Modeling Multi-benefit Groundwater Smart Markets: Open Water Trade

CWEMF 2024 Annual Meeting

Brooks Ronspies

This work was supported, in part, by the USDA National Institute of Food and Agriculture, project #1016467.

Topics

1. Traditional versus "Smart" water markets
2. Incorporating third party buyers into smart markets
3. Case study applications
   - Surface Water Markets
   - Groundwater Markets

Water Market Types

Bilateral Markets

- Peer to Peer
- High transaction costs

Semi-Formal Markets

- Bulletin Boards
- Water Brokers

Auctions and Smart Markets

- Continuous double auction
- Periodic double auction

Double Auction

Bids ordered from lowest WTA to highest

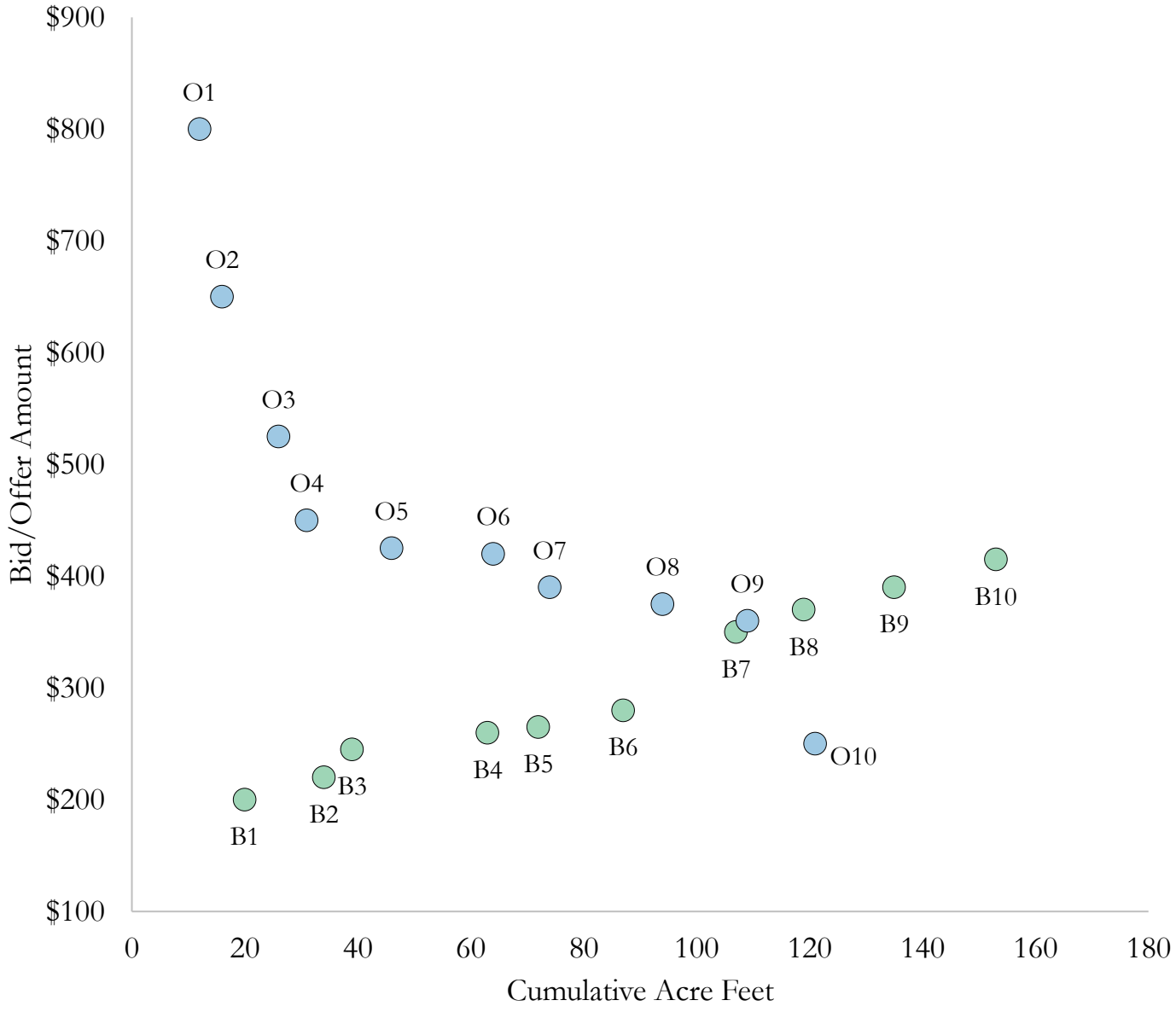
Bids		
Bid ID	WTA	Quantity
B1	$200	20
B2	$220	14
B3	$245	5
B4	$260	24
B5	$265	9
B6	$280	15
B7	$350	20
B8	$370	12
B9	$390	16
B10	$415	18

