

Niobrara River Basin Study Update

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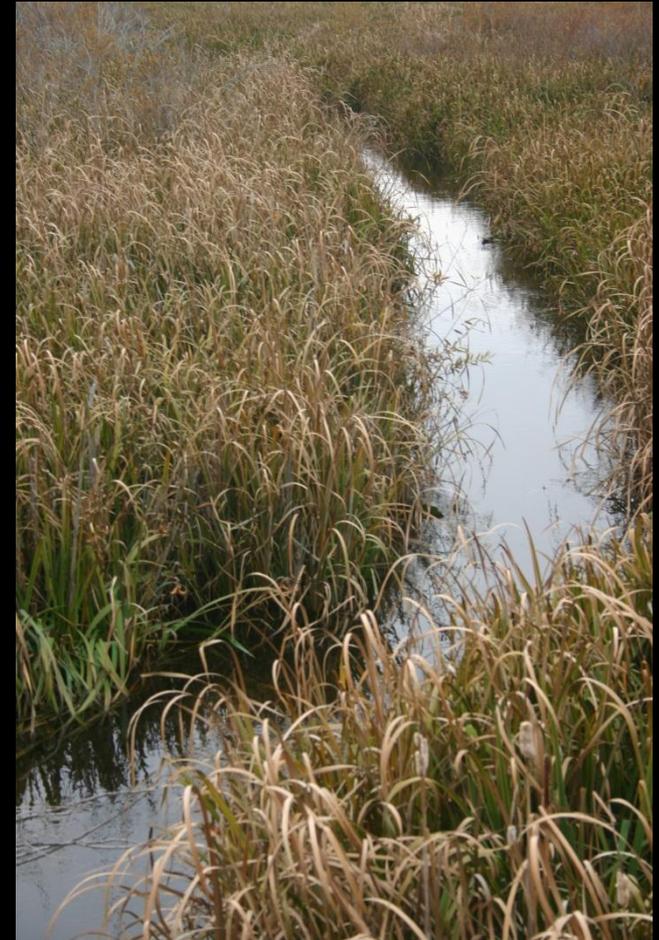


Overview

- Project Purpose & Goals
- Model Approach
- Upper & Lower Model Progress
- Scenario Development
- Timelines
- Stakeholder Input

Purpose

- Model the hydrologic surface-groundwater interactions and economic effects of various water management strategies in order to develop water management tools



Goals

- Develop Tools for Water Managers
- IMP Data Development
- Water Use Optimization
- Evaluate Effects of a Variable Water Supply
- Evaluation of Management Options

Objectives

- Characterize & quantify basin water resources
- Determine current/future water demands
- Provide foundational info for development and implementation of IMPs
- Identify opportunities for meeting water supply needs (i.e. aquifer storage, retiming, water banking)
- Evaluate future operations of basin reservoirs through variable supply conditions

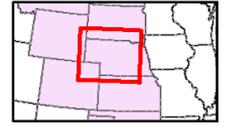
NDNR & USBR: Project Components

- Integrated land-surface-groundwater model (NDNR)
- Economic tool development and analyses (Bureau)
- Effects of variable water supply (Bureau)

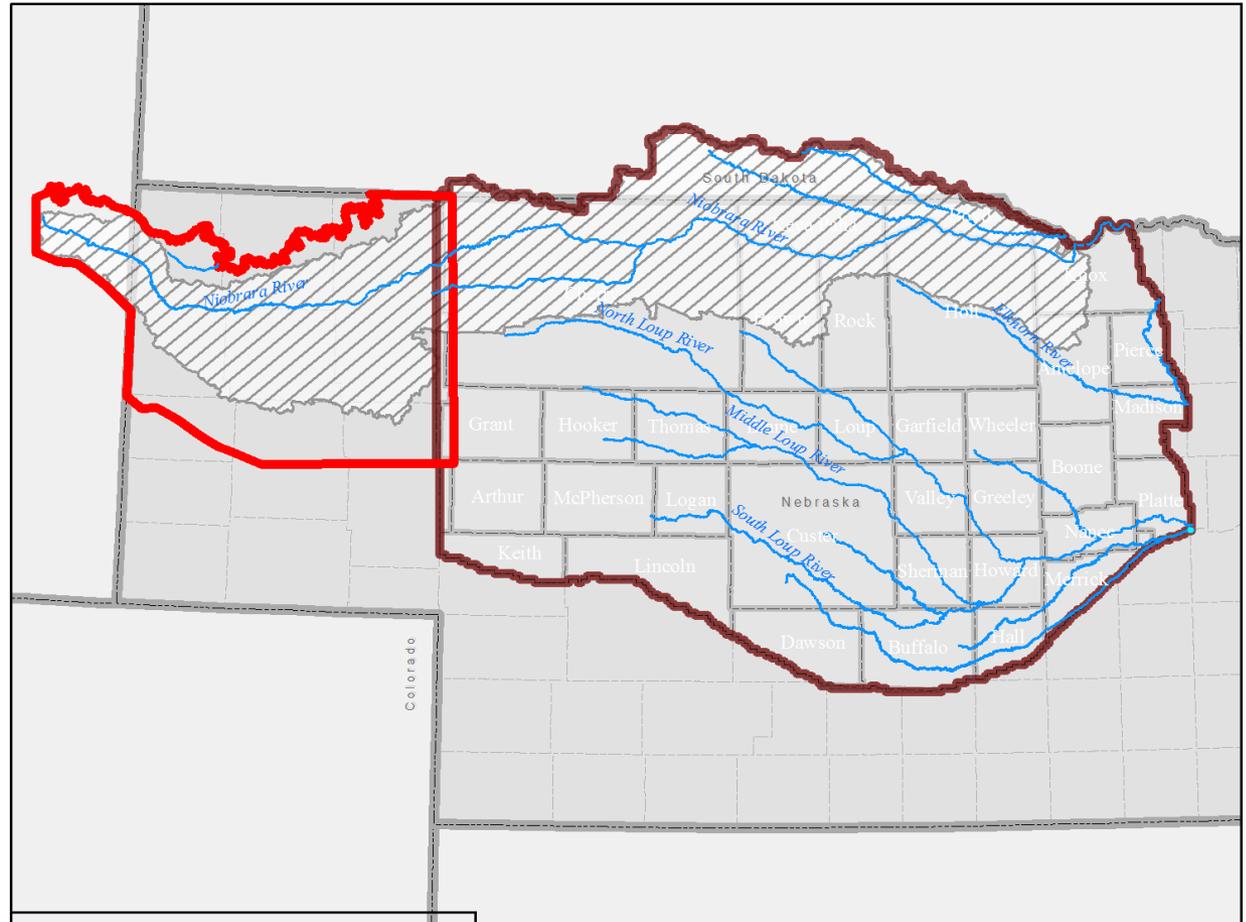




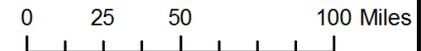
Niobrara Basin WaterSMART Study: Model Areas



Study Area map

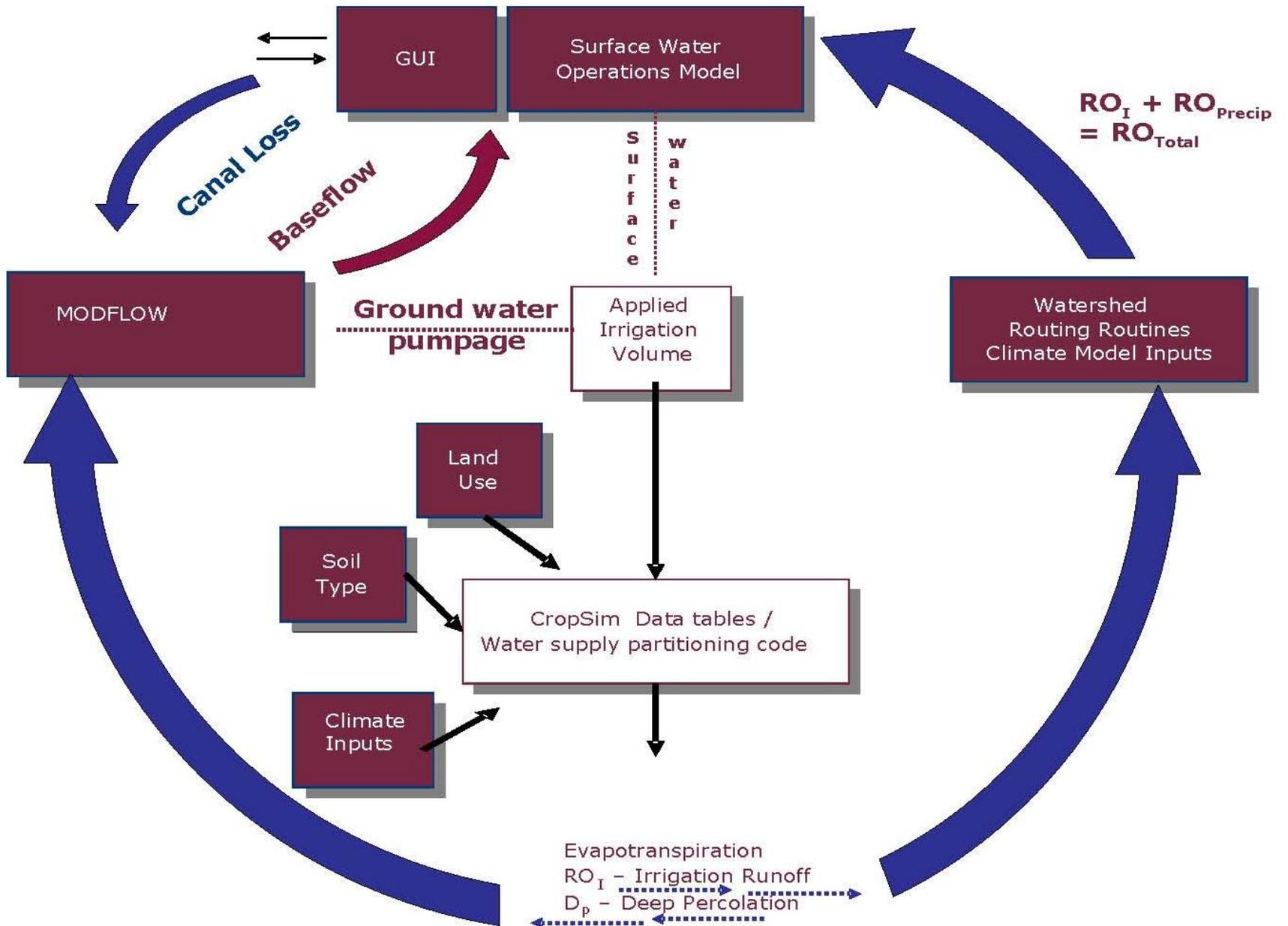


- Study Area Rivers
- Upper (UNW) Model Boundary
- Lower (CENEB) Model Boundary
- ▨ Niobrara Basin
- Counties



