported as *Harvest cropland and pasture value* in USBR Crop report for the modeled system total. This acreage represents irrigated land that is grown for grazing and generally not harvested, and the absence of this crop in the total modeled irrigated acreage results in an underestimate of the total land to which irrigation water is applied.
- Model acreage information is the only publically available source that provides total acreage for non-USBR project districts in the Wyoming portion of the study area.

3) USGS Land Use Information

The 1992 and 2001 National Land Cover Database (NLCD) coverages were developed by the USGS EROS Data Center based on Landsat-5 and Landsat-7 satellite data, respectively. The NLCD imagery represents a 21-class land cover unsupervised classification scheme at a 30-meter pixel spatial resolution. Although both datasets used a 21-class classification, irrigated and dryland acreage were classified differently between the two datasets.

Table 3: USGS Landuse Information Summary Table

	USGS 1992 Coverage	USGS 2001 Coverage
Years Available	1992	2001
Area Extent	Statewide, WY and NE	Statewide, WY and NE
Parcel Boundaries	No*	No*
Water Source	No	No
Structure Assignment	No	No
Crop Types	Yes	Yes
Irrigation Method	No	No

* Polygon coverage was not provided but can be produced based on classification of the imagery

Assessment Comments:

- Based on visual inspection and comparison to known land use information, the 2001 Land Use coverage does not appear to accurately reflect dryland vs. irrigated acreage in the study area. Utilizing this source would greatly overestimate the amount of *irrigated* acreage.
- The 1992 USGS Land Use coverage does appear to more accurately reflect the irrigated vs. dryland acreage in the study area and could provide spatial information of crop types for the Wyoming portion of the study area.

4) National and County Agricultural Statistics (NASS)

National Agricultural Statistics Service (NASS), an agency of the USDA, is responsible for the Census of Agriculture which, taken every five years, is a count of U.S. farms and ranches and the people who operate them. The Census looks at land use and ownership, operator characteristics, production practices, income and expenditures and many other areas. The information is provided on County level and is available on the NASS website (www.nass.usda.gov). NASS information for Nebraska has been compiled by the DNR in two different spreadsheet formats; the Census of Agriculture spreadsheet reflecting raw NASS information every five years and the Master Stats reflecting interpolated NASS information incorporated with 1997 COHYST non-cropped classification results.

Table 4: NASS Information Summary Table

	Census of Ag Spreadsheet	Master Stats Spreadsheet
Years Available	1945 through 1997, every five years	1950 through 1997, Annually
Area Extent	Statewide, NE	Statewide, NE
Parcel Boundaries	No	No
Water Source	No	No
Structure Assignment	No	No
Crop Types	Yes	Yes
Irrigation Method	No	No

Assessment Comments:

- Provides tabular crop type information for an extended period back time, could provide an overall 'big-picture' check on total irrigated acreage in the basin.
- Information on a county-wide basis would need to be evaluated on a district level to compare to spatial information.

5) Wyoming Framework Water Plan

The Wyoming Framework Water Plan was developed by the WWDC to provide an inventory of the State’s current water resources and demands, as well as provide future water resource planning direction. As shown in **Figure 1** the Guernsey to State Line subbasin encompasses a majority of the NNPR study area in Wyoming. Technical memorandums in the Platte River Basin Plan discuss the development of the irrigated acreage shapefile and associated attributing. Some general comments regarding the acreage development and attribution include:

- Originally developed by States West Water Resources Corp. for the WY SEO in support of the Nebraska vs. Wyoming litigation. Assessment was based on 1992 through 1994 imagery.
- Surface water rights permitted to divert water at a rate of 10 cfs or greater and agricultural wells having permitted capacities equal to or greater than 50 gpm were assigned to irrigated lands based on PLSS description.
- Shapefile coverage relies on a *Permit Linking* table for attribution of the polygons. The associated permit indicates the type of supply (surface/ground) and specific structure (ditch/well).

Figure 1: WY Framework Irrigated Acreage

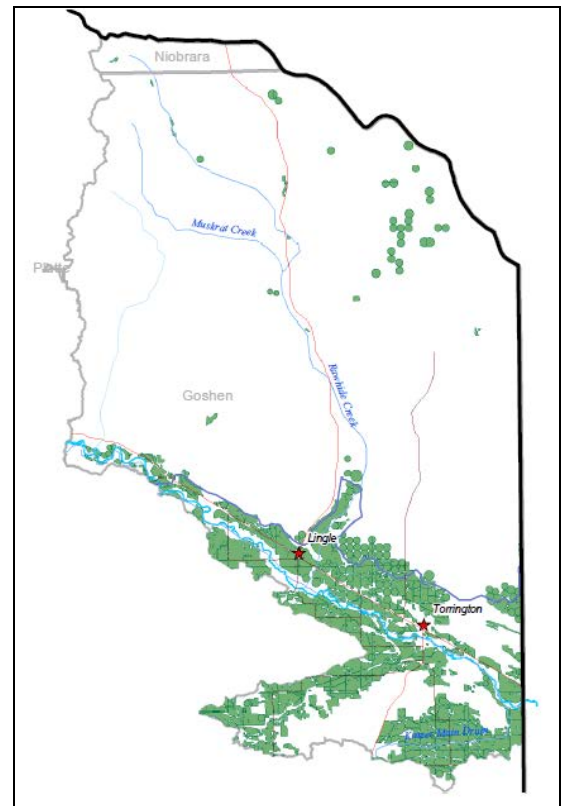


Table 5: WY Framework Information Summary

	WY Framework Plan
Years Available	1994
Area Extent	Wyoming Model Study Area
Parcel Boundaries	Yes
Water Source	Yes
Structure Assignment	Yes
Crop Types	No
Irrigation Method	No

Assessment Comments:

- This coverage was developed in support of the litigation; therefore the parcel boundaries were likely delineated to reflect actual irrigated acreage.
- This is the only publically available source of spatial irrigated acreage information in Wyoming, and provides several of the attributes necessary for the modeling efforts.

6) COHYST/CALMIT

The Center for Advanced Land Management Information Technologies (CALMIT), located at UNL, developed historical land cover databases for the COHYST region based on Landsat satellite imagery and ancillary data ². Land cover and irrigated acreage information were developed by CALMIT for 2005, 2001, 1997, and 1982. Three spatial coverages and a report were provided for each year:

- Land Use Classification (ESRI Grid format)
- Delineation of lands served by center pivots (Polygon Shapefile format)
- Delineation of lands served by ‘other’ non-pivot irrigation methods (Polygon Shapefile format)
- Procedural documentation of method and information used to develop the spatial information

²Source: COHYST Land Use Mapping, www.calmit.unl.edu/cohyst/

Table 6: COHYST Spatial Information Summary Table

	Land Use	Center Pivot Shapefile	‘Other’ Shapefile
Years Available	1982, 1997, 2001, and 2005	1982, 1997, 2001, and 2005	1982, 1997, 2001, and 2005
Area Extent	COHYST Area	COHYST Area	COHYST Area
Parcel Boundaries	No	Yes	Yes
Water Source	No	No	No
Structure Assignment	No	No	No
Crop Types	Yes	No	No
Irrigation Method	No	Yes	Yes

Assessment Comments:

- The spatial resolution of the Landsat imagery used for the 1997 and later coverages is 30 meters, equivalent to 0.20 acres per/pixel. The spatial resolution of the Landsat imagery used for the 1982 coverage is 80 meters, equivalent to 0.80 acres per/pixel. Note that field boundaries and other features are not as distinguishable and the accuracy of the land use classification is significantly decreased in the 1982 coverage as shown in **Figure 2**.

Figure 2: Example Landsat Imagery from 2005 and 1982, respectively



- Delineation of the center pivot and 'other' lands coverages was based primarily on the Landsat imagery and supplemented by DOQQ aerial imagery from 1993, 1999 and 2005 and anecdotal information (e.g. FSA mapping, NRD interviews). As a result, the field boundaries for each year do not necessarily correspond to the boundaries on the available imagery.
- The accuracy of crop classification was discussed in the documentation, which notes areas where certain crops may have been over or under estimated. As noted in the documentation, the crop classification is only as good as the accuracy of the samples used in the supervised classification.
- The total irrigated acreage reported by COHYST is based on the land use grid, not actual field boundaries from the center pivot or 'other' shapefiles.

7) NPNRD Certified Acres

The North Platte NRD provided a spatial coverage of irrigated parcels that are assigned to certified wells, which represents lands that are served in total or in part by ground water. The underlying irrigated parcels in the coverage were based on the 2005 USDA Common Land Unit or recent aerial photography. In addition, a spatial coverage of certified well meters provides the location of wells within the NPNRD area.

Table 7: Certified Acres Information Summary Table

	Certified Acres
Years Available	2005*
Area Extent	NPNRD
Parcel Boundaries	Yes
Water Source	Yes
Structure Assignment	Yes, Wells Only
Crop Types	No
Irrigation Method	No

* Spatial information based on 2005 imagery, however well information in the coverage extends back to the early 1900's

Assessment Comments:

- This coverage provides the most accurate attribution of surface water and/or ground water supplies to irrigated parcels and is the only publically available source that explicitly assigns well structures to parcels.
- This coverage also provides the most accurate delineation of parcel boundaries based on the 2005 aerial imagery, although parcel boundaries are only available for certified lands.
- The certification and/or irrigation date will assist in removing irrigated lands back in time served only by wells.
- The Certified Acreage coverage does not appear to currently have an explicit link to the DNR well database; however a relational table can be used to link the coverage to the well database.

8) Recent Aerial Imagery

Aerial imagery assists in this irrigated acreage assessment effort by providing a ‘visual’ of lands that are under crop production at the time the imagery was generated. Aerial imagery, for more recent years, is publically available in an electronic format and geo-referenced from many sources, generally free of charge. Aerial imagery over the entire study area was compiled, as shown in **Table 8**. The imagery acquired for the Nebraska portion of the study matches the imagery used in the COHYST efforts. The aerial imagery is available in several formats including digital orthophoto quarter quadrangles (DOQQ), aerial imagery from the National Agricultural Inventory Program (NAIP), and color infra-red DOQQ (IR DOQQ). Note that the aerial imagery in **Table 8** are in addition to the aerial imagery already housed at the NRD, which include imagery from 2003, 2004, 2006, 2007 and 2009.

Table 8: Recent Aerial Imagery

Year	Format	Area of Coverage
1993	DOQQ	NPNRD and SPNRD areas
1994	B&W DOQQ	Goshen and Platte Counties, Wyoming
1999	Terraserver Imagery*	Statewide, Nebraska and Wyoming
1999	DOQQ	NPNRD and SPNRD areas
2000	IR DOQQ	Goshen and Platte Counties, Wyoming
2003	NAIP	NPNRD and SPNRD areas
2004	NAIP	Goshen and Platte Counties, Wyoming
2005	NAIP	NPNRD and SPNRD areas
2005	DOQQ	NPNRD and SPNRD areas

* Terraserver imagery is accessed through a GIS link to the Terraserver website. Terraserver imagery can be viewed through GIS with this link, no imagery was purchased or stored externally from Terraserver.

Assessment Comments:

- Aerial imagery over time provides a visual as to the changing irrigation in the NRD areas.
- Aerial imagery for years corresponding to COHYST coverages will assist in irrigated parcel boundary refinement.

Summary and Recommendation of Current Sources

Compilation and inventory of the current sources allowed LRE to determine what information is available, the useful attributes of each source, and how different sources may be used together to develop fully attributed irrigated acreage information. The matrix shown in **Table 9** was generated based on the results of the inventory of publically available irrigated acreage information. The matrix is intended to provide a visual overview of the sources and their available attributes; an 'x' in the table denotes the presence of a specific attribute in the source data. Note the recent aerial imagery was not included in the matrix due to lack of attributes. Recommended use of recent aerial imagery is discussed below.

Table 9: Attribution of Irrigated Acreage Assessment Data Sources

	Years Available	Area Extent	Parcel Boundaries	Water Source	Structure Assignment	Crop Types	Irrigation Method
USBR Crop Reports	1977, 1980, 1985, 1990, and 1995	Model Study Area			x	x	
DNR Spreadsheet Summary	1946 through 2005	NP and SP NRD Areas			x		
NPRRFM Crop Information	1977, 1980, 1985, 1990, and 1995	Model Study Area		x	x	x	x
USGS 1992 Coverage	1992	Statewide, WY and NE				x	
USGS 2001 Coverage	2001	Statewide, WY and NE				x	
Census of Ag Spreadsheet	1945 through 1997, every five years	Statewide, NE				x	
Master Stats Spreadsheet	1950 through 1997	Statewide, NE				x	
WY Framework Plan	1994	Wyoming Model Study Area	x	x	x		
COHYST Land Use	1982, 1997, 2001, and 2005	NPNRD, SPNRD and CPNRD				x	
COHYST Center Pivot Shapefile	1982, 1997, 2001, and 2005	NPNRD, SPNRD and CPNRD	x				x
COHYST 'Other' Shapefile	1982, 1997, 2001, and 2005	NPNRD, SPNRD and CPNRD	x				x
NPNRD Certified Acres	2005	NPNRD	x	x	x		

Recommendation for Wyoming Spatial Information

The irrigated acreage coverage developed in support of the Wyoming Framework Platte River Basin Plan, based on 1994 aerial imagery, provides the most complete spatial coverage of the Wyoming

portion of the study area. The existing Wyoming shapefile has water source attribution via the linked table but does not include crop type and irrigation method attributes. The parcel boundaries in the shapefile appear to accurately represent the irrigated acreage based on a cursory comparison to the 1994 DOQQ aerial imagery. The coverage underwent more extensive review during the Nebraska vs. Wyoming litigation.

Our recommendation is to use the existing Wyoming spatial delineation of the irrigated parcels and explicitly attribute each parcel with the water source information available from the linking table. Attribution of irrigation method will be based on visual inspection of lands served by center pivots. As no crop types are attributed to the spatial coverage, we recommend externally processing the crop type mix by irrigation district based on information from the USBR using a relational table. The resulting shapefile will provide a 1994 spatial ‘snapshot’ of irrigated acreage with irrigation method and surface and ground water sources attribution, as summarized in **Table 10**.

Table 10: Wyoming Spatial Information Recommendation

	Attribute	Recommended Source
1994	Parcel Boundaries	1994 WY Framework Plan
	Water Source	1994 WY Framework Plan
	Structure Assignment	1994 WY Framework Plan
	Crop Types	LRE Assignment based on USBR Information (<i>not included in spatial coverage</i>)
	Irrigation Method	LRE Assignment based on center pivots
	Aerial Imagery	1994 DOQQ

We do not recommend developing a new Wyoming spatial irrigated acreage coverage at this time, because it is anticipated that any future surface water modeling scenarios will not involve changes to Wyoming irrigated acreage. Discussion regarding the recommended process for refining the existing Wyoming coverage is provided below.

The only other irrigated acreage information publically available for the Wyoming portion of the model is information developed in support of the NPRRFM and USBR information. The selection of a tabular source of information to be used back in time will be made subsequent to the Wyoming spatial information refinement and an analysis of the total irrigated acreage under each irrigation district.

Recommendation for Nebraska Spatial Information

The irrigated acreage coverages developed in support of COHYST provide the most complete spatial coverage of the Nebraska portion of the study area. The combination of the COHYST coverages provide a good starting point for irrigated parcel boundaries, as well as crop types and irrigation method. Reliable water source attribution of surface and ground water sources and structures is available from the NPNRD Certified Acres.

Our recommendation for Nebraska spatial information, as summarized in **Table 11**, is to use the existing 2005 COHYST shapefiles in conjunction with the NPNRD Certified Acres shapefiles to establish parcel boundaries of irrigated land in 2005. Overlapping parcels will be removed and parcel boundaries will be refined based on 2005 aerial imagery. We recommend investing significant effort to refine the 2005 parcel boundaries, as they will serve as the starting point for subsequent years. Once the 2005 parcel boundaries have been refined and reviewed, we will overlay them on the historic imagery from 1999 and 1993 to determine if parcels have changed over time. Irrigated parcels will either be removed or added in the 2001 and 1997 coverage based on the aerial imagery.

Table 11: Nebraska Spatial Information Recommendation

	Attribute	Recommended Source
2005	Parcel Boundaries	2005 COHYST Shapefiles
	Water Source	NPNRD Certified Acres
	Structure Assignment	NPNRD Certified Acres, Registered Wells, and Nebraska Service Area Mapping
	Crop Types	2005 COHYST Land Use
	Irrigation Method	2005 COHYST Shapefiles
	Aerial Imagery	2005 DOQQ
2001	Parcel Boundaries	2001 COHYST Shapefiles
	Water Source	NPNRD Certified Acres
	Structure Assignment	NPNRD Certified Acres, Registered Wells, and Nebraska Service Area Mapping
	Crop Types	2001 COHYST Land Use
	Irrigation Method	2001 COHYST Shapefiles
	Aerial Imagery	1999 and 2003 DOQQ
1997	Parcel Boundaries	1997 COHYST Shapefiles
	Water Source	NPNRD Certified Acres
	Structure Assignment	NPNRD Certified Acres, Registered Wells, and Nebraska Service Area Mapping
	Crop Types	1997 COHYST Land Use
	Irrigation Method	1997 COHYST Shapefiles
	Aerial Imagery	1993 and 1999 DOQQ

Designation of surface and/or ground water supplies will be attributed based on the NPNRD Certified Acres and actual structure designations will be based on Certified Acres and registered wells for ground water sources. Structure designation for surface water sources is generally based on ditch service area maps, or the area of land that the ditch could potentially serve. For the purposes of these attribution efforts, and to assist in the review of the surface water designations, LRE has developed ditch service area maps, based on COHYST service areas, for the Nebraska portion of the study area. Pending review of these service area maps, they will be used for the attribution of surface water sources to irrigated

parcels. Crop types will be attributed based on the COHYST Land Use coverage. The irrigation method will be attributed based on the COHYST 'Other' and Center Pivot shapefiles.

Due to the absence of representative imagery, as well as the low resolution of Landsat imagery, we recommend not using or refining the 1982 COHYST imagery at this time. If this time period is deemed necessary to the NRD, we recommend purchasing historical aerial imagery and hand delineating actual parcel boundaries based on the acquired imagery.

The selection of a tabular source of information to be used back in time will be made subsequent to the Nebraska spatial information refinement and an analysis of the total irrigated acreage under each irrigation district.

Refinement and Attribution of Irrigated Acreage Information

Refinement of recommended source information will improve the accuracy of the information and more easily allow the information to be used in modeling efforts. The following recommended approach discusses the steps needed to refine the Wyoming and COHYST information. Due to the importance of the Nebraska portion of the model, compared to the Wyoming portion of the model, more quality control and refinement is recommended for the COHYST information. The resulting deliverable from these recommended refinements will be irrigated acreage coverages with each parcel attributed with crop types, irrigation method, type of water source and specific source structures.

Recommended Approach to Refine Wyoming Information

As discussed above, we recommend using the existing Wyoming Framework Platte River Basin Plan spatial information as the basis and directly attributing the water source (permit) information from the linking table to the coverage. This allows each irrigated parcel to be explicitly attributed and more easily used in the modeling. The following steps outline the recommended process to refining the Wyoming spatial information:

- 1) **Limit to Study Area**

The irrigated acreage information was developed Statewide; therefore the information will be limited to the Wyoming portion of the study area. This includes the area from Whalen Dam to the Stateline along the North Platte River, generally bounded on the north by Interstate Canal and on the south by Fort Laramie Canal.

- 2) **Link Permit Information to Spatial Coverage**

Irrigated acreage information was developed based on spatial coverage and a linked table listing surface and ground water permits assigned to each polygon. Using a unique polygon identifier (Poly_ID), the two pieces of information can be linked to determine the permit assignment for each spatial polygon.

- 3) **Surface Water Source Attribution**

Surface water permit information from the linking table provides the spatial coverage with attribution of specific surface water structures. When the coverage was developed, permits

were assigned based on PLSS areas; any surface water permitted to divert at a rate of 10 cfs or greater was assigned to any polygon that is located within the PLSS area on the permit. This included original permits, permits for enlargements and permits for secondary supply from reservoirs. We recommend utilizing the surface water permit assignment to identify a single primary surface water source/facility name to each polygon, limiting the structure facility name list to those included in the surface water model. Note that the unique attribute (Poly_ID) used to relate the linking table to the spatial coverage will be maintained in this process so that the original information in the linking table can still be accessed.

4) Develop Service Areas

Once primary surface water structures are assigned, we recommend developing a service area map for each irrigation district in the Wyoming portion of the model. This assists in the review of the surface water assignment; specifically, a review of polygons that overlay two different surface water service areas is needed. These polygons will be split at the surface area boundary and reassigned to the correct surface water structure.

5) Ground Water Source Attribution

Ground water permit information from the linking table provides the spatial coverage with attribution of specific well structures. The permit assignment process of ground water structures was performed in a similar fashion as the surface water structure assignment, resulting in more than one well assigned to each polygon. As more than one well can feasibly serve one irrigated parcel, these multiple well assignments will be maintained in the refined coverage. For those polygons that were split based on surface water source, the ground water sources will be reassigned based on proximity to the split parcels.

6) Irrigation Method Attribution

Irrigation method will be assigned based on the identification of circular polygons served by sprinkler center pivots; all remaining parcels will be assigned to flood irrigation method.

7) QA/QC Based on Aerial Imagery

Wyoming aerial imagery from 1994, the same year reflected by the Wyoming spatial coverage, was acquired during the compilation efforts. We recommend a cursory review of the refined irrigated acreage to determine the overall accuracy of the spatial information.

8) Externally Process Crop Type Attribution

Reliable spatial crop type information was not collected for the Wyoming portion of the study area. Although the 1992 USGS Land Use does provide a visual of selected crop types, we recommend using the USBR and NPPRFM information from 1995 for crop type information. The USBR and NPPRFM provides a more accurate assessment of the crop types and more specific crops grown in the Wyoming portion of the study area. Tabular processing of a general crop mix per district using a related table will provide the surface water model with sufficient information to develop crop demands. The crop type will not be attributed in the spatial coverage.

