

COLUMBIA RIVER BASIN 2016 LONG-TERM WATER SUPPLY & DEMAND FORECAST

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Improvements For the 2016 Forecast

Forecast through 2035

Improved hydrology, cropping models, consumptive loss simulation

Utilized improved WSDA cropping data

Utilized improved climate change projections

Improvements in ability to capture water rights curtailment and Yakima Basin pro-rationing

Include declining groundwater evaluation

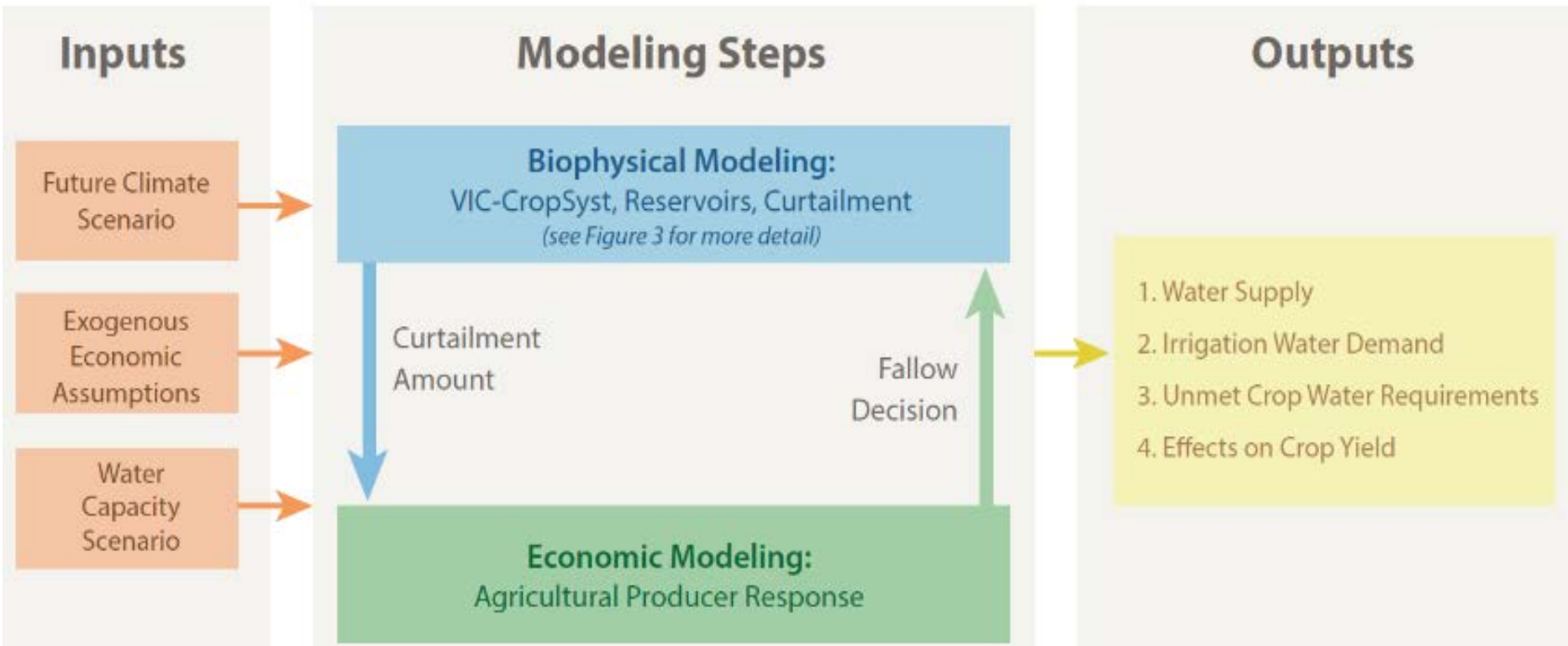
Evaluate potential for the forecast to be extended to Western WA in 2021

Evaluate policy issues necessary for program administration and investments

Approach

- 1. Overview of Integrated Modeling**
- 2. Biophysical Modeling of Water Supply and Irrigation Demand**
- 3. Economic Modeling of Future Crop Mix**
- 4. Municipal Demand**
- 5. Hydropower Demand**

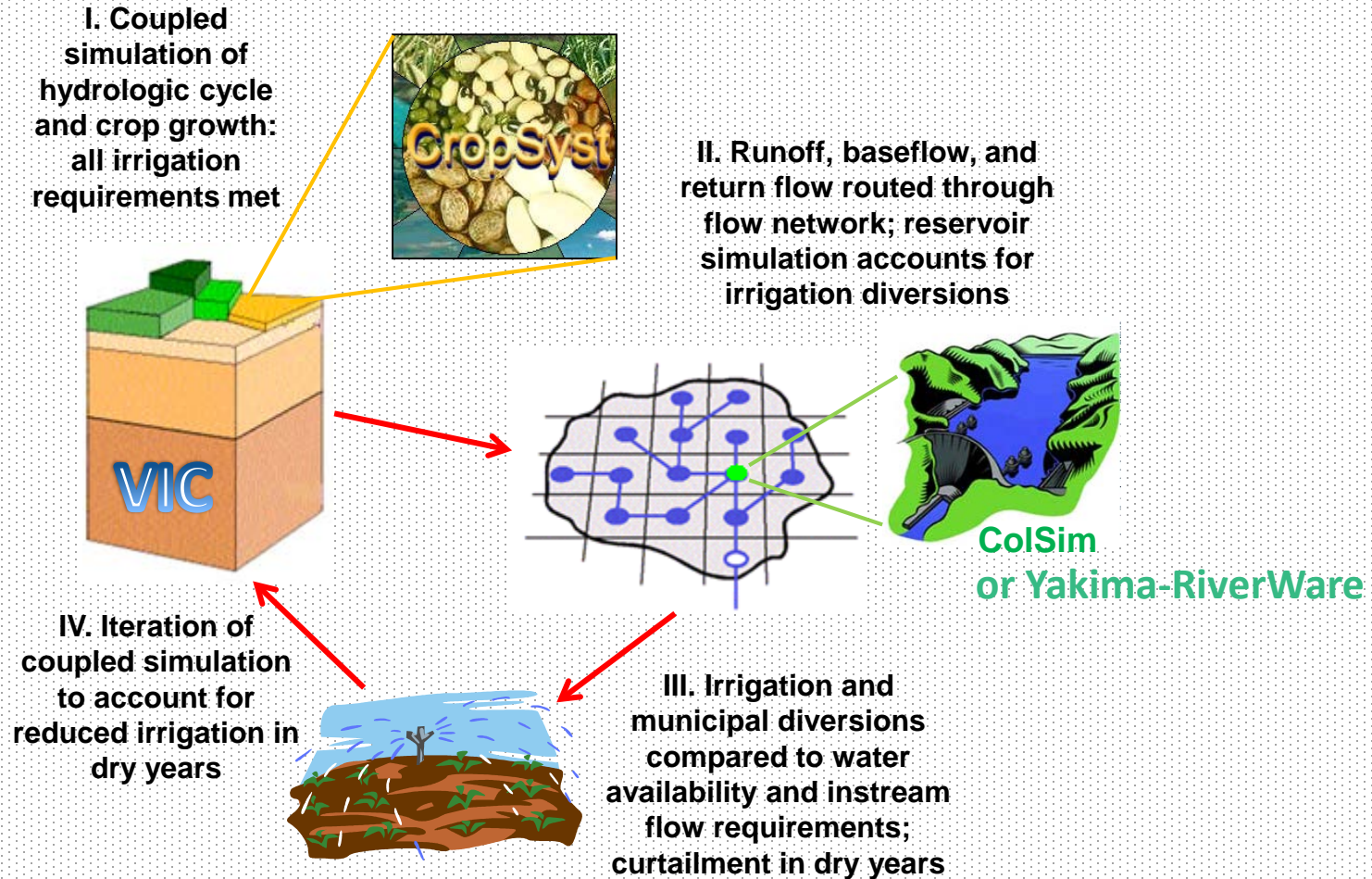
Overview of Integrated Modeling: Biophysical and Economic Models