Offers ordered from highest WTP to lowest

Offers		
Offer ID	WTP	Quantity
O1	$800	12
O2	$650	4
O3	$525	10
O4	$450	5
O5	$425	15
O6	$420	18
O7	$390	10
O8	$375	20
O9	$360	15
O10	$250	12

Double Auction

Ledger			
Buyer	Seller	Quantity	Price (Split)
O1	B1	12	$500
O2	B1	4	$425
O3	B1	4	$363
O3	B2	6	$373
O4	B2	5	$335
O5	B2	3	$323
O5	B3	5	$335
O5	B4	7	$343
O6	B4	17	$340
O6	B5	1	$343
O7	B5	8	$328
O7	B6	2	$335
O8	B6	13	$328
O8	B7	7	$363
O9	B7	13	$355



Smart Market

- Pros
  - Limits search costs
  - Incorporate physical limitations
  - Many to many trades
  - Potentially reduces speculation
- Cons
  - High upfront investment
  - Limited price discovery

Eligibility Matrix

	B1	B2	B3	B4	B5	B6	B7
O1							
O2	1						
O3							
O4			1				
O5	1	1	1	1			
O6	1	1	1	1	1		
O7	1	1	1	1	1	1	

WATER TRADING EXTERNALITIES AND INCORPORATING A THIRD-PARTY BUYER

Surface Water Systems

Surface Water Systems

No 3rd Party

- Seller B Price < Seller A Price
- Buyer purchases from Seller B
- Flow increase along section in red

Surface Water Systems

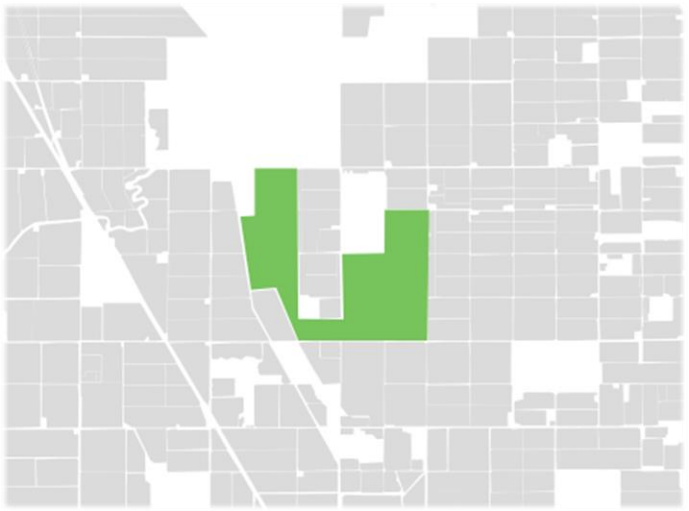
No 3rd Party

- Seller B Price < Seller A Price
- Buyer purchases from Seller B
- Flow increase along section in red

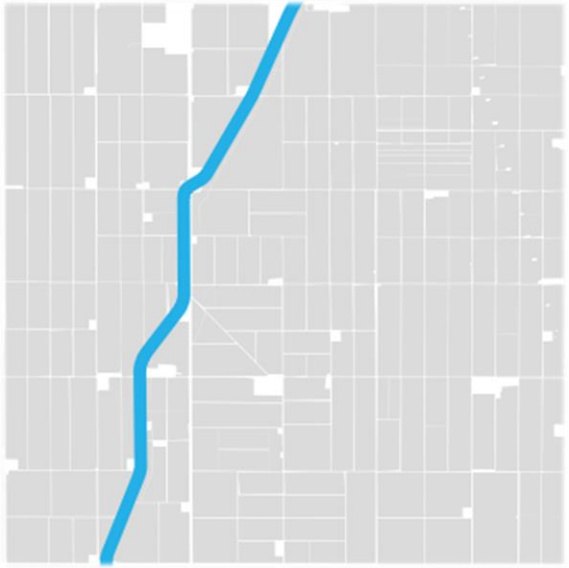
With 3rd Party

- 3rd Party offers $50 per AF for trades that cross priority reach
- Seller B Price > (Seller A Price – 3rd party payment)
- Buyer purchases from Seller A
- Flow increase along section in red