Recommended Approach to Refine Nebraska Information

- 1) Digitize Parcel Boundaries for 2005 Coverage
Polygons representing irrigated parcels are available from COHYST center pivot and 'other' coverages as well as NPNRD Certified Acres coverage. The Certified Acres coverage provides the most accurate delineation of actual parcel boundaries based on aerial imagery; therefore we will use this coverage as the primary data source for developing the 2005 parcel boundaries. The COHYST center pivot will be considered as the secondary data source in terms of accuracy. The 2005 COHYST 'other' coverage will be used as a reference for the manual effort to refine parcel boundaries by hand. Parcel boundaries will be manually reviewed and refined as they will serve as the starting point for subsequent coverages.
- 2) Refine Field Boundaries on 2001 and 1997 Coverages
With the 2005 coverage complete, compare to 2001 and 1997 to determine which fields were not irrigated during those snapshots or add fields that were historically irrigated but not represented in the 2005 coverage. Remove or add parcels manually as needed.
- 3) Crop Type Attribution
Crop information, based on Landsat imagery, was developed as part of CALMIT's Land Use Coverage and is available for each of the COHYST irrigated acreage coverages. For irrigated parcels that show a clear division of crop types, the parcel will be split to explicitly represent each crop. For irrigated parcels with an ambiguous crop mix, area-weighted averages of the Landsat classified imagery will be used to assign up to three crop types to the irrigated parcels (polygons) in the 2005, 2001 and 1997 coverages.
- 4) Irrigation Method Attribution
Irrigation method, represented by center pivot sprinklers or flood application, will be attributed based on the COHYST center pivot and 'other' coverages and visual assessment.
- 5) Surface and Ground Water Attribution
Designation of surface and/or ground water supplies will be attributed based on the NPNRD Certified Acres.
- 6) Structure Assignment
Structure designation of ground water sources will be based on the NPNRD Certified Acres. At a minimum, the certification number, presence of surface water and first irrigation date attributes from the Certified Acres coverage will be included to maintain a link to the NPNRD well database, as well as to assist in determining when lands first came into production. Surface water structures will be spatially attributed based on the service area mapping.

Implementing the attribution steps discussed above will result in the following recommended attribute fields, as shown in **Table 12**, in the final 2005, 2001 and 1995 coverages:

Table 12: Recommended Nebraska Spatial Information Attributes

Attribute	Description
Parcel_ID	Unique identifier for each spatial polygon
Cal_Year	Year of Assessment
Acres	Area of parcel in acres
IRR_Type	Irrigation method, sprinkler or flood
SW	Served by surface water, Y/N
GW	Served by ground water, Y/N
Certified	Represents a certified area by NPNRD, Y/N
Cert_Num	Certification number based on NPNRD Certified Acres
First_Irrigated	Year first served/irrigated based on NPNRD Certified Acres
Crop1-3	Crop type of parcel, up to three crops per parcel
Crop1-3_COV	Percent of parcel with 'Crop1-3' grown
SW_Facility	Name of surface water structure serving parcel
GWID1-4	'G' Number of well serving parcel, up to four wells per parcel
URF_RowCol	Assignment to URF Zone

Future Efforts

The efforts discussed herein will result in spatial coverages for both the Wyoming and Nebraska portions of the surface water model. Based on the original irrigated acreage assessment scope, the next step in developing the irrigated acreage information is to overlay the spatial coverages with the URF areas to spatially determine the irrigated acreage information per URF area. Years between the spatial snapshots will be filled in using tabular data or filling techniques. Irrigation demands (i.e. crop irrigation requirement) per URF zone over time can then be estimated based on CropSim analyses. The irrigation demands will then be input directly in the surface water model.

Dryland Acreage and SPNRD Area

Available aerial imagery and other irrigated acreage information were compiled for the entire North and South Platte NRD areas in support of future irrigated and dryland acreage assessment efforts. Identification of irrigated acreage in the South Platte NRD and dryland acreage in the North and South Platte NRD areas has been discussed but not yet scoped. Many aspects of the recommended approach discussed above are applicable for performing the irrigated and dryland acreage assessment.

Historical Aerial Imagery

Several sources of historical aerial imagery were investigated in support of developing new spatial irrigated acreage information in the Nebraska portion of the study area. It is anticipated that new historical spatial information will be developed by digitizing irrigated acreage based on aerial imagery. At the request of the NPNRD, newly developed spatial information will focus on the period during which the development of ground water acreage increased, as well as the period during which surface water acreage increased due to higher commodity prices. Although initial efforts in the scope amendment are focusing on the NPNRD area, any aerial imagery collected would also need to be available and collected for the SPNRD area. This information provided the parameters for the aerial imagery investigation.

The aerial investigation began by contacting two mapping service entities, MapMart and the Digital Data Services (DDS), and requesting availability information on aerial imagery in the NPNRD and SPNRD areas prior to the mid-1970's. After establishing the years available, quotes were requested on the cost and time frame of delivery of aerial imagery. **Table 13** summarizes the results of the inquiries to these two companies.

Table 13: MapMart and DDS Aerial Imagery Inquiry Results - NPNRD and SPNRD Areas

Available Year	MapMart		DDS Inc.		
	1950's Mosaic	1970's Mosaic	1961	1967	1977
Image Quality	B & W, Geo-referenced 1:20,000	B & W, Geo-referenced 1:40,000	USDA Images, B&W, Geo-referenced 1:20,000	USDA Images, B&W, Geo-referenced 1:20,000	USDA Images, B&W, Geo-referenced 1:40,000
Area	NP & SP NRD Areas	NP & SP NRD Areas	NP & SP NRD Areas	NP & SP NRD Areas	NP & SP NRD Areas
Est. Cost	\$ 489,000	\$ 53,000	\$ 370,400	\$ 353,000	\$ 99,400
Delivery Time	3 months	3 months	8 - 10 weeks	8 - 10 weeks	8 - 10 weeks

It is our opinion that the cost and/or time frame of delivery estimates of the MapMart and DDS products are prohibitive to the project's progress. Therefore, the investigation continued into other imagery sources. The mapping service entities indicated that the source aerial imagery is available from the USDA, generally through the Farm Service Agency (FSA) and from USGS. Inquiries were sent to USDA and USGS to determine availability of the aerial imagery of the study area, as well as the cost and time frame of delivery. **Table 14** summarizes the results of these inquiries. Note that USDA imagery is not available geo-referenced, therefore an estimate of geo-referencing the images at LRE was included. The estimated geo-referencing cost is based on the number of images purchased.

Table 14: USDA and USGS Aerial Imagery Inquiry Results - NPNRD and SPNRD Areas

Available Year	USGS	USDA		
	1953	1961	1967	1977
Image Quality	B & W, 1:56,000	B & W, 1:20,000	B & W, 1:20,000	B & W, 1:40,000
Number of Images	600	1852	1765	497
Area	NP & SP NRD Areas	NP & SP NRD Areas	NP & SP NRD Areas	NP & SP NRD Areas
Est. Delivery Time	4 - 6 weeks	6 - 8 weeks	6 - 8 weeks	6 - 8 weeks
Approx. Image Cost	\$ 18,000	\$ 24,000	\$ 23,000	\$ 6,500
LRE Geo-Ref. Cost	\$ 24,000	\$ 65,000	\$ 62,000	\$ 17,400
Total Cost	\$ 42,000	\$ 89,000	\$ 85,000	\$ 23,900

Due to the large extent of both NRD areas, there are several individual aerial images that would need to be purchased and geo-referenced prior to assessing the irrigated acreage from the images. The purchasing and processing of this imagery could be phased, both to reflect the fiscal year of current NPNRD grant and to accommodate the more pressing need of NPNRD area imagery in support of the ongoing surface water model efforts. **Table 15** summarizes the cost estimate for acquiring and

processing only the NPNRD aerial imagery. This area includes Scotts Bluff, Banner, Morrill, and Garden counties plus a portion of Sioux county.

Table 15: USDA and USGS Aerial Imagery Inquiry Results - NPNRD Area

	USGS	USDA		
Available Year	1953	1961	1967	1974
Image Quality	B & W, 1:56,000	B & W, 1:20,000	B & W, 1:20,000	B & W, 1:40,000
Area	NP & SP NRD Areas	NP & SP NRD Areas	NP & SP NRD Areas	NP & SP NRD Areas
Approx. Image Cost	\$ 12,000	\$ 14,600	\$ 13,800	\$ 4,000
LRE Geo-Ref. Cost	\$ 16,000	\$ 39,000	\$ 37,000	\$ 10,700
Total Cost	\$ 28,000	\$ 53,600	\$ 50,800	\$ 14,700

Historical aerial imagery circa 1980, 1984 and 1988 is also available from the USDA for both North Platte and South Platte NRD areas, however quotes were not requested for the imagery at this time.

Appendix A
Irrigated Acreage Assessment Scope Amendment

AMENDMENT TO EXISTING SCOPE OF SERVICES

Introduction

The North Platte NRD (NRD) and Leonard Rice Engineers, Inc. (LRE) entered into an agreement (Attachment A) on January 14, 2010 under which LRE is developing the Nebraska North Platte River (NNPR) StateMod Surface Water model to assist the NRD with its water resources planning needs. The scope of services involves the following tasks:

- Develop Historical Model Data Set
- Calibrate Historical Model
- Develop Baseline Data Set
- Develop Model Documentation
- Develop What-if Scenarios
- Train NRD Staff on NNPR StateMod model

One of the critical pieces of information used by the model is irrigated acreage data within the model study area. The model study area encompasses the Whalen Dam to Lewellan reach of the North Platte River located in the lower Platte River basin in Wyoming and the North Platte NRD boundary in Nebraska. During original scoping efforts, irrigated acreage information was going to be developed by The Flatwater Group in coordination with crop irrigation water requirement efforts. Due to scheduling constraints, LRE will develop this information based on the tasks scoped herein.

Irrigated acreage information necessary for the model includes the amount of irrigated acreage served by surface/ground water sources, crop type, and irrigation application type (flood/sprinkler). In order to link irrigated acreage to their sources of water supply, mapping of ditch system service areas and well locations is needed. This information is read by StateMod as a time series that reflects the dynamic irrigation practices in the study area. The irrigated acreage amount and crop type information will be used in determining the crop irrigation water requirement. The source type and application type information will be used in determining efficiency factors applied to pumped or diverted water.

Background

A main objective of this task is to develop the irrigated acreage for the surface water model; however, understanding land use over time is important to other water resources planning tools in the study area as well. The irrigated acreage assessment results will also support the

consumptive use analysis and ground water model. Although the study period for the surface water model begins in 1961, any available irrigated acreage information will be collected back to 1950 in support of the ground water model. The resulting irrigated acreage information produced from this assessment will then be used in the surface water, ground water and consumptive use (CropSim) modeling efforts.

Information required for this analysis is currently available from many sources in both spatial and tabular formats. Key sources of spatial information in the Nebraska portion of the study area are the coverages developed by the NRD (certified acres) and by CALMIT for COHYST. Each of these coverages identifies different attributes but may be used together to determine an irrigation 'snapshot' or a picture of irrigated acreage and practices for a specific time. The four CALMIT spatial irrigated acreage 'snapshots' provide a good starting point to the irrigated acreage and NRD certified acreage coverages will provide information on sources of data (surface vs. ground water). Tabular data from the USBR, NRCS, and USGS are available back in time for much of the study area. We believe a maximum of four spatial 'snapshots' for the Nebraska portion of the study area will adequately represent the recent irrigation development in the basin, with tabular data to be used back in time.

It is our understanding that land use information for the Wyoming portion of the study area will be provided by Nebraska. The irrigated acreage information acquired by the NRD or Nebraska DNR may have been in support of the North Platte River Compact litigation and will indicate surface/ground water sources on irrigated lands. Our understanding is information submitted to the court is publicly available. Spatial irrigated acreage information for Wyoming was also developed during the Wyoming Statewide Framework Study for the Platte River basin. This publicly available source of information would be used 'as-is' as we cannot perform a quality assessment/control of data without engaging in discussions with the State of Wyoming. LRE can approach Wyoming for additional information if prior approval is provided by the NRD.

Approach

The purpose of this amendment, as outlined in the following tasks, is to:

1. Compile the available irrigated acreage information
2. Recommend currently available sources for inclusion in the model
3. Develop potentially new sources of irrigated acreage information
4. Assign attributes to spatial irrigated parcels
5. Integrate the data for use in the StateMod model

Task 1 – Compile Available Irrigated Acreage Information

With the help of information provided by NRD and Nebraska DNR, LRE will compile the currently available sources of irrigated acreage information. LRE will develop an inventory of the sources and provide a summary of their attributes in reference to their use in the surface water model. Example attributes include:

- Year of analysis
- Study area covered (partial/full, Nebraska/Wyoming)
- Entity responsible for developing the source data
- Format of information (spatial/tabular)
- Availability of source type, irrigation application method, and/or crop type information
- Assignment to a specific ditch or well structure
- General assessment of completeness and quality of data

It is anticipated that as we go through the inventory process, additional important attributes will be identified and included in the compilation efforts. The inventory of available data will allow us to assess the quality of available data and the time period that it covers. The inventory will also help determine if additional development of irrigated acreage coverage is recommended. The inventory of irrigated acreage information will involve the collection of various sources in a single location and result in a matrix of important attributes for the collected sources.

NRD has indicated that there is a need for an irrigated acreage assessment in the southern panhandle region of Nebraska, in the South Platte NRD boundary. As LRE collects and inventories various sources of land use data, we will also collect aerial imagery and irrigated acreage information for the South Platte NRD area. No additional analysis will be provided for these lands or coverages at this time as focus will be placed on actual irrigated land, not dryland acres. Additional scoping and budget estimates will be developed to assess the dryland and irrigated acreage in the South Platte NRD area.

Task 2 – Recommend Use of Current Sources

Based on the compilation of information in the first task, LRE will evaluate the currently available data and provide a recommendation of how each source can be used in the development of the irrigated acreage. The sources will be evaluated and prioritized for use in the modeling efforts based on comparisons to other available source data (e.g. tabular data, reported values), comparison to available aerial imagery, as well as an assessment of anecdotal or reported information regarding the quality of the source data. To determine anecdotal or reported information, LRE may contact knowledgeable entities to discuss the quality of irrigated acreage information.

It is anticipated that the sources will either be used directly in modeling efforts or will be used as a check of the other sources. Two sources may be used together to develop a single ‘snapshot’ of irrigated acreage with all the attributes needed for the model efforts. LRE will

make a recommendation for each source on how it may be used in the model, the general quality of the data and the attributes available for each source.

During this recommendation task, missing information, both in terms of spatially in the study area and back in time, will be documented. Ideally, multiple 'snapshots' of irrigated acreage information that cover the entire study area are needed for the surface water model. The 'snapshot' would represent a single year of irrigated acreage and associated irrigation practices, whereby multiple 'snapshots' would represent the change in historical irrigated acreage and practices over time. Not every year will have an individual 'snapshot' however years between 'snapshots' are filled using linear interpolation to create a complete time series of irrigation information. Due to the importance of the baseline year of 1997, understanding the irrigated acreage and practices in that year as well as the changes to the irrigation regime in the study area since then will be critical. Identification of potential gaps in information and recommendations on how to fill those gaps will also be performed in this task.

Deliverables

LRE will develop a technical memorandum summarizing the sources, identifying areas and/or time periods where information may be missing, and recommend the use of irrigated acreage information. LRE will attend a meeting with NRD and Nebraska DNR to discuss the results of the inventory efforts and recommendation task.

Task 3 – Develop New Irrigated Acreage Information

Depending on the irrigated acreage information available, it may be necessary to develop an additional source or 'snapshot' of irrigated information to capture the changes of irrigated acreage and practices over the study period or for areas currently missing from existing sources. There are many ways to develop this information, ranging from developing estimated information based on engineering judgment applied to other source data to conducting an aerial imagery analysis with water user supplied quality control of the resulting information. New spatial data may focus on the period during which the development of ground water acreage was increasing as well as the period during which surface water acreage increased due to increased commodity prices. The approach that needs to be taken will depend on the type and area of the missing information.

If necessary, new spatial information will be developed by digitizing irrigated acreage from aerial imagery and 'ground-truthed' based on conversations with water users in the basin. Note that the quality of the imagery impacts the quality of the irrigated acreage assessment. Historical imagery may not be in color therefore LRE will rely on source information to determine whether a parcel has an irrigating source or is dryland farming. Only irrigated acreage will be identified in the new spatial coverage at this time. Aerial imagery used to produce new acreage in the current study area will also include the area in the South Platte NRD, although additional scoping and budget efforts will need to take place prior to performing the irrigated acreage and dryland assessment in that area. New tabular information may be

developed based on a variety of sources including water user supplied information or other sources identified in Task 2.

Deliverables

If information is available and if deemed necessary, new spatial information, limited to two 'snapshots', will be developed under this task. New tabular information, generally more historic in nature, may be developed based on an appropriate method for the source. Information management of tabular data will take place in a database. Any new irrigated acreage information, including aerial imagery used to produce the acreage information, developed will be delivered to both the NRD and Nebraska DNR with documentation of the approach and use of the new data. The acreage information will be formatted for use directly in the surface water model as discussed below.

Task 4 – Assign Attributes to Spatial Irrigated Parcels

Spatial irrigated acreage information for each 'snapshot' will be assigned on a parcel level with the following attributes:

- Year of analysis
- Acreage
- Surface water source name (if applicable)
- Ground water source name (Well Permit ID, if applicable)
- Crop Type
- Irrigation Application Method (Sprinkler/Flood)

These individual attributes may be based on one or more initial source, and both spatial techniques and engineering judgment may be used in the parcel assignment process. We anticipate that water source attributes will be assigned based on surface water service areas and well locations. Attention will be given to ground water only and co-mingled lands to appropriately assign wells as they were constructed over time. Likewise, attention will be given to sprinkler-served lands and changes in ditch operation/ownership to appropriately represent these changes to irrigation practices over time. Ideally these attributes will be available for each parcel of irrigated acreage throughout the study area, however, data (i.e., crop type) may not be available for land in both Wyoming and Nebraska. External processing of this type of data may be necessary in order to provide this information to the surface water model.

Deliverables

A maximum of six spatial irrigated acreage coverages, including the potential coverage developed in Task 3, representing annual 'snapshots' with the above-listed attributes. The spatial information will include documentation and metadata summarizing the source, approach, and extent of the coverages and will be delivered to NRD and Nebraska DNR.

Task 5 – Integrate Data for Surface Water Model

Once the source irrigated acreage information has been reviewed and accepted, LRE will integrate and format the various sources of information for use in the surface water model. Spatial and tabular information will be integrated differently. It is anticipated that spatial information will be used to determine irrigated acreage for each unit response function (URF) zone as determined by the ground water model analysis for more recent ‘snapshots’. Tabular data, more likely representing historical irrigation practices, will then be used to determine cropping patterns and irrigated acreage historically, and the amount per URF zone can be estimated based on the spatial analysis. The resulting integrated data will then be used in the surface water, ground water and consumptive use (CropSim) modeling efforts. The following subtasks summarize how the spatial and tabular data will be integrated.

Subtask 5.1 – URF Zone Assignment

URF zones of the study area will be provided spatially by NRD based on the ground water model analysis. These zones represent an area where recharge experiences similar return flow timing and reaches the river at similar locations. Using spatial techniques, the parcels in each ‘snapshot’ will be assigned to a URF zone. The parcels are then grouped by URF zone to determine separate irrigation demands in the surface water model.

Subtask 5.2 – Tabular Data Integration

It is anticipated that annual tabular irrigated acreage will be available on a ditch/district-wide basis, for a more historical time period. In order to use this tabular information with the irrigation demand approach described above, it must be distributed down to the URF zone level. The most historical spatial ‘snapshot’ will be used to determine the pro-rata percentage of the ditch/district-wide acreage by URF zone. This pro-rata percentage will then be applied to the tabular information to develop the URF zone irrigated acreage. Any additional attributes available in the tabular data, including crop type, irrigation application type or source type, will be distributed using the same acreage-based pro-rata percentage.

Subtask 5.3 – Combine and Format

Once both the spatial and tabular ‘snapshots’ have been distributed on a URF zone basis, the data will be combined and formatted for use in the surface water model. This combination will result in a time-series of ‘snapshots’ for each irrigation demand ‘node’. Years in between ‘snapshots’ are filled using linear interpolation to create a complete time series of irrigation information. Annual total irrigated acreage by source (surface/ground water) and by irrigation application method (flood/sprinkler) information is used in the irrigation practices file. Annual total irrigated acreage and

crop type information is used to determine the crop irrigation requirement for the irrigation demand. We anticipate that The Flatwater Group will provide crop irrigation water requirement information by crop for each URF zone, based on information from CropSim.

Deliverables

The following information will be developed and delivered during Task 5 for the 1950 to 2008 time period:

- Time series of crop irrigation water requirement by irrigation demand (URF Zone)
- Total acres by surface water source for each irrigation demand (URF Zone)
- Total acres by ground water source for each irrigation demand (URF Zone)
- Total acres by crop type for each irrigation demand (URF Zone)
- Total acres by irrigation application method for each irrigation demand (URF Zone)

Schedule

LRE can begin the proposed work as soon as authorization to proceed is received; see Scope Cover Letter for authorization. LRE estimates the work discussed above (Tasks 1 through 5) will be completed in 3 months.

Estimated Budget

LRE has estimated the work described above for Tasks 1 through 5 to be accomplished for \$75,000 for the LRE efforts. The budget breakdown by task is shown in **Exhibit 1**. Note that as discussed on the Scope Cover Letter, the terms and conditions from the original scope remain in effect for these tasks. We anticipate reallocating the budget from Tasks 4 and 5 in the original scope to meet the estimated budget for the tasks discussed herein.