NDNR: Integrated Hydrologic Models

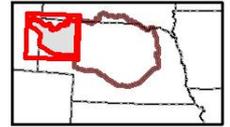
- CROPSIM – formulates crop water demands, recharge, & runoff
- MODFLOW – Models effects of changing recharge & pumping on groundwater flow
- STELLA – Approximation of water routing through streams, canals, & reservoirs



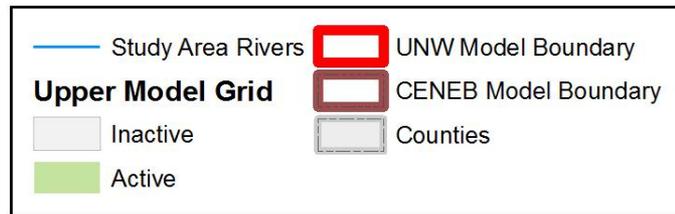
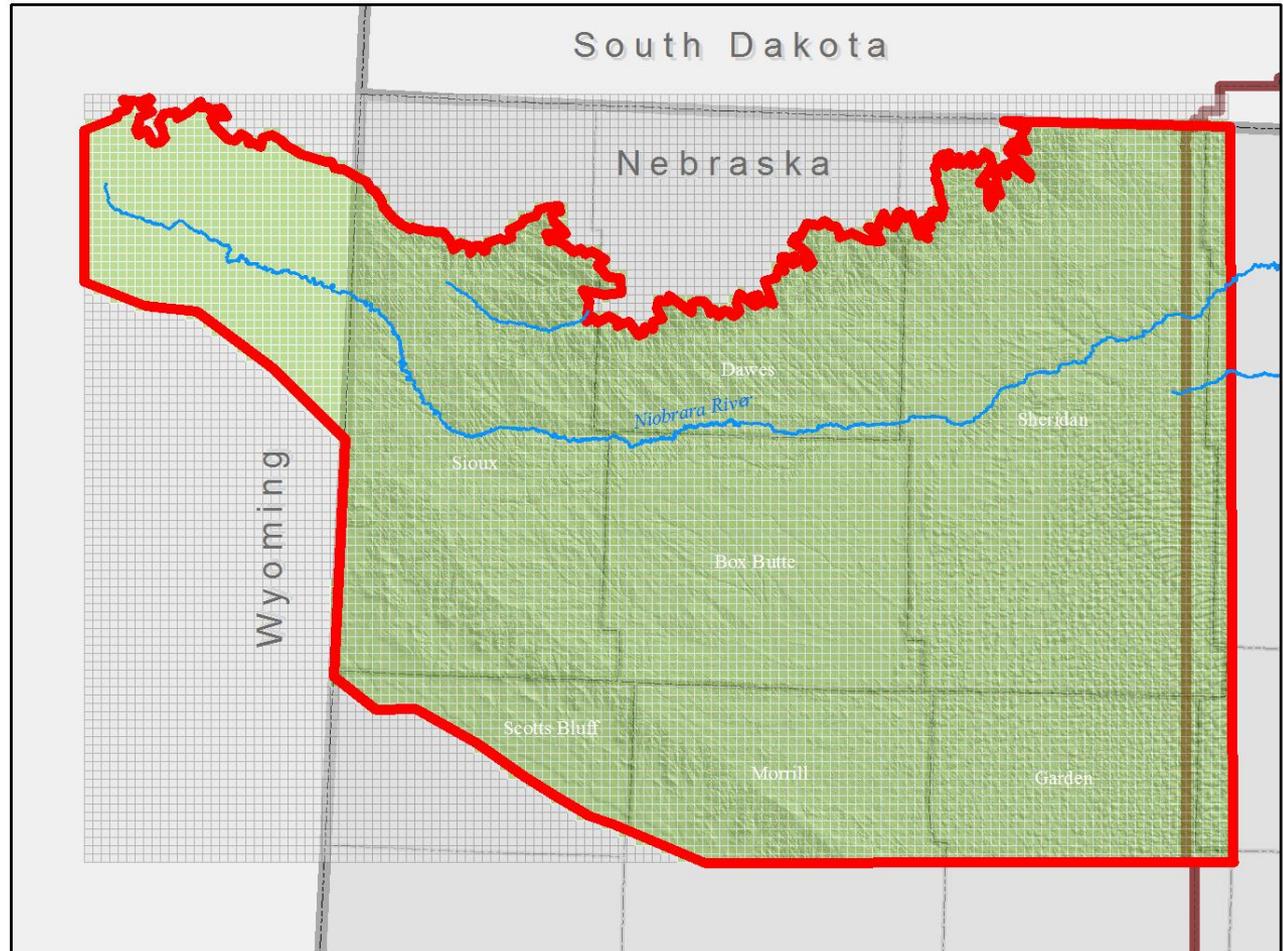
UPPER BASIN MODEL



