STATE ENGINEER STATE OF NEVADA

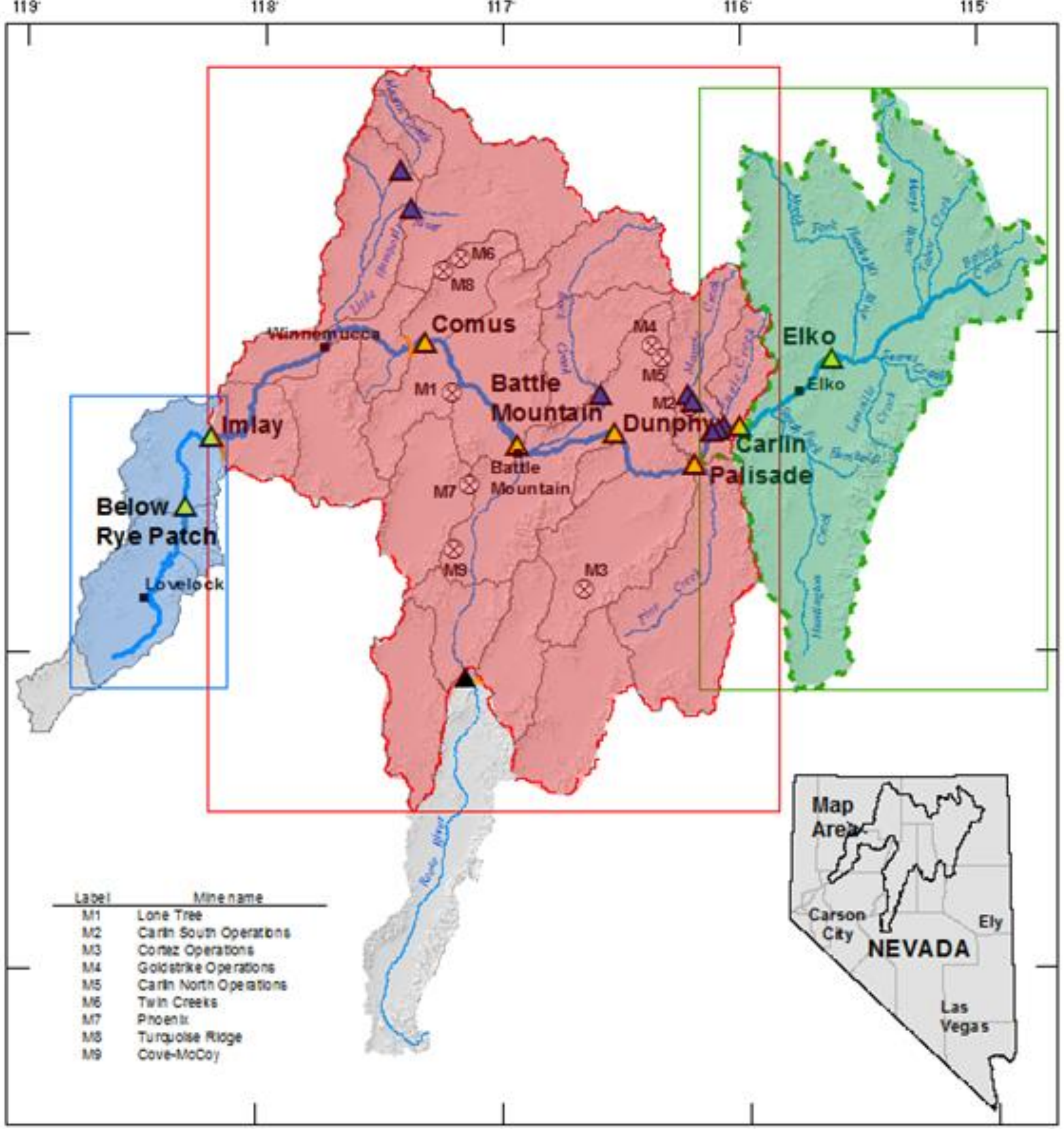
DRI Desert Research Institute

USGS science for a changing world

HUMBOLDT RIVER REGION MODELING UPDATE

February 4, 2021
Virtual Meeting

DEPARTMENT OF CONSERVATION & NATURAL RESOURCES



Humboldt River Region Modeling Update - Outline

- Intro
- Water Supply Forecast
- Regionwide ET Analysis
- Model output and Demonstrative Tools to Implement and Apply Results
  - Capture Concepts
  - Upper Basin Model
  - Middle Basin Model
  - Lower Basin Model
- 10 Min Break
- Draft Order Management Approach
- Recap/Next Steps
- Q & A

Water Supply Forecast

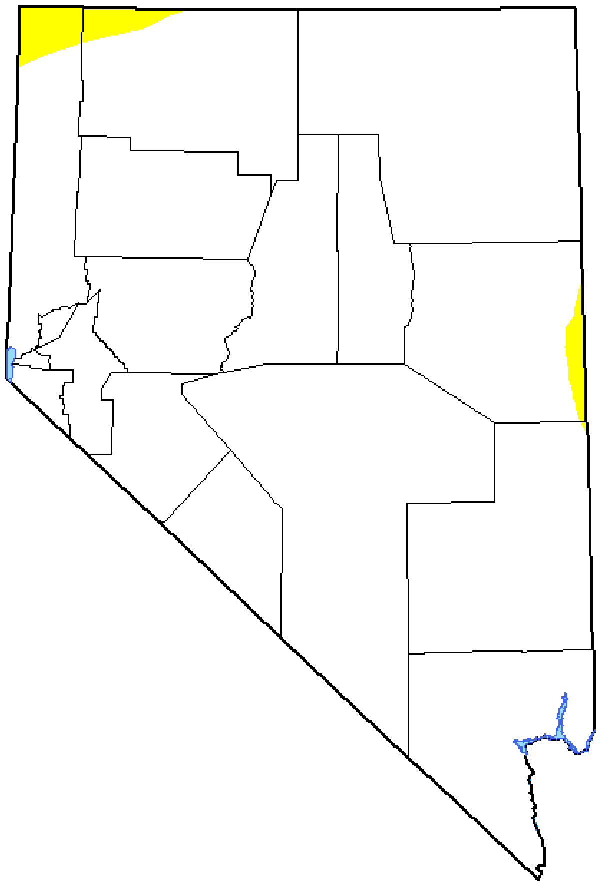
NDWR

January 7, 2020

January 26, 2021

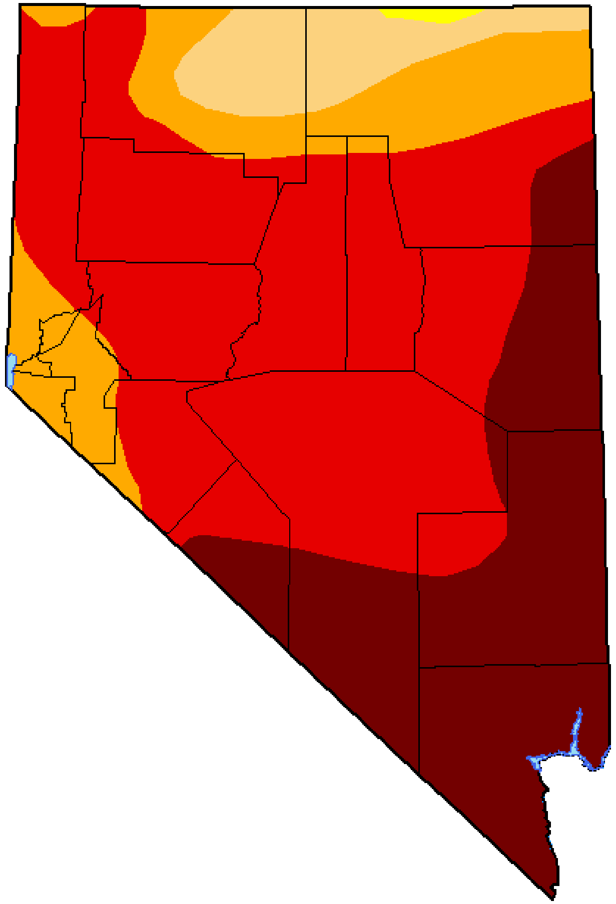
U.S. Drought Monitor

Nevada



U.S. Drought Monitor

Nevada



January 26, 2021

(Released Thursday, Jan. 28, 2021)

Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	99.71	93.07	79.58	28.98
Last Week 01-19-2021	0.00	100.00	99.71	91.24	72.56	23.68
3 Months Ago 10-27-2020	0.00	100.00	99.36	79.66	58.20	5.80
Start of Calendar Year 12-29-2020	0.00	100.00	99.71	91.18	72.49	23.68
Start of Water Year 09-29-2020	0.44	99.56	97.13	79.39	51.41	5.80
One Year Ago 01-28-2020	95.91	4.09	0.00	0.00	0.00	0.00

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

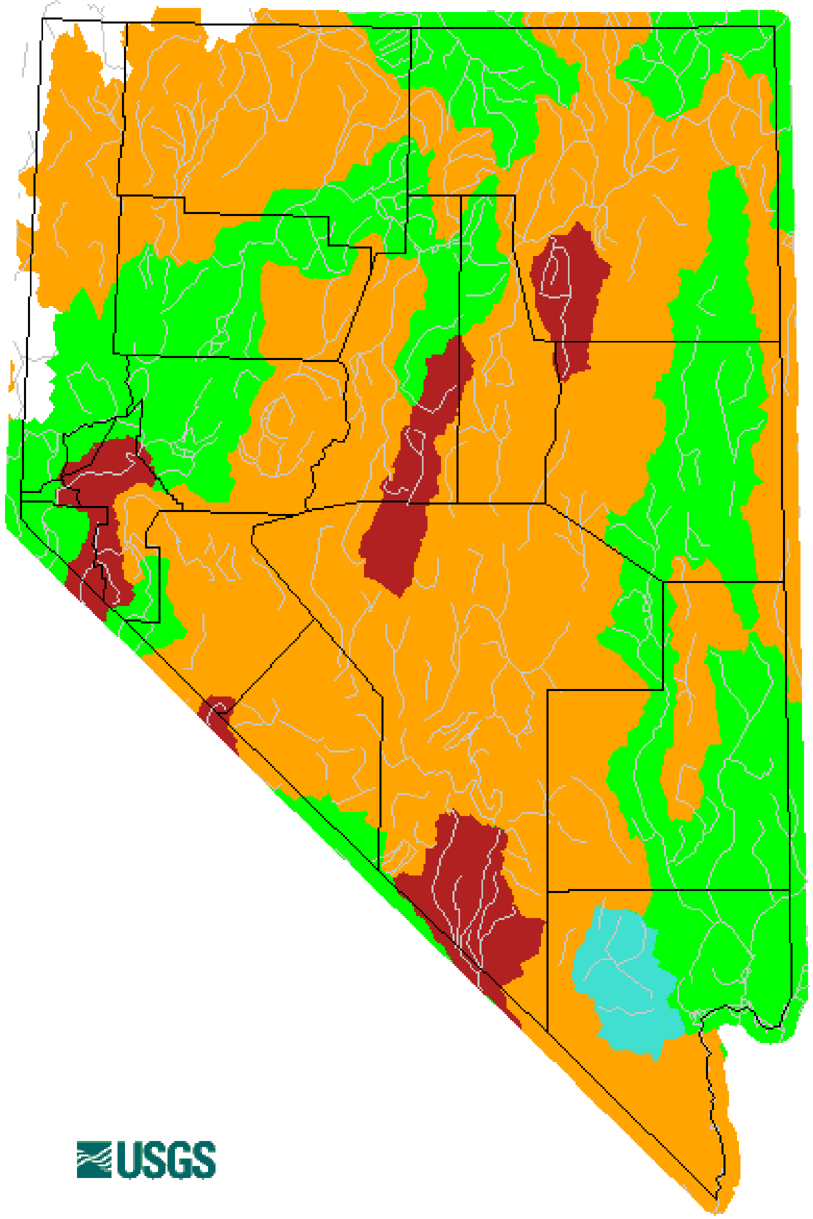
Author:

Richard Tinker

CPC/NOAA/NWS/NCEP

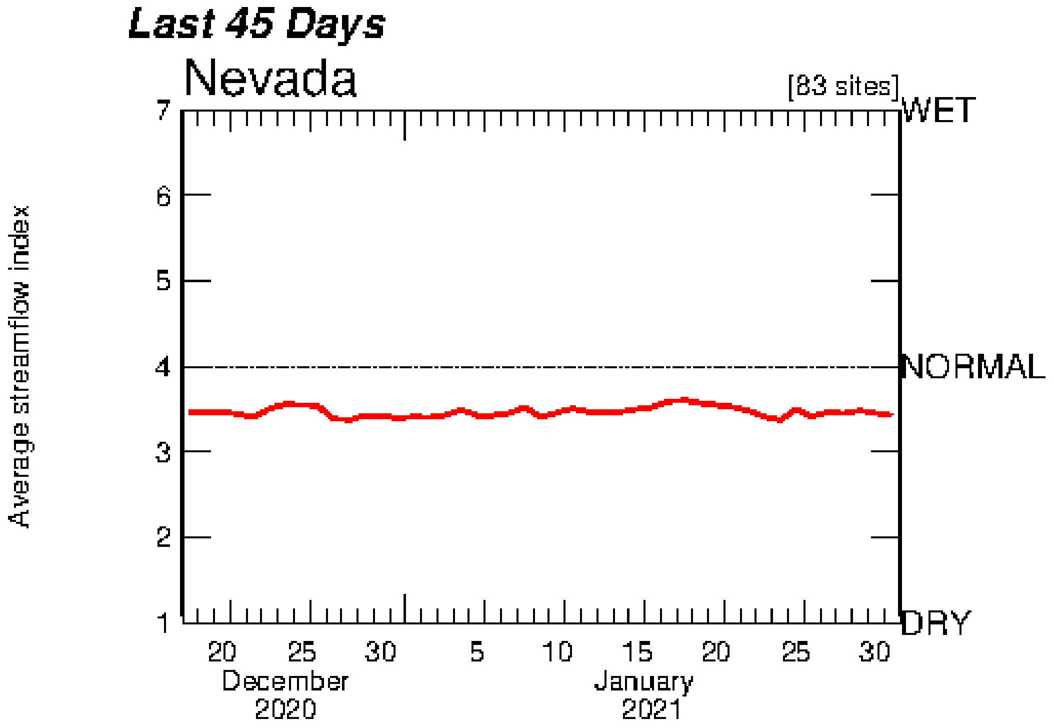
droughtmonitor.unl.edu

Sunday, January 31, 2021



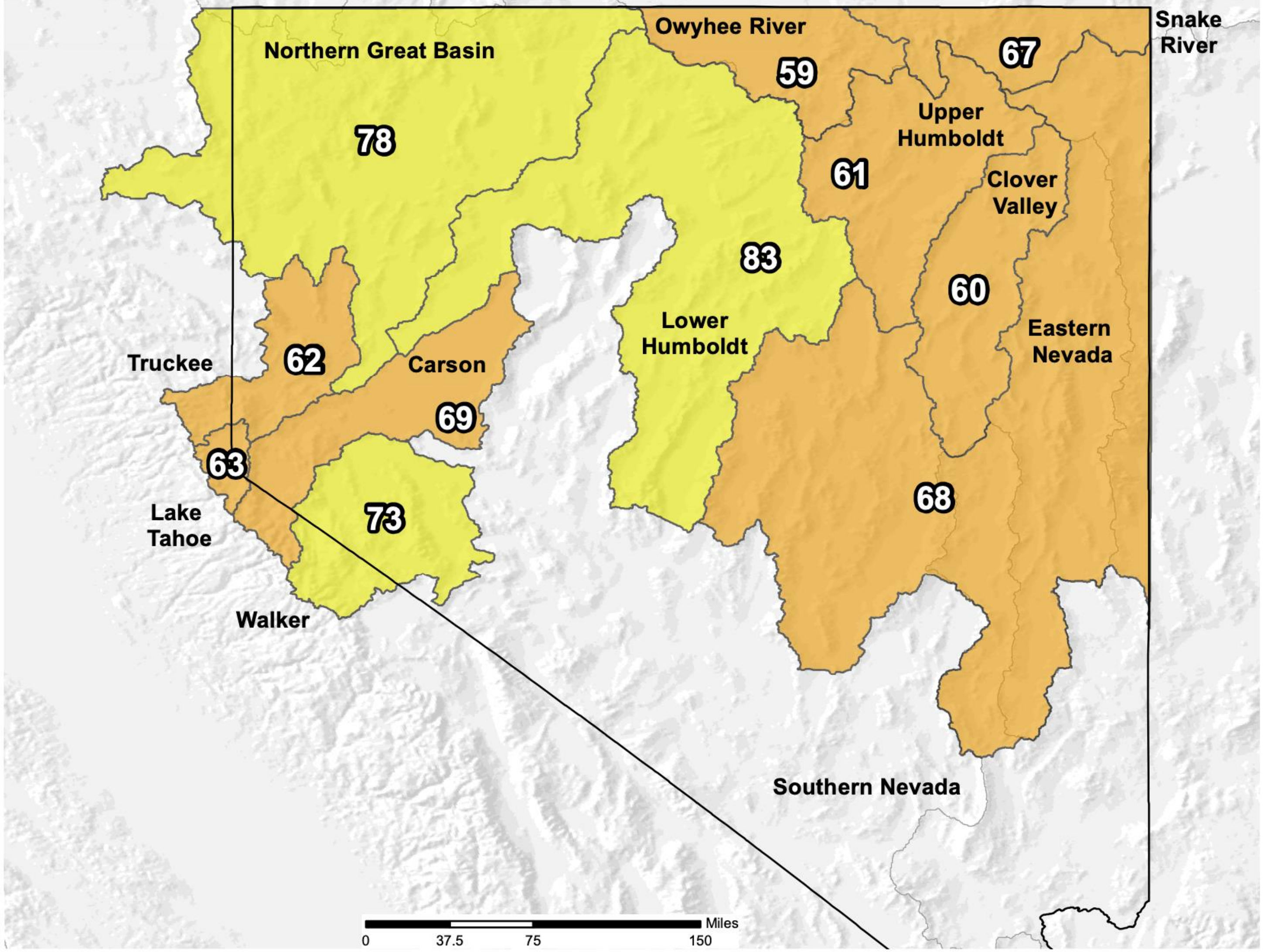
USGS

Explanation - Percentile classes							
Low	<10	10-24	25-75	76-90	>90	High	No Data
	Much below normal	Below normal	Normal	Above normal	Much above normal		



Nevada/California SNOTEL Water Year (Oct 1) to Date Precipitation % of Normal

Feb 02, 2021



Water Year (Oct 1) to Date Precipitation Basin-wide Percent of 1981-2010 Average

- unavailable *
- <50%
- 50 - 69%
- 70 - 89%
- 90 - 109%
- 110 - 129%
- 130 - 149%
- >=150%

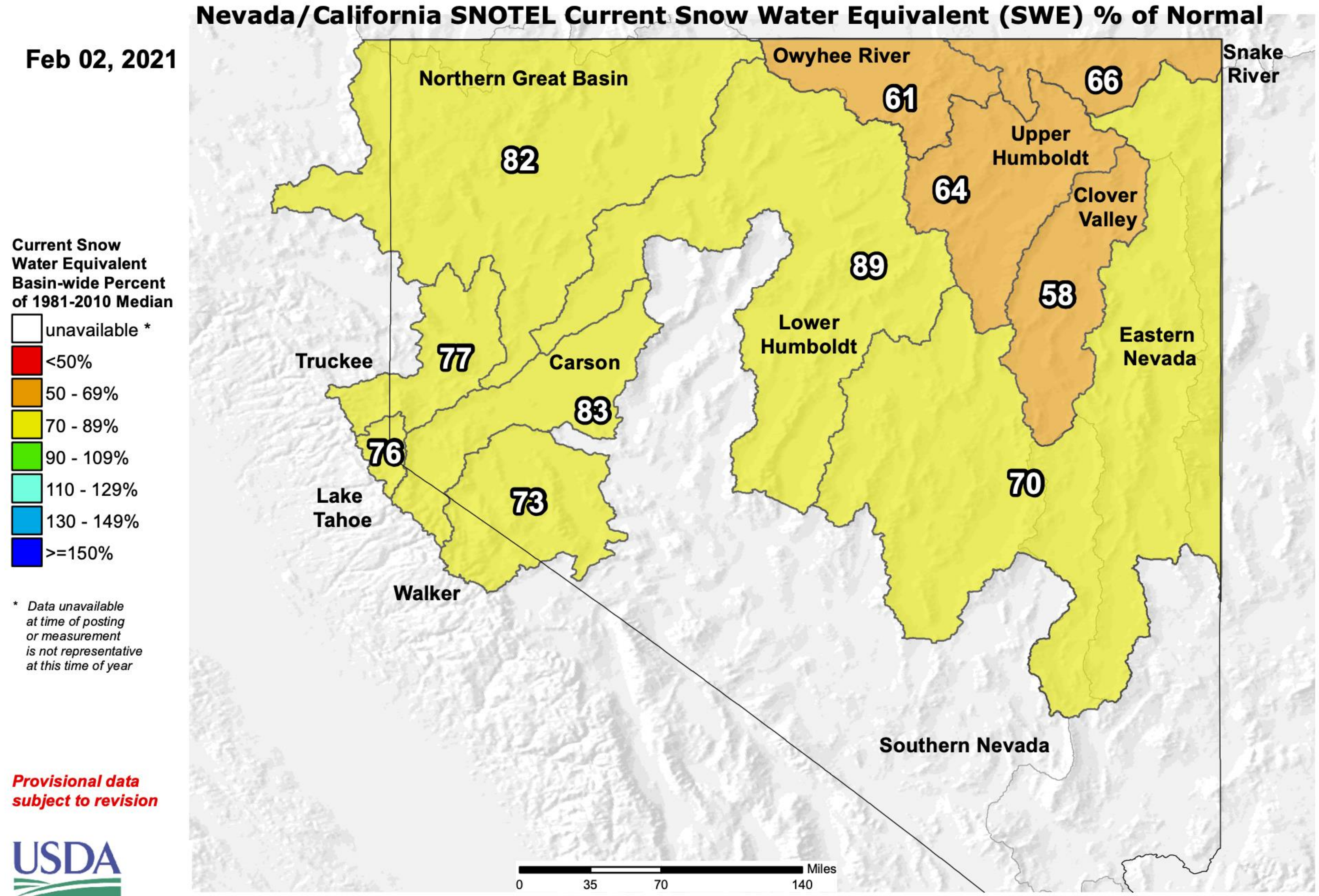
* *Data unavailable at time of posting or measurement is not representative at this time of year*

Provisional data subject to revision

USDA NRCS

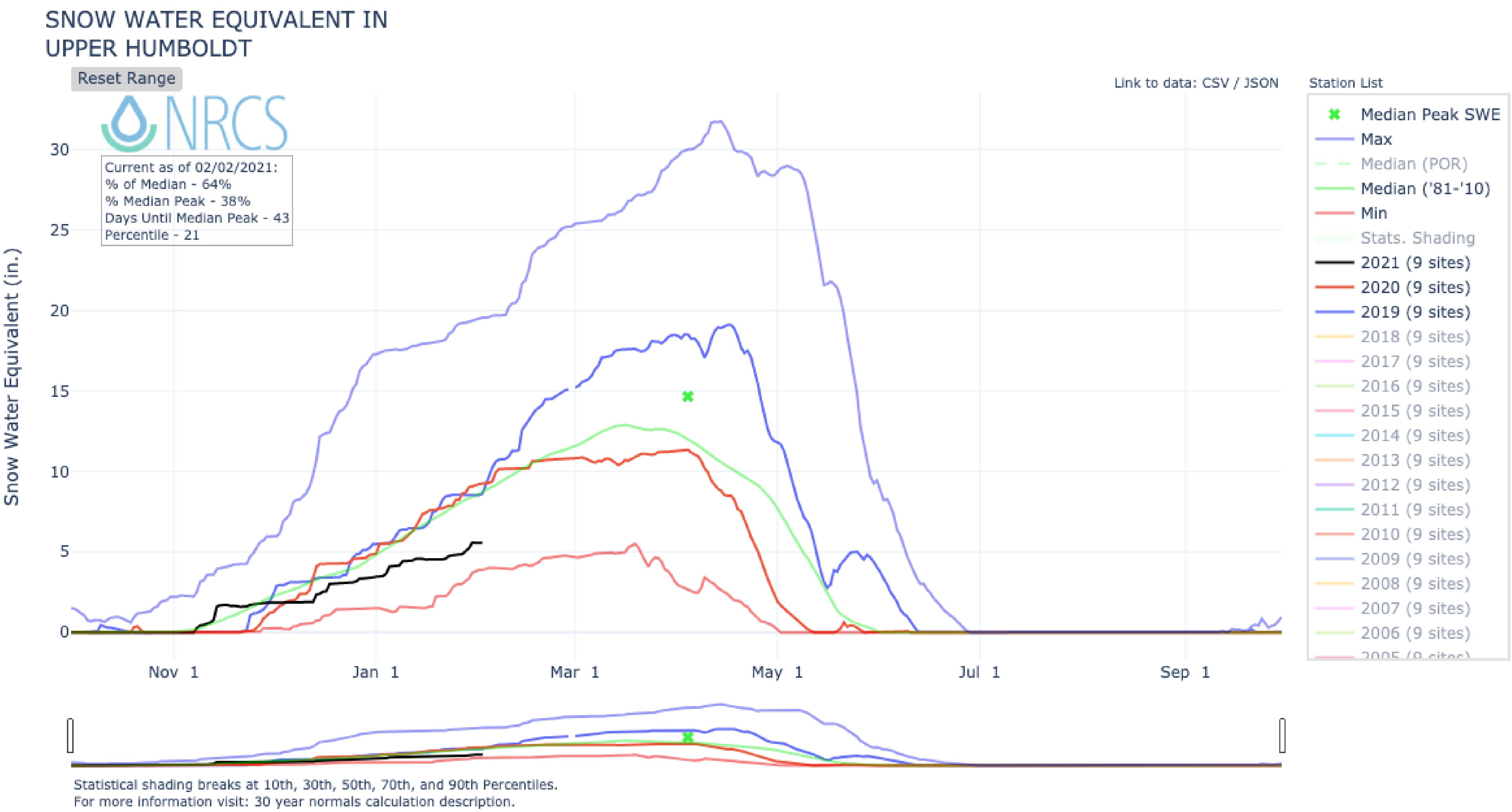
The water year to date precipitation percent of normal represents the accumulated precipitation found at selected SNOTEL sites in or near the basin compared to the average value for those sites on this day. Data based on the first reading of the day (typically 00:00).

Prepared by:
USDA/NRCS National Water and Climate Center
Portland, Oregon
http://www.wcc.nrcs.usda.gov



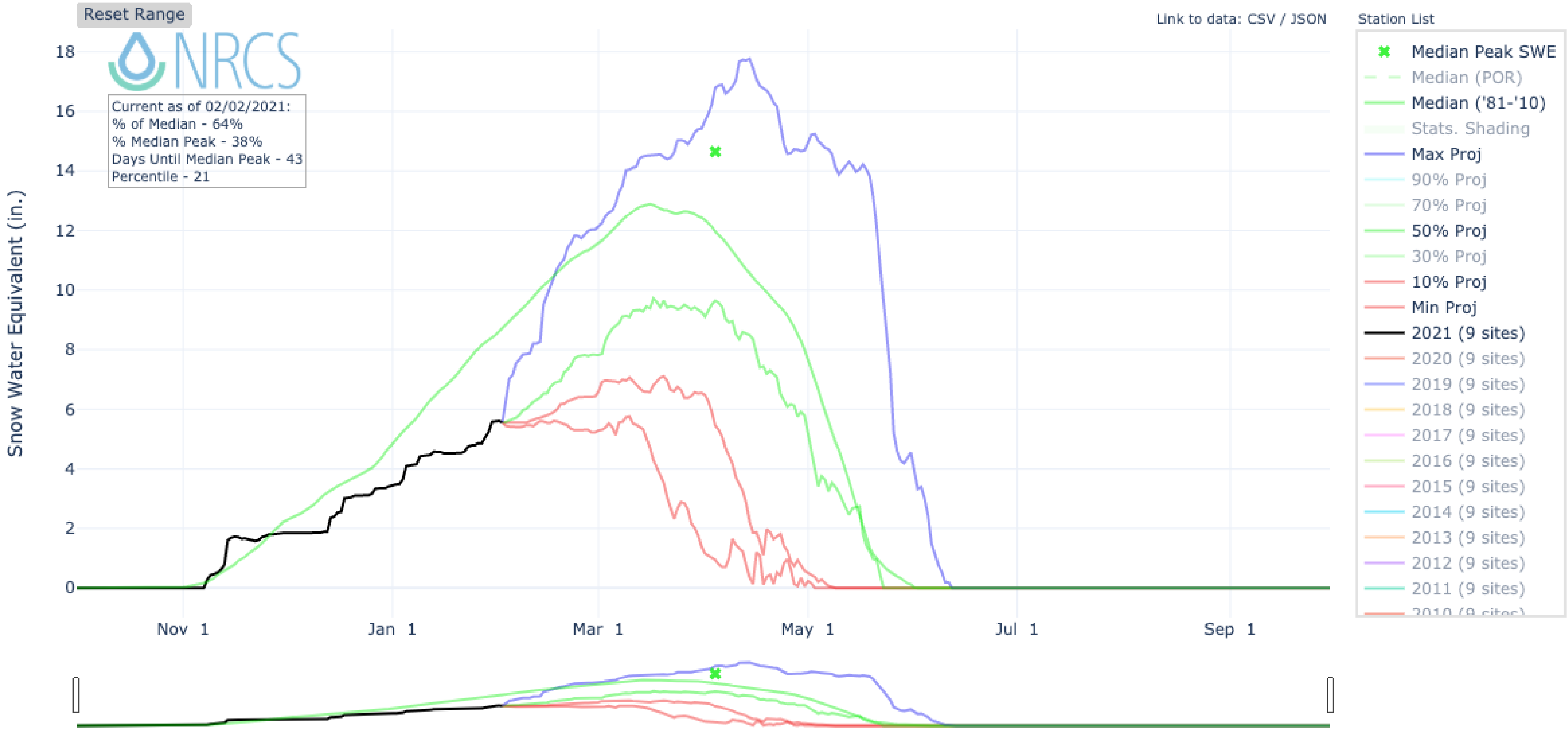
The current snow water equivalent percent of normal represents the snow water equivalent found at selected SNOTEL sites in or near the basin compared to the average value for those sites on this day. Data based on the first reading of the day (typically 00:00).

Prepared by:
USDA/NRCS National Water and Climate Center
Portland, Oregon
http://www.wcc.nrcs.usda.gov



SNOW WATER EQUIVALENT IN
UPPER HUMBOLDT
Reset Range
NRCS
Current as of 02/02/2021:
% of Median - 64%
% Median Peak - 38%
Days Until Median Peak - 43
Percentile - 21
Link to data: CSV / JSON
Station List
Median Peak SWE
Max
Median (POR)
Median ('81-'10)
Min
Stats. Shading
2021 (9 sites)
2020 (9 sites)
2019 (9 sites)
2018 (9 sites)
2017 (9 sites)
2016 (9 sites)
2015 (9 sites)
2014 (9 sites)
2013 (9 sites)
2012 (9 sites)
2011 (9 sites)
2010 (9 sites)
2009 (9 sites)
2008 (9 sites)
2007 (9 sites)
2006 (9 sites)
Snow Water Equivalent (in.)
0
5
10
15
20
25
30
Nov 1
Jan 1
Mar 1
May 1
Jul 1
Sep 1
Statistical shading breaks at 10th, 30th, 50th, 70th, and 90th Percentiles.
For more information visit: 30 year normals calculation description.

SNOW WATER EQUIVALENT PROJECTIONS IN UPPER HUMBOLDT



Statistical shading breaks at 10th, 30th, 50th, 70th, and 90th Percentiles.
For more information visit: 30 year normals calculation description.

