



Prior Appropriations Doctrine During Water Shortages: Hydro-Economic Evaluation of Spatial and Temporal Efficiency

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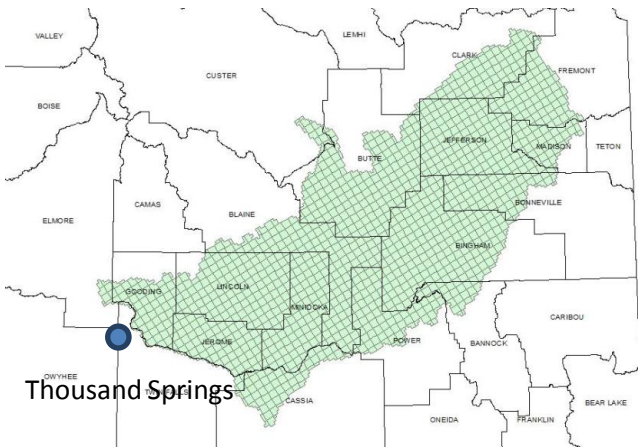
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Outline

- Eastern Snake River Plain Aquifer Background
- Research Objective
- Model
- Results
- Conclusions
- Future work

ESRPA Background

- Western water law is based on Prior Appropriations Doctrine, or —first in time, first in right.
- Aquifer water levels have been dropping since the introduction of pumping and sprinkler technologies
- Senior vs. Junior users



Discharge at Thousand Springs reach of the Snake River



Source:
Cosgrove, Johnson, Tuthill, 2007

ESRPA Curtailment Background

- Senior spring water users
 - Fish farms rely on cold spring water, which depends on aquifer water levels. Water rights date back to 30s and 40s.
 - Groundwater rights date back to 50s and later.
- During water shortages senior water users can issue “water calls”
- Department of water resources is obligated to ensure that senior water users have access to water before junior water users