Upper Niobrara Basin (UNW) Model Boundary



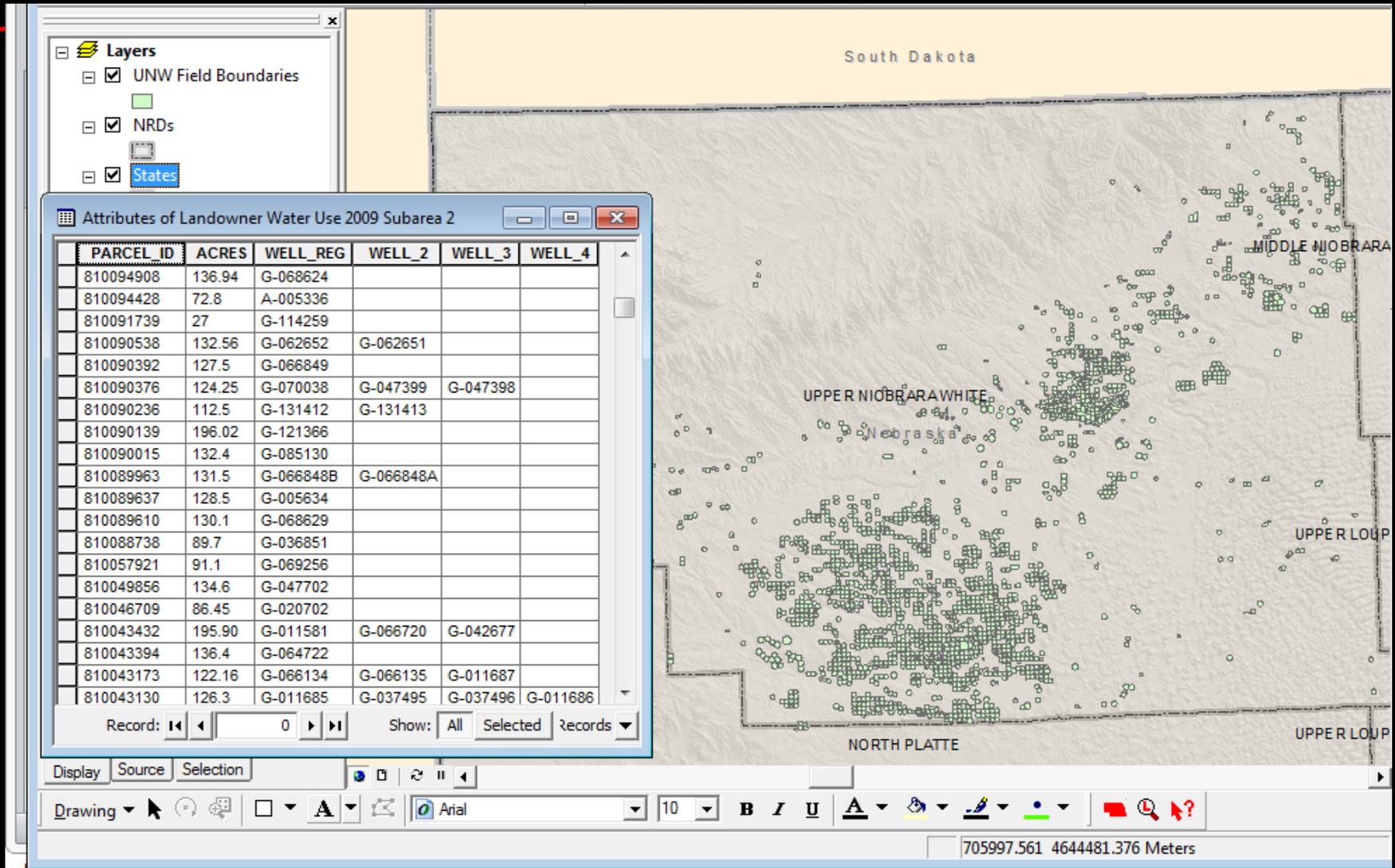
Upper Basin Model Area



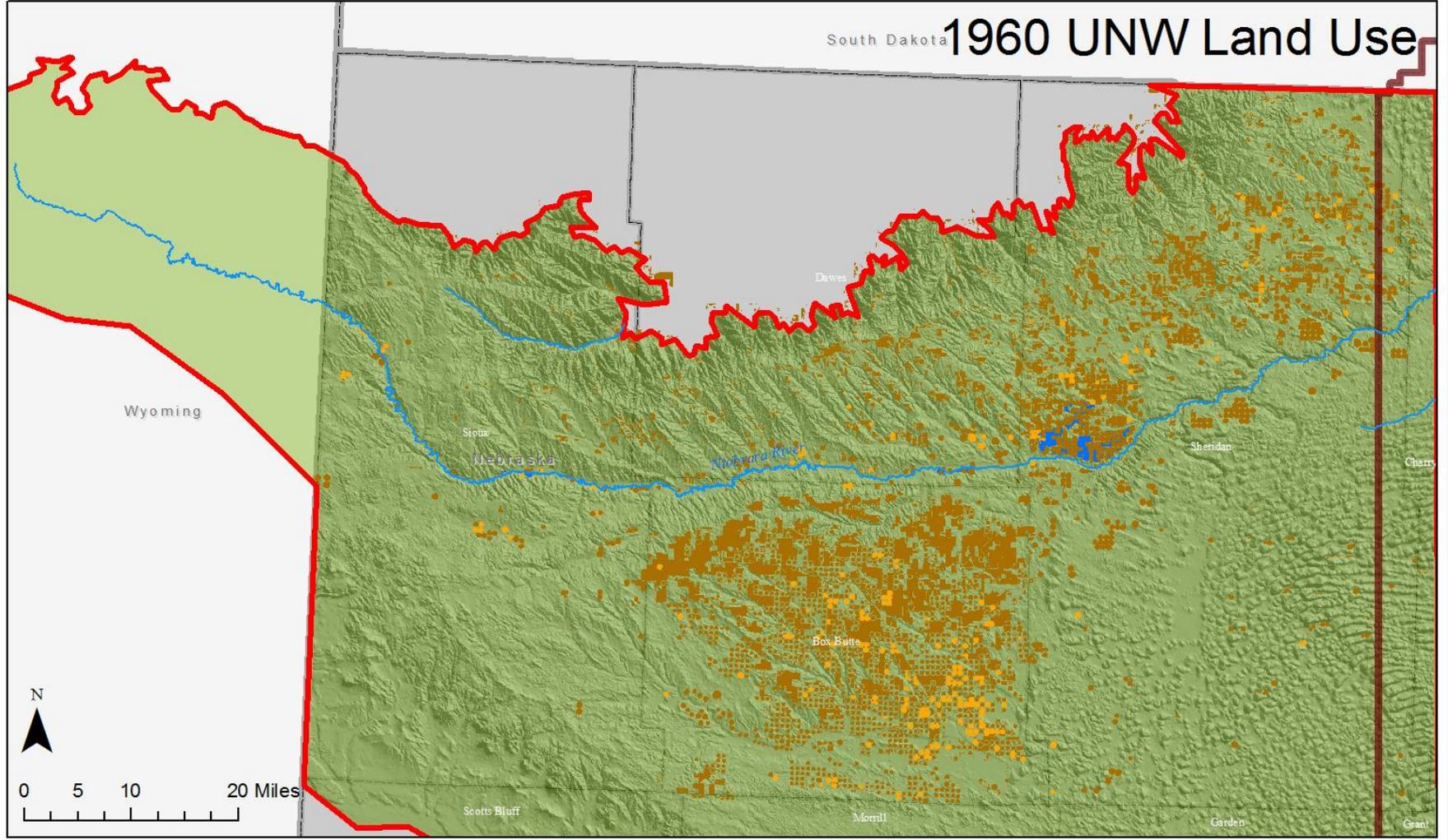
Land Use

- Purpose: To estimate land cover, ie crop types through the length of the model
- Data Sources
 - UNWNRD Certified Acres
 - NASS annual county acres data
 - COHYST landuse (outside of UNWNRD)
- 1940-Present

UNWNRD Certified Acres Dataset



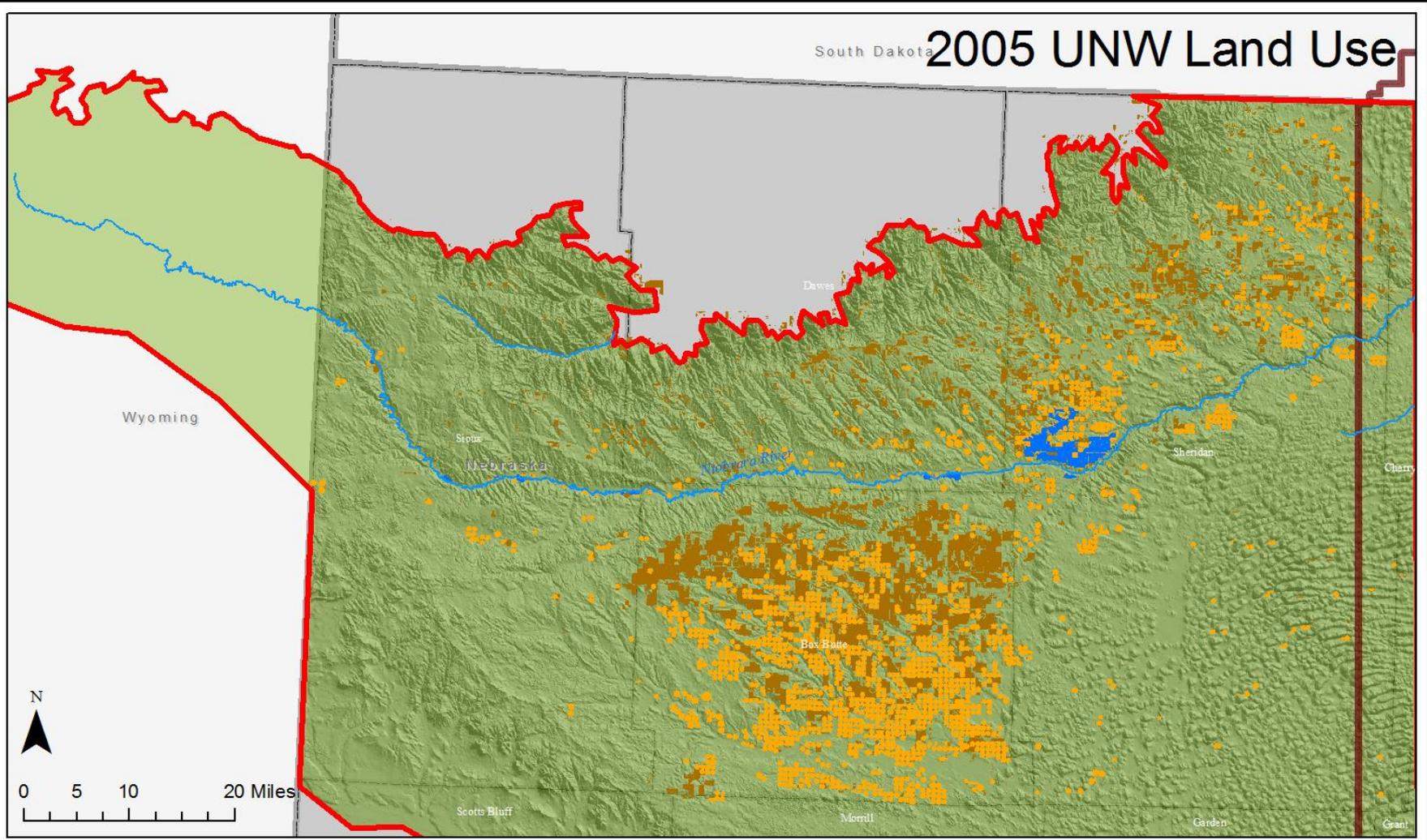
South Dakota 1960 UNW Land Use



- | | | | | | |
|---|--------------------|---|----------------------|---|-------------------------|
|  | Study Area Rivers |  | CENEB Model Boundary |  | Groundwater Irrigated |
|  | Counties |  | Dryland |  | Surface Water Irrigated |
|  | UNW Model Boundary |  | Rangeland | | |



2005 UNW Land Use



- | | | |
|--|--|---|
|  Study Area Rivers |  CENEb Model Boundary |  Groundwater Irrigated |
|  Counties |  Dryland |  Surface Water Irrigated |
|  UNW Model Boundary |  Rangeland | |