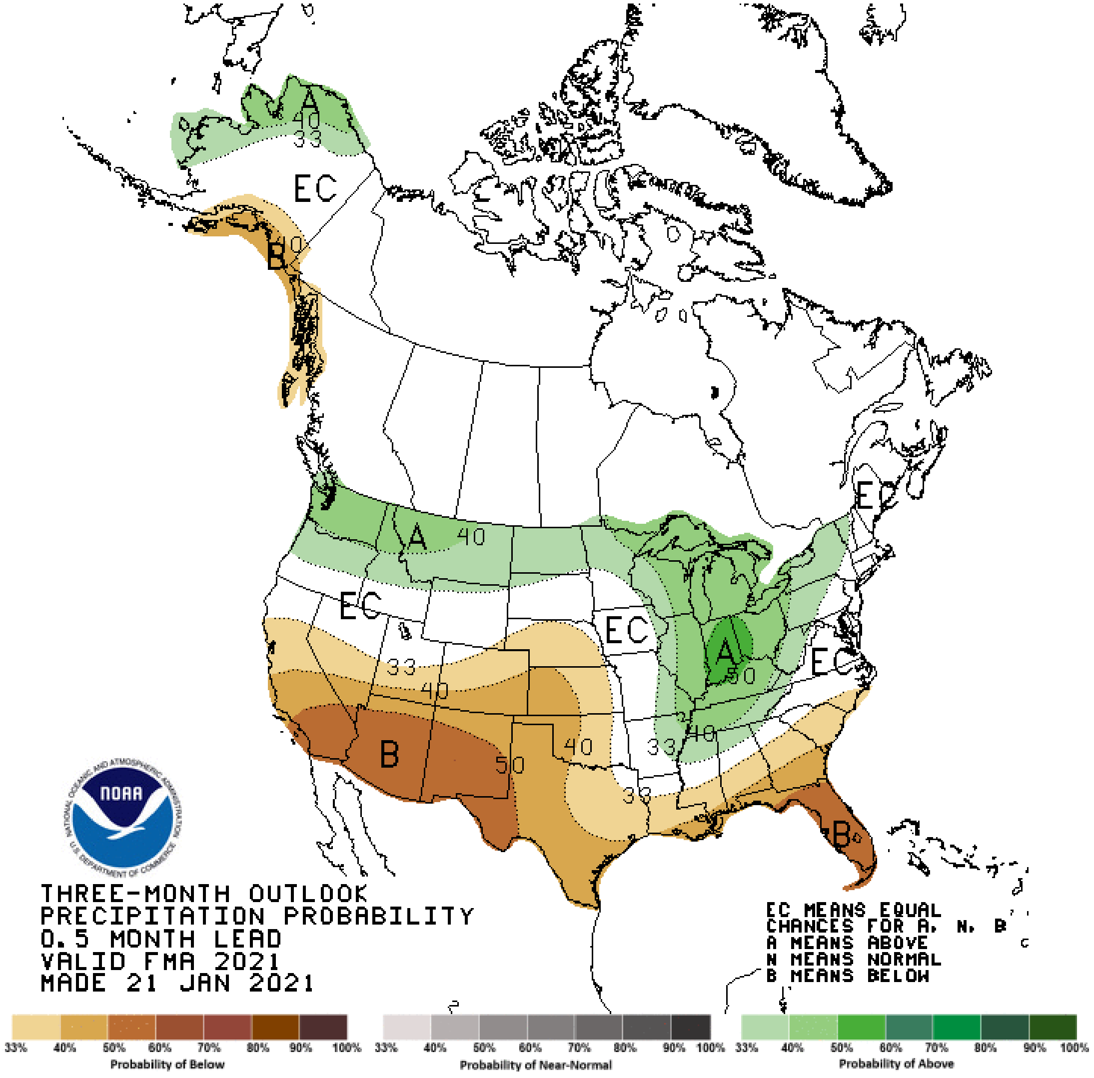
JAN 1, 2021: NRCS Rye Patch Reservoir Storage Comparison

Rye Patch Reservoir			
Current		Last Year	Average
KAF	% of Capacity	KAF	KAF
62.2	32	175.4	69.2

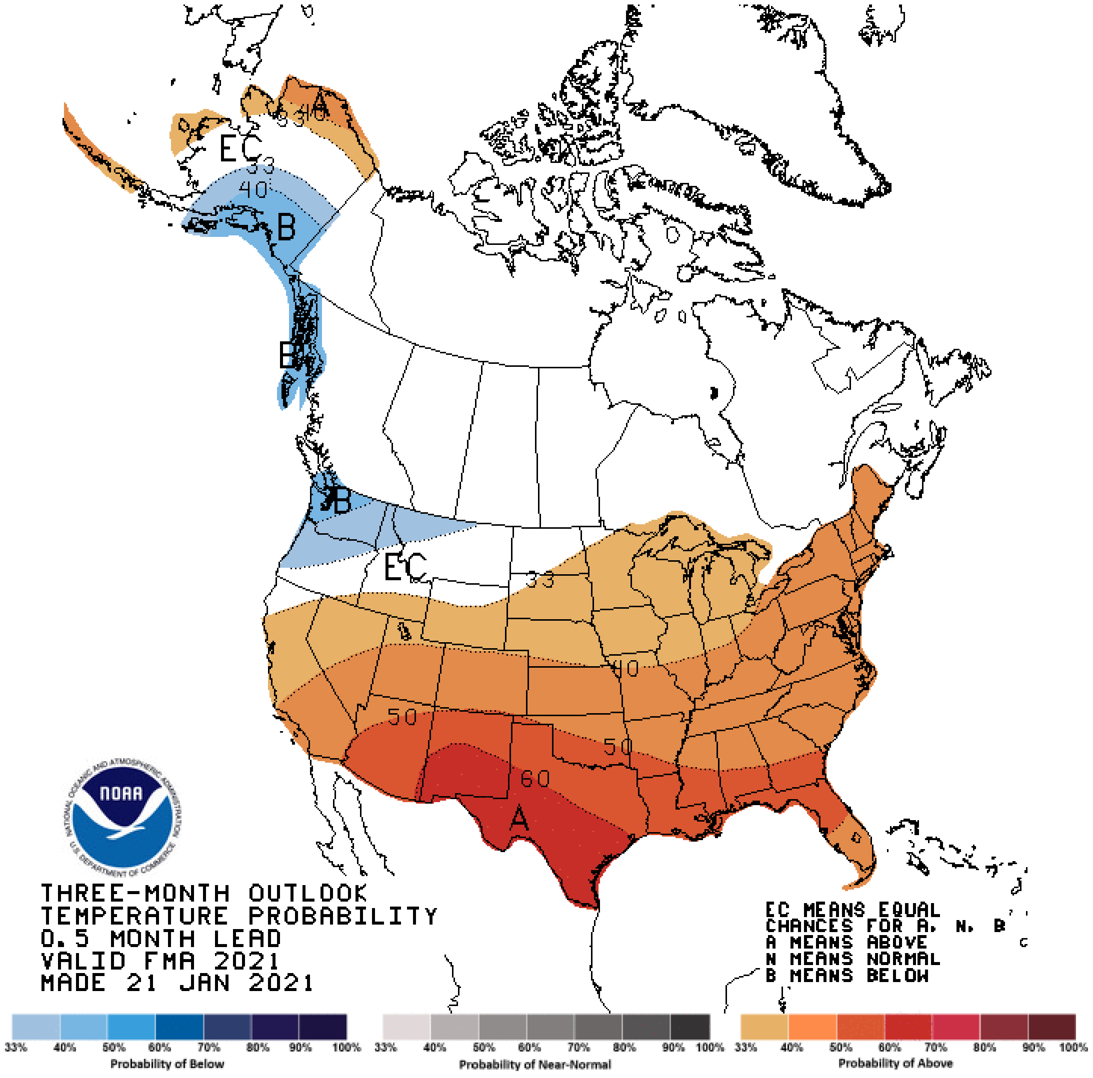
Reservoir Storage Summary for the end of December 2020

3 – Month Outlook

Precipitation



Temperature



Resources

National Weather Service

https://www.weather.gov

NRCS

https://www.wcc.nrcs.usda.gov/snow

Great Basin Weather and Climate Dashboard

https://gbdash.dri.edu

USGS WaterWatch

https://waterwatch.usgs.gov/index.php

Regionwide ET Study

DRI

Quantifying Groundwater ET across Humboldt River Region

Justin Huntington
February 4, 2021
DRI

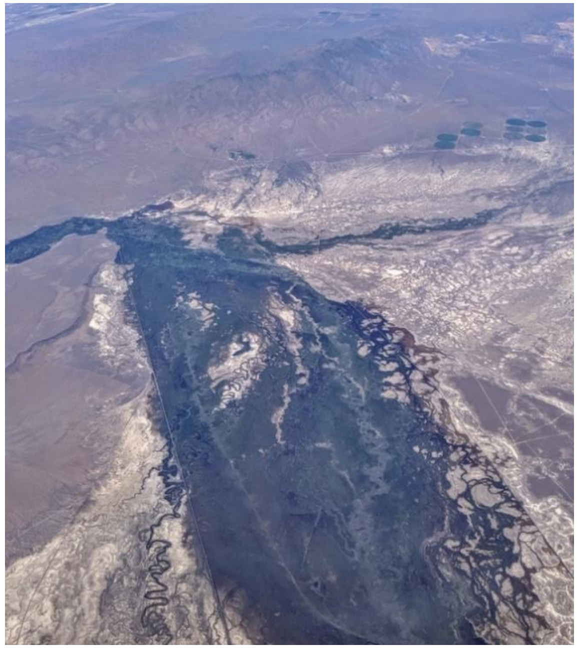
Groundwater Discharge via Evapotranspiration

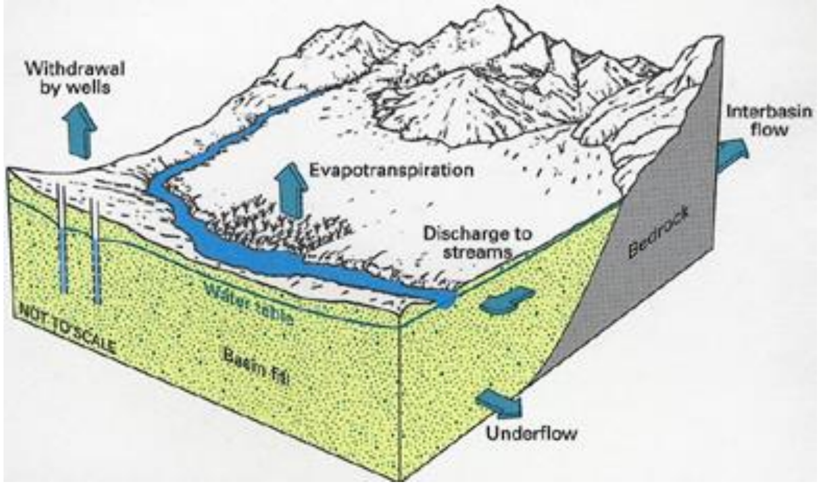
Paradise Valley, NV

Desert Research Institute

Groundwater Discharge via Evapotranspiration

- Objective
  - Delineate areas where phreatophytes discharge groundwater through the process of evapotranspiration
  - Use best available science to estimate the rates of groundwater evapotranspiration (ETg) from phreatophyte vegetation
  - Summarize and compare to previous studies, and provide results to USGS and DRI groundwater modeling groups to use for calibration of groundwater models





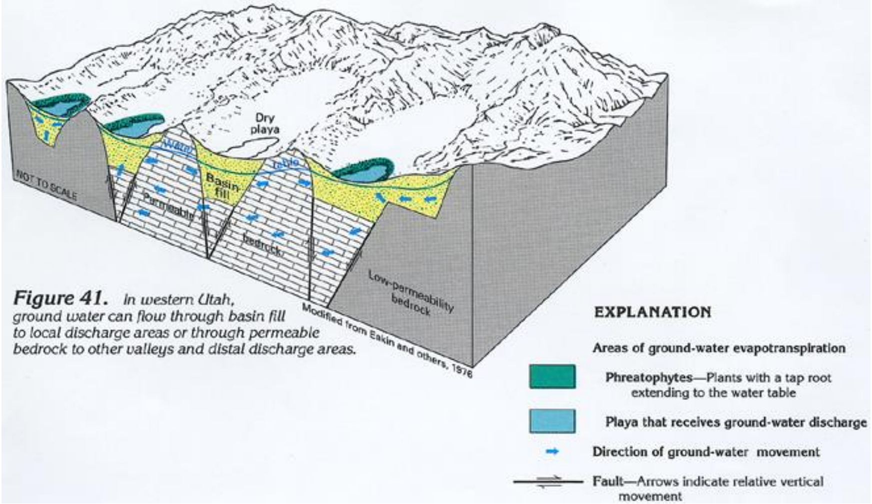
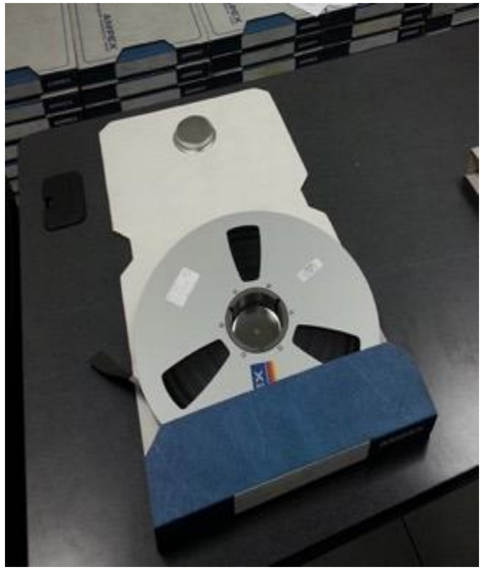


Figure 41. In western Utah, ground water can flow through basin fill to local discharge areas or through permeable bedrock to other valleys and distal discharge areas.

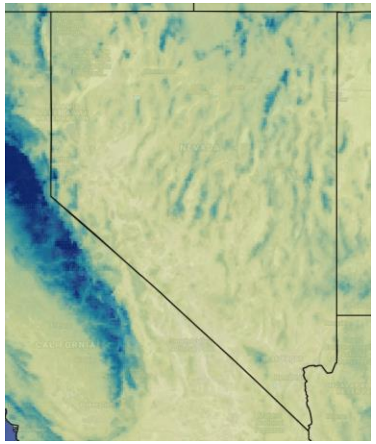
USGS HA730C – Groundwater Atlas of U.S.

Satellite and Climate Data

1971-1984

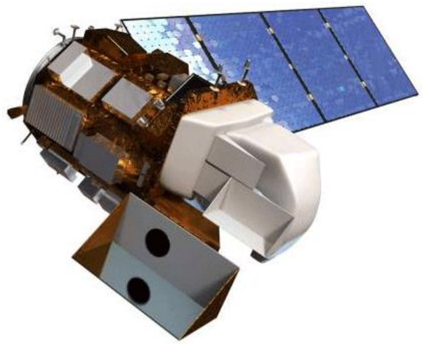


1985-2020

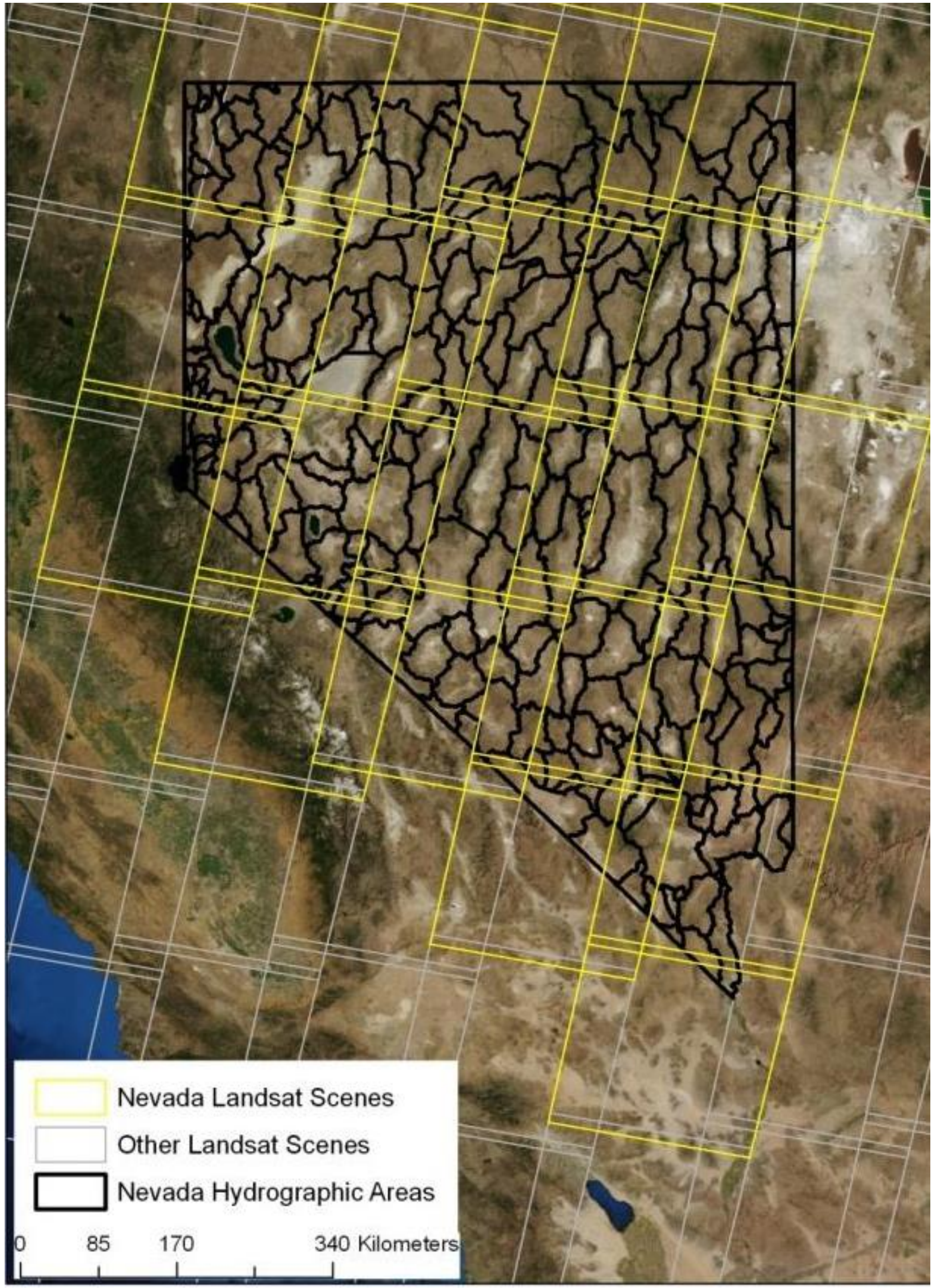


Geospatial Data

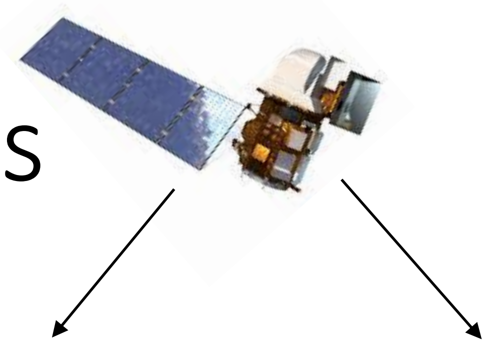
- Previous phreatophyte boundaries, aerial imagery, Landsat imagery, digital elevation models, soils data, wells and water levels, field surveys of phreatophytes
- Landsat satellite imagery to compute vegetation indices
  - 1985-2015, summer period
- gridMET weather data for estimating precipitation and evaporative demand
  - Solar radiation, temperature, humidity, and wind speed

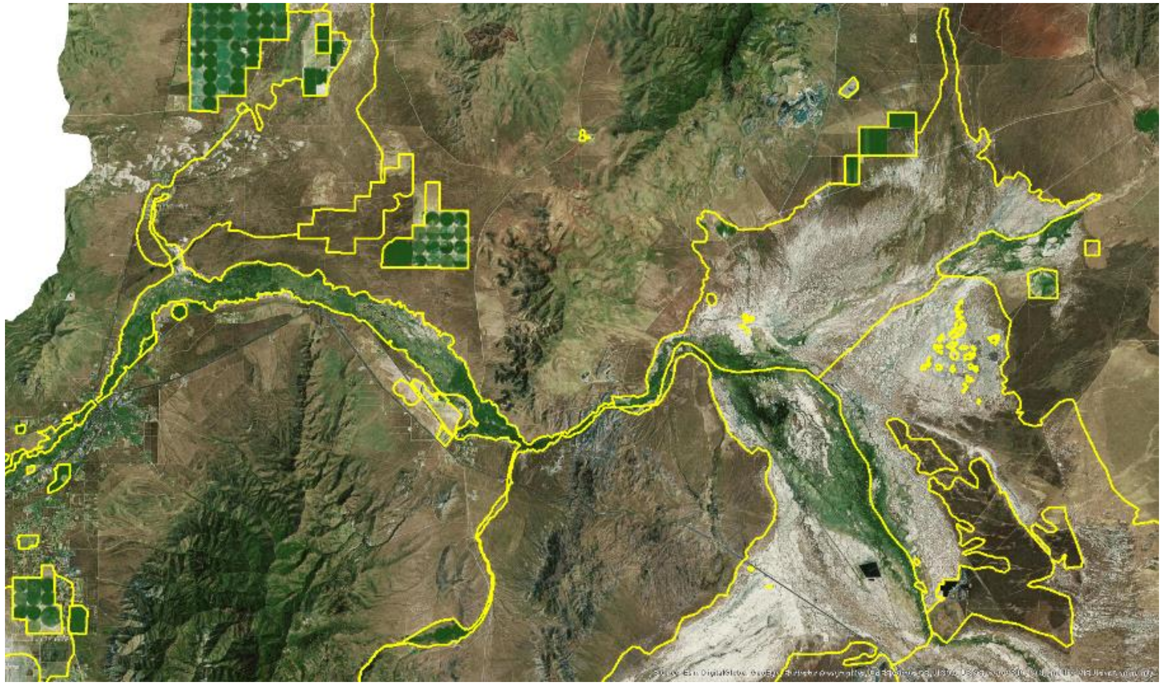


Landsat MODIS

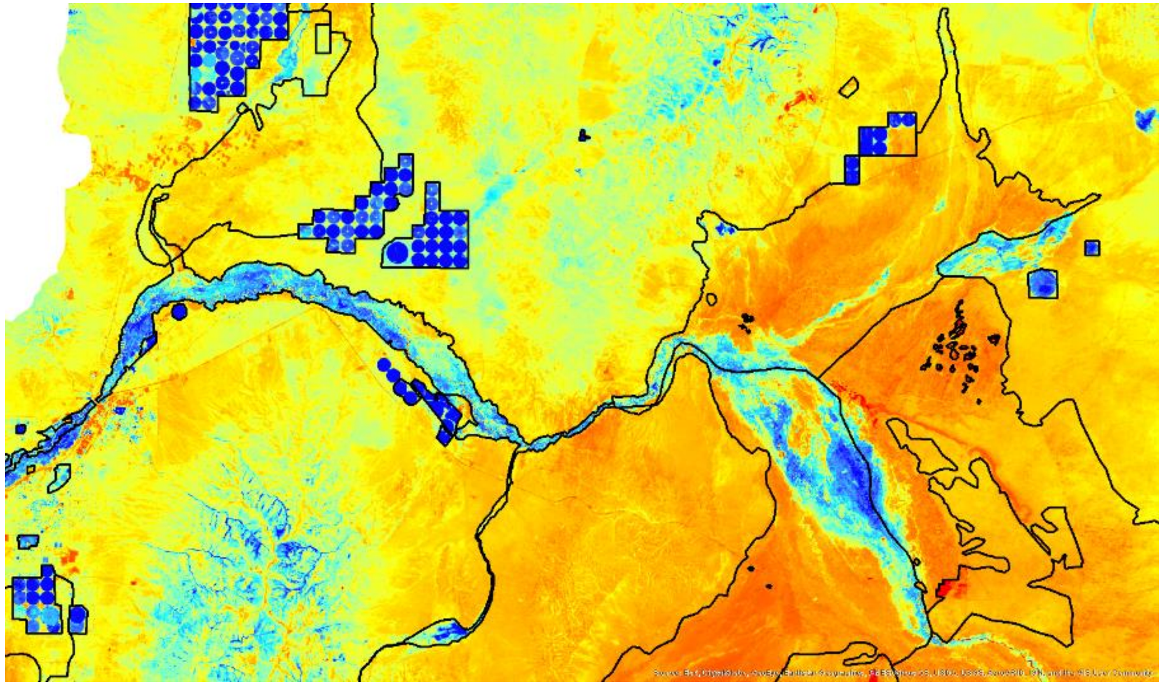


Groundwater Discharge Boundaries



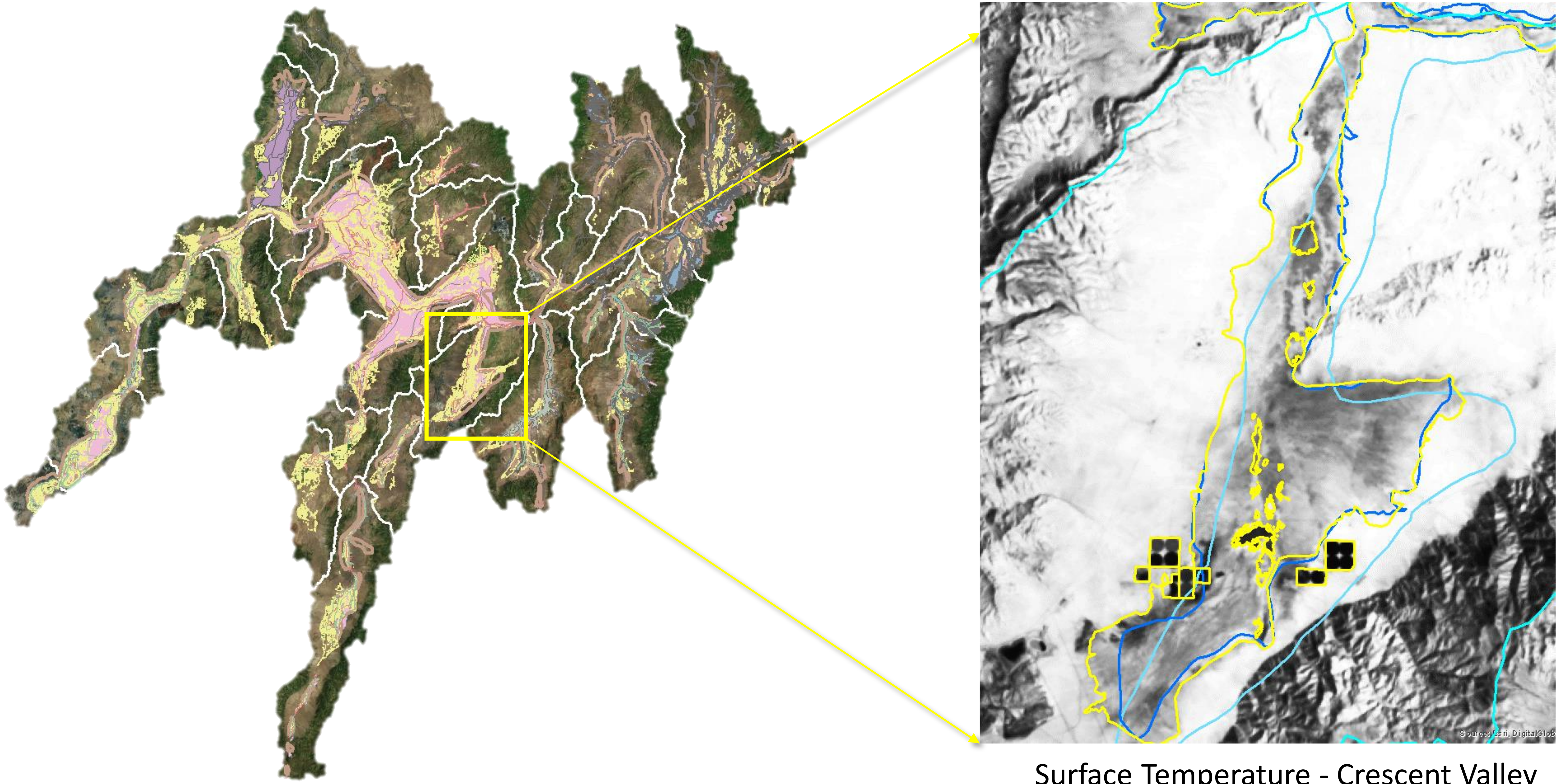


True Color NAIP Imagery



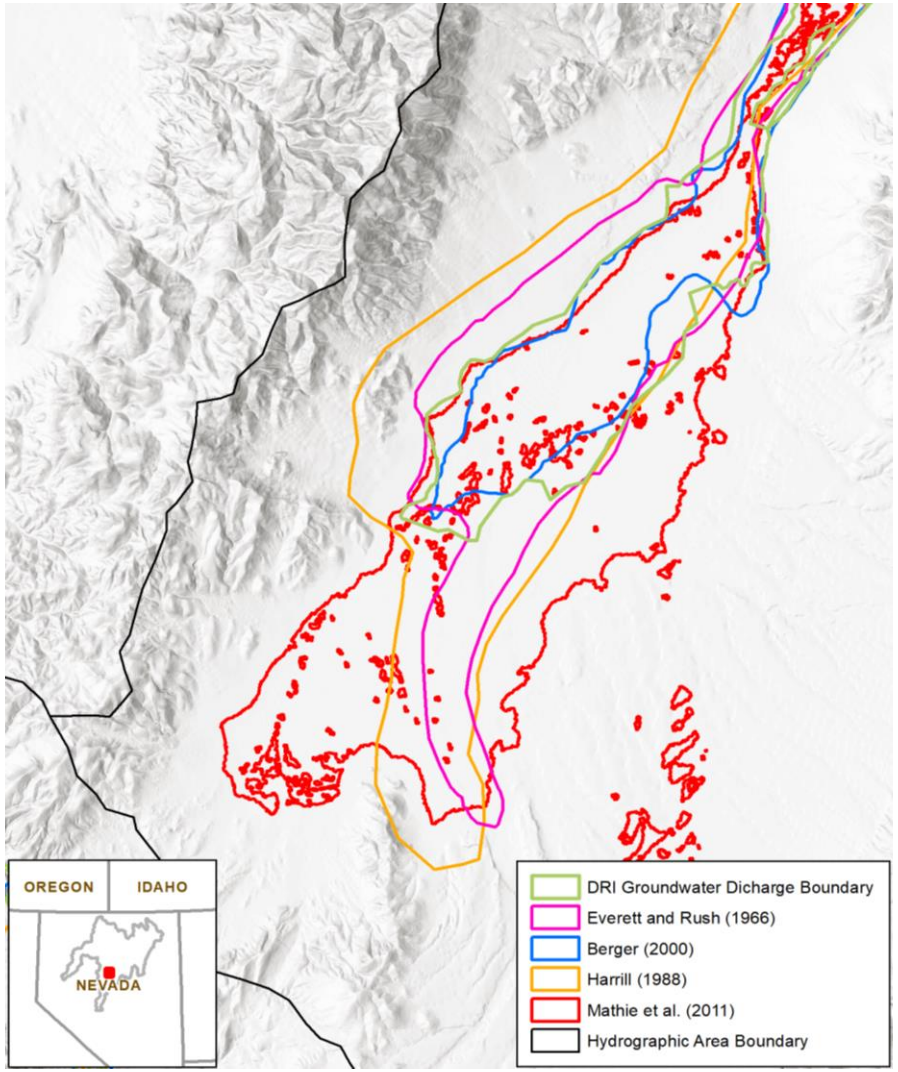
Vegetation Index (30m)

Groundwater Discharge Boundaries

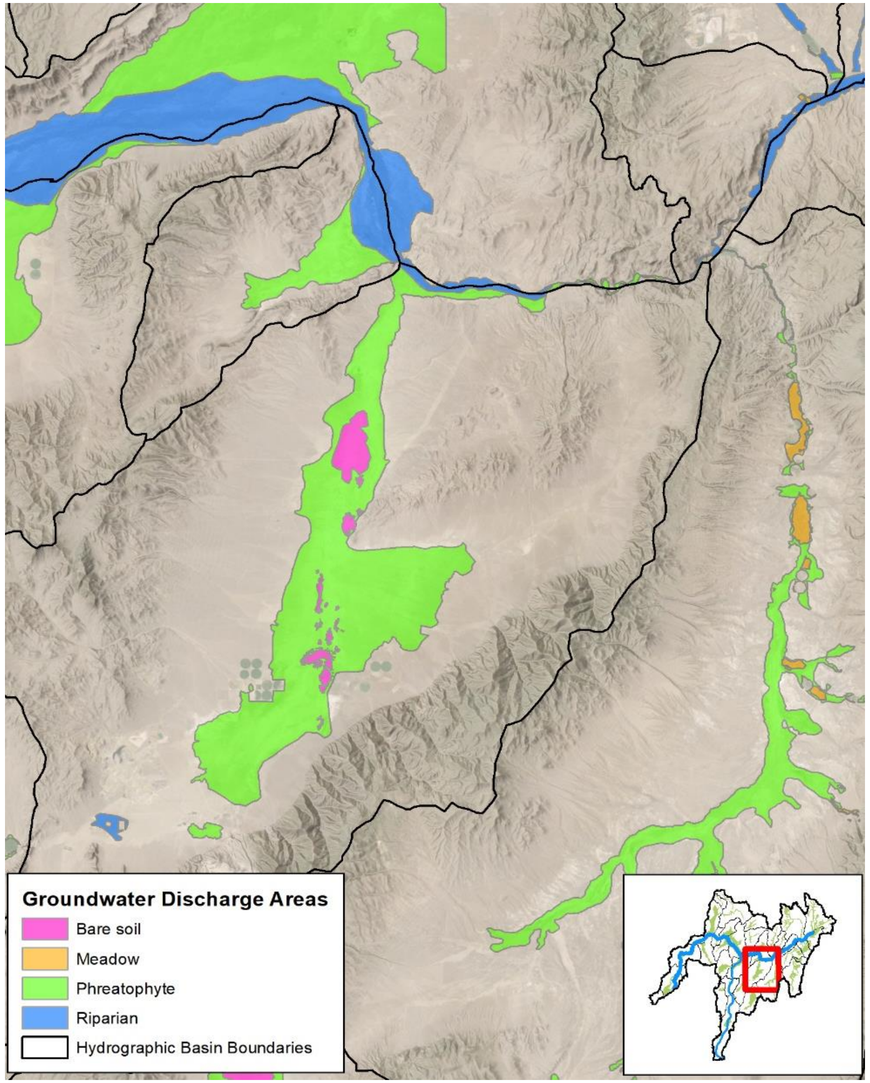


Surface Temperature - Crescent Valley

Groundwater Discharge Boundaries

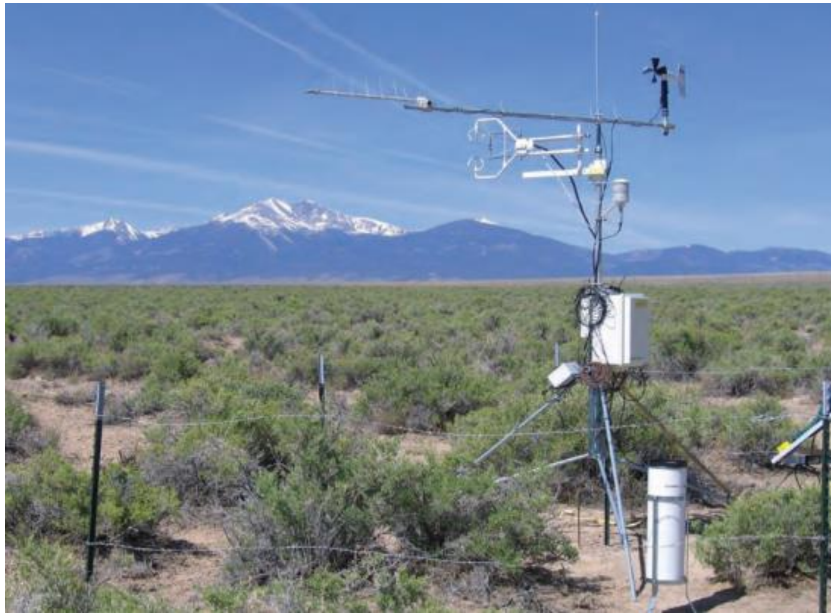


Carico Lake Valley



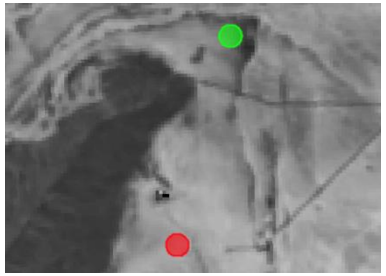
Crescent and Pine Valley Areas

Landsat and Climate -> ETg



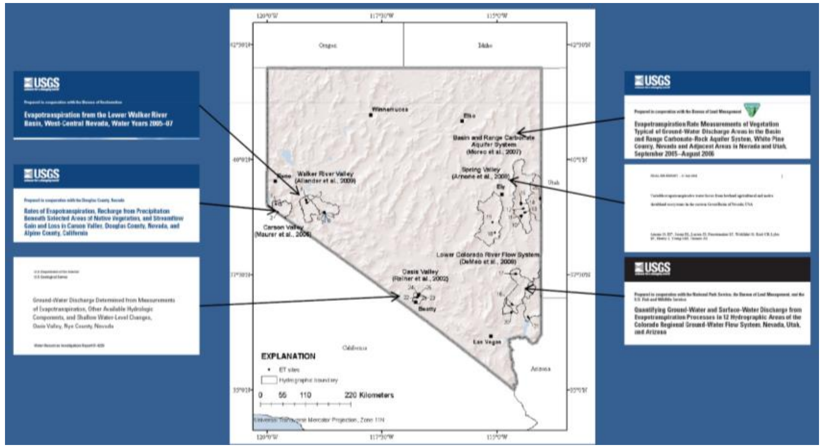
Moreo et al (2007)