Groundwater Systems



Local Depressions



Subsidence
Streamflow Depletion

Seawater Intrusion

Groundwater Systems

Purchases on parcels near AOI amplify externalities

Sales reduce pumping which may help mitigate

CASE STUDIES:

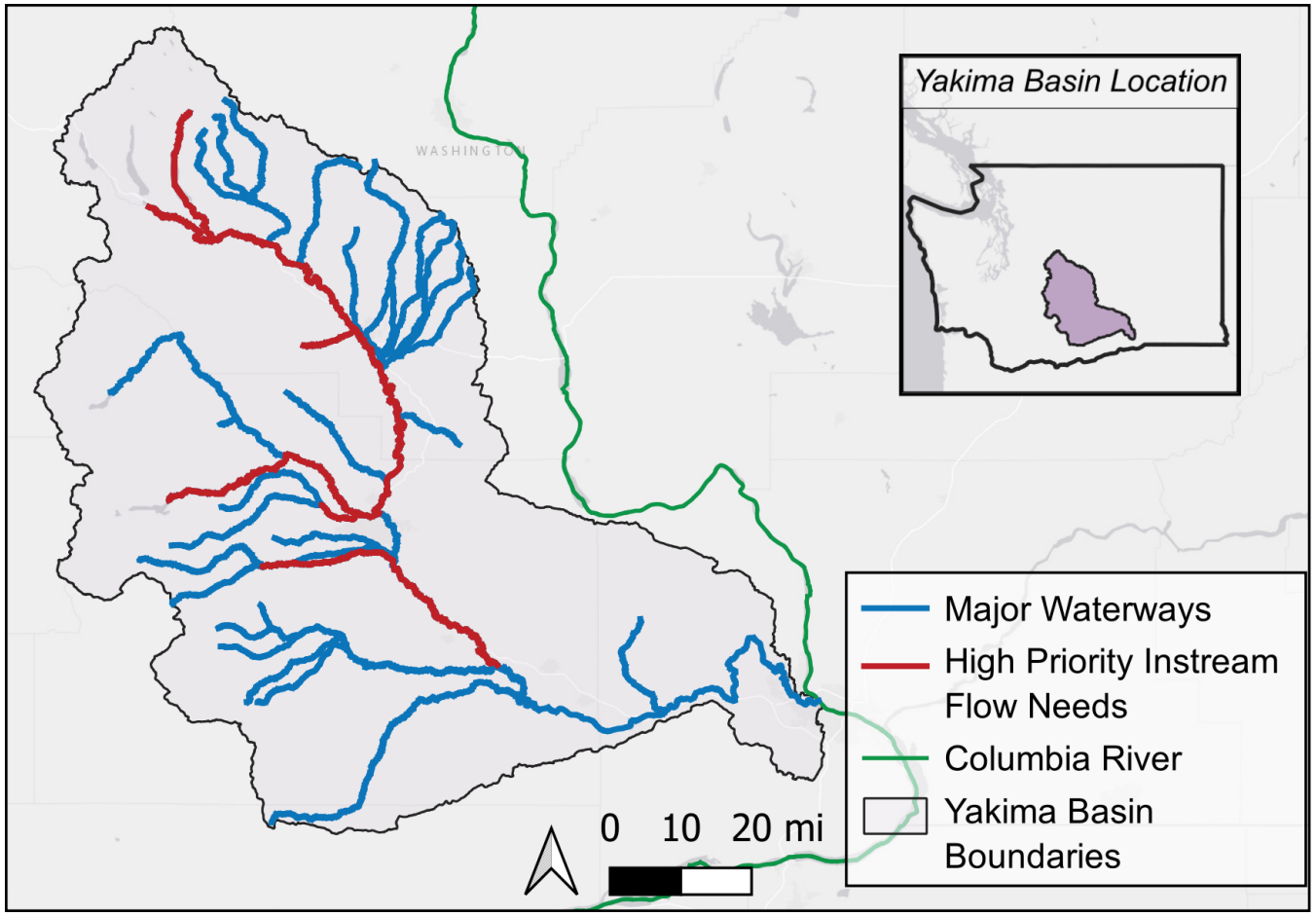
YAKIMA RIVER – WASHINGTON STATE

TULE SUBBASIN – CALIFORNIA