HISTORICAL (1981-2011)

FUTURE (2035)

Biophysical Modeling: Overview of Framework



Overview of Integrated Modeling: Projected Climate in the Pacific Northwest

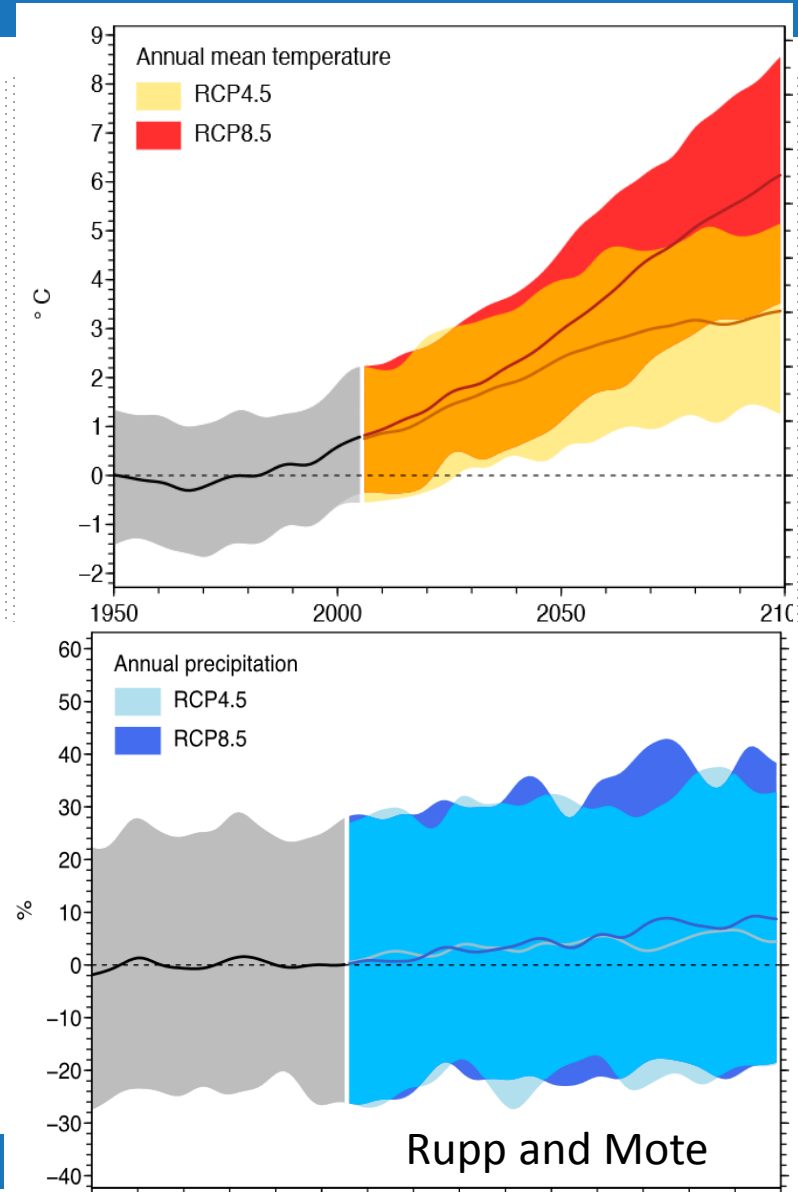
Temperature

- Annual temperature increase
- Summer increases are greater than other seasons

Precipitation

- Annual precipitation: most projections suggest a slight increase
- Summer precipitation decreases; other seasons increase

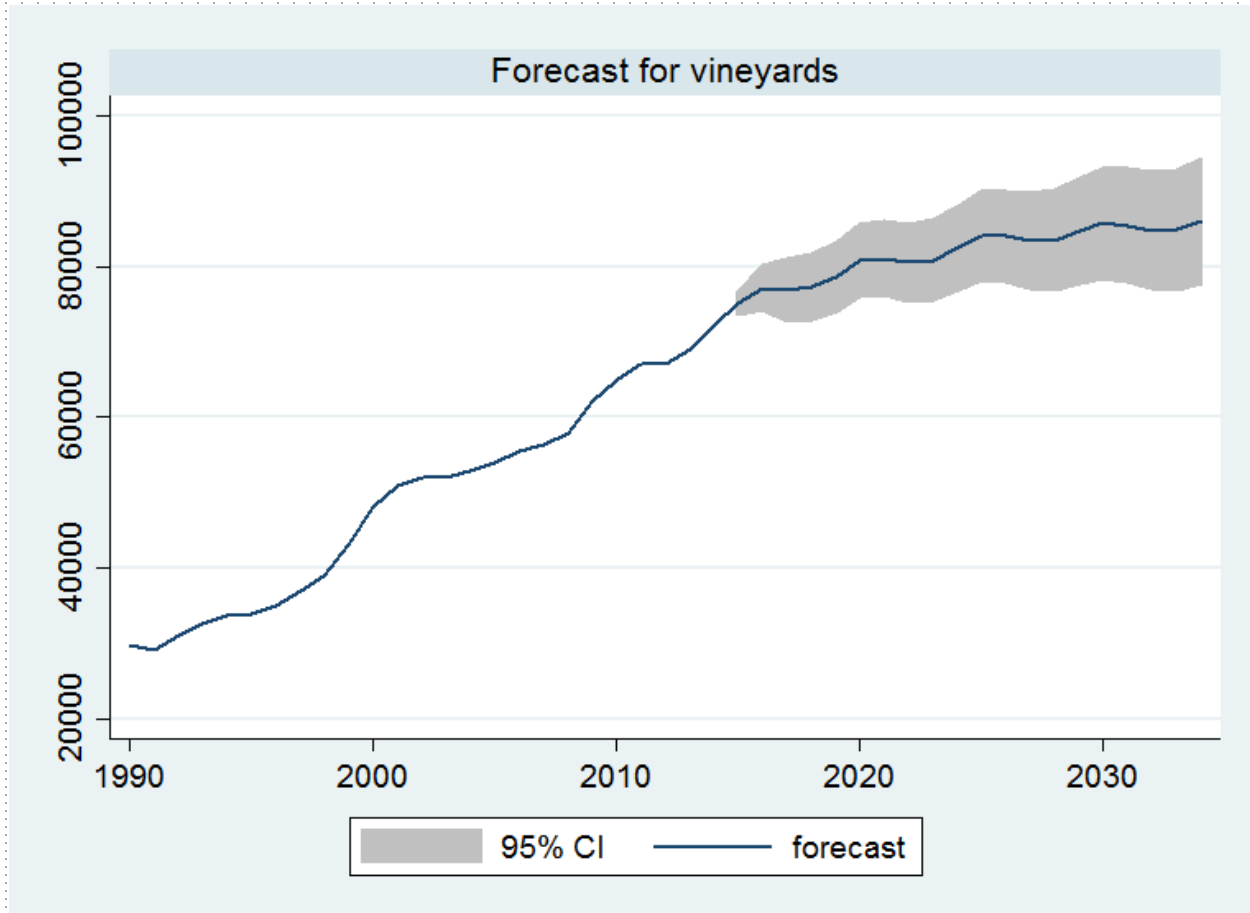
Five scenarios for each greenhouse gas increase