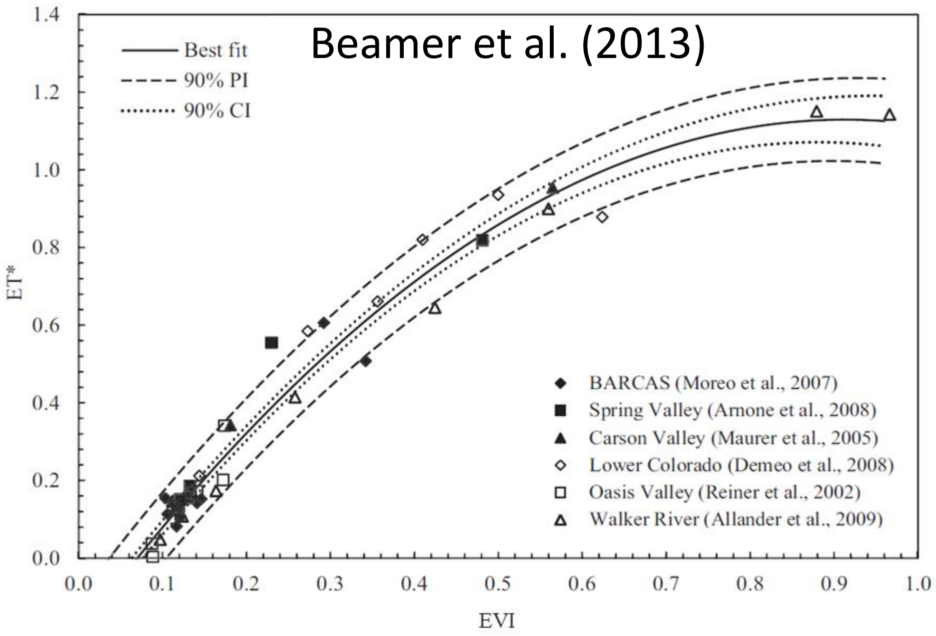
+



$$ET^* = \frac{ET - PPT}{ETo - PPT}$$

->

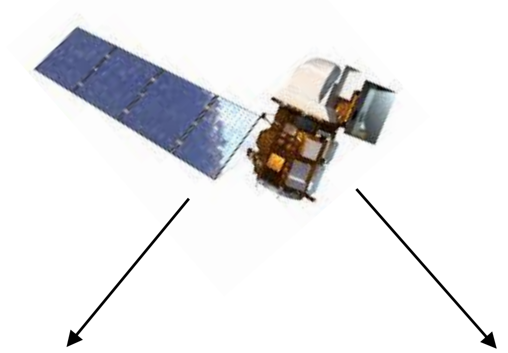


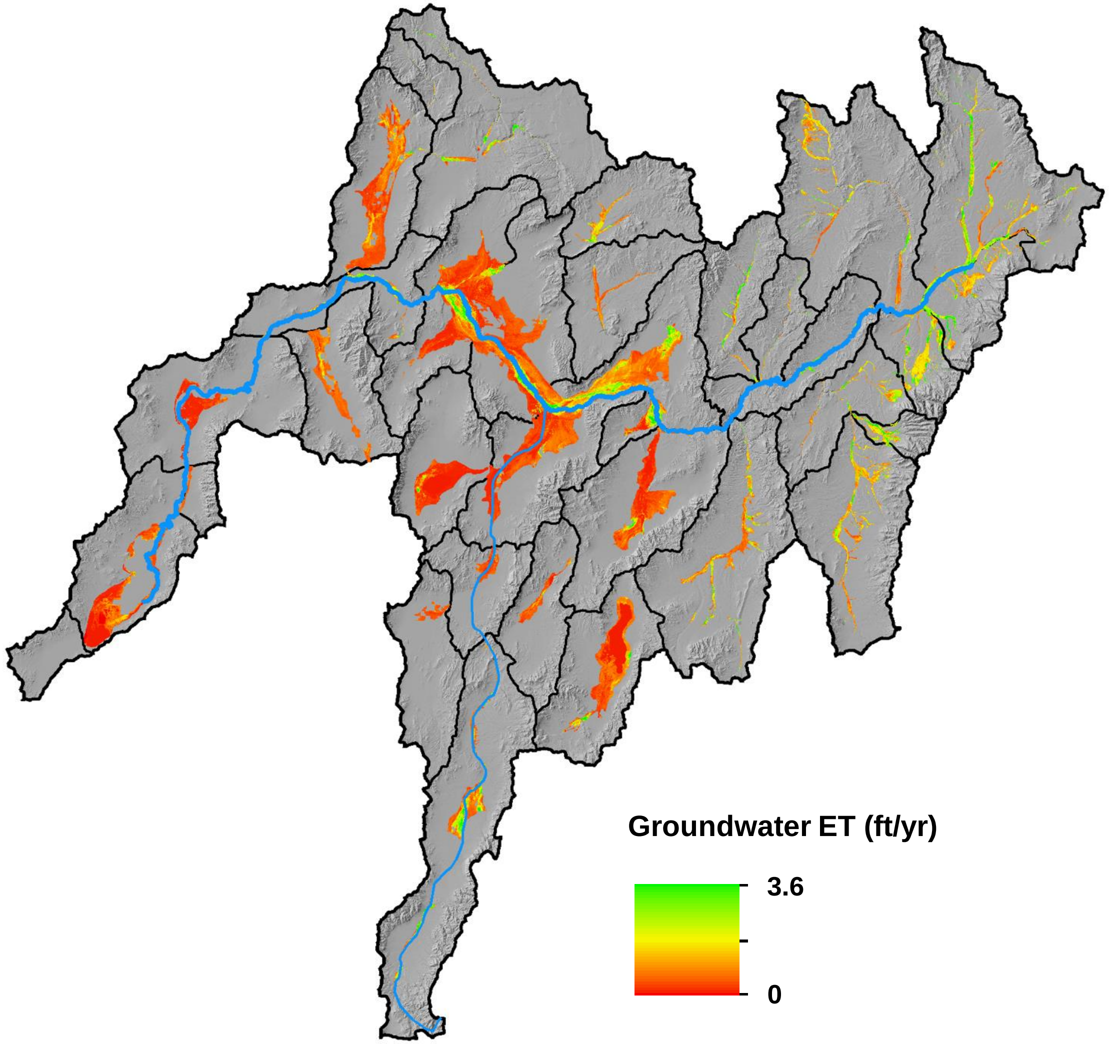


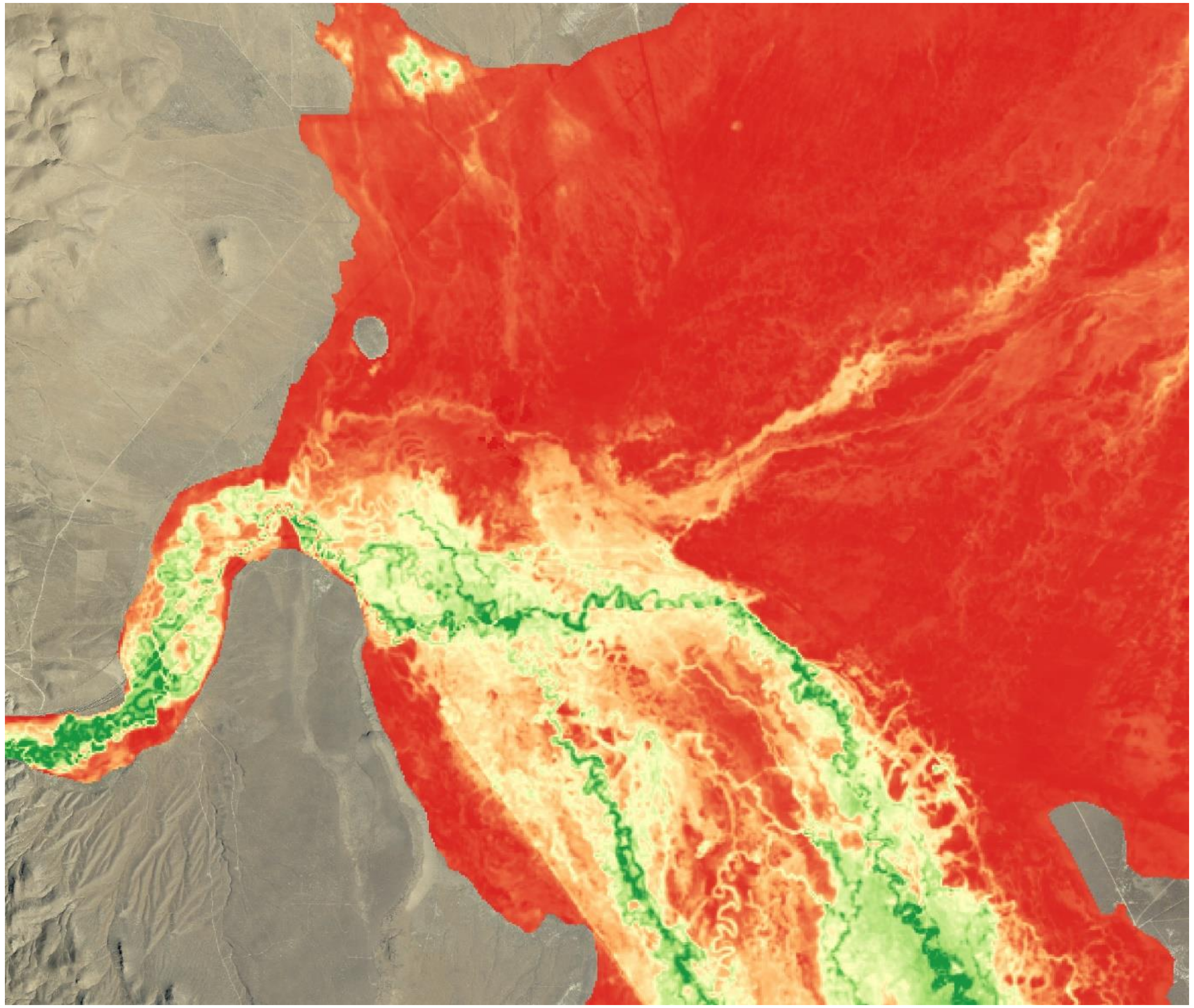
$$ET^* = \beta_0 + \beta_1 EVI + \beta_2 EVI^2$$

*Rate of ETg (ft/yr) = (ETo – PPT) * ET**

Groundwater ET Distribution



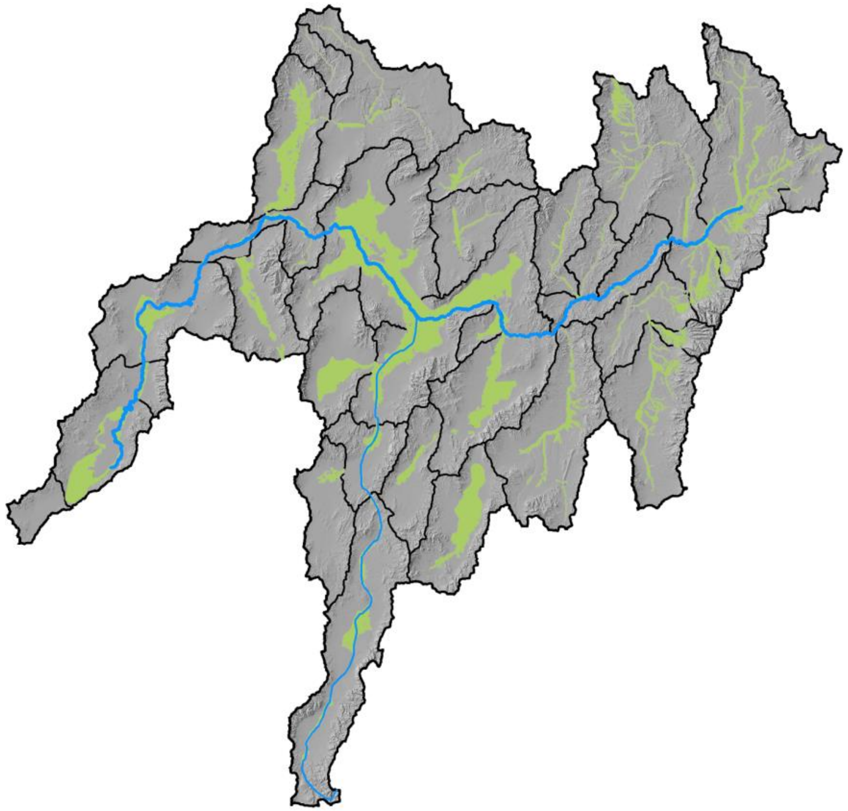




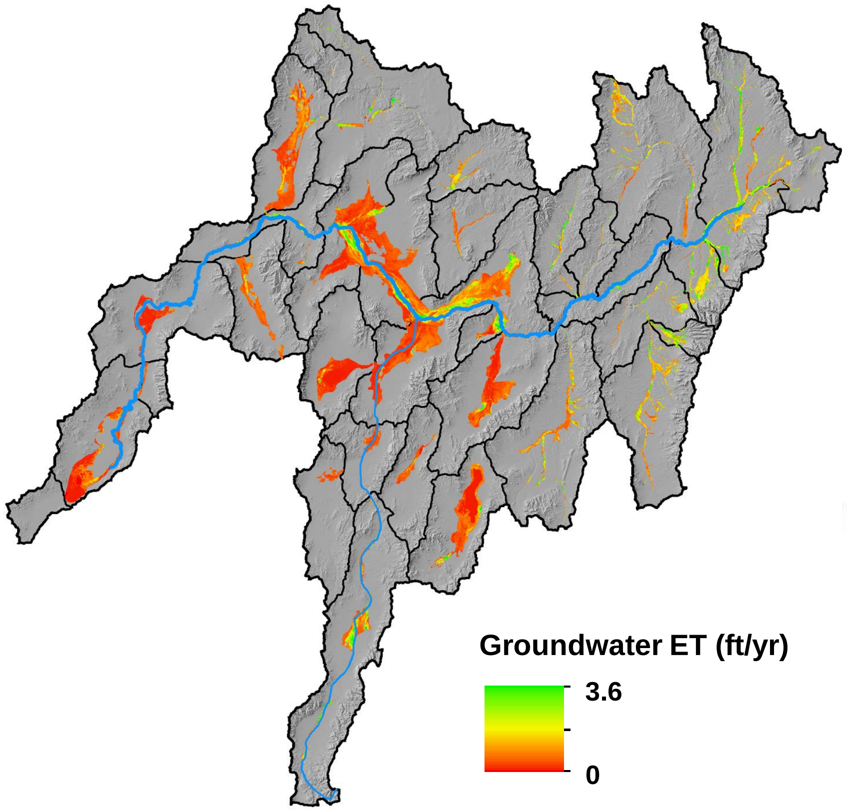
Kelley Creek Area, Clovers Area, and Pumpernickel Valley

Evapotranspiration Discharge

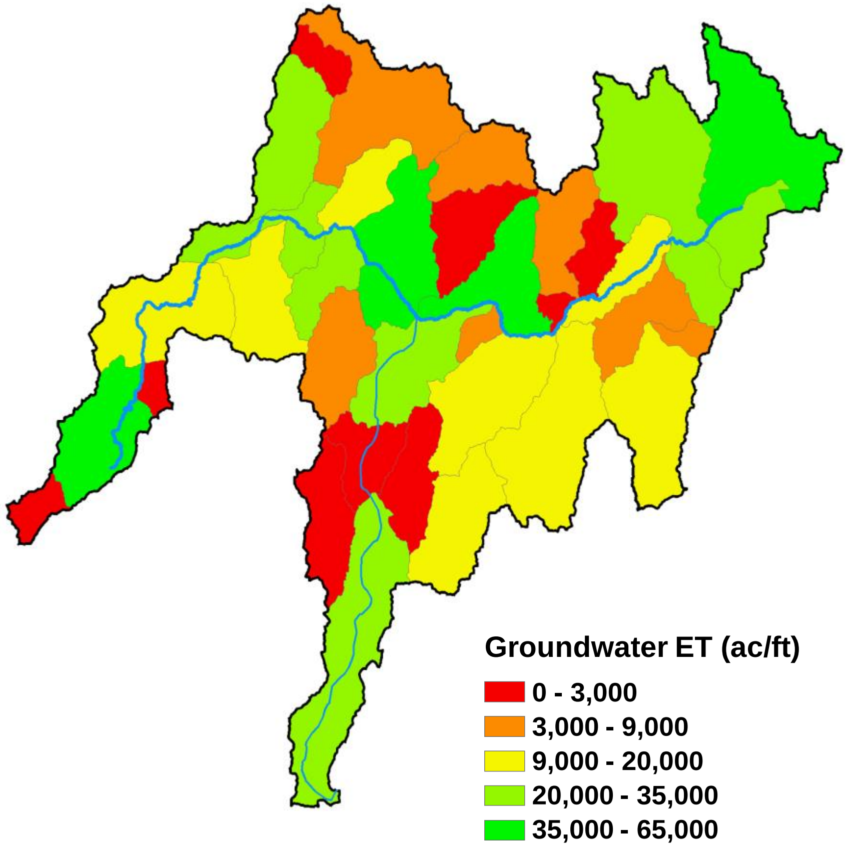
Potential areas of GW discharge



Groundwater ET



Groundwater ET



Summary

- Delineated and revised groundwater discharge areas
- Use a combination of satellite and gridded climate data to estimate median ETg from phreatophyte vegetation from 1985-2015
- Summarize and compare to previous studies, and provided results to USGS and DRI groundwater modeling groups
- Developing geodatabase and report that will be publicly available on a DRI website in April 2021

Stream Capture Concepts

USGS

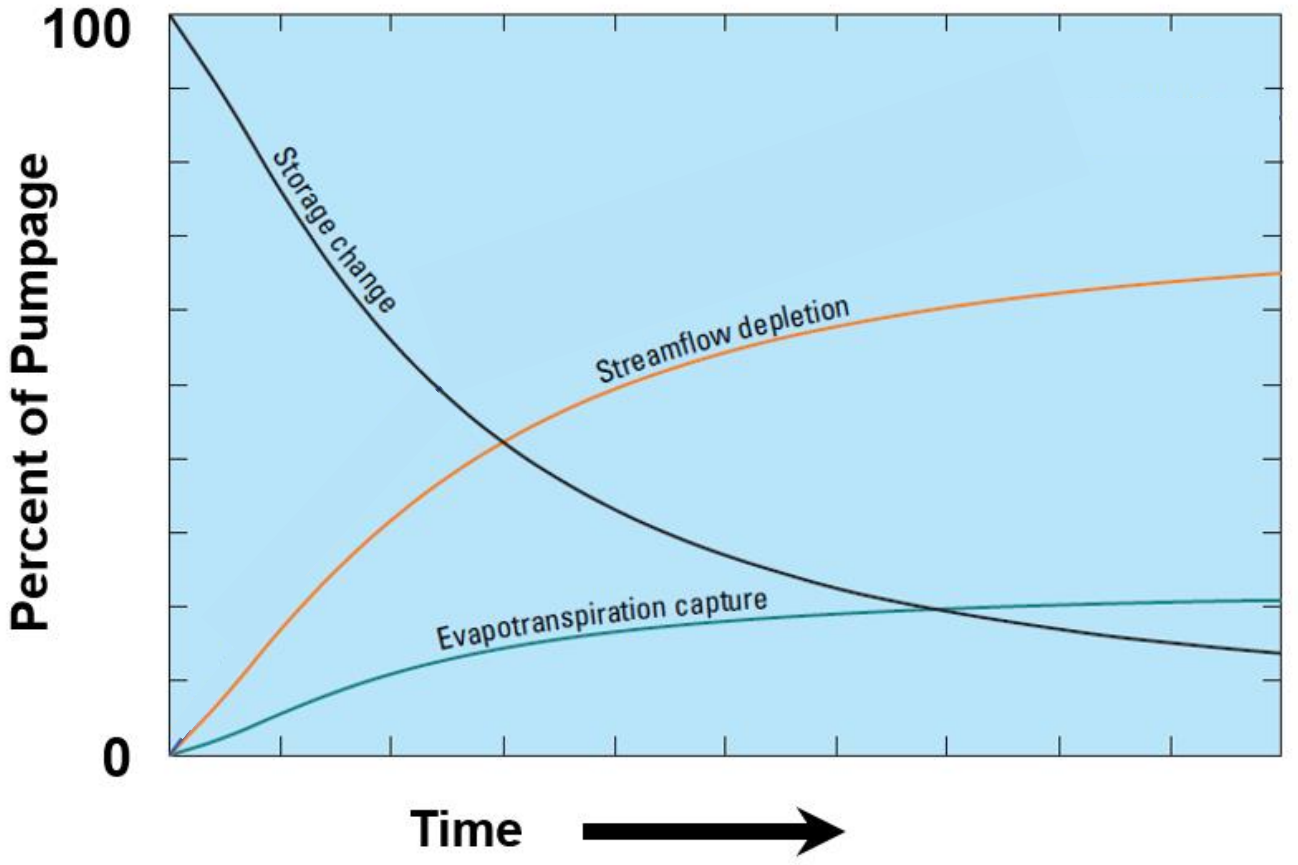
Stream capture and capture maps:
Stakeholder meeting

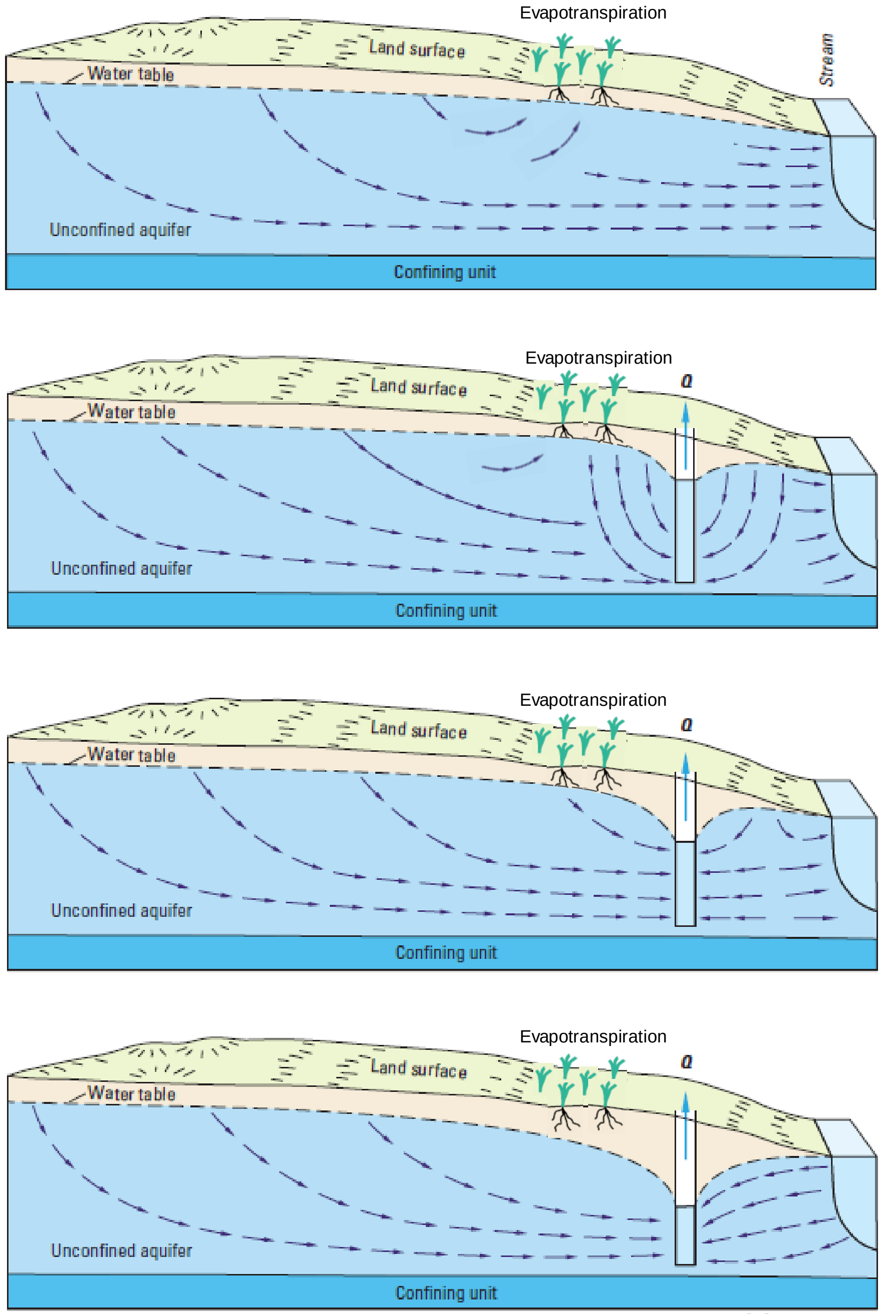
Update 2021-02-04

USGS NVWSC

What is stream capture?

Reduction in streamflow caused by a pumping well.





Stream Capture = Streamflow Depletion

How to interpret Capture Maps

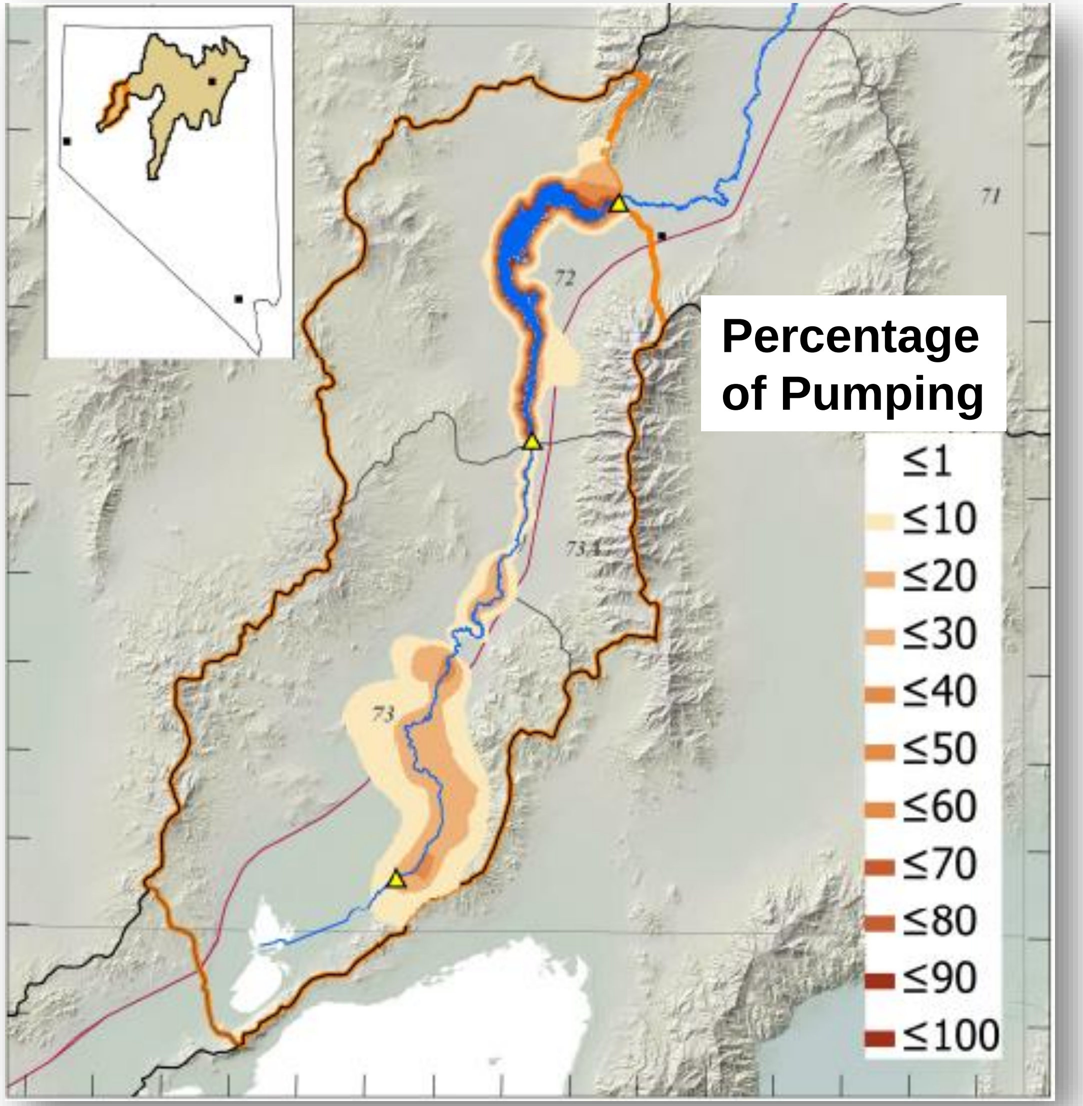
Capture maps represent the ‘hypothetical’ stream depletion from a well in any given location for a given duration of pumping.

Generally expressed as percentage of pumping.

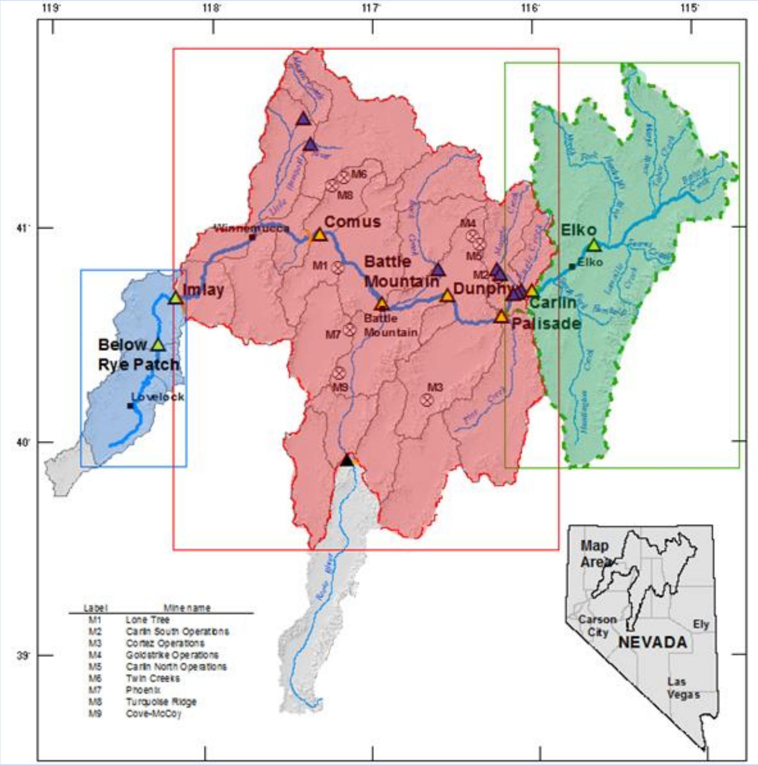
Darker colors indicate higher capture.