CROPSIM

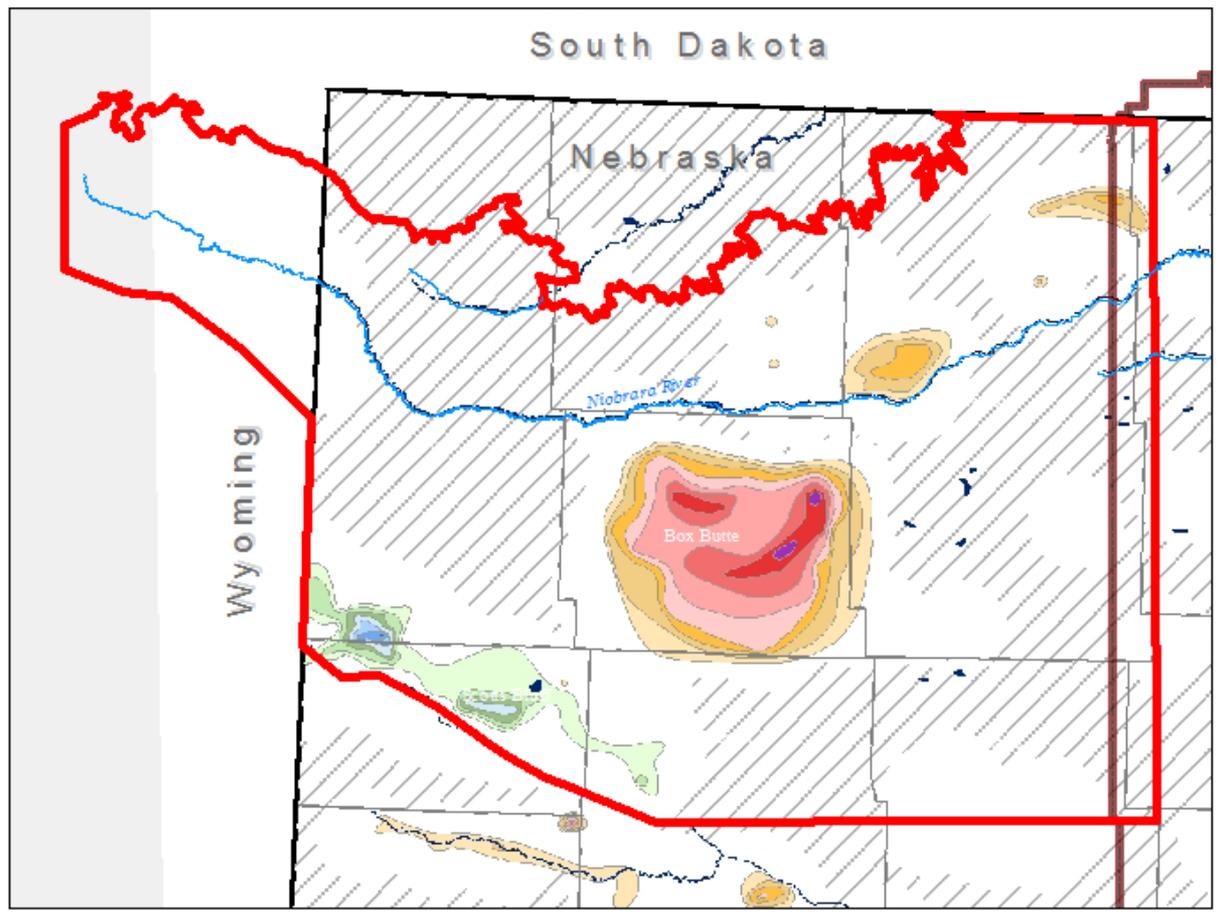
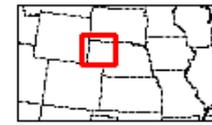
- Model Program that:
 - Determines crop irrigation requirements
 - Determines estimates of pumping and recharge
 - Provides input to both surface and groundwater models

Upper Niobrara Basin Groundwater Model

- MODFLOW—Groundwater Flow Model
- Relevant Outputs
 - Drawdown in Box Butte County
 - Groundwater Contribution to Niobrara River Flow
 - Gain/Loss of Box Butte Reservoir

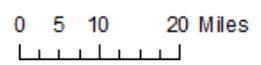


CSD Reported Drawdown Predevelopment to Spring 2011



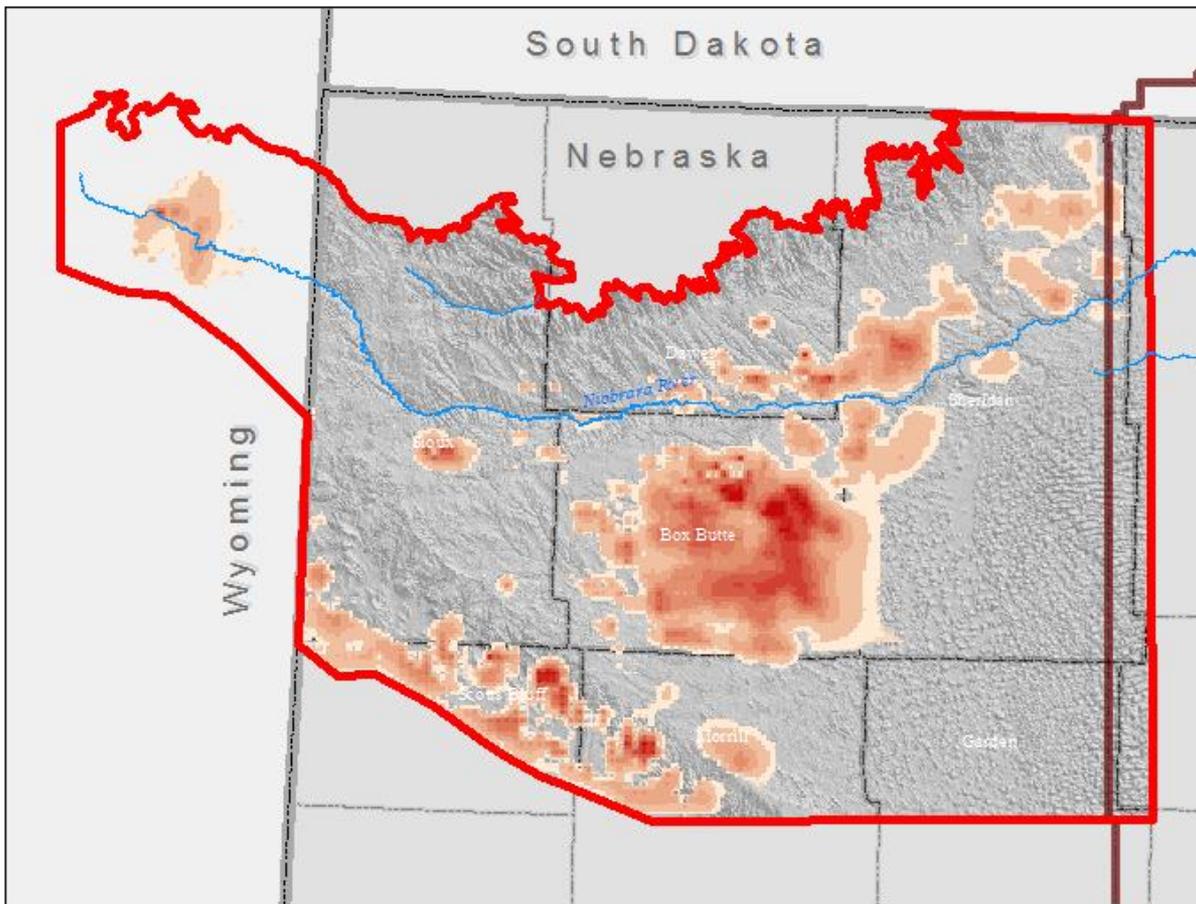
Study Area Rivers	Decline in Feet
UNW Model Boundary	0 to 10
CENEB Model Boundary	10 to 20
Counties	20 to 30
	30 to 40
	40 to 50
	50 to 60
	60 to 70
	> 70

This image is a georeferenced Figure 13 from "Nebraska Statewide Groundwater-Level Monitoring Report, 2011" Nebraska Water Survey Paper Number 79 Conservation and Survey Division