Economic Modeling: Forecasting Future Crop Mix

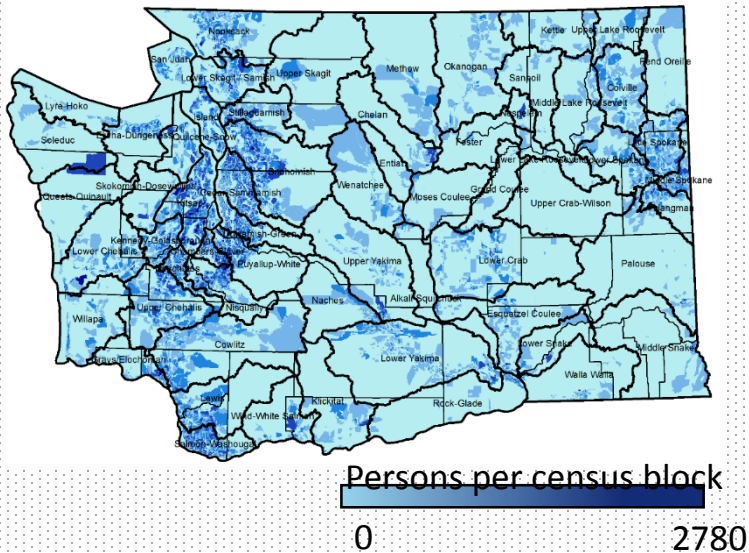
- **Changes in crop mix can affect overall water demand due to differences in crop water requirements.**
- **Data on recent trends in the irrigated crop mix in Eastern Washington were used in a statistical model to forecast future crop mix.**
- **This approach has been shown to produce more accurate forecasts than complex economic models.**

Economic Modeling: Example - Vineyard Forecast



Municipal Demand: Overview of Approach

Municipal Demand = Population x Per Capita Use + Wastewater Returns



Data:

U.S. Census Bureau 2010 Block Estimates;
2010 USGS Estimate Use of Water Report

Historical population:

2015 population (OFM and DOH)

Future population:

Estimated via logistic curve model

Limitations:

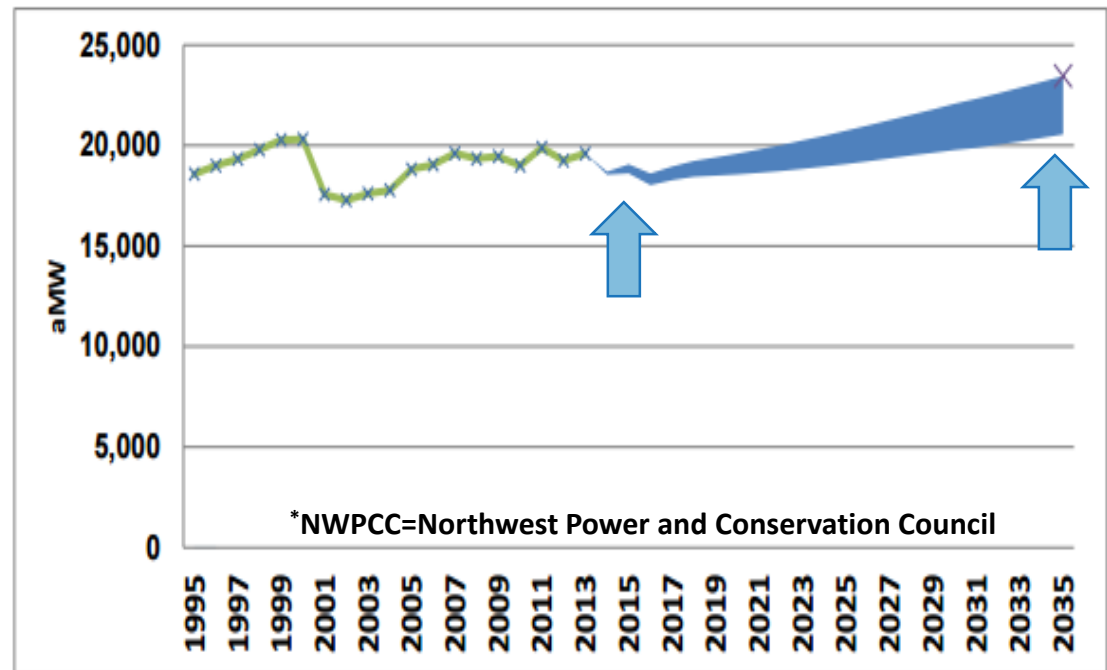
- No accounting for seasonal variations in water use
- No accounting directly for municipal inflow and infiltration
- Assumed no change in consumptive use per capita

Hydropower Demand: Review of Reports, Newspapers, Websites

NWPCC forecast of average regional electricity demand

- Increases of between 2,200 and 4,800 average MW, including distribution and transmission system losses

Converted to non-consumptive water demand based on Ground Coulee and Chelan PUD water right amount



Results

Summary Results:

Average of all Climate Scenarios

Detailed Results:

Mid-Range Climate Scenario

Municipal Demand

Hydropower Demand



Summary of Changes in Water Supply and Demand

Supply:

- Average annual increase at Bonneville: **+11.7%**
- Average shift in seasonality:



-10.6% between **June and October**



28.6% between **November and May**

Demand:

- Average decrease in eastern WA irrigation demand:
 - **-4.8%** (historical crop mix)
 - **-6.5%** (future crop mix)
- Average shift in seasonality (future crop mix):



-14.1% between **July and October**



6.1% between **March and June**

Summary of Water Demand Results

Water Use or Need	Estimated Volume (AF) (average of climate scenarios)
Projected changes in Eastern WA Agricultural Demand by 2035	-301,300 to -242,200
Projected changes in Eastern WA Municipal and Domestic Demand (including municipally-supplied commercial) by 2035	80,000
Projected changes in CRB Hydropower Demand by 2035	35,000 to 75,000
<i>Water Use or Need to be Met with Surface Supplies</i>	
Unmet Columbia River Instream Flows in 2001 at McNary Dam	13,400,000
Unmet Tributary Instream Flows (historical droughts)	659,918
Unmet Columbia River Interruptibles (historical droughts)	40,000 to 310,000
Yakima Basin Water Supply (pro-ratables, municipal/ domestic and fish) (from 2011 Yakima Report)	450,000
Alternate Supply for Odessa (from 2010 Odessa Report)	155,000
Declining Groundwater Supplies (other than in the Odessa Subarea)	750,000

Causes of Projected Decrease in Irrigation Demand

In Response to Climate Change

- **Water Supply:** Springs are getting wetter
- **Water Demand:** shifting of irrigation requirements earlier in the season
 - Earlier planting and shorter irrigation season for most crops
 - Higher water-use efficiencies due to increases in CO₂