Appendix B
Detailed Data Source Summaries

NNPR Irrigated Acreage Assessment

Appendix B

This appendix documents the source data and quality control methodology for evaluating irrigated acreage data within the surface water model study area in the State of Nebraska and the State of Wyoming. Spatial and tabular format information was compiled and summarized herein. The following source data in Nebraska and Wyoming was compiled and evaluated:

1. USBR Information
 - a. USBR Data Summaries, DNR
 - b. USBR Crop Report
2. NPPRFM Model
3. USGS Land Use Information
 - a. 1992 & 2001 USGS Land Use Coverages
 - b. 1992 USGS – 200m
 - c. 2001 USGS Landsat Imagery
4. National Agricultural Statistics Service (NASS)
 - a. Census of Agriculture, NASS
 - b. Master Stats, NASS
 - c. 1997 NASS Information, Spatial Coverage
5. Wyoming Framework Water Plan
 - a. Framework Water Plan
 - b. 1982 Agricultural Land Coverage
6. COHYST/CALMIT
 - a. 1982 Land Use Mapping
 - b. 1997 Land Use Mapping
 - c. 2001 Land Use Mapping
 - d. 2005 Land Use Mapping
7. NPNRD Certified Acres
 - a. 2005 Certified Acres GIS Layer

USBR Data Summaries, provided by the Division of Natural Resources (DNR)

Source: Nebraska Division of Natural Resources

Responsible Entity: USBR

Source Link: O:\NorthPlatteNRD\IrrigatedAcreage\USBR\Tabular\npddiv-del_USBR.xls

Year: 1946-2005

Type: Tabular

Format: Excel Spreadsheet

Area Extent: NNPD study area in State of Nebraska

Background: In general, the largest of the irrigation districts along the North Platte River are those that are under contract with the USBR and that receive irrigation water via the system of federal reservoirs located on the North Platte River. For these irrigation districts, the USBR maintains annual records reporting total irrigated acreage and total diversions of natural flow and storage releases to systems/districts that receive USBR project water (e.g. Glendo Res., Guernsey Res., Pathfinder Res.). This tabulation in spreadsheet form represents this reporting and has been summarized for each system/district in the NPNRD area. The USBR total irrigated acreage summarized in this spreadsheet was compared to the USBR Crop Reports to gain a better understanding of the crop types and irrigated acreage information included in the total acreage value. Note that the spreadsheet data has annual data for each year, whereas the Crop Reports available were generally available in five year increments from 1977 to 1995.

Crop Type Information: Specific crop types are not provided.

Irrigation Method Information: Irrigation methods are not provided.

Water Source Information: Surface and ground water sources are not provided.

Quality Control Method and Comments: This spreadsheet, although in tabular form, appears to provide the most accurate summary of irrigated acreage for structures that receive USBR project water. Based on a comparison to our evaluation of the crop information from actual USBR Crop Report data, the spreadsheet summarizes the correct irrigated acreage per system. The following comments apply to the summary of the total irrigated acreage from the Crop Reports to the spreadsheet value:

- The USBR data provided in the spreadsheet has annual data over a longer period than any other USBR source available during this analysis. The years from 2006 to 2009 have been requested from NDNR to complete the crop information over the entire study period.
- The USBR data provided in the spreadsheet accurately accounts for *Cropland Not Harvested*, a crop that was not accounted for in the Crop Report total acreage summary and *Harvest Cropland and pasture value* that was not reported in the BBA modeling summaries.

USBR Crop Report

Source: Appendix data to the NPRRFM, hard copies of the USBR Crop Reports

Responsible Entity: USBR

Source Link: N/A

Year: 1977, 1980, 1985, 1990, 1995

Type: Document

Format: Hardcopy

Area Extent: Irrigated acreage coverage of NPRRFM study area

Background: The USBR Crop Reports (Crop Production and Water Utilization Data) summarize crop information for irrigation systems/districts that receive USBR project water (e.g. Glendo Res., Guernsey Res., Pathfinder Res.). The Crop Reports for each system/district include the annual acreage summary, crop value summary, farm/population count, and a crop type summary. As an Appendix to the NPRRFM, only five years of reported data were available for comparison (1977, 1980, 1985, 1990, 1995).

Crop Type Information: Crop types are reported as irrigated acreage. No spatial coverage provided.

Irrigation Method Information: Irrigation methods are not provided.

Water Source Information: Surface and ground water sources are not provided.

Quality Control Comments: Review of the crop reports allowed us to analyze the types of crops included in other interpretations and/or summaries of data from the USBR. This was a good supplemental source for crop type and irrigated acreage and was used for comparative purposes.

1997 BBA Report – NPRRFM

Source: Bishop-Brogden Associates, as part of North Platte River Return Flow Model, 1997

Responsible Entity: United State Bureau of Reclamation

Source Link: O:\NorthPlatteNRD\DocSW\Background Previous Reports\IWR_BBAReport_AppD.pdf

Year: 1977, 1980, 1985, 1990, 1995

Type: Document

Format: Hard Copy/Scanned

Area Extent: Irrigated Acreage coverage of NPRRFM study area

Background: This report provides a summary of the development, calibration and operation of the North Platte River Return Flow Model (NPRRFM). The NPRRFM is a RIBSIM surface water model that simulates the diversion of natural flow and storage releases to meet irrigation demands. The objective of the NPRRFM was to examine the return flows associated with the irrigation, both from surface and ground water, and the subsequent reuse of return flow water to meet the demand for water by various crops grown within the valley. BBA obtained the irrigated acreage data from the USBR in support of the irrigation demands in the model.

NPRRFM crop information was based on the USBR Crop Reports, generally in five year increments. These hard copy tabulations were included as an appendix to the model documentation. USBR Crop Report information is tabulated for irrigation systems/districts that receive storage water from USBR projects (e.g. Glendo Res., Guernsey Res., Pathfinder Res.). This includes a majority of the large systems in the model area; however there are a small number of systems where irrigated acreage was not available from the USBR. Decisions were made by BBA during the development of the model regarding which pieces of information (e.g. crop types, harvested crops) were to be included in the total irrigated acreage for each modeled system. Differences between the formats of each five year USBR Crop Report also led to decisions by BBA as to which information should be included. Therefore the BBA model represents one interpretation of the USBR crop information. This interpretation of the irrigated acreage is available in hard copy or scanned summary form for each of the modeled systems.

Modeled acreage information for irrigation districts not served or recorded by USBR was based on interviews with Nebraska and Wyoming Departments of Water Resources and information from *Post-Decree Changes in Water Supply and Irrigation Development in the North Platte River Valley (Martin, 2000)*.

Information regarding modeled water users was compared to data obtained from the USBR:

- Irrigation water district's water rights and storage contracts
- Canals and structures
- Shareholder information
- Irrigated acreage
- Types of crops grown and cropping patterns

- Methods of irrigation
- Ditch and lateral loss and waste
- Farm efficiencies
- Drains and/or tributaries included in operation of the district
- Ground water use

Crop Type Information: Crop type is provided based on a percentage of irrigated crop acreage per cumulative irrigated acreage for each of the 5 reported years. The crops reported for each ditch are the same four crops: corn, hay, beans, and beets.

Irrigation Method Information: Irrigation methods are described per irrigation district within this report. The methods are provided only in tabular form, not in spatial. The methods reported are one of three irrigation types: flood, furrow, and sprinkler.

Water Source Information: The water source is provided for each irrigation district included within the report. The water sources are only provided in tabular form, not in spatial. The source may need further investigation using aerial imagery to determine accuracy. Primary and supplemental ground water information was summarized in the report.

Quality Control Method: Further efforts were made to compare and assess legitimacy of the BBA report. Compared to recent aerial imagery for general accuracy with water sources and compare to more historical tabular data to determine if crop types/irrigation types/irrigated acreage are accurate.

Quality Control Comments: Based on our evaluation of the BBA reported information as compared to the USBR Crop Report information, we believe that the BBA interpretation of the crop information did not accurately reflect the total acreage or the crop type distribution. We identified the following issues:

- Crop type as reported by USBR was generally categorized by BBA in the four broad crop types. For example, *corn sweet*, *corn silage*, and *corn fodder* were combined into *corn* in the BBA report. In addition *other cereals* appear to be included in the *hay* category.
- BBA did not include acreage that was reported as *Harvest cropland and pasture value* in USBR Crop report for the modeled system total. This acreage represents irrigated land that is grown for grazing and generally not harvested.

2001 & 1992 USGS Land Use Coverage

Source: USGS National Map Seamless Server

Responsible Entity: USGS

Source Link: <http://seamless.usgs.gov/>

Year: 2001 & 1992

Type: Spatial

Format: Shapefile

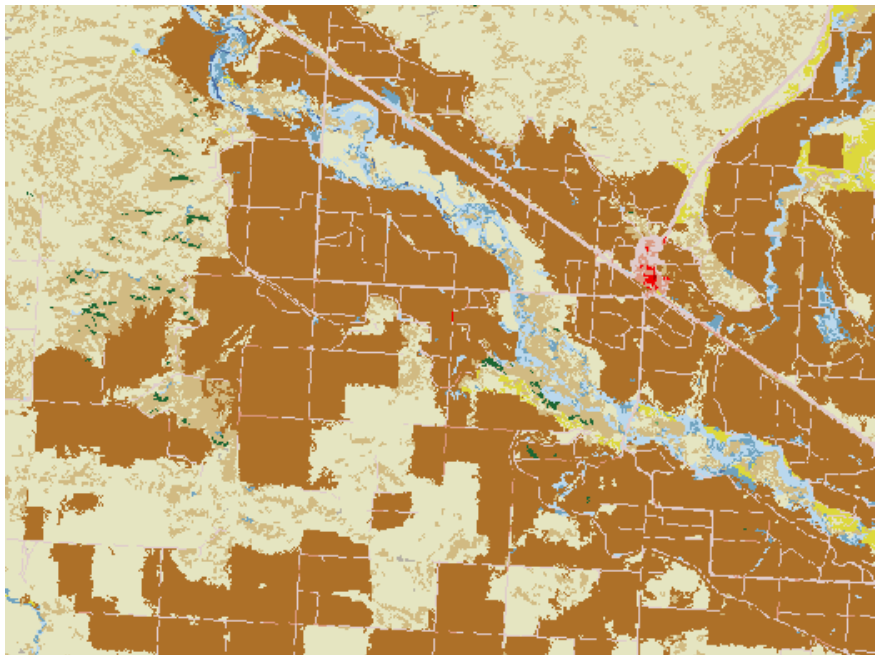
Area Extent: Nationwide coverage of irrigated acreage available, focus on Wyoming portion of study area.

Background: In 1993, a consortium of federal agencies called the Multi-Resolution Land Characteristics (MRLC) Consortium pooled their resources to purchase nationwide Landsat-5 satellite data, and to create a National Land Cover Database(NLCD) with the circa 1992 data³. The MRLC repeated this effort using Landsat-7 data to produce the NLCD 2001. The USGS EROS Data Center (EDC) took the lead developing the NLCD 2001 classification methodology and also maintains the 1992 and 2001 databases. The NLCD imagery represents a 21-class land cover unsupervised classification scheme at a 30-meter pixel spatial resolution.

The website allows a user to select the area of interest and download the shapefile. Land use coverages for Wyoming were available for the years of 2001 and 1992. Classification of the imagery was achieved by the use of a classification and decision tree method using a combination of Landsat imagery and ancillary data; an accuracy of approximately 88 percent was estimated for the selected area.

Land in the Wyoming portion of the study area from the 2001 dataset primarily includes the following land use types:

- Type 71: Grassland/Herbaceous - areas are not subject to intensive management such as tilling, but can be utilized for grazing
- Type 81: Pasture/Hay - areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle
- Type 82: Cultivated Crops - areas used for the production

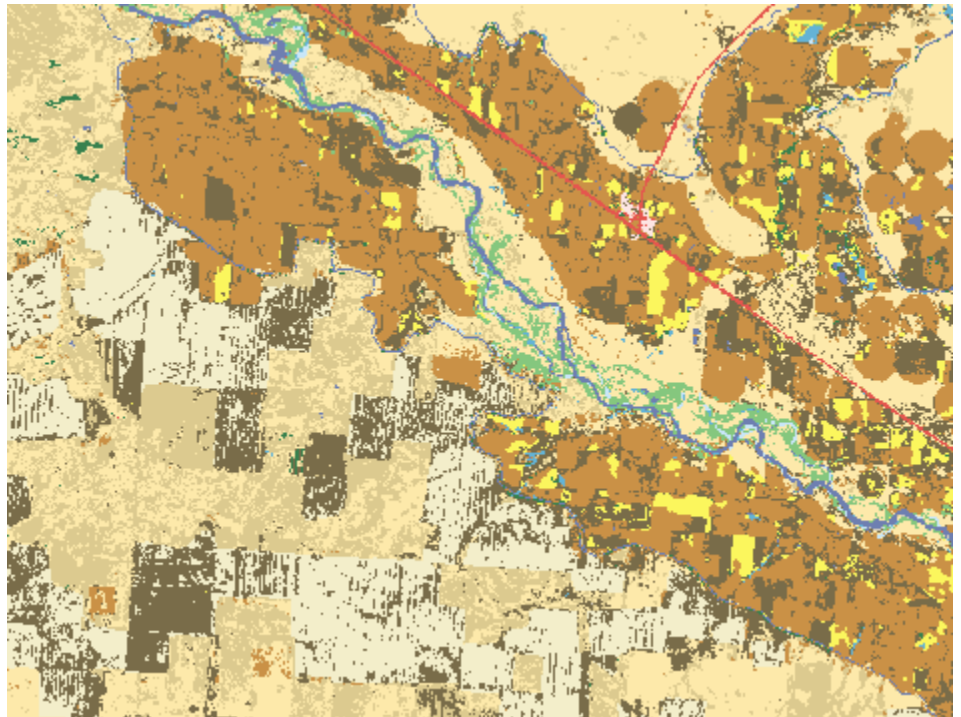


of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Includes all land being actively tilled.

- Type 31: Barren Land - Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material.
- Type 11: Open Water

Land in the Wyoming portion of the study area from the 1992 dataset primarily includes the following land use types:

- Type 51: Shrubland - areas dominated by shrubs
- Type 71: Grassland/Herbaceous - areas are not subject to intensive management such as tilling, but can be utilized for grazing.
- Type 81: Pasture/Hay - areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops.
- Type 82: Row Crops - areas used for the production of crops, such as corn, soybeans, vegetables, tobacco, and cotton.
- Type 83: Small Grains - areas used for the production of graminoid crops such as wheat, barley, oats, and rice.
- Type 84: Fallow - areas used for the production of crops that are temporarily barren or with sparse vegetative cover as a result of being tilled in a management practice that incorporates prescribed alternation between cropping and tillage.
- Type 11: Open Water



Crop Type Attributes: Specific crop types are generally not attributed with this spatial coverage. The 1992 land use coverage attributes indicate row crops, small grains, and pasture crop areas, however these attributes are not available in the 2001 coverage.

Irrigation Method Attributes: Irrigation methods are not attributed with this spatial coverage. Center pivot land areas (circles) are very clear in both coverages indicating the presence of sprinklers.

Water Source Attributes: Surface and ground water sources are not attributed in this coverage.

Quality Control Method and Comments:

- Based on visual inspection and lack of attribution of the 2001 land use coverage, it does not appear to accurately reflect dryland vs. irrigated acreage in the study area. Much of the land use attributed to Type 82 (chocolate brown in picture above) is non-irrigated, rather it is dryland farming. We know this because there is not an irrigation water source available to those crops and other information, including the Statewide Framework Plan, indicate that this land is not irrigated. Utilizing this source would greatly overestimate the amount of *irrigated* acreage in this portion of the study area. **It is our recommendation to not use the 2001 USGS Land Use coverage.**
- The 1992 USGS land use coverage does appear to more accurately reflect the irrigated vs. dryland acreage in the study area. Digitization of the irrigated agricultural crop types could be performed to determine total irrigated acreage in the study area. Based on visual comparison of the land use coverage to the Statewide Framework coverage and the limited accuracy of the attribution process, digitization of the 1992 land use coverage may produce a slight overestimate of the total irrigated acreage in the study area. This will however produce some crop type information on a spatial level for the Wyoming portion of the study area.

³ Source: Multi-Resolution Land Characteristics, www.mrlc.gov

1992 National Atlas Satellite – 200m

Source: National Atlas

Responsible Entity: USGS Seamless Server

Source Link: <http://seamless.usgs.gov/>

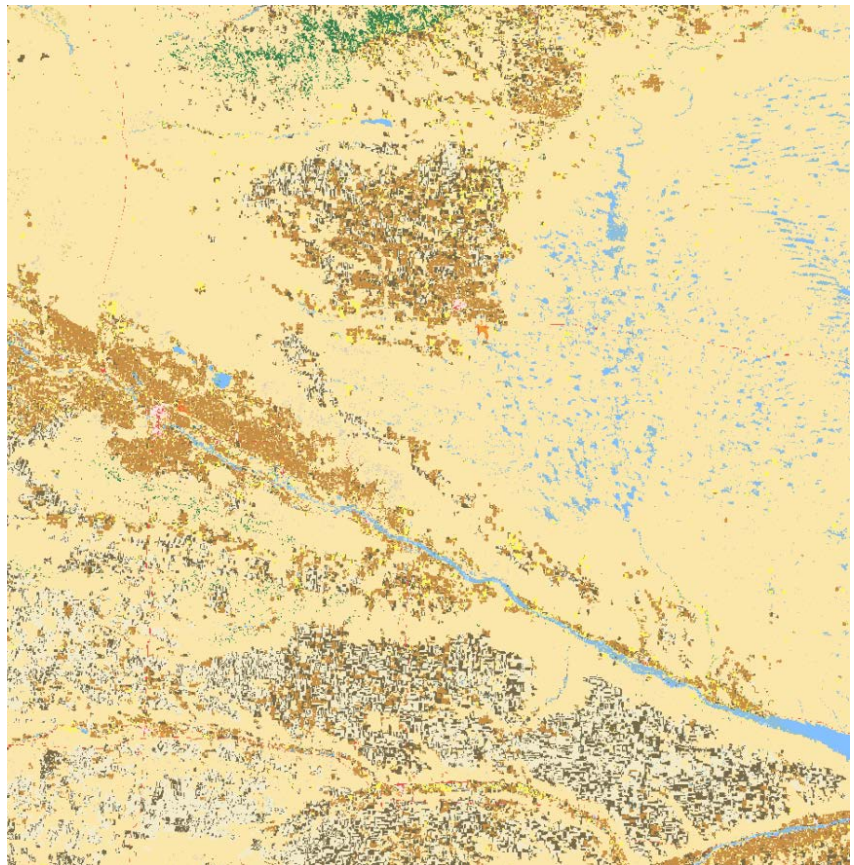
Year: 1992

Type: Imagery

Format: TIF Image

Area Extent: Statewide coverage, focus on NNPD area in Nebraska

Background: The Satellite View of the Conterminous United States map layer is a 200-meter-resolution simulated-natural-color image of the United States. Vegetation is generally green, with forests in darker green and grasslands or shrub lands in lighter green. Areas of high reflectance, including urban areas, rock, and dry bare soil, are shown in shades of pink. Very bright areas, such as snow and ice, are colored blue. The image was produced by combining Landsat Thematic Mapper (TM) imagery from the Landsat 4 and Landsat 5 satellites. The image was developed to portray the land cover of the conterminous United States and is intended for visual purposes only. The original Landsat Thematic Mapper imagery data must be used for conducting analysis.



Land in the Nebraska portion of the study area from the 1992 snapshot primarily includes the following land use types:

- Type 51: Shrubland - areas dominated by shrubs
- Type 71: Grassland/Herbaceous - areas are not subject to intensive management such as tilling, but can be utilized for grazing.

- Type 81: Pasture/Hay - areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops.
- Type 82: Row Crops - areas used for the production of crops, such as corn, soybeans, vegetables, tobacco, and cotton.
- Type 83: Small Grains - areas used for the production of graminoid crops such as wheat, barley, oats, and rice.
- Type 84: Fallow - areas used for the production of crops that are temporarily barren or with sparse vegetative cover as a result of being tilled in a management practice that incorporates prescribed alternation between cropping and tillage.
- Type 11: Open Water

Crop Type Attributes: Specific crop types are generally not attributed with this spatial coverage. The 1992 land use coverage attributes indicate row crops, small grains, and pasture crop areas

Irrigation Method Attributes: Irrigation methods are not attributed with this spatial coverage. Center pivot land areas (circles) are very clear in both coverages indicating the presence of sprinklers.

Water Source Attributes: Surface and ground water sources are not attributed in this coverage.

Quality Control Method and Comments:

- The 1992-200m USGS land use coverage does appear to more accurately reflect the irrigated vs. dryland acreage in the study area than the USGS Landsat Imagery. Digitization of the irrigated agricultural crop types could be performed to determine total irrigated acreage in the study area. However, compared to the 1992 USGS land use coverage, the 1992-200m coverage has a coarser resolution resulting in a less accurate depiction of the irrigated acreage. **We recommend using the USGS 1992 coverage as a supplemental source for the digitization of the irrigated acreage and refine the produced coverage based on recent aerial imagery.**

2001 USGS Landsat Imagery

Source: USGS

Responsible Entity: USGS

Source Link: <http://seamless.usgs.gov/>

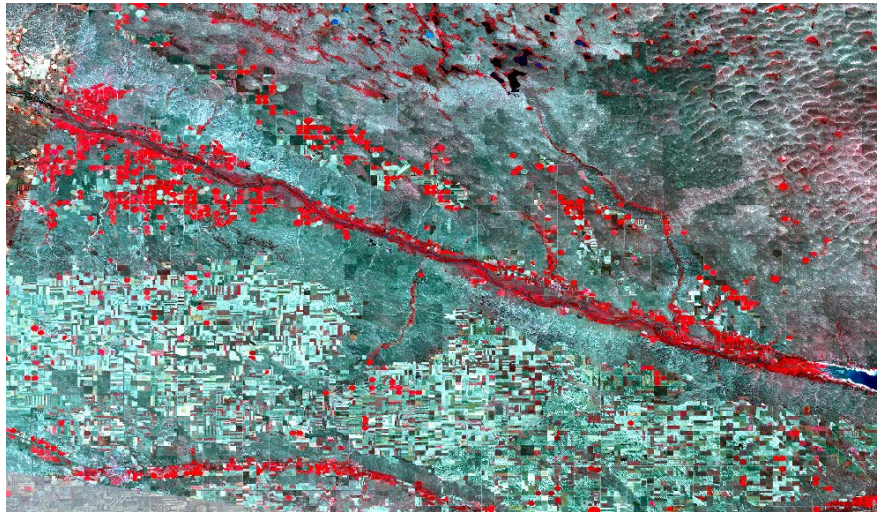
Year: 2001

Type: Imagery

Format: TIF Image

Area Extent: Coverage of NNPD area in Nebraska

Background: An orthoimage is remotely-sensed image data in which displacement of features in the image caused by terrain relief and sensor orientation have been mathematically removed. Orthoimagery combines the image characteristics of a photograph with the geometric qualities of a map. The Landsat Mosaic orthoimagery database contains Landsat Thematic Mapper imagery for the conterminous United States. Three bands have been selected from the eight spectral bands available for each frame. These are bands 4 (near-infrared), 3 (red), and 2 (green), typically displayed as red, green, and blue, respectively. The image is a full-resolution (spectral and spatial), 24-bit color-infrared composite that simulates color infrared film as a "false color composite."



