



Nebraska
Department of Natural Resources

NEBRASKA'S WATER MANAGEMENT RESOURCE

Providing the sound science and support for managing
Nebraska's most precious resource.

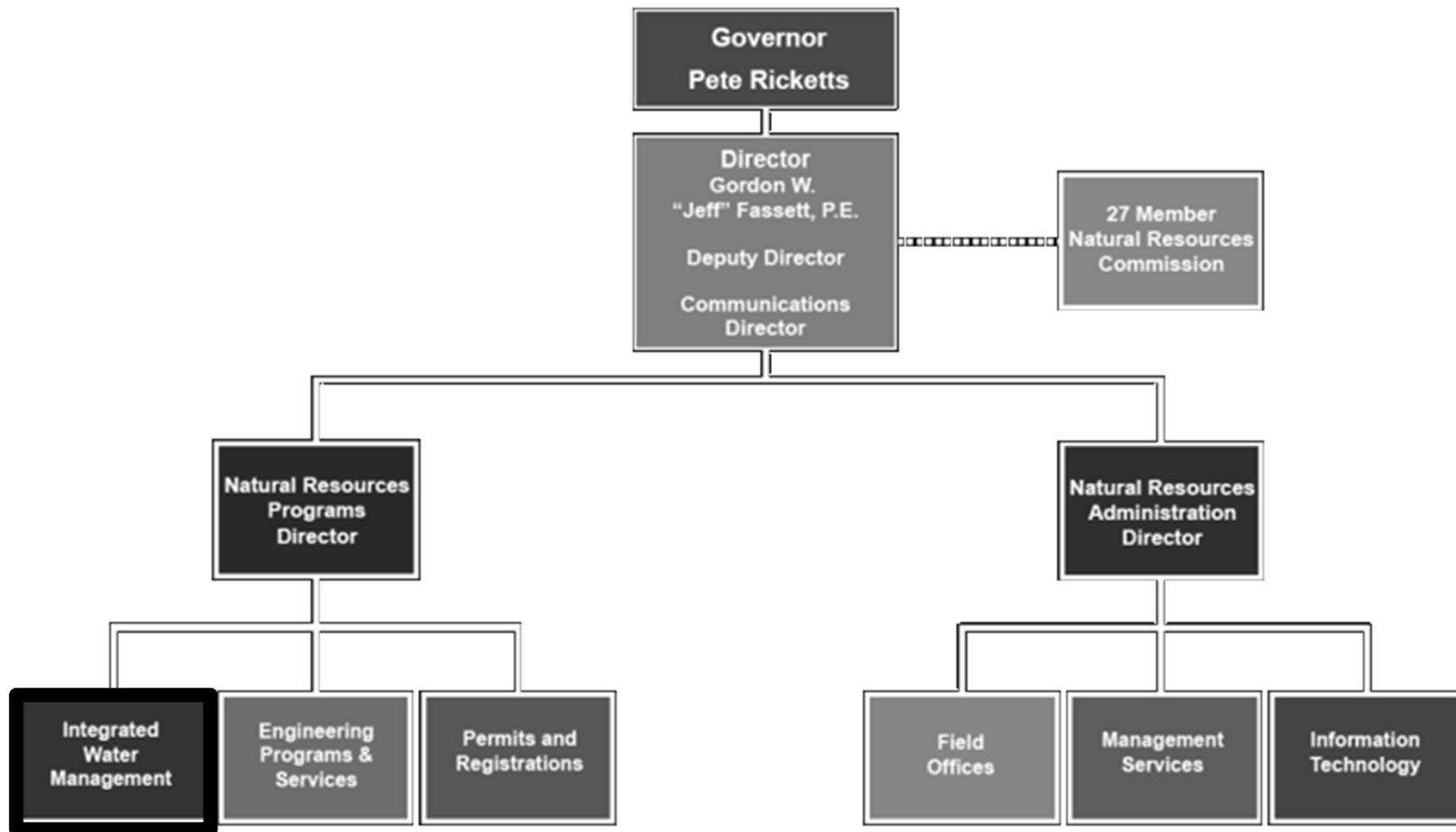
Integrated Water Management Modeling for Climate Variability Study in Niobrara River Basin

Mahesh Pun, EIT

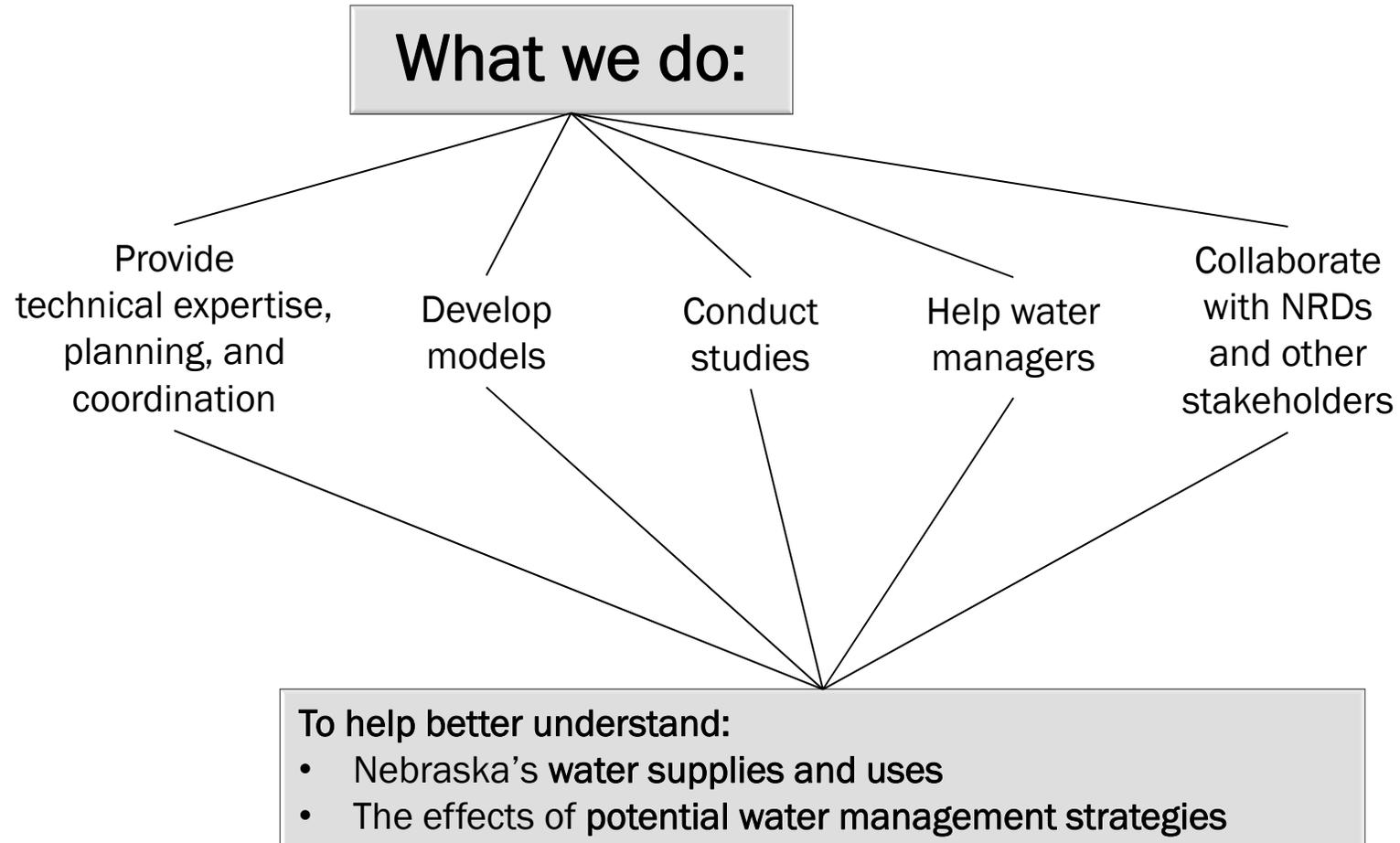
Integrated Water Management Analyst

Nebraska Department of Natural Resources

Nebraska Department of Natural Resources



Integrated Water Management Division



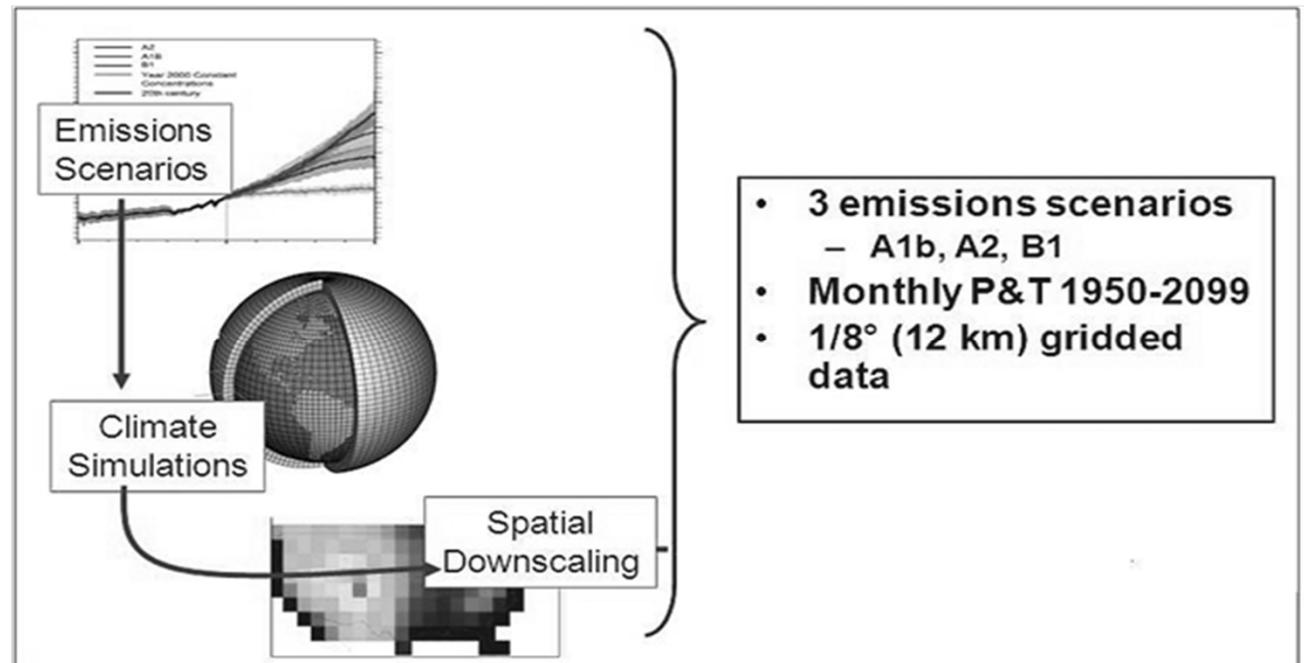
Introduction and Background

- Niobrara River basin Study
 - a collaborative effort by the Nebraska Department of Natural Resources and the U.S. Bureau of Reclamation
 - evaluate the current and future water supply and demand to identify potential adaptation strategies to reduce any identified gaps

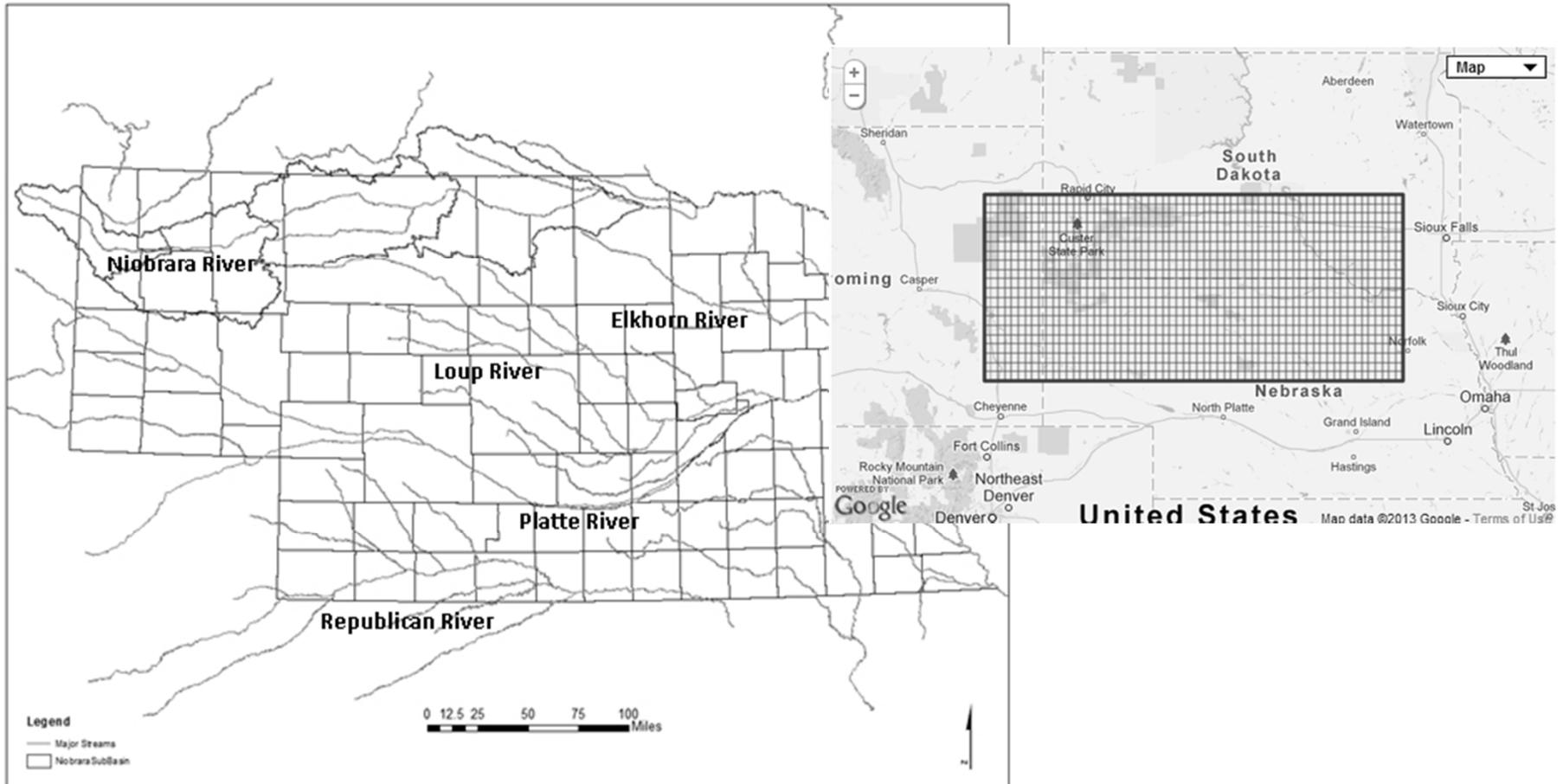


Climate Variability Projection

- Intergovernmental Panel on Climate Change (IPCC)
 - Coupled Model Intercomparison Project Phase 3 (CMIP3)
 - General Circulation Model (GCM) projections downscaling



Climate Variability Projection



Climate Variability Projection

1) Start from 112 archived CMIP3 climate & hydrology projections, including P, T, RO, ET

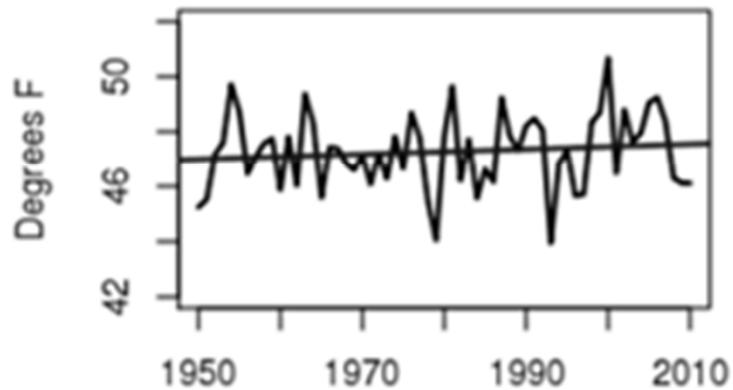
2) Rank projections based on change between 2030-2059 and 1970-1999

3) Select projections that represent projected ranges in P, T, P-ET

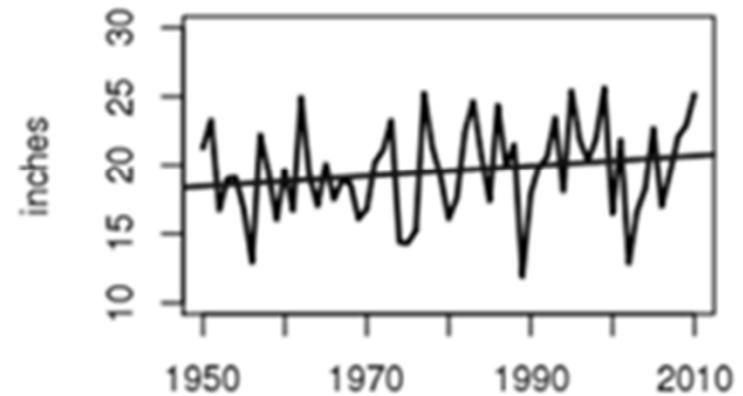
Low	10 th of P	90 th of T	10 th of P-ET
CT	50 th of P	50 th of T	50 th of P-ET
High	90 th of P	10 th of T	90 th of P-ET

Historical Trends in Niobrara Basin

Mean Annual Temperature

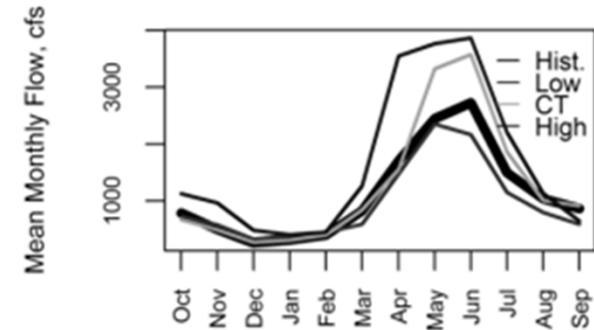


Mean Annual Precipitation



Climate Variability Projection

- Projection Analysis Results



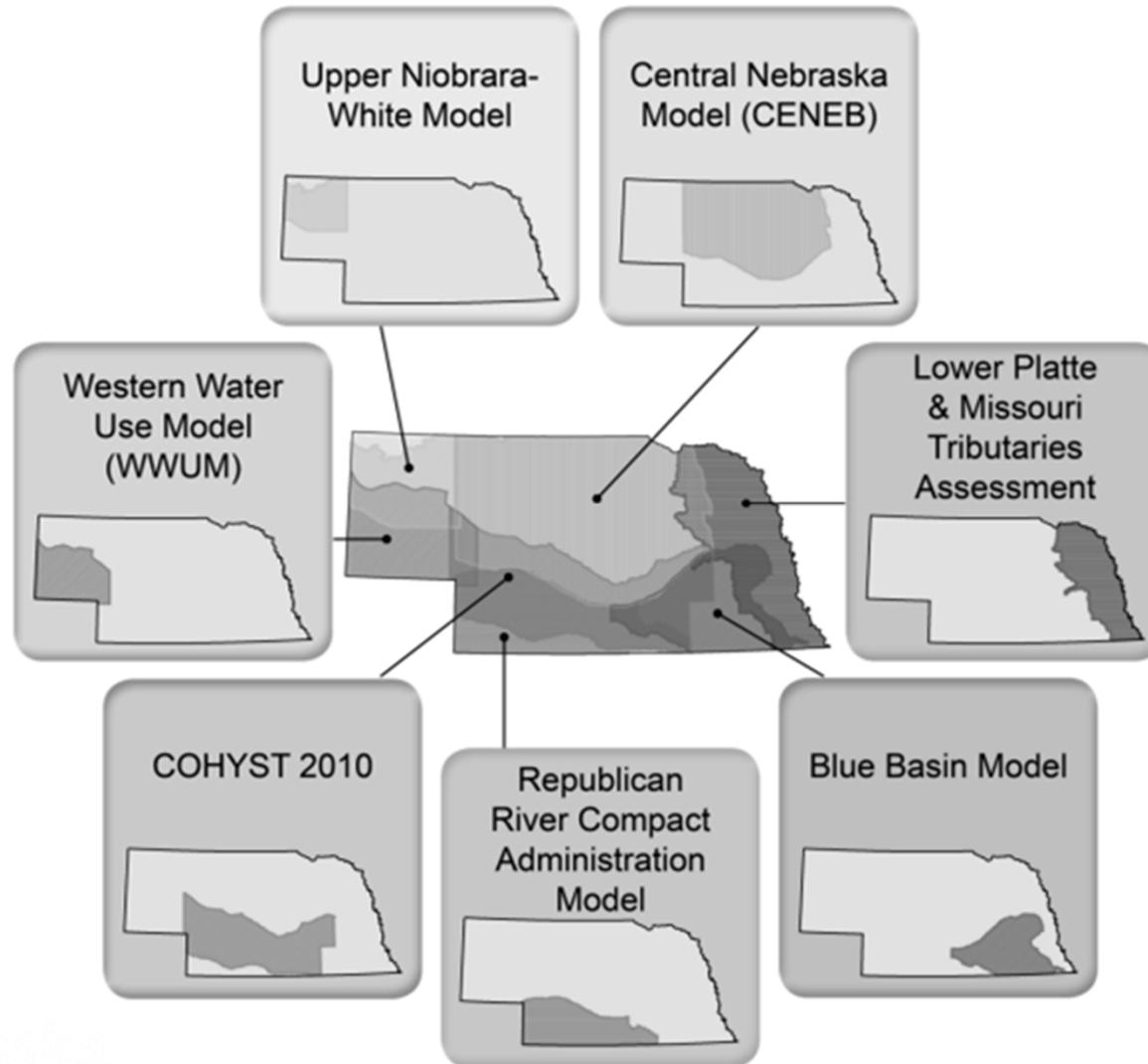
Niobrara River near Spencer (06465000)

		Low	Central Tendency	High
Mean Summer Temperature (June - August)	Select Projection	+2.9°C	+1.9°C	+1.2°C
	Based on 112 Projections	+3.3°C	+2.1°C	+1.96°C
Mean Summer Precipitation (June - August)	Select Projection	-13%	+5.4%	+13%
	Based on 112 Projections	-15%	+4.7%	+17%

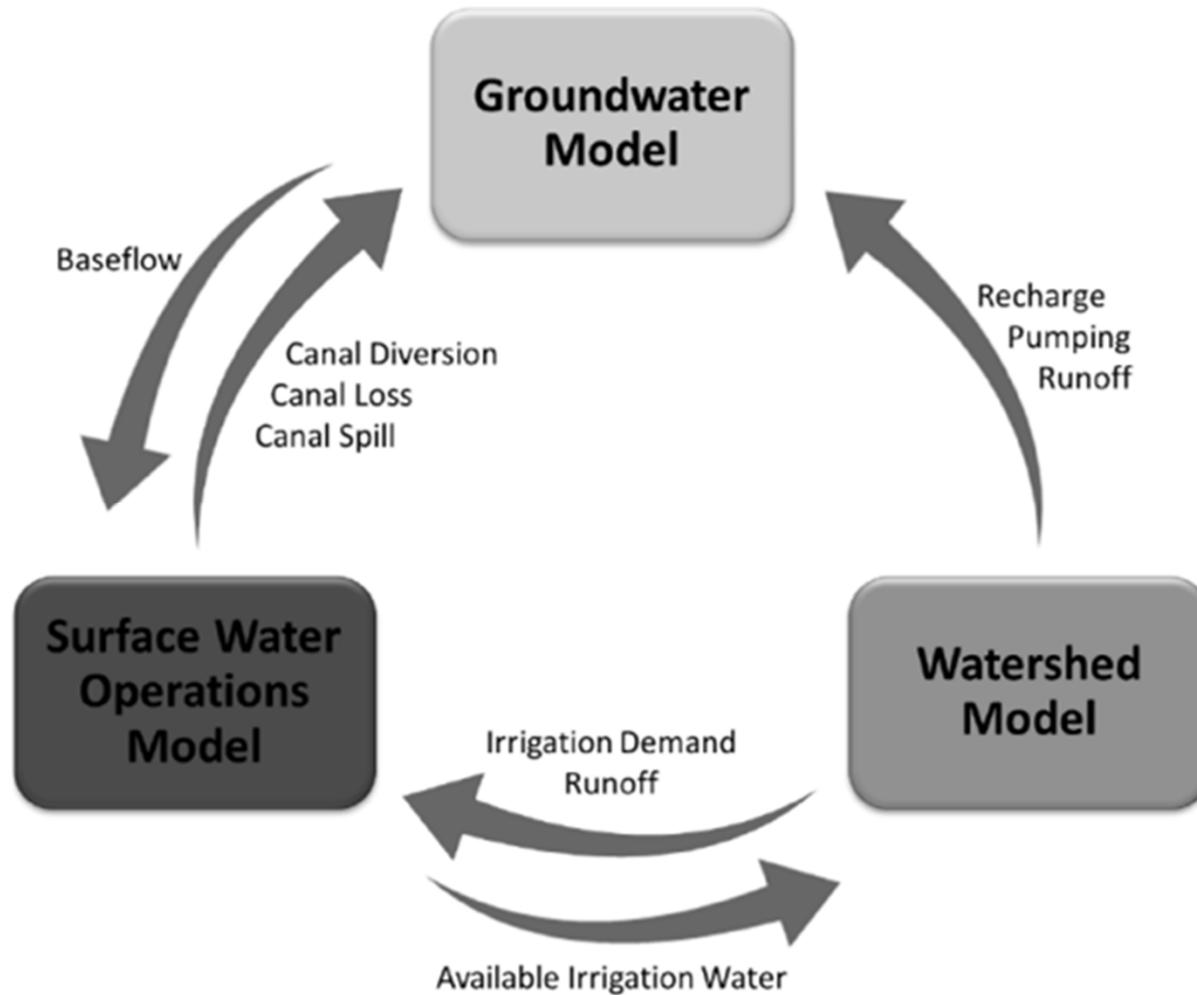
Integrated Water Management Modeling

- Change in one hydrological component may affect the other components of the system
- Integrated Water Management (IWM) Model for better understanding of
 - interaction between surface water and groundwater systems
 - response of different hydrological components to stress
- Integrated Water Management (IWM) Model for
 - evaluation of basin water supply and use
 - effective management of water resources

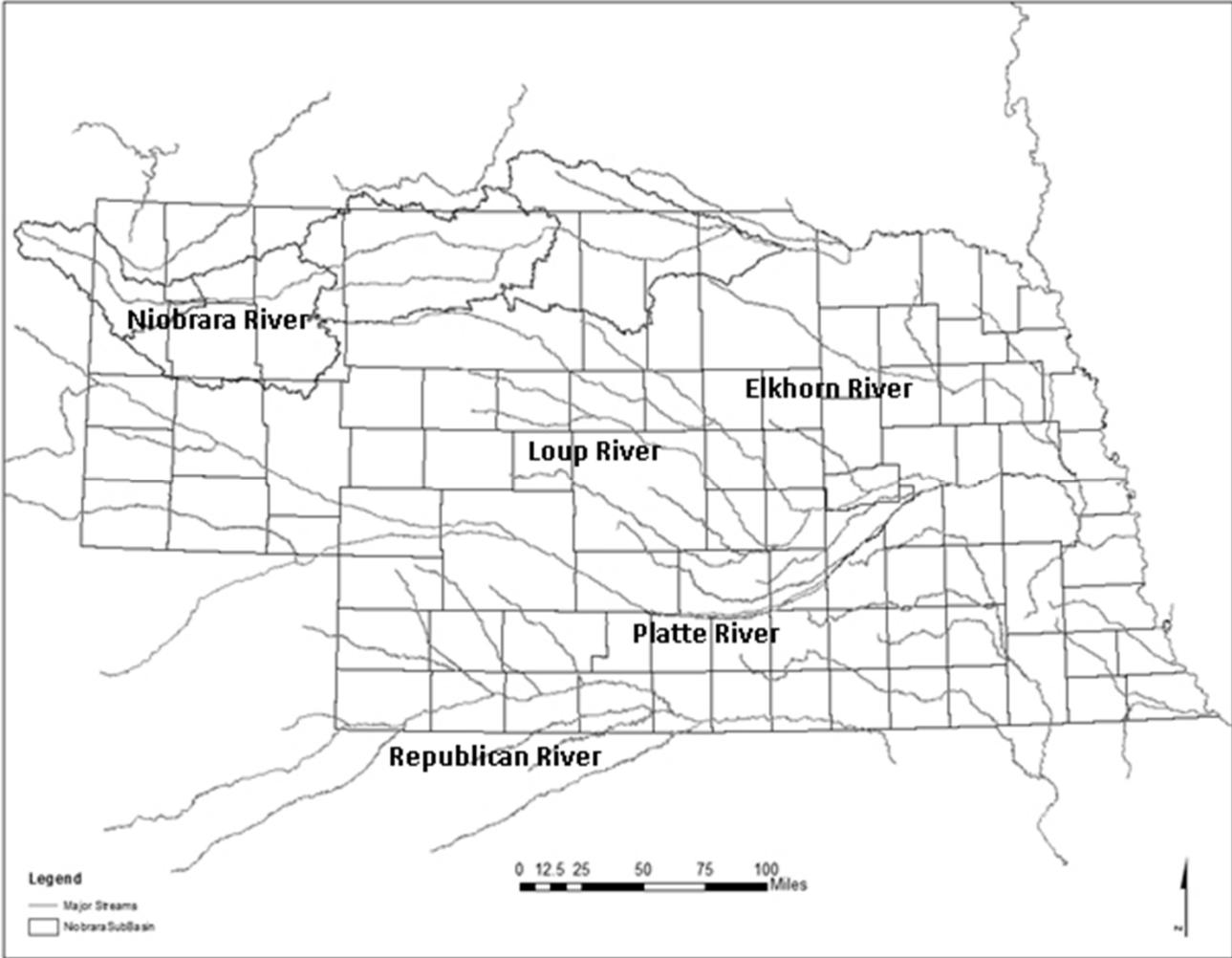
Integrated Water Management Modeling



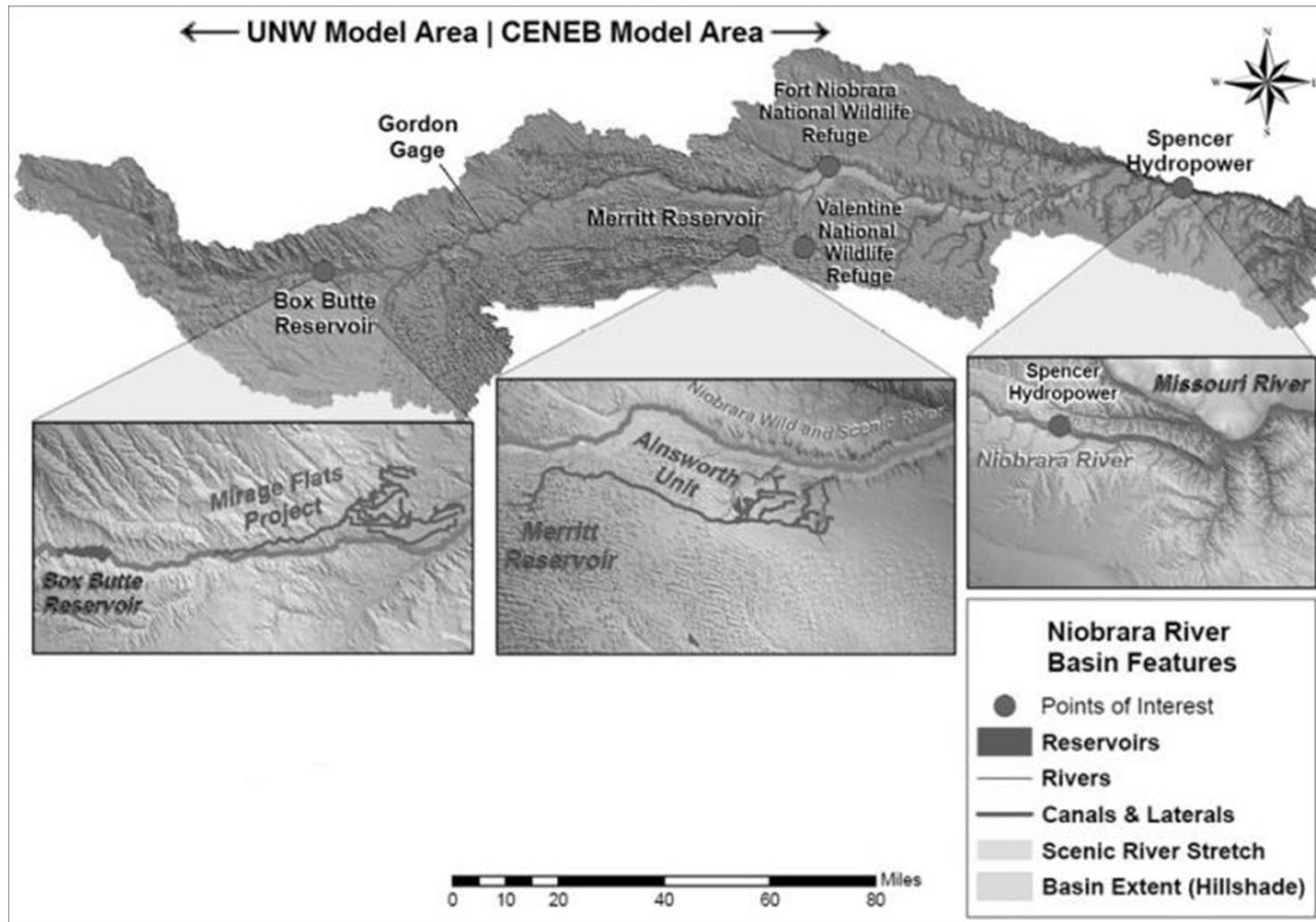
Framework for IWM Modeling



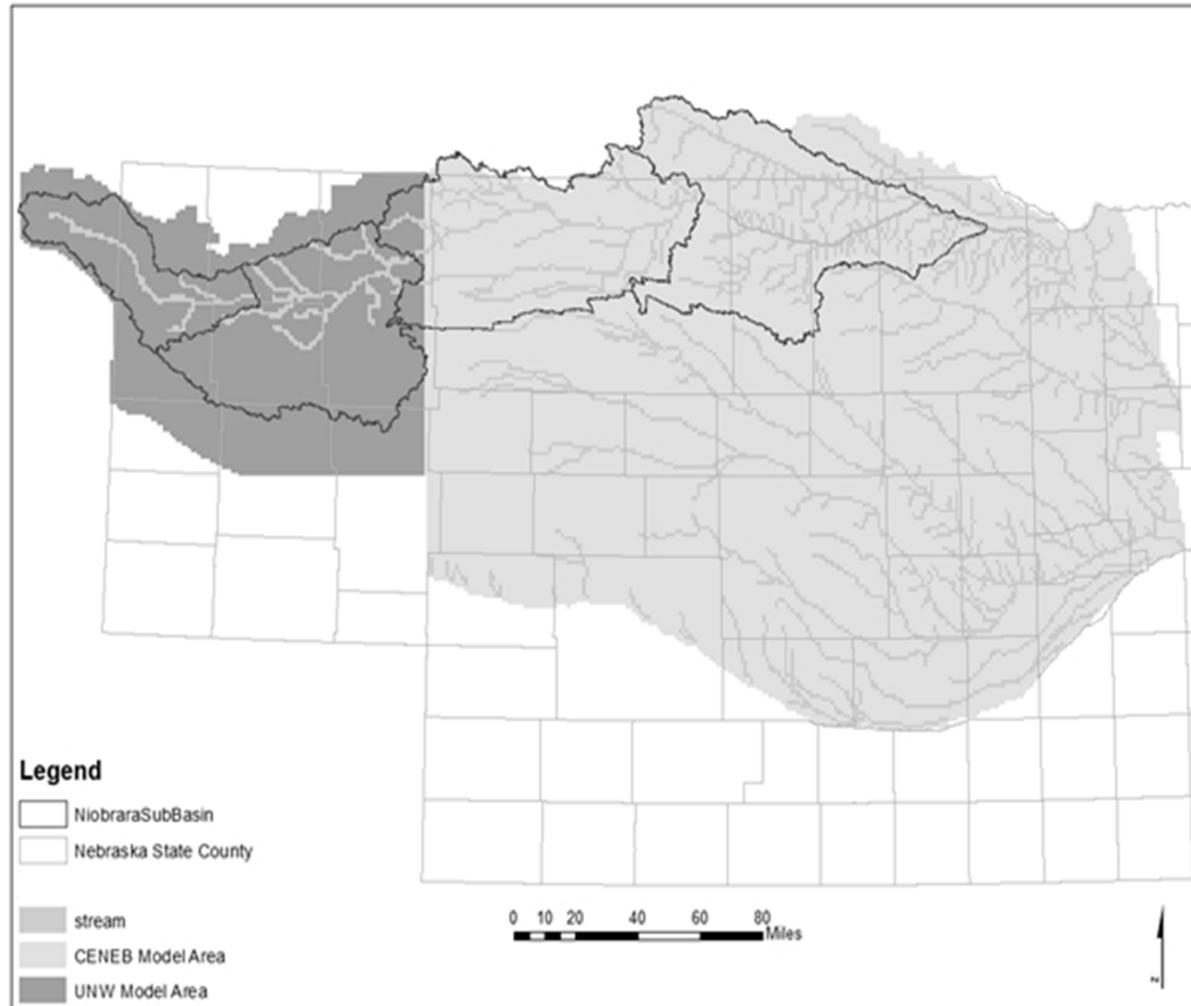
Framework for IWM Modeling

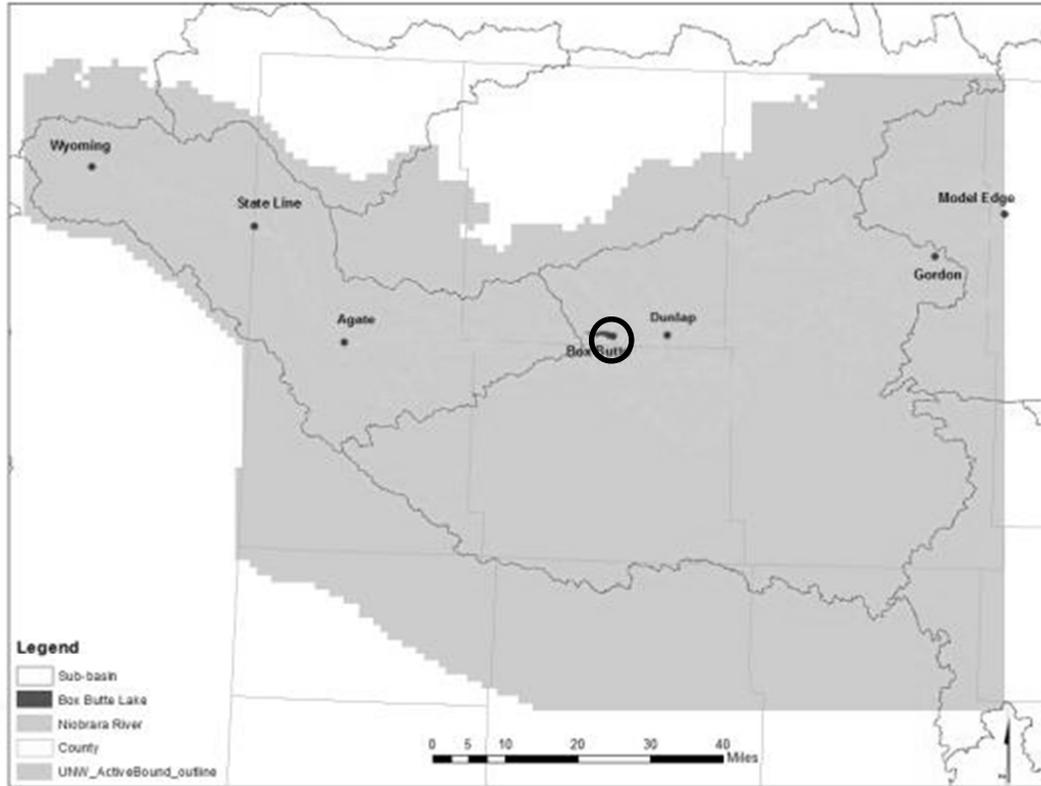


Framework for IWM Modeling

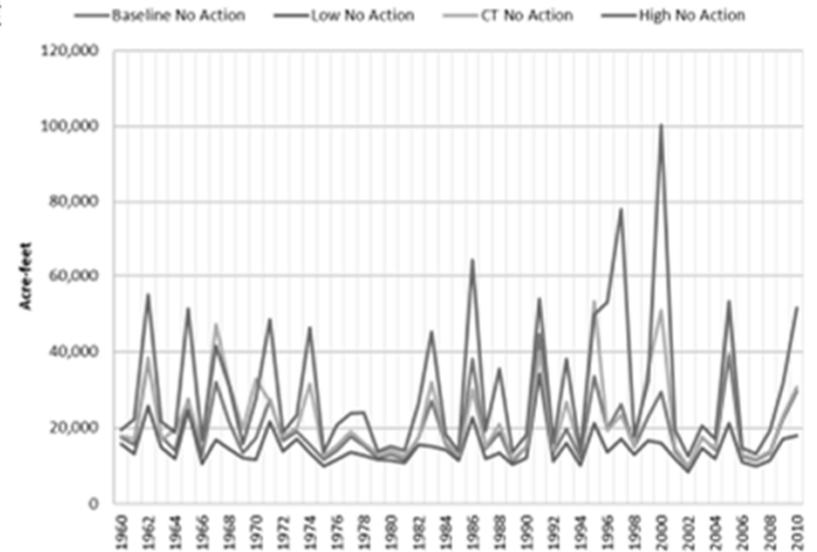


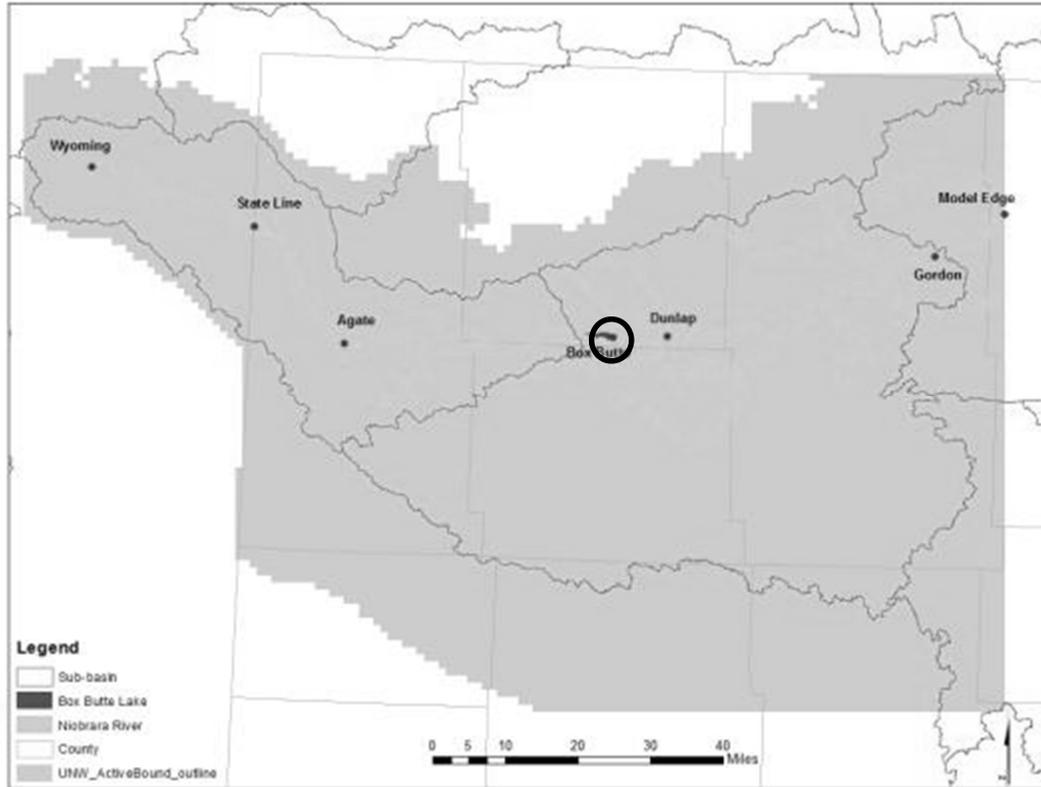
Application of IWM Modeling



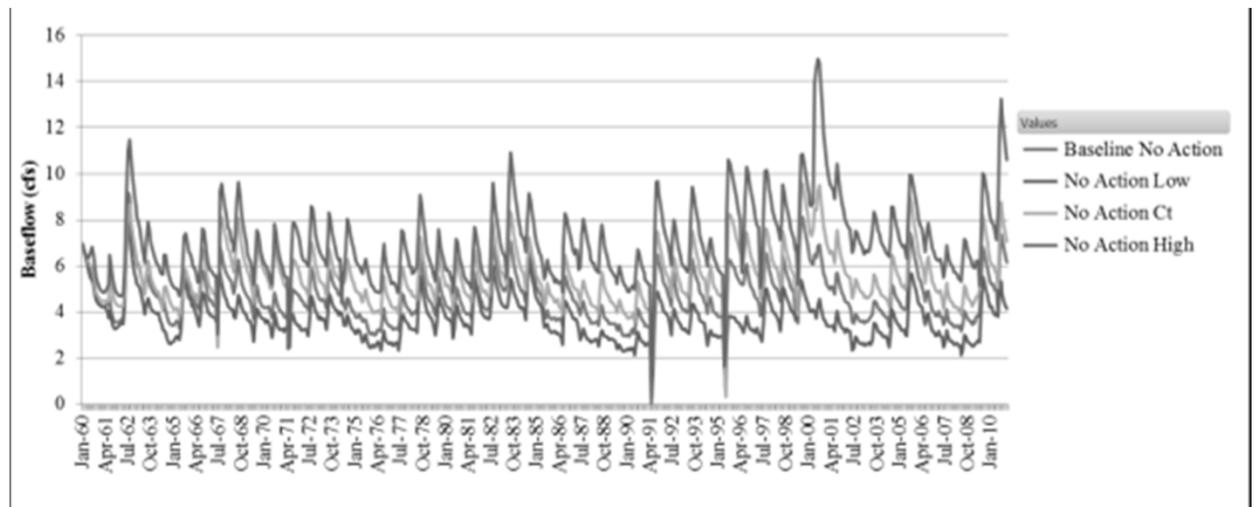


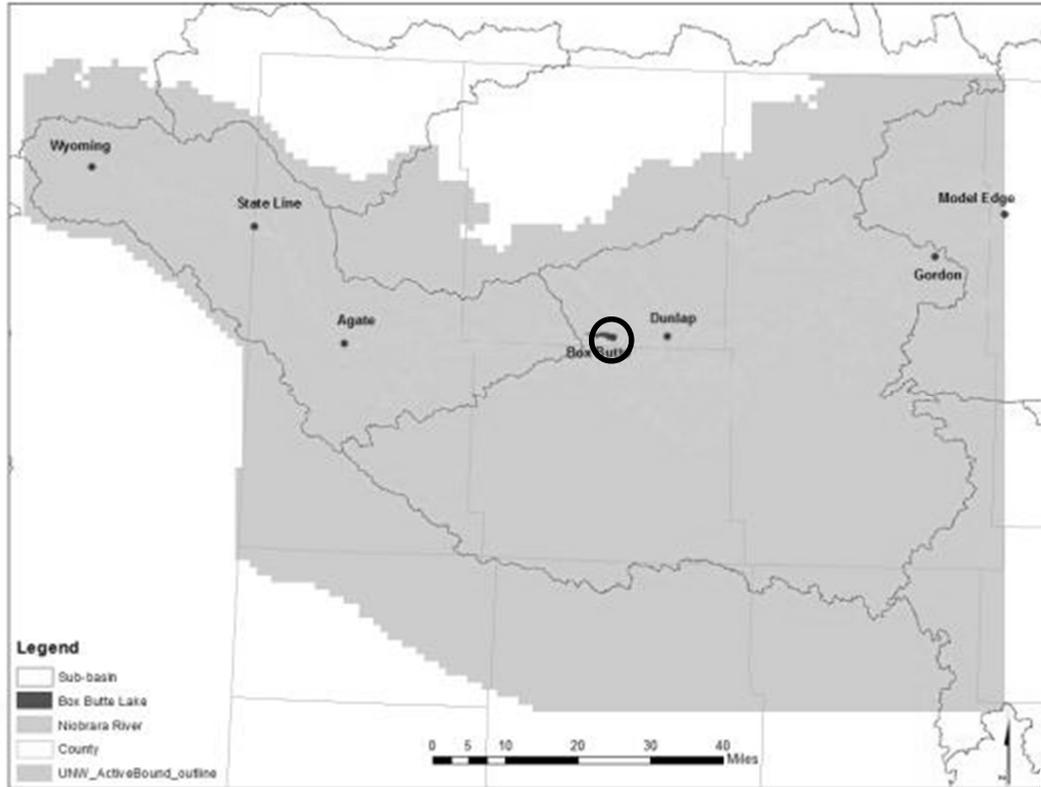
Total Flow



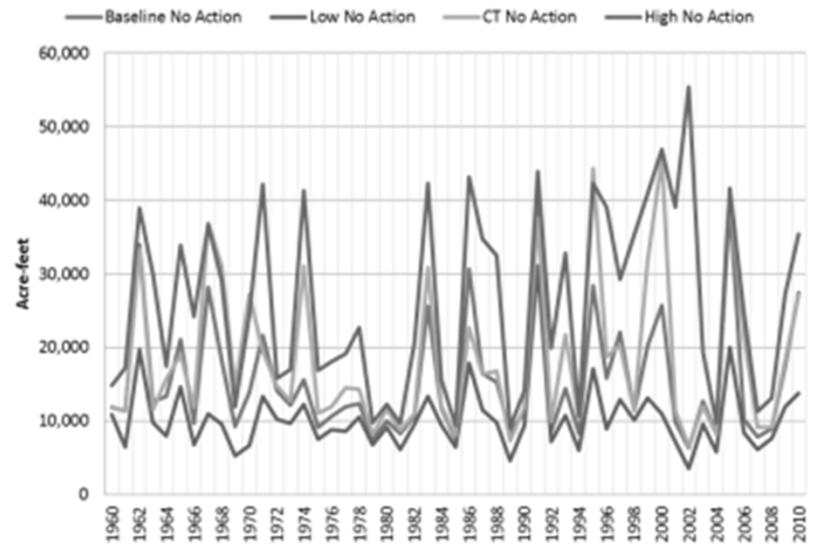


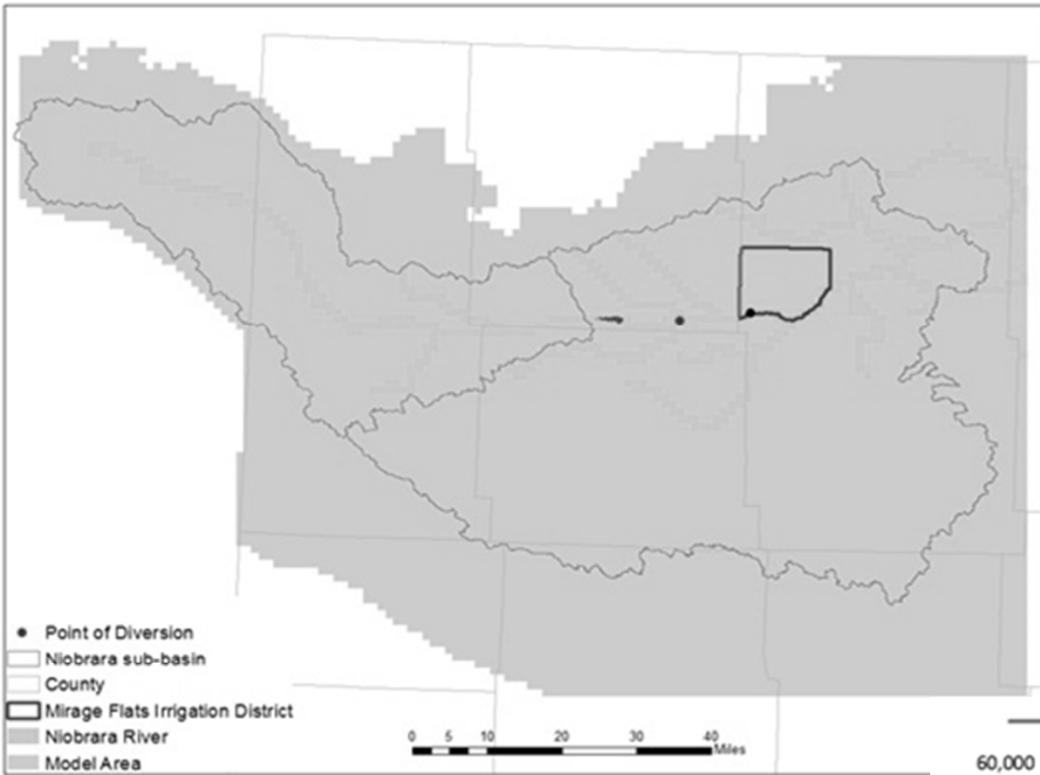
Baseflow



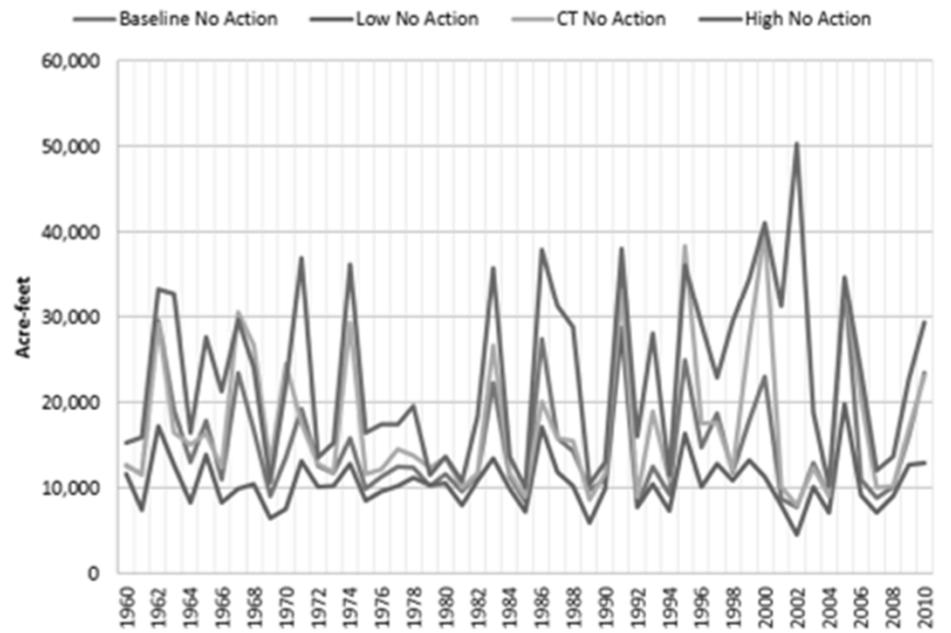


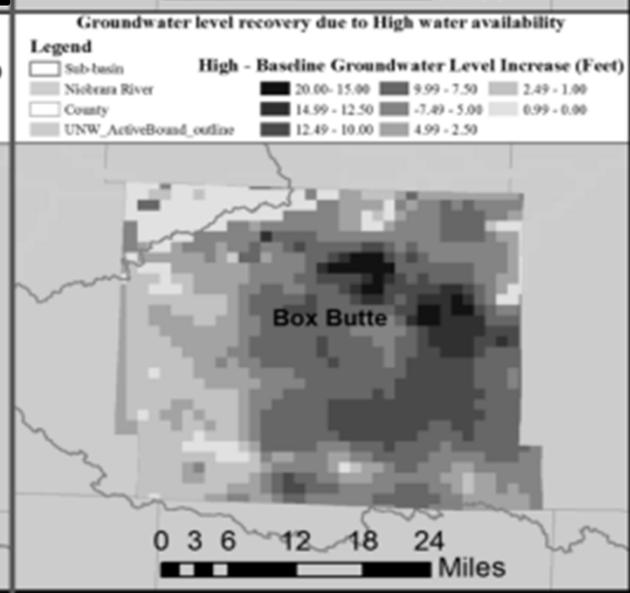
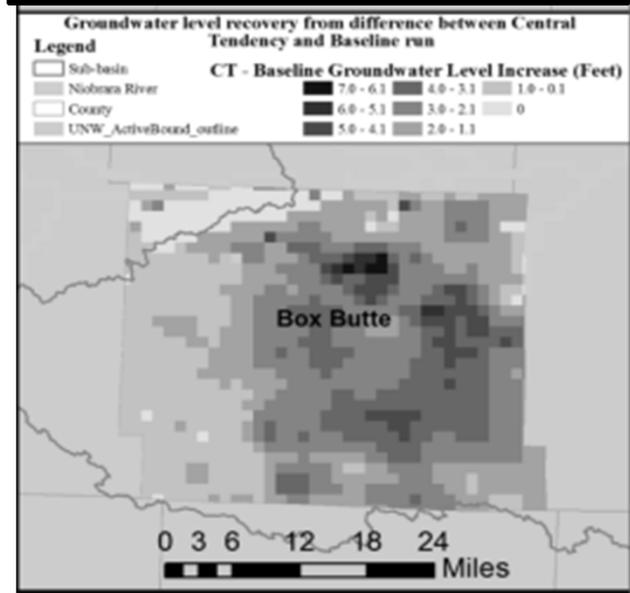
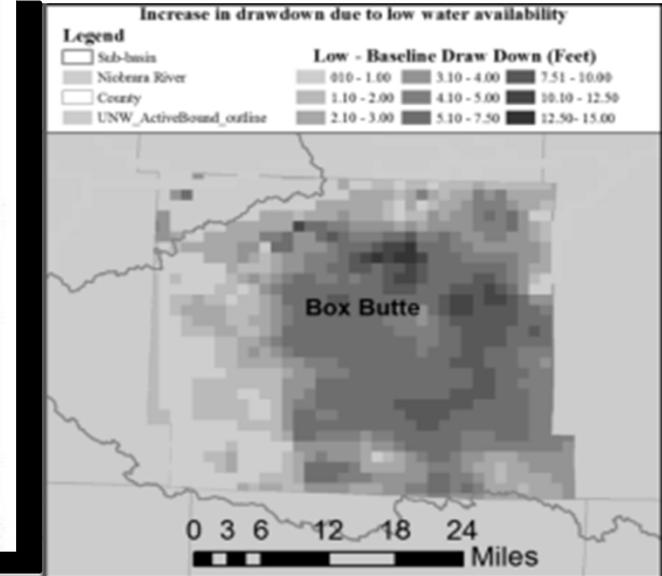
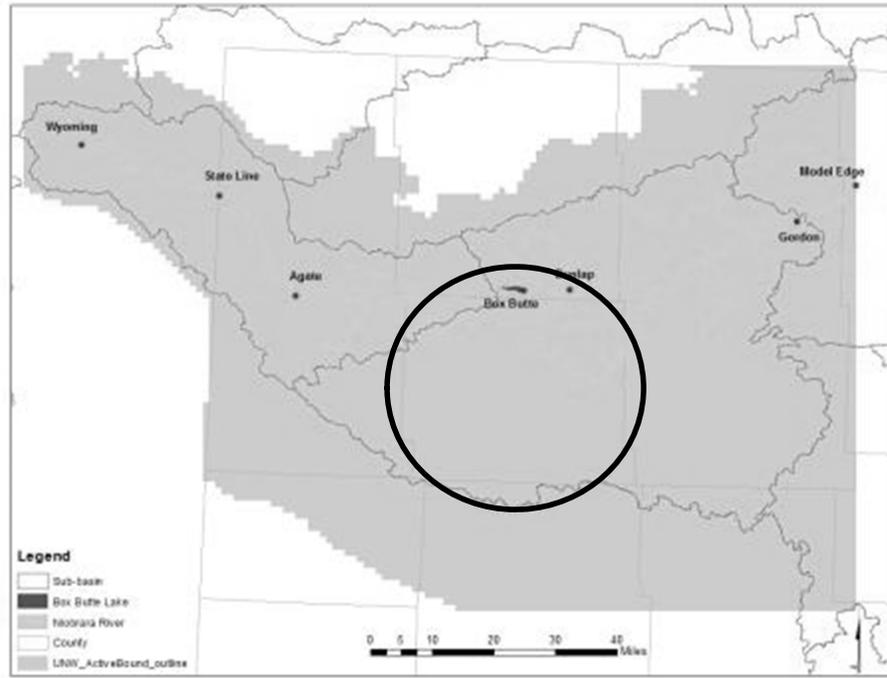
Reservoir Release

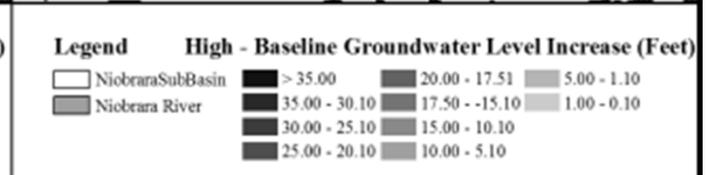
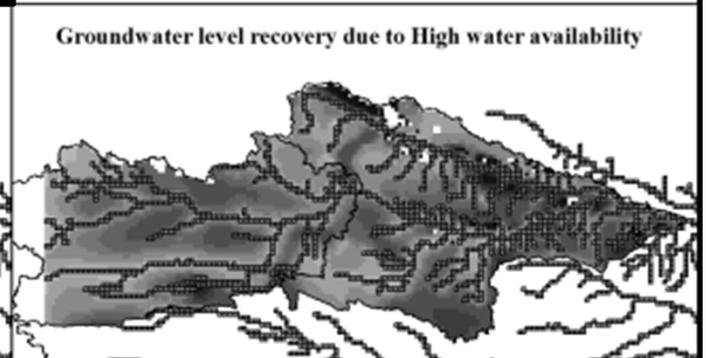
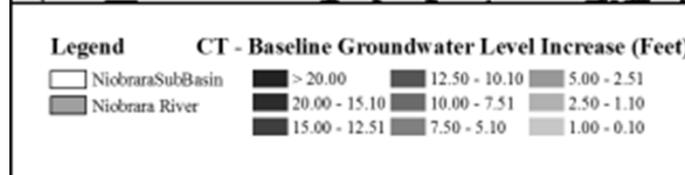
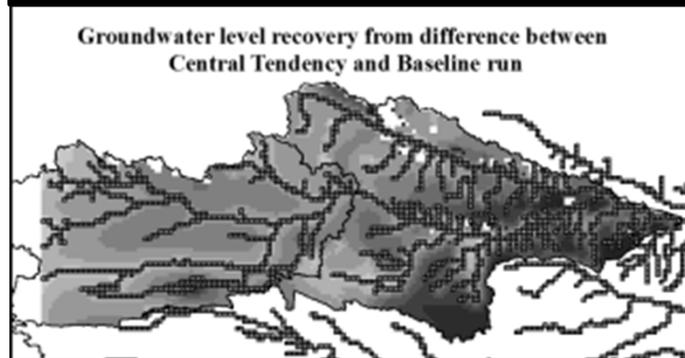
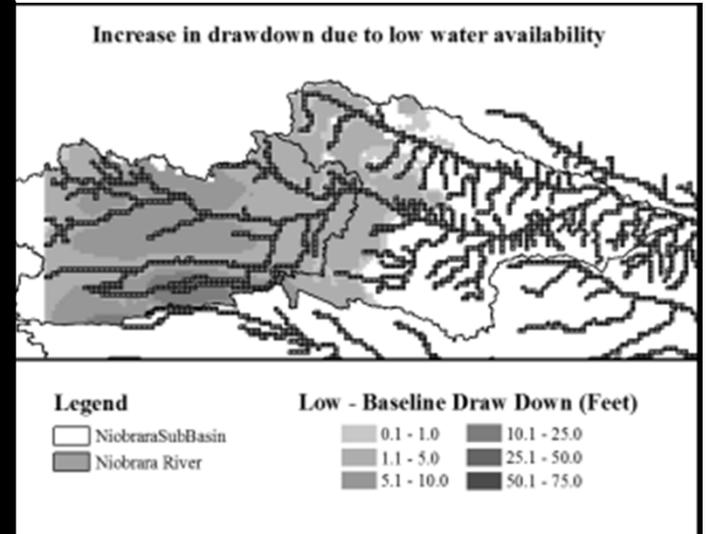
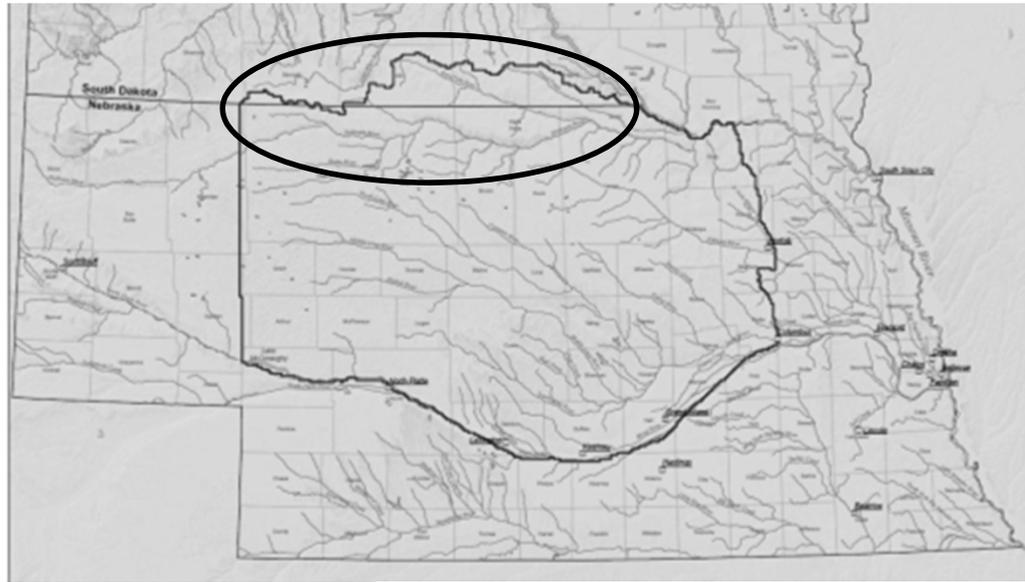




Surface water Diversion

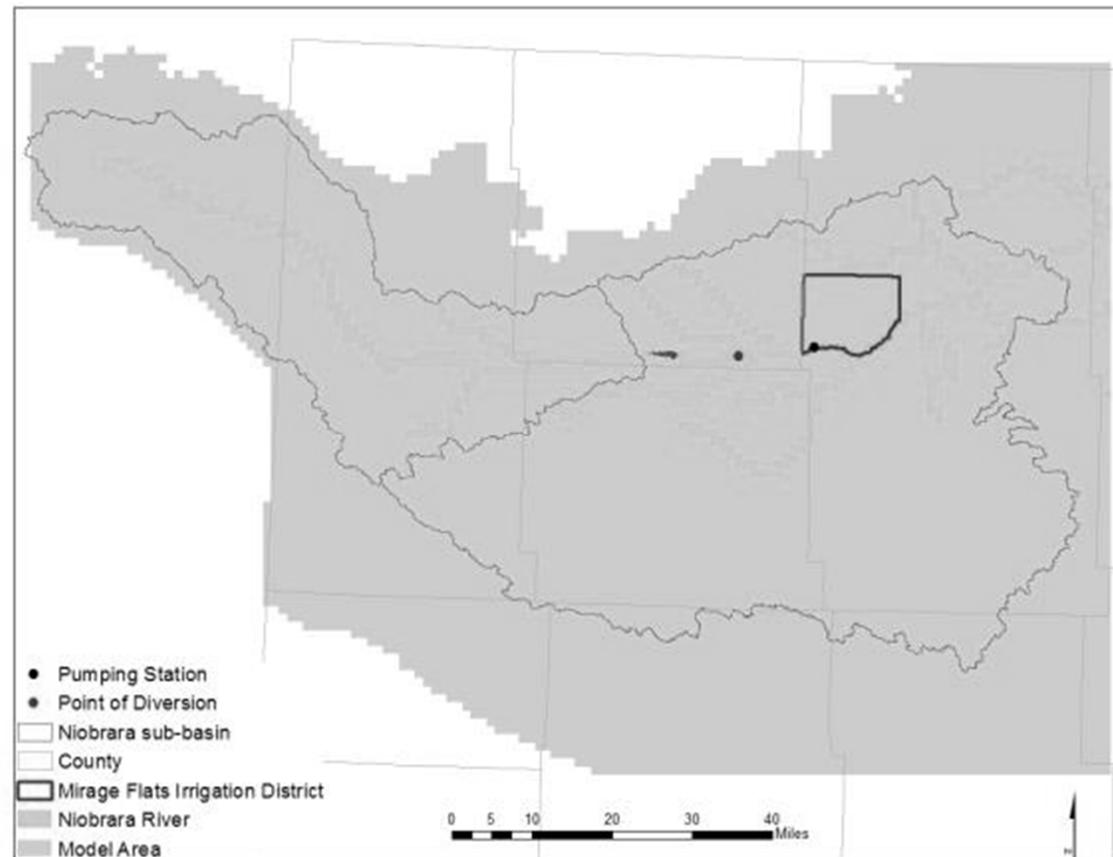






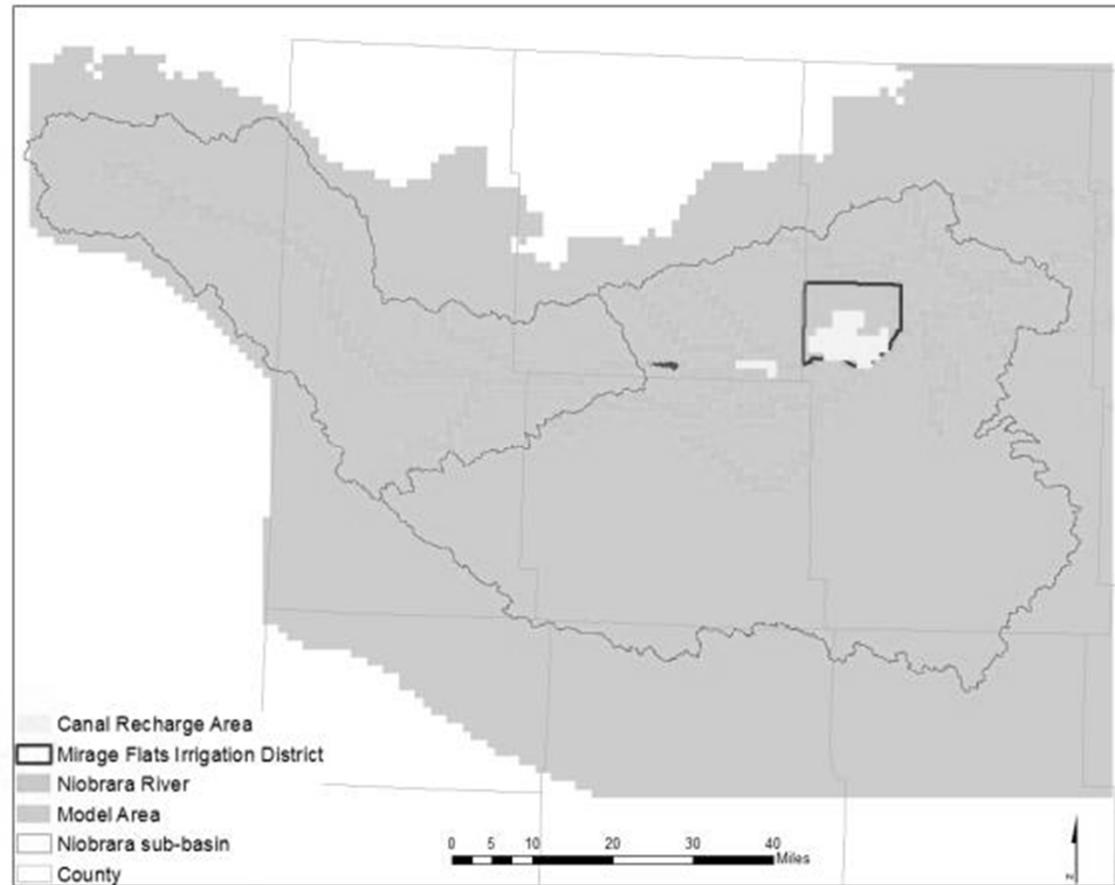
Alternative water Management Scenario

- Mirage Flats Pumping Station Scenario (Alt1)