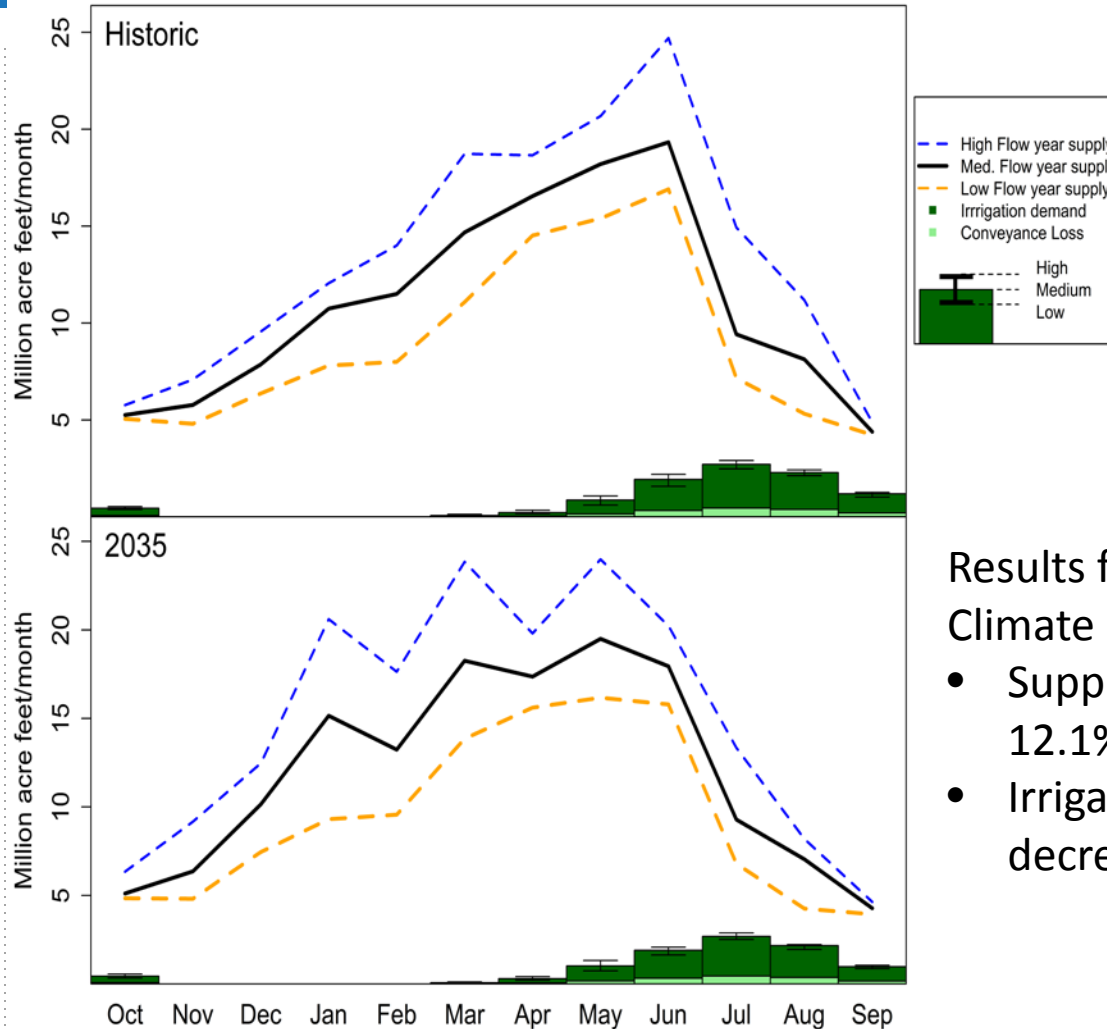
In Response to Economic Drivers

- Shift towards more water-use efficient crops

Note that irrigated acreage was held constant and double cropping was not accounted for; new (more slowly maturing) crop varieties were not used for future simulations; changes in irrigation technology and management were not implemented.

Columbia River Basin: Regulated Supply and Demand

Note: Supply is reported prior to accounting for demands

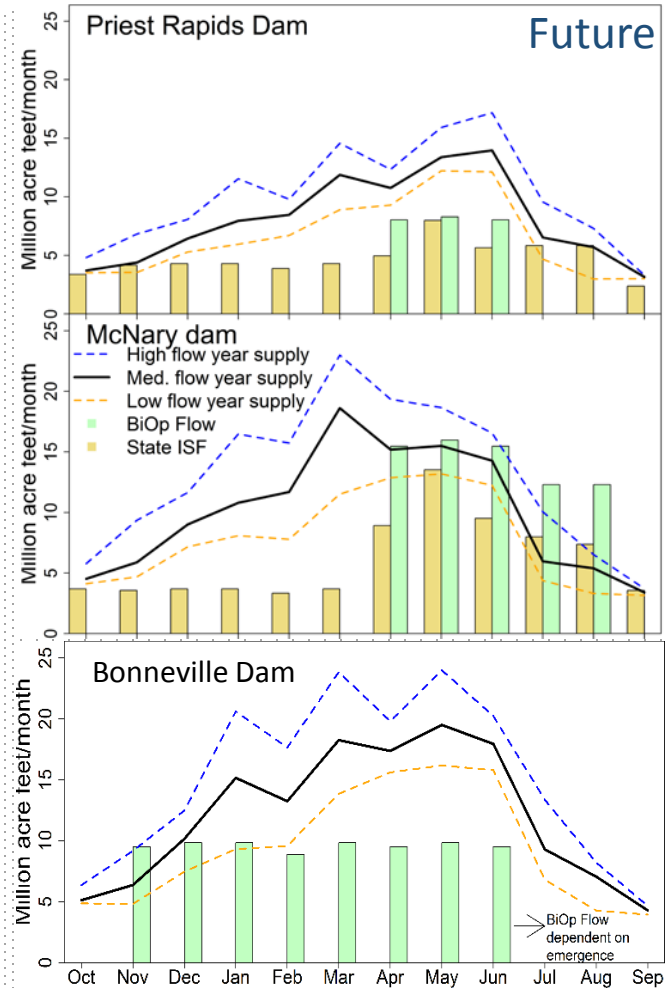
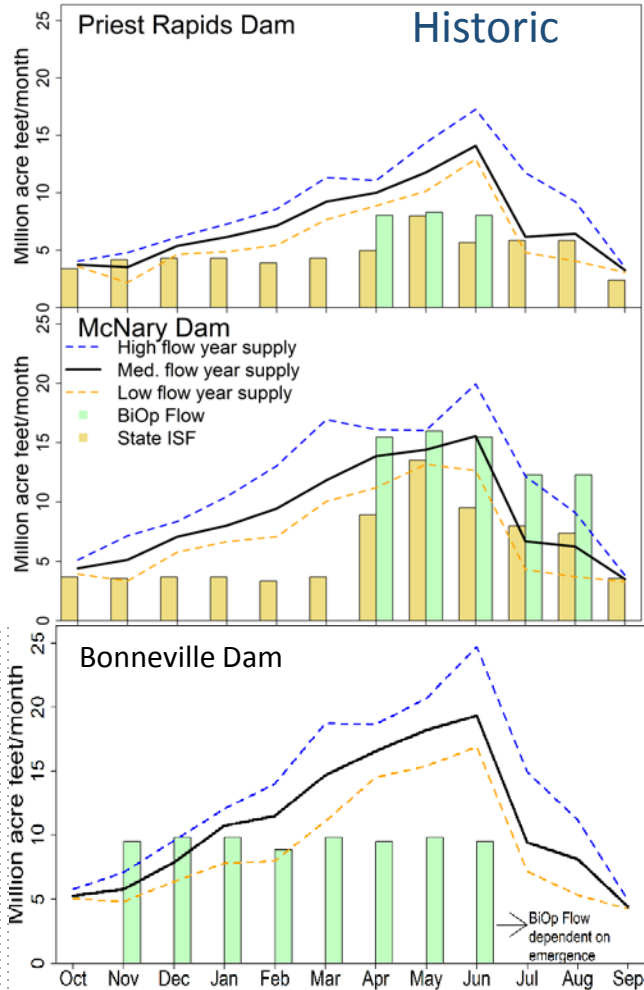