State holds off on water curtailment

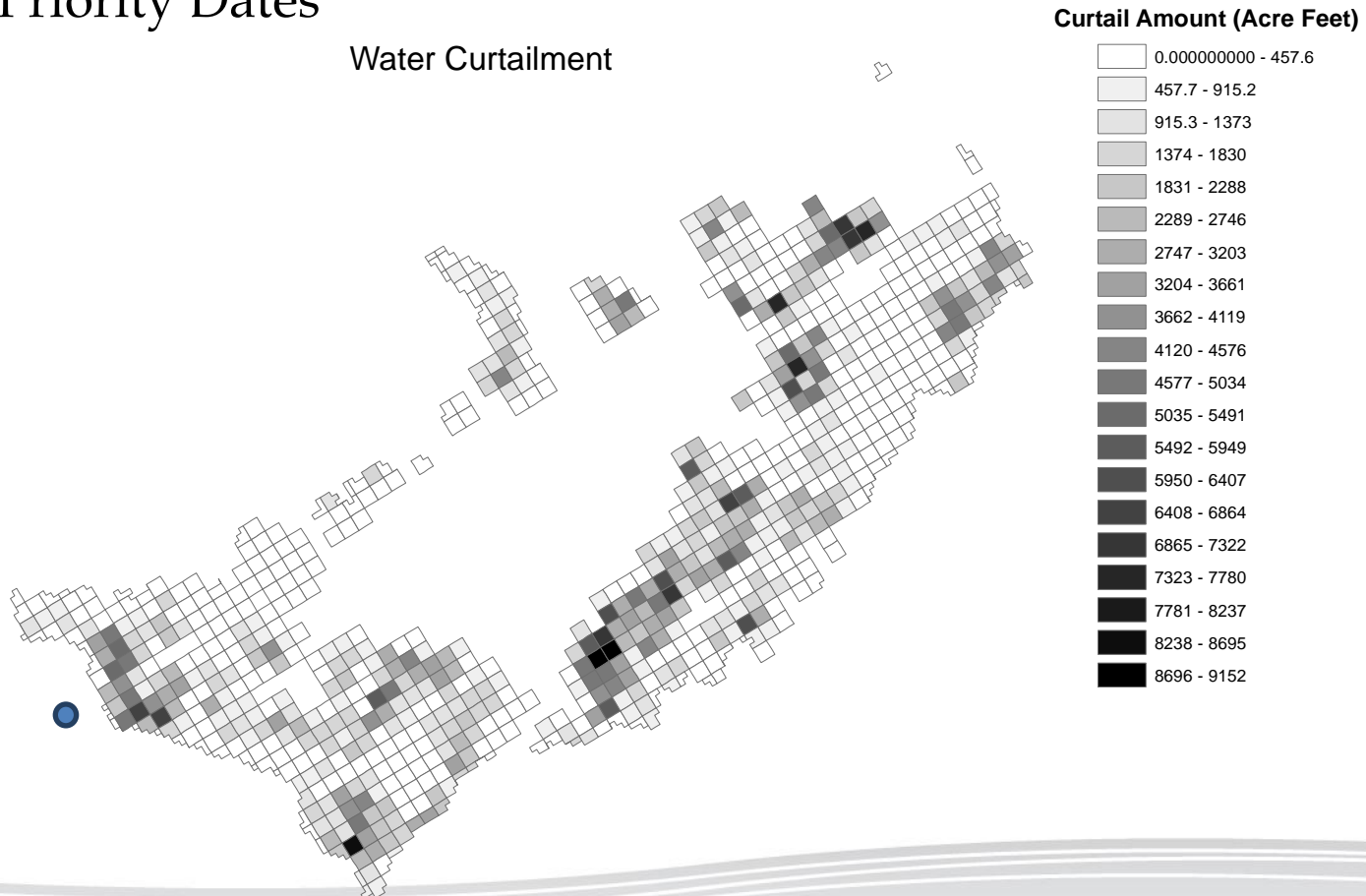


Curtailment

- 430 agricultural, municipal, industrial, and commercial holders
- 41,000 acres of irrigated farm land

ESRPA Curtailment Background

- Curtailment order: 865 junior water rights
- Curtailment based on hydrologic back-calculation in combination with Priority Dates

