Institutional Water Risk and Agricultural Land Use Decisions

Idaho NSF EPSCoR at Boise State University
Team Members:
Dr. Kelly M. Cobourn, Dr. Scott E. Lowe,
Dr. Siân Mooney, and Dr. Wenchao Xu

Introduction

Water availability will affect the choices that growers make about what to grow (e.g., a potato grower):

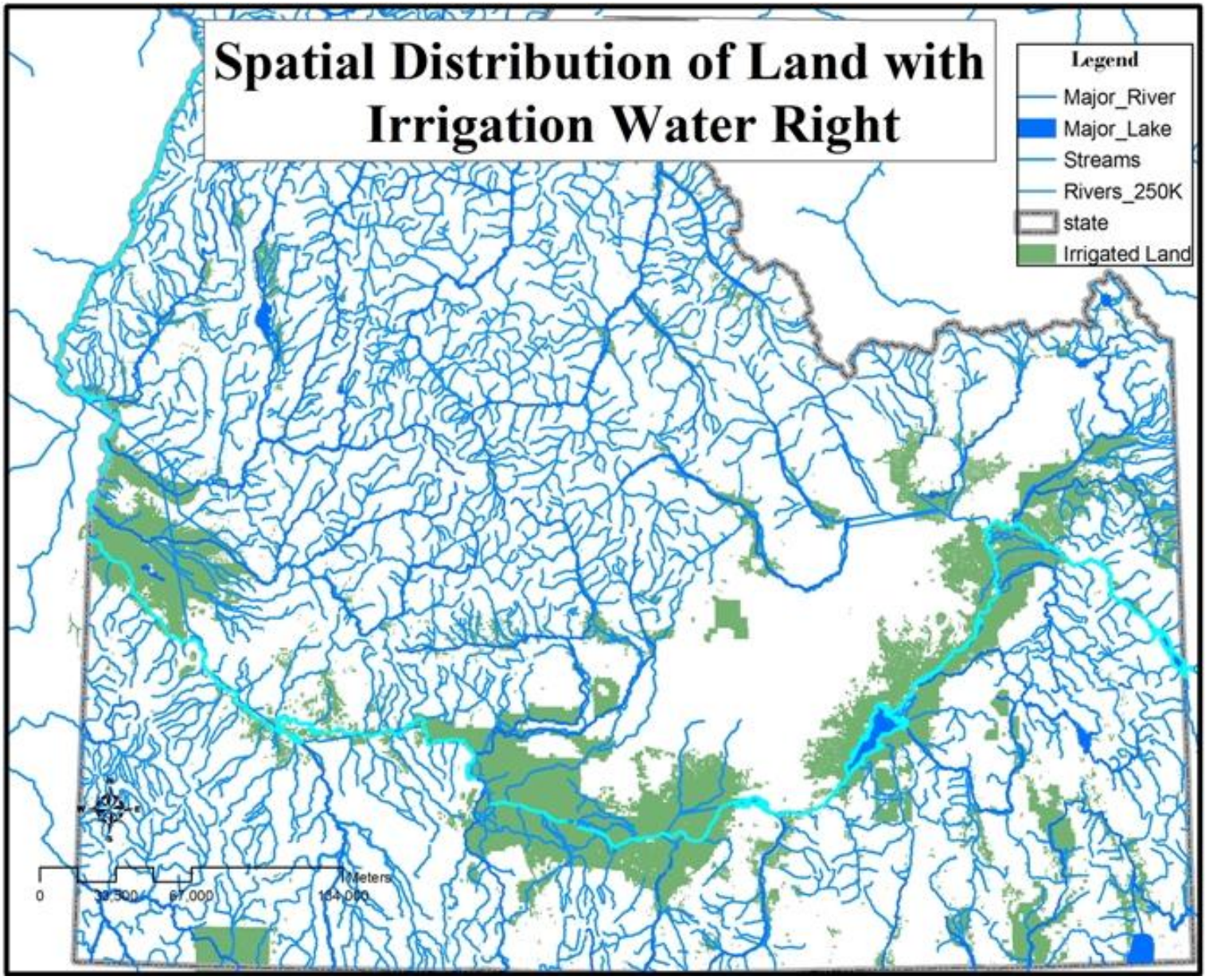
- Should I continue growing potatoes, which will die if a watering date is missed because I have junior rights and my water use is curtailed?
- Or should I grow something more resilient to drought but may generate less revenue?