Crop Type Attributes: Cropping patterns are not attributed with this spatial coverage.

Irrigation Method Attributes: Irrigation methods are not attributed with this spatial coverage although it is distinctly noticeable where center pivots are within the study area. This is purely an image for viewing/checking purposes.

Water Source Attributes: Surface and ground water sources are not attributed with this spatial coverage.

Quality Control Comments: Based on the coarse digitization of the original source and the limited attribution of the lands, we recommend not using this source in determining irrigated acreage in the Nebraska portion of the study area. This source may be revisited if future efforts involve identifying acreage using this image as a supplemental source.

Census of Agriculture

Source: United States Department of Agriculture (USDA)

Responsible Entity: National Agriculture Statistics Service (NASS)

Source Link: <http://www.nass.usda.gov/>, Census_Agriculture_18Jun09.csv

Year: 1945 through 1997, every five years

Type: Tabular

Format: Excel File, sorted by County

Area Extent: County statistics of Nebraska

Background: The Census of Agriculture is the leading source of facts and figures about American agriculture. Conducted every five years, the Census provides a detailed picture of U.S. farms and ranches and the people who operate them. It is the only source of uniform, comprehensive agricultural data for every state and county in the United States.

The USDA's National Agricultural Statistics Service (NASS) is responsible for the Census of Agriculture, as well as hundreds of surveys every year and prepares reports covering virtually every aspect of U.S. agriculture. Production and supplies of food and fiber, prices paid and received by farmers, farm labor and wages, farm finances, chemical use, and changes in the demographics of U.S. producers are only a few examples of the information available.

NASS is committed to providing timely, accurate, and useful statistics in service to U.S. agriculture. To uphold our continuing commitment, NASS will:

- Report the facts on American agriculture, facts needed by people working in and depending upon U.S. agriculture.
- Provide objective and unbiased statistics on a preannounced schedule that is fair and impartial to all market participants.
- Conduct the Census of Agriculture every five years, providing the only source of consistent, comparable, and detailed agricultural data for every county in America.
- Serve the needs of our data users and customers at a local level through our network of State field offices and our cooperative relationship with universities and State Departments of Agriculture.
- Safeguard the privacy of farmers, ranchers, and other data providers, with a guarantee that confidentiality and data security continue to be our top priorities.

Crop Type Attributes: Crop types are tabulated within this file and include: total cropland, irrigated land, harvested land, corn for grain, corn for feed, all corn, sorghum for grain, sorghum for feed, all sorghum, wheat for grain, oats for grain, barley for grain, rye for grain, all small grains, soybeans, dry edible beans, sugar beets,

potatoes, hay, alfalfa, sunflowers, etc. Crop types and acreages are provided by county and acreages summed in one file.

Irrigation Method Attributes: Irrigation method is not included in this data source.

Water Source Attributes: Specific surface and ground water sources are not attributed in this data source.

Quality Control Method: Compare irrigated acreage by crop type on county basis with other crop type irrigated acreage sources.

Quality Control Comments: This coverage will serve as a supplemental coverage to other sources already obtained. The most important attributes include: total cropland, harvested cropland, irrigated land, county area and sum of land.

Master Stats

Source: United States Department of Agriculture (USDA)

Responsible Entity: National Agriculture Statistics Service (NASS)

Source Link: <http://www.nass.usda.gov/>, Master_Stats_090623.csv

Year: 1950 through 1997

Type: Tabular

Format: Excel File, sorted by County

Area Extent: County statistics of Nebraska

Background: This data source appears to serve as a 'balancing' sheet between NASS information and COHYST information on a county wide basis. NASS cropping information, derived from 5-year Census of Agriculture results, is linearly interpolated to fill missing years. Non-crop information from the 1997 COHYST assessment including Urban Land, Woodland, Wetland, Dryland crops, Roads, etc., was used back in time. The total area of the county less the crop and non-crop areas were considered Rangeland.

Crop Type Attributes: Crop types are tabulated within this file and include the following:

Irrigated Corn	Summer Fallow
Irrigated Sugar Beets	Dryland Corn
Irrigated Soybeans	Dryland Soybeans
Irrigated Sorghum	Dryland Sorghum
Irrigated Dry Edible Beans	Dryland Dry Edible Beans
Irrigated Potatoes	Dryland Alfalfa
Irrigated Alfalfa	Dryland Small Grains
Irrigated Small Grains	Dryland Sunflowers
Rangeland	Dryland Sugar Beets
Urban Land	Dryland Potatoes
Open Water	Irrigated Hay
Riparian Woodland	Sum
Wetlands	County area
Other Agricultural Lands	
Irrigated Sunflowers	
Roads	

Irrigation Method Attributes: Irrigation method is not included in this data source.

Water Source Attributes: Specific surface and ground water sources are not attributed in this data source.

Quality Control Method: Compare irrigated acreage by crop type on county basis with other crop type irrigated acreage sources.

Quality Control Comments: This coverage will serve as a supplemental coverage to other sources already obtained.

1997 NASS Information, Spatial Coverage

Source: United States Geological Survey (USGS), 2002

Responsible Entity: National Agricultural Statistics Service (NASS), USDA

Source Link: <http://seamless.usgs.gov/>

Year: 1997

Type: Spatial

Format: Shapefile, polygons by county

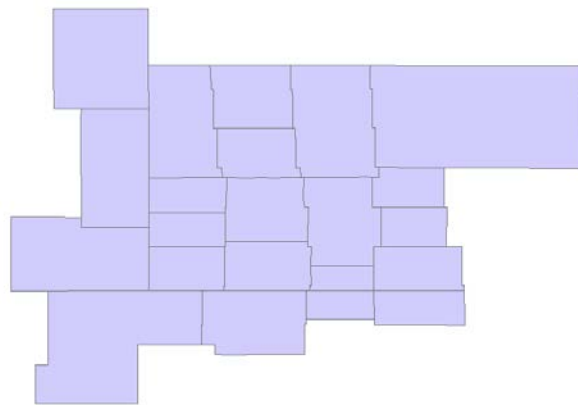
Area Extent: Irrigated Acreage coverage of NNPR study area in Nebraska and Wyoming.

Background: This data set portrays the National Agricultural Statistics Service, U.S. Department of Agriculture's 1997 Census data for the United States, presented by county. There are 25 categories of data which include information about farms, crops, livestock, values of products, and farm operator characteristics.

Poly_ID	Poly_Description
M003_02	The average size of farms in acres.
M009_02	The percentage of farms with sales less than \$10,000.
M010_02	The percentage of farms with sales of \$10,000 to \$249,000.
M013_02	The average value of agricultural products sold per farm, in dollars.
M016_02	The average value of crops sold per acre for harvested cropland, in dollars.
M023_02	The value of nursery, greenhouse, floriculture, and sod as a percentage of the total market value of agricultural products sold, in dollars.
M026_02	The value of livestock, poultry, and their products as a percentage of the total market value of agricultural products sold, in dollars.
M049_02	The average total farm production expenses per farm, in dollars.
M084_02	The acres of total cropland as a percentage of land area in acres.
M088_02	The acres of harvested cropland as a percentage of land in farms acreage.
M089_02	The acres of irrigated harvested cropland as a percentage of all harvested cropland acreage.
M098_02	The average market value of all machinery and equipment per farm, in dollars.
M117_02	The percentage of farms operated by a family or individual.
M123_02	The average age of principal farm operators.
M126_02	The percentage of farms with female principal operators.
M135_02	The average number of cattle and calves per 100 acres of all land in farms.

M141_02	Milk cows as a percentage of all cattle and calves.
M146_02	Other cattle as a percentage of cattle and calves.
M178_02	Corn for grain, harvested acres.
M189_02	All wheat for grain, harvested acres.
M206_02	Upland cotton, harvested acres.
M212_02	Soybeans for beans, harvested acres.
M242_02	Vegetables, acres harvested for sale
M259_02	Total acres of land in orchards.
M260_02	Irrigated land in orchards.

Note: M084_02 – The percentage values may be greater than 100 because the land area in acres is calculated as the land within the county and the acres of total cropland are calculated for the entire farm, which may include parts of more than one county.



Crop Type Attributes: All Crop attributes are presented by county in the shapefile attribute table. Recommended attributes include: Corn for grain, all wheat for grain, upland cotton, soybeans for beans, vegetables, irrigated land in orchards and the average size of farms in acres.

Irrigation Method Attributes: Irrigation method is not included in the spatial coverage.

Water Source Attributes: Surface and ground water sources are not attributed in this coverage.

Quality Control Method: Could compare acreage by crop listed in this coverage with crop type by acreage provided in BBA report (NPRRFM). Provides limited information as generally only provides tabular information of the 1997 NASS Census of Agriculture results.

Quality Control Comments: Crops are listed by county; not shown at a specific location in the spatial coverage. Not recommended for use in the irrigated acreage assessment.

Wyoming Framework Water Plan

Source: Platte River Basin Plan, part of the Wyoming Framework Water Plan, October 2007

Responsible Entity: Wyoming Water Development Commission

Source Link: <http://waterplan.state.wy.us/plan/statewide/gis/irriglands.html>

Year: Irrigated Acreage based on 1992 - 1994 Imagery

Type: Spatial

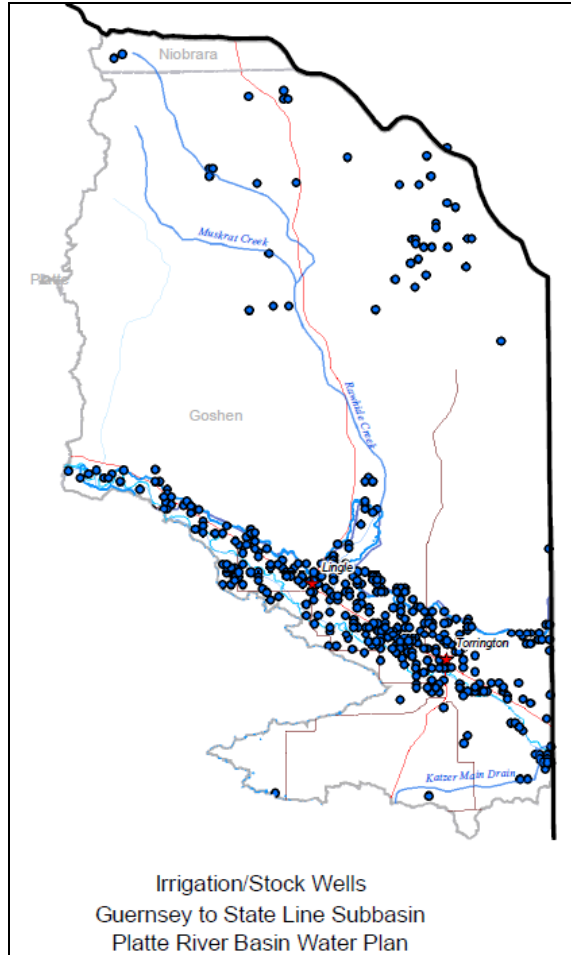
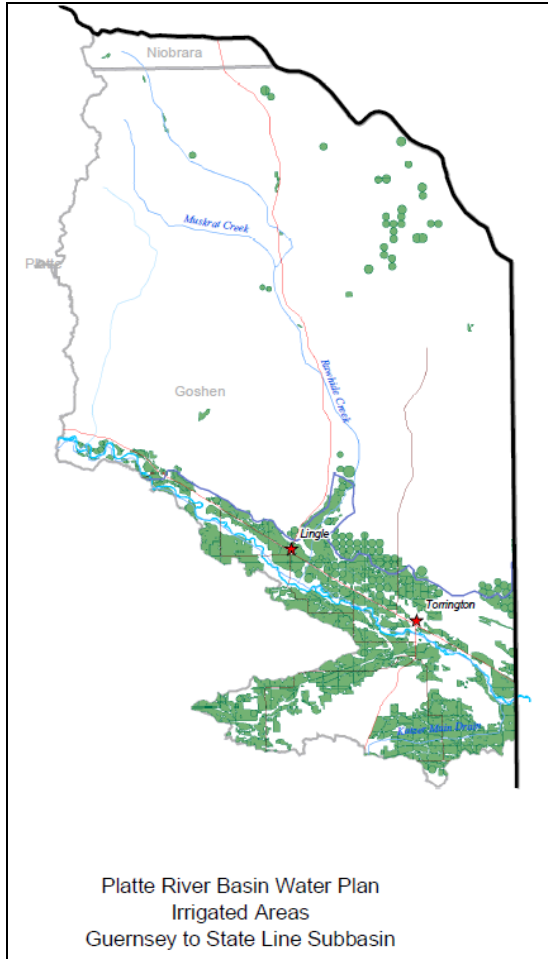
Format: Shapefile

Area Extent: Statewide coverage of Wyoming irrigated acreage, focus on Guernsey to Stateline subbasin.

Background: The Wyoming Framework Water Plan was developed by the WWDC to provide an inventory of the State's current water resources and demands, as well as provide future water resource planning direction. Seven basin plans were completed; the Guernsey to State Line subbasin encompasses a majority of the NNPR study area in Wyoming. These recent basin planning efforts are an update of the 1973 statewide planning process.

Technical Memorandum 1.1 (TechMemo_1.1_Mapping.pdf) in the Platte River Basin Plan discusses the development of the irrigated acreage shapefile and associated attributing. Some general comments regarding the acreage development and attribution include:

- Originally developed by States West Water Resources Corp. for the WY SEO in support of the Nebraska vs. Wyoming litigation.
- Surface water rights permitted to divert water at a rate of **10 cfs** or greater and agricultural wells having permitted capacities equal to or greater than **50 gpm** were tabulated based on information from the WY SEO and State Board of Control.
- These water sources were assigned to irrigated lands through a PLSS description; documentation notes the inaccuracy of this method.
- Due to the assignment method, irrigated acreage assigned to a water source is not limited to the permitted amount of irrigated acreage (1 cfs/70 acres).
- Shapefile coverage and attribution relies on polygon coverage and a *Permit Linking* table for attribution of the polygons.



The Framework Plan also references the 2003 Irrigation System Survey Report whereby it summarizes information by basin from the survey including structure specific physical info, contact info, irrigated acreage info and current structural problems. A survey was also performed in 2001 and is available on the WWDC website.

Crop consumptive use was also estimated for the Framework Plan, as summarized in [Section 2.1.4](#) technical memorandum. Note that the consumptive use estimates in the Guernsey to Stateline basin was in accordance with the estimates derived for the litigation.

Agricultural Water Use: Irrigation Districts

The annual Irrigation System Survey Report, which is published by the Wyoming Water Development Commission, provides a summary of information regarding 28 irrigation districts. These districts lie within a portion of what the Wyoming State Engineer's Office designates as Water Division I. Information regarding the irrigation districts within the Guernsey to State Line subbasin as listed in the *2003 Irrigation System Survey Report* is represented in the following table.

Irrigation Districts	Surface source	Acres in district (total)	District acres irrigated	Number of users
Angel Draw Irrigation District	--	--	--	--
Burbank Ditch	North Platte River	360	310	1
Goshen Hole Water Users Assoc	Horse Creek	--	2,600	5
Goshen Mutual Water Users Association, Inc.	--	--	--	--
Hill Irrigation District	Glendo, Guernsey Reservoirs	--	3,844.59	79
Lingle Water Users	Pathfinder Reservoir	11,288	11,288	100
Lucerne Canal and Power Company	--	--	--	--
New Grattan Ditch Company	North Platte River	1,320	1,320	5
New North Platte Irrigation District	North Platte River	4,200	2,900	17
Pratte-Ferris Irrigation District	--	--	--	--
Rock Ranch Ditch Company	Rock Ranch Irrigation Ditch	3,561	3,561	22
Torrington Irrigation District	North Platte River	--	2,249	110
Wright & Murphy Ditch Company	Glendo Reservoir, North Platte River	245	245	1

Crop Type Attributes: Cropping patterns are not attributed with this spatial coverage. The Framework report sites NASS and indicates that the Guernsey to Stateline basin is comprised of:

- Alfalfa on 27 percent
- Corn on 23 percent
- Pasture on 17 percent
- Sugar Beets on ~ 10 percent
- Grass Hay on ~10 percent
- Dry Beans on 8 percent
- Remaining 5 percent is spring grains (barley, oats)

Consumptive use of irrigation water was calculated for crops during high, low, and normal or average stream flow during the 1972 through 2001 study period.

Irrigation Method Attributes: Irrigation methods are not attributed with this spatial coverage. The Framework plan does not appear to take into account flood vs. sprinkler application.

Water Source Attributes: Surface and ground water sources, including ditch names and permit numbers are attributed in this coverage. Surface water sources were limited to those permitted to divert at a rate of 10 cfs or greater. Original, supplemental, secondary and additional supply, as well as priority date and amount, are also noted.

Includes wells permitted by the SEO to yield 50 gallons per minute or more. The SEO water right database was used to obtain information on major irrigation [wells permitted within the Guernsey to State Line Subbasin](#). Wells that have been recorded by the SEO as cancelled or abandoned have been excluded from this basin water plan. Many wells permitted through the SEO for irrigation are also permitted for stock use.

As summarized the [Section 1.1](#) technical memorandum, the following summarizes the shapefile attribute table.

Irrigation Attribute Table (PLTirrag)	
POLYID (linking field)	Assigned number – unique for each polygon
SOURCE	Who created the original polygon delineations
AREA_METER	Area of the polygons in square meters (area values calculated in UTM, Zone 13, NAD 27)
AREA_FEET	Area of the polygons in square feet (area values calculated in UTM, Zone 13, NAD 27)
AREA_ACRES	Area of the polygons in acres (area values calculated in UTM, Zone 13, NAD 27)
Points of Diversion Attribute Table (PLTpdos)	
PointID (linking field)	Assigned number – unique for each point
POINT_X	The longitude of the point (decimal degrees/NAD 27)
POINT_Y	The latitude of the point (decimal degrees/NAD 27)
Water Rights Table (PLTwrrights)	
UniqueID (linking field)	Assigned number – representing a unique permit occurrence
PERMIT_NO	Permit number as assigned by the Wyoming State Engineer's Office (SEO). The word "None" or a blank in this field indicates there is no SEO permit information for this parcel of land.
SOURCE	Source of supply for appropriation. A blank or the numbers 999 in this field indicate that there is no SEO permit information for this parcel of land.
FACILITY	Facility name. A blank or the numbers 999 in this field indicate that there is no SEO permit information for this parcel of land.
PDATE	Priority date of appropriation in year, month and day (YYYYMMDD). The numbers 0 or 999 in this field indicate that there is no SEO permit information for this parcel of land.
PAMOUNT	Amount of appropriation. The numbers 999 in this field indicate that there is no SEO permit information for this parcel of land.
UNIT	Measure of appropriation in cubic feet per second (cfs), gallons per minute (gpm), or acre-feet (acft)
PACRES	Number of irrigated acres allowed under appropriation
TYPE	Type of supply of appropriation. Original supply (OS), supplemental supply (SS), secondary supply (SE) and additional supply (AS)
STATUS	Adjudicated (adj), unadjudicated (una), cancelled (can)
USES	Type of beneficial use – examples: irrigation (irr), domestic (dom), stock (sto), municipal (mun)
Source_Att	Name of firm responsible for compiling the data from SEO

Quality Control Method: Efforts are needed to refine the spatial information due to the presence of the 'linking table' in order to assign irrigated acreage parcels to surface and ground water sources (remove duplicates, set surface water source as primary). Compare to recent aerial imagery for general spatial accuracy

and compare to more historical spatial and tabular data to determine if total under a structure/district is accurate.

Quality Control Comments: Based on visual comparison to 1994 aerial imagery, the coverage appears to accurately represent parcel boundaries. The linking table will need to be explicitly attributed to the spatial coverage to make the coverage more usable in the modeling efforts.

1982 Agricultural Land Use

Source: Wyoming Geographic Information Science Center

Responsible Entity: Wyoming Geographic Information Science Center

Source Link: <http://piney.wygisc.uwyo.edu/data/agriculture/agland.zip>

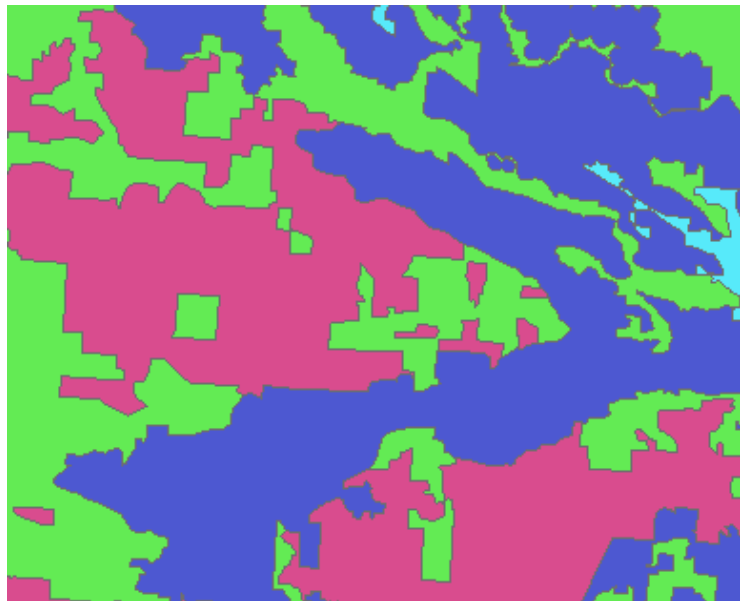
Year: 1982

Type: Spatial

Format: Shapefile

Area Extent: Statewide coverage of Wyoming irrigated acreage, focus on Wyoming portion of the study area.