Lighter colors indicate lower capture.

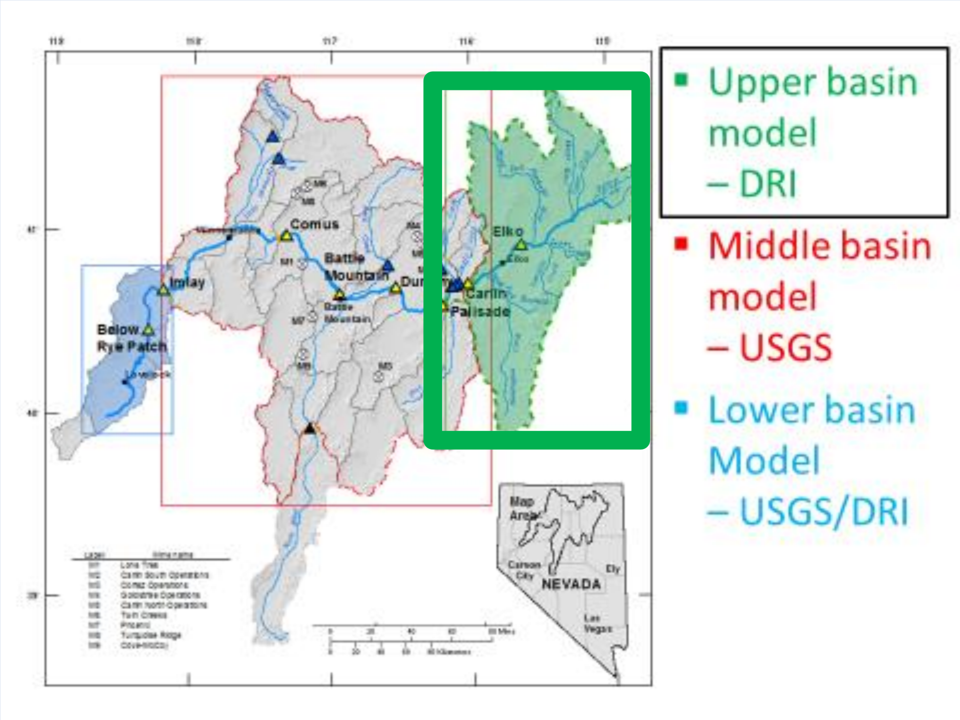
Preview of Lower Humboldt Capture map – 10 years of pumping



Model Results



Upper Humboldt River Basin Model



DRI

Upper Humboldt Basin Groundwater Modeling Update

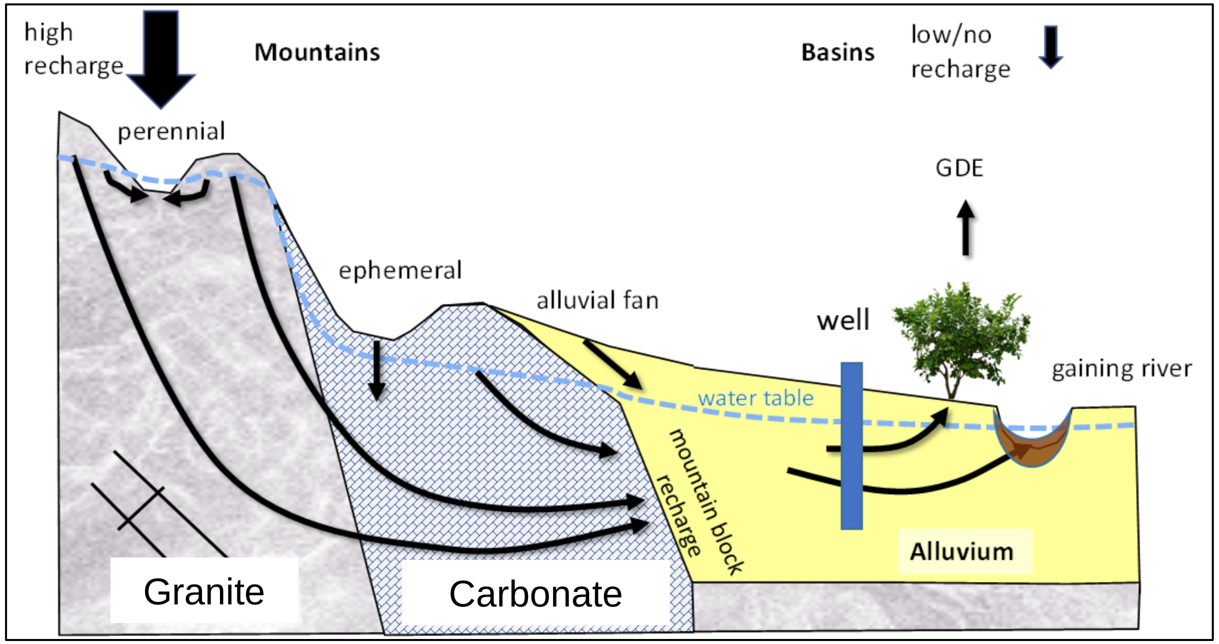
Rosemary WH Carroll
February 4, 2021
DRI

Outline

- Conceptual Model
- Upper Basin Modeled Characteristics
- Historic Capture (1960-2016)
- Capture Analysis
- Concluding Remarks

Conceptual Model

Pre-Groundwater Development (<1960)



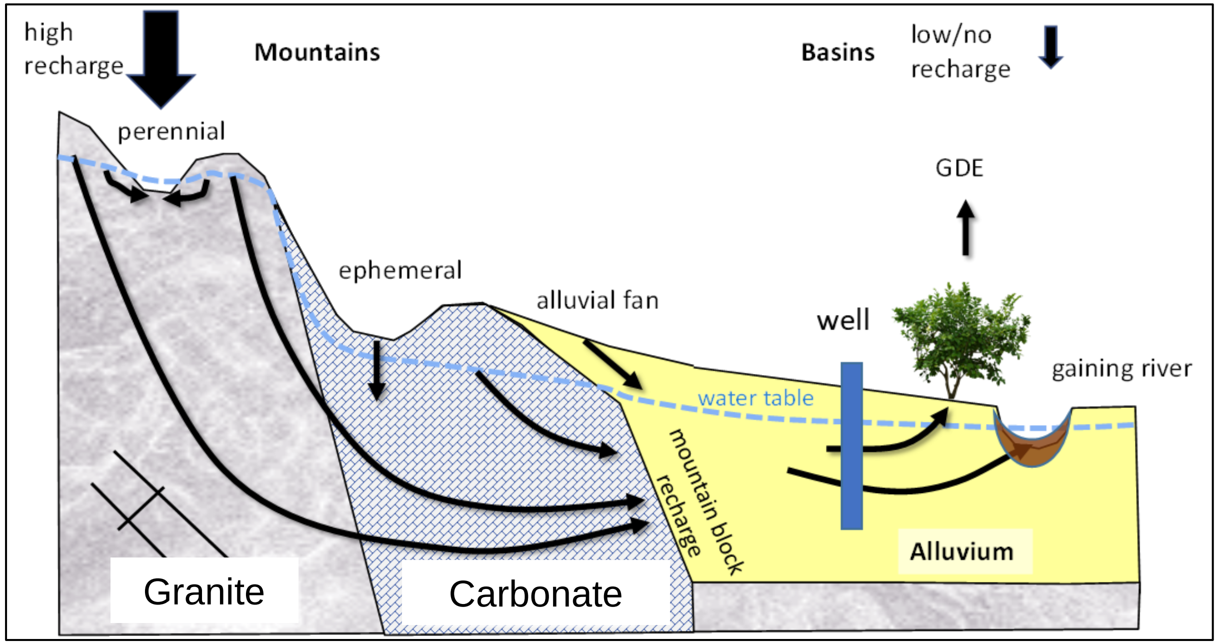
Gradients
Elevation
Geology

Low Storage
Low permeability (K)
High drainage network

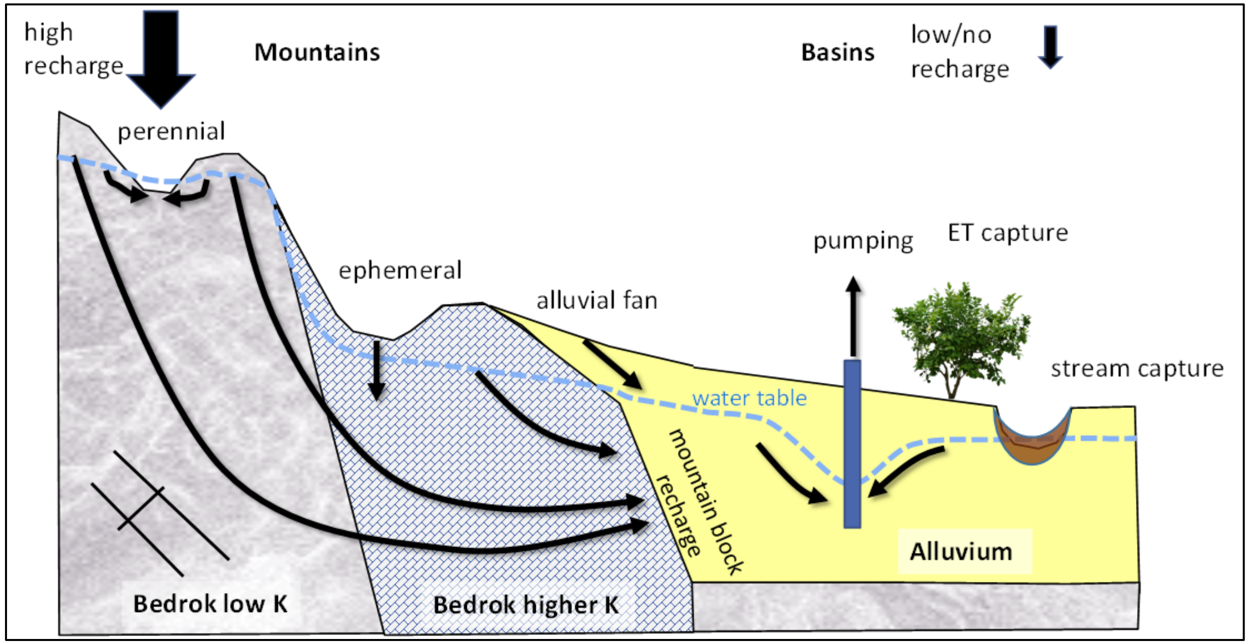
High Storage
High permeability
Low drainage network

Conceptual Model

Pre-Groundwater Development (<1960)



Historical Period (1960-2016)



<u>Gradients</u>
Elevation
Geology

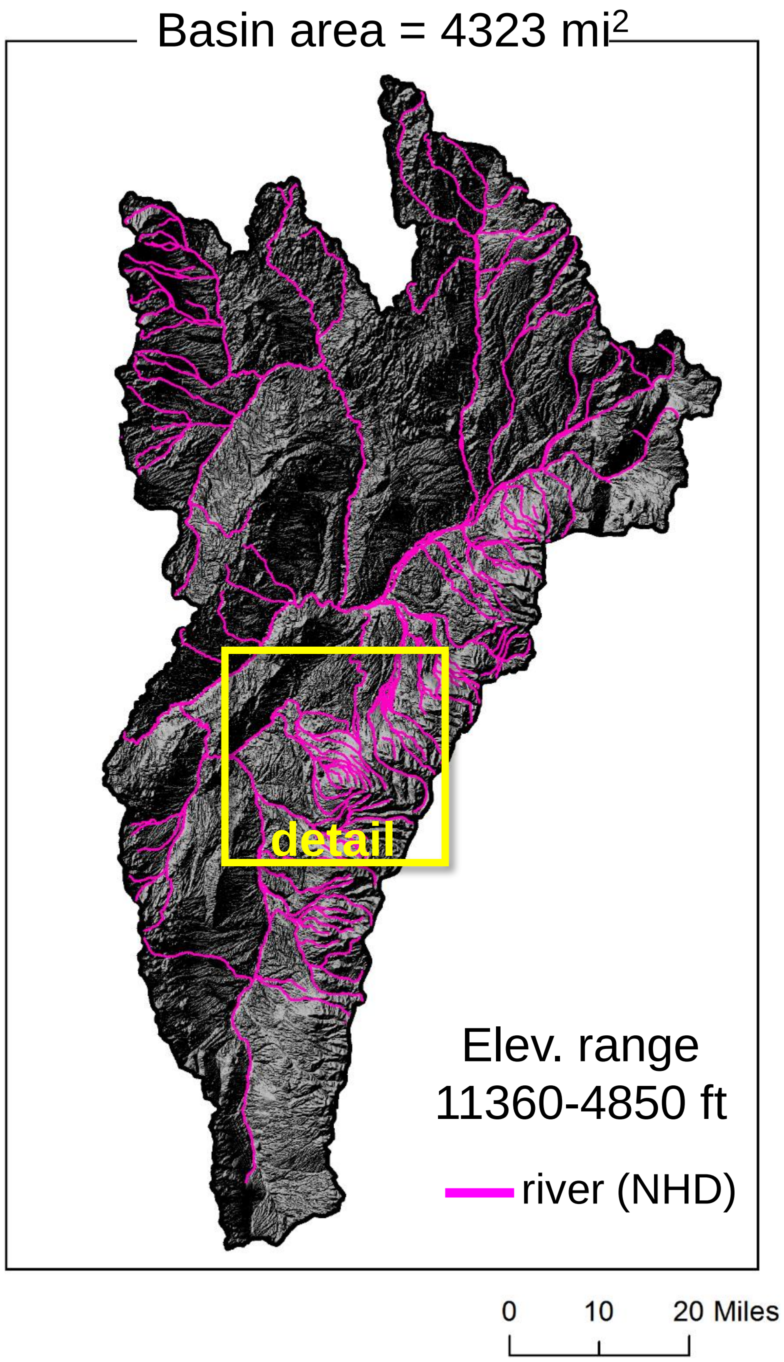
Low Storage
Low permeability (K)
High drainage network

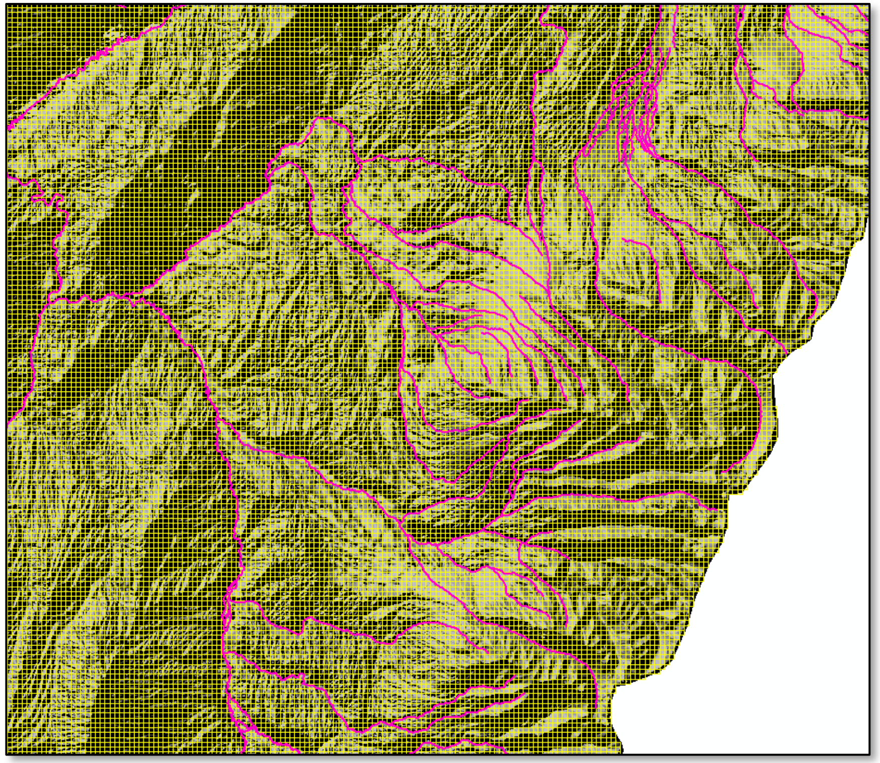
High Storage
High permeability
Low drainage network

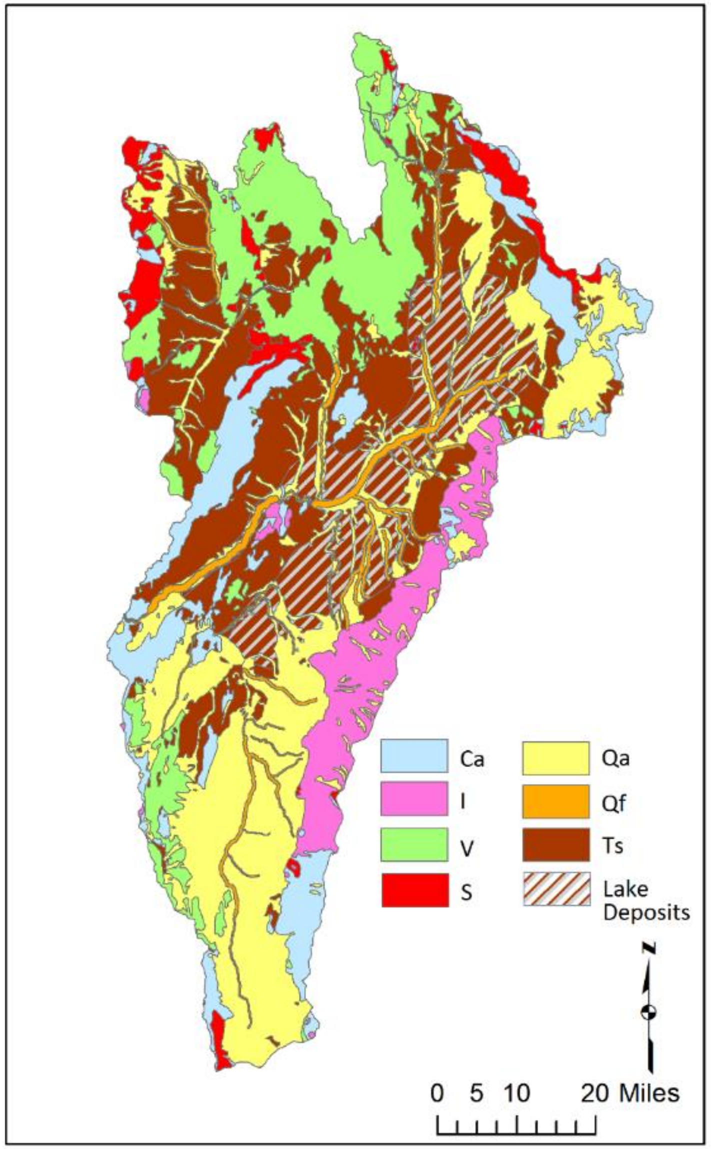
<u>Stream Capture Controls:</u>

- Close to river = higher capture
- Higher storage = lower capture
- Higher permeability = higher capture
- Higher drainage network = higher capture
- Higher streambed conductance = higher capture

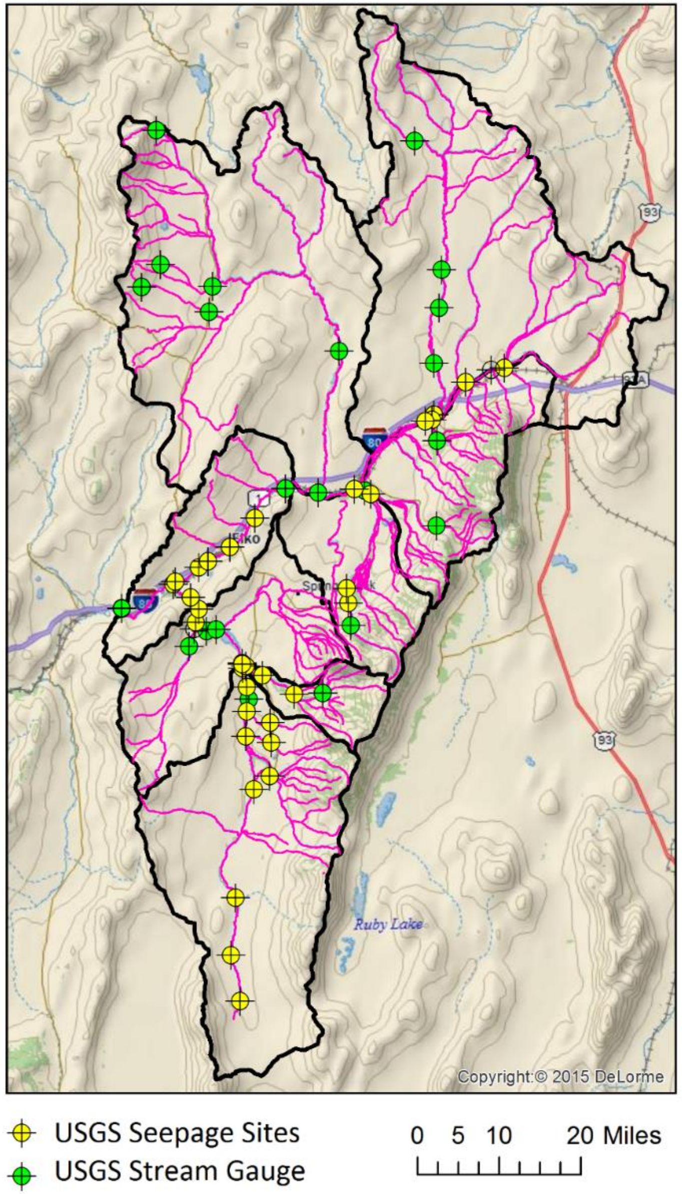
Model Characteristics

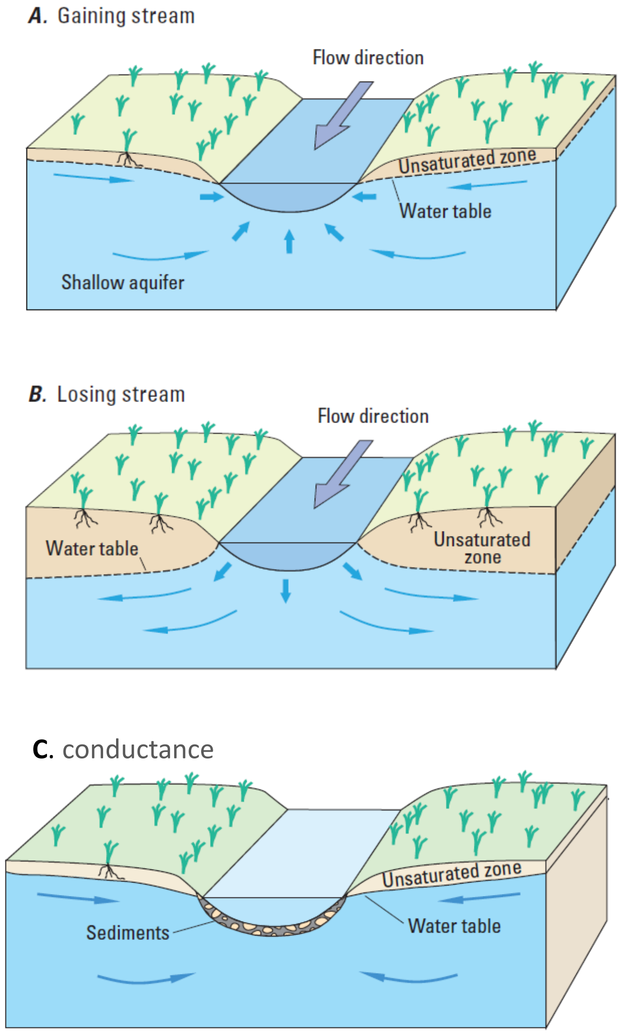






- Cells 900 ft x 900 ft: ~half a million active cells
- Three model layers:
  - Layer 1 = 300 ft



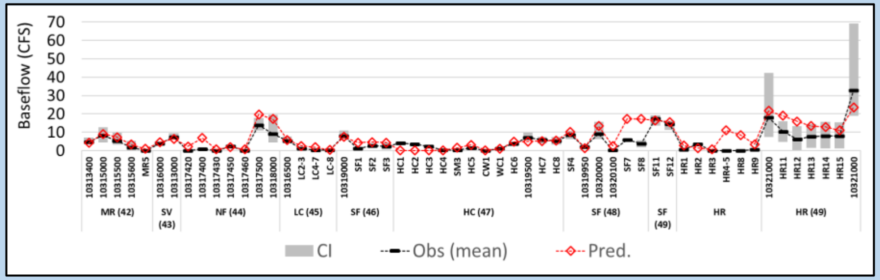


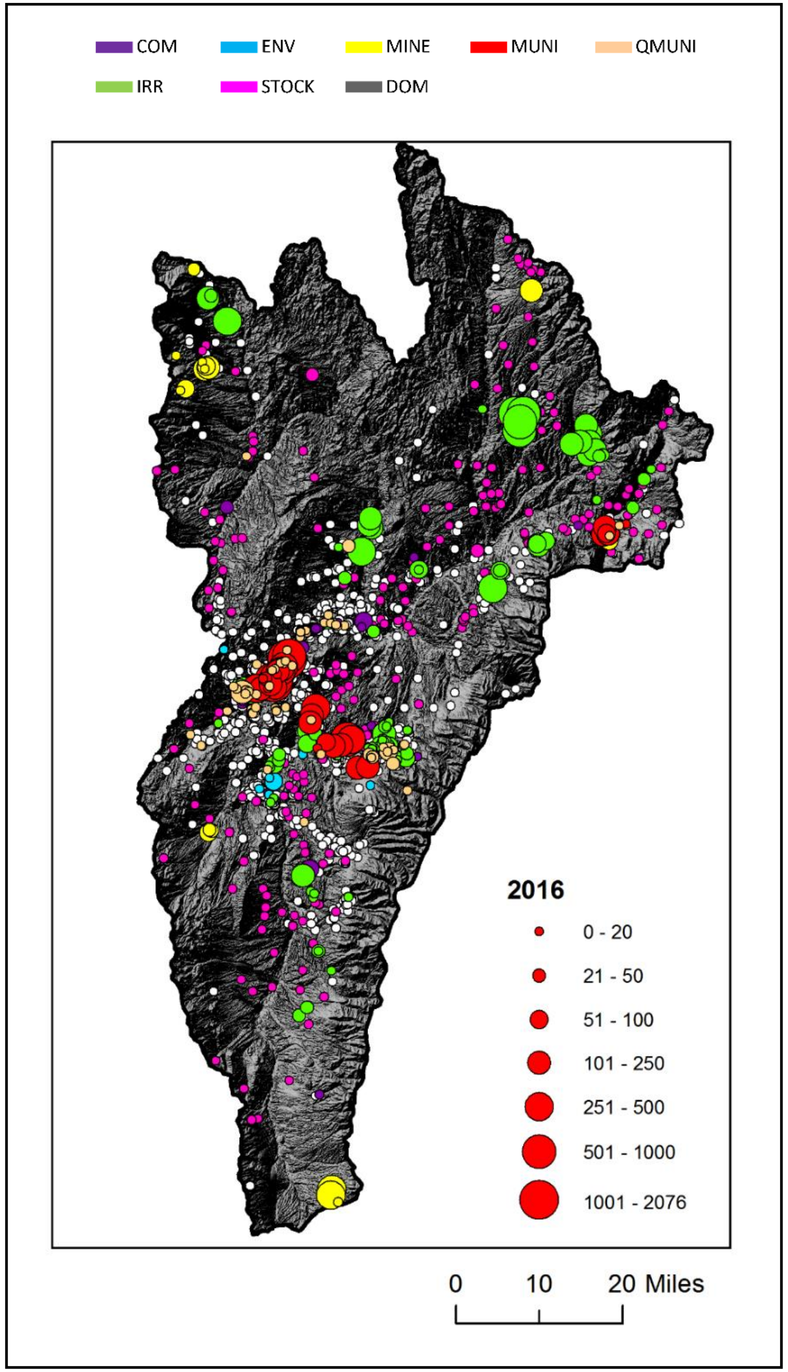
Stream with streambed and streambank sediments less permeable than surrounding aquifer sediments.

Barlow and Leake, 2012

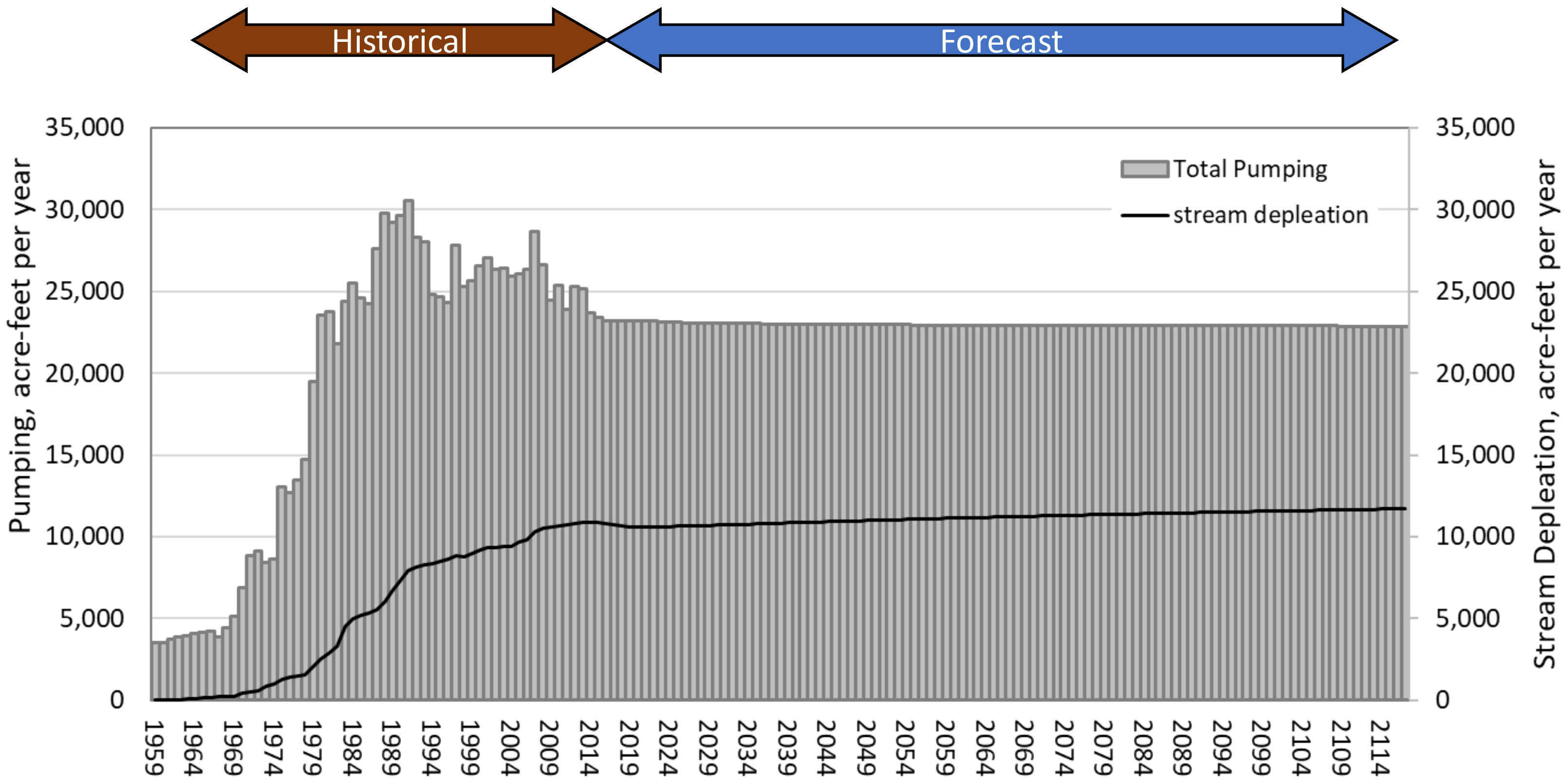
Rivers

- Simulate baseflow only.
- No seasonality.
- Allow gaining and losing based on water table elevation.
- Model does not allow for ephemeral conditions.
- Riverbed conductance adjusted to match observed streamflow
- Riverbed conductance is important to estimated stream capture.