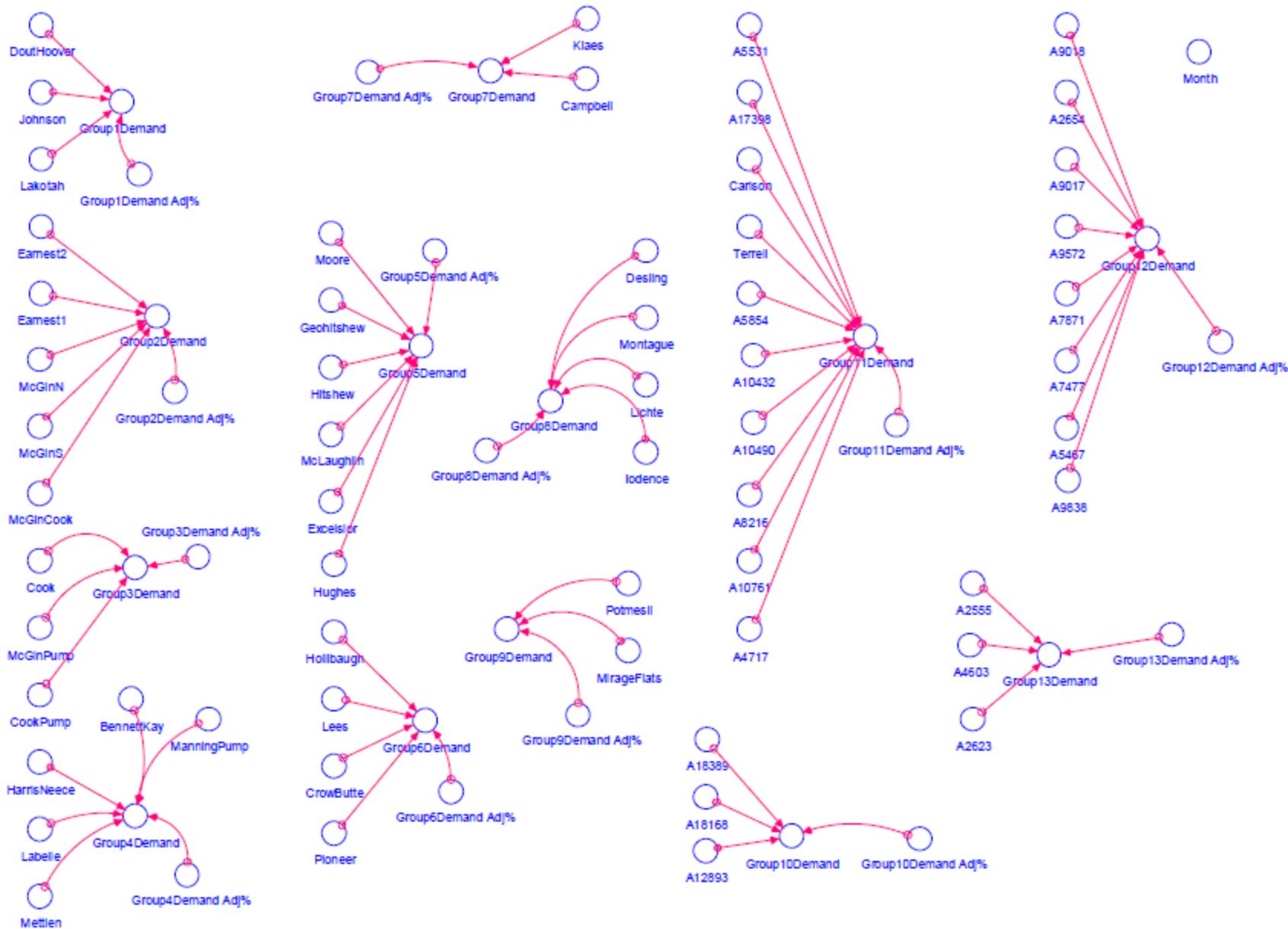


Modeled Drawdown



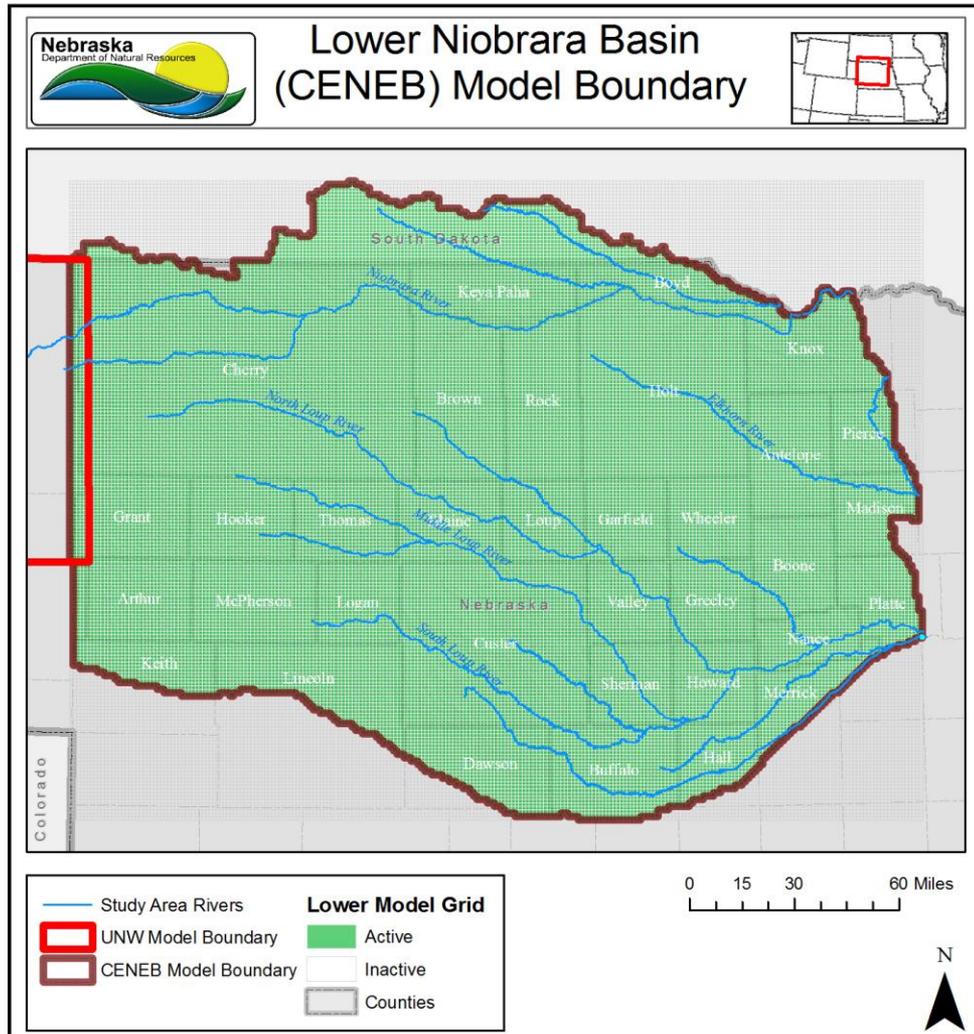
Study Area Rivers	Modeled Drawdown	
UNW Model Boundary	Low	High
CENES Model Boundary		
Counties		