Results for the Mid-Range Climate Scenario:

- Supply increased by 12.1%
- Irrigation demand decreased by 4.9%

Note that supply and demand results were quantified for low, medium, and high values due to year-to-year variability

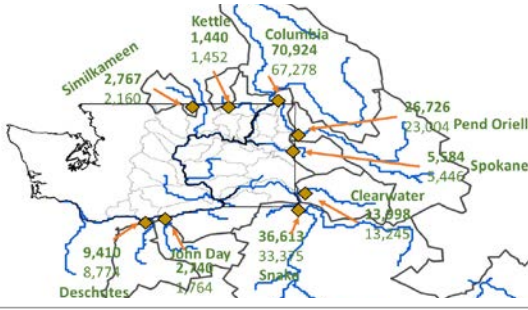
Mainstem: Regulated Supply and Instream Flow Requirements at Key Locations



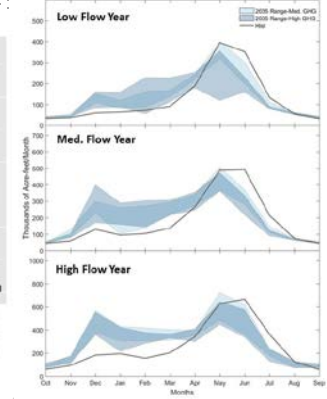
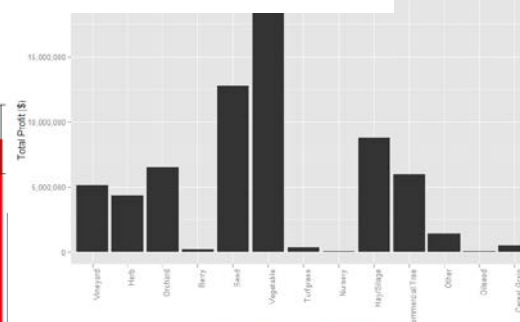
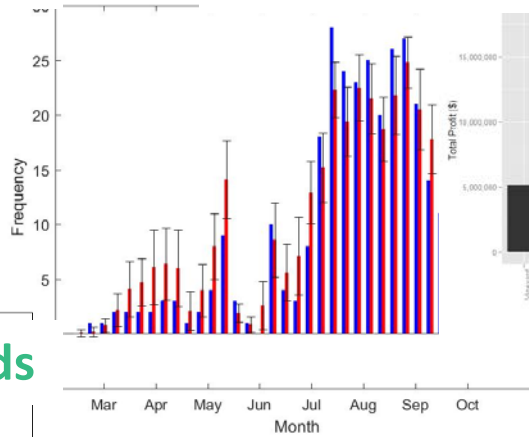
Note: Mid-Range Climate Scenario; Supply is reported prior to accounting for demands

Wealth of Other Results, Tools, and Ongoing Work

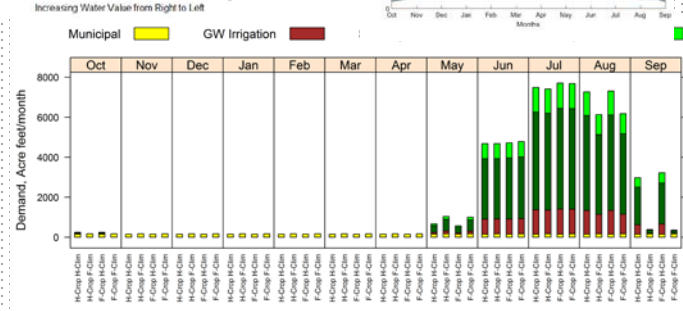
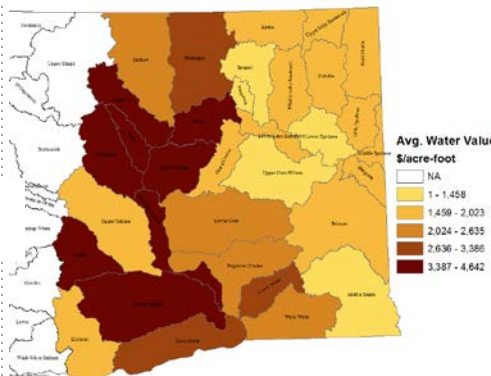
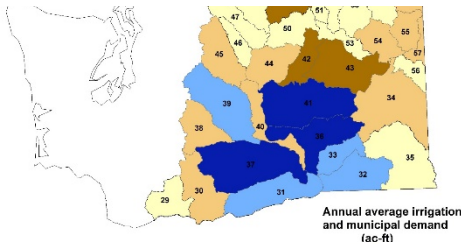
Columbia River Basin



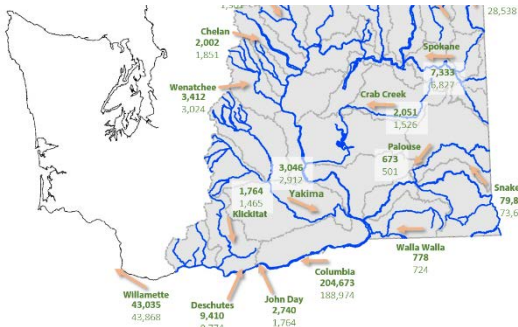
CURTAILMENT MODELING



Washington's Watersheds

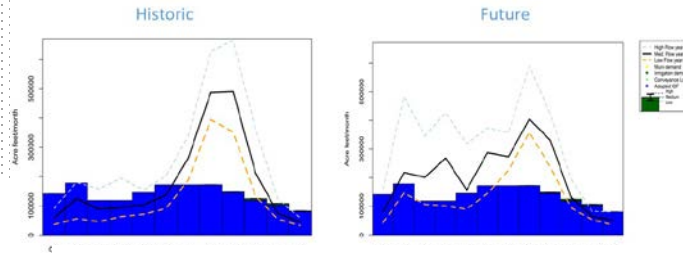


Columbia River Mainstem



WATER CAPACITY SCENARIOS

WRIA-Specific Supply and Demand



Modules

- 1. Integrating Declining Groundwater Into The Forecast**
- 2. Pilot Application of METRIC Crop Demand Modeling**
- 3. Water Banking Update**
- 4. Effects of User-Pay Requirements on Water Right Permitting**
- 5. West Side Forecast Scoping**

Groundwater Integration

New component for 2016 Forecast

- **Why:**

- 2011 Forecast did not evaluate effects of declining groundwater on demand
- Users who rely on declining groundwater supplies may rely on surface water in the future
- Surface and groundwater interactions can lead to water rights conflicts



