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 and Water Management Alternative Scenarios

2015 AWRA Annual Water Resources Conference
Denver, Colorado
November 17th, 2015

Mahesh Pun, EIT
Integrated Water Management Analyst
Nebraska Department of Natural Resources

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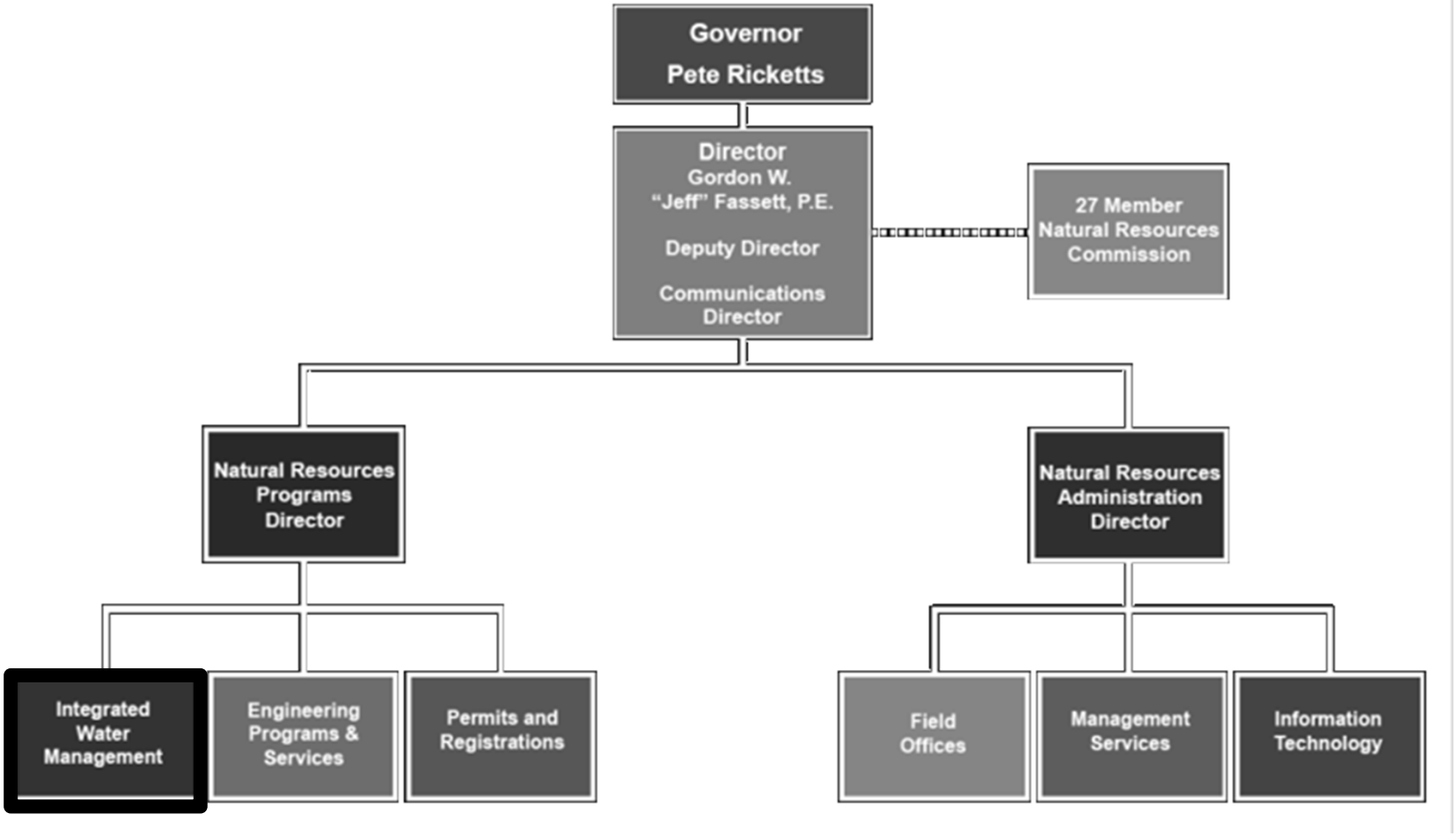
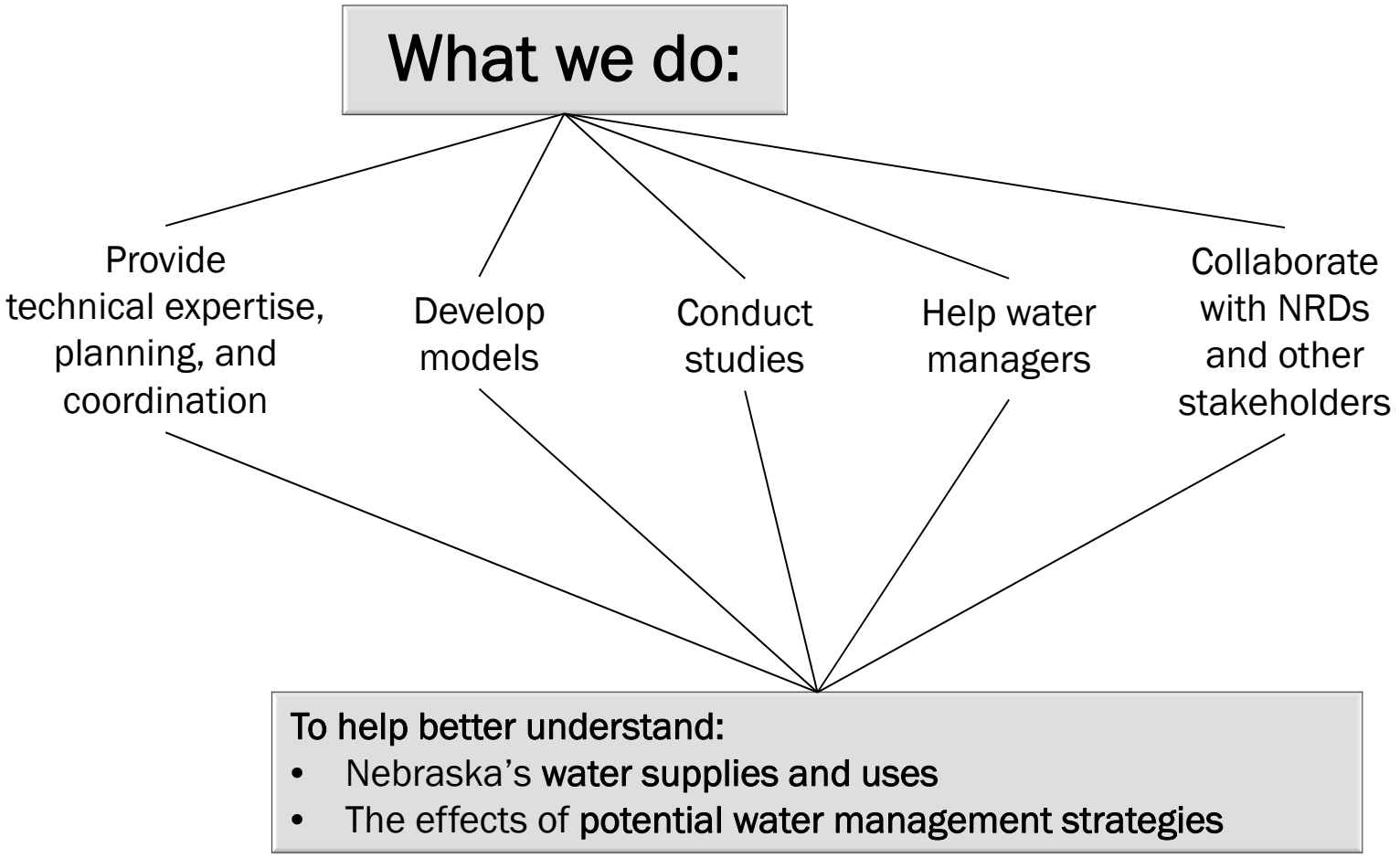


Integrated Water Management Division



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

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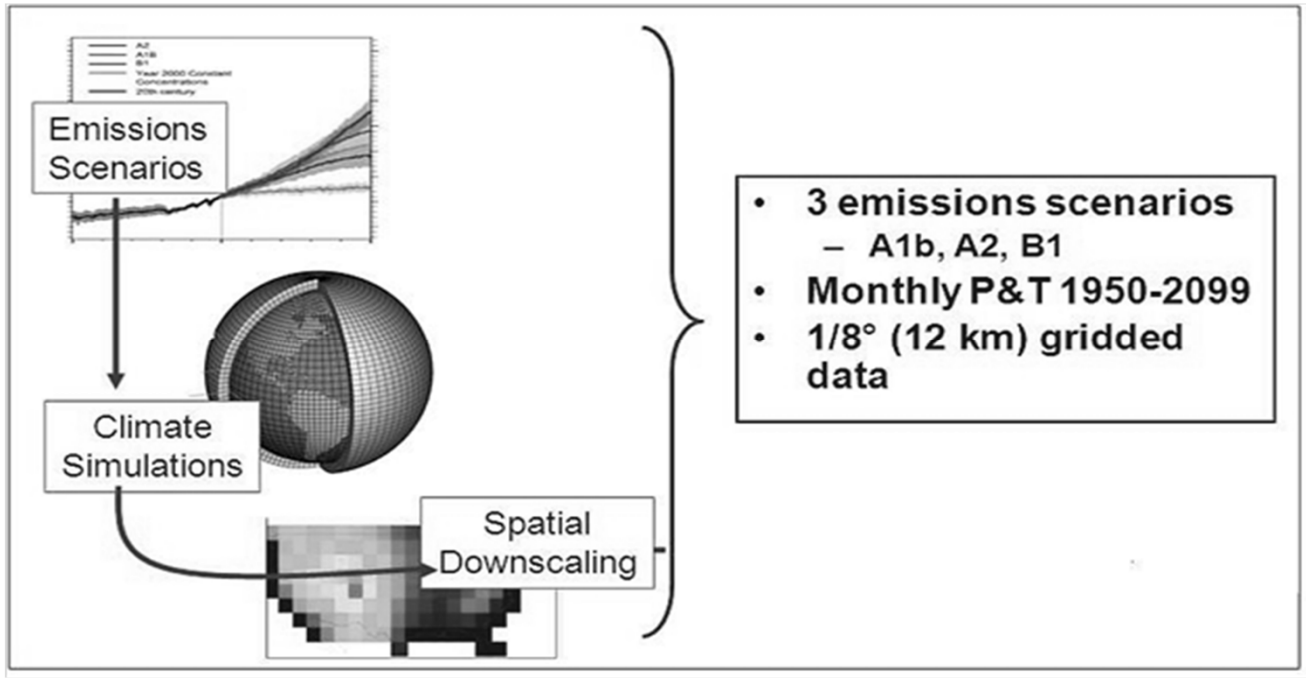
U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center | Nebraska-Kansas Office
Denver, Colorado | McCook, Nebraska