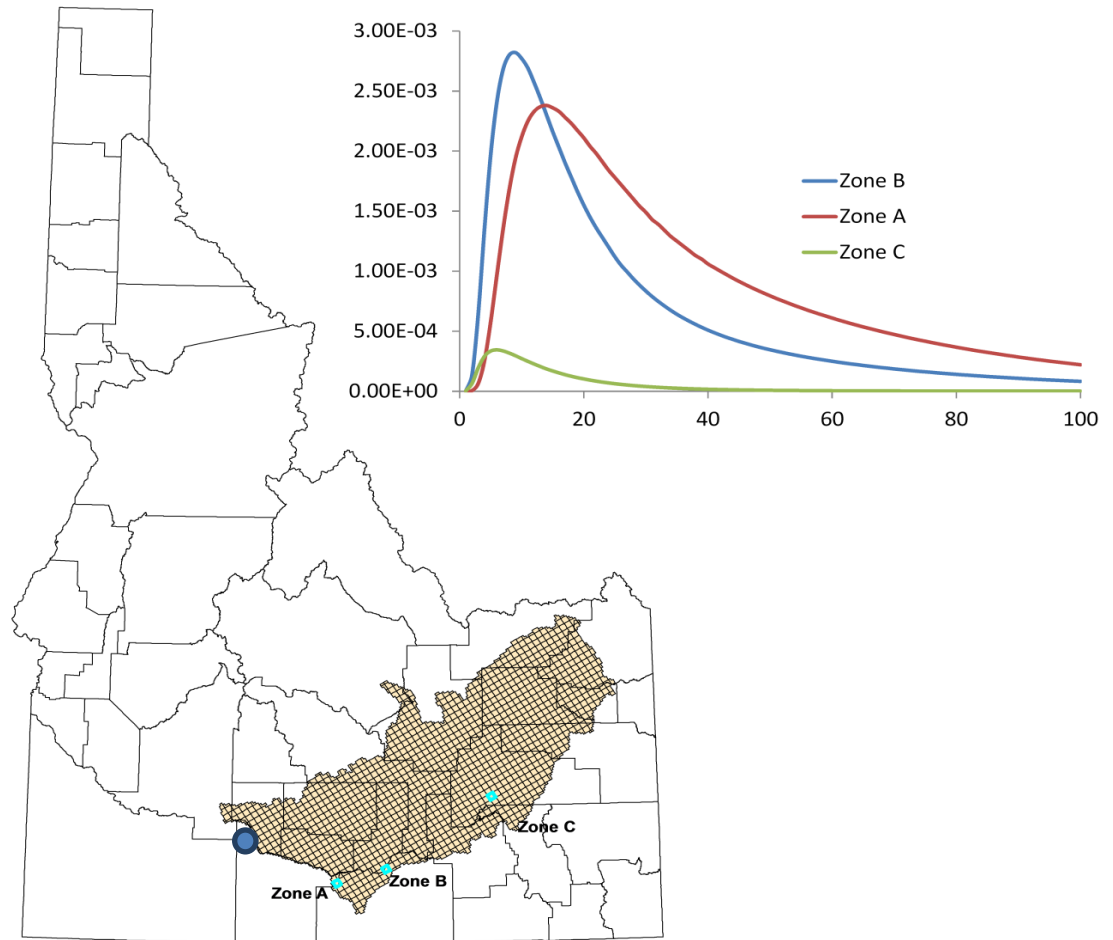


Research objective

- Might water right leasing produce a different spatial and temporal distribution of required reductions in pumping?
 - Compare spatial and temporal distribution of administrative curtailment based on 1973 curtailment date, and
 - The same mechanism enhanced with possibility of water leasing