Background: This dataset represents croplands of Wyoming as interpreted from 1:58,200-scale National High Altitude Program (NHAP) color infrared aerial photography. The photos, which were taken in 1980-1982, were interpreted and land use designations were hand-drawn onto plots produced at the same scale as the photos, using a light table. The plots were then digitized as polygons into ARC/INFO 7.0.2. Valid polygons include irrigated croplands, non-irrigated croplands, urban lands, golf-courses, and non-agricultural lands. The purpose of this data layer is to provide a digital layer showing areas of agriculture and agricultural chemical use in Wyoming. This layer was designed to be applied in the Wyoming Ground-Water Vulnerability Mapping Project.



Attributes include:

- 'ir' for irrigated cropland
- 'ni' for non-irrigated cropland
- 'ur' for urban or built up
- 'na' for non-agricultural land
- 'gc' for golf courses

Crop Type Attributes: Cropping patterns are not attributed with this spatial coverage.

Irrigation Method Attributes: Irrigation methods are not attributed with this spatial coverage.

Water Source Attributes: Surface and ground water sources are not attributed with this spatial coverage.

Quality Control Comments: Based on the coarse digitization of the original source and the limited attribution of the lands, we do not recommend using this source in determining irrigated acreage in the Wyoming portion of the study area. This source may be revisited if future efforts involve identifying dryland acreage.

COHYST/CALMIT

This portion of the appendix documents the source data and quality control methodology for evaluating the COHYST irrigated acreage data. Both tabular and spatial information was compiled and summarized herein. The following COHYST data was compiled and evaluated:

COHYST Land Use Coverages:

- 1982 Land Use Mapping
 - Land Use Grid (landuse_82)
 - Center Pivots (Pivots_82)
 - Other Irrigation (Oth_Irr_82)
 - 1982 COHYST Land Cover Report (COHYST_Rpt_82)
- 1997 Land Use Mapping
 - Land Use Grid (landuse_97)
 - Center Pivots (Pivots_97)
 - Other Irrigation (Oth_Irr_97)
 - 1997 Final Report (COHYST_Rpt_97)
- 2001 Land Use Mapping
 - Land Use Grid (landuse_01)
 - Center Pivots (Pivots_01)
 - Other Irrigation (Oth_Irr_01)
 - 2001 COHYST Report (COHYST_Rpt_01)
- 2005 Land Use Mapping
 - Land Use Grid (landuse_05)
 - Center Pivots (Pivots_05)
 - Other Irrigation (Oth_Irr_05)
 - 2005 Nebraska Department of Natural Resources Report (NDNR_Rpt_05)

COHYST Shapefiles:

Description	Shapefile
2005 Registered Well Coverage	g003regwell_05.shp
South Platte Monitoring Wells	g003spwell_99.shp
North Platte Monitoring Wells	g003npwell_99.shp
Wheather Station Location	weather_sta_loc.shp
Topography	g002toporeg_97.shp
Statewide STATSGO	g004statsgo_94.shp
COHYST STATSGO	g012cohyststatsgo_01.shp
Shaded Relief	land.tif
Sections Corners Point File (SE Corner)	g003sectpt_92.shp
Section Polygons	g003sectpol_95.shp
Roads	g010road_92.shp
USGS Quadrangle Boudaries	quadsp.shp
Natural Resource District Boundaries	g003nrdbd_06.shp
Detailed Streams from 7 1/2 Quads	g003rivbstrms_05.shp
1998 Stream Stations	g001strmpt_0899.shp
COHYST Streams	g003strm_05.shp
Hyrologic Unit Boundaries	g003hu_rivb_95.shp
Lakes	g005lakes_99.shp
North Platte Tributaries and Canals	g006nptrib_99.shp
South Platte Tributaries and Canals	g006sptrib_99.shp
COHYST Surface Water Stations	g001swgage_95.shp
County Boundaries	g003cntybd_92.shp
COHST Boundary	g003cohyst_09.shp

1982 Land Use Mapping

Source: Delineation of 1982 Land Use Patterns for the Cooperative Hydrology Study in the Central Platte River Basin

Responsible Entity: CALMIT/University of Nebraska Lincoln

Source Link: http://www.calmit.unl.edu/cohyst/1987_landuse.shtml

Year: 1982

Type: Spatial

Format(s):

1982 Land Use Classification - Arc_Grid_82 (ESRI Grid)

1982 Center Pivots – Center_Pivots_82 (Shapefile)

1982 Other Irrigation – other_irr_82 (Shapefile)

1982_cohyst_landcover_report (PDF Document)

Area Extent: COHYST Boundary (SPNRD/NPNRD/CPNRD)

Background: An assessment of the 1982 land use patterns was completed in support of COHYST in January 2004 for the Central Platte River Basin. The assessment used the 1982 Landsat 3 satellite imagery to define 13 classes of land use. Crops were classified using multi-date imagery acquired April through October to account for spectral variations due to crop development. CALMIT used supervised and unsupervised classification methods to interpret the 1982 Landsat images.

Supervised classification involves three basic steps: sample/training stage, classification, and output. In the training stage, the user identifies pixels in the image that represent a land cover type present in the scene. Sample areas of known crops and land use were classified to train the computer system to identify pixels (areas) with similar spectral characteristics. Training areas were selected using NRCS field data points from the 1982 growing season validating crop type and location. After all of the training sites were collected and evaluated, they were used to drive the supervised classification, which is an iterative process to optimize the classifications.

Unsupervised classifications were completed for scenes when less than three dates of imagery were available and on scenes with substantial cloud coverage. Unsupervised classification does not use training sites as a basis for classification. Instead, the image is classified based on natural groupings of pixels with similar spectral properties. NRCS field data points were used where available to confirm classifications. Classified images were combined into a single coverage and then post processed to remove urban areas, roads, and smooth the image to only include major classes as contiguous areas.

The initial supervised and unsupervised land use classification results do not identify dryland or irrigated lands. The output of the classification results in 13 land use classes:

- | | |
|------------------------|------------------------------|
| 1. Corn | 8. Barren Land |
| 2. Sugar Beets | 9. Open Water |
| 3. Soybean | 10. Riparian Forest |
| 4. Sorghum | 11. Woodlands |
| 5. Alfalfa | 12. Other Agricultural Crops |
| 6. Small Grains | 13. Wetlands |
| 7. Range/Pasture/Grass | |

1982 Irrigated Areas

Two types of irrigated areas were created for the COHSYT study area for 1982: center pivots, and other irrigated areas (non-pivots). The 1982 irrigated areas shapefiles were used to classify whether the crops in the land use coverage were irrigated. Crops not identified as irrigated are considered dryland crops.

The 1982 center pivots were identified using the Landsat 3 imagery, 1982 registered irrigation wells, land cover data from the NRCS/NDNR, and the 1993 digital orthophoto quarter quadrangles (DOQQ). The result is the **Center_Pivot_82** shapefile.

The “other” irrigated areas were digitized from 1980 irrigation inventory maps for South Central Nebraska provided by the NDNR and land cover maps for Central Nebraska provided by the NRCS. Canal project maps were also used to digitize irrigated areas. The canal project maps include; Castle Rock, Steamboat, Chimney Rock, Empire, Midland-Overland, Graf Canal, Keith Lincoln, North Platte Canal, Paxton Hershey, Birdwood, Suburban, Cody-Dillon, Western Canal, Thirty Mile Canal, Six Mile Canal, Cozad Canal, and Orchard-Alfalfa Canal. In some areas the 1997 irrigation layer developed by CALMIT was used to help define field boundaries where data was not available. The result is the **other_ Irr_82** shapefile.

Once irrigated areas were identified and digitized they were overlaid onto the land use grid. Land use cells with irrigated areas were then reclassified by crop as irrigated and areas that are not irrigated were reclassified by crop as a dryland. The result is the final 1982 Land Use Classification **landcover_82** (ESRI Grid). The classification contains the 13 listed above as well as 6 dryland crops classes and summer fallow.

There has been a substantial effort to create the 1982 land use data set and corresponding irrigated areas shapefiles. Although useful for comparison, this data set has accuracy limitations that are inherent to the Landsat 3 imagery. Below are some general comments and primary issues that we identified with the land use coverage and shapefile development:

- The spatial resolution of the 1982 Landsat 3 Multi Spectral Scanner (MSS) is 80 meters. Due to such a low resolution, the resulting pixel size is large (187 ft x 187 ft). At this resolution fields, roads, and other political boundaries are not distinguishable and the accuracy of the land use classification is significantly decreased. The pixel size is equivalent to 0.80 acres per/pixel. The result is an overestimation of cropped areas.
- The 1993 DOQQ is the primary source for the center pivot and other irrigation shapefiles, which is not representative of 1982 field boundaries.

- The Landsat imagery used to classify land use on the Wyoming/Nebraska Stateline were unsupervised classifications, which may result in less accurate classifications.
- The 1982 Landsat cell size (80 meter) is more than double the size of the Landsat TM (30 meter) used in the 1997 and 2001 COHYST classifications.
- A significant amount of corn was classified in the 1982 coverage, which in part is the result of being unable to clearly separate sorghum from corn using Landsat 3.
- The acreage totals by crop are based on the land use grid not actual field boundaries, therefore may not be directly comparable to other sources such as NASS.
- The classification of the 1982 coverage is only as good as the accuracy of the samples used for the supervised classifications. In some cases the NRCS field points did not supply sufficient field verification to classify soybeans, sugar beets, and other crops (potatoes, sunflowers, and dry edible beans).
- There are only 13 land classes identified in the 1982 land use coverage. The other crops category is not included in any of the other land use analyses, and due to the pixel size urban areas and roads were also not classified.

Crop Type Attributes: Cropping patterns are not attributed in the other or pivot irrigated areas shapefiles, but are classified as a part of the land use coverage. Below is a comparison of the 1982, 1997, and 2001 total crop acreage from COHYST by county from the 1982 final report (COHYST, 2004). Note that the acreage totals by crop are based on the land use grid not actual field boundaries, therefore may be not comparable to other sources such as NASS.

Banner County

CLASS	2001 Acres	1997 Acres	1982 Acres	Acres Change (1982-2001)	% of County Change
Dryland Other Agricultural Crops	5,102.66	1,323.49	285.79	4,816.87	1.01%
Irrigated Other Agricultural Crops	4,313.07	2,844.47	923.99	3,389.07	0.71%
Irrigated Small Grains	5,613.21	7,264.32	2,560.85	3,052.36	0.64%
Irrigated Corn	7,255.18	4,592.06	5,674.81	1,580.37	0.33%
Dryland Soybeans	94.89	626.22	0.00	94.89	0.02%
Irrigated Soybeans	43.33	2,079.96	0.00	43.33	0.01%
Irrigated Sugar Beets	983.18	1,627.76	1,532.50	-549.32	-0.12%
Irrigated Alfalfa	4,244.26	5,563.09	5,186.73	-942.47	-0.20%
Dryland Corn	2,354.13	1,245.01	3,357.20	-1,003.07	-0.21%
Dryland Alfalfa	859.00	3,508.82	5,568.85	-4,709.84	-0.99%
Dryland Small Grains	59,499.07	70,349.05	85,465.79	-25,966.72	-5.44%
Summer Fallow	50,422.37	50,342.02	81,532.20	-31,109.83	-6.52%

Cheyenne County

Cheyenne						
CLASS	2001 Acres	1997 Acres	1982 Acres	Acres Change (1982-2001)	% of County Change	
Dryland Other Agricultural Crops	16,997.70	16,830.18	85.90	16,911.80	2.21%	
Irrigated Small Grains	17,944.37	17,971.22	4,659.30	13,285.06	1.74%	
Irrigated Other Agricultural Crops	8,408.88	3,247.50	1,010.69	7,398.18	0.97%	
Dryland Sorghum	2,537.89	7.63	0.00	2,537.89	0.33%	
Dryland Small Grains	237,136.07	271,866.05	234,919.14	2,216.93	0.29%	
Irrigated Soybeans	488.68	5,665.06	0.00	488.68	0.06%	
Dryland Corn	9,619.34	6,896.82	9,278.47	340.88	0.04%	
Irrigated Sorghum	173.73	88.31	0.00	173.73	0.02%	
Dryland Soybeans	84.05	1,659.47	0.00	84.05	0.01%	
Irrigated Corn	17,263.71	14,560.95	17,446.70	-182.99	-0.02%	
Irrigated Sugar Beets	333.81	2,662.43	689.58	-355.77	-0.05%	
Irrigated Alfalfa	4,996.74	3,543.75	6,860.51	-1,863.77	-0.24%	
Dryland Alfalfa	1,599.85	1,606.89	13,151.05	-11,551.21	-1.51%	
Summer Fallow	172,757.82	176,532.35	240,137.98	-67,380.16	-8.81%	

Deuel County

Deuel						
CLASS	2001 Acres	1997 Acres	1982 Acres	Acres Change (1982-2001)	% of County Change	
Dryland Other Agricultural Crops	13,977.15	21,407.79	455.17	13,521.97	4.80%	
Dryland Corn	9,471.50	3,342.43	4,718.71	4,752.79	1.69%	
Irrigated Small Grains	3,414.34	3,428.14	1,674.59	1,739.76	0.62%	
Irrigated Other Agricultural Crops	1,111.17	1,732.93	427.88	683.29	0.24%	
Dryland Sorghum	662.61	0.40	2.41	660.20	0.23%	
Irrigated Corn	12,831.28	11,525.60	12,223.05	608.23	0.22%	
Irrigated Soybeans	189.37	865.87	0.00	189.37	0.07%	
Dryland Soybeans	41.53	224.60	0.00	41.53	0.01%	
Irrigated Sorghum	17.45	1.00	34.52	-17.07	-0.01%	
Irrigated Sugar Beets		514.42	533.85	-533.85	-0.19%	
Irrigated Alfalfa	1,161.72	1,371.86	2,469.33	-1,307.61	-0.46%	
Dryland Alfalfa	236.12	321.34	2,324.03	-2,087.92	-0.74%	
Summer Fallow	77,313.24	71,088.06	89,742.97	-12,429.73	-4.41%	
Dryland Small Grains	72,399.96	90,007.84	91,380.63	-18,980.68	-6.73%	

Garden County (partial)

Garden						
CLASS	2001 Acres	1997 Acres	1982 Acres	Acres Change (1982-2001)	% of County Change	
Dryland Other Agricultural Crops	6,184.54	12,899.08	74.66	6,109.88	0.56%	
Irrigated Small Grains	4,216.78	4,161.41	1,579.86	2,636.92	0.24%	
Dryland Corn	8,717.41	8,433.15	7,268.32	1,449.09	0.13%	
Irrigated Other Agricultural Crops	871.04	756.49	0.00	871.04	0.08%	
Irrigated Soybeans	578.35	1,334.84	0	578.35	0.05%	
Dryland Sorghum	574.14	10.43	0.00	574.14	0.05%	
Irrigated Sorghum	307.13	30.69	26.49	280.64	0.03%	
Dryland Soybeans	121.97	629.11	0.00	121.97	0.01%	
Irrigated Alfalfa	9,114.82	5,969.49	9,413.33	-298.52	-0.03%	
Irrigated Sugar Beets	0.00	631.31	816.42	-816.42	-0.07%	
Dryland Alfalfa	2,833.59	3,478.34	6,870.95	-4,037.36	-0.37%	
Dryland Small Grains	50,830.41	58,741.37	54,933.06	-4,102.66	-0.37%	
Irrigated Corn	13,473.02	14,781.99	17,696.36	-4,223.34	-0.39%	
Summer Fallow	44,968.24	47,115.95	55,208.41	-10,240.17	-0.93%	

Kimball County

Kimball						
CLASS	2001 Acres	1997 Acres	1982 Acres	Acres Change (1982-2001)	% of County Change	
Irrigated Corn	11,175.86	5,822.41	3,938.41	7,237.45	1.19%	
Dryland Other Agricultural Crops	3,927.10	3,652.73	161.36	3,765.74	0.62%	
Irrigated Small Grains	6,201.19	8,377.86	3,919.15	2,282.04	0.37%	
Dryland Small Grains	148,595.21	144,552.94	146,570.58	2,024.63	0.33%	
Irrigated Other Agricultural Crops	2,432.17	1,557.92	734.54	1,697.63	0.28%	
Dryland Sorghum	227.69	2.01	0.00	227.69	0.04%	
Irrigated Sorghum	11.23	8.03	0.00	11.23	0.00%	
Irrigated Soybeans	2.01	1,706.04	0.00	2.01	0.00%	
Dryland Soybeans	0.00	1,515.36	0.00	0.00	0.00%	
Dryland Corn	2,534.08	3,933.32	2,610.62	-76.55	-0.01%	
Irrigated Sugar Beets	1,341.06	1,840.52	1,880.90	-539.84	-0.09%	
Irrigated Alfalfa	5,918.93	4,753.23	7,806.18	-1,887.25	-0.31%	
Dryland Alfalfa	911.76	3,526.28	3,754.58	-2,842.81	-0.47%	
Summer Fallow	97,946.96	126,460.29	206,719.27	-108,772.32	-17.86%	

Morrill County

Morrill						
CLASS	2001 Acres	1997 Acres	1982 Acres	Acres Change (1982-2001)	% of County Change	
Irrigated Other Agricultural Crops	16,057.05	13,765.53	7,920.17	8,136.88	0.89%	
Irrigated Alfalfa	23,759.19	16,396.04	17,396.93	6,362.26	0.70%	
Irrigated Small Grains	7,919.80	12,770.41	1,854.41	6,065.39	0.66%	
Dryland Other Agricultural Crops	6840.93	2509.28	1,115.05	5,725.87	0.63%	
Dryland Sorghum	1,049.58	3.81	0.00	1,049.58	0.11%	
Irrigated Sorghum	400.41	24.69	0.00	400.41	0.04%	
Irrigated Soybeans	258.78	11,904.74	0.80	257.98	0.03%	
Dryland Soybeans	78.24	1,549.69	0.00	78.24	0.01%	
Irrigated Corn	57,286.77	46,911.88	63,189.60	-5,902.83	-0.65%	
Dryland Small Grains	26,835.91	48,118.55	33,052.64	-6,216.73	-0.68%	
Irrigated Sugar Beets	461.00	4,758.04	6,838.84	-6,377.84	-0.70%	
Dryland Alfalfa	5,021.01	3,849.23	14,308.65	-9,287.64	-1.02%	
Dryland Corn	9,619.34	5,990.41	19,157.41	-9,538.07	-1.04%	
Summer Fallow	18,530.14	32,207.02	34,085.81	-15,555.67	-1.70%	

Scotts Bluff County

Scottsbluff						
CLASS	2001 Acres	1997 Acres	1982 Acres	Acres Change (1982-2001)	% of County Change	
Irrigated Other Agricultural Crops	39,316.12	34,344.99	22,543.52	16,772.60	3.52%	
Irrigated Small Grains	12,928.37	9,801.50	2,954.21	9,974.16	2.09%	
Irrigated Corn	78,598.34	66,458.88	72,059.46	6,538.88	1.37%	
Irrigated Alfalfa	27,340.03	26,641.11	22,557.97	4,782.07	1.00%	
Dryland Other Agricultural Crops	5,160.44	2,371.60	2,816.94	2,343.50	0.49%	
Irrigated Sorghum	66.40	11,255.45	0.00	66.40	0.01%	
Dryland Sorghum	11.84	1,111.74	0.00	11.84	0.00%	
Dryland Corn	7,607.25	5,605.64	11,291.83	-3,684.58	-0.77%	
Dryland Alfalfa	3,677.54	7,725.95	7,496.31	-3,818.77	-0.80%	
Dryland Small Grains	14,648.98	16,253.14	19,698.48	-5,049.50	-1.06%	
Irrigated Sugar Beets	7,757.30	17,138.47	27,674.85	-19,917.55	-4.18%	
Summer Fallow	7,934.04	12,050.06	35,550.07	-27,616.03	-5.79%	

Sioux County (partial)

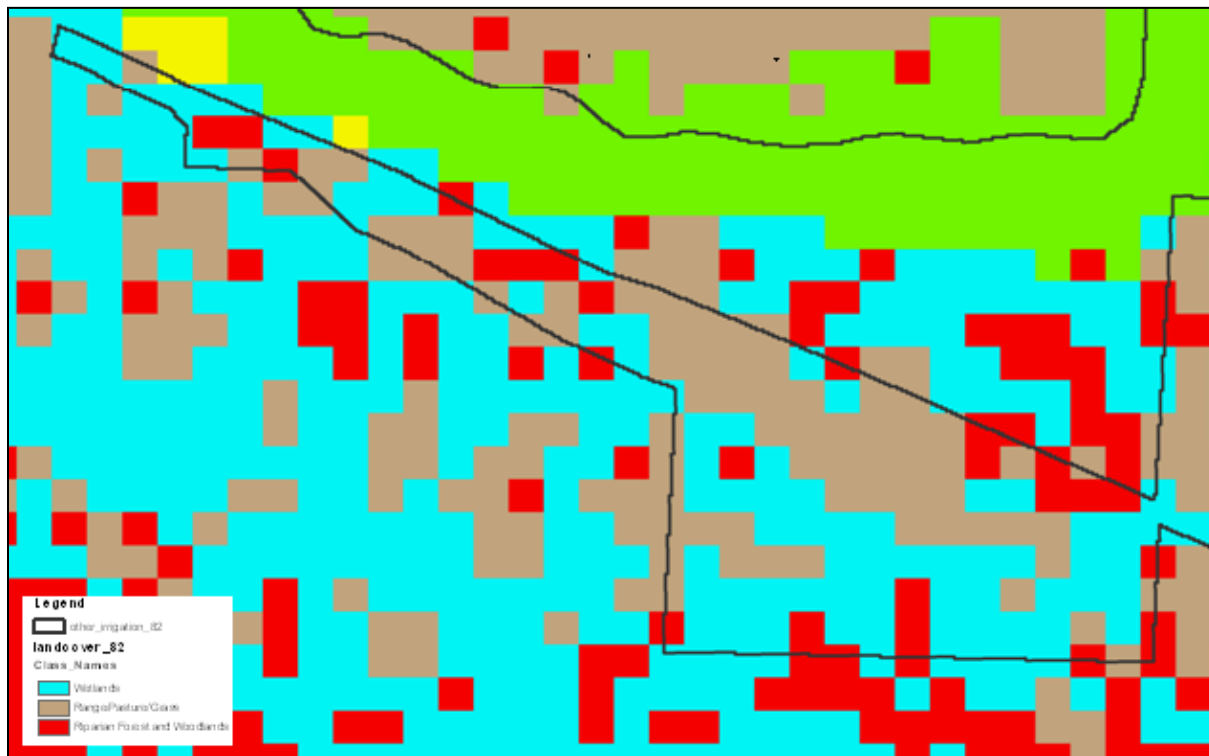
Sioux					
CLASS	2001 Acres	1997 Acres	1982 Acres	Acres Change (1982-2001)	% of County Change
Irrigated Alfalfa	8,104.35	6,930.00	4,992.46	3,111.90	0.62%
Irrigated Small Grains	2,387.43	3,003.70	496.11	1,891.32	0.38%
Irrigated Other Agricultural Crops	3,234.40	3,954.78	1,648.10	1,586.30	0.32%
Irrigated Corn	13,493.28	12,025.84	12,646.91	846.37	0.17%
Dryland Other Agricultural Crops	392.59	294.09	241.64	150.95	0.03%
Dryland Sorghum (Milo, Sudan)	10.43	0.00	0.00	10.43	0.00%
Irrigated Sorghum (Milo, Sudan)	6.62	0.00	0.00	6.62	0.00%
Dryland Soybeans	0.00	140.22	0.00	0.00	0.00%
Irrigated Soybeans	0.00	1,211.27	0.00	0.00	0.00%
Dryland Alfalfa	957.90	1,055.00	1,468.27	-510.37	-0.10%
Dryland Corn	1,471.66	728.61	2,513.49	-1,041.83	-0.21%
Dryland Small Grains	877.46	3,014.13	3,461.56	-2,584.11	-0.51%
Irrigated Sugar Beets	1,329.23	1,694.94	4,018.69	-2,689.46	-0.53%
Summer Fallow	945.67	3,865.31	6,177.35	-5,231.69	-1.04%

Irrigation Method Attributes: The 1982_pivots (sprinkler) and 1982_other_irrigation (flood) shapefiles provide irrigation method attribution.