If the variability of water supply happens on a large scale, crops supply and generated revenue can vary considerably.

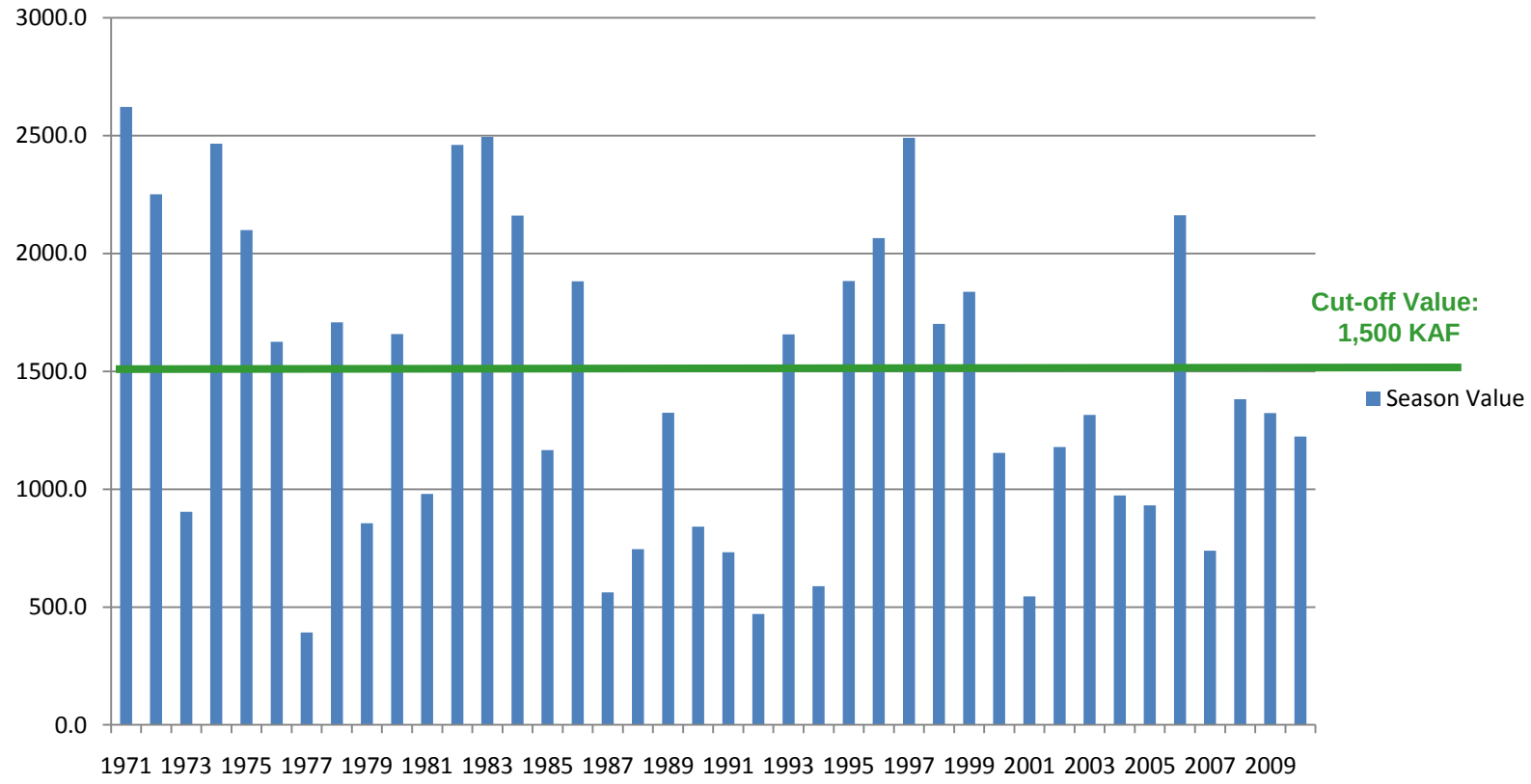
Water Availability in the Snake Plain (2 Major Factors):

- Natural : Climate variability changes the timing and amount of water available for agricultural production.
- Institutional : The amount of water an individual producer can receive also depends on his water rights. (Producers with earlier rights are more sure to receive their water than junior producers.)