Climate Variability Projection

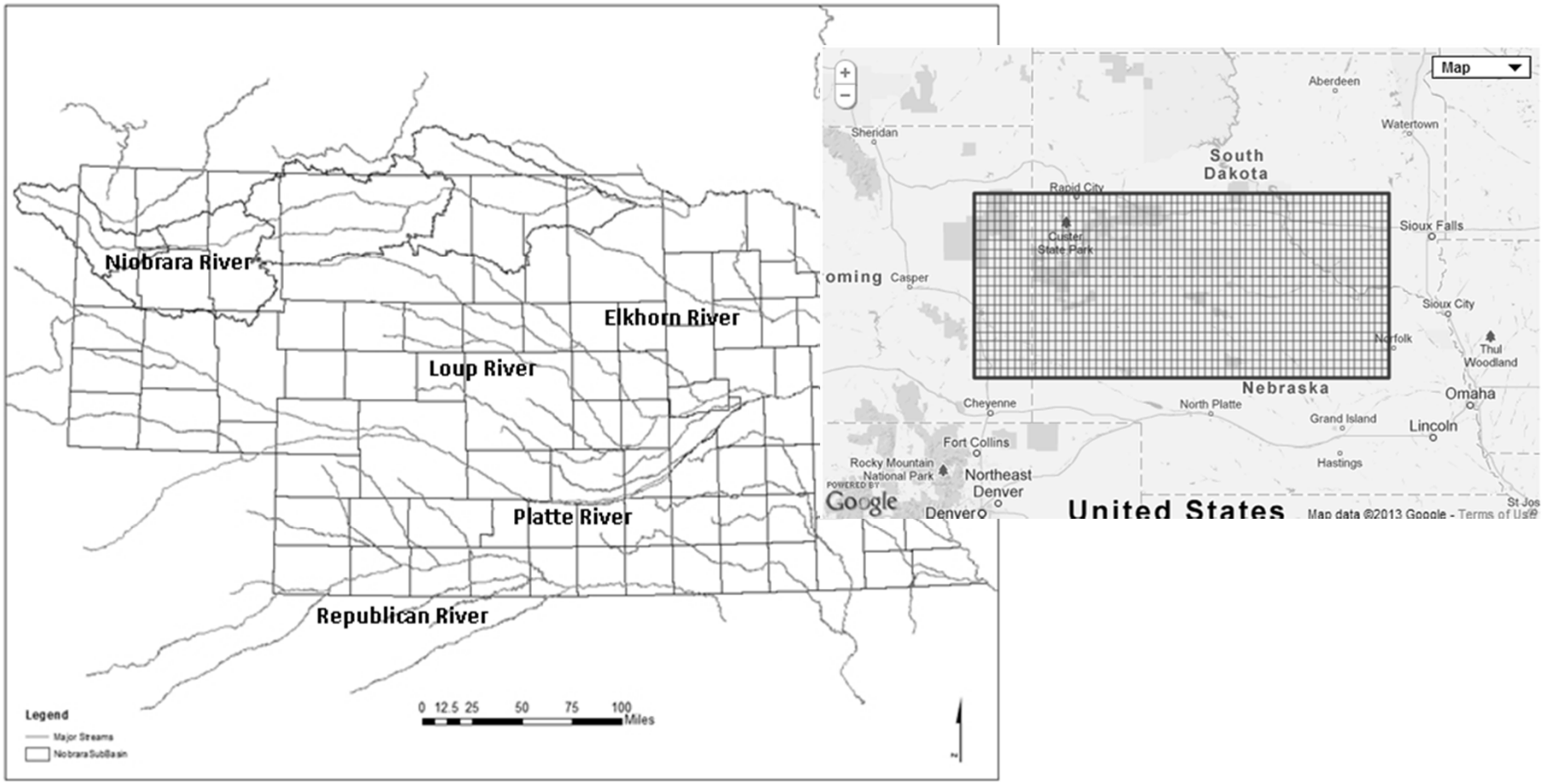
- Intergovernmental Panel on Climate Change (IPCC)

  - Couples Model Intercomparison Project Phase 3 (CMIP3)

  - General Circulation Model (GCM) projections downscaling



Climate Variability Projection



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Climate Variability Projection

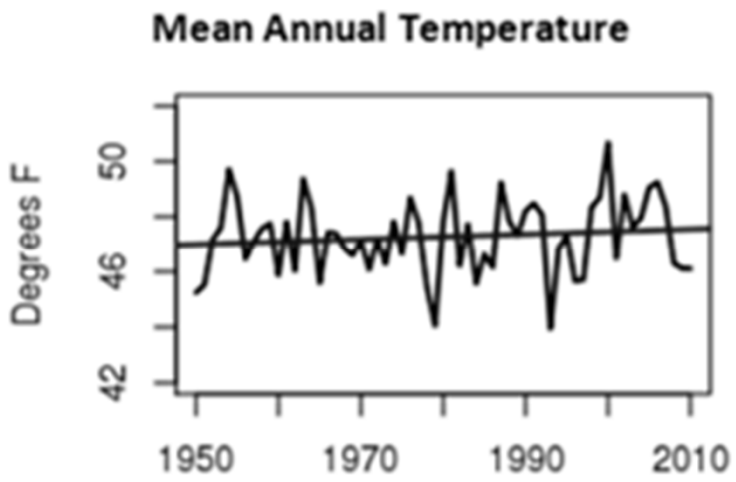
1) Start from 112 archived CMIP3 climate & hydrology projections, including P, T, RO, ET

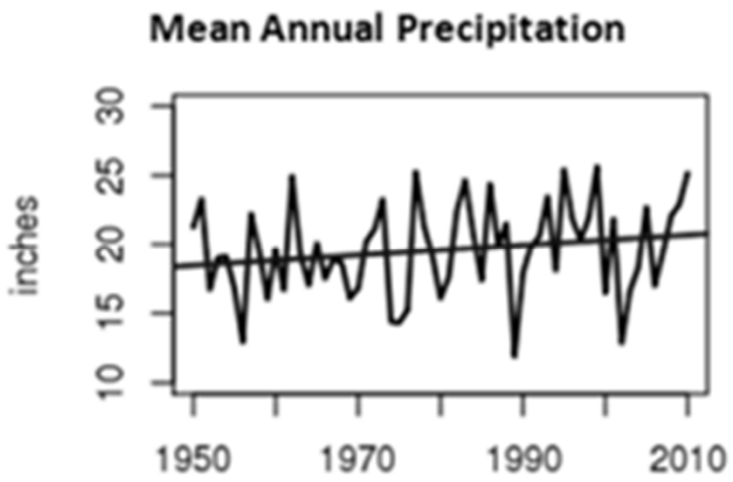
2) Rank projections based on change between 2030-2059 and 1970-1999

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

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

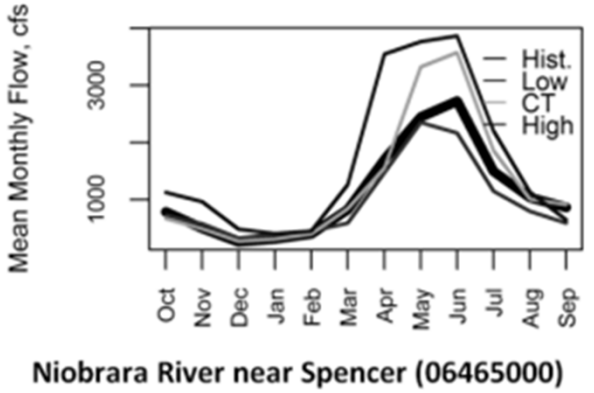
Historical Trends in Niobrara Basin





Climate Variability Projection

- Projection Analysis Results



Niobrara River near Spencer (06465000)

		Low	Central Tendency	High
Mean Summer Temperature (June - August)	Select Projection Based on 112 Projections	+2.9°C	+1.9°C	+1.2°C
		+3.3°C	+2.1°C	+.96°C
Mean Summer Precipitation (June - August)	Select Projection Based on 112 Projections	-13%	+5.4%	+13%
		-15%	+4.7%	+17%