Water Source Attributes: Surface and ground water sources are not currently assigned in any of the COHYST data sets.

Quality Control Method: Review of documentation to determine the level of accuracy, sources of information, and methodology used to develop the land use coverage and irrigated areas. A visual inspection of the land use coverage and shapefiles to confirm approximate field boundaries, irrigated areas, and cropped areas. In addition the use of geoprocessing tools would be used to assess the quality and integrity of the shapefiles to identify overlapping polygons and other spatial errors. Geoprocessing tools may also be used to identify misclassified pixels based on a nearest neighbor approach. Below are a couple of images from the 1982 analysis illustrating some of the issues with the coverage:

Visual inspection of irrigated acreage coverage and corresponding land use shows irrigated wetlands



Visual inspection shows 1982 digitized irrigated field boundaries overlap



Quality Control Comments: If used as a source of spatial irrigation information, we recommend refining the spatial information based on well supported information that may be difficult to obtain. The Landsat 3 imagery does not support a high quality land use classification in 1982 and is not suitable for use in the irrigated acreage assessment without further refinement.

1997 Land Use Mapping

Source: Delineation of 1997 Land Use Patterns for the Cooperative Hydrology Study in the Central Platte River Basin

Responsible Entity: CALMIT/University of Nebraska Lincoln

Source Link: http://www.calmit.unl.edu/cohyst/1997_landuse.shtml

Year: 1997

Type: Spatial

Format(s):

1997 Land Use Classification – landcover_97 (ESRI Grid)

1997 Center Pivots – 97_pivot_update (Shapefile)

1997 Other Irrigation – other_irr_97 (Shapefile)

1997_final_report (PDF Document)

Area Extent: COHYST Boundary

Background: An assessment of the 1997 land use patterns was completed in support of COHYST in January 2001 for the Central Platte River Basin. The assessment used the 1997 Landsat 5 TM satellite imagery to define 17 classes of land use. Crops were classified using multi-date imagery acquired for May, July, and September to account for spectral variations due to crop development. To improve the accuracy of the classifications spectral signatures for specific crops were characterized during their dates of maturation. The classification of spring to mid-summer crops such as winter wheat, grass/hay/pasture, and range were the highest when all three images were used (May, July, and September). For crops that mature during the late summer only two images were used (July and September). To cover the COHYST study area, ten scenes and 24 Landsat 5 TM images were used to classify the 1997 land use coverage using supervised and unsupervised classification methods.

Supervised classification involves three basic steps: sample/training stage, classification, and output. In the training stage, the user identifies pixels in the image that represent a land cover type present in the scene. Sample areas of known crops and land use were classified to train the computer system to identify pixels (areas) with similar spectral characteristics. Due to the variation of sampled spectral signatures for each crop between images, an average signature was developed for each crop. The success of the classification is directly dependent on the collection of truly representative samples or training areas. USDA Farm Service Agency (FSA) reporting records from 1997 were the main source of crop information used to determine training areas for agricultural classes. Other supplemental data such as 1993 digital orthophoto quarter quadrangles (DOQQ) and National Wetlands Inventory (NWI) were used to support the supervised land use classification process. After all of the training sites were collected and evaluated, they were used to drive the supervised classification, which is an iterative process to optimize the classifications.

Unsupervised classifications were completed for scenes when less than three dates of imagery were available and on scenes with substantial cloud coverage. Unsupervised classification does not use training sites as a basis for classification. Instead, the image is classified based on natural groupings of pixels with similar spectral properties. Ancillary information such as the 1993 DOQQ and 1997 FSA reporting records were used to confirm classifications. Classified images were combined into a single coverage and then post processed to remove urban areas, roads, and smooth the image to only include major classes as contiguous areas.

The initial supervised and unsupervised land use classification results do not identify dryland or irrigated lands. The output of the classification resulted in 17 land use classes:

- | | |
|------------------------|-----------------------------------------------------|
| 1. Corn | 10. Open Water |
| 2. Sugar Beets | 11. Riparian Forest and Woodlands |
| 3. Soybean | 12. Wetlands |
| 4. Sorghum | 13. Other Agricultural Lands (Farmsteads, Feedlots) |
| 5. Dry Edible Beans | 14. Sunflower |
| 6. Potatoes | 15. Summer Fallow |
| 7. Alfalfa | 16. Urban Areas |
| 8. Small Grains | 17. Roads |
| 9. Range/Grass/Pasture | |

1997 Irrigated Areas

Two types of irrigated areas were created for the COHSYT study area for 1997: center pivots, and other irrigated areas (non-pivots). The 1997 irrigated areas shapefiles are used to define irrigated area within the land use coverage.

The 1997 center pivots were identified primarily using the Landsat 5 TM imagery supplemented with information from FSA reporting records from 1997, and 1993 digital orthophoto quarter quadrangles (DOQQ). The initial pivot irrigation shapefile was updated using the 2001 FSA certified reporting reports and registered wells. The result is the **97_pivot_update** shapefile.

The “other” irrigated areas were digitized from sources such as digital maps from Pathfinder Irrigation District and canal project maps from the Nebraska Division of Natural Resources (NDNR). The canal project maps include; Castle Rock, Steamboat, Chimney Rock, Empire, Midland-Overland, Graf Canal, Keith Lincoln, North Platte Canal, Paxton Hershey, Birdwood, Suburban, Cody-Dillon, Western Canal, Thirty Mile Canal, Six Mile Canal, Cozad Canal, and Orchard-Alfalfa Canal. Other sources used to delineate field boundaries include FSA reporting records from 1997, and the 1993 digital orthophoto quarter quadrangles (DOQQ). The 1997 irrigated acreage maps were then sent to each corresponding Division of Natural Resources (DNR) within the COHYST boundary to be checked for accuracy. The result is the **other_ Irr_97** shapefile.

Once irrigated areas were identified and digitized they were overlaid onto the land use grid. Land use cells with irrigated areas were then reclassified by crop as irrigated and areas that are not irrigated were reclassified by crop as a dryland. The result is the final 1997 Land Use Classification **landcover_97** (ESRI Grid). The classification contains the 17 listed above as well as 8 dryland crops classes.

There has been a substantial effort to create the 1997 land use data set and corresponding irrigated areas shapefiles. The information that has been compiled will help support the North Platte NRD Irrigated Acreage Assessment. Below are some general comments and concerns that we identified with the land use coverage and shapefile development:

- The spatial resolution of the 1997 Landsat 5 Thematic Mapper (TM) is 30 meters. At this resolution fields, roads, and other political boundaries are distinguishable and the accuracy of the land use classification is significantly increased. The pixel size is equivalent to 0.20 acres per/pixel resulting in a more accurate classification than the 1982 classification.
- The 1993 DOQQ is the primary source for the center pivot and other irrigation shapefiles, which is not representative of 1997 field boundaries.
- The Landsat imagery used to classify land use within the NPNRD and SPNRD boundaries was of good quality, with only one of the images having any significant cloud cover.
- The accuracies reported in the 1997 final report indicate that irrigated corn is over classified and irrigated sorghum is under classified in the 1997 land use coverage.
- The acreage totals by crop are based on the land use grid not actual field boundaries, therefore may not be directly comparable to other sources such as NASS.
- The classification of the 1997 coverage is only as good as the accuracy of the samples used for the supervised classifications. In some cases the 1997 FSA reporting records did not supply sufficient field verification to classify crops.
- Land use classification of transition zones between crops were not correctly classified due to the variation of mixed of pixels in these areas.
- Although there were efforts made to check and confirm irrigated areas, irrigation records were not always available for counties in 1997. Some counties only have irrigation records of acres certified for crop insurance.
- Although the 1997 pivot shapefile was updated it appears that the 1997 other was not.

Crop Type Attributes: Cropping patterns are not attributed in the other or pivot irrigated areas shapefiles, but are classified as a part of the land use coverage. Below is a summary of the 1997 total crop acreage from COHYST by county from the 1997 final report (COHYST, 2001). Note that the acreage totals by crop are based on the land use grid not actual field boundaries. Also, note that the counties that are partially within the COHYST boundary are not summarized (Sioux, Garden).

Banner County

Banner County				
CLASS	VALUE	PIXEL COUNT	SQUARE METERS	ACRES
Irrigated Corn	1	22879	18583467.75	4592.06
Irrigated Sugar Beets	2	8110	6587347.50	1627.76
Irrigated Soybeans	3	10363	8417346.75	2079.96
Irrigated Dry Edible Beans	5	8346	6779038.50	1675.13
Irrigated Potatoes	6	105	85286.25	21.07
Irrigated Alfalfa	7	27717	22513133.25	5563.09
Irrigated Small Grains	8	36193	29397764.25	7264.32
Range/Pasture/Grass	9	1524458	1238241010.50	305974.80
Urban Land	10	703	571011.75	141.10
Open Water	11	450	365512.50	90.32
Riparian Forest and Woodlands	12	80027	65001930.75	16062.26
Wetlands	13	26022	21136369.50	5222.89
Other Agricultural Lands	14	31	25179.75	6.22
Irrigated Sunflower	15	5721	4646882.25	1148.27
Summer Fallow	16	250819	203727732.75	50342.02
Roads	17	138	112090.50	27.70
Dryland Corn	18	6203	5038386.75	1245.01
Dryland Soybeans	19	3120	2534220.00	626.22
Dryland Dry Edible Beans	21	1966	1596883.50	394.60
Dryland Alfalfa	22	17482	14199754.50	3508.82
Dryland Small Grains	23	350500	284693625.00	70349.05
Dryland Sunflower	24	4628	3759093.00	928.89
Dryland Sugar Beets	25	507	411810.75	101.76
Dryland Potatoes	26	6	4873.50	1.20

Cheyenne County

Cheyenne County				
CLASS	VALUE	PIXEL COUNT	SQUARE METERS	ACRES
Irrigated Corn	1	72547	58926300.75	14560.95
Irrigated Sugar Beets	2	11440	9292140.00	2296.13
Irrigated Soybeans	3	28225	22925756.25	5665.06
Irrigated Sorghum (Milo, Sudan)	4	440	357390.00	88.31
Irrigated Dry Edible Beans	5	7994	6493126.50	1604.48
Irrigated Alfalfa	7	17656	14341086.00	3543.75
Irrigated Small Grains	8	89538	72727240.50	17971.22
Range/Pasture/Grass	9	1119855	909602223.75	224766.71
Urban Land	10	15427	12530580.75	3096.36
Open Water	11	170	138082.50	34.12
Riparian Forest and Woodlands	12	59588	48400353.00	11959.94
Wetlands	13	11880	9649530.00	2384.44
Other Agricultural Lands	14	3839	3118227.75	770.53
Irrigated Sunflower	15	8186	6649078.50	1643.02
Summer Fallow	16	879537	714403928.25	176532.35
Roads	17	3073	2496044.25	616.78
Dryland Corn	18	34362	27910534.50	6896.82
Dryland Soybeans	19	8268	6715683.00	1659.47
Dryland Sorghum (Milo, Sudan)	20	38	30865.50	7.63
Dryland Dry Edible Beans	21	5188	4213953.00	1041.29
Dryland Alfalfa	22	8006	6502873.50	1606.89
Dryland Small Grains	23	1354518	1100207245.50	271866.05
Dryland Sunflower	24	78665	63895646.25	15788.90
Dryland Sugar Beets	25	1825	1482356.25	366.30

Deuel County

Deuel County				
CLASS	VALUE	PIXEL COUNT	SQUARE METERS	ACRES
Irrigated Corn	1	57424	46642644.00	11525.60
Irrigated Sugar Beets	2	2563	2081796.75	514.42
Irrigated Soybeans	3	4314	3504046.50	865.87
Irrigated Sorghum (Milo, Sudan)	4	5	4061.25	1.00
Irrigated Dry Edible Beans	5	2880	2339280.00	578.05
Irrigated Alfalfa	7	6835	5551728.75	1371.86
Irrigated Small Grains	8	17080	13873230.00	3428.14
Range/Pasture/Grass	9	332793	270311114.25	66795.07
Urban Land	10	4683	3803766.75	939.93
Open Water	11	1967	1597695.75	394.80
Riparian Forest and Woodlands	12	29643	24077526.75	5949.66
Wetlands	13	5711	4638759.75	1146.26
Other Agricultural Lands	14	2773	2252369.25	556.57
Irrigated Sunflower	15	5754	4673686.50	1154.89
Summer Fallow	16	354182	287684329.50	71088.06
Roads	17	3055	2481423.75	613.17
Dryland Corn	18	16653	13526399.25	3342.43
Dryland Soybeans	19	1119	908907.75	224.60
Dryland Sorghum (Milo, Sudan)	20	2	1624.50	0.40
Dryland Dry Edible Beans	21	1936	1572516.00	388.58
Dryland Alfalfa	22	1601	1300412.25	321.34
Dryland Small Grains	23	448446	364250263.50	90007.84
Dryland Sunflower	24	104724	85062069.00	21019.21
Dryland Sugar Beets	25	1117	907283.25	224.19

Kimball County

Kimball County				
CLASS	VALUE	PIXEL COUNT	SQUARE METERS	ACRES
Irrigated Corn	1	29009	23562560.25	5822.41
Irrigated Sugar Beets	2	9170	7448332.50	1840.52
Irrigated Soybeans	3	8500	6904125.00	1706.04
Irrigated Sorghum (Milo, Sudan)	4	40	32490.00	8.03
Irrigated Dry Edible Beans	5	4902	3981649.50	983.88
Irrigated Alfalfa	7	23682	19235704.50	4753.23
Irrigated Small Grains	8	41741	33904127.25	8377.86
Range/Pasture/Grass	9	1448743	1176741501.75	290778.00
Urban Land	10	7880	6400530.00	1581.60
Open Water	11	1644	1335339.00	329.97
Riparian Forest and Woodlands	12	14739	11971752.75	2958.27
Wetlands	13	38976	31658256.00	7822.89
Other Agricultural Lands	14	248	201438.00	49.78
Irrigated Sunflower	15	2860	2323035.00	574.03
Summer Fallow	16	630063	511768671.75	126460.29
Roads	17	246	199813.50	49.37
Dryland Corn	18	19597	15917663.25	3933.32
Dryland Soybeans	19	7550	6132487.50	1515.36
Dryland Sorghum (Milo, Sudan)	20	10	8122.50	2.01
Dryland Dry Edible Beans	21	4782	3884179.50	959.80
Dryland Alfalfa	22	17569	14270420.25	3526.28
Dryland Small Grains	23	720206	584987323.50	144552.94
Dryland Sunflower	24	13417	10897958.25	2692.93
Dryland Sugar Beets	25	661	536897.25	132.67

Morrill County

Morrill County				
CLASS	VALUE	PIXEL COUNT	SQUARE METERS	ACRES
Irrigated Corn	1	233729	189846380.25	46911.88
Irrigated Sugar Beets	2	23706	19255198.50	4758.04
Irrigated Soybeans	3	59313	48176984.25	11904.74
Irrigated Sorghum (Milo, Sudan)	4	123	99906.75	24.69
Irrigated Dry Edible Beans	5	60541	49174427.25	12151.22
Irrigated Alfalfa	7	81690	66352702.50	16396.04
Irrigated Small Grains	8	63626	51680218.50	12770.41
Range/Pasture/Grass	9	3124758	2538084685.50	627171.89
Urban Land	10	6432	5224392.00	1290.97
Open Water	11	30147	24486900.75	6050.82
Riparian Forest and Woodlands	12	127438	103511515.50	25578.15
Wetlands	13	273643	222266526.75	54923.04
Other Agricultural Lands	14	1097	891038.25	220.18
Irrigated Sunflower	15	8043	6532926.75	1614.31
Summer Fallow	16	160465	130337696.25	32207.02
Roads	17	3067	2491170.75	615.58
Dryland Corn	18	29846	24242413.50	5990.41
Dryland Soybeans	19	7721	6271382.25	1549.69
Dryland Sorghum (Milo, Sudan)	20	19	15432.75	3.81
Dryland Dry Edible Beans	21	5024	4080744.00	1008.37
Dryland Alfalfa	22	19178	15577330.50	3849.23
Dryland Small Grains	23	239741	194729627.25	48118.55
Dryland Sunflower	24	7478	6074005.50	1500.91
Dryland Sugar Beets	25	1515	1230558.75	304.08
Dryland Potatoes	26	3	2436.75	0.60

Scotts Bluff County

Scotts Bluff County				
CLASS	VALUE	PIXEL COUNT	SQUARE METERS	ACRES
Irrigated Corn	1	331118	268950595.50	66458.88
Irrigated Sugar Beets	2	85389	69357215.25	17138.47
Irrigated Soybeans	3	56078	45549355.50	11255.45
Irrigated Dry Edible Beans	5	160190	130114327.50	32151.82
Irrigated Potatoes	6	1	812.25	0.20
Irrigated Alfalfa	7	132734	107813191.50	26641.11
Irrigated Small Grains	8	48834	39665416.50	9801.50
Range/Pasture/Grass	9	985816	800729046.00	197863.67
Urban Land	10	53480	43439130.00	10734.00
Open Water	11	28232	22931442.00	5666.46
Riparian Forest and Woodlands	12	92155	74852898.75	18496.48
Wetlands	13	166626	135341968.50	33443.60
Other Agricultural Lands	14	661	536897.25	132.67
Irrigated Sunflower	15	10926	8874643.50	2192.96
Summer Fallow	16	60037	48765053.25	12050.06
Roads	17	1018	826870.50	204.32
Dryland Corn	18	27929	22685330.25	5605.64
Dryland Soybeans	19	5539	4499052.75	1111.74
Dryland Dry Edible Beans	21	10078	8185855.50	2022.76
Dryland Alfalfa	22	38493	31265939.25	7725.95
Dryland Small Grains	23	80978	65774380.50	16253.14
Dryland Sunflower	24	1738	1411690.50	348.83
Dryland Sugar Beets	25	6546	5316988.50	1313.85

Irrigation Method Attributes: The 1997_pivots (sprinkler) and 1997_other_irrigation (flood) shapefiles provide irrigation method attribution.

Water Source Attributes: Surface and ground water sources are not currently assigned in any of the COHYST data sets.