Major Basins, Rivers, and Land Cover of Idaho
The Kootenai, Pend Oreille, and Spokane River Basins
The Lower Snake River Basin
The Middle Snake River Basin
The Upper Snake River Basin
N
W
E
S
0
50,000
100,000
200,000
Meters


Spatial Distribution of Land with Irrigation Water Right
Legend
Major_River
Major_Lake
Streams
Rivers_250K
state
Irrigated Land
0
Meters

Boise River near Boise
(One of Major Tributaries of the Snake River)
Apr-Sept Streamflow Estimated at Apr (1971 - 2010)



Data Source: USDA/NRCS

Issues & Objectives

- Key Issues:
  - Water Availability/Security and Agricultural Production
    1. Climate Change and Water Availability
    2. Water Rights and Water Availability (Curtailment is very likely during dry seasons.)

- Objectives:
  1. Develop a theoretical framework linking climatic variability and water rights to land-use change
  2. Estimate an empirical model of land-use change
  3. Identify the effect of climate change and water rights on agricultural land-use decisions

Hypotheses

- There are 2 ways that a grower can hedge against the risk of water shortage in a dry year:

1. He can change his land use:
   - Water Allocation Strategy Change – dryland vs. irrigated production
   - Crop Choice Strategy Change – water allocated to more valuable crops; increase land base in drought-tolerant crops

2. He can change his water right(s) to make water supply more secure:
   - Short-run: Water Banking Trading
   - Long-term: Water Right Change Petitions (Based on Current Water Right Holdings, Vintage, POU, POD, and etc.)

Hypotheses (cont'd)

- Although a grower can change either land use or water rights, we focus on land use.

  3 Major Reasons:

  – Water banking is new and limited.

  – Long-term water-right changes face high institutional cost!
    - Legal obstacles (no-harm rule)
    - Time (application process could last 10 years or even longer)

  – Water markets may not be feasible.

Theoretical Framework

A grower chooses how to allocate his land each season to maximize profits.

The decision depends on:

- The probability that his water use will be curtailed during the growing season (depends on his water right vintage and growing-season drought severity.);
- The crops that he chooses to grow (their historical/future prices, yield, and sensitivity to drought).

Theoretical Framework (cont'd)

- What we can show:
  - Junior producers will concentrate their irrigation on a smaller land base (of their most high-quality land) and on their most high-value crops
- Does this correspond to reality?
  - Anecdotally, yes!

    Evidence: Fish Creek Reservoir (IDWR)

- In the future, we'll also look at how producers will change their water rights in response to water shortages.

Data

- **Climate:** Long-term Daily Climate Record (ORNL), Monthly Average (PRISM), 1970-2000 U.S. Climate Normals (NOAA), and etc.
- **Water Right:** Water Rights- Place of Use and Point of Diversion (IDWR).
- **Agriculture:** Processed NASA LANDSAT Remote Sensoring Data; National Cropland Layers (USDA), and etc.
- Other **Environmental Factors:** Soil (USGS), Hydrology (USGS), Geology (USGS), and etc.
- Other **Socio-economic Factors:** Census 2000 Boundaries (US Census), Water Administrative Boundaries (IDWR), and etc.