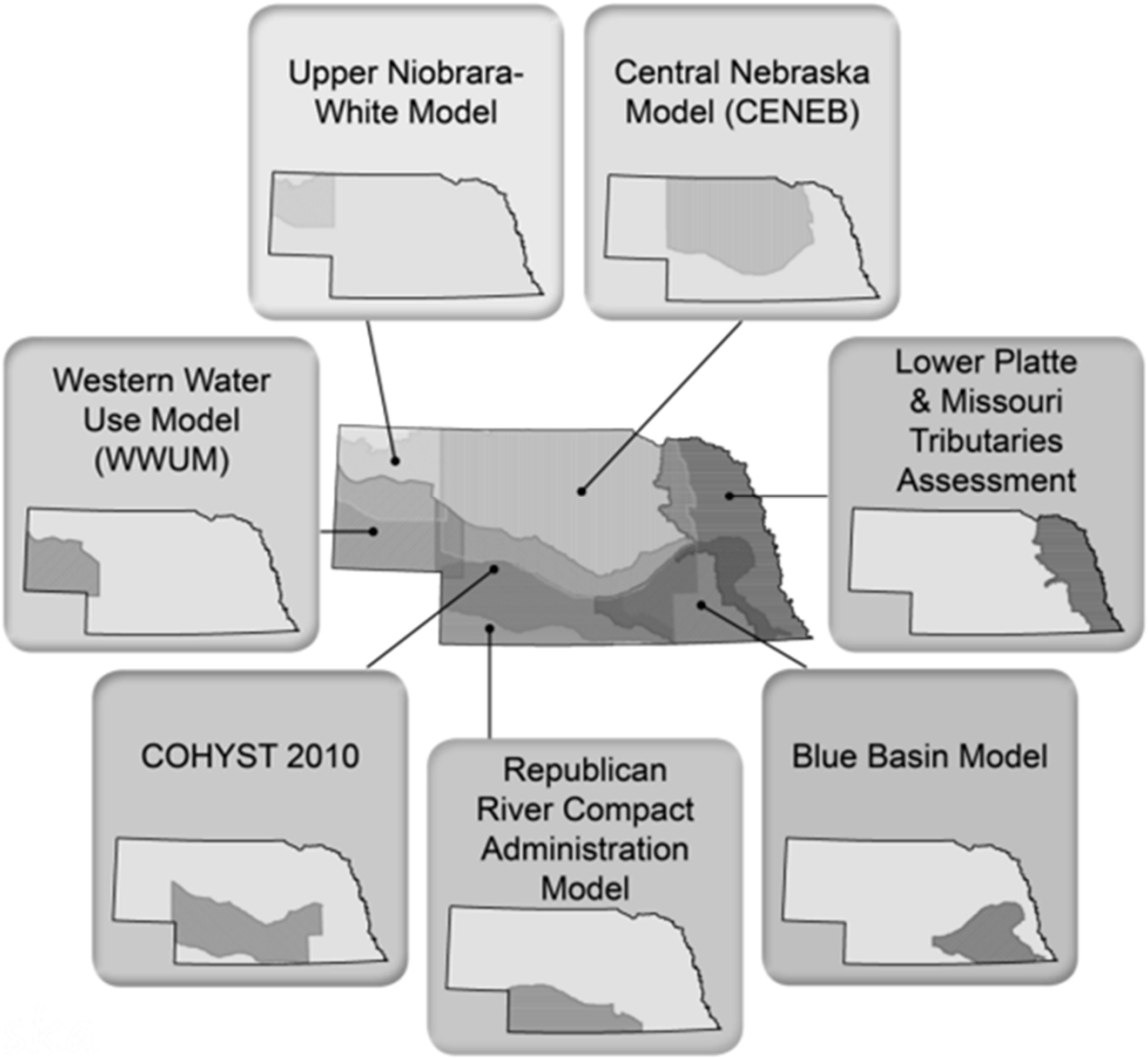
Integrated Water Management Modeling

- Change in one hydrological component may affect the other components of the system

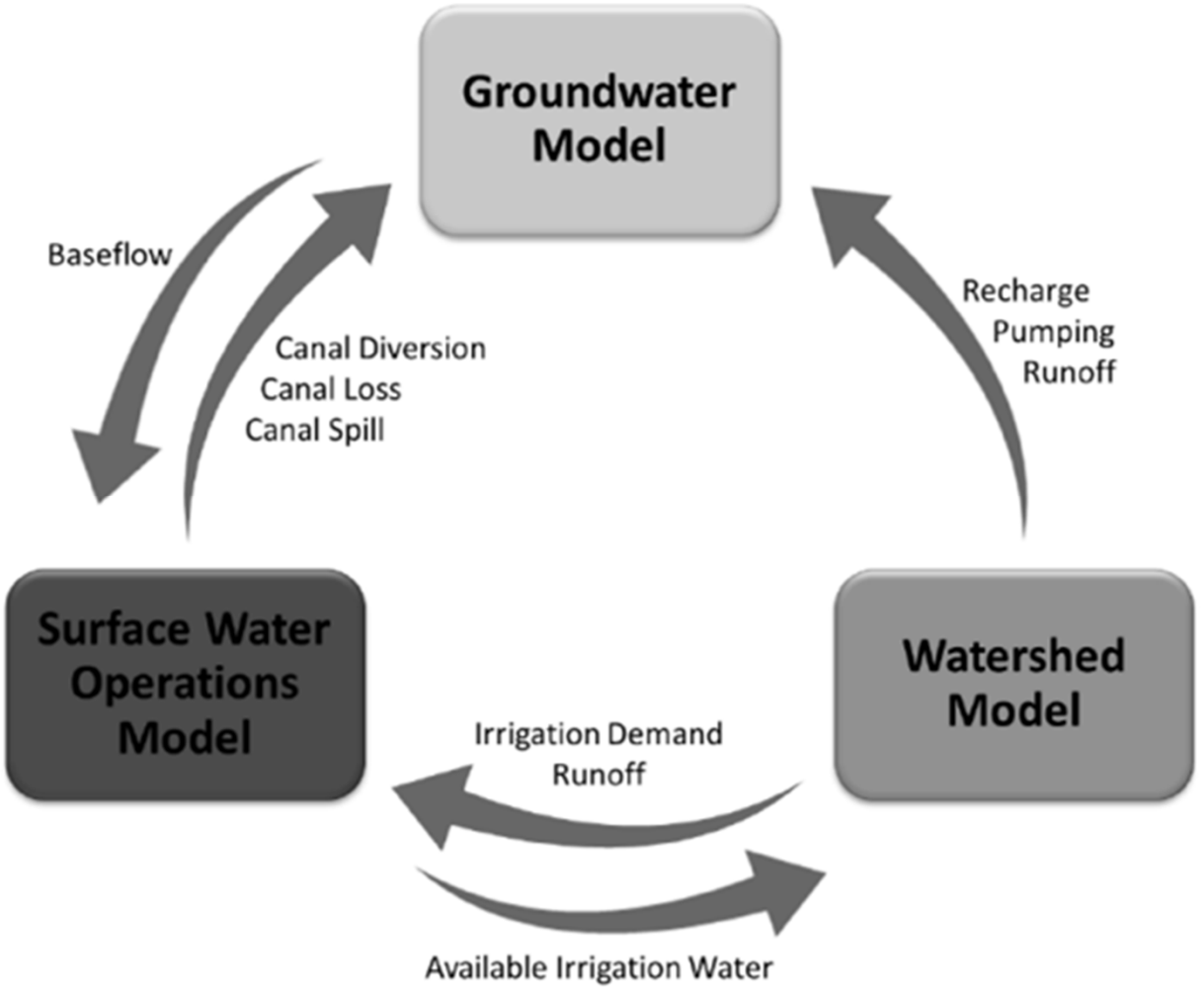
- Integrated Water Management (IWM) Model for better understanding of
  - interaction between surface water and groundwater systems
  - response of different hydrological components to stress

- 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



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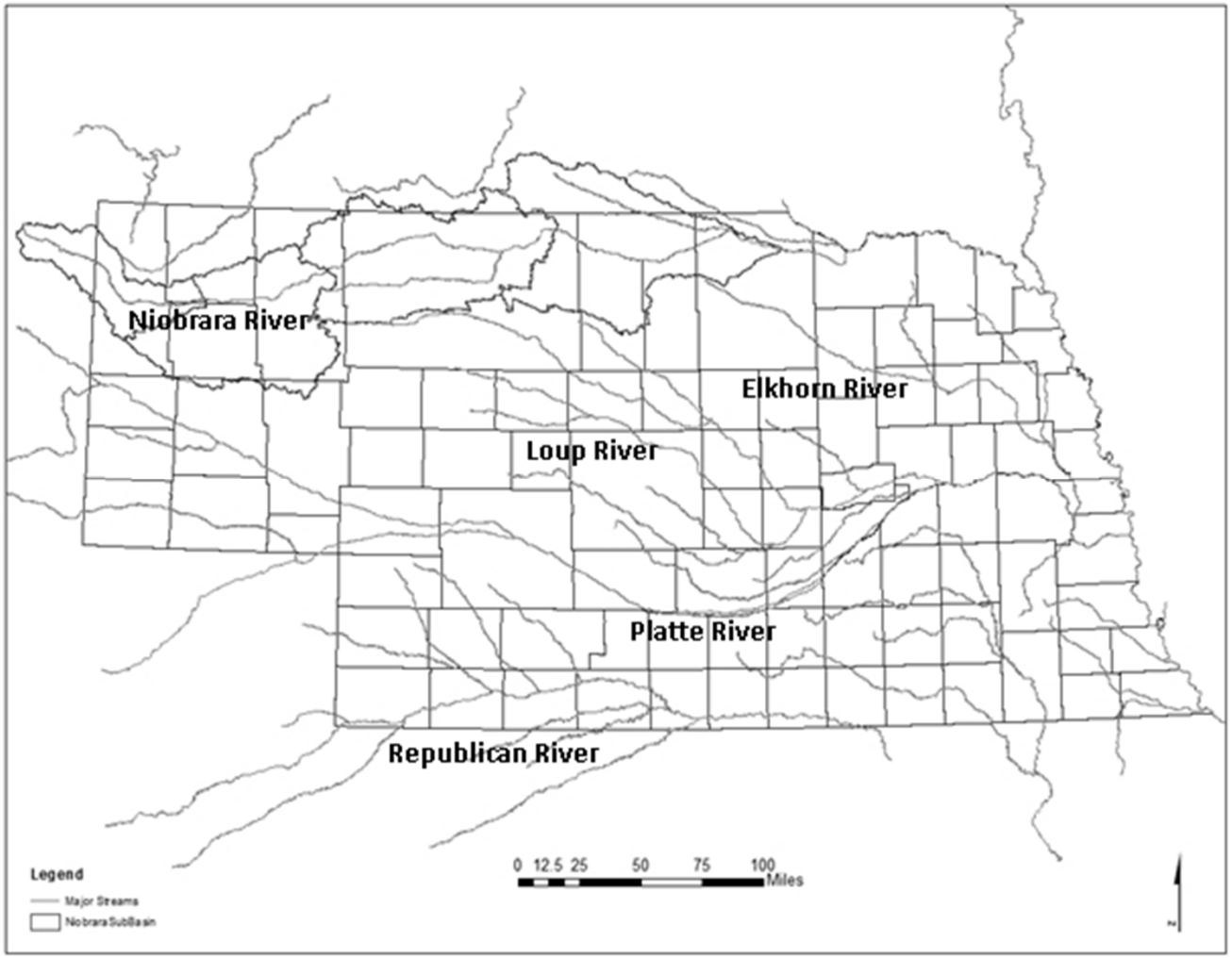