LOWER BASIN MODEL

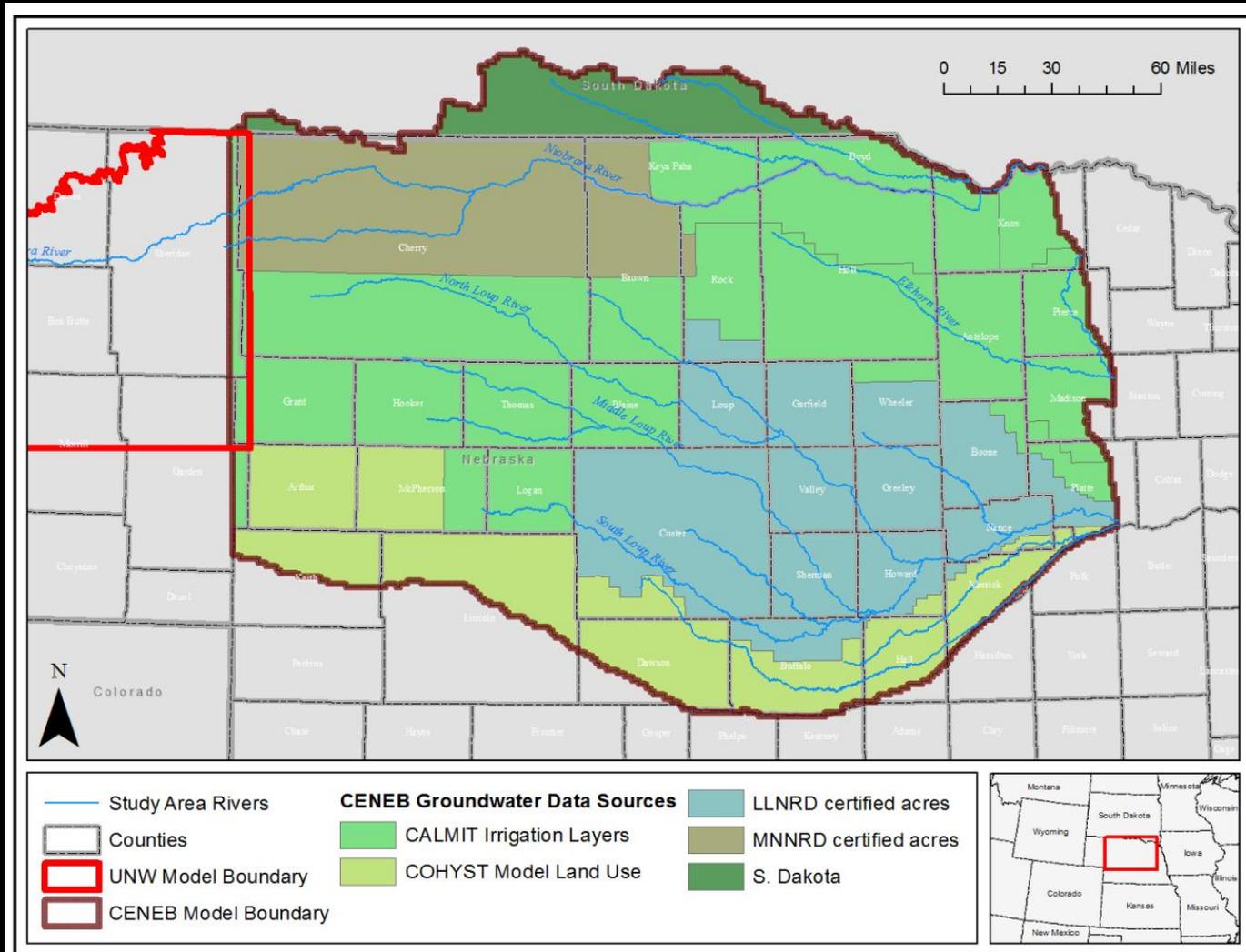
Lower Basin Study Area Map



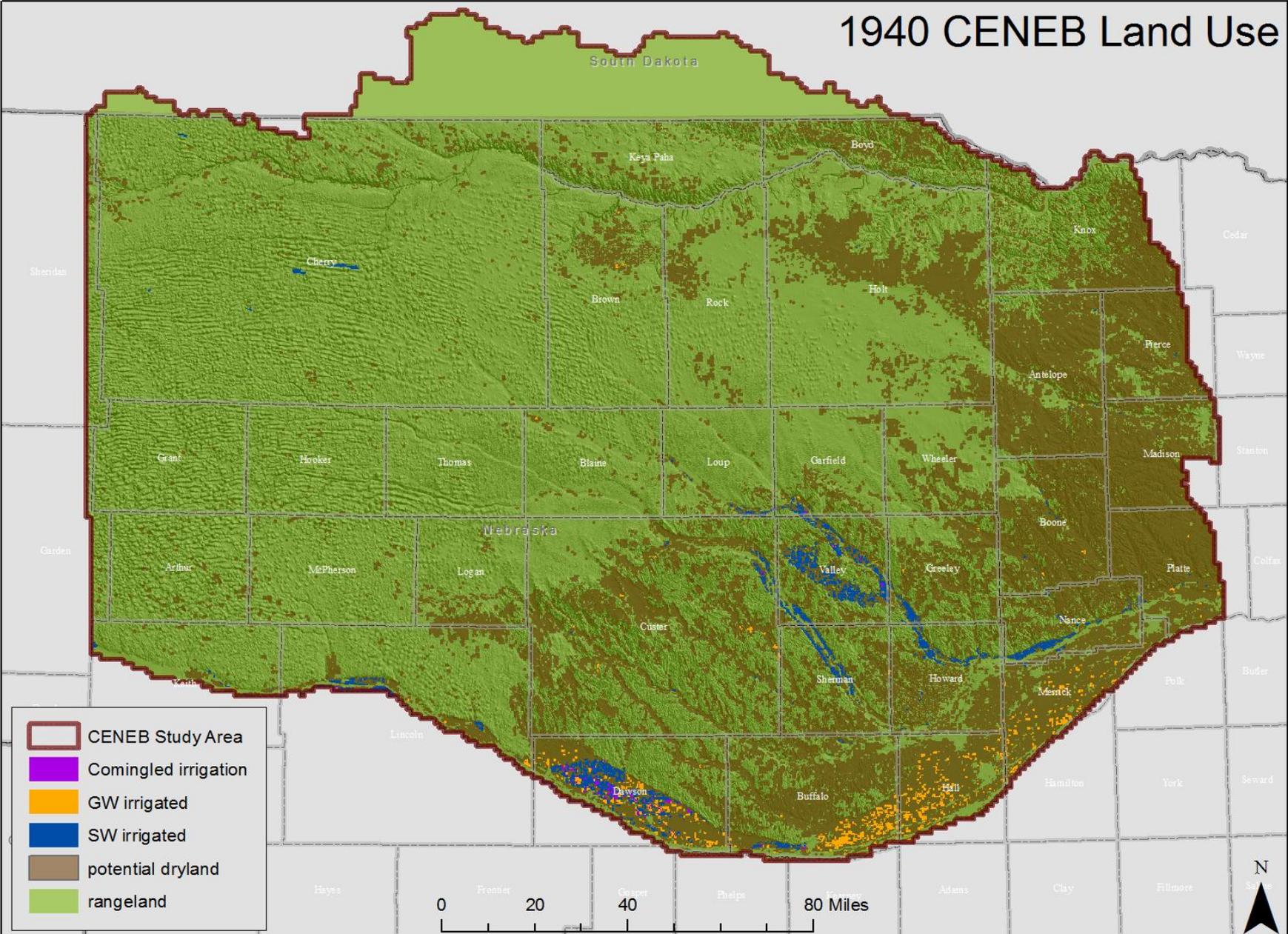
Land Use

- Purpose: To estimate land cover, ie crop types through the length of the model
- Data Sources
 - NRD Certified Acres
 - COHYST
 - CALMIT 2005 state-wide coverage
 - NASS annual county acres data
- 1940-Present