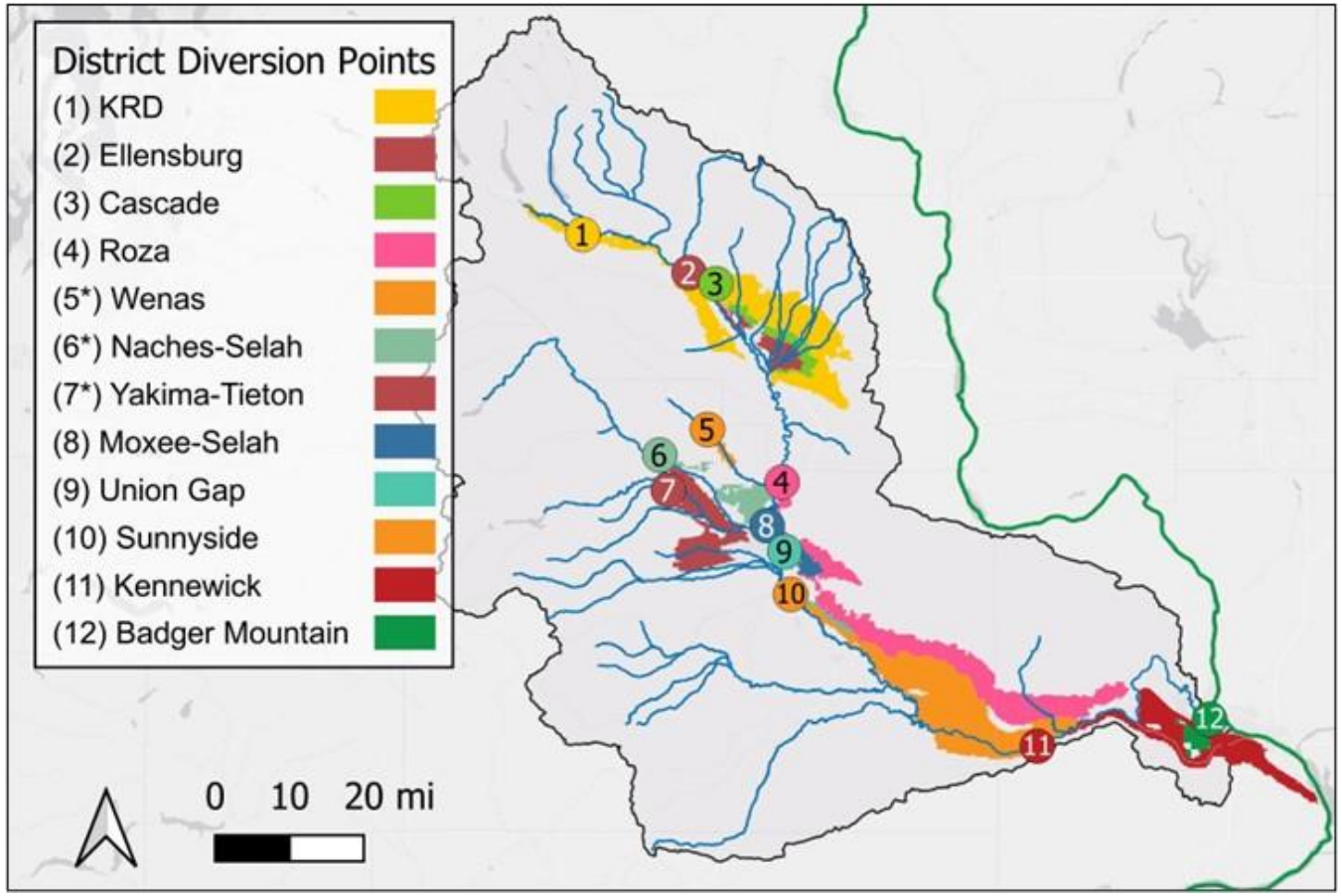
General Methodology

- Each parcel receives a WTP/WTA for water based on crop type and remote sensed irrigation demand
- Local trading rules are imposed (no upstream trading)
- Smart market is run at three levels of water shortage, with and without a 3rd party buyer
- Outcomes for our area of interest are assessed