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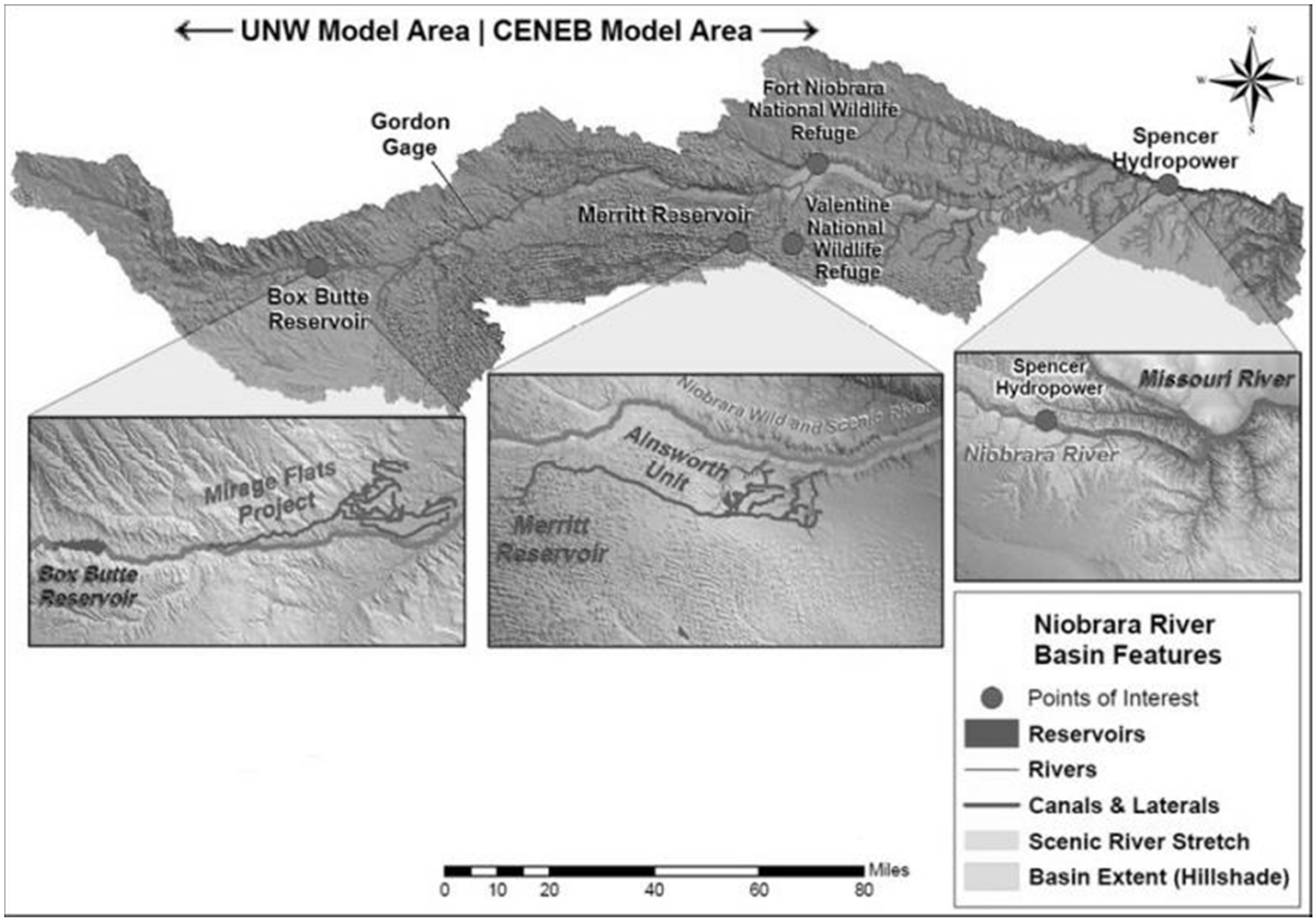
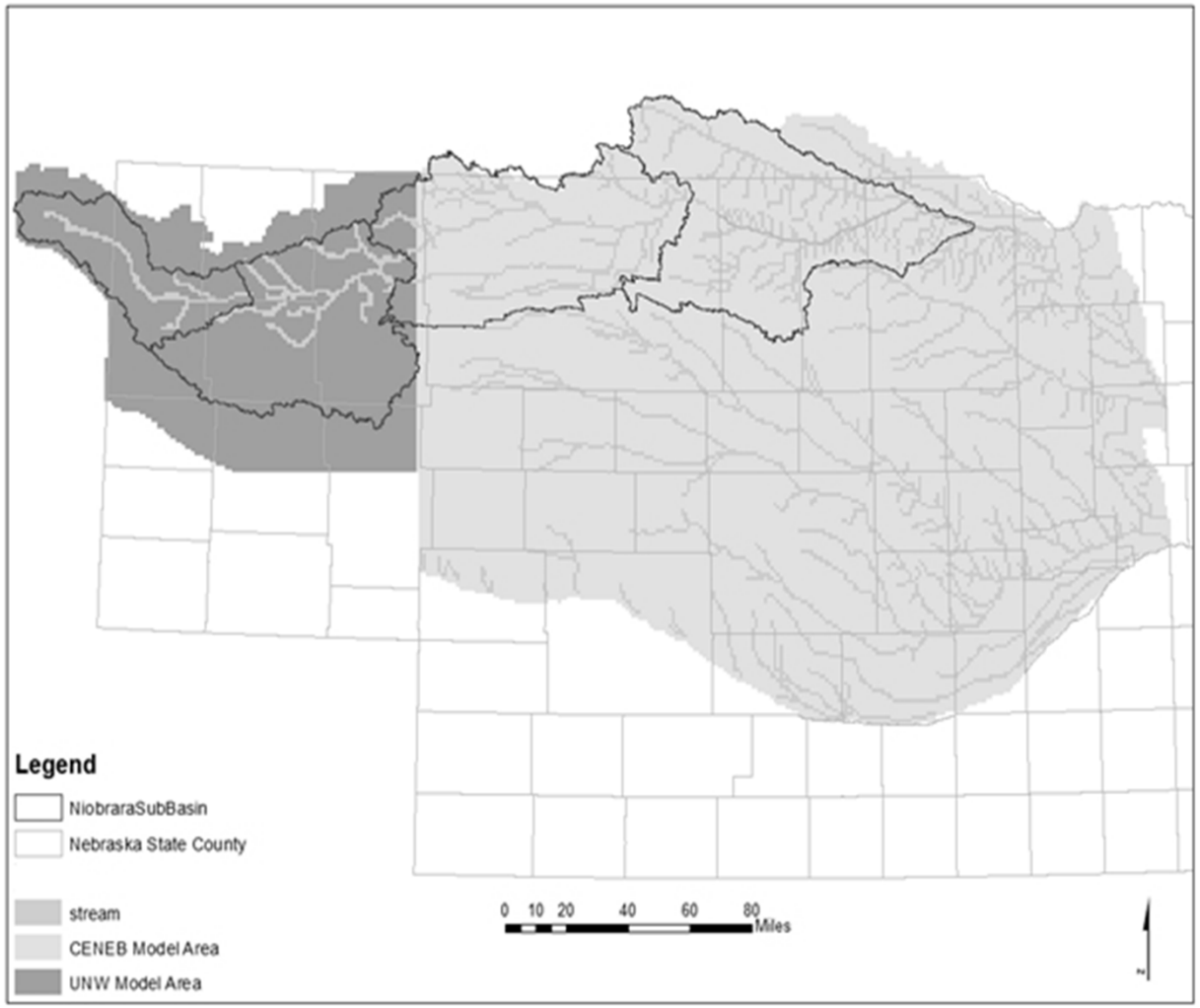
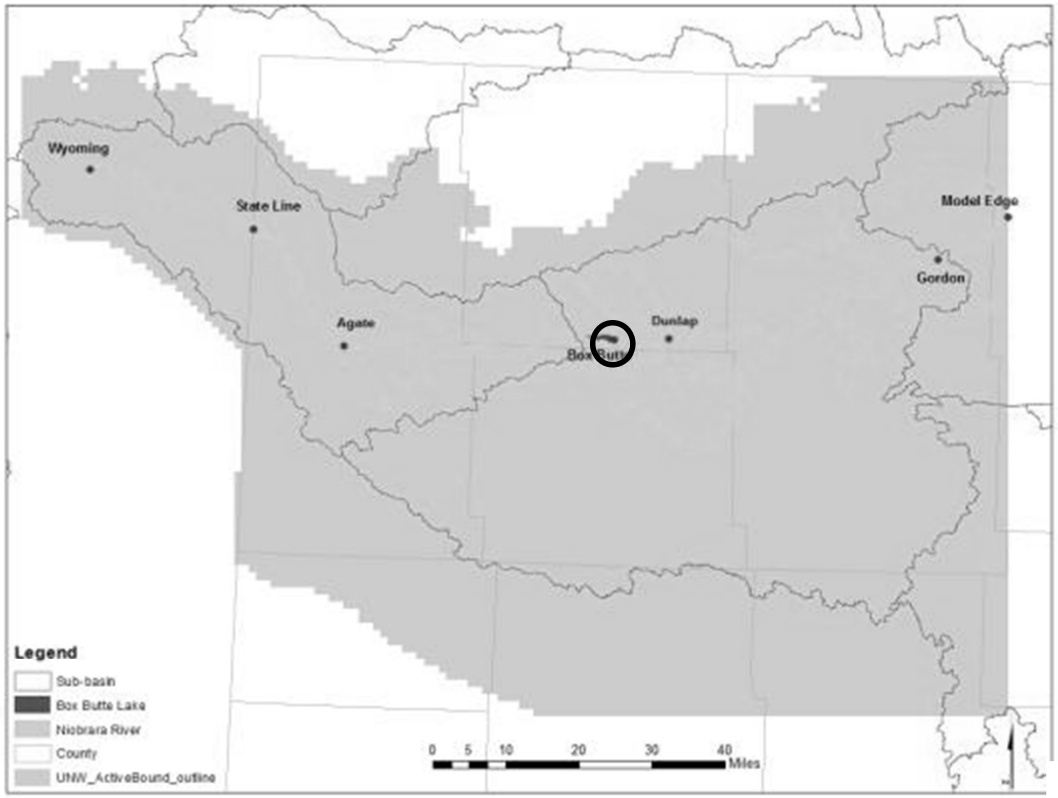
Framework for IWM Modeling