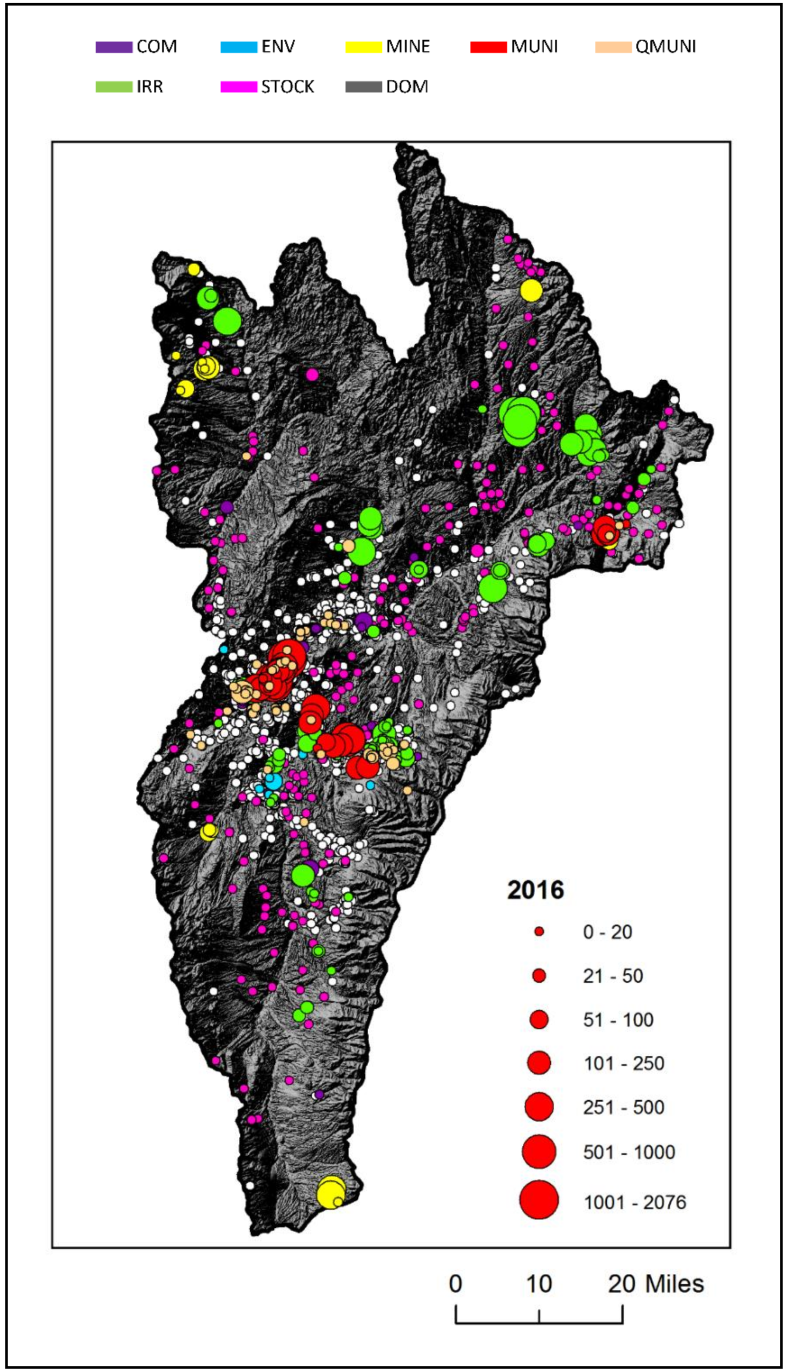


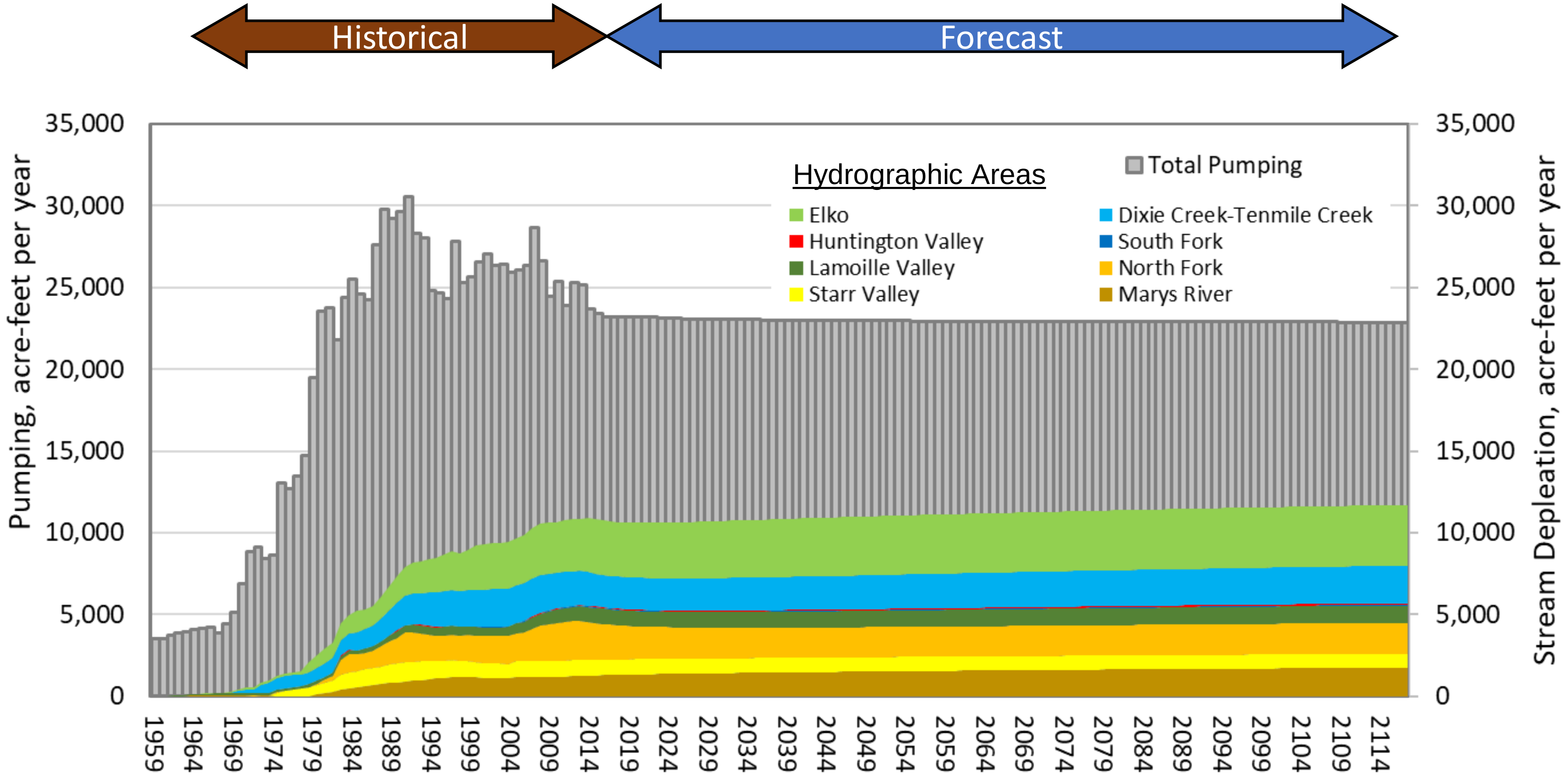


Historical Capture 1960-2016
Forecast/Baseline: 2017-2116

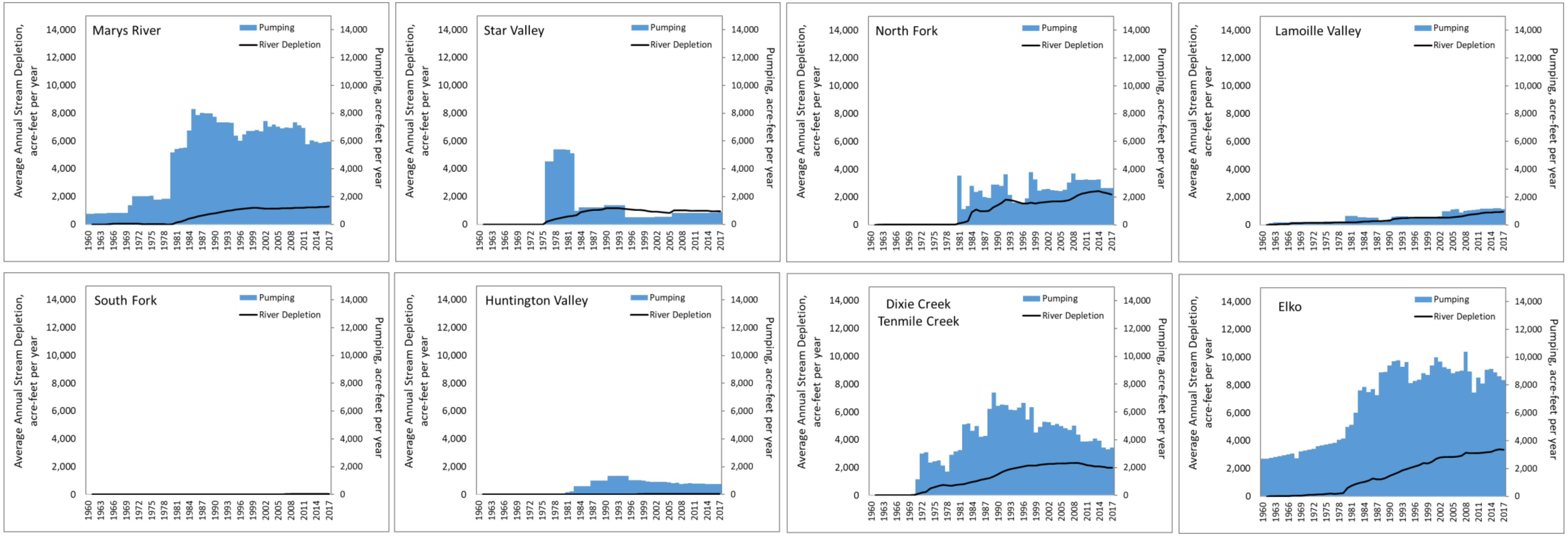


Historical Capture 1960-2016
Forecast/Baseline: 2017-2116

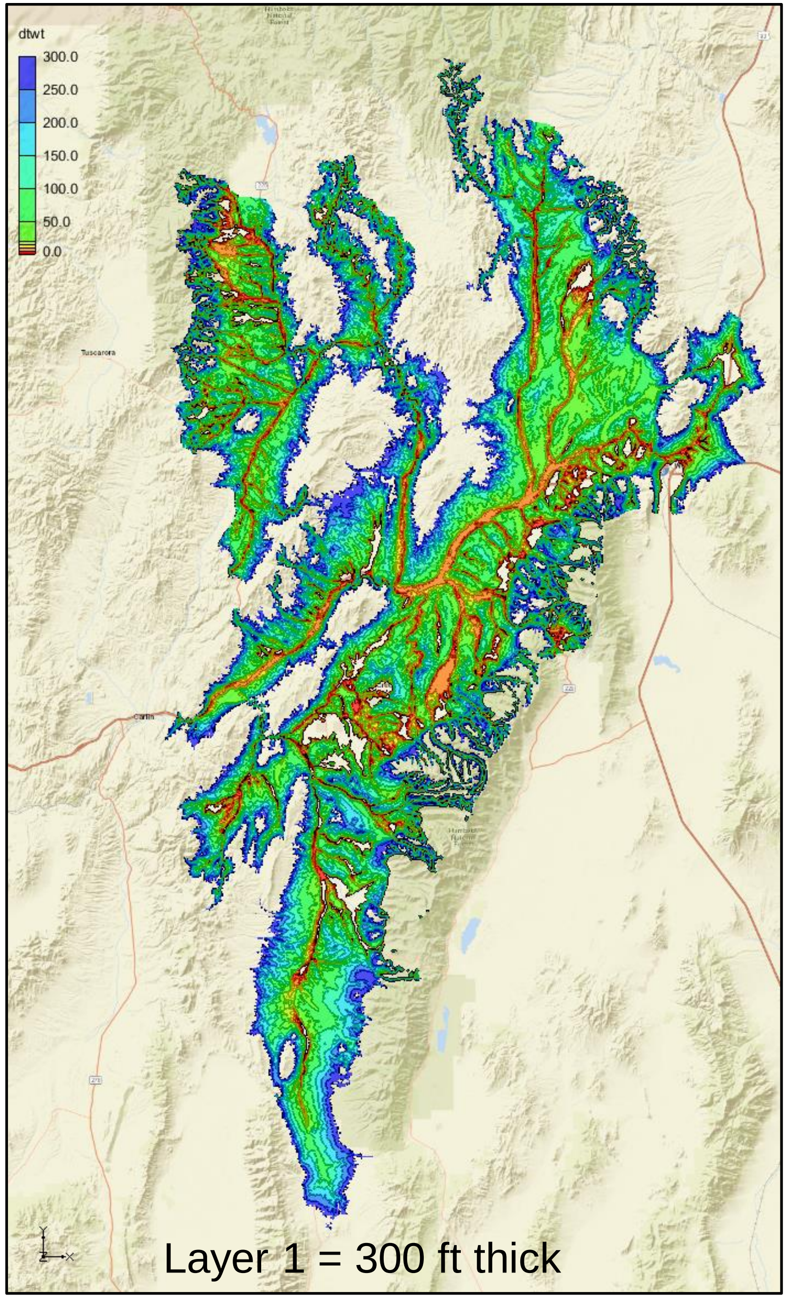




Sub-basin Historical Capture



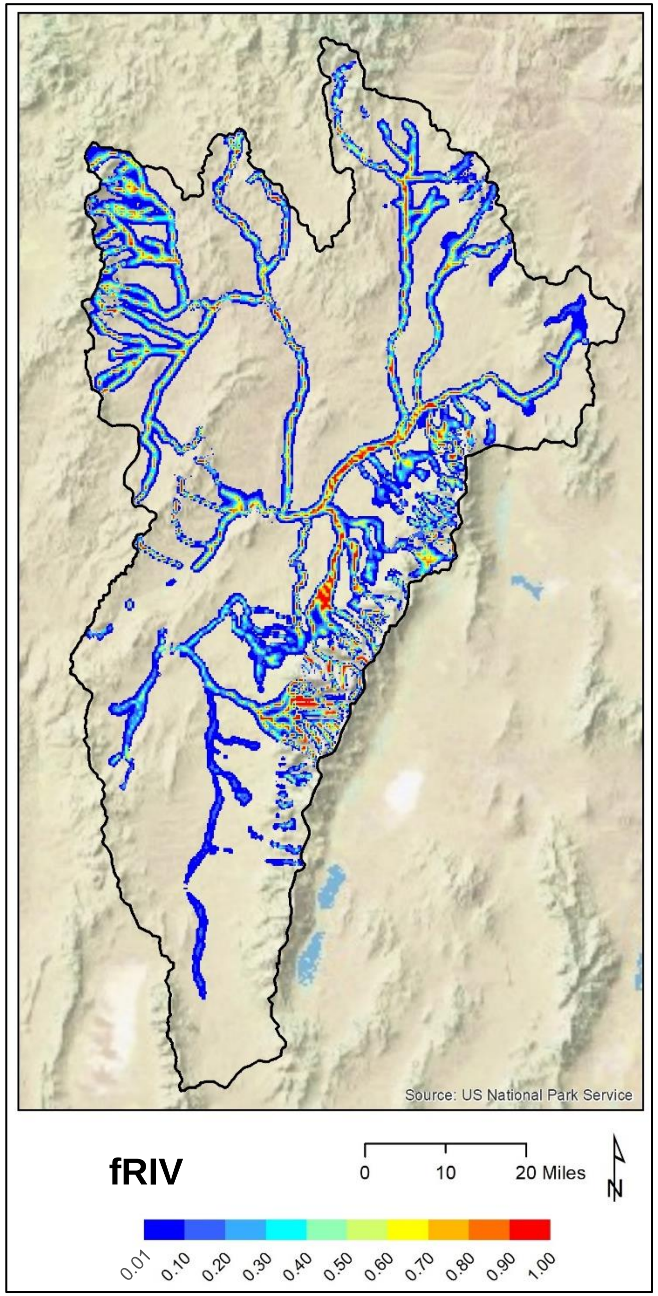
Layer 1: Depth to Water Table



Capture Analysis

- Run the 2016 pumping for 100 years into the future (baseline)
- Run baseline with additional hypothetical pumping in one location for 100 years at 50 AFY.
- Assess fraction of water in the hypothetical well over time that is derived from the river (fRIV).
- Not all model cells are active (water table is too low). These are excluded from the analysis.
- The model is very large, so we run the experiment for every other cell and interpolate.

Year 1

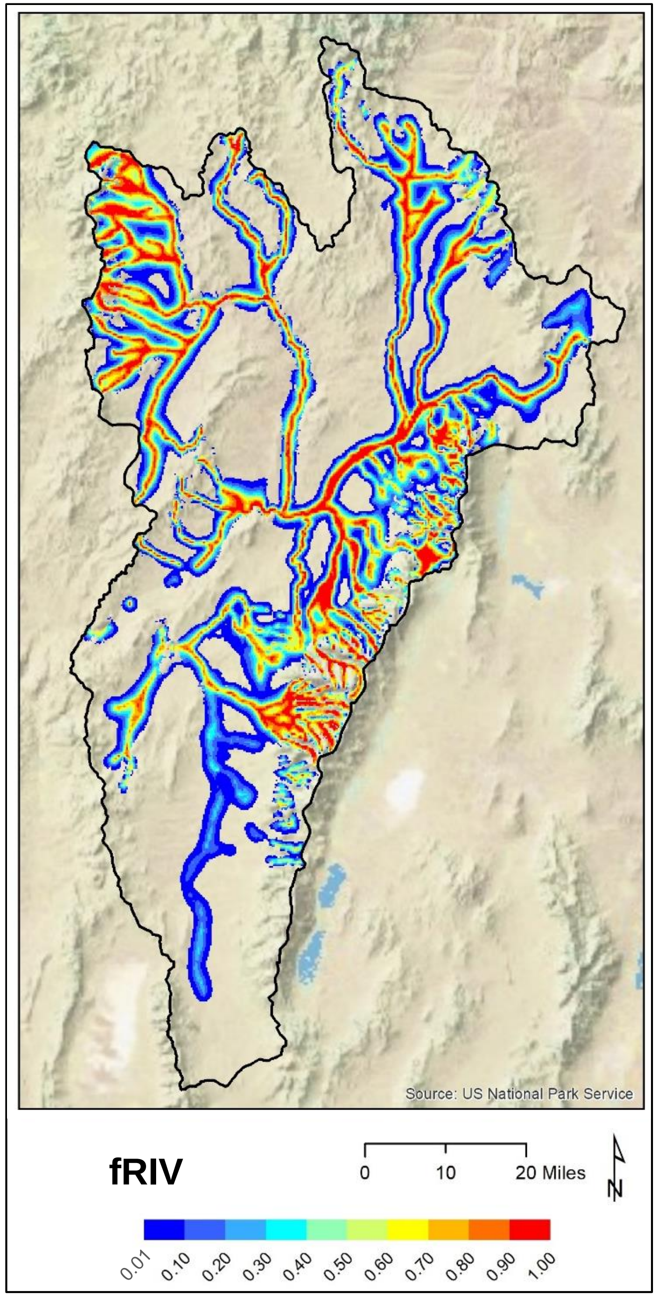


Capture Analysis

Year 1

- Stream capture to satisfy hypothetical pumping is limited to river corridors.

Year 10



Capture Analysis

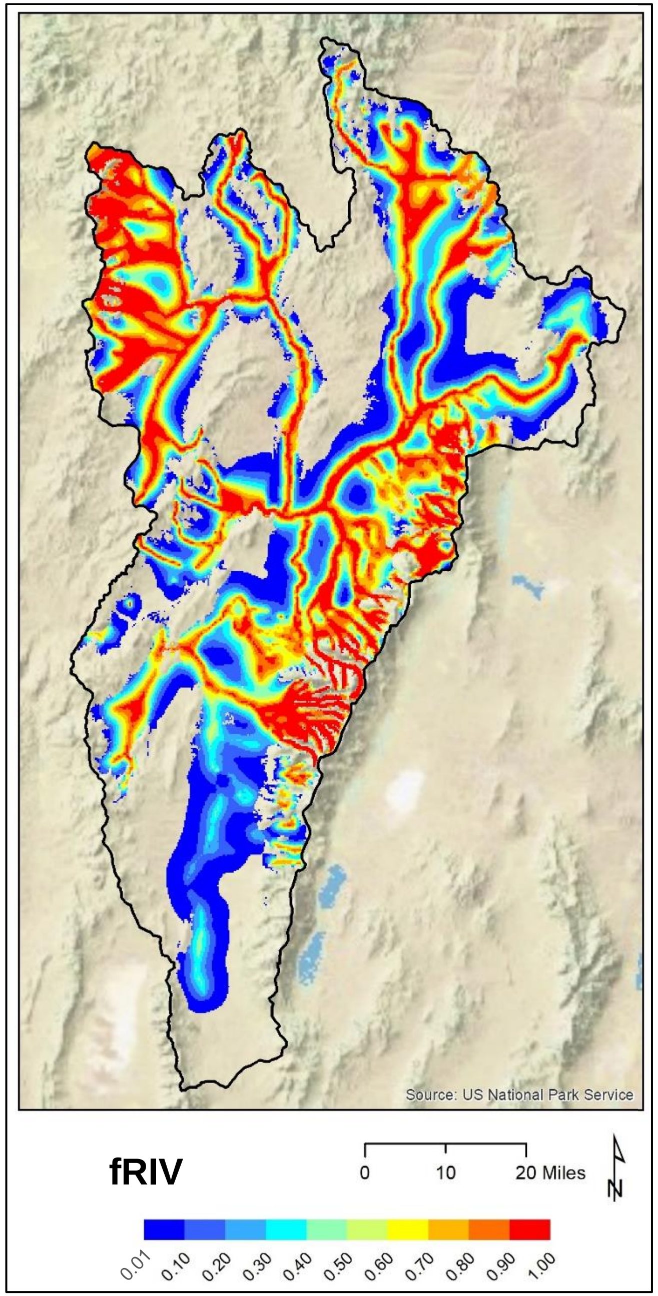
Year 1

- Stream capture to satisfy hypothetical pumping is limited to river corridors.

Year 10

- Stream capture is expanding away from the river but there is spatial variability.
- Stream capture fractions in the headwater mountains is large.

Year 50



Capture Analysis

Year 1

- Stream capture to satisfy hypothetical pumping is limited to river corridors.

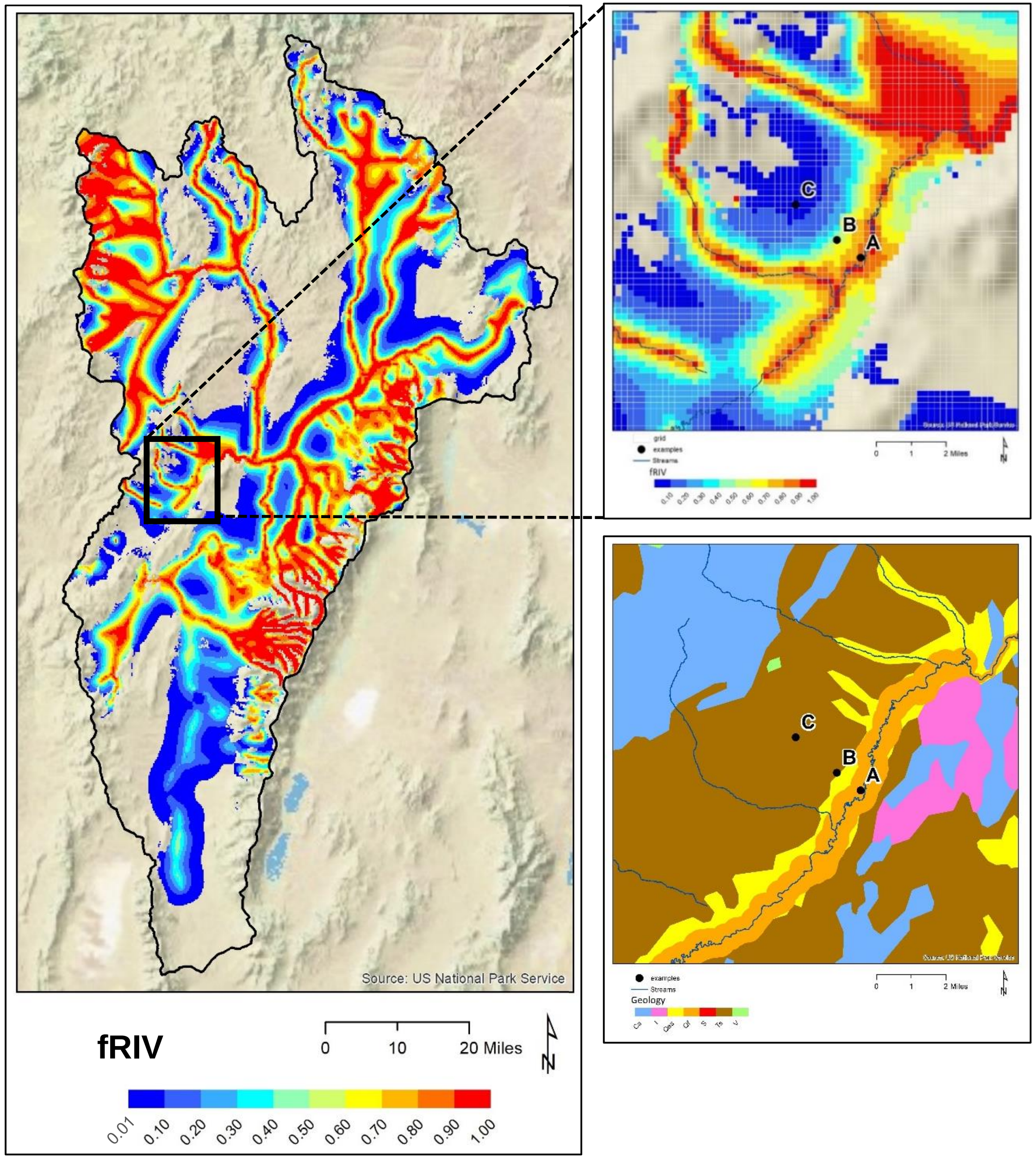
Year 10

- Stream capture is expanding away from the river but there is spatial variability.
- Stream capture fractions in the headwater mountains is large.

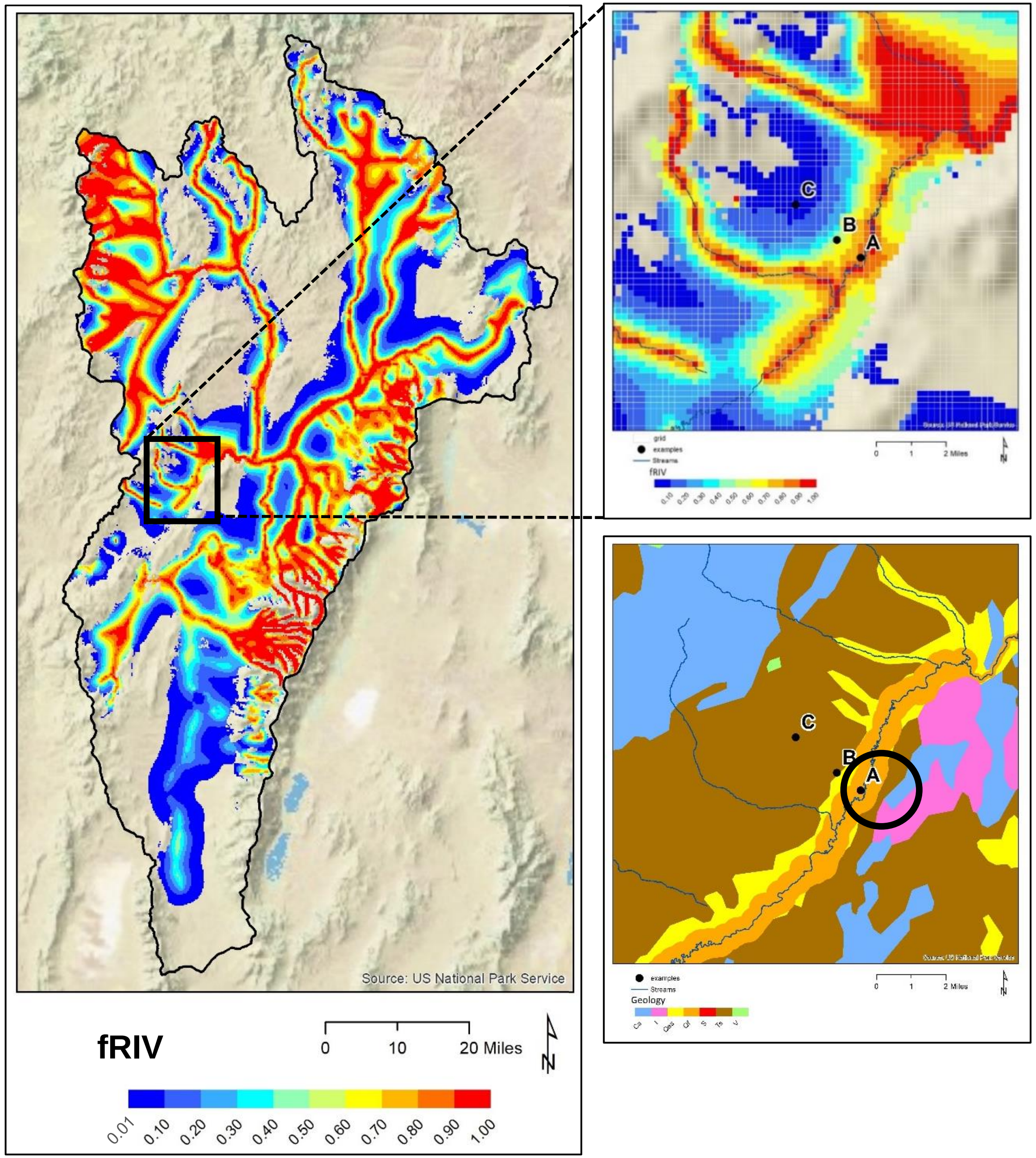
Year 50

- Stream capture continues to expand away from the river. Spatial variability still exists.
- Stream capture fractions merge in system headwaters and their alluvial fans.