Hydrology

- Response functions
- Zones



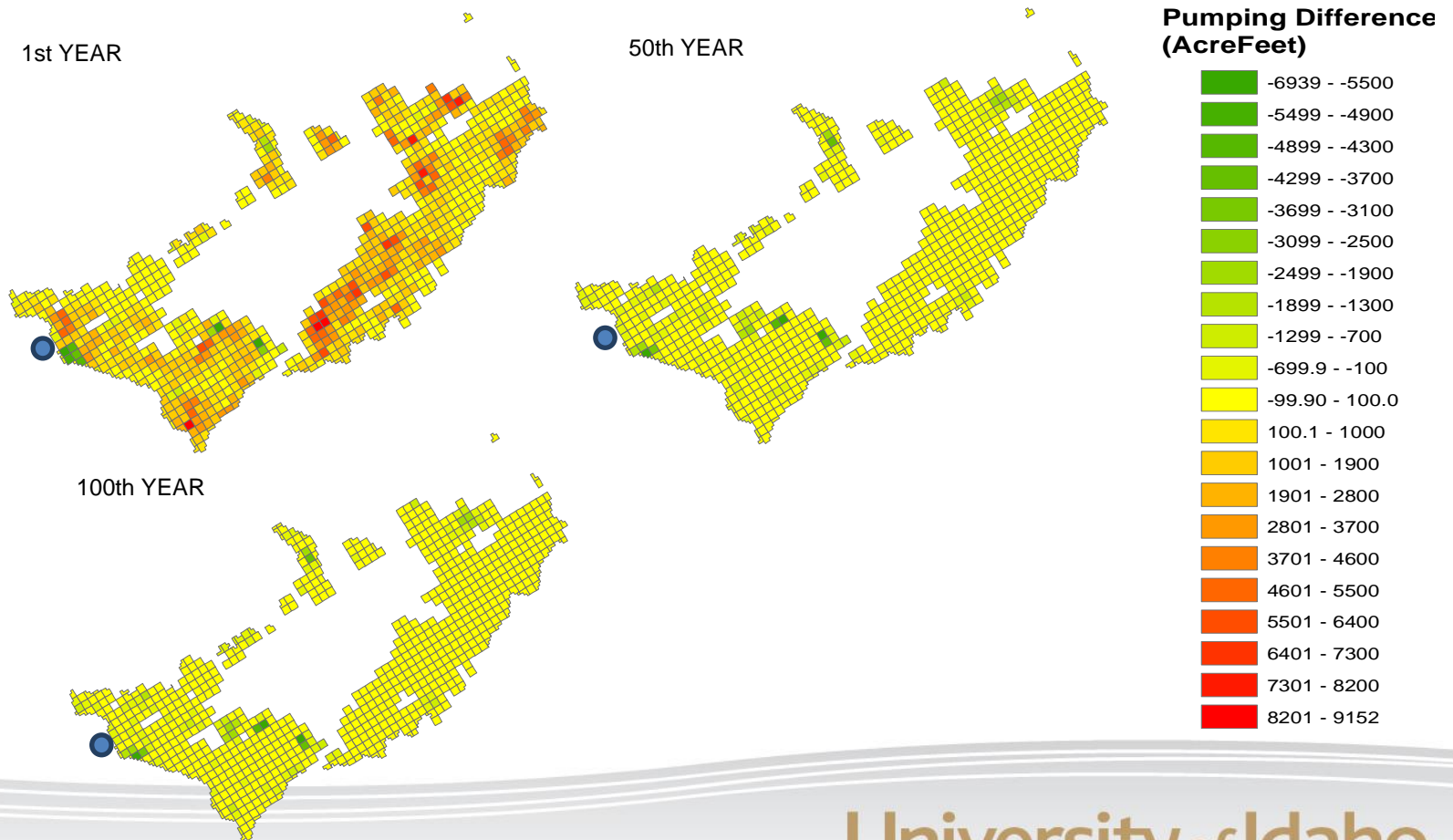
Economic Model

- Objective function:
 - Maximize discounted net present value of profits in crop production ESRP
- Choice variables
 - Planted crop acreage
 - Per acre applied water per crop
 - Dimensions
 - 795 zones
 - 9 crops
 - 18 counties
 - 6 soil classes
 - 2 water sources
 - 2 irrigation technologies
 - 100 years
- Constraints
 - Land availability constrains
 - Surface water availability constraints
 - Groundwater availability constraint
 - Thousand springs water requirement
 - Crop mix constraints