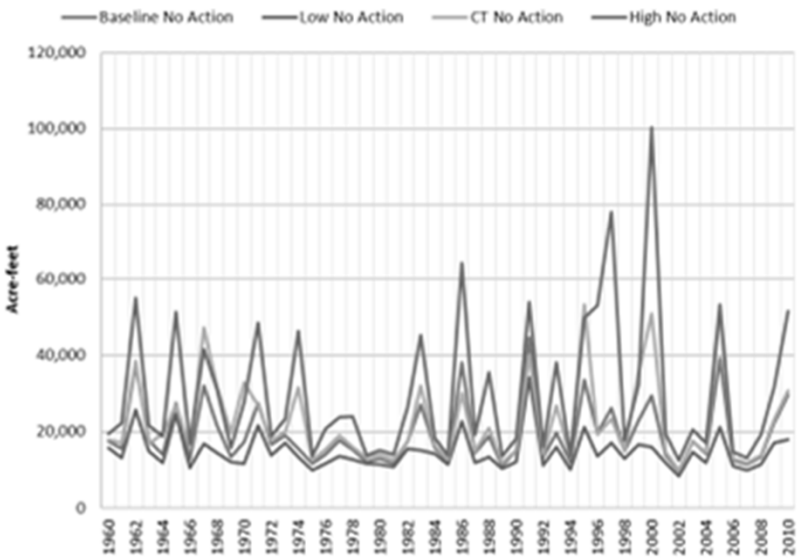


Application of IWM Modeling





Total Flow



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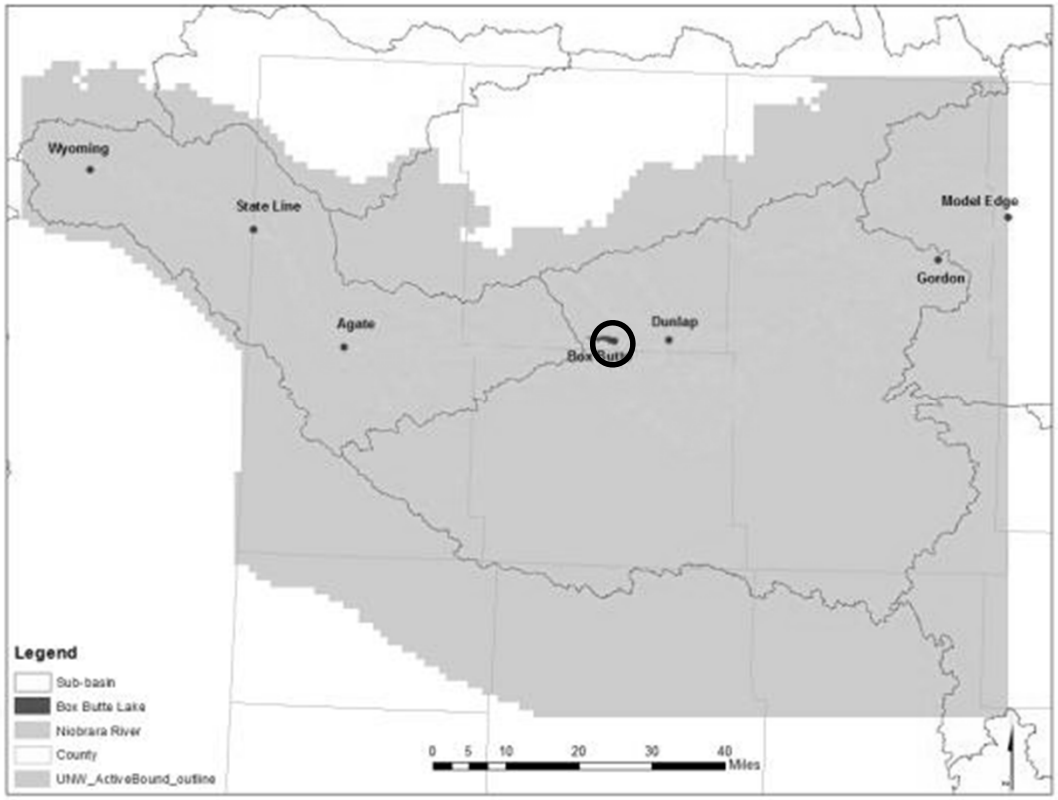
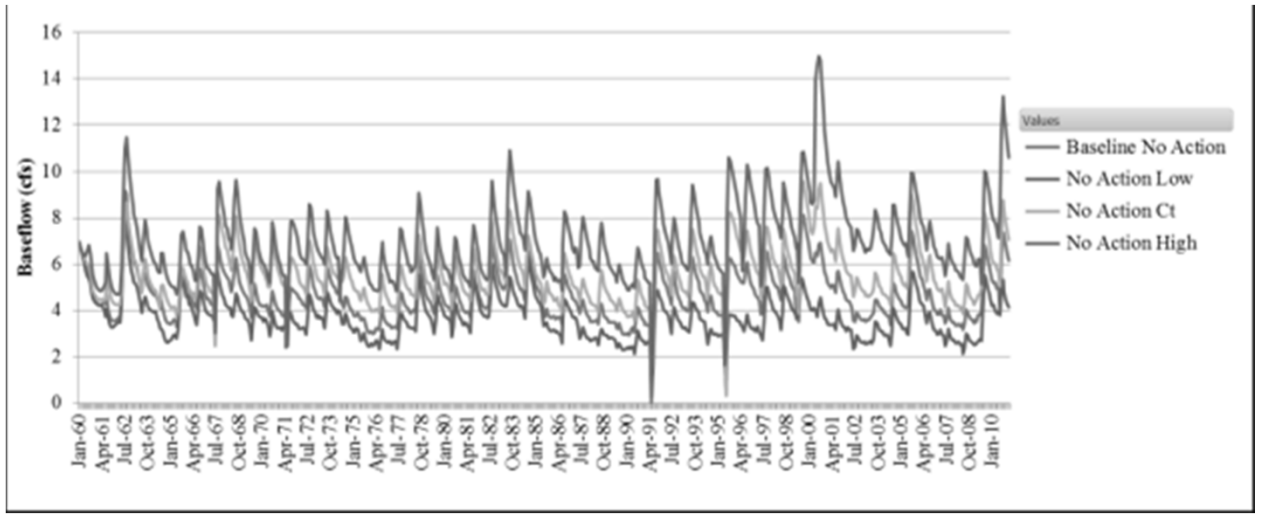


Baseflow



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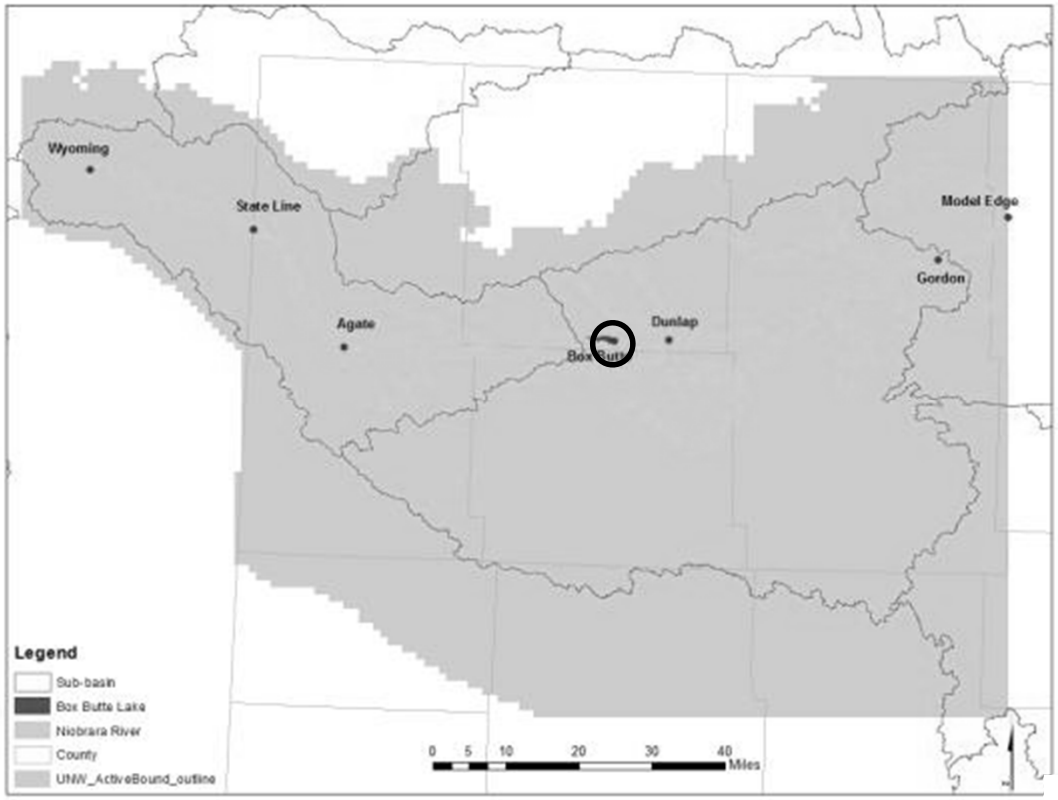
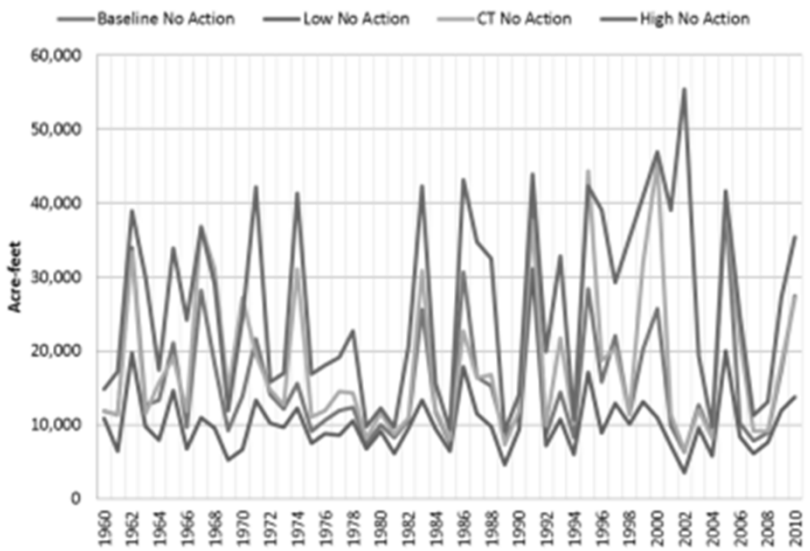