Photo: Dept. of Ecology

Research and Analysis

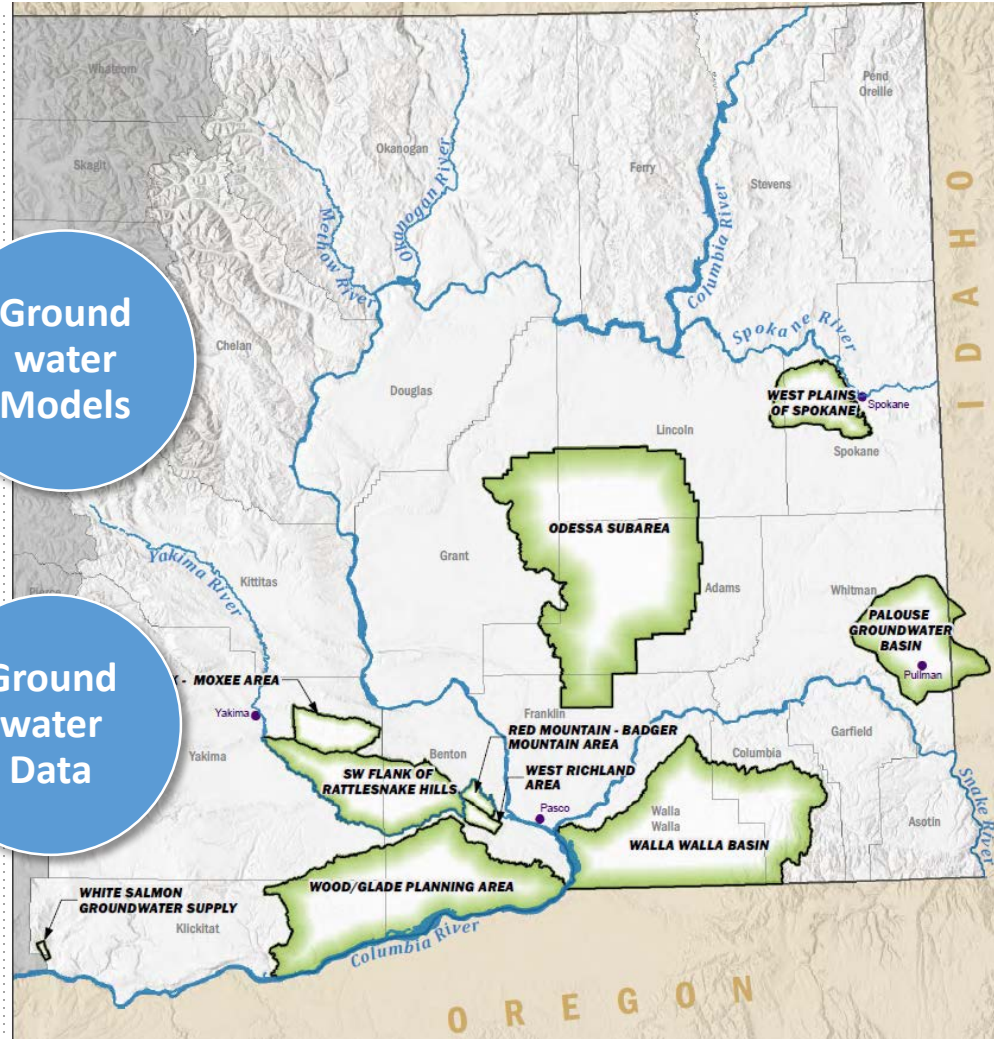


Declining
Ground
water
Areas

Ground
water
Models

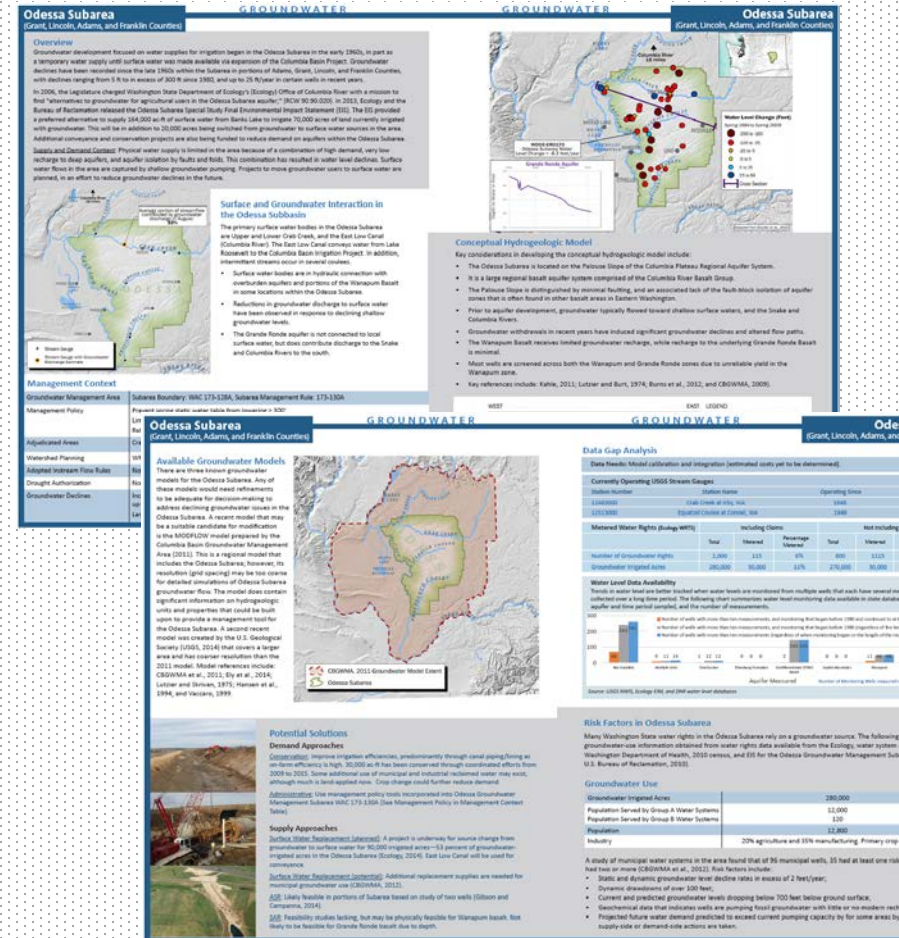
Ground
water
Data

Instream
Flow Rules



Groundwater Integration - Recommendations

- Greater monitoring of extent and declines needed.
- Increased public outreach warranted to promote conservation.
- State and County government coordination needed.
- Effects of declining groundwater can be modeled through more robust curtailment modeling.