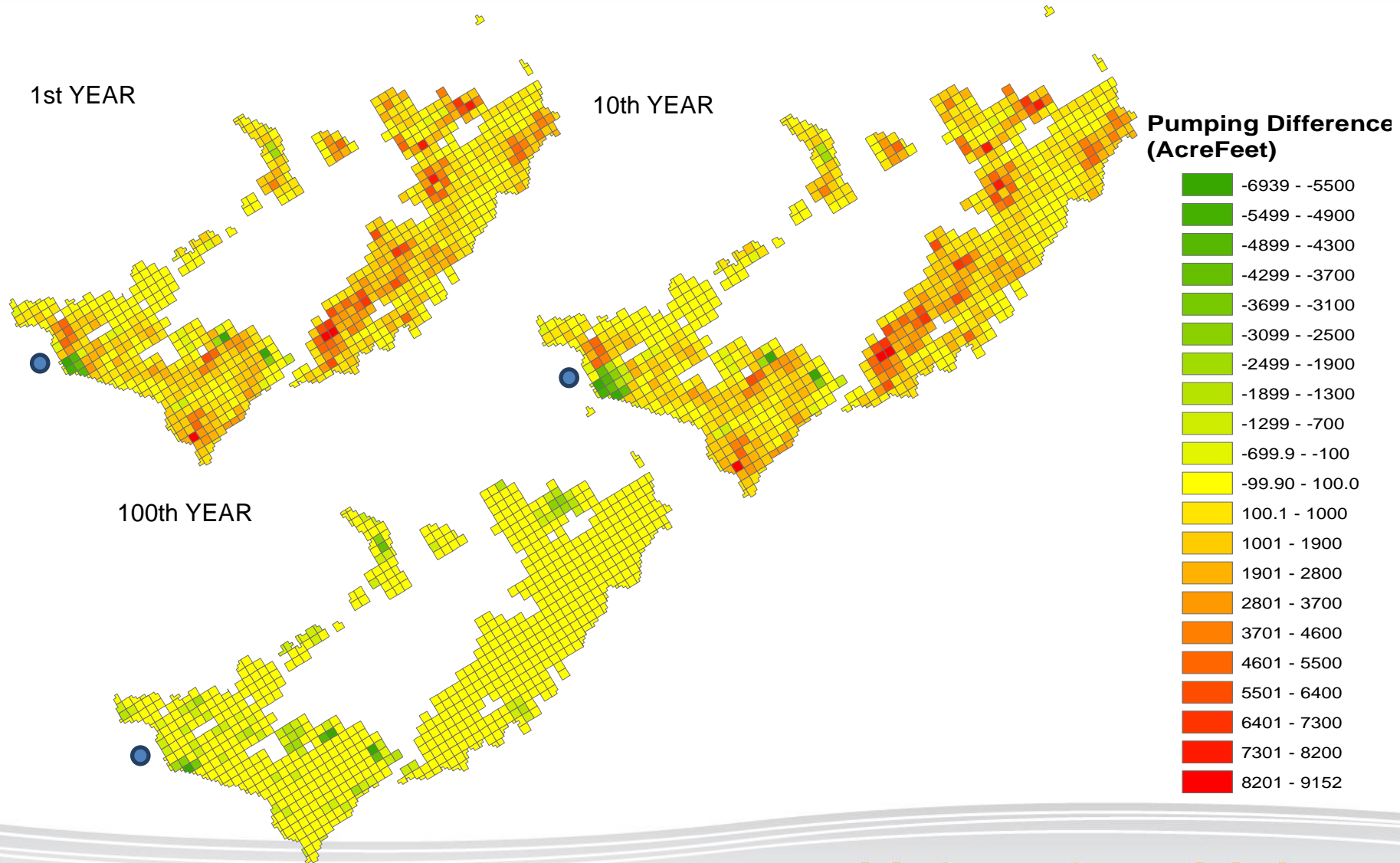
Water flow at thousand springs has to be no less than the water flow generated by the above administrative curtailment scenarios

Results 1 year curtailment

Pumping difference in acre-feet under prior appropriations based administrative curtailment (W^A) and market based reduction in pumping (W^M) : $\Delta W = W^M - W^A$