Reservoir Release



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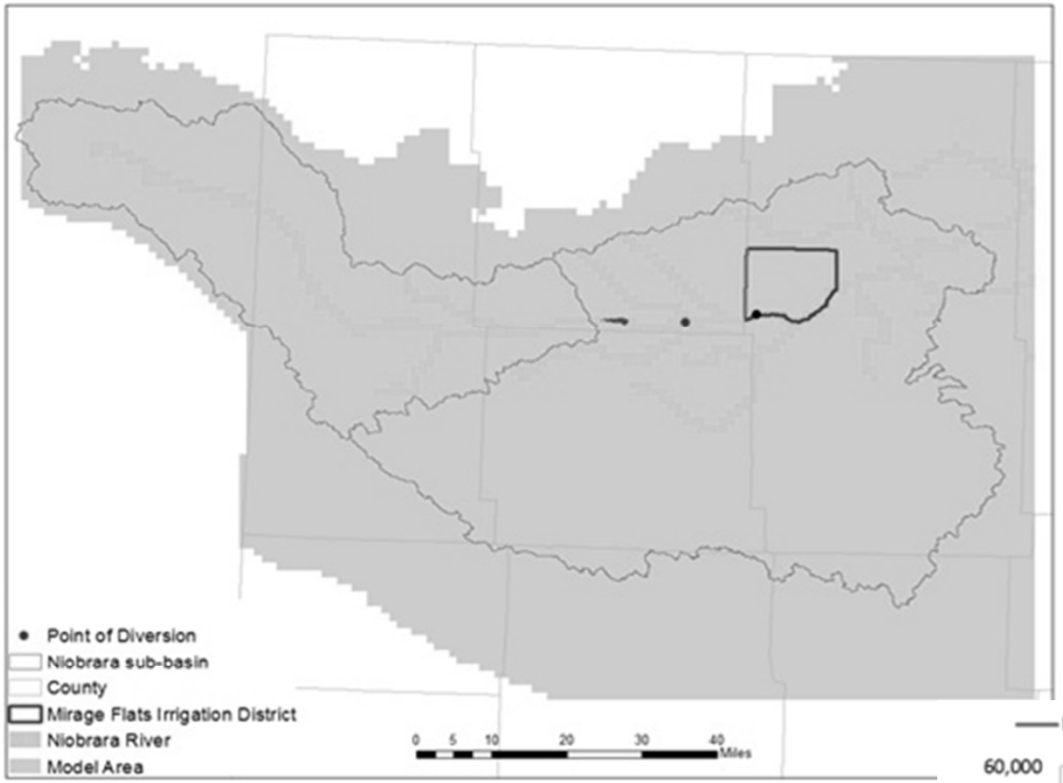
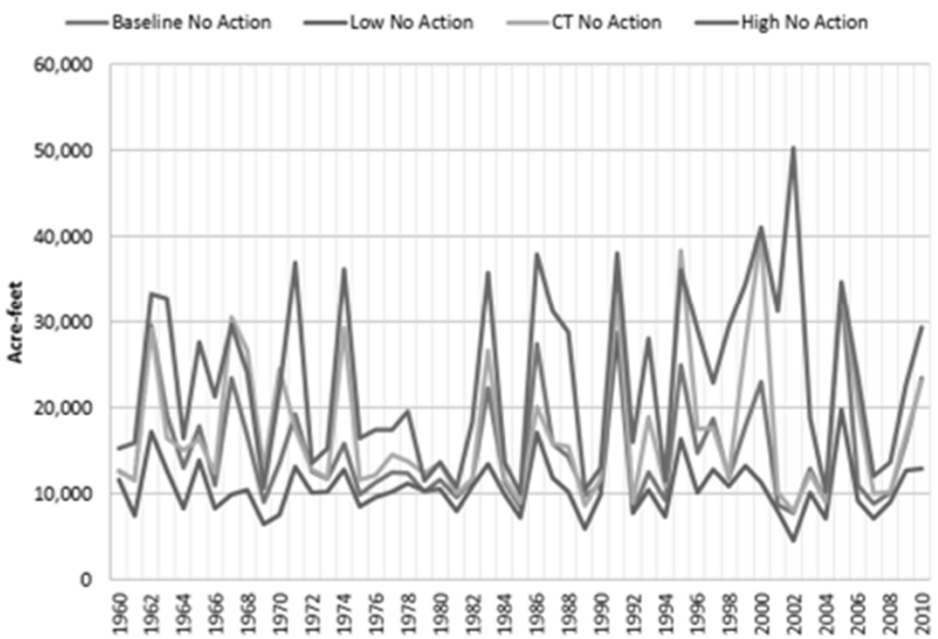


Surface water Diversion



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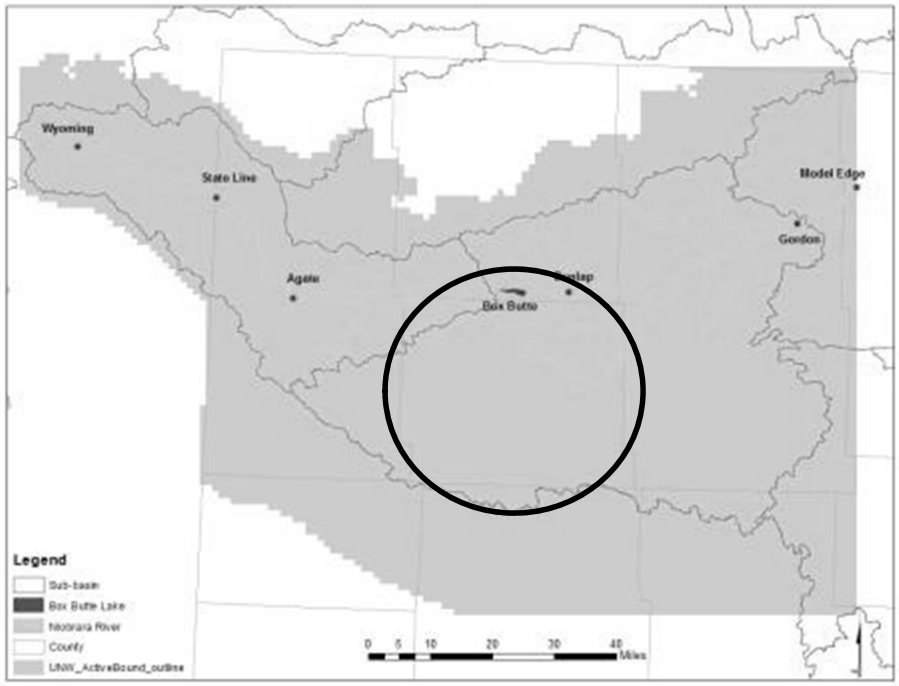

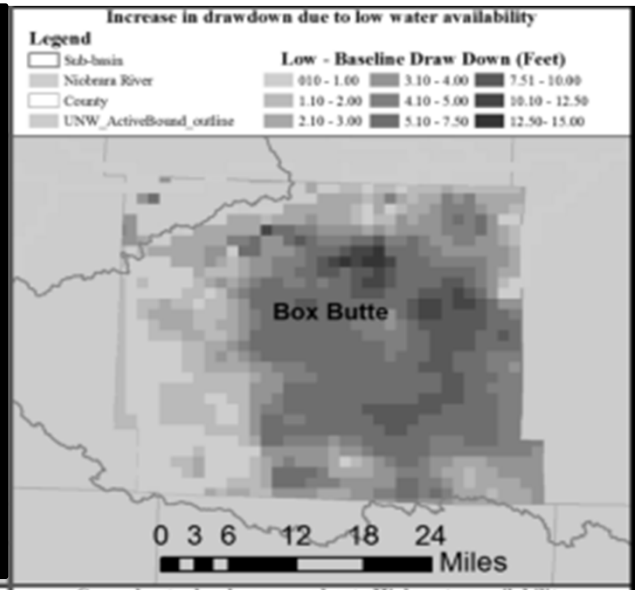

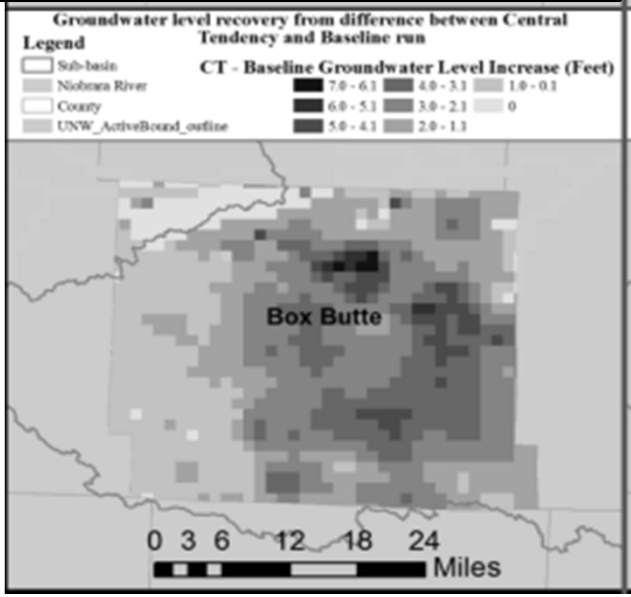

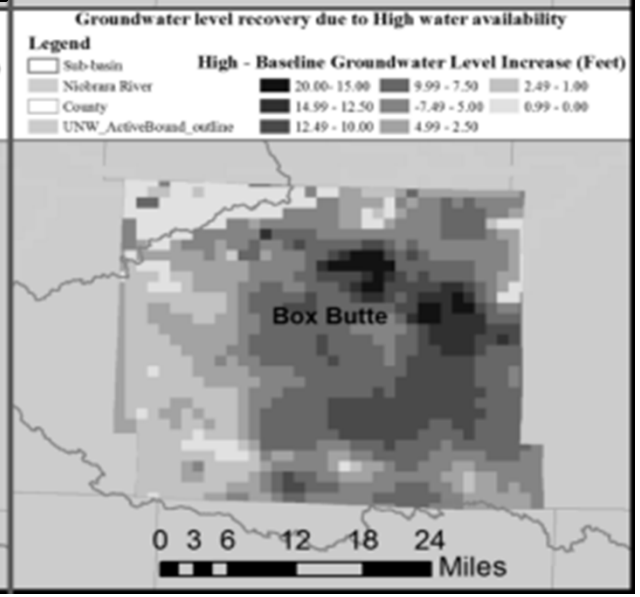

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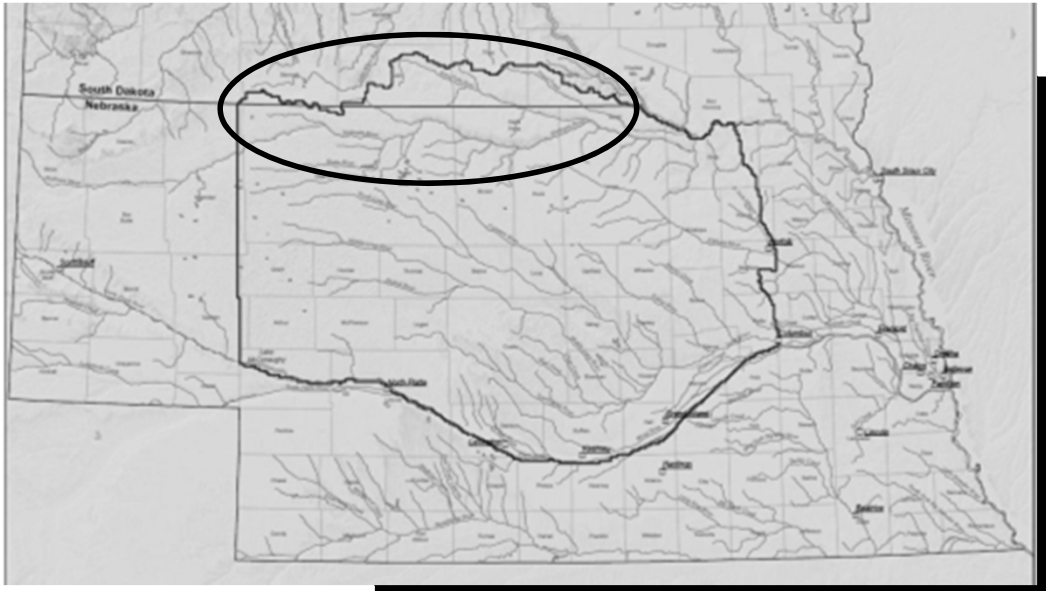