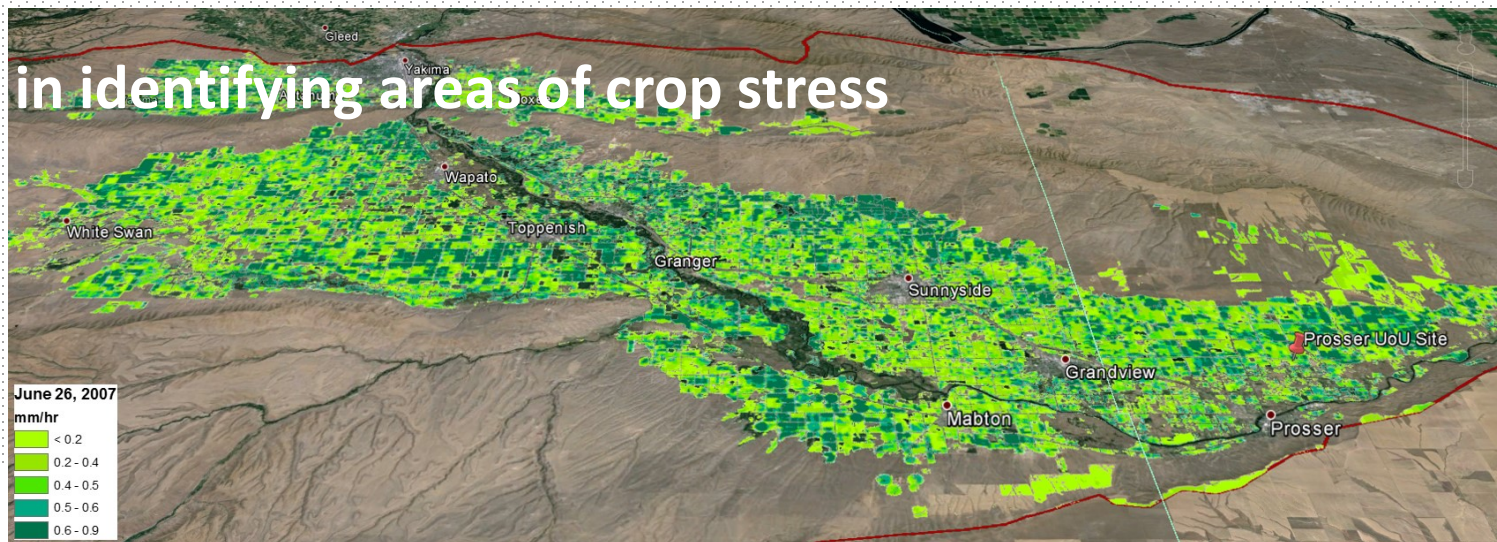


METRIC – A Model to Estimate Crop Water Use from Satellite Images

- **Why:**

- To see if we can improve accuracy of demand estimates
- To provide a surrogate or compliment to metering data
- To assist in water right evaluations and adjudications

- To assist in identifying areas of crop stress



METRIC - Approach

METRIC: Satellite based image processing model

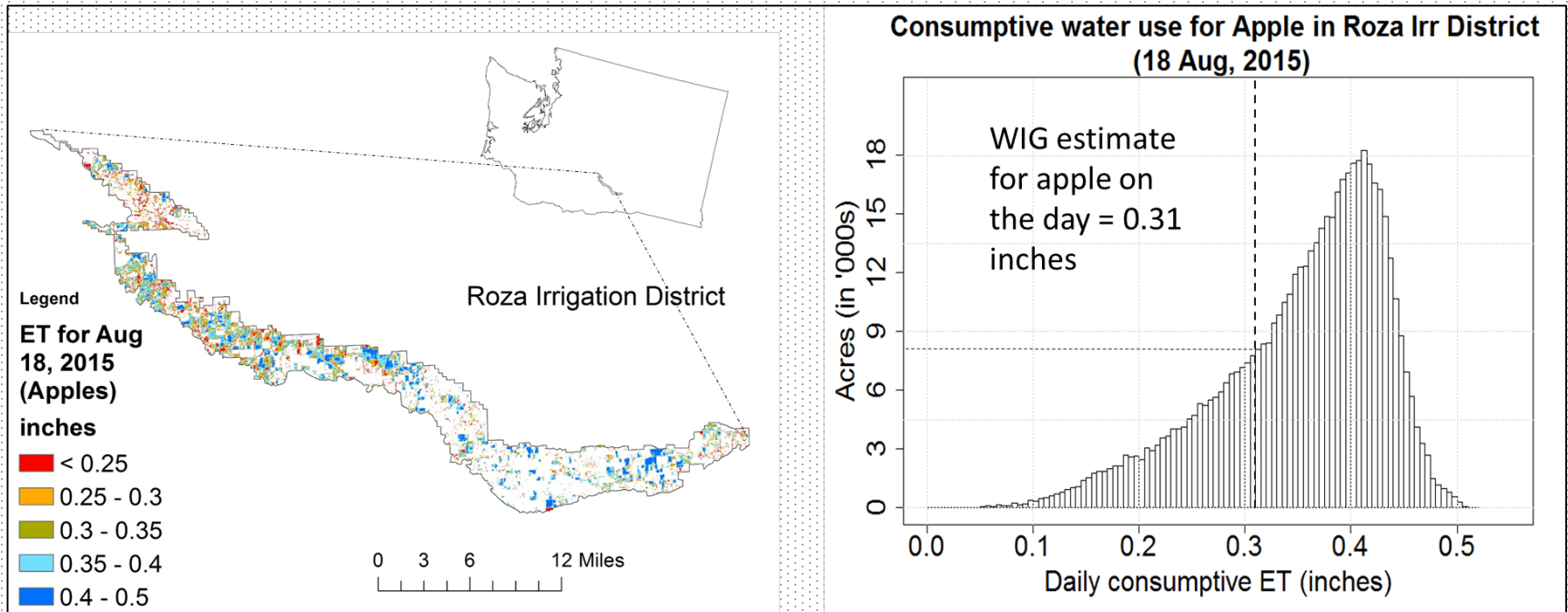
Data required:

1. Satellite imagery (Landsat)
2. Weather (WSU AgweatherNet, USBR Agrimet)



Pilot Application in Yakima – RESULTS

Consumptive water use for apples in Roza using METRIC



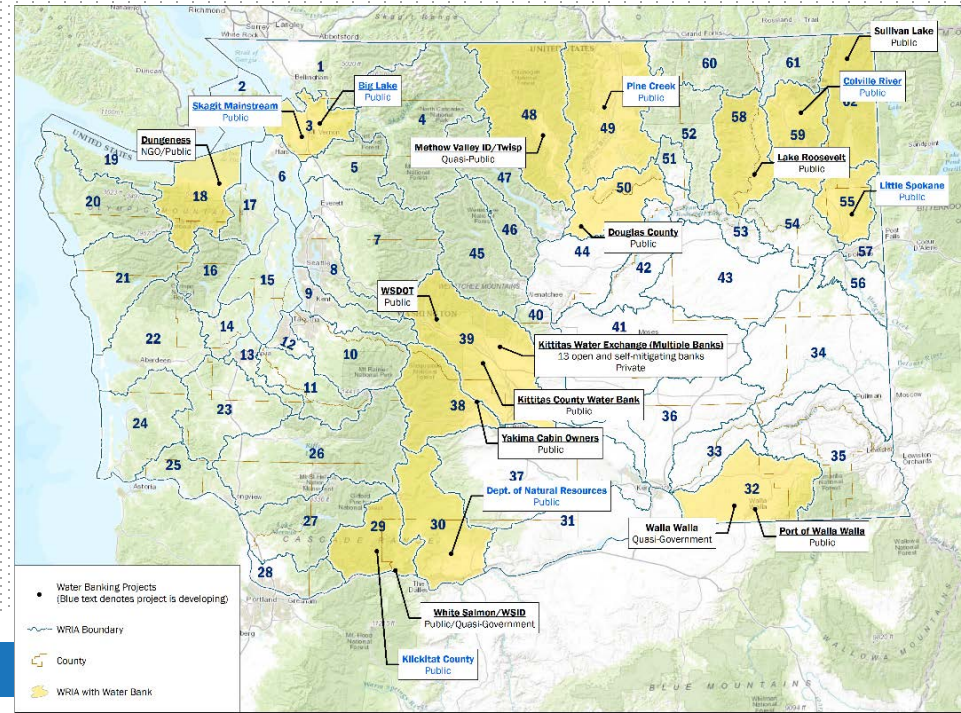
Variability in ET estimates from METRIC could help in identifying differences in water use patterns for similar crops.