Yakima River Basin



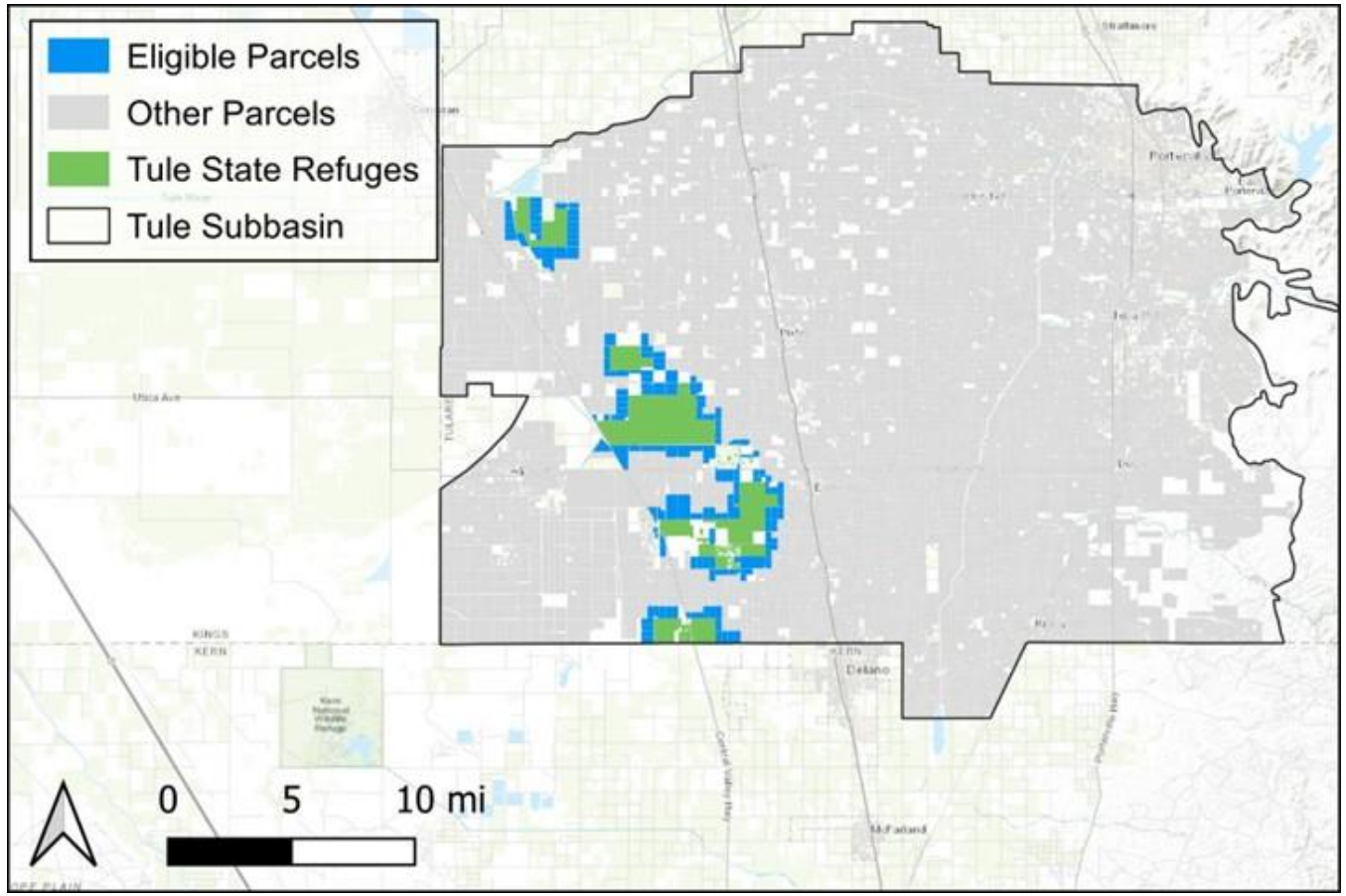
Yakima River Basin



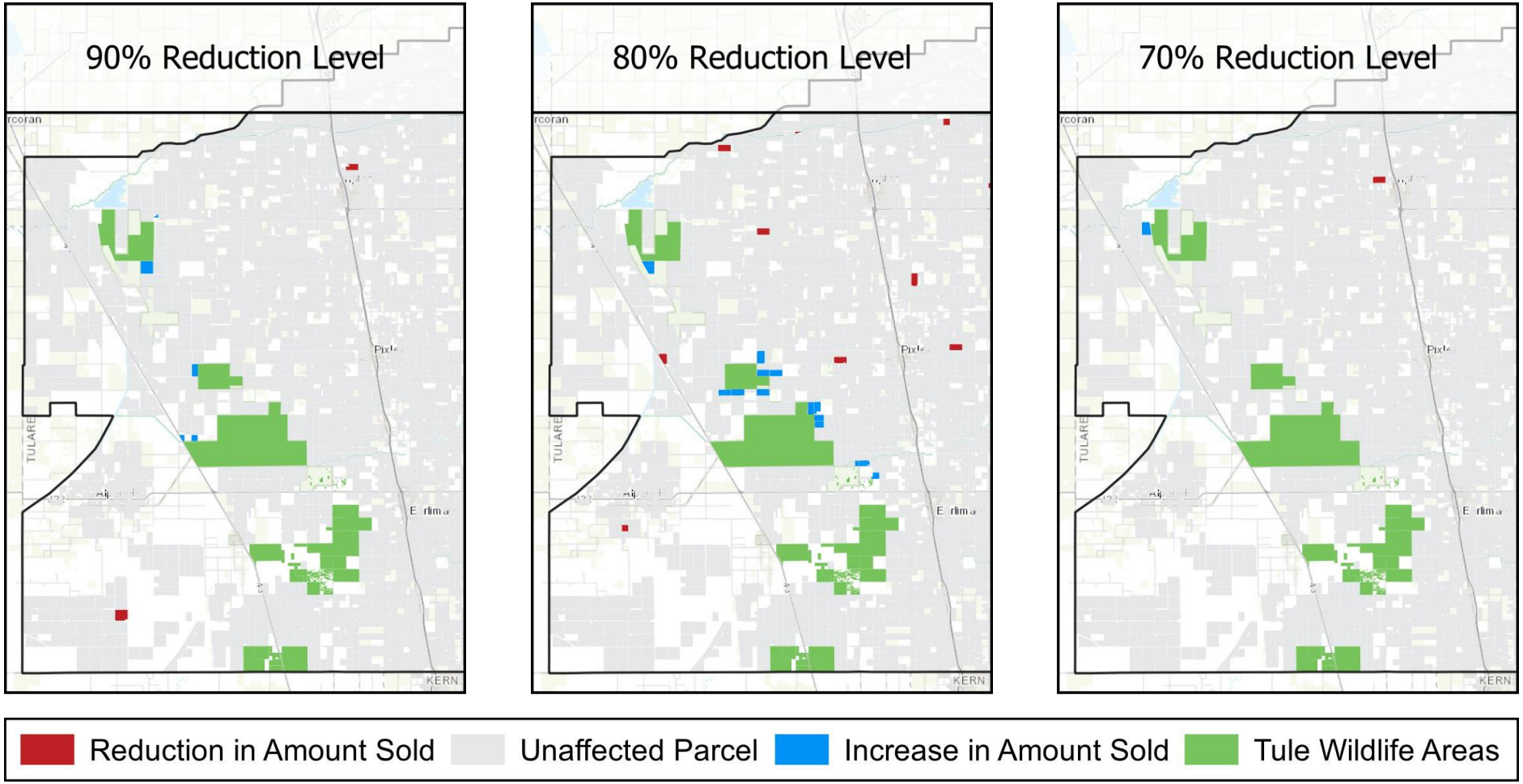
Yakima River Basin

Approach	Value	Critical Reach Flow by Proration Level 90%	80%	70%
Co- Benefit	acre feet	10,180	29,438	56,902
	total cost	$1,357,420	$3,536,050	$5,638,725
	unit cost ($/AF)	$133	$120	$99
Spot Transaction	acre feet	10,180	29,438	56,902
	total cost	$1,353,940	$4,297,977	$9,388,830
	unit cost ($/AF)	$133	$146	$165
Proration	acre feet	10,180	29,438	56,902
	total cost	$2,838,015	$5,427,508	$15,063,191
	unit cost ($/AF)	$279	$184	$265

Tule Subbasin



Tule Subbasin



Tule Subbasin

Approach	Value	Reduction Level 90%	80%	70%
Target Payment	acre feet	1,020	2,948	710
	total cost	$209,400	$434,715	$383,850
	unit cost ($/AF)	$205	$147	$541
Local Restriction	acre feet	1,020	2,948	710
	total cost	$239,838	$758,328	$217,078
	unit cost ($/AF)	$235	$257	$306

THANK YOU

Brooks Ronspies
ERA Economics
brooks@eraeconomics.com