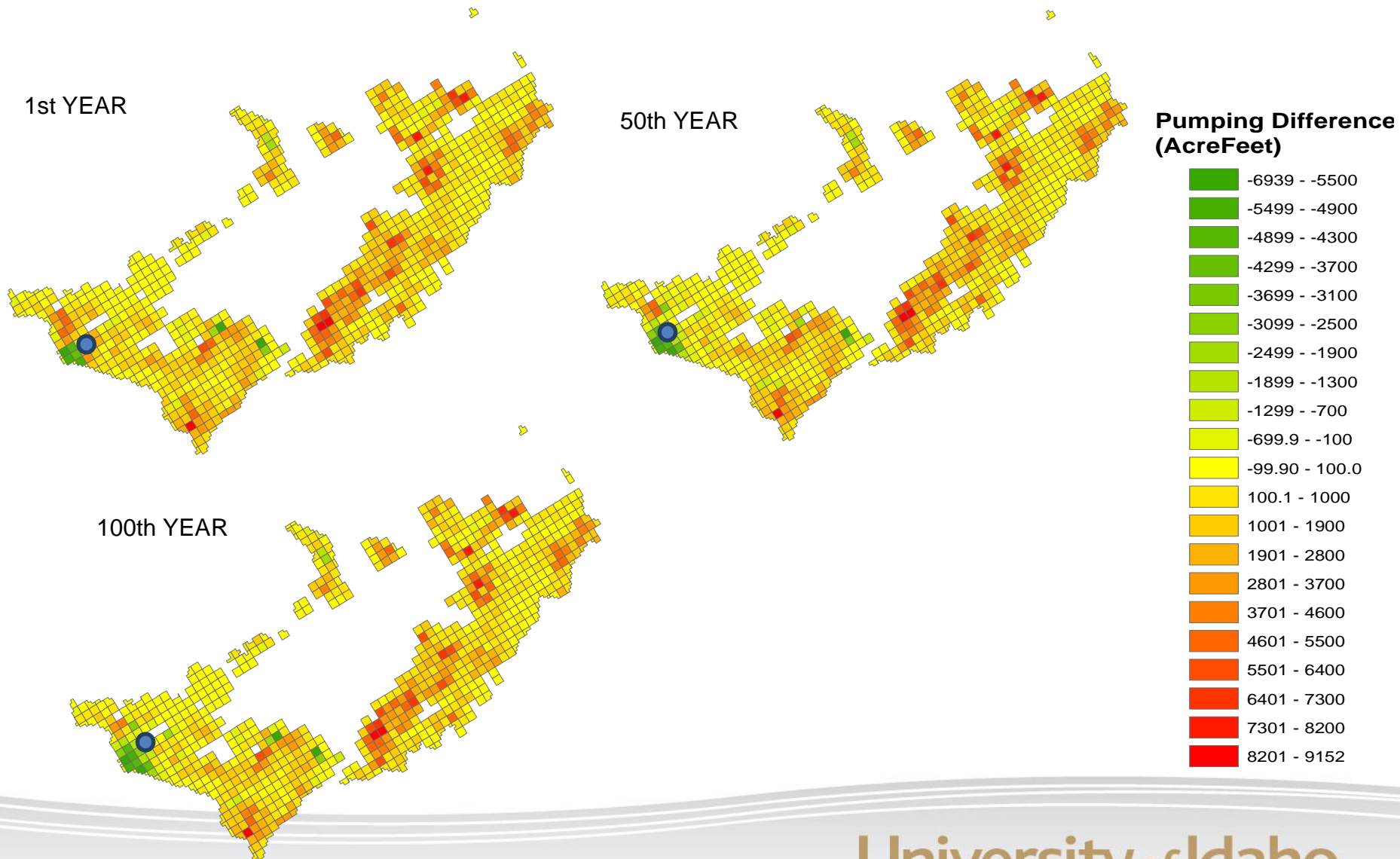


Results 10 year curtailment



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Results 100 year curtailment



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Results

	Ratio of total profits under market based mechanism and administrative curtailment (percentage)	Ratio of total amount of extracted water under Market based mechanism and administrative curtailment (percentage)
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r=0.05		
1 year	100.31	100.30
10 years	102.56	102.98
100 years	106.85	140.36
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r=0.07		
1 year	100.42	100.26
10 years	103.27	102.99
100 years	106.86	140.27
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Conclusion

- There is a notable difference in spatial and temporal distribution of pumping reductions between the two mechanisms
- Caveats
 - Coasian assumptions:
 - clear property rights, low bargaining costs, perfect competition, perfect information.

Future work

- Merits of potential water leasing throughout ESRPA in general
 - Beyond the singular context of satisfying water calls issued by senior water users in Thousand Springs.
 - Multiple reaches of snake river
- Climate change factors can be introduced



Thank you!

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College of **Agricultural
and Life Sciences**

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A LEGACY OF LEADING