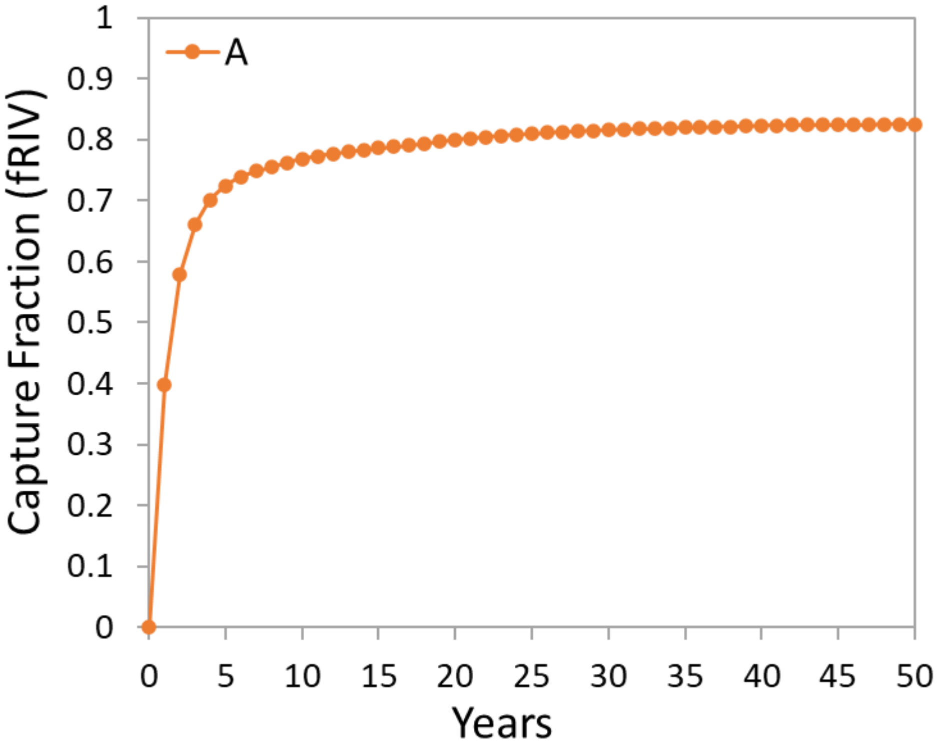
Controls on River Capture



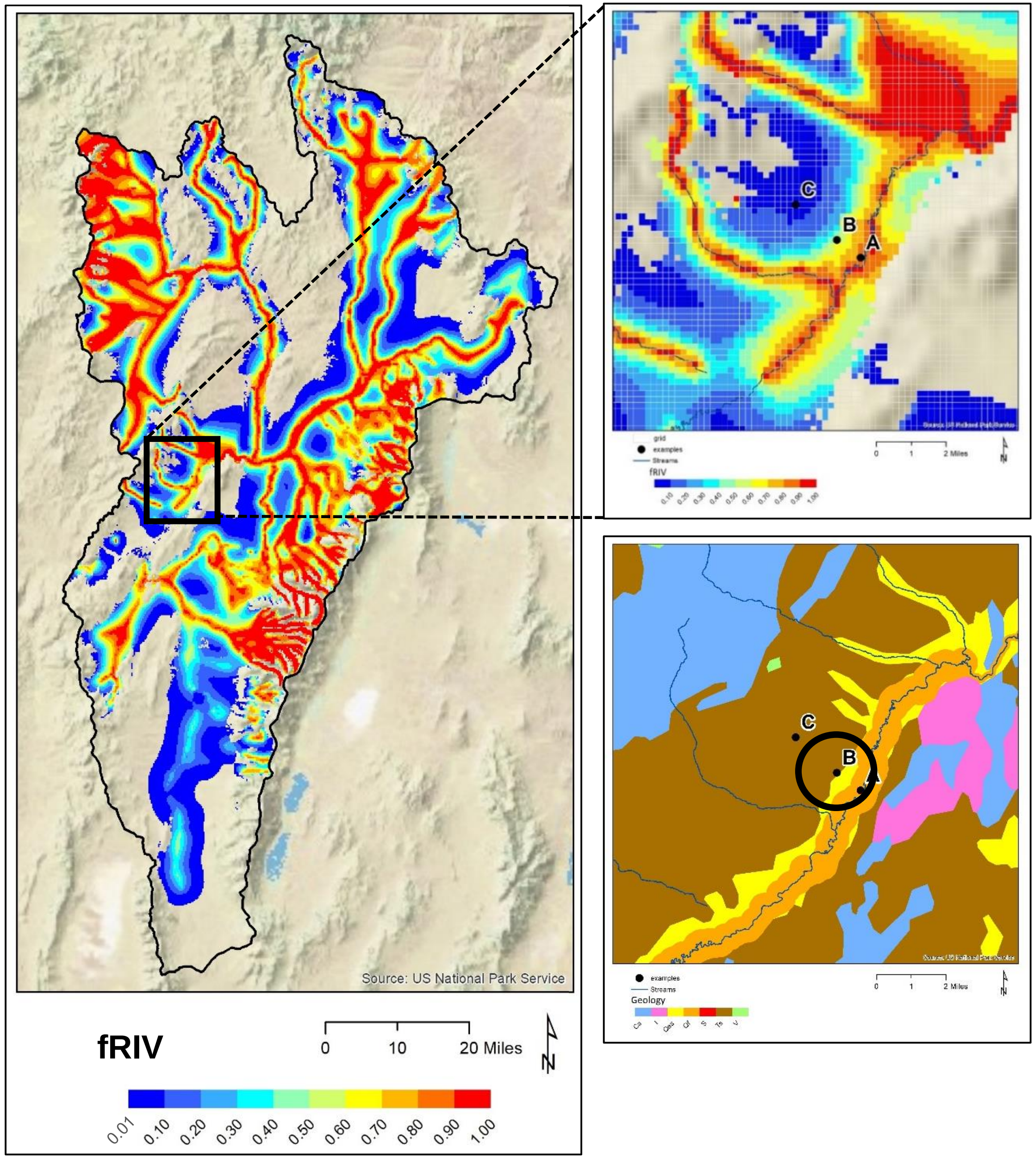
Controls on River Capture



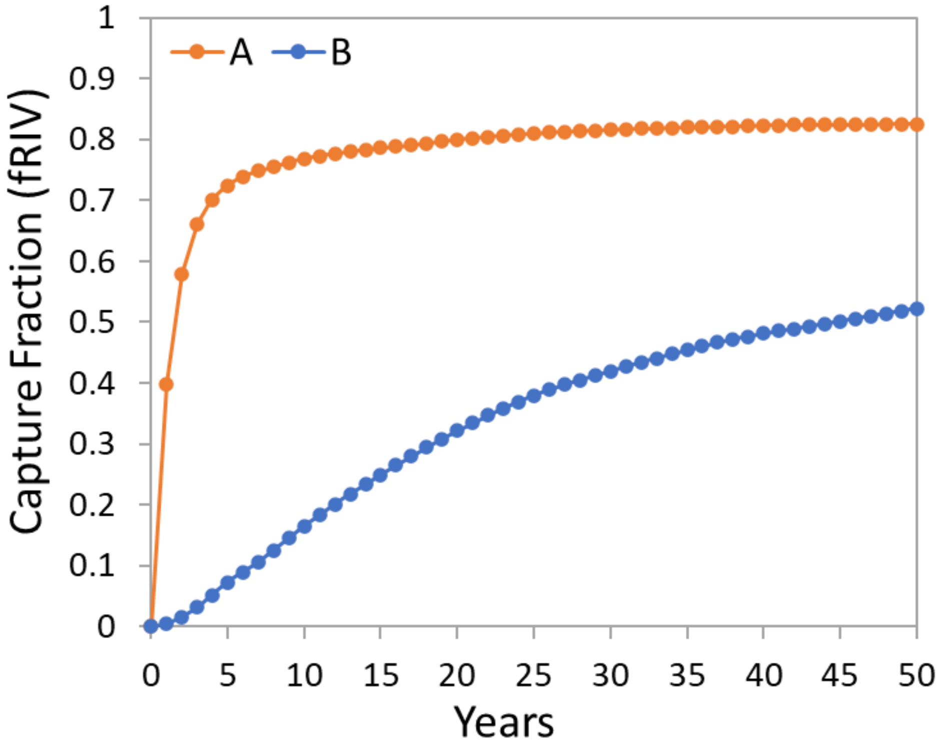
A: large amount of capture occurs quickly



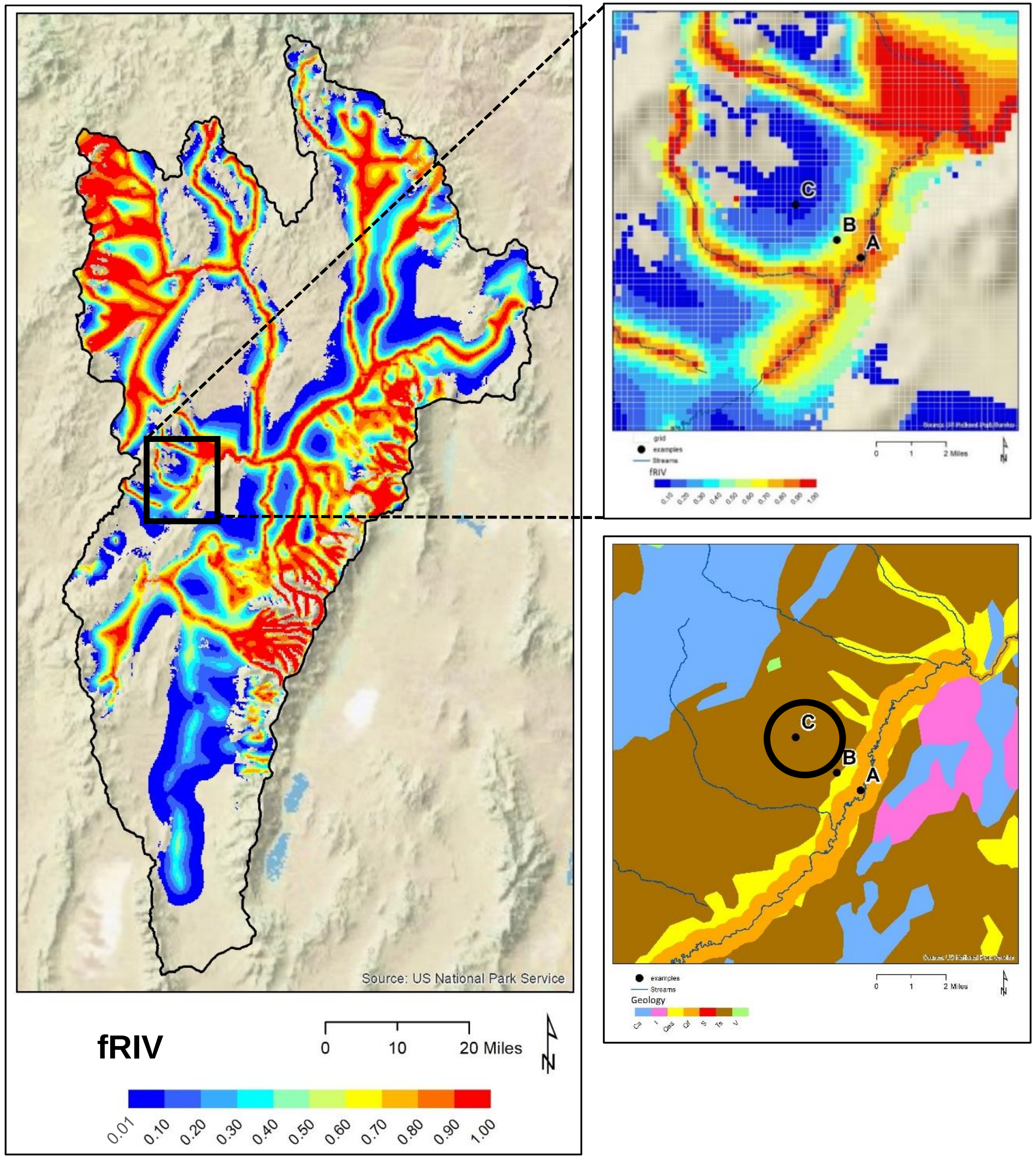
Controls on River Capture



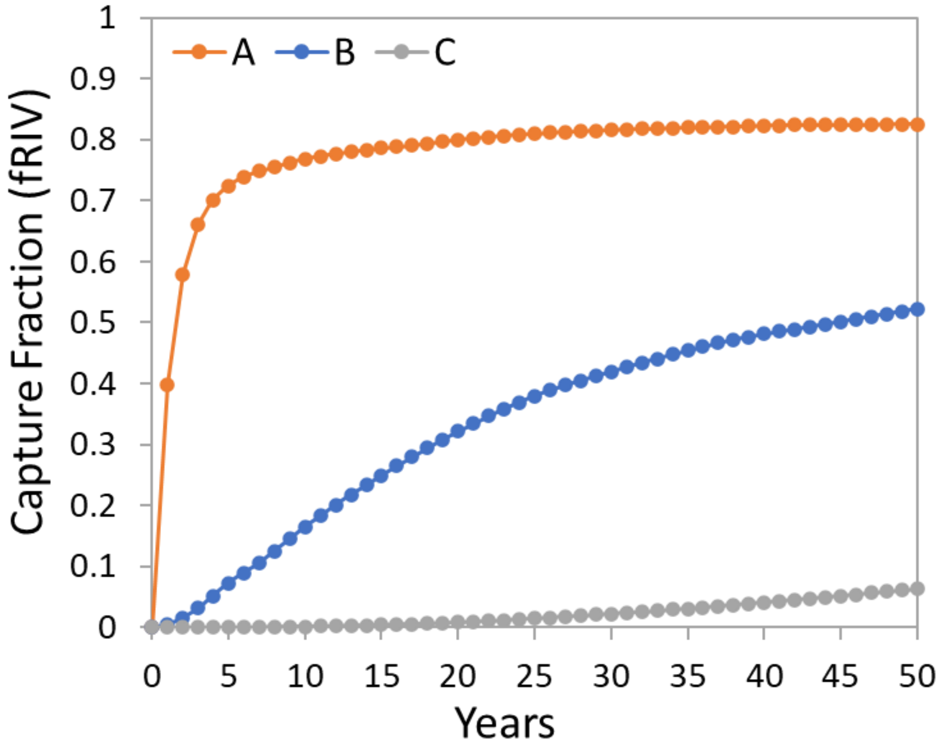
A: large amount of capture occurs quickly
B: Capture amount is lower and delayed.



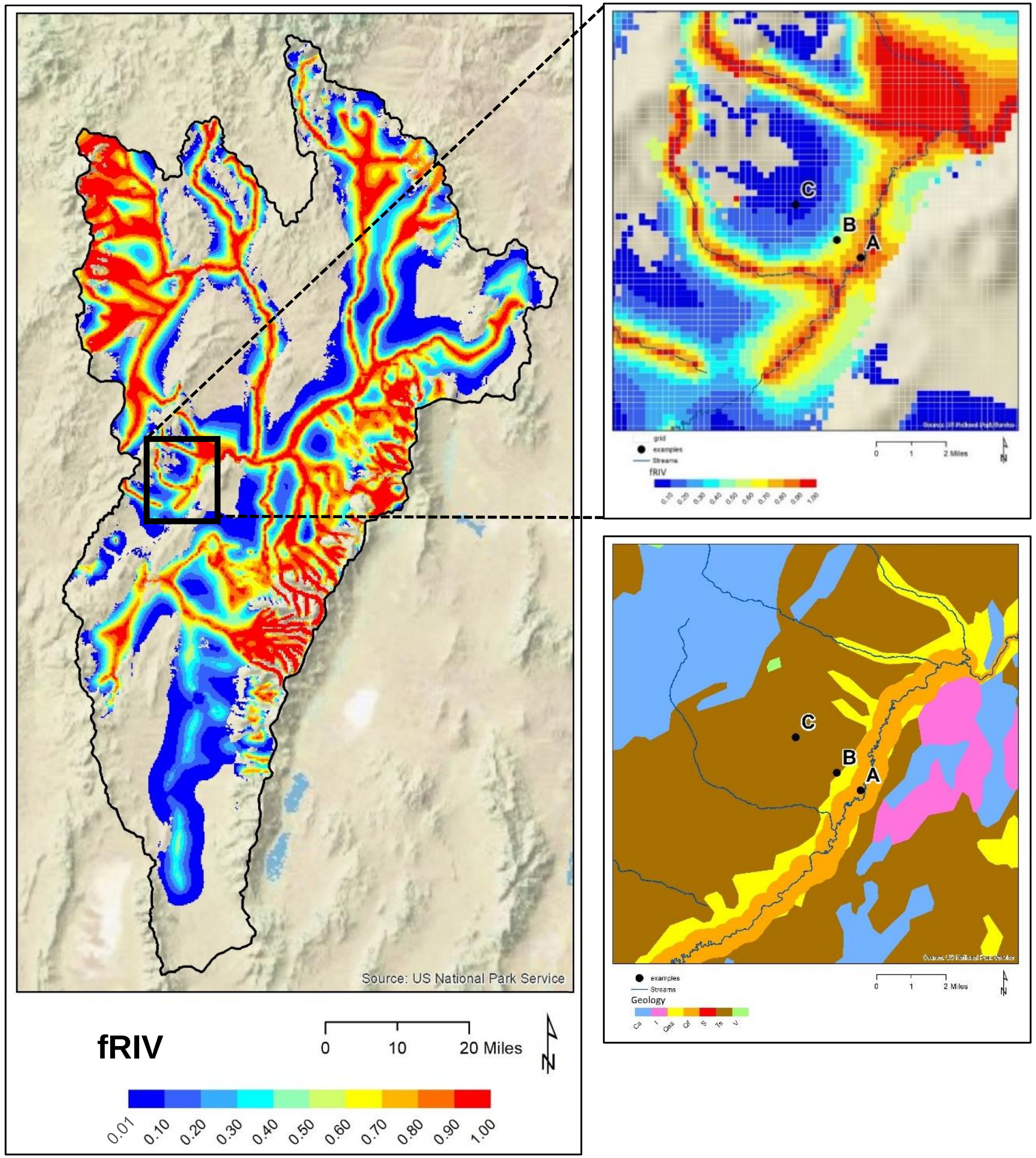
Controls on River Capture



A: large amount of capture occurs quickly
B: Capture amount is lower and delayed.
C: Capture is small and more delayed.



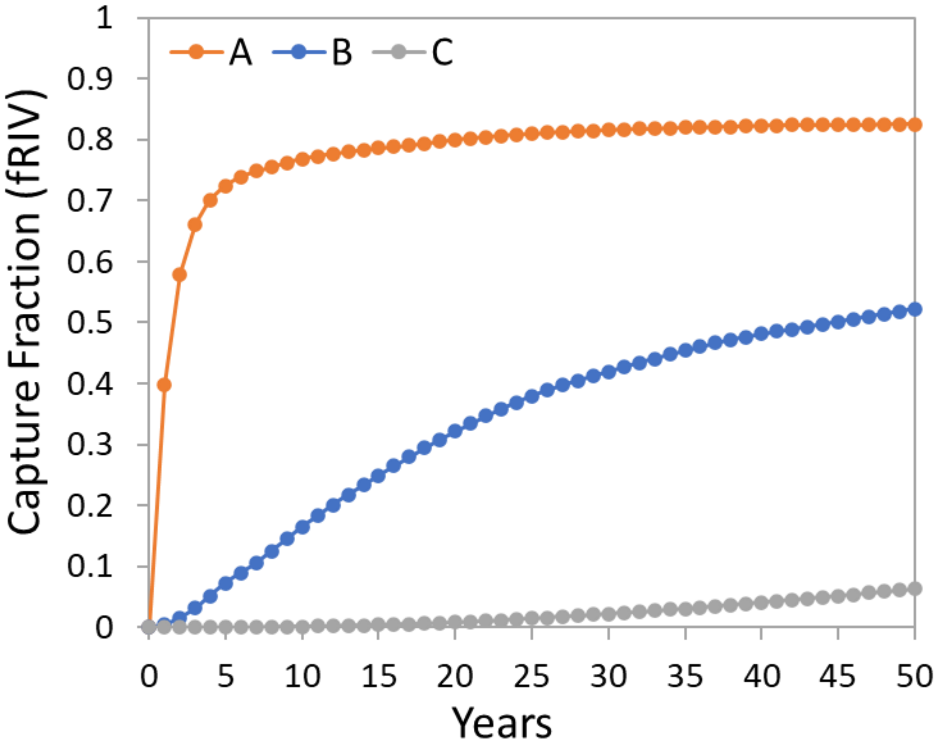
Controls on River Capture



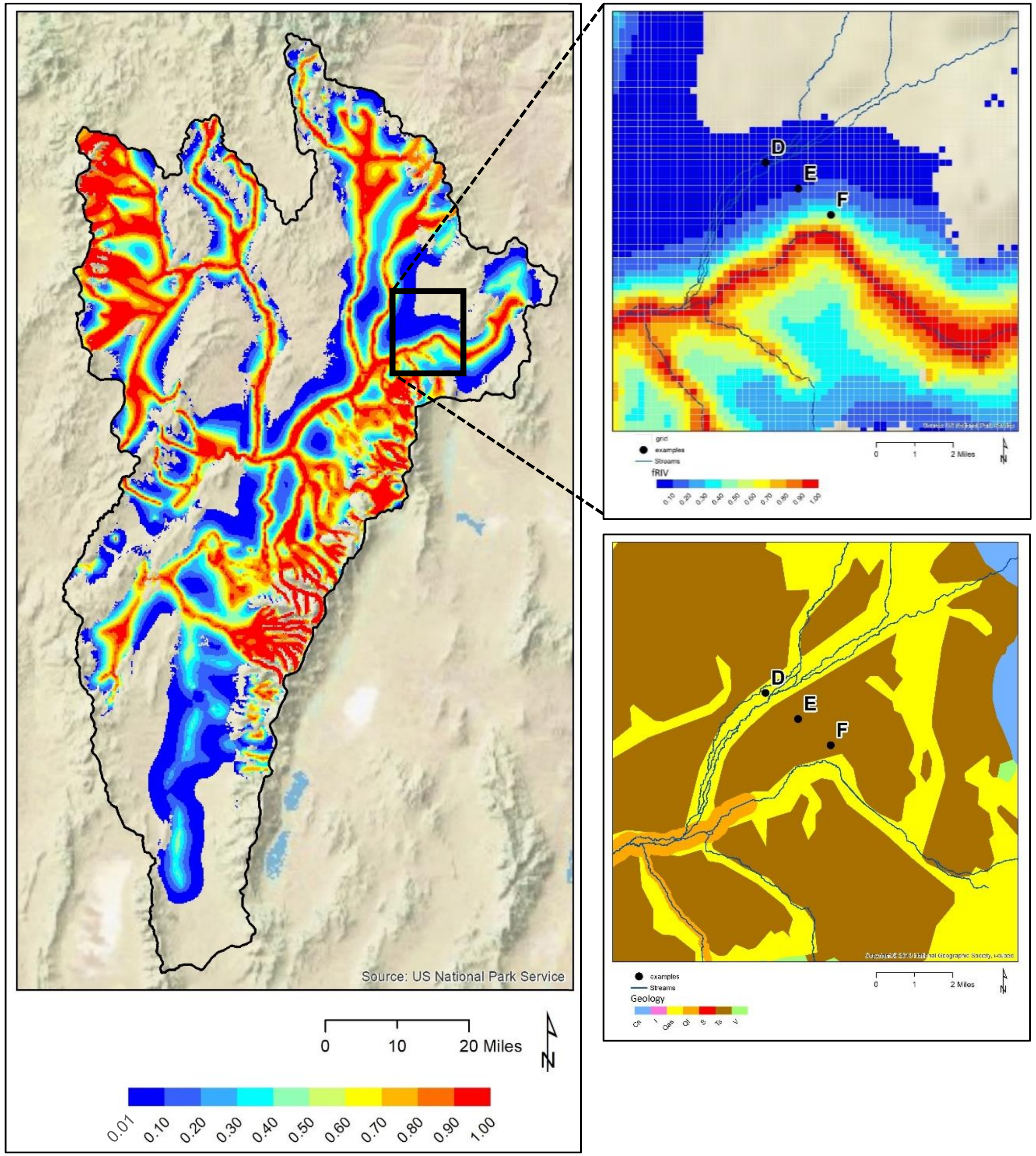
A: large amount of capture occurs quickly
B: Capture amount is lower and delayed.
C: Capture is small and more delayed.

Controlling Factor(s)

- Distance from River

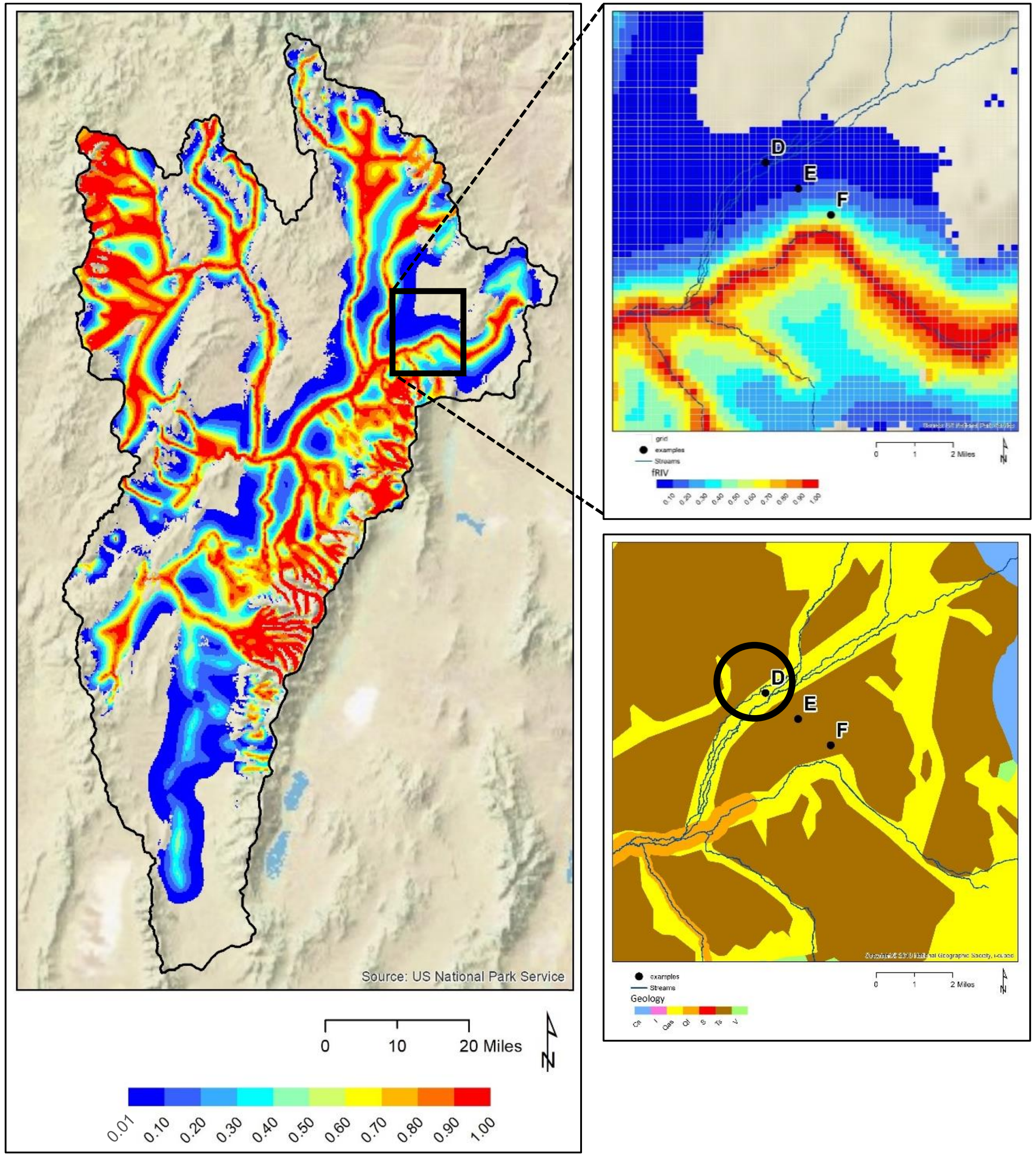


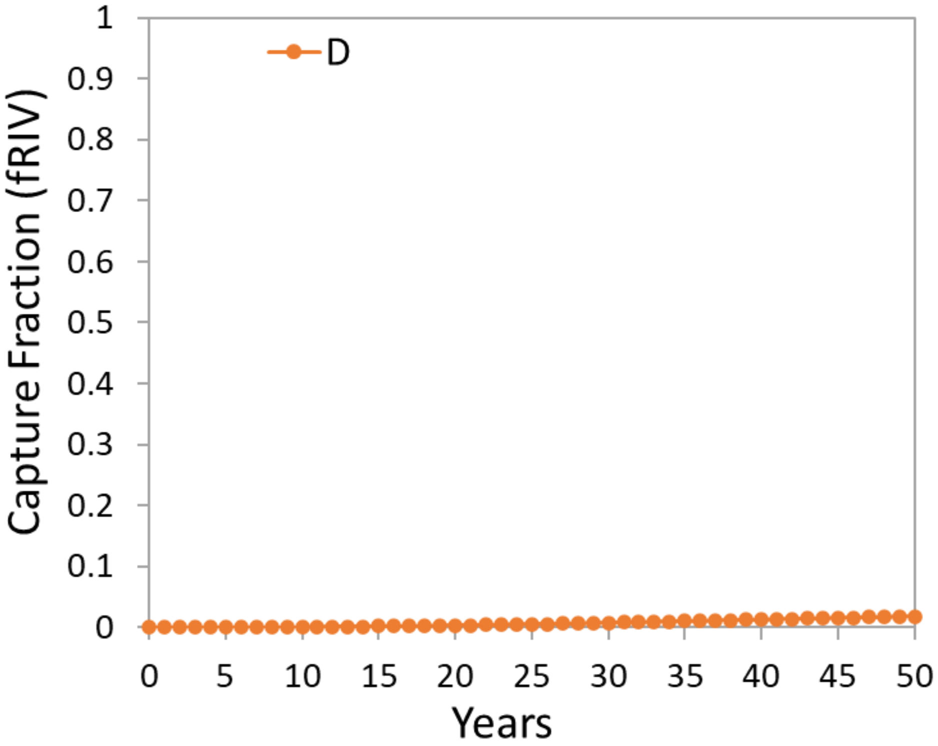
Controls on River Capture



Controls on River Capture

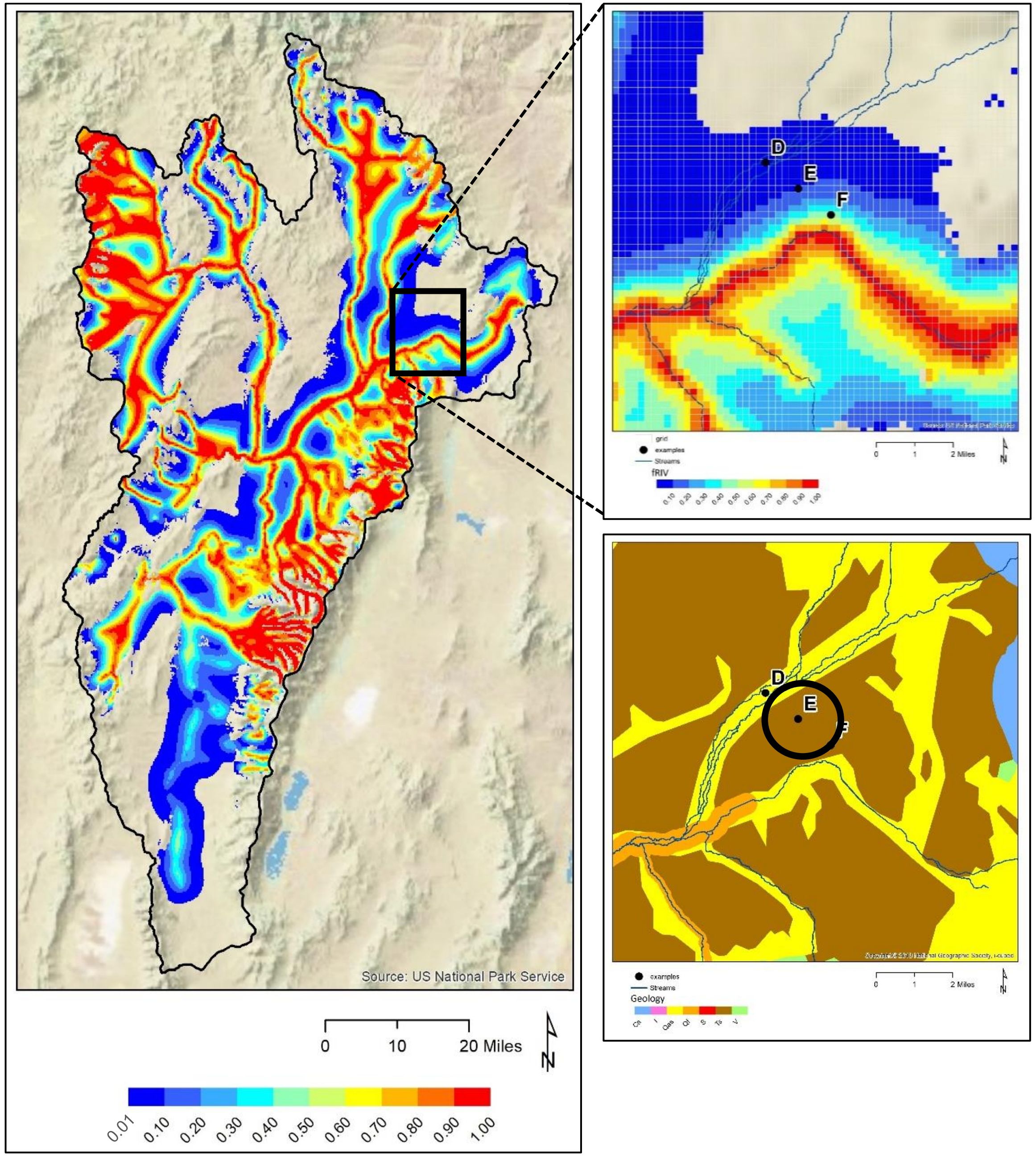
D: Limited river capture.

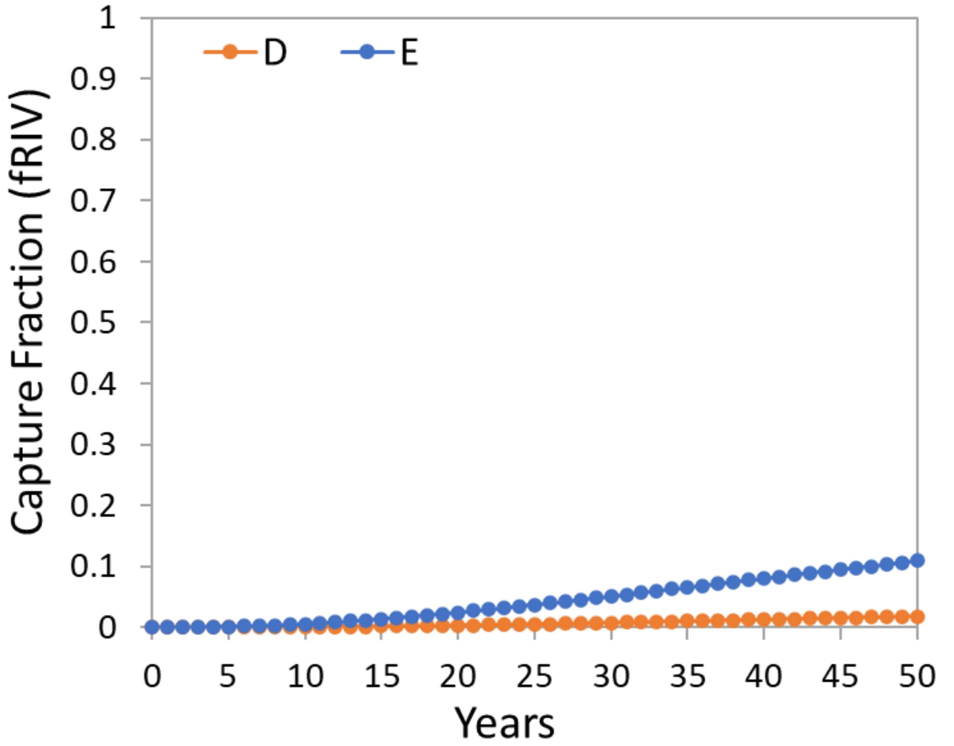




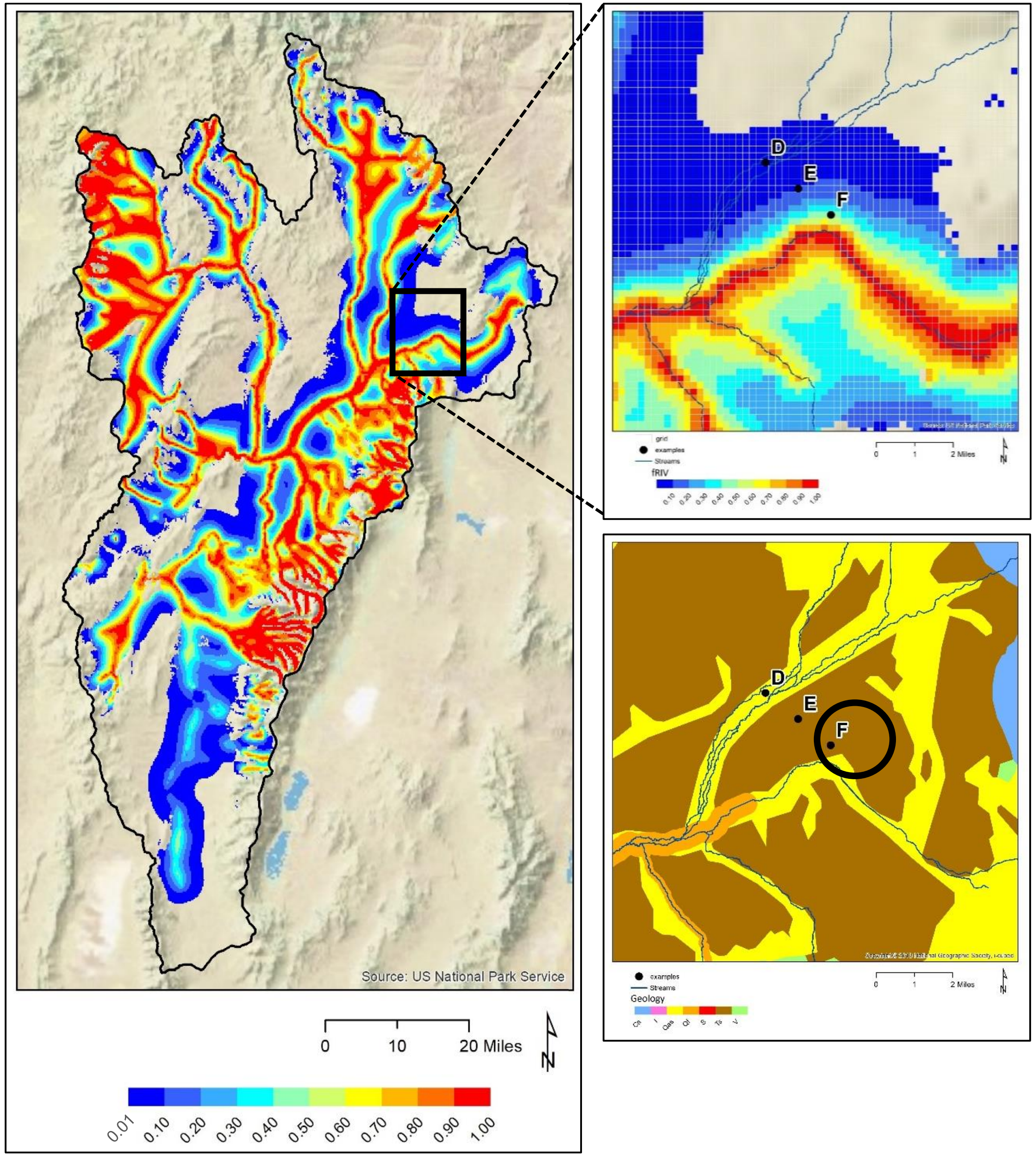
Controls on River Capture

D: Limited river capture.
E: Capture increases but still low & delayed.