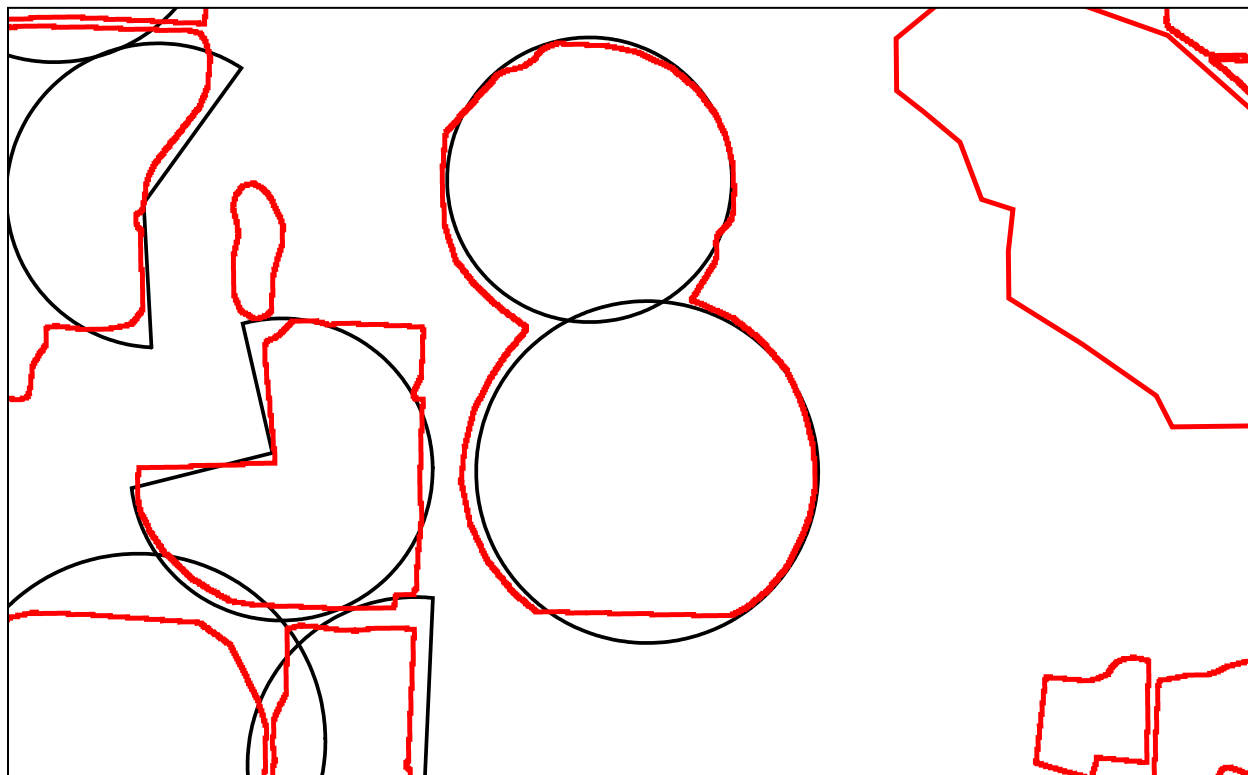
Quality Control Method:

Review of documentation to determine the level of accuracy, sources of information, and methodology used to develop the land use coverage and irrigated areas. A visual inspection of the land use coverage and shapefiles to confirm approximate field boundaries, irrigated areas, and cropped areas. In addition the use of geoprocessing tools would be used to assess the quality and integrity of the shapefiles to identify overlapping polygons, silvers, and other spatial errors. Geoprocessing tools can also be used to identify misclassified pixels based on a nearest neighbor approach. Below are a couple of images from the 1997 coverage's illustrating some of the issues with the coverage:

Visual inspection of land use coverage irrigate land with multiple crop classes



Visual inspection shows 1997 shows “other” and “pivot” shapefile overlap



Quality Control Comments:

If used as a source of spatial irrigation information, we recommend refining the irrigated acreage shapefiles. The Landsat 5 imagery does support a land use classification in 1997, but is not suitable for use in the irrigated acreage assessment without further refinement.

2001 Land Use Mapping

Source: Delineation of 2001 Land Use Patterns for the Cooperative Hydrology Study in the Central Platte River Basin

Responsible Entity: CALMIT/University of Nebraska Lincoln

Source Link: http://www.calmit.unl.edu/cohyst/2001_landuse.shtml

Year: 2001

Type: Spatial

Format(s):

2001 Land Use Classification – landcover_01 (ESRI Grid)

2001 Center Pivots – center_pivots_2001 (Shapefile)

2001 Other Irrigation – other_irrigation_2001 (Shapefile)

2001_cohyst_report (PDF Document)

Area Extent: COHYST Boundary

Background: An assessment of the 2001 land use patterns was completed in support of COHYST in September 2003 for the Central Platte River Basin. The assessment used the 2001 Landsat 7 Enhanced Thematic Mapper Plus (ETM+) satellite imagery to define 17 classes of land use. Crops were classified using multi-date imagery acquired for May, July, and September to account for spectral variations due to crop development. To improve the accuracy of the classifications spectral signatures for specific crops were characterized during their dates of maturation. The classification of spring to mid-summer crops such as winter wheat, grass/hay/pasture, and range were the highest when all three images were used (May, July, and September). For crops that mature during the late summer only two images were used (July and September). To cover the COHYST study area, ten scenes and 24 Landsat 7 ETM+ images were used to classify the 2001 land use coverage using supervised and unsupervised classification methods.

Supervised classification involves three basic steps: sample/training stage, classification, and output. In the training stage, the user identifies pixels in the image that represent a land cover type present in the scene. Sample areas of known crops and land use were classified to train the computer system to identify pixels (areas) with similar spectral characteristics. The success of the classification is directly dependent on collection of truly representative samples or training areas. USDA Farm Service Agency (FSA) reporting records from 2001 were the main source of crop information used to determine training areas for agricultural classes. Certified FSA reporting records were checked for accuracy to confirm the most accurate crop information possible. Other supplemental data such as 1993 digital orthophoto quarter quadrangles (DOQQ) and National Wetlands Inventory (NWI) were used to support the supervised land use classification process. In some areas the 1999 digital orthophoto quarter quadrangles (DOQQ) were used to confirm classifications. After all of the training

sites were collected and evaluated, they were used to drive the supervised classification, which is an iterative process to optimize the classifications.

Unsupervised classifications were completed for scenes when less than three dates of imagery were available and on scenes with substantial cloud coverage. Unsupervised classification does not use training sites as a basis for classification. Instead, the image is classified based on natural groupings of pixels with similar spectral properties. Ancillary information such as the 1993 and 1999 (in some areas) DOQQ and 2001 FSA reporting records were used to confirm classifications. Classified images were combined into a single coverage and then post processed to remove urban areas, roads, and smooth the image to only include major classes as contiguous areas.

The initial supervised and unsupervised land use classification results do not identify dryland or irrigated lands. The output of the classification resulted in 17 land use classes:

- | | |
|------------------------|-----------------------------------------------------|
| 1. Corn | 10. Open Water |
| 2. Sugar Beets | 11. Riparian Forest and Woodlands |
| 3. Soybean | 12. Wetlands |
| 4. Sorghum | 13. Other Agricultural Lands (Farmsteads, Feedlots) |
| 5. Dry Edible Beans | 14. Sunflower |
| 6. Potatoes | 15. Summer Fallow |
| 7. Alfalfa | 16. Urban Areas |
| 8. Small Grains | 17. Roads |
| 9. Range/Grass/Pasture | |

2001 Irrigated Areas

Two types of irrigated areas were created for the COHSYT study area for 2001: center pivots, and other irrigated areas (non-pivots). The 2001 irrigated areas shapefiles are used to define irrigated area within the land use coverage.

The 2001 center pivots were primarily identified using the Landsat 7 ETM+ imagery. Supplemental information such as FSA reporting records from 2001, and the 1993 and 1999 (in some areas) digital orthophoto quarter quadrangles (DOQQ), and 2001 registered wells was also used. Anecdotal information provided by the Natural Resource Districts was also used to identify sprinkler irrigated fields. The result is the **01_pivot_update** shapefile.

The 2001 final report does not document the development of the 2001 “other” irrigated areas shapefile. It is assumed the same approach used to develop the 1997 “other” irrigated acreage was used. In the previous COHYSY analyses the “other” irrigated areas shapefile were digitized from sources such as digital maps from Pathfinder Irrigation District and canal project maps from the Nebraska Division of Natural Resources (NDNR). The canal project maps include; Castle Rock, Steamboat, Chimney Rock, Empire, Midland-Overland, Graf Canal, Keith Lincoln, North Platte Canal, Paxton Hershey, Birdwood, Suburban, Cody-Dillon, Western Canal, Thirty Mile Canal, Six Mile Canal, Cozad Canal, and Orchard-Alfalfa Canal. Other sources used to delineate field boundaries include FSA reporting records from 2001, and the 1993 and 1999 (when available) digital orthophoto quarter

quadrangles (DOQQ). It is assumed the 2001 irrigated acreage maps were then sent to each corresponding Division of Natural Resources (DNR) within the COHYST boundary to be checked for accuracy. The result is a shapefile **other_Irr_01**.

Once irrigated areas were identified and digitized they were overlaid onto the land use grid. Land use cells with irrigated areas were then reclassified by crop as irrigated and areas that are not irrigated were reclassified by crop as a dryland. The result is the final 2001 Land Use Classification **landcover_01** (ESRI Grid). The classification contains the 17 listed above as well as 7 dryland crops classes.

There has been a substantial effort to create the 2001 land use data set and corresponding irrigated areas shapefiles. The information that has been compiled will help support the North Platte NRD Irrigated Acreage Assessment. Below are some general comments and primary issues that we identified with the land use coverage and shapefile development:

- The spatial resolution of the 2001 Landsat 7 ETM+ is 30 meters. At this resolution fields, roads, and other political boundaries are distinguishable and the accuracy of the land use classification is significantly increased. The pixel size is equivalent to 0.20 acres per/pixel resulting in a more accurate classification.
- The 1993 DOQQ was the primary source for the center pivot and other irrigation shapefiles, which may not be representative of 2001 field boundaries. In some areas the 1999 DOQQ was used, but these areas were not identified in the report.
- The Landsat imagery used to classify land use within the NPNRD and SPNRD boundaries was of good quality using only images with minimal cloud cover.
- The accuracies reported in the 2001 final report indicate that irrigated sorghum is under classified in the 2001 land use coverage.
- The acreage totals by crop are based on the land use grid not actual field boundaries, therefore may not directly comparable to other sources such as NASS.
- The classification of the 2001 coverage is only as good as the accuracy of the samples used for the supervised classifications. In some cases the 2001 FSA reporting records did not supply sufficient field verification to correctly classify crops.
- Land use classification of transition zones between crops were not correctly classified due to the variation of mixed of pixels in these areas.
- For the 2001 study, all sugar beets and potatoes are assumed to be irrigated. The 1997 assessment has acreage for dryland sugar beets.
- Due to the number of spectral bands available from Landsat 7 ETM+ imagery. The spectral signatures unique to each specific image were used to classify crops in that image instead of using an “average signature” to classify crops.

Crop Type Attributes: Cropping patterns are not attributed within the other or pivot irrigated areas shapefiles, but are classified as a part of the land use coverage. Below is a summary of the 2001 total crop acreage from COHYST by county from the 2001 final report (COHYST, 2003). Note that the acreage totals by crop are based on the land use grid not actual field boundaries, therefore may not be directly comparable to other sources such as NASS.

Banner County

Banner				
CLASS	2001 Acres	1997 Acres	Acres Change	% of County Change
Irrigated Corn	7,255.18	4,592.08	2,663.12	0.56%
Irrigated Dry Edible Beans	4,144.78	1,675.13	2,469.63	0.52%
Dryland Sunflower	3,148.14	928.89	2,219.25	0.47%
Dryland Dry Edible Beans	1,954.52	394.60	1,559.92	0.33%
Dryland Corn	2,354.13	1,245.01	1,109.12	0.23%
Summer Fallow	50,422.37	50,342.02	80.35	0.02%
Irrigated Potatoes	3.81	21.07	-17.26	0.00%
Dryland Soybeans	94.89	626.22	-531.33	-0.11%
Irrigated Sugar Beets	983.18	1,627.76	-644.58	-0.14%
Irrigated Sunflower	164.50	1,148.27	-983.77	-0.21%
Irrigated Alfalfa	4,244.26	5,563.09	-1,318.84	-0.28%
Irrigated Small Grains	5,613.21	7,264.32	-1,651.11	-0.35%
Irrigated Soybeans	43.33	2,079.96	-2,036.63	-0.43%
Dryland Alfalfa	859.00	3,508.82	-2,649.82	-0.56%
Dryland Small Grains	59,499.07	70,349.05	-10,849.98	-2.27%

Cheyenne County

Cheyenne				
CLASS	2001 Acres	1997 Acres	Acres Change	% of County Change
Dryland Dry Edible Beans	8,267.65	1,041.29	7,226.36	0.94%
Irrigated Dry Edible Beans	5,386.92	1,604.48	3,782.44	0.49%
Dryland Corn	9,619.34	6,896.82	2,722.53	0.36%
Irrigated Corn	17,263.71	14,560.95	2,702.76	0.35%
Dryland Sorghum	2,537.89	7.63	2,530.26	0.33%
Irrigated Alfalfa	4,996.74	3,543.75	1,452.99	0.19%
Irrigated Sunflower	2,979.03	1,643.02	1,336.01	0.17%
Irrigated Sorghum	173.73	88.31	85.41	0.01%
Irrigated Potatoes	42.93	0.00	42.93	0.01%
Dryland Alfalfa	1,599.85	1,606.89	-7.04	0.00%
Irrigated Small Grains	17,944.37	17,971.22	-26.85	0.00%
Dryland Soybeans	84.05	1,659.47	-1,575.42	-0.21%
Irrigated Sugar Beets	333.81	2,662.43	-2,328.61	-0.30%
Summer Fallow	172,757.82	176,532.35	-3,774.53	-0.49%
Irrigated Soybeans	488.68	5,665.06	-5,176.37	-0.68%
Dryland Sunflower	8,730.05	15,788.90	-7,058.85	-0.92%
Dryland Small Grains	237,136.07	271,866.05	-34,729.98	-4.54%

Deuel County

Deuel				
CLASS	2001 Acres	1997 Acres	Acres Change	% of County Change
Dryland Dry Edible Beans	8,134.25	388.58	7,745.67	2.75%
Summer Fallow	77,313.24	71,088.06	6,225.18	2.21%
Dryland Corn	9,471.50	3,342.43	6,129.06	2.17%
Irrigated Corn	12,831.28	11,525.60	1,305.67	0.46%
Dryland Sorghum	662.61	0.40	662.21	0.23%
Irrigated Sorghum	17.45	1.00	16.45	0.01%
Irrigated Small Grains	3,414.34	3,428.14	-13.79	0.00%
Irrigated Dry Edible Beans	557.09	578.05	-20.96	-0.01%
Dryland Alfalfa	236.12	321.34	-85.22	-0.03%
Dryland Soybeans	41.53	224.60	-183.07	-0.06%
Irrigated Alfalfa	1,161.72	1,371.86	-210.14	-0.07%
Irrigated Sugar Beets		514.42	-514.42	-0.18%
Irrigated Sunflower	554.08	1,154.89	-600.81	-0.21%
Irrigated Soybeans	189.37	865.87	-676.49	-0.24%
Dryland Sunflower	5,842.90	21,019.21	-15,176.31	-5.38%
Dryland Small Grains	72,399.96	90,007.84	-17,607.89	-6.25%

Garden County (partial)

Garden				
CLASS	2001 Acres	1997 Acres	Acres Change	% of County Change
Irrigated Alfalfa	9,114.82	5,969.49	3,145.33	0.29%
Dryland Dry Edible Beans	3,552.76	450.97	3,101.80	0.28%
Dryland Sorghum	574.14	10.43	563.71	0.05%
Dryland Corn	8,717.41	8,433.15	284.26	0.03%
Irrigated Sorghum	307.13	30.69	276.44	0.03%
Irrigated Dry Edible Beans	657.39	518.37	139.02	0.01%
Irrigated Small Grains	4,216.78	4,161.41	55.37	0.01%
Irrigated Sunflower	213.65	238.12	-24.47	0.00%
Dryland Sugar Beets	0.00	336.22	-336.22	-0.03%
Dryland Soybeans	121.97	629.11	-507.14	-0.05%
Irrigated Sugar Beets	0.00	631.31	-631.31	-0.06%
Dryland Alfalfa	2,833.59	3,478.34	-644.75	-0.06%
Irrigated Soybeans	578.35	1,334.84	-756.49	-0.07%
Irrigated Corn	13,473.02	14,781.99	-1,308.97	-0.12%
Summer Fallow	44,968.24	47,115.95	-2,147.71	-0.20%
Dryland Small Grains	50,830.41	58,741.37	-7,910.97	-0.72%
Dryland Sunflower	2,631.77	12,448.12	-9,816.34	-0.90%

Kimball County

Kimball				
CLASS	2001 Acres	1997 Acres	Acres Change	% of County Change
Irrigated Corn	11,175.86	5,822.41	5,353.45	0.88%
Dryland Small Grains	148,595.21	144,552.94	4,042.27	0.66%
Irrigated Alfalfa	5,918.93	4,753.23	1,165.71	0.19%
Irrigated Dry Edible Beans	2,006.28	983.88	1,022.40	0.17%
Dryland Sunflower	3,304.01	2,692.93	611.08	0.10%
Dryland Sorghum	227.69	2.01	225.68	0.04%
Irrigated Sorghum	11.23	8.03	3.21	0.00%
Irrigated Potatoes	1.20	0.00	1.20	0.00%
Irrigated Sunflower	424.69	574.03	-149.35	-0.02%
Dryland Dry Edible Beans	623.09	969.80	-336.71	-0.06%
Irrigated Sugar Beets	1,341.06	1,840.52	-499.45	-0.08%
Dryland Corn	2,534.08	3,933.32	-1,399.25	-0.23%
Dryland Soybeans	0.00	1,515.36	-1,515.36	-0.25%
Irrigated Soybeans	2.01	1,706.04	-1,704.03	-0.26%
Irrigated Small Grains	6,201.19	8,377.88	-2,176.67	-0.36%
Dryland Alfalfa	911.76	3,526.28	-2,614.52	-0.43%
Summer Fallow	97,946.96	126,460.29	-28,513.33	-4.68%

Morrill County

Morrill				
CLASS	2001 Acres	1997 Acres	Acres Change	% of County Change
Irrigated Corn	57,286.77	46,911.88	10,374.89	1.13%
Irrigated Alfalfa	23,759.19	16,396.04	7,363.14	0.81%
Dryland Dry Edible Beans	4,847.09	1,008.37	3,838.72	0.42%
Dryland Corn	9,619.34	5,990.41	3,628.94	0.40%
Dryland Alfalfa	5,021.01	3,849.23	1,171.79	0.13%
Irrigated Sunflower	2,773.80	1,614.31	1,159.49	0.13%
Irrigated Dry Edible Beans	13,283.25	12,151.22	1,132.03	0.12%
Dryland Sorghum	1,049.58	3.81	1,045.77	0.11%
Dryland Sunflower	1,993.84	1,500.91	492.93	0.05%
Irrigated Sorghum	400.41	24.69	375.73	0.04%
Dryland Soybeans	78.24	1,549.69	-1,471.45	-0.16%
Irrigated Sugar Beets	461.00	4,758.04	-4,297.05	-0.47%
Irrigated Small Grains	7,919.80	12,770.41	-4,850.61	-0.53%
Irrigated Soybeans	258.78	11,904.74	-11,645.96	-1.27%
Summer Fallow	18,530.14	32,207.02	-13,676.88	-1.50%
Dryland Small Grains	26,835.91	48,118.55	-21,282.64	-2.33%

Scotts Bluff County

Scottsbluff				
CLASS	2001 Acres	1997 Acres	Acres Change	% of County Change
Irrigated Corn	78,598.34	66,458.88	12,139.46	2.55%
Irrigated Dry Edible Beans	38,955.23	32,151.82	6,803.40	1.43%
Irrigated Small Grains	12,928.37	9,801.50	3,126.87	0.66%
Dryland Dry Edible Beans	5,125.73	2,022.76	3,102.97	0.65%
Dryland Corn	7,607.25	5,605.64	2,001.60	0.42%
Irrigated Alfalfa	27,340.03	26,641.11	698.92	0.15%
Irrigated Potatoes	70.61	0.20	70.41	0.01%
Dryland Sunflower	34.71	348.83	-314.13	-0.07%
Dryland Sorghum	11.84	1,111.74	-1,099.90	-0.23%
Dryland Small Grains	14,648.98	16,253.14	-1,604.16	-0.34%
Irrigated Sunflower	290.28	2,192.96	-1,902.68	-0.40%
Dryland Alfalfa	3,677.54	7,725.95	-4,048.41	-0.85%
Summer Fallow	7,934.04	12,050.06	-4,116.02	-0.86%
Irrigated Sugar Beets	7,757.30	17,138.47	-9,381.17	-1.97%
Irrigated Sorghum	66.40	11,255.45	-11,189.04	-2.35%

Sioux County (partial)

Sioux				
CLASS	2001 Acres	1997 Acres	Acres Change	% of County Change
Irrigated Corn	13,493.28	12,025.84	1,467.45	0.29%
Irrigated Sugar Beets	1,329.23	1,694.94	-365.71	-0.07%
Irrigated Soybeans	0.00	1,211.27	-1,211.27	-0.24%
Irrigated Sorghum (Milo, Sudan)	6.62	0.00	6.62	0.00%
Irrigated Dry Edible Beans	3,116.24	3,492.58	-376.34	-0.07%
Irrigated Potatoes	0.40	0.60	-0.20	0.00%
Irrigated Alfalfa	8,104.35	6,930.00	1,174.36	0.23%
Irrigated Small Grains	2,387.43	3,003.70	-616.27	-0.12%
Irrigated Sunflower	117.76	461.60	-343.84	-0.07%
Summer Fallow	945.67	3,865.31	-2,919.65	-0.58%
Dryland Corn	1,471.66	728.61	743.05	0.15%
Dryland Soybeans	0.00	140.22	-140.22	-0.03%
Dryland Sorghum (Milo, Sudan)	10.43	0.00	10.43	0.00%
Dryland Dry Edible Beans	365.51	267.01	98.50	0.02%
Dryland Alfalfa	957.90	1,055.00	-97.09	-0.02%
Dryland Small Grains	877.46	3,014.13	-2,136.67	-0.42%
Dryland Sunflower	27.08	27.08	0.00	0.00%

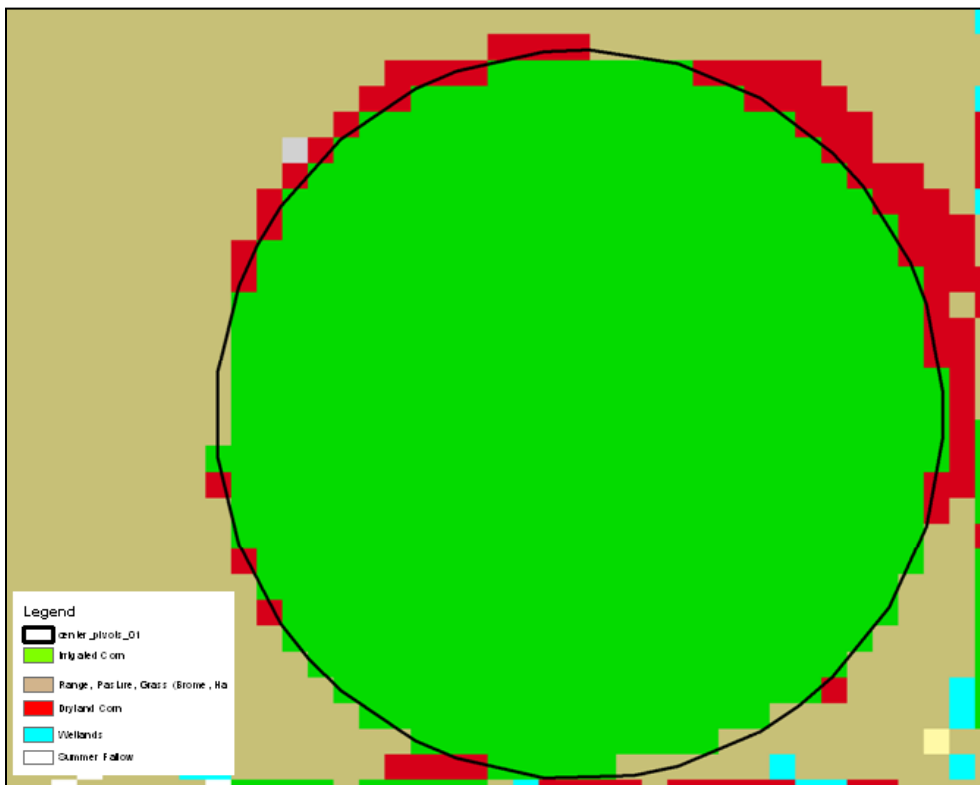
Irrigation Method Attributes: The 2001_pivots (sprinkler) and 2001_other_irrigation (flood) shapefiles provide irrigation method attribution.