Things to Consider

- Constraining Assumptions:
  - Theory: Interactions between short-term vs. long-term decision making;
  - Empirics: Spatial and Temporal Correlation

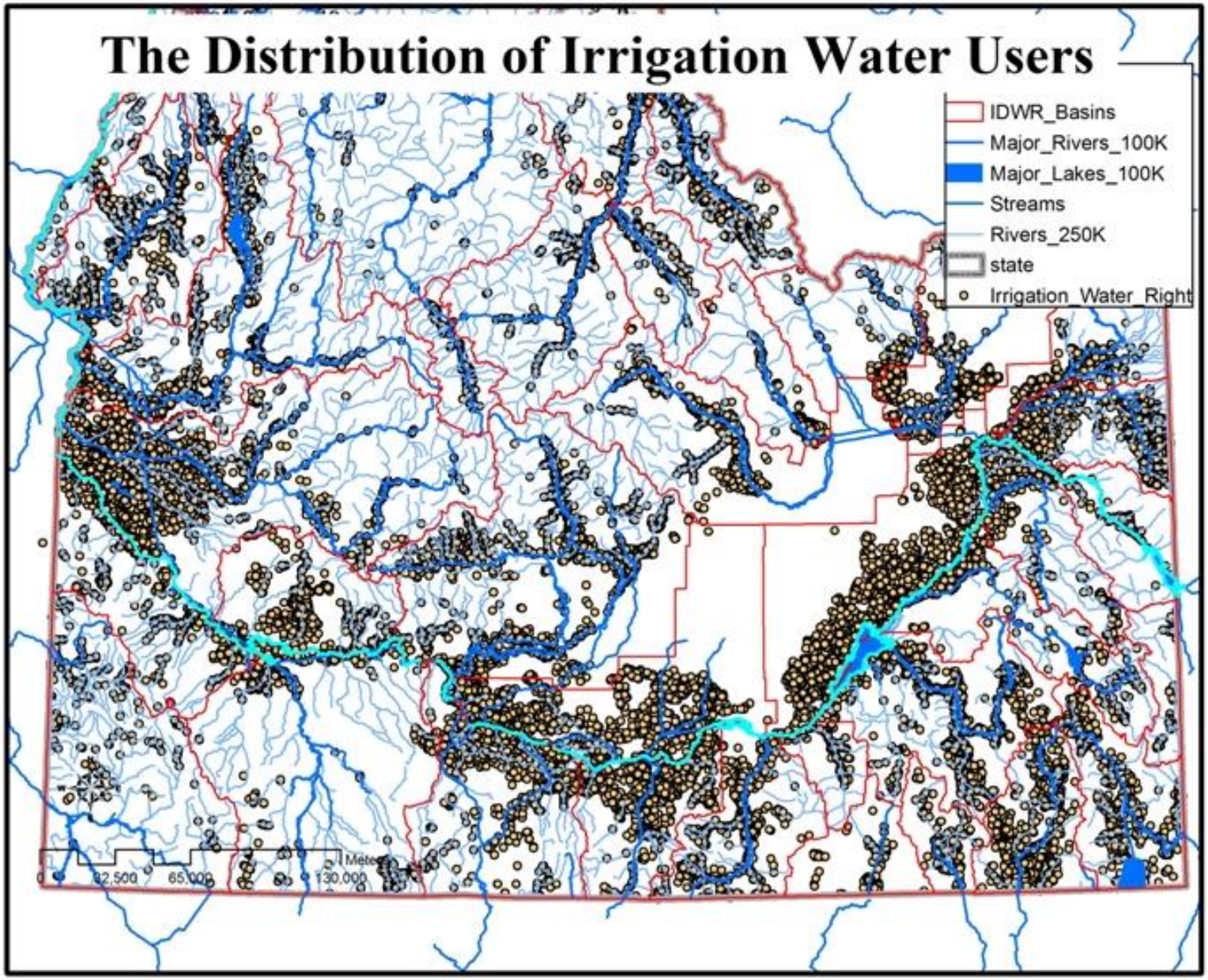
- Problematic Data:
  - Climate Variability
  - Crop Choice and Change
  - Water Right Portfolio and Change

Progress

- Models:
  - Theoretical models are in the process of finalization
  - Empirical models will be derived afterwards

- Data Collection & Compilation:
  - Data collection is done
  - Data Post-processing required: e.g. to calculate the degree days (DD) from Long-term Daily Climate Record (ORNL)
  - Further Compilation required : the data at the farm level need to be extracted and compiled in a single data spreadsheet

Thank you!


The Distribution of Irrigation Water Users
IDWR_Basins
Major_Rivers_100K
Major_Lakes_100K
Streams
Rivers_250K
state
Irrigation_Water_Right
32,500
65,000
130,000