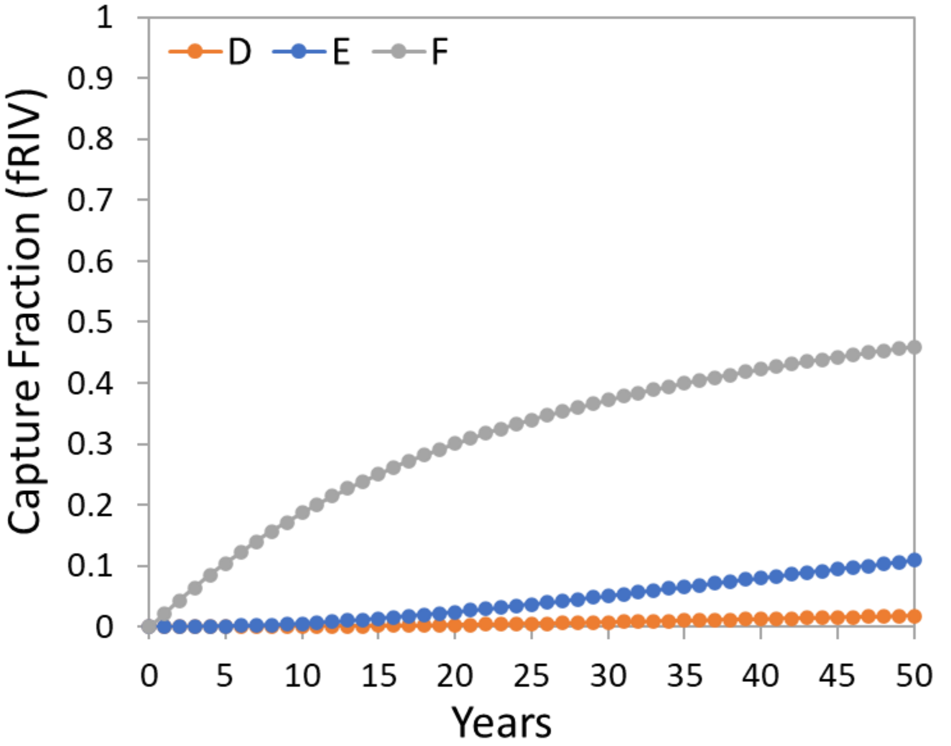




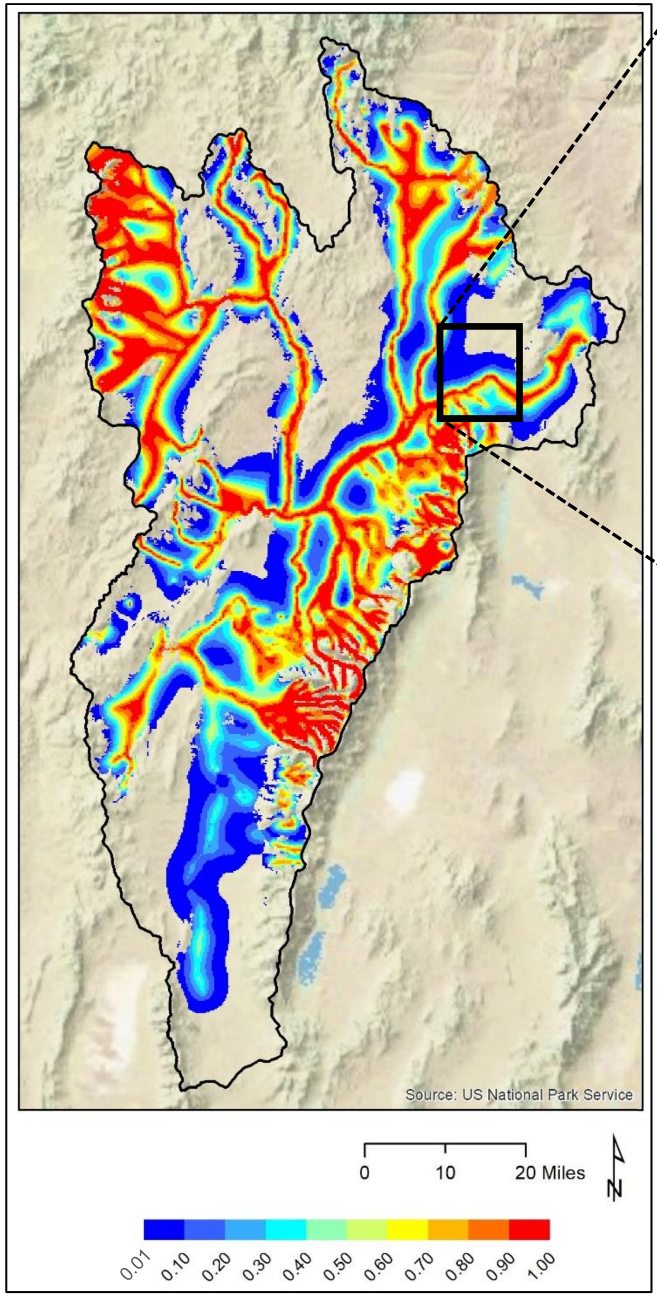
Controls on River Capture

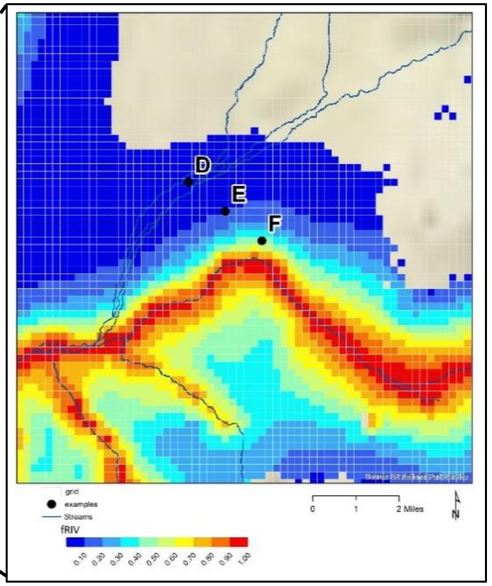


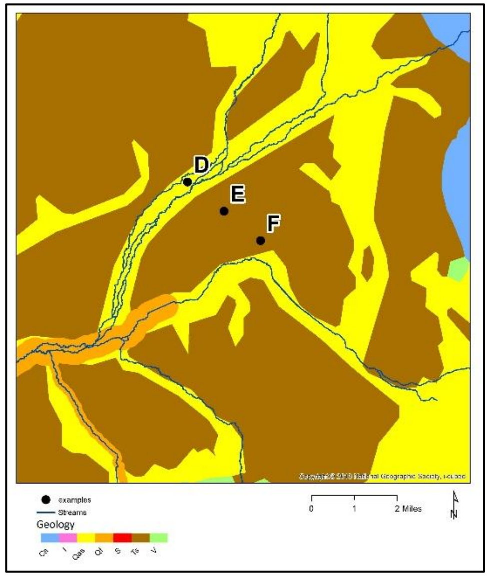
D: Limited river capture.
E: Capture increases but still low & delayed.
F: Capture much larger and less delayed.



Controls on River Capture



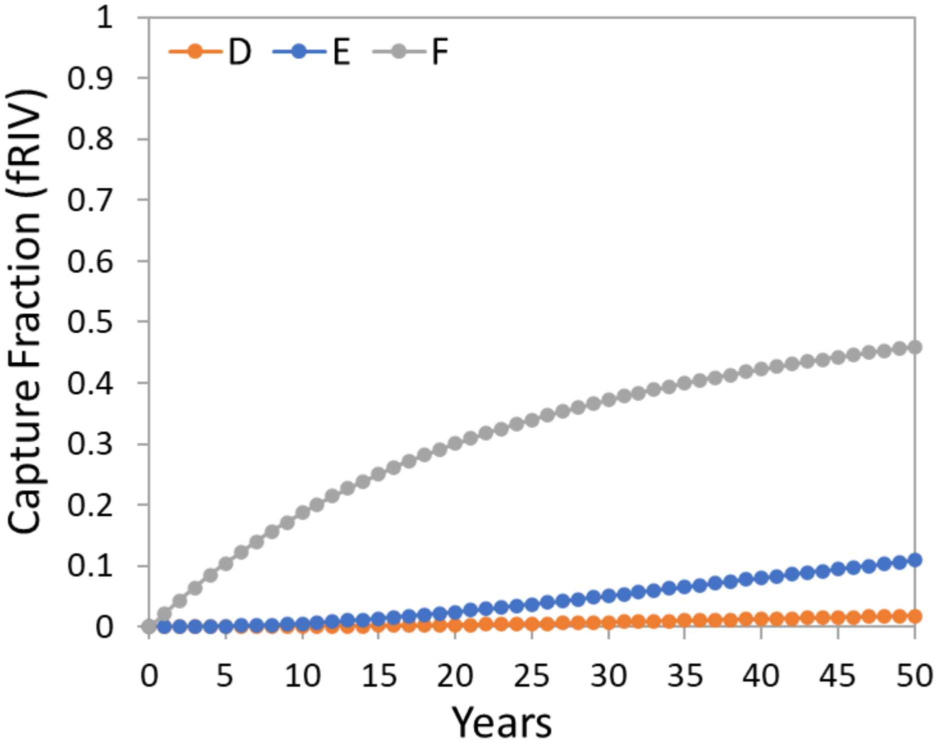




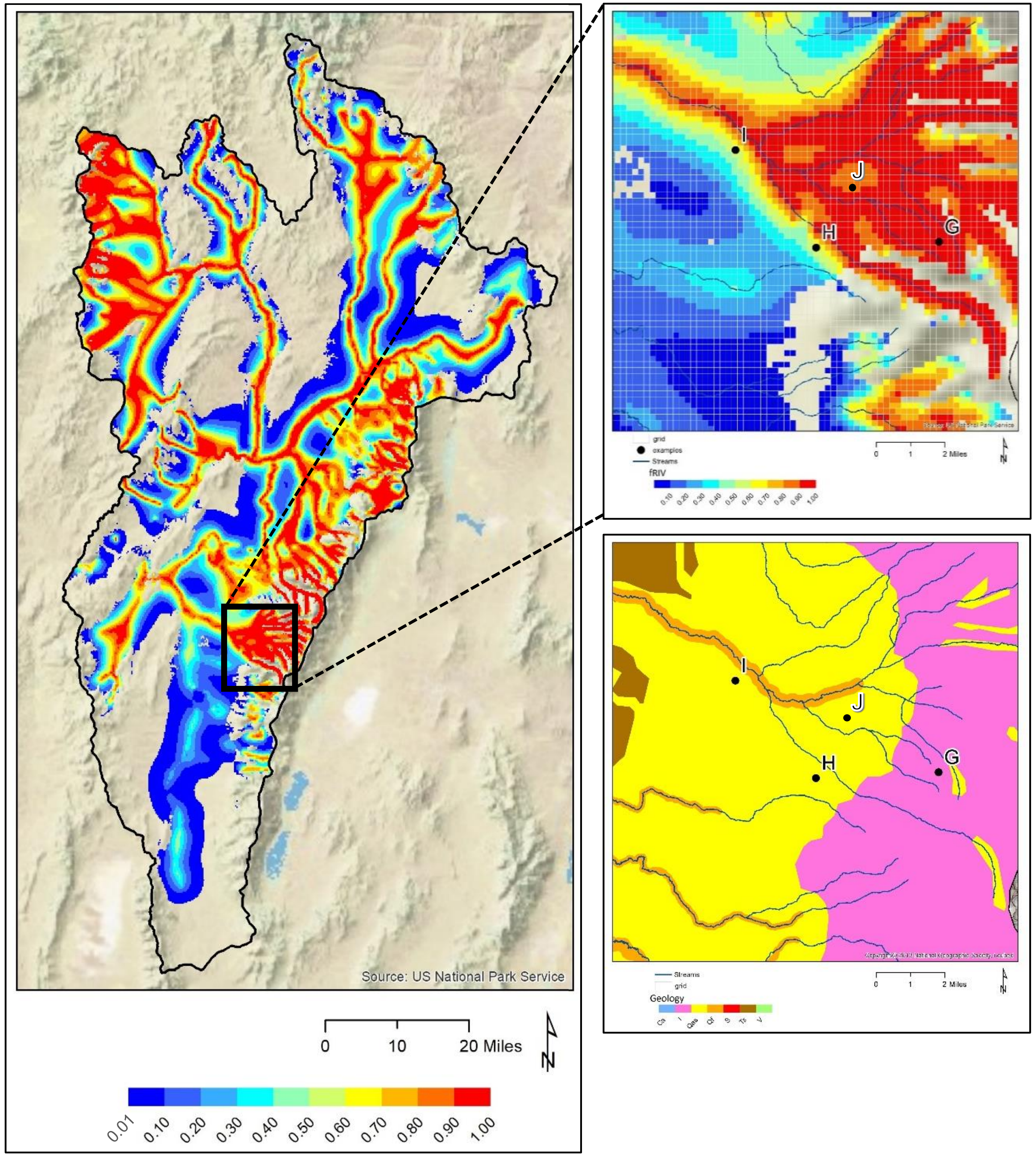
D: Limited river capture.
E: Capture increases but still low & delayed.
F: Capture much larger and less delayed.

<u>Controlling Factor(s)</u>

- Riverbed conductance
- Distance from River

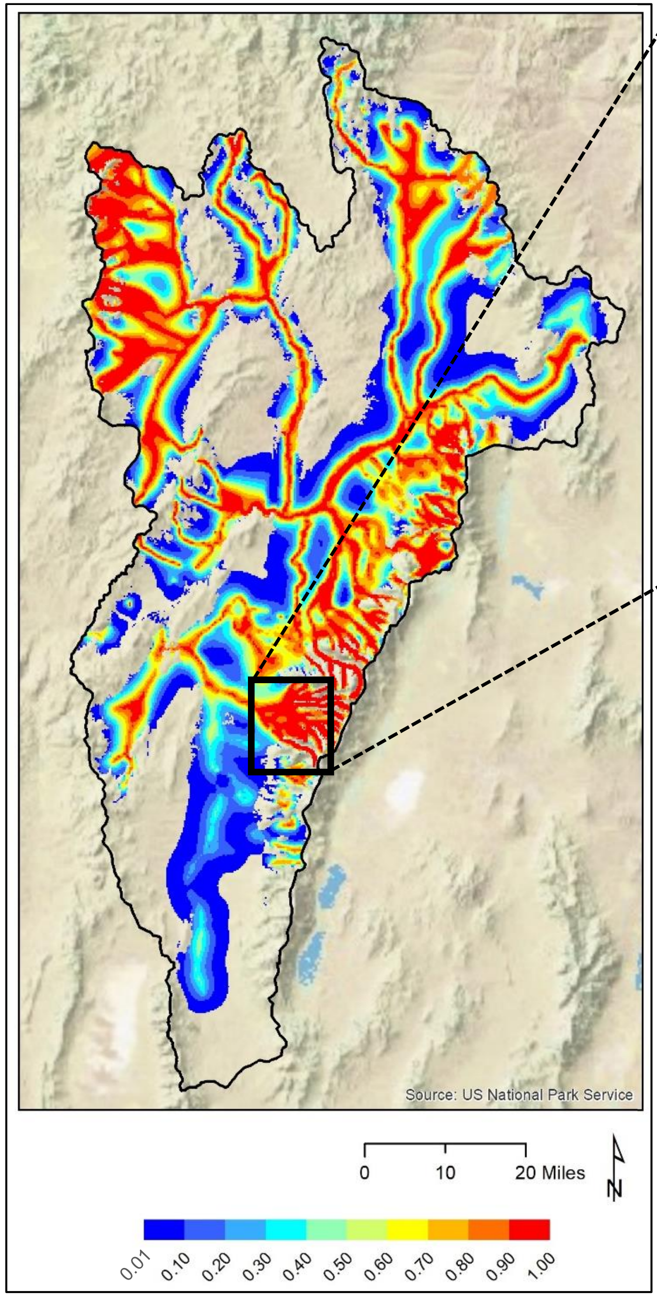


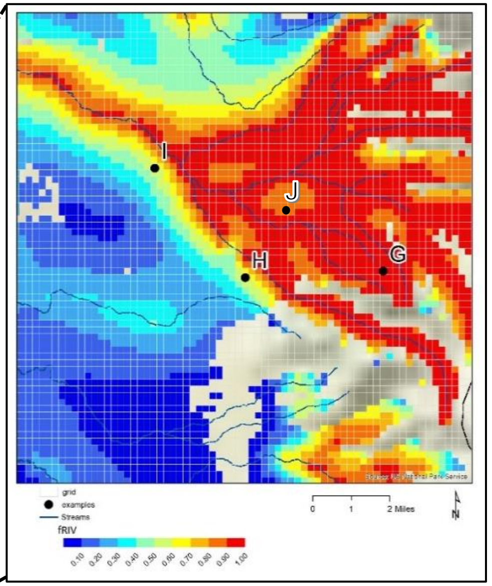
Controls on River Capture

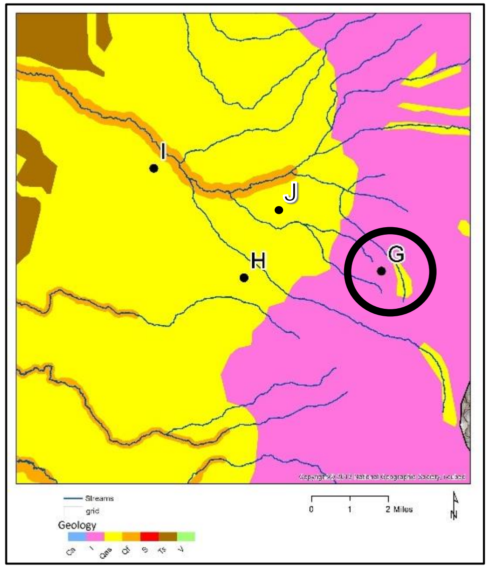


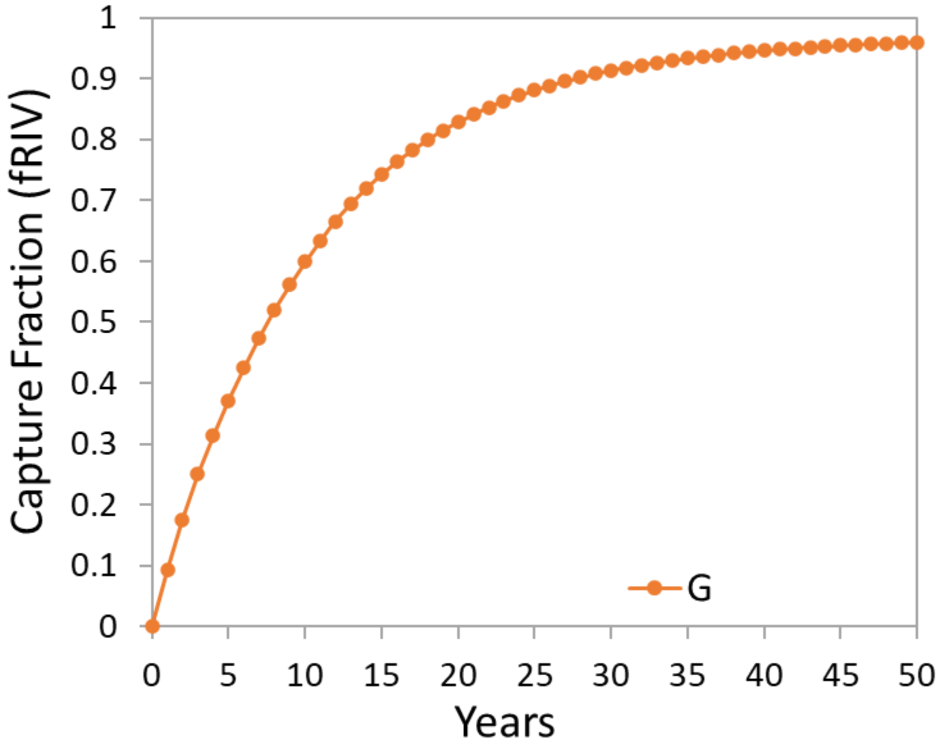
Controls on River Capture

G: High capture, but slightly delayed

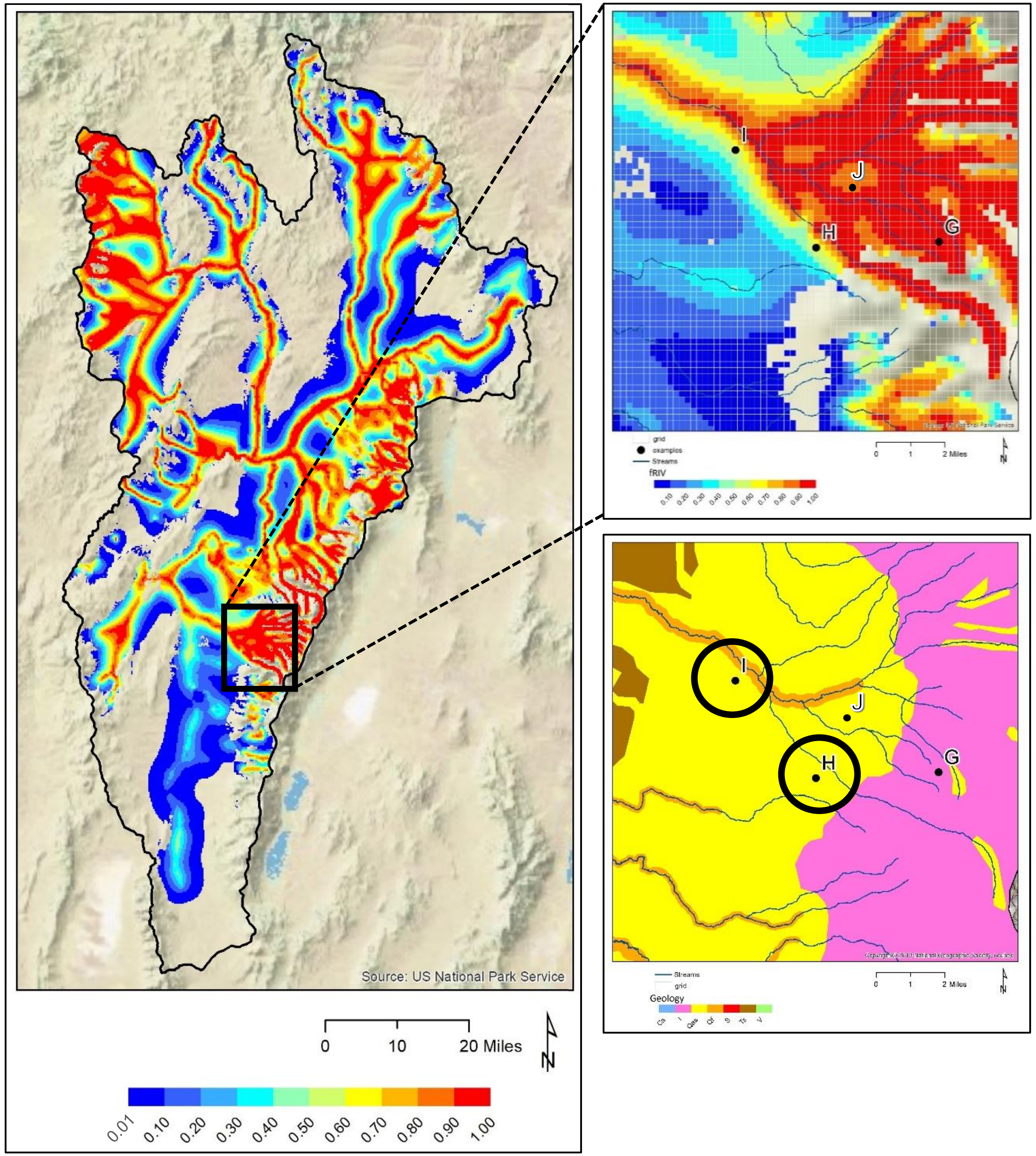




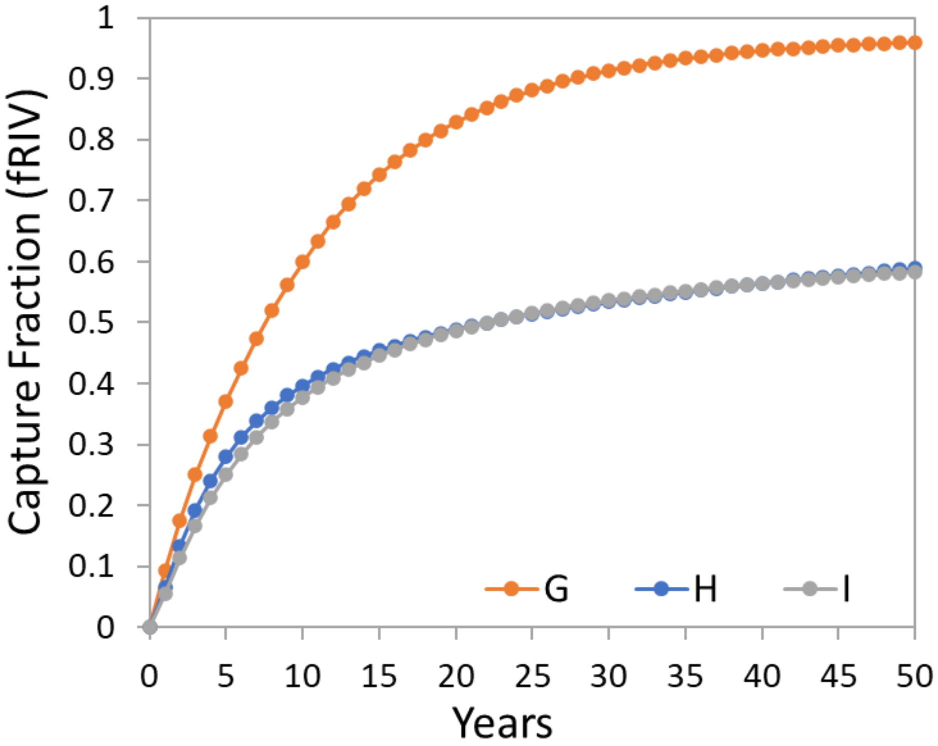




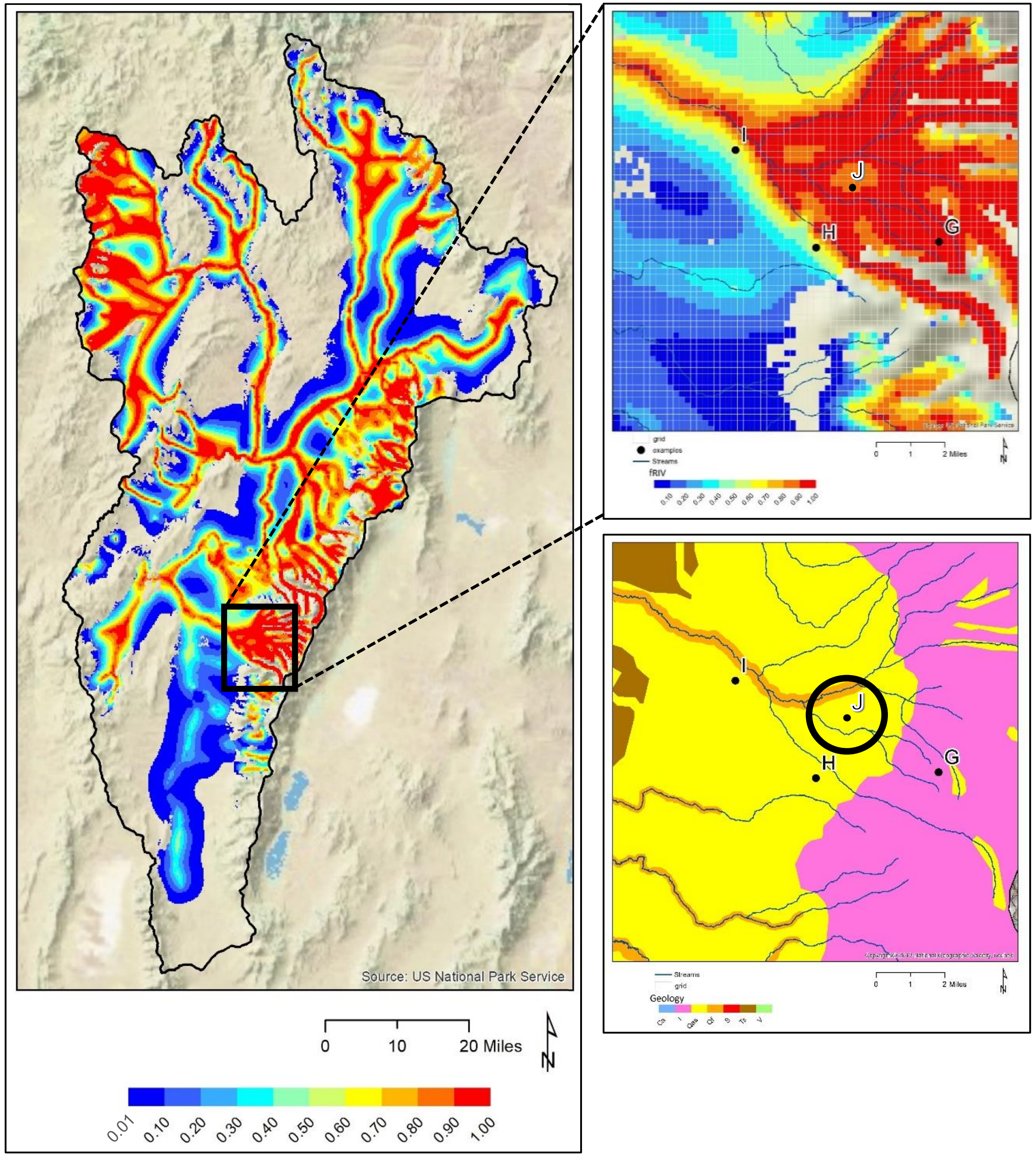
Controls on River Capture



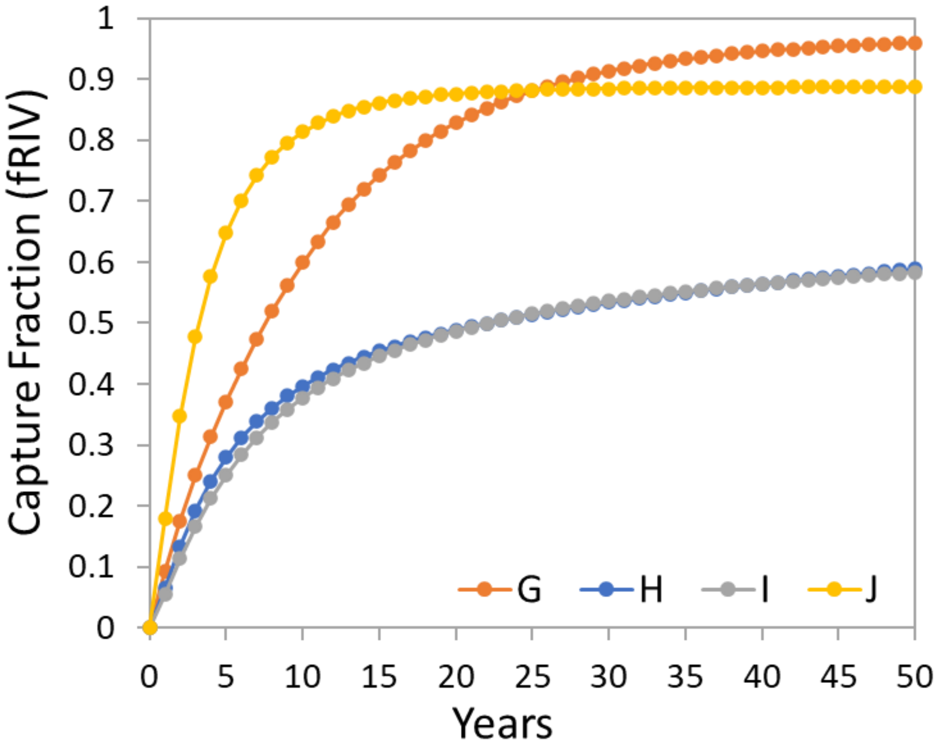
G: High capture, but slightly delayed
H: Capture is much lower
I: Similar to location H