Water Banking

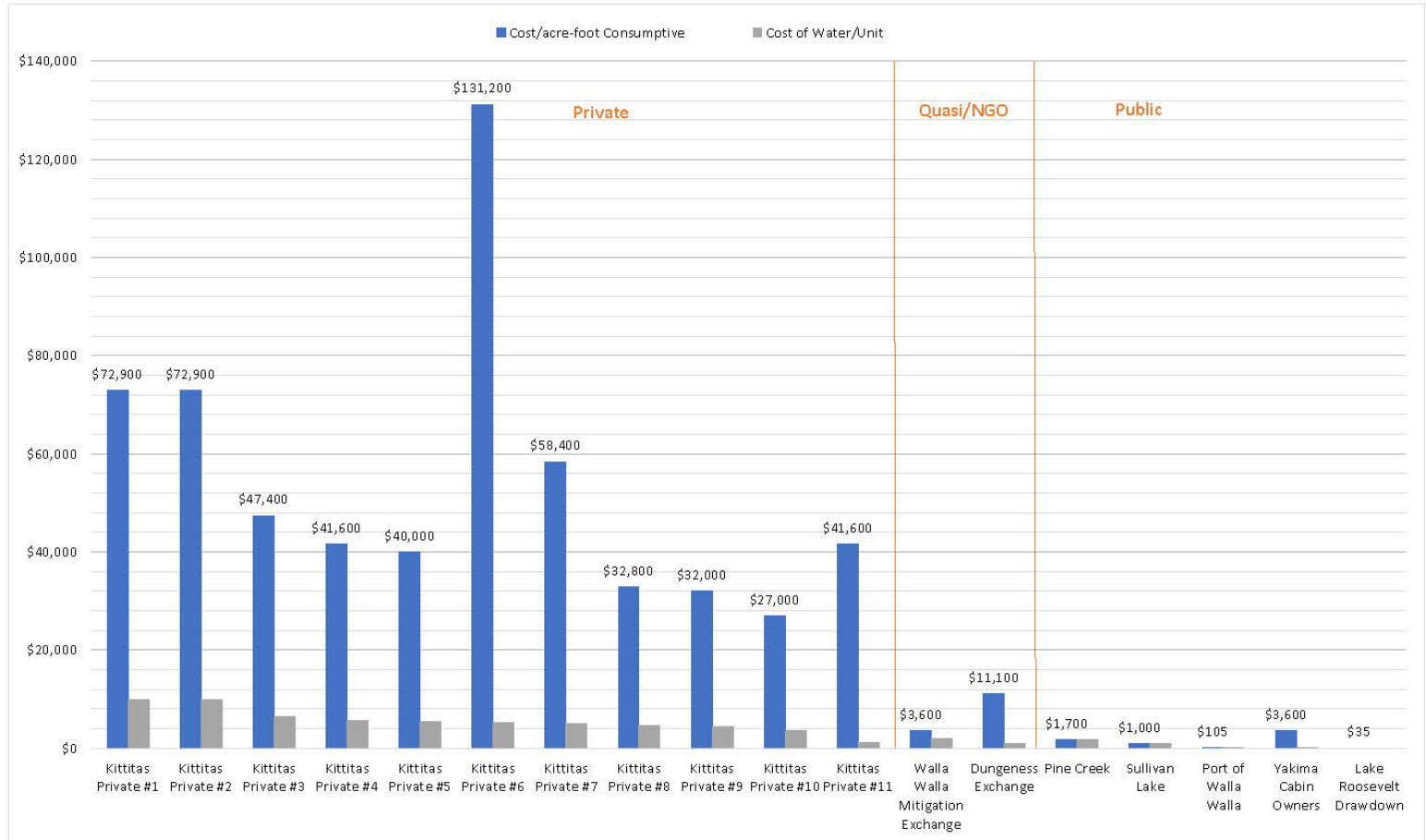
Why?

- To update 2004 Water Banking Report
- To document Ecology impacts
- To document how bank design/operation affect costs
- To identify regulatory, funding, and operational barriers
- To develop recommendations and future visioning

Note: New pricing and transaction data became available on July 1st and will be integrated into the Final Forecast



Water Banking - Recommendations



Water Banking - Recommendations

- **Greater clarity on mitigation standards.**
- **Out-of-WRIA transfer policies.**
- **Public interest criteria for bank operation.**
- **Cost-recovery for State bank operation.**
- **Streamlined process between exempt and non-exempt uses.**
- **Evaluation of metering priorities methods.**
- **Options on streamlined processes for small uses.**

How Payment Affects Demand

Why?

- **Legislature has moved towards an applicant-pays system**
- **Some applicants are choosing to defer or postpone rather than receive new water rights when offered**

How?

- **This study will survey 500 applicants from various programs (Lake Roosevelt, Wenatchee, Yakima, Cabin Owners, etc.) to understand how time and financial terms of a program are affecting processing and demand for new service.**

Paying for Water – Survey Data (preliminary)

LOCATION	Sample size	Number completed	Response Rate
Sullivan Lake	8	0	0%
Lake Roosevelt	214	58	27%
Wenatchee Basin	37	2	5%
Yakima Basin	383	85	22%
Port of Walla Walla	6	1	17%
Yakima Cabin Owners	37	22	59%
Overall	859	168	19.5%

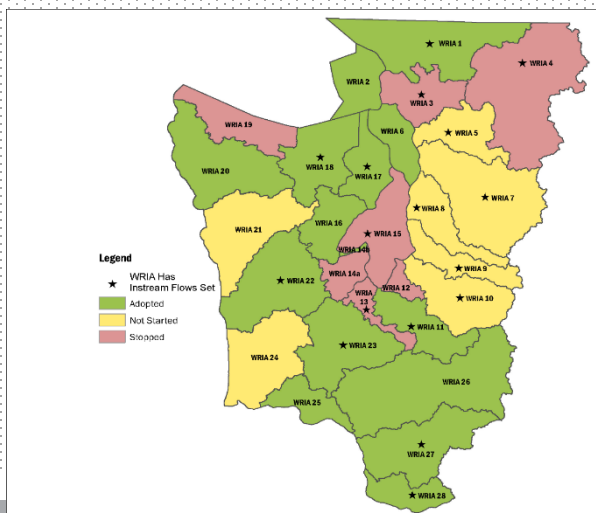
How Payment Affects Demand – Recommendations (preliminary—statistical analysis pending)

- **Paying for water makes some projects unfeasible.**
- **The long time period between applying for a water right and receiving a permit creates project uncertainty.**
- **Some participants could not participate because of unique program requirements.**
- **A regulatory imperative (e.g. groundwater closure, court order) is a driver to participate in cost-recovery programs even if costs are perceived to be high.**

Westside Scoping

Why?

- Currently watershed plans, water system plans, GMA plans and other planning documents are only aggregated in Eastern WA.
- Policy implications being evaluated in Eastern WA have statewide implications (e.g. declining groundwater, water banking, user pay programs).



Westside Scoping - Recommendations

- **Relevant data sources available on the west side.**
- **Overall modeling effort is applicable statewide.**
- **Some unique westside difference exist (e.g. tidal effects, rainwater, reuse, small farms).**
- **Recommendations moving forward include:**
 - Robust stakeholder outreach strategy.
 - More comprehensive scoping following targeted meetings with stakeholder groups.
 - Data gap filling for non-planning jurisdictions.
 - Integrated solutions and cross-jurisdictional partnerships.