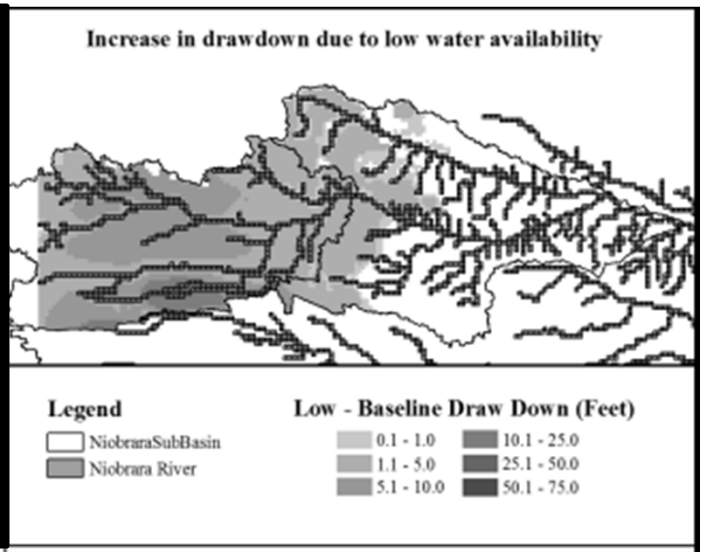

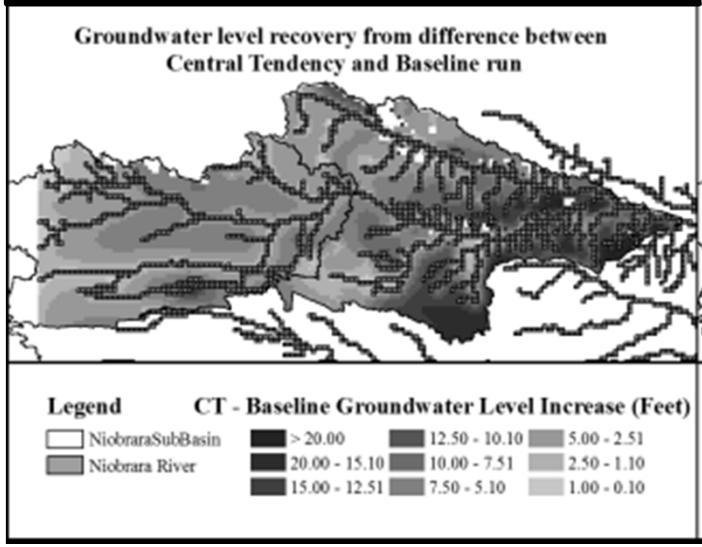

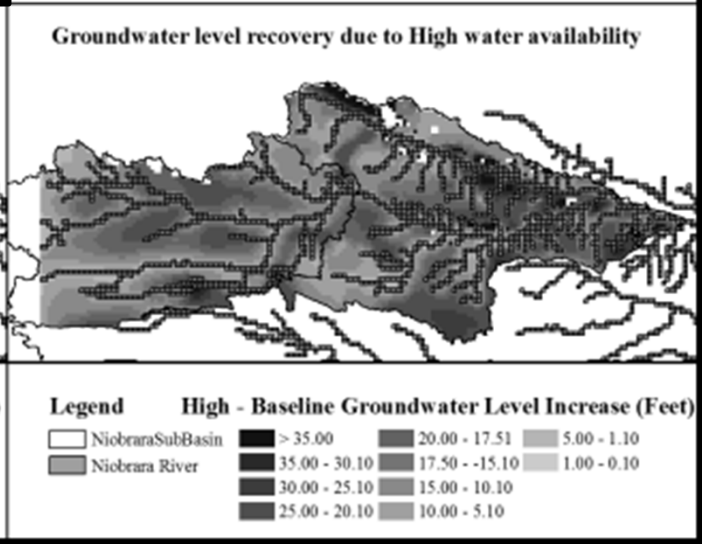

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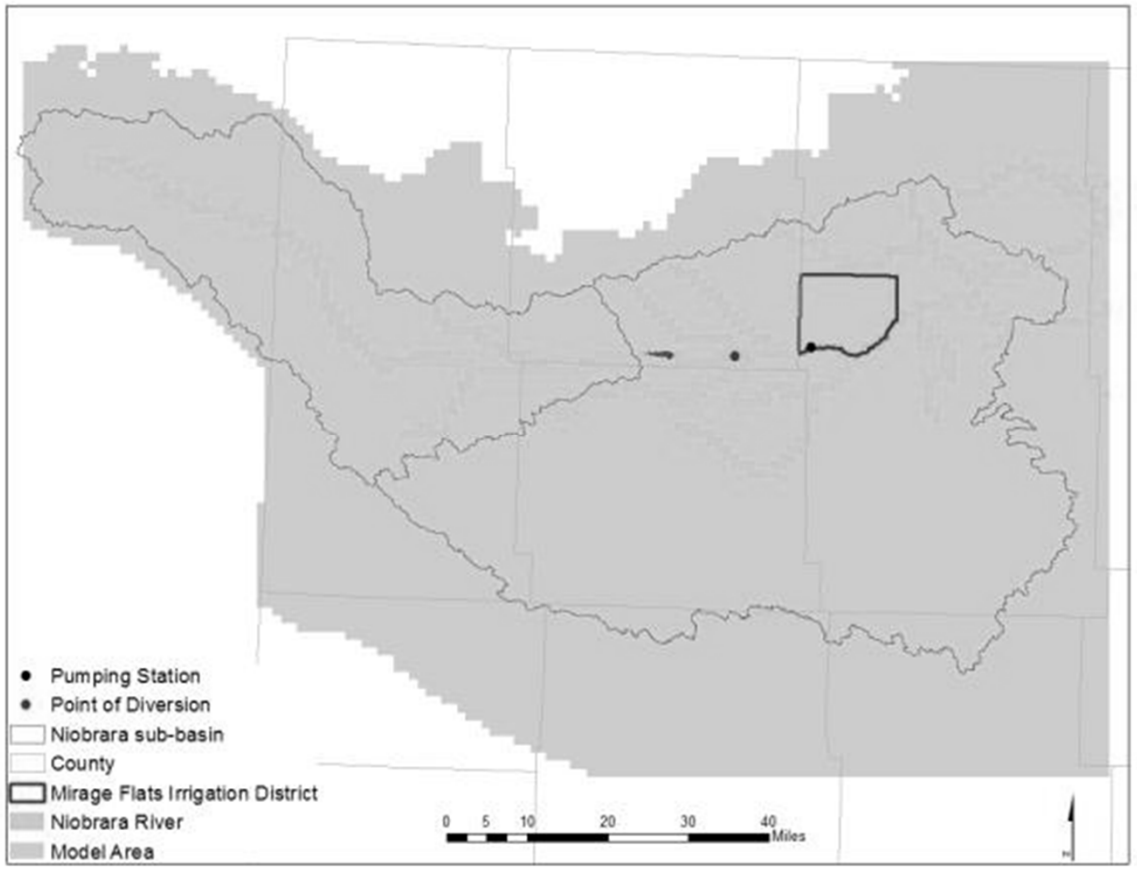
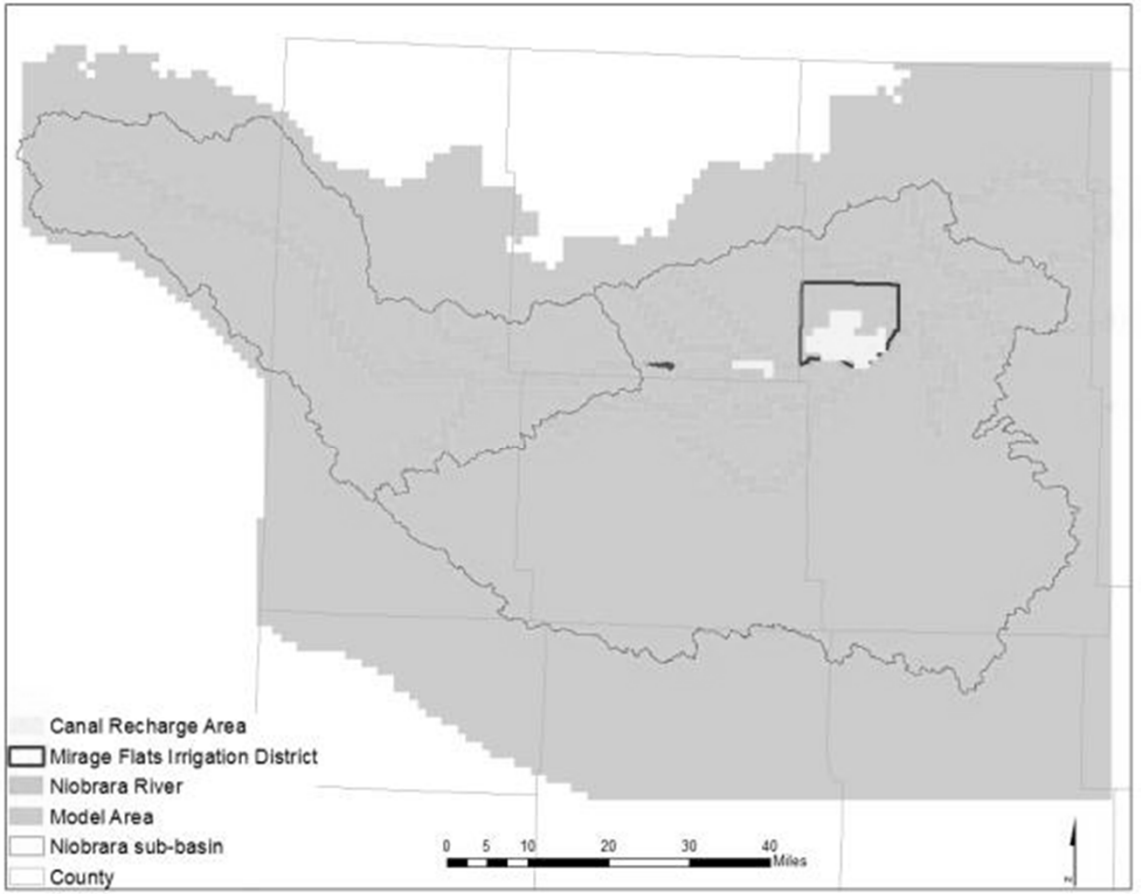
Alternative water Management Scenario