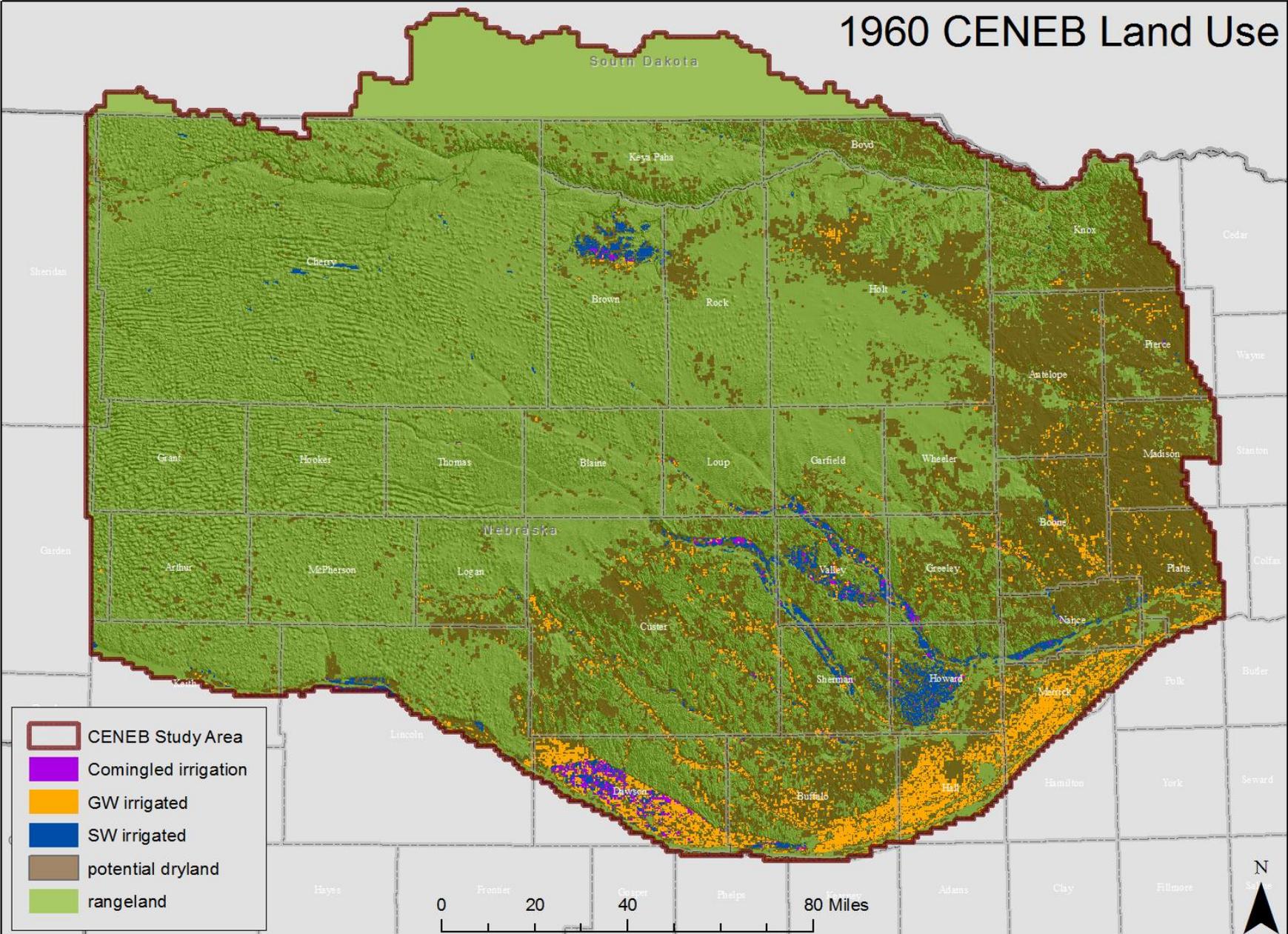
Land-Use



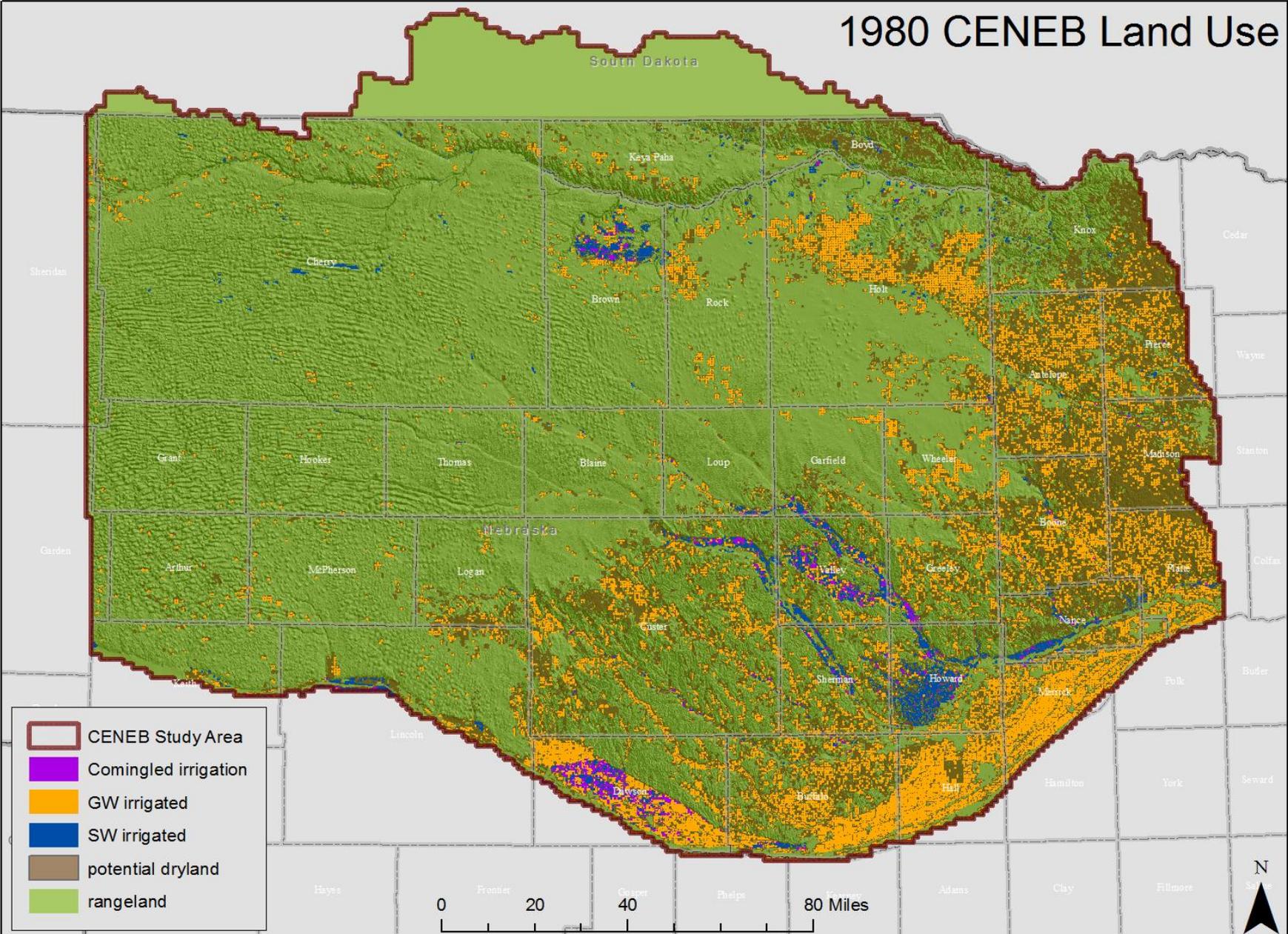
1940 CENEb Land Use



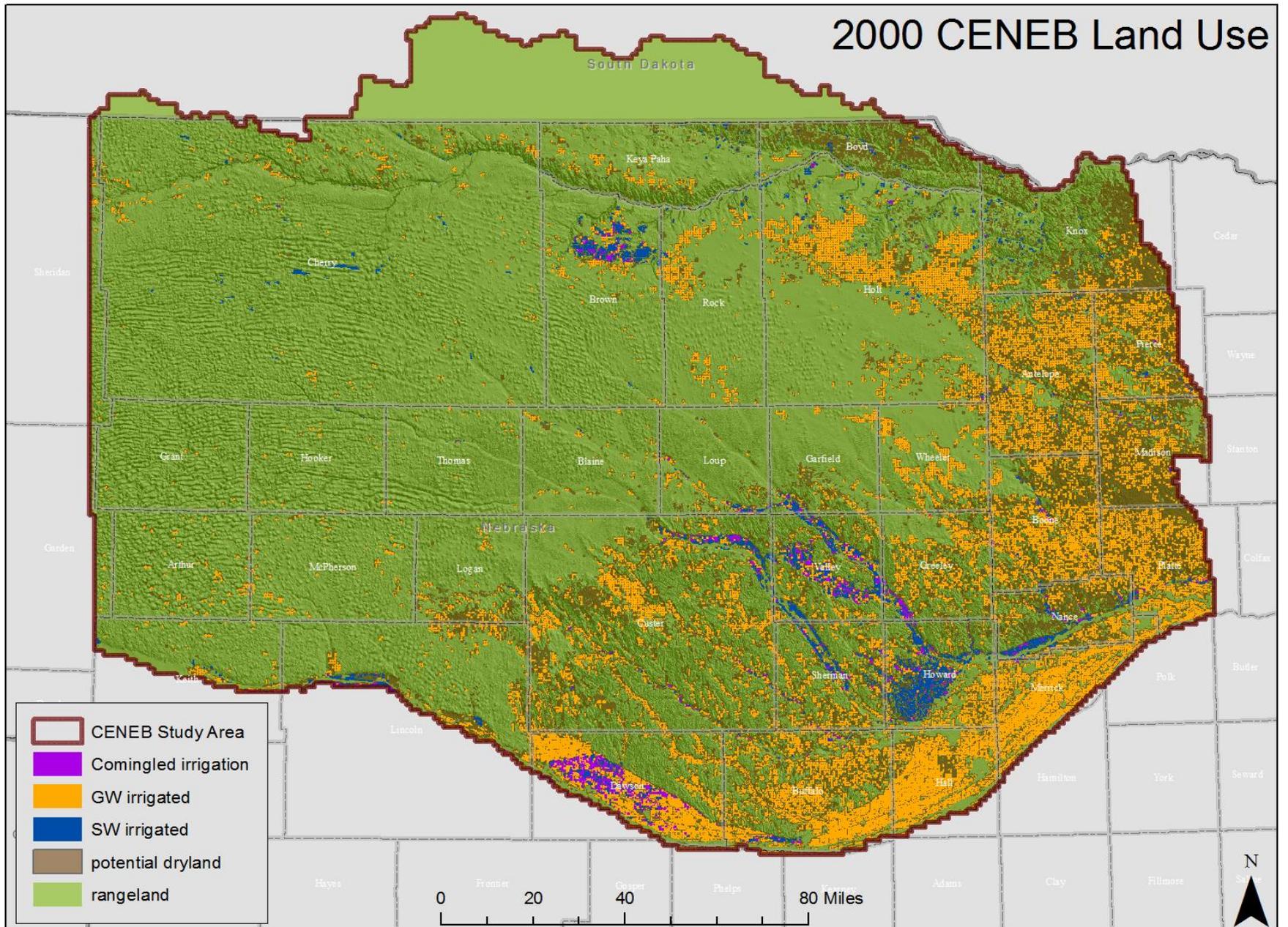
1960 CENEb Land Use



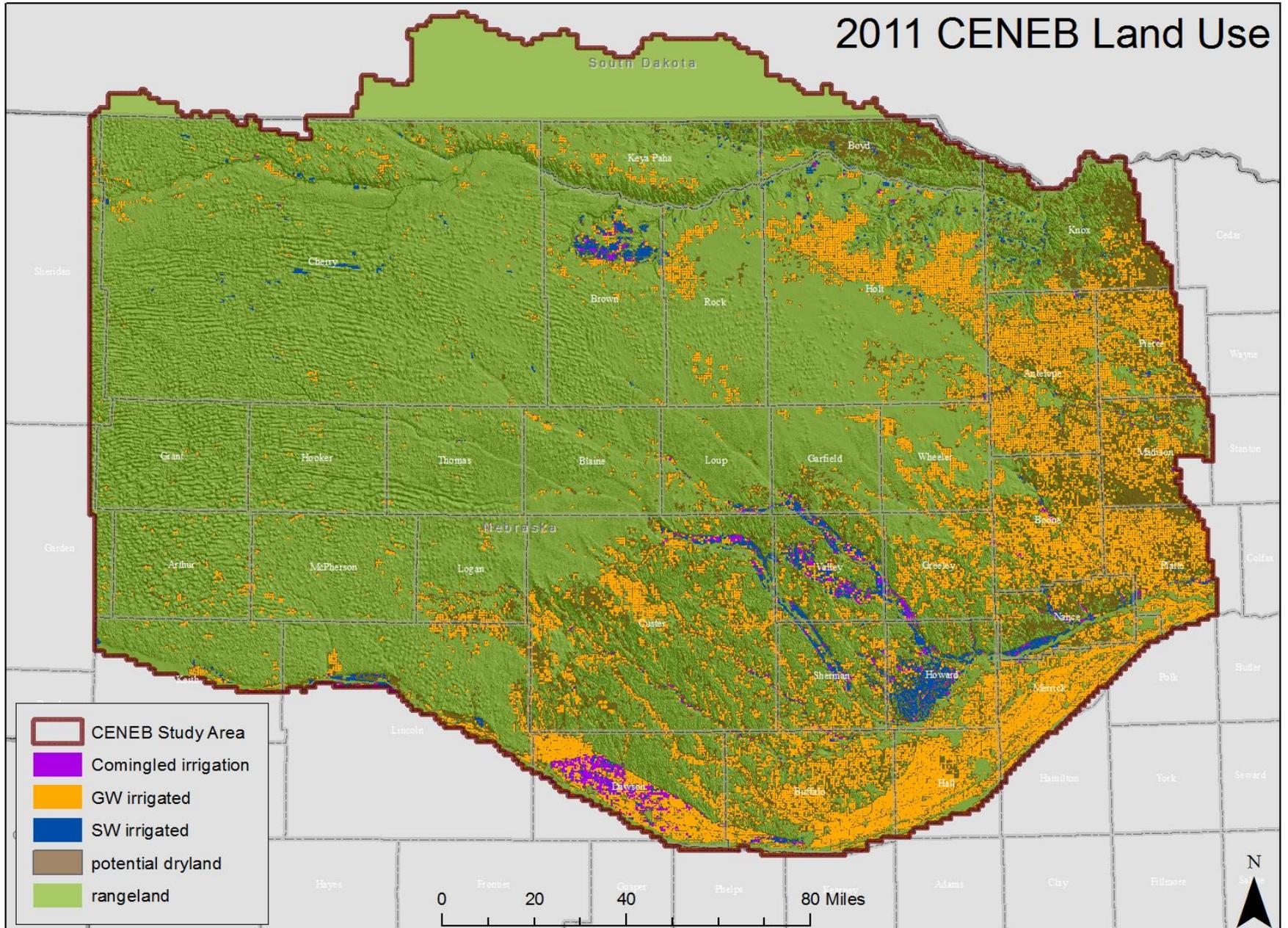
1980 CENEb Land Use



2000 CENEb Land Use



2011 CENEB Land Use

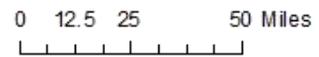
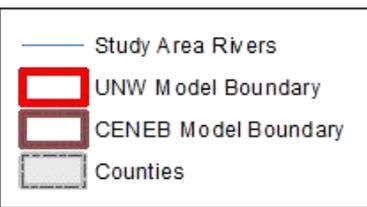
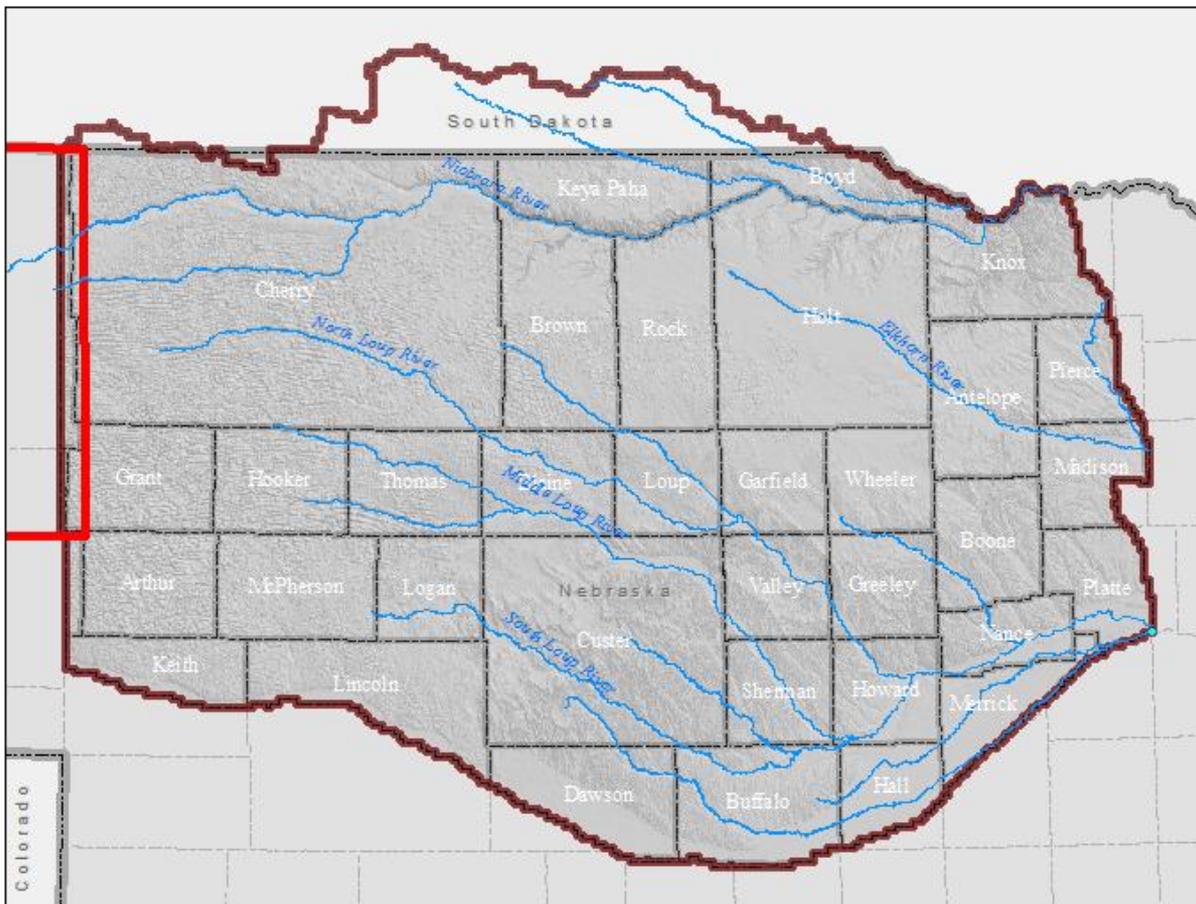


Groundwater Model

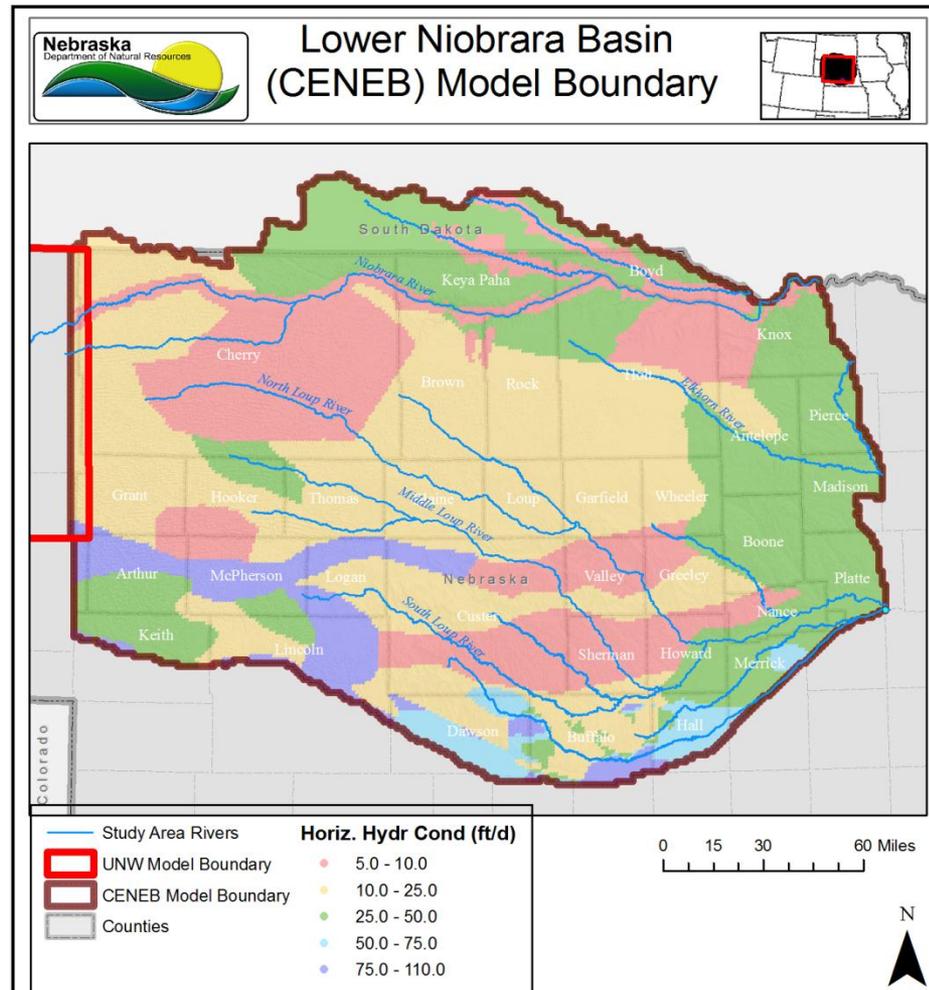
- To model the potential impacts to groundwater by changing recharge and pumping rates and locations
- Model potential water management alternatives



CENEB Streams



CENEB GW Model



Surface Water Operations Model

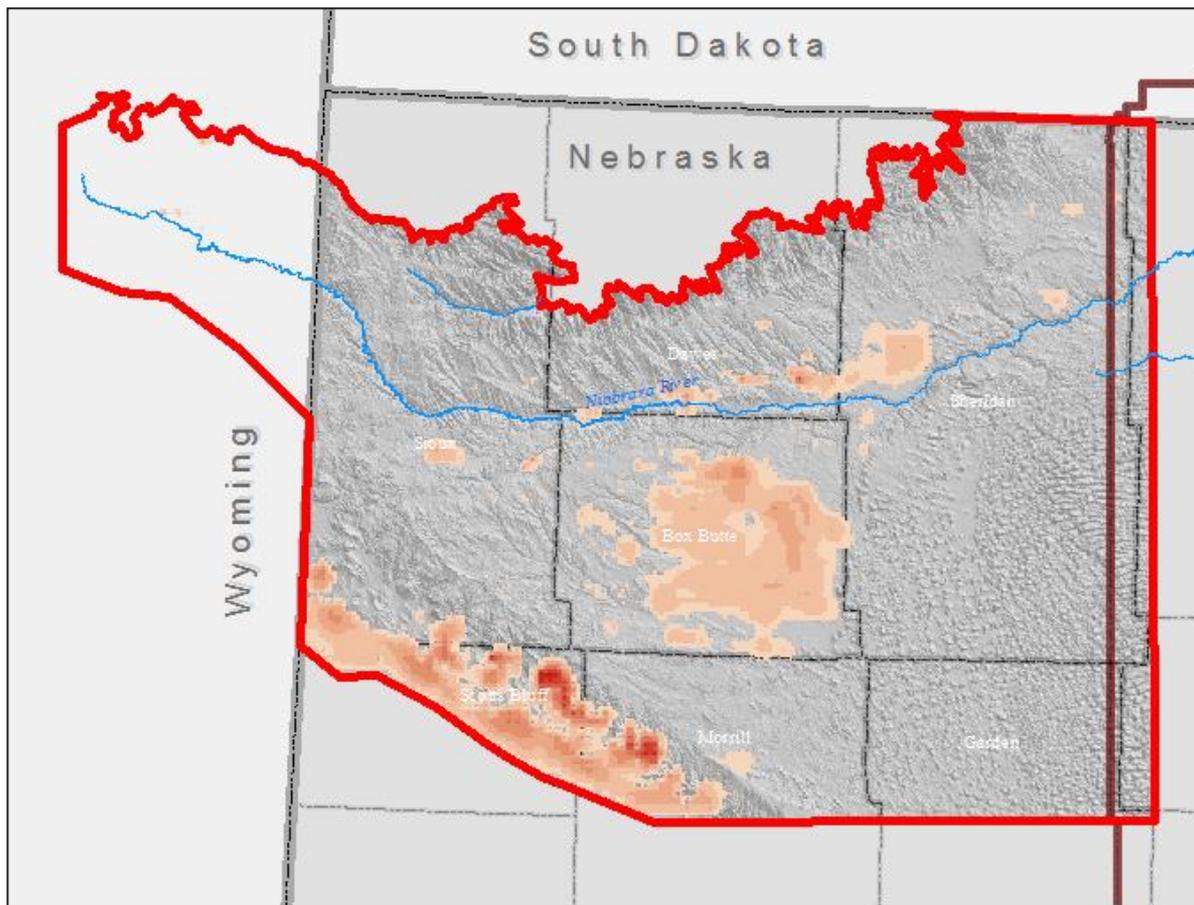
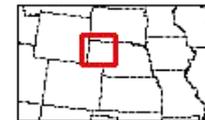
- Will include
 - Merritt Reservoir/AID operations
 - Spencer Hydropower demands
 - Senior/Junior appropriators

Scenario Development

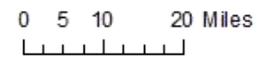
- How these tools help us manage water resources
- Examples of simple scenarios
- Stakeholder Input



Modeled Drawdown 10% Pumpage



	Study Area Rivers	Modeled Drawdown	
	UNW Model Boundary		Low
	CENEB Model Boundary		
	Counties		
			High



Timeline

- Project completion April 2013

Summary

- Combine hydrologic, economic, and climate models to evaluate water management strategies
- Hydrologic models broken into the Upper & Lower Basin components
- Hydrologic models include land-use, surface water, & groundwater models



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