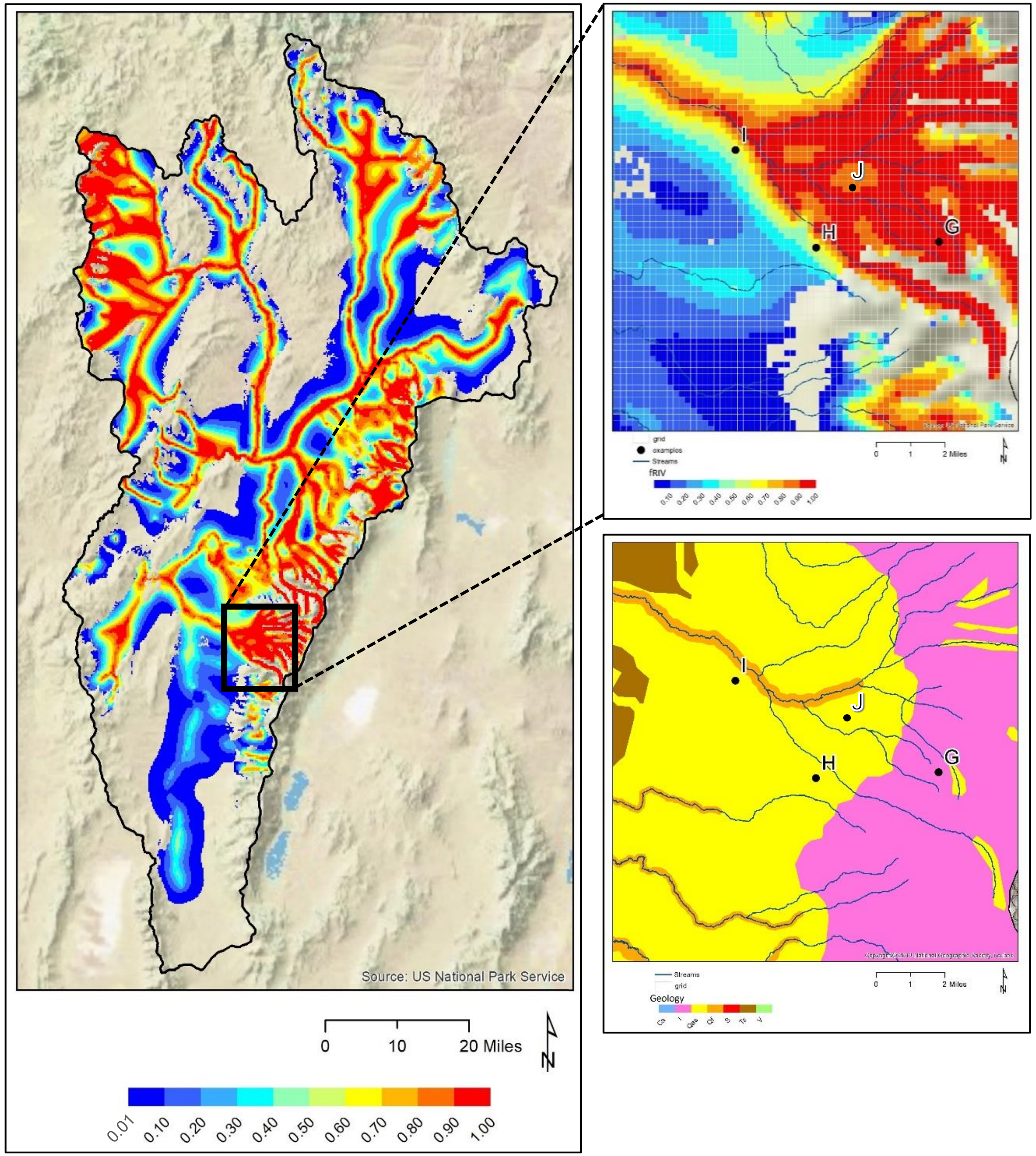
Controls on River Capture



G: High capture, but slightly delayed
H: Capture is much lower
I: Similar to location H
J: Higher capture early, lower capture later



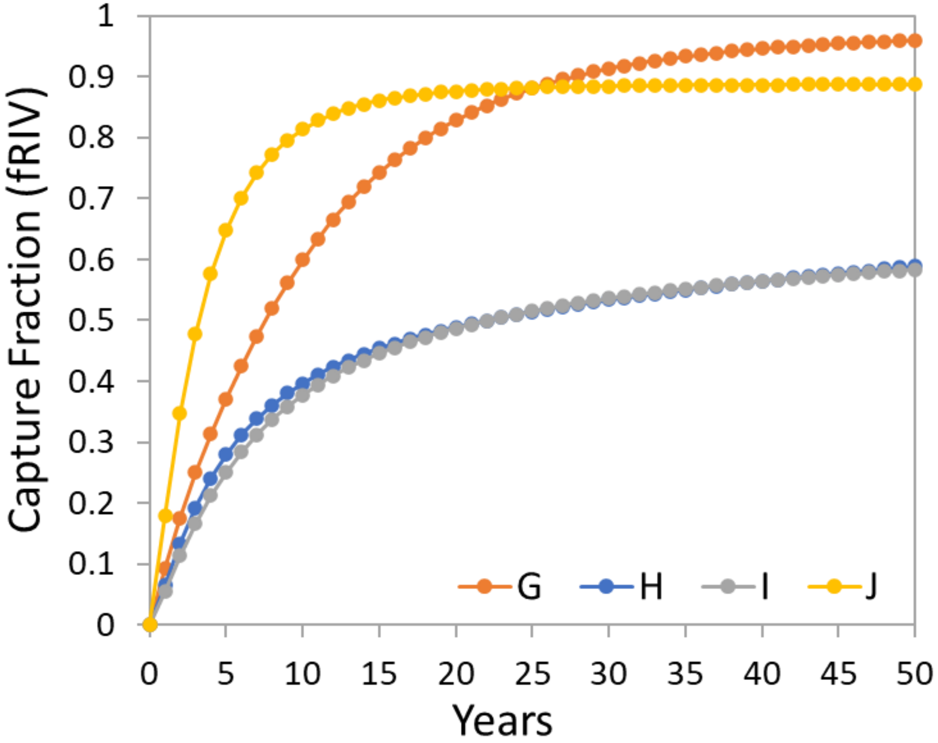
Controls on River Capture



G: High capture, but slightly delayed
H: Capture is much lower
I: Similar to location H
J: Higher capture early, lower capture later

<u>Controlling Factor(s)</u>

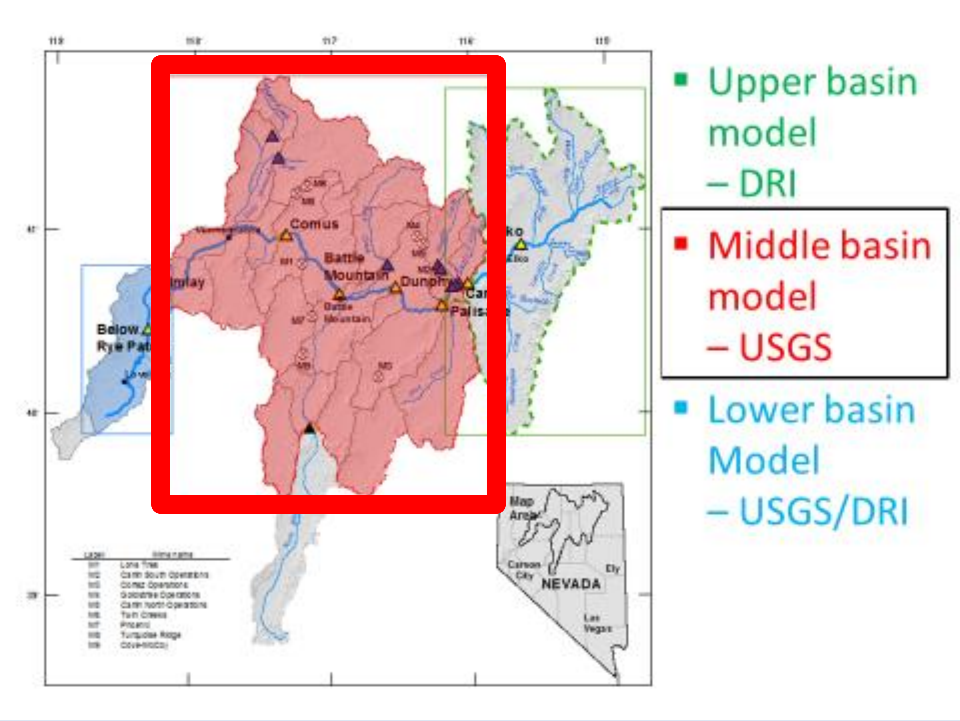
- Riverbed conductance
- River network density
- Geology



Concluding Remarks

- The Upper Humboldt Model extends over a large and complex geographic area with large gradient in elevation/recharge, geology, river characteristics.
- There are simplifying assumptions to allow the model to be more computationally efficient but still emulate observed data (technical report).
- River capture in the valleys:
  - Distance from river is a primary control.
  - Riverbed conductance is also important
- River capture in the headwaters:
  - Larger and more expansive than valleys
  - Dense river network
  - Low storage in bedrock units
  - Perennial streams
  - Riverbed conductance is also important

Middle Humboldt River Basin Model



USGS

Middle Humboldt Capture Model

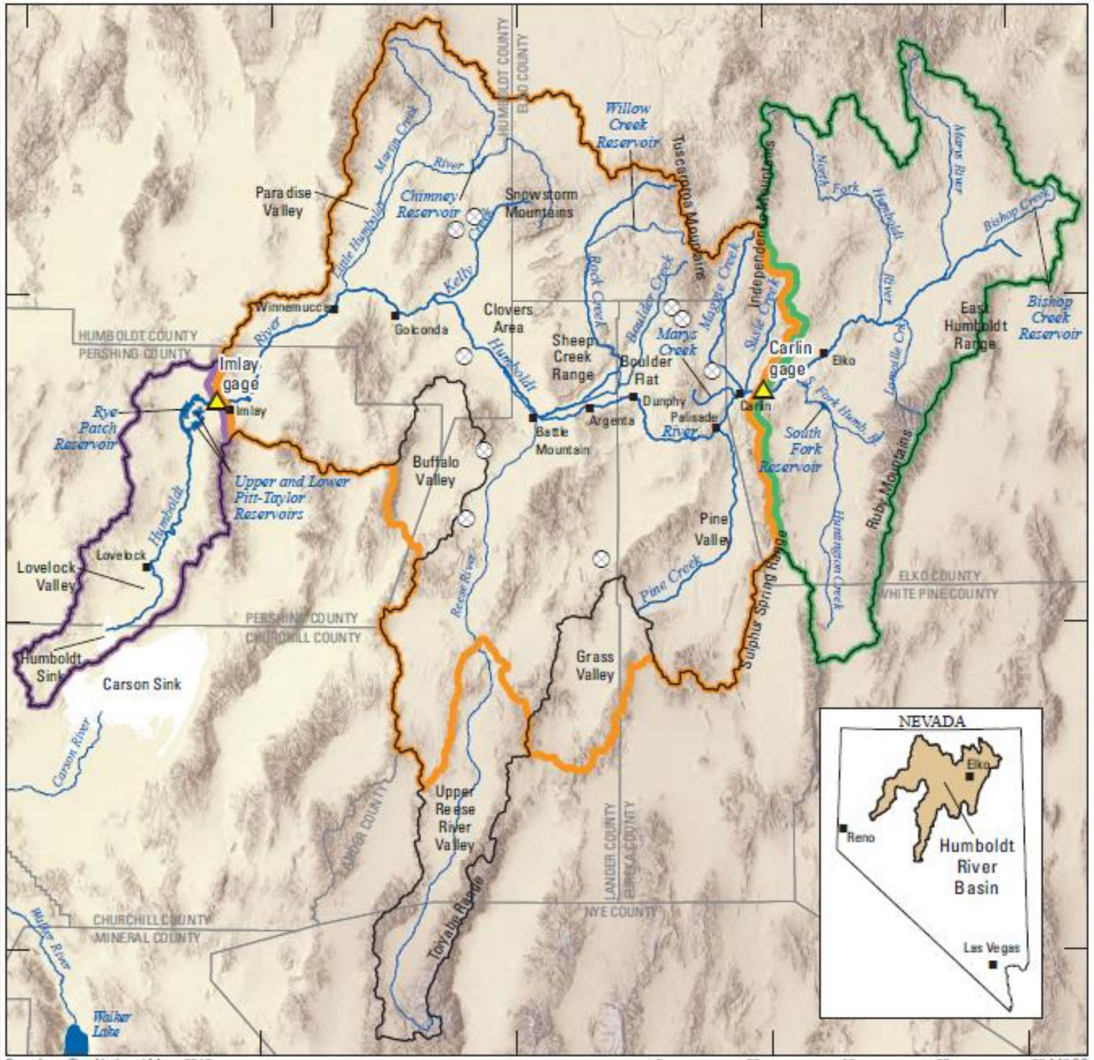
<u>Middle Humboldt Team:</u>
Kyle Davis, William Eldridge, Kip Allander, Justin Mayers

USGS, Nevada Water Science Center

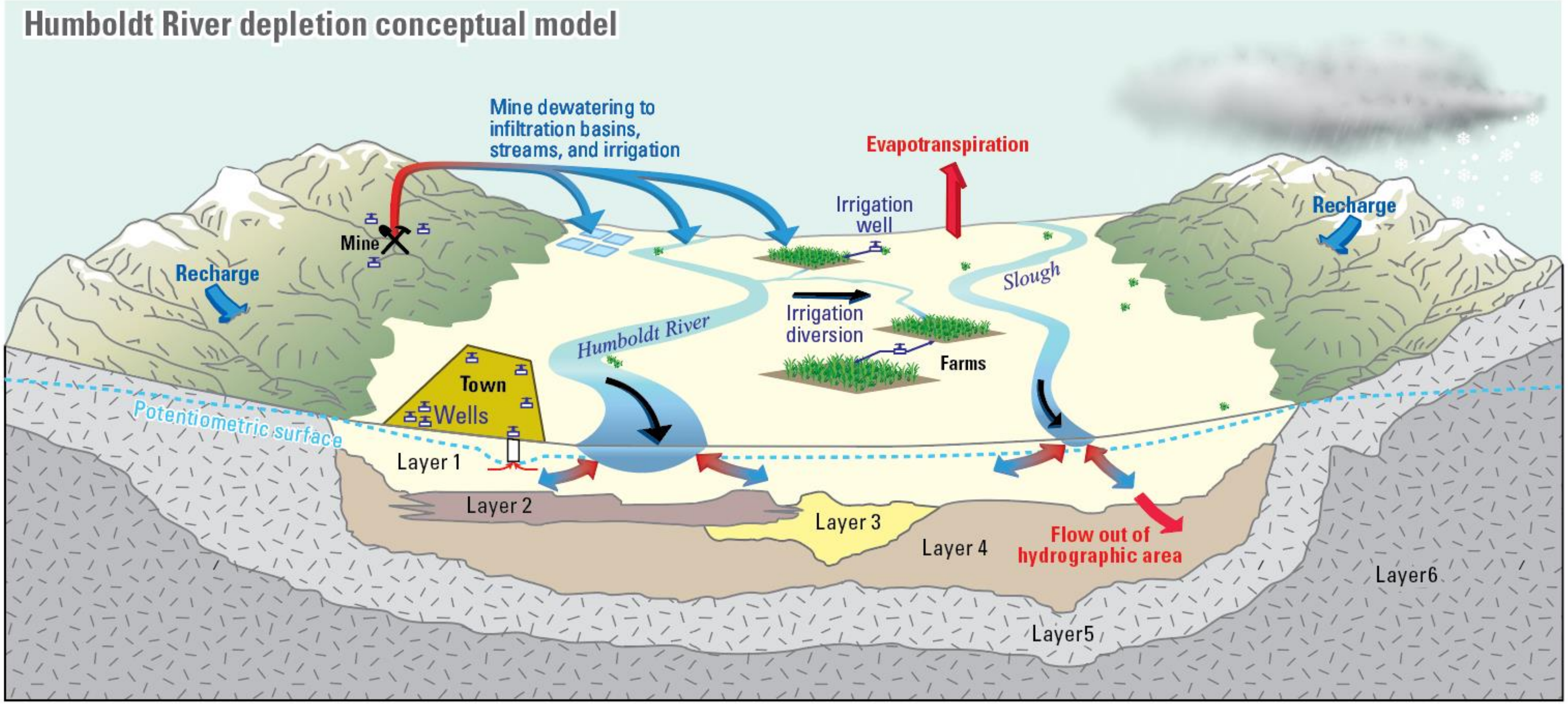
Humboldt Stakeholder Meeting:

February 4, 2021

*** All model results are provisional and subject to change***



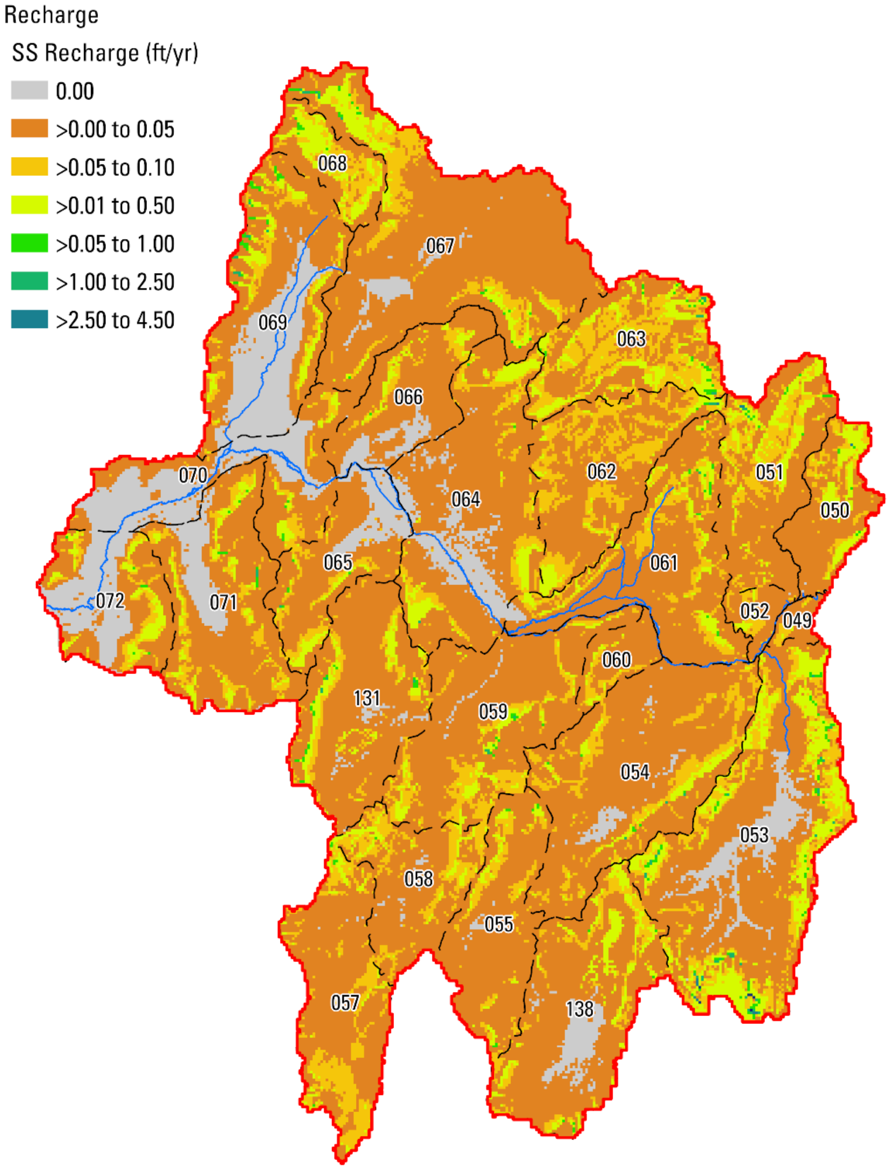
Base from The National Map, 2018.
Universal Transverse Mercator projection, Zone 11,
World Geodetic System of 1984
Shaded-relief image is the intellectual property of Esri and is used herein under license.

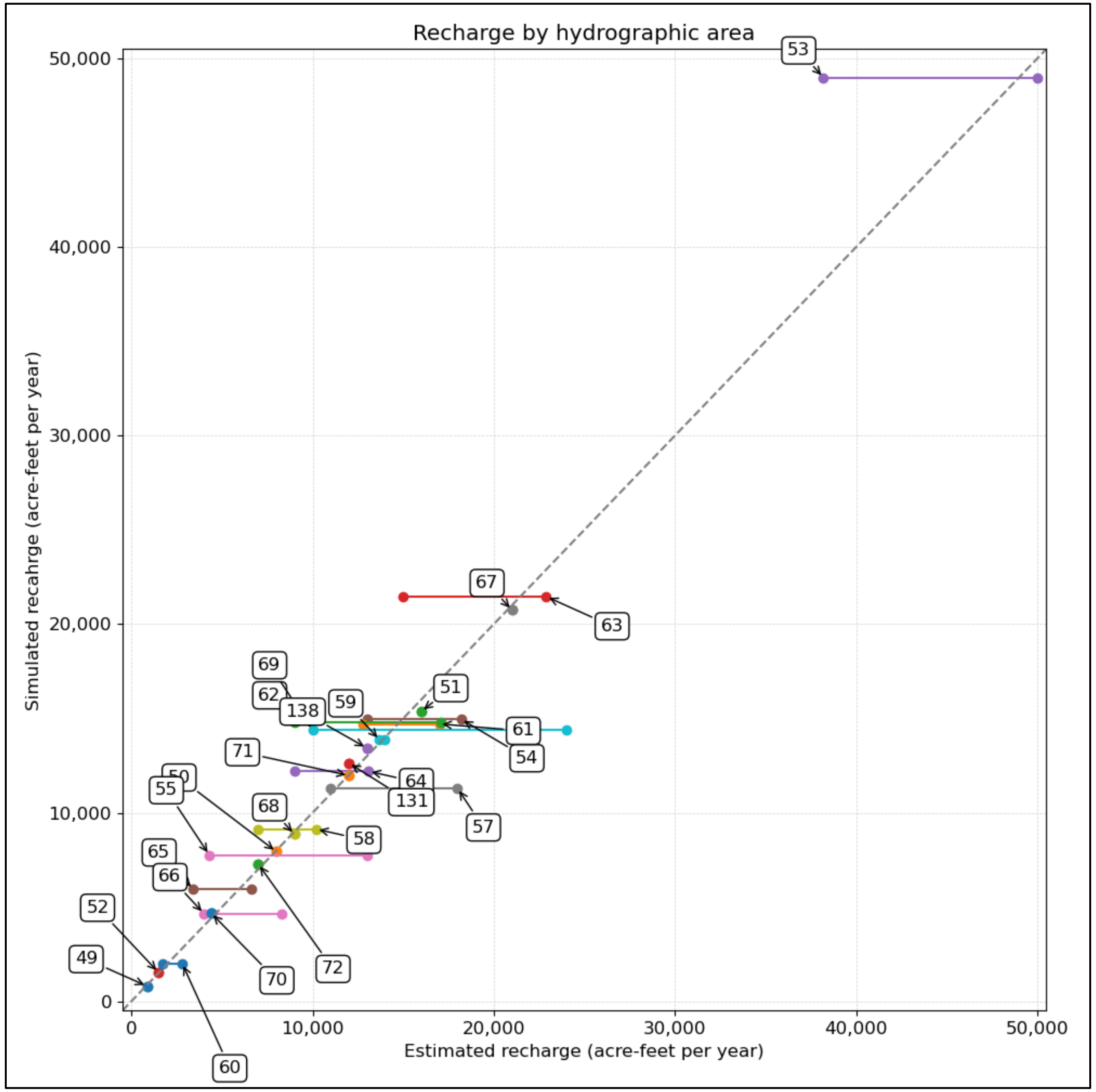


EXPLANATION

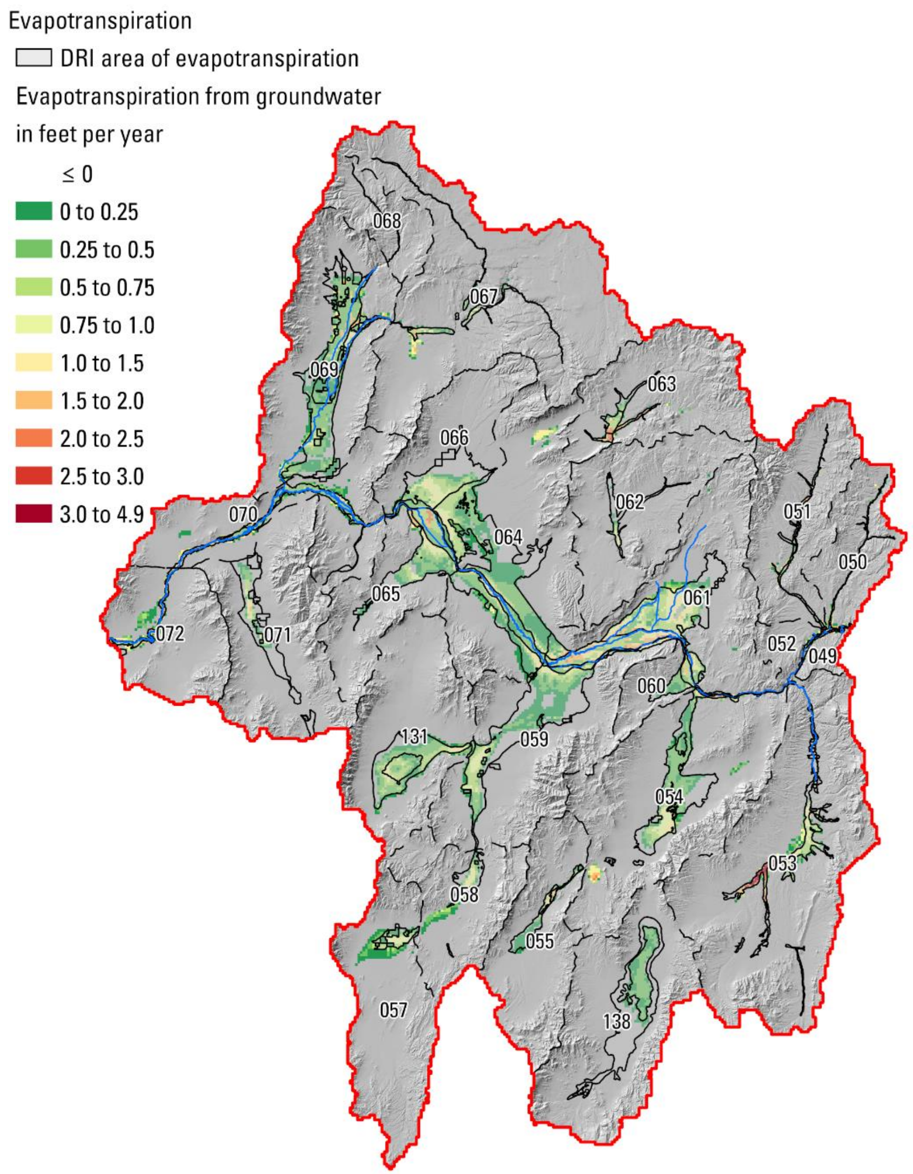
- Layer 1: **Basin fill deposits**—playa, valley floor, alluvial slope, fluvial deposits (thickenss 25 to 50 feet)
- Layer 2: **Clay layer below layer 1 (thickness 10 to 130 feet)**
- Layer 3: **Lower basin fill**—valley floor, fluvial deposits (thickness up to 400 feet)
- Layer 4: **Older basin fill**—Tertiary fine-grain semi-consolidated sediments (thickness up to 1,000 feet)
- Layer 5: **Upper hard rock**—clastic sedimentary, carbonate and mixture, intrusive, metamorphic, clastic sandstones (thickness 1,200 feet)
- Layer 6: **Lower hard rock**—clastic sedimentary, carbonate and mixture, intrusive, metamorphic, clastic sandstones (thickness variable ~1,800 feet)
- **Groundwater inflow**
- **Groundwater outflow**
- **Surface water flow direction**

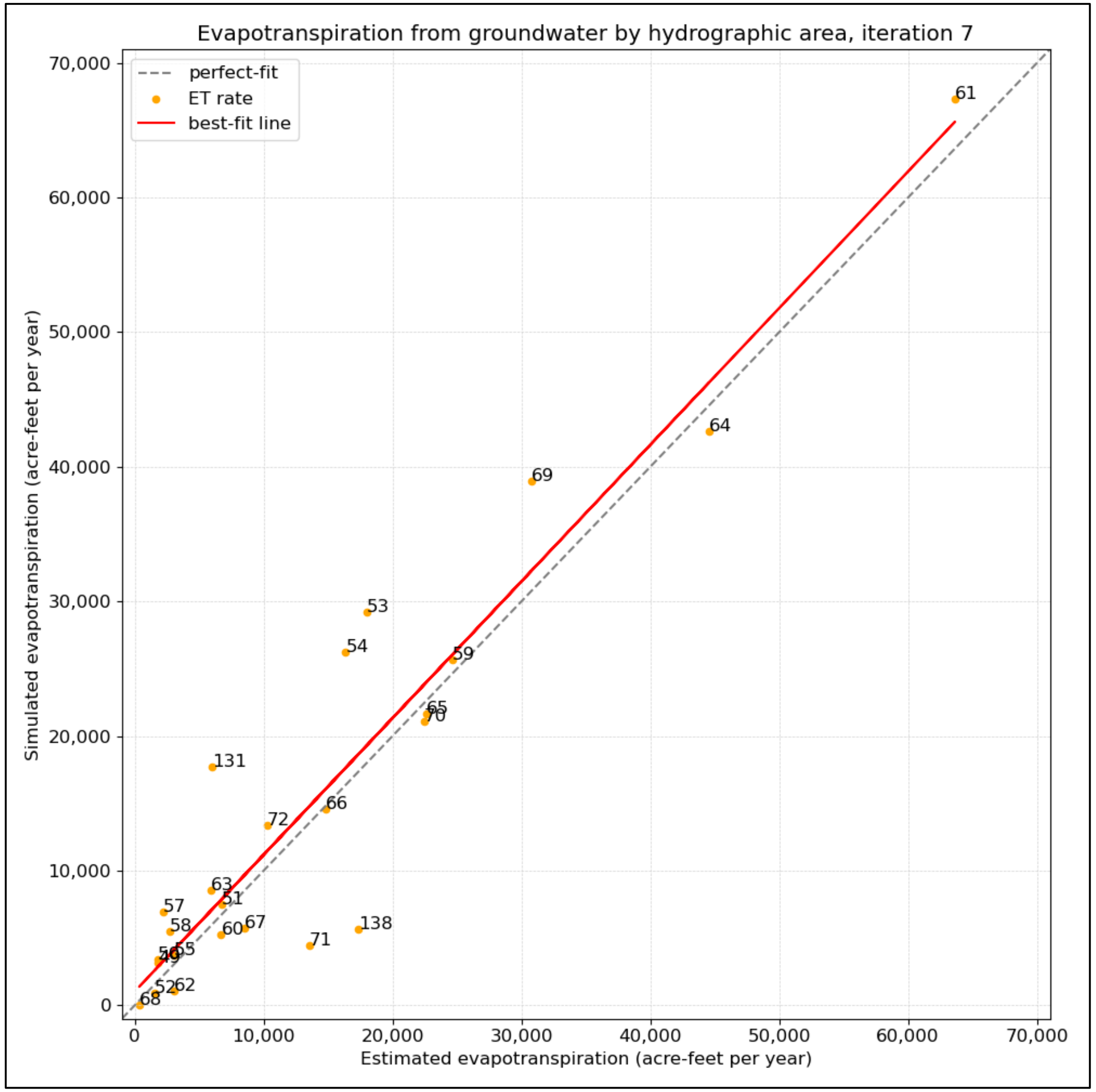
Recharge distribution and results by HA