Water Source Attributes: Surface and ground water sources are not currently assigned in any of the COHYST data sets.

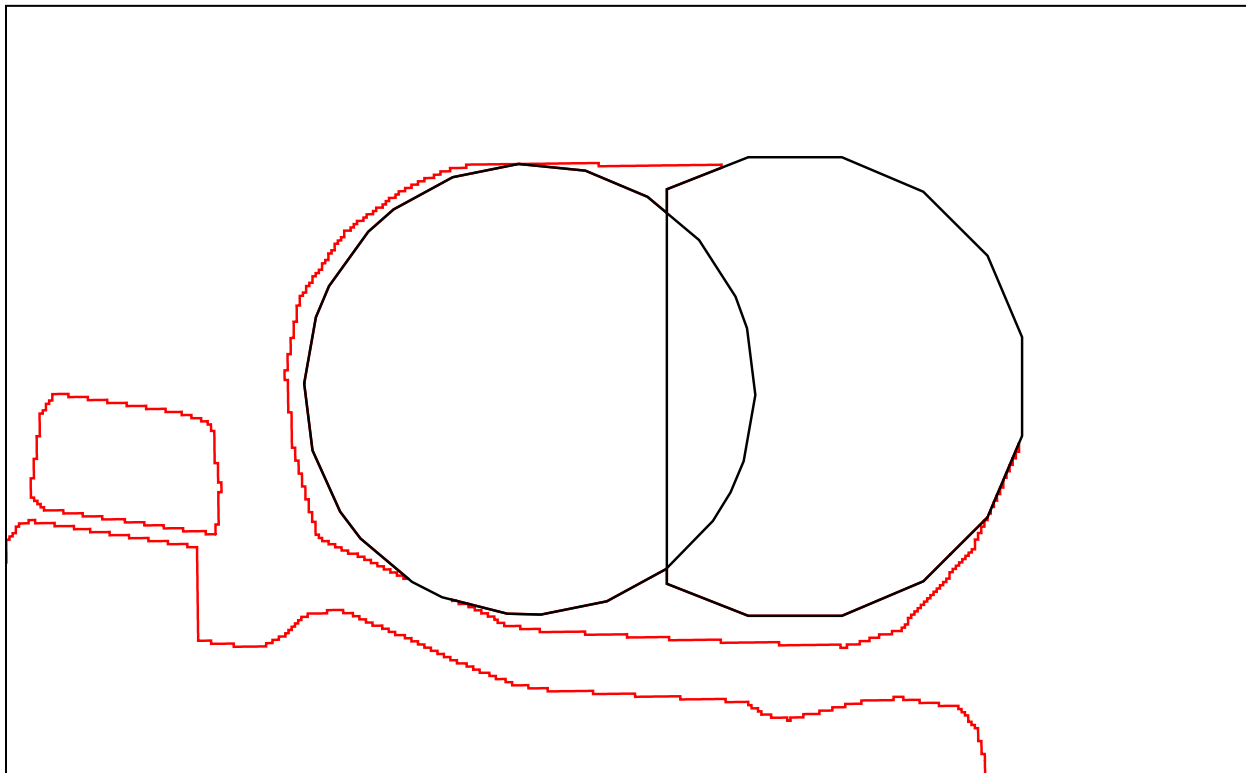
Quality Control Method:

Review of documentation to determine the level of accuracy, sources of information, and methodology used to develop the land use coverage and irrigated areas. A visual inspection of the land use coverage and shapefiles to confirm approximate field boundaries, irrigated areas, and cropped areas. In addition the use of geoprocessing tools would be used to assess the quality and integrity of the shapefiles to identify overlapping polygons, silvers, and other spatial errors. Geoprocessing tools can also be used to identify misclassified pixels based on a nearest neighbor approach. Below are a couple of images from the 2001 coverages illustrating the condition of the coverage:

Visual inspection of land use coverage shows dryland and irrigated corn in the same field



Visual inspection shows 2001 shows “other” and “pivot” shapefiles overlap



Quality Control Comments:

If used as a source of spatial irrigation information, we recommend refining the irrigated acreage shapefiles. The Landsat 7 ETM+ imagery does support a crop attribution in 2001, but may require some refinement to be used for the irrigated acreage assessment.

2005 Land Use Mapping

Source: Delineation of 2005 Land Use Patterns for the State of Nebraska Department of Natural Resources

Responsible Entity: CALMIT/University of Nebraska Lincoln

Source Link: http://www.calmit.unl.edu/cohyst/2005_landuse.shtml,
<http://www.calmit.unl.edu/2005landuse/>

Year: 2005

Type: Spatial

Format(s):

2005 Land Use Classification – 2005_landuse (ESRI Grid)

2005 Center Pivots – pivots_2005 (Shapefile)

2005 Other Irrigation – other_irr_2005 (Shapefile)

Area Extent: State of Nebraska

Background: An assessment of the 2005 land use patterns was completed in September 2007 for the Nebraska Department of Natural Resources. The assessment is an extension of the Platte River Cooperative Hydrology Study (COHST) to include the delineation of land use patterns statewide. Using the same methodologies developed in the previous COHST land use classification the assessment used the 2005 Landsat 5 Thematic Mapper (TM) satellite imagery to define 17 classes of land use. Landsat 7 ETM+ that was used to classify the 2001 land use developed technical issues and was not used for this effort. Crops were classified using multi-date imagery acquired for May, July, and September to account for spectral variations due to crop development. To improve the accuracy of the classifications spectral signatures for specific crops were characterized during their dates of maturation. The classification of spring to mid-summer crops such as winter wheat, grass/hay/pasture, and range were the highest when all three images were used (May, July, and September). For crops that mature during the late summer only two images were used (July and September). To cover the COHST study area eighteen scenes and 37 Landsat 5 TM images were used to classify the 2005 land use coverage using supervised and unsupervised classification methods.

Supervised classification involves three basic steps: sample/training stage, classification, and output. In the training stage, the user identifies pixels in the image that represent a land cover type present in the scene. Sample areas of known crops and land use were classified to train the computer system to identify pixels (areas) with similar spectral characteristics. The success of the classification is directly dependent on collection of truly representative samples or training areas. Previous COHST efforts used USDA Farm Service Agency (FSA) reporting records as the primary source of crop information to determine training areas for agricultural classes. At the time that the 2005 assessment the FSA reporting records were unavailable. The primary source of crop information used to determine training areas for agricultural classes were provided by the Nebraska Natural

Resource Districts (NRDs). Each NRD was responsible for collecting field data in their district. Each NRD collected a minimum of fifty GPS points and recorded crop type and whether the crop was irrigated or non-irrigated. Other supplemental data such as 2003 and 2005 digital orthophoto quarter quadrangles (DOQQ) and National Wetlands Inventory (NWI) were used to support the supervised land use classification process. After all of the training sites were collected and evaluated, they were used to drive the supervised classification, which is an iterative process to optimize the classifications.

Unsupervised classifications were completed for scenes that only have one date of imagery that was available. Unsupervised classification does not use training sites as a basis for classification. Instead, the image is classified based on natural groupings of pixels with similar spectral properties. Ancillary information such as the 2003 and 2005 DOQQ and field data obtained from the NRDs were used to confirm classifications.

Classified images were combined into a single coverage and then post processed to account for urban areas, roads, and smooth the image to only include major classes as contiguous areas. The initial supervised and unsupervised land use classification results do not identify dryland or irrigated lands. The output of the classification resulted in 17 land use classes:

- | | |
|------------------------|-----------------------------------------------------|
| 1. Corn | 10. Open Water |
| 2. Sugar Beets | 11. Riparian Forest and Woodlands |
| 3. Soybean | 12. Wetlands |
| 4. Sorghum | 13. Other Agricultural Lands (Farmsteads, Feedlots) |
| 5. Dry Edible Beans | 14. Sunflower |
| 6. Potatoes | 15. Summer Fallow |
| 7. Alfalfa | 16. Urban Areas |
| 8. Small Grains | 17. Roads |
| 9. Range/Grass/Pasture | |

2005 Irrigated Areas

Two types of irrigated areas were created for the COHSYT study area for 2005: center pivots, and other irrigated areas (non-pivots). The 2005 irrigated areas shapefiles are used to define irrigated area within the land use coverage.

The 2005 center pivots were primarily identified using the 2005 Landsat 5 TM imagery. Supplemental information such as the field data from the NRDs, and the 2003 and 2005 digital orthophoto quarter quadrangles (DOQQ), and 2005 registered wells was also used. The result is the **05_pivot_update** shapefile.

The 2005 final report does not document the development of the 2005 “other” irrigated areas shapefile specifically. It is assumed the same approach used to develop the 1997 “other” irrigated acreage was used. In the previous COHYSY analyses the “other” irrigated areas shapefile were digitized from sources such as digital maps from Pathfinder Irrigation District and canal project maps from the Nebraska Division of Natural Resources (NDNR). The canal project maps include; Castle Rock, Steamboat, Chimney Rock, Empire, Midland-Overland, Graf Canal, Keith Lincoln, North Platte Canal, Paxton Hershey, Birdwood, Suburban, Cody-Dillon, Western Canal, Thirty Mile Canal, Six Mile Canal, Cozad Canal, and Orchard-Alfalfa Canal. Other sources used to delineate field

boundaries include FSA reporting records from 2001, field data from the NRDs, and the 2003 and 2005 digital orthophoto quarter quadrangles (DOQQ), county assessors information (where available), and surface irrigation rights maps from the NDNR. One method used to delineate irrigated areas that is unique to the 2005 irrigated shapefiles is the use of the Normalized Difference Vegetation Index (NDVI). Using the 2005 Landsat 5 TM images the NDVI method classifies images to determine irrigated versus non-irrigated areas. Similar to the supervised classification method the NDVI method uses training areas to determine spectral differences between irrigated and non-irrigated areas. Once the 2005 irrigated areas shapefiles were completed it is assumed the 2005 irrigated acreage maps were then sent to each corresponding Division of Natural Resources (DNR) within the COHYST boundary to be checked for accuracy. The result is a shapefile **other_Irr_05**.

Once irrigated areas were identified and digitized they were overlaid onto the land use grid. Land use cells with irrigated areas were then reclassified by crop as irrigated and areas that are not irrigated were reclassified by crop as a dryland. The result is the final 2005 Land Use Classification **land_cover_05** (ESRI Grid). The classification contains the 17 listed above as well as 7 dryland crops classes.

There has been a substantial effort to create the 2005 land use data set and corresponding irrigated areas shapefiles. The information that has been compiled will help support the North Platte NRD Irrigated Acreage Assessment. Below are some general comments and primary issues that we identified with the land use coverage and shapefile development:

- The spatial resolution of the 2005 Landsat 5 TM is 30 meters. At this resolution fields, roads, and other political boundaries are distinguishable and the accuracy of the land use classification is significantly increased. The pixel size is equivalent to 0.20 acres per/pixel resulting in a more accurate classification.
- Irrigated field boundaries digitized from the 2005 Landsat TM do not match the boundaries from the 2005 DOQQ.
- Only July and August of 2005 Landsat 5 TM imagery was used to classify land use within the NPNRD and SPNRD boundaries.
- The accuracies reported in the 2005 final report indicate the highest error arose from misclassification of irrigated soybeans and irrigated corn in the 2005 land use coverage.
- The acreage totals by crop are based on the land use grid not actual field boundaries, therefore may not directly be comparable to other sources such as NASS. Note acreage totals are for the whole county so acreage summaries for counties that are partially in the COHYST boundary are not correctly accounted for.
- The classification of the 2005 coverage is only as good as the accuracy of the samples used for the supervised classifications. In some cases the field data from the NRDs did not supply sufficient field verification to correctly classify crops.
- Land use classification of transition zones between crops were not correctly classified due to the variation of mixed of pixels in these areas.
- For the 2005 study, all sugar beets and potatoes are assumed to be irrigated. The 1997 assessment has acreage for dryland sugar beets.

Crop Type Attributes: Cropping patterns are not attributed within the other or pivot irrigated areas shapefiles, but are classified as a part of the land use coverage. Acreage totals are tabulated by county in the final 2005

report. Note that the acreage totals in the report by crop are based on the land use grid not actual field boundaries, therefore may not be directly comparable to other sources such as NASS. Also, note that the acreage totals are for the whole county so acreage summaries for counties that are partially in the COHYST boundary are not correctly accounted for.

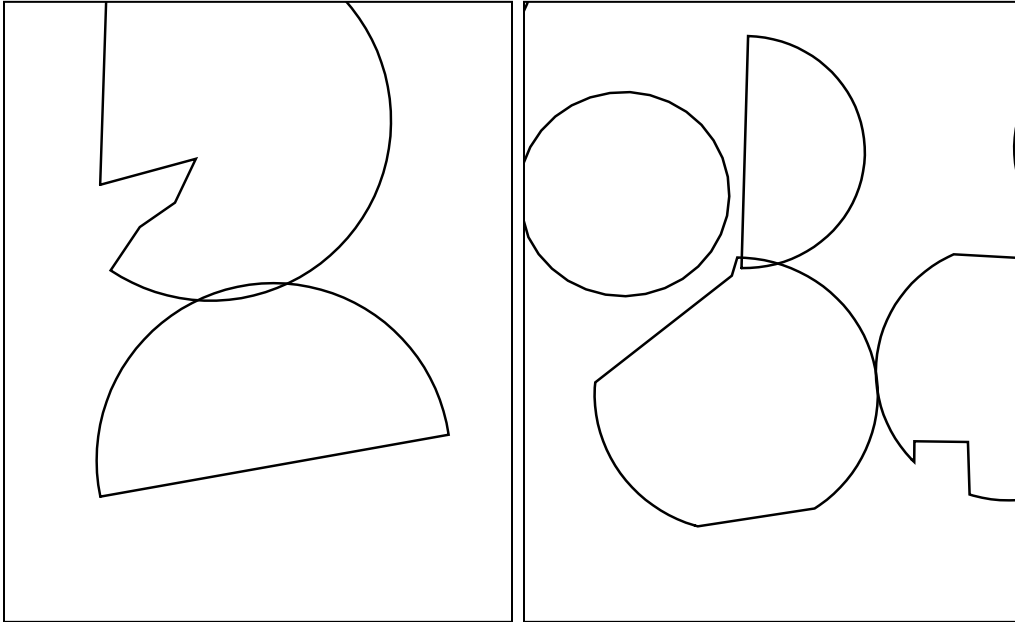
Irrigation Method Attributes: The 2005_pivots (sprinkler) and 2005_other_irrigation (flood) shapefiles provide irrigation method attribution.

Water Source Attributes: Surface and ground water sources are not currently assigned in any of the COHYST data sets.

Quality Control Method:

Review of documentation to determine the level of accuracy, sources of information, and methodology used to develop the land use coverage and irrigated areas. A visual inspection of the land use coverage and shapefiles to confirm approximate field boundaries, irrigated areas, and cropped areas. In addition the use of geoprocessing tools would be used to assess the quality and integrity of the shapefiles to identify overlapping polygons, silvers, and other spatial errors. Geoprocessing tools can also be used to identify misclassified pixels based on a nearest neighbor approach. Below are a couple of images from the 2005 coverages illustrating the condition of the coverage:

Visual inspection of sprinkler coverage shows overlapping polygons



Visual inspection shows 2005 shows “other” irrigated area shapefiles should be refined



Quality Control Comments:

If used as a source of spatial irrigation information, we recommend refining the irrigated acreage shapefiles. The Landsat 5 TM imagery does support a crop attribution in 2005, but may require some refinement to be used for the irrigated acreage assessment.

2005 Certified Acres GIS Layer

Source: United States Department of Agriculture (USDA)

Responsible Entity: North Platte Natural Resources District (NPNRD)

Source Link: <http://www.npnrd.org/certification.htm>

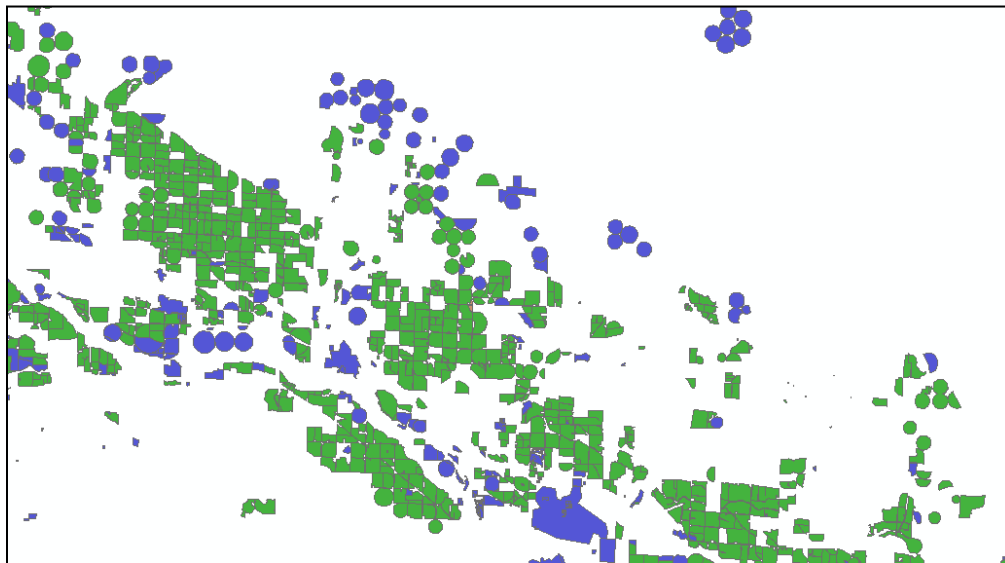
Year: Spatial coverage based on 2005 imagery

Type: Spatial

Format: Shapefile, polygons

Area Extent: Irrigated Acreage partial coverage of NNPR study area in Nebraska.

Background: This data set consists of multipart-polygons of acreages and properties certified for the use of ground water throughout the North Platte Natural Resources District. The polygon features (tract) in this data set represent areas where ground water was used between January 1st 1997 and July 24th 2004 (these are the parcels used in recent water accounting). These polygons were either copied from the United State Department of Agriculture's (USDA) Common Land Unit (CLU) 2005 Layer or hand digitized based on aerial photography. The polygons in this data layer are certified by the North Platte Natural Resources District (NPNRD) for the use of ground water.



Description of Attributes

Attribute	Description
Cert_Num	Stands for certification number. This is a unique number assigned to each tract (multi-part polygon) certified for groundwater use in the NPNRD
Surface_Wat	Stands for surface water. This is a yes or no field. Y means the tract also has surface water assigned to. The NPNRD refers to this as commingled tracts. No means the only source of water for this tract is ground water. The NPNRD calls these ground water only tracts.
OA	Stands for Overappropriated Area. This is a yes no field. Yes means the tract is in the Overappropriated Area. No means the tract is not in the Overappropriated Area.
HYPERLINK	This is a hyperlink field that will open the scanned certification (pdf) when activated in GIS at the NPNRD.
Date_Cert_1	This is the date the NPNRD board approved the certification.
App_Num_1	This is the owner (Applicant Number) number. This number corresponds to an owner record in the NPNRD Access Database.
ContactID	This is the contact number for the tract. This number corresponds to a contact record in the NPNRD Access Database.
DAUPECIT_1	This is the id field for allocation units. These allocation units combine tracts and their water use.
First_Irr_1	This field contains the year the tract was first serviced (e.g. First irrigated) by a groundwater well.
CertifiedU	Stand for Certified Units. This field contains the units certified to each tract (e.g. units for irrigated tracts are acres)
CertType	Stands for Certification type. This field indicates the type of certified ground water use (e.g. irrigation, feedlot, commercial, municipal).

Crop Type Attributes: Crop type is not included in the spatial coverage.

Irrigation Method Attributes: Irrigation method is not included in the spatial coverage.

Water Source Attributes: Specific surface and ground water sources are not attributed in this coverage. However, each tract is labeled as having either a surface water source, a groundwater source, or even both sources.

Quality Control Method: Compare spatial polygons to 2005 aerial imagery to determine accuracy of parcel boundaries. Determine which attributes can be linked back to the NPNRD and DNR well databases.

Quality Control Comment: This coverage provides the most accurate attribution of surface water and/or ground water supplies to irrigated parcels and is the only publically available source that explicitly assigns well structures to parcels. This coverage also provides the most accurate delineation of parcel boundaries based on the 2005 aerial imagery, although parcel boundaries are only available for certified lands. We recommend utilizing this data source as the basis of the parcel boundary refinement and use the attributes to assist in removing irrigated lands back in time.