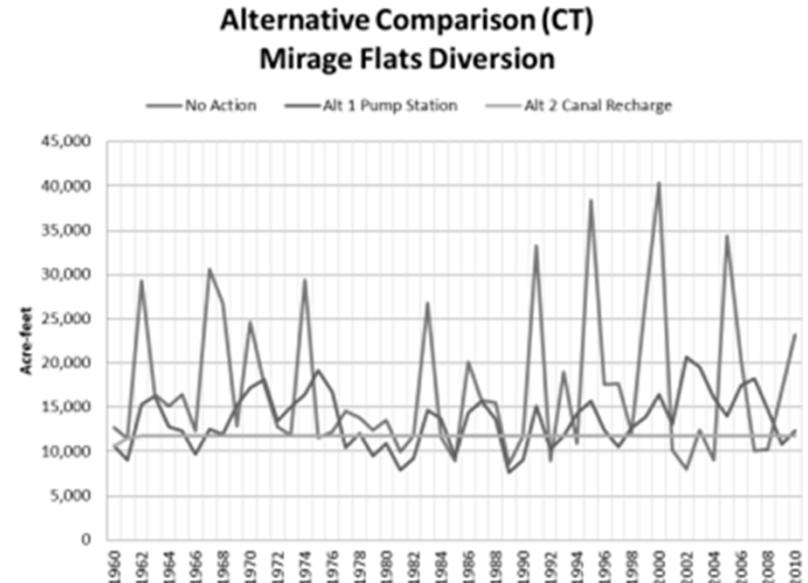
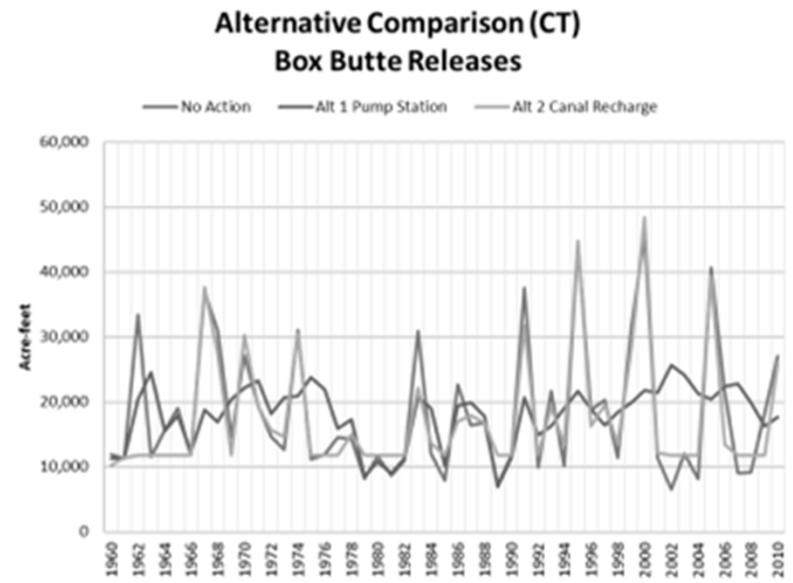
Alternative water Management Scenario

- Mirage Flats Canal Recharge (Alt2)



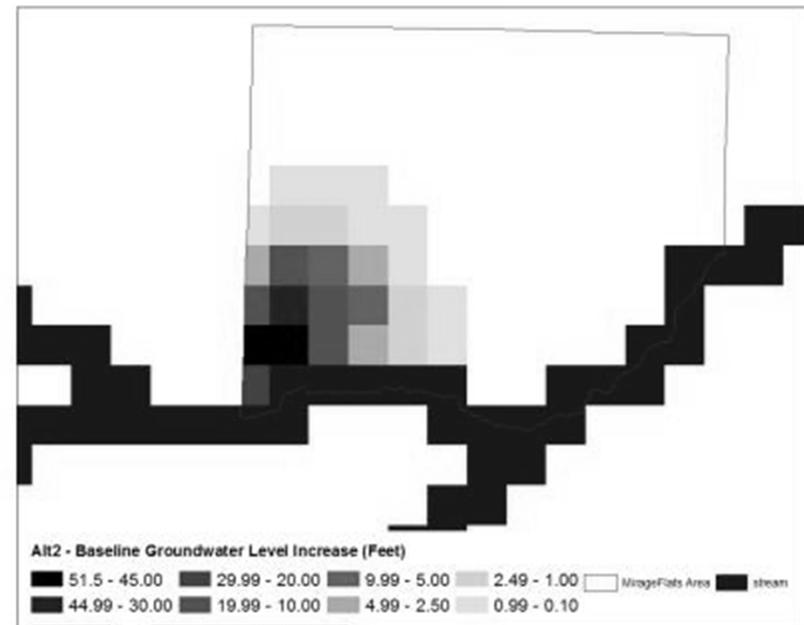
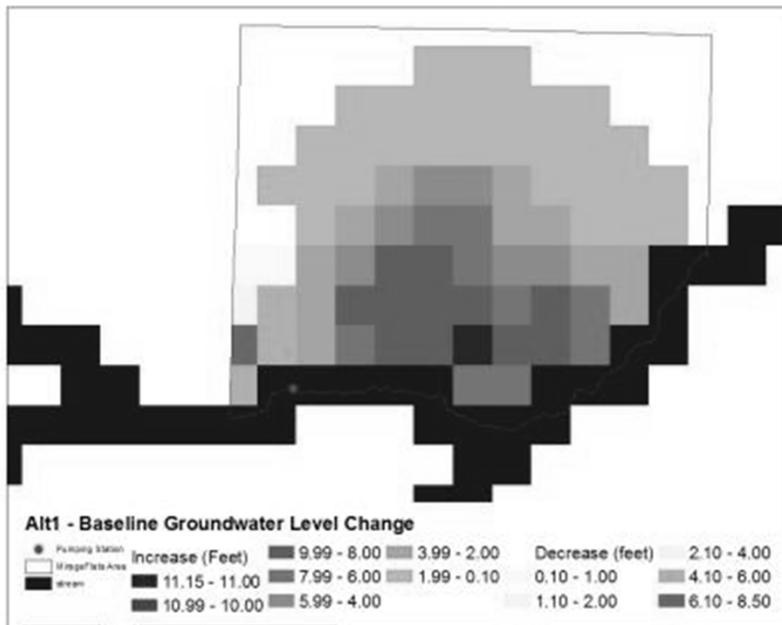
Alternative water Management Scenario

- Alternative water management scenario comparison



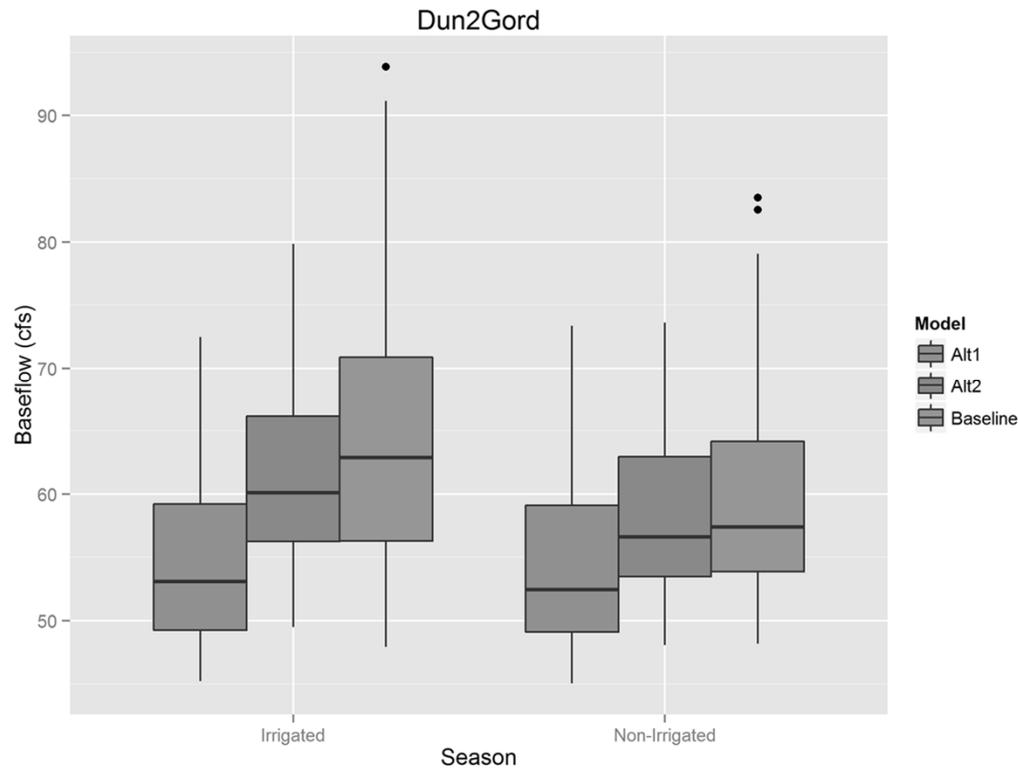
Alternative water Management Scenario

- Alternative water management scenario comparison



Alternative water Management Scenario

- Alternative water management scenario comparison



Summary

- Projections of GCM used to analyze the condition of future water availability of Niobrara basin
- Better understanding of the response of hydrological components to future climate projections with integrated water management model
- Application of Integrated water management model is necessary for adaptation and effective management of water resources to changing environment



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Providing the sound science and support for managing
Nebraska's most precious resource.

THANK YOU

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