- **Mirage Flats Pumping Station Scenario (Alt1)**



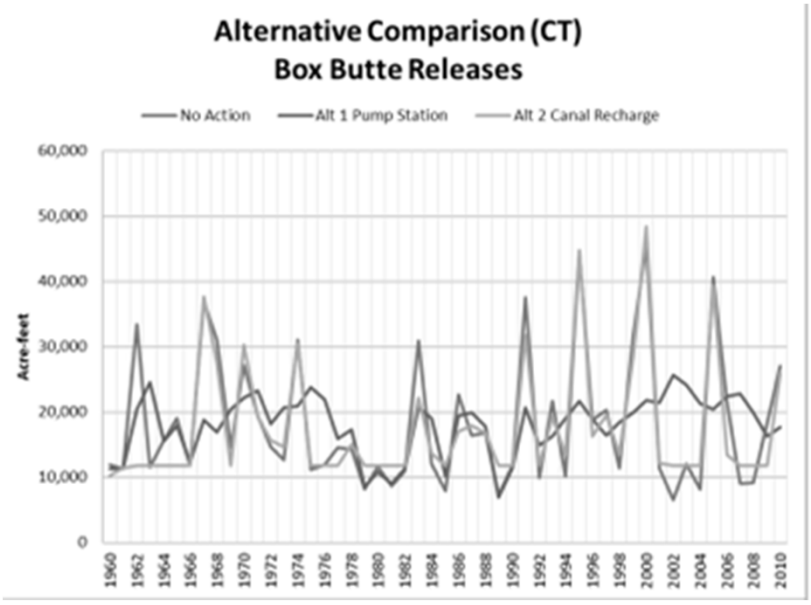
Alternative water Management Scenario

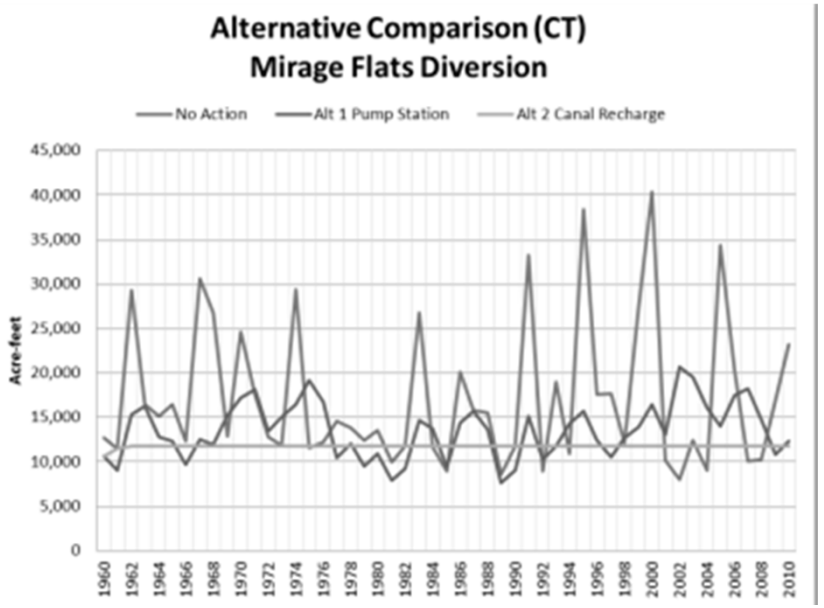
- Mirage Flats Canal Recharge (Alt2)



Alternative water Management Scenario

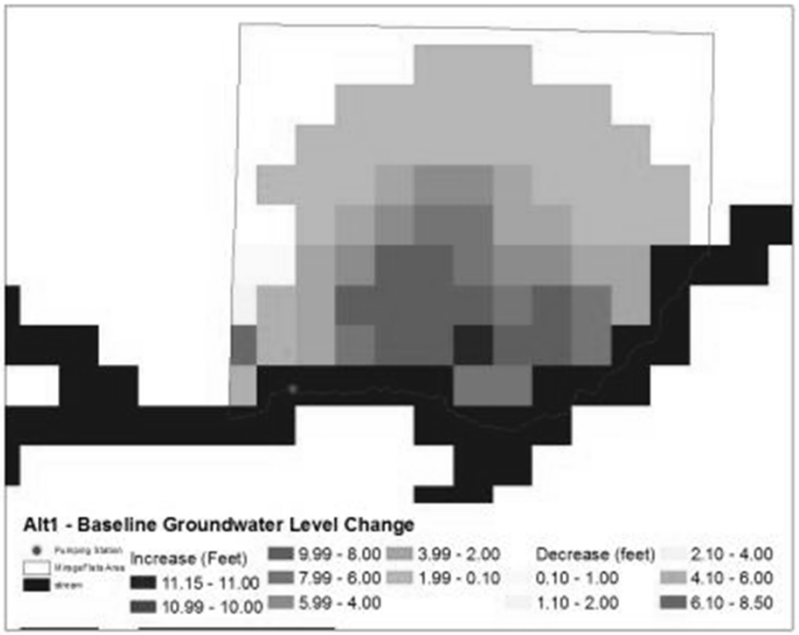
- Alternative water management scenario comparison

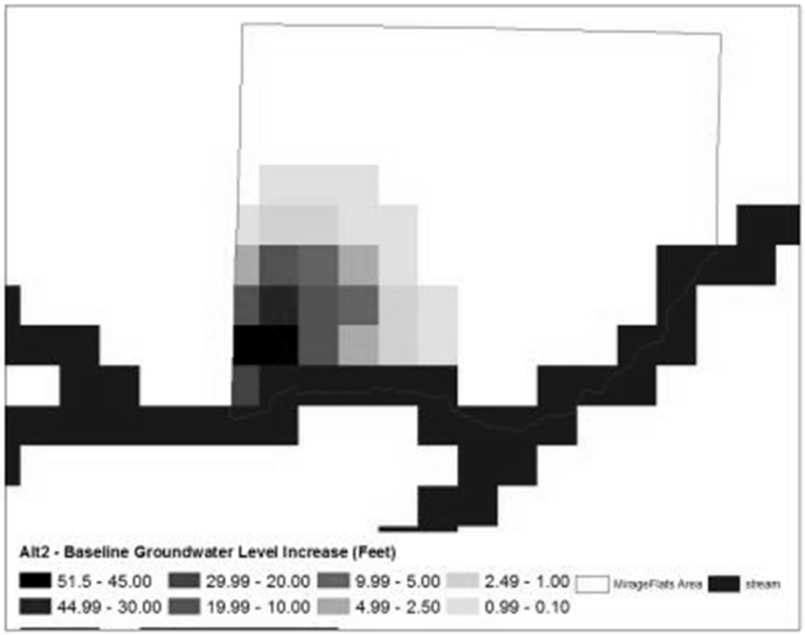




Alternative water Management Scenario

- Alternative water management scenario comparison





Alternative water Management Scenario

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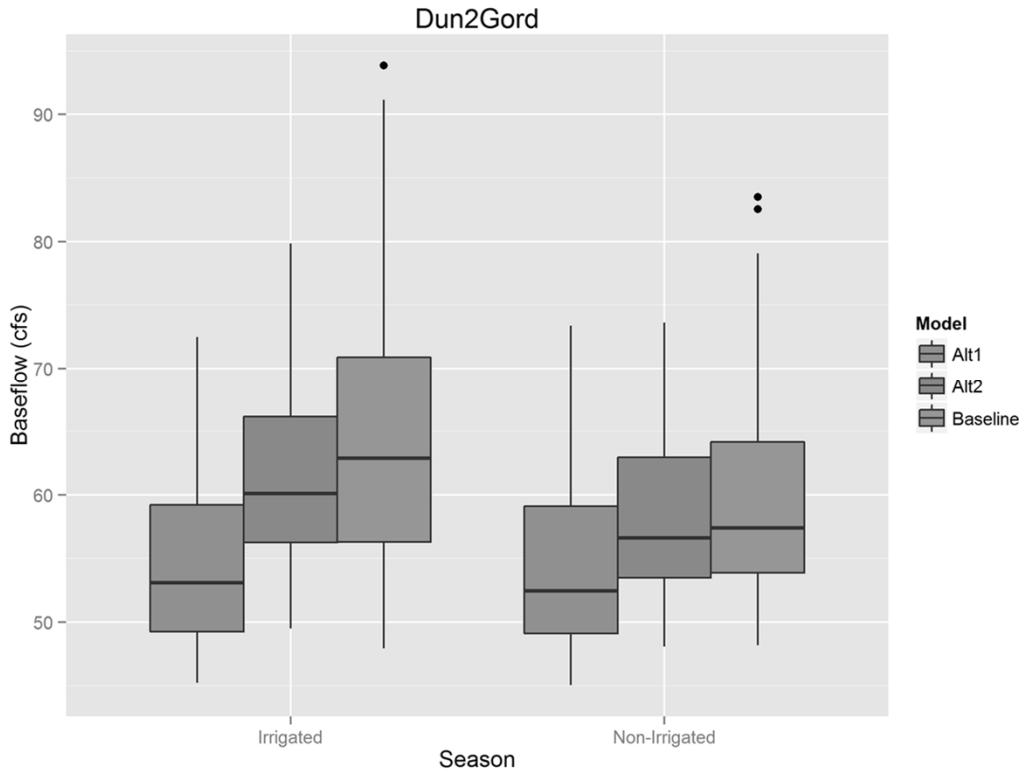

Summary

- 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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NEBRASKA'S WATER MANAGEMENT RESOURCE

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

THANK YOU

Mahesh Pun, EIT
Integrated Water Management Analyst
Mahesh.pun@nebraska.gov
402-471-3959

Nebraska Department of Natural Resources
402-471-2363
dnr.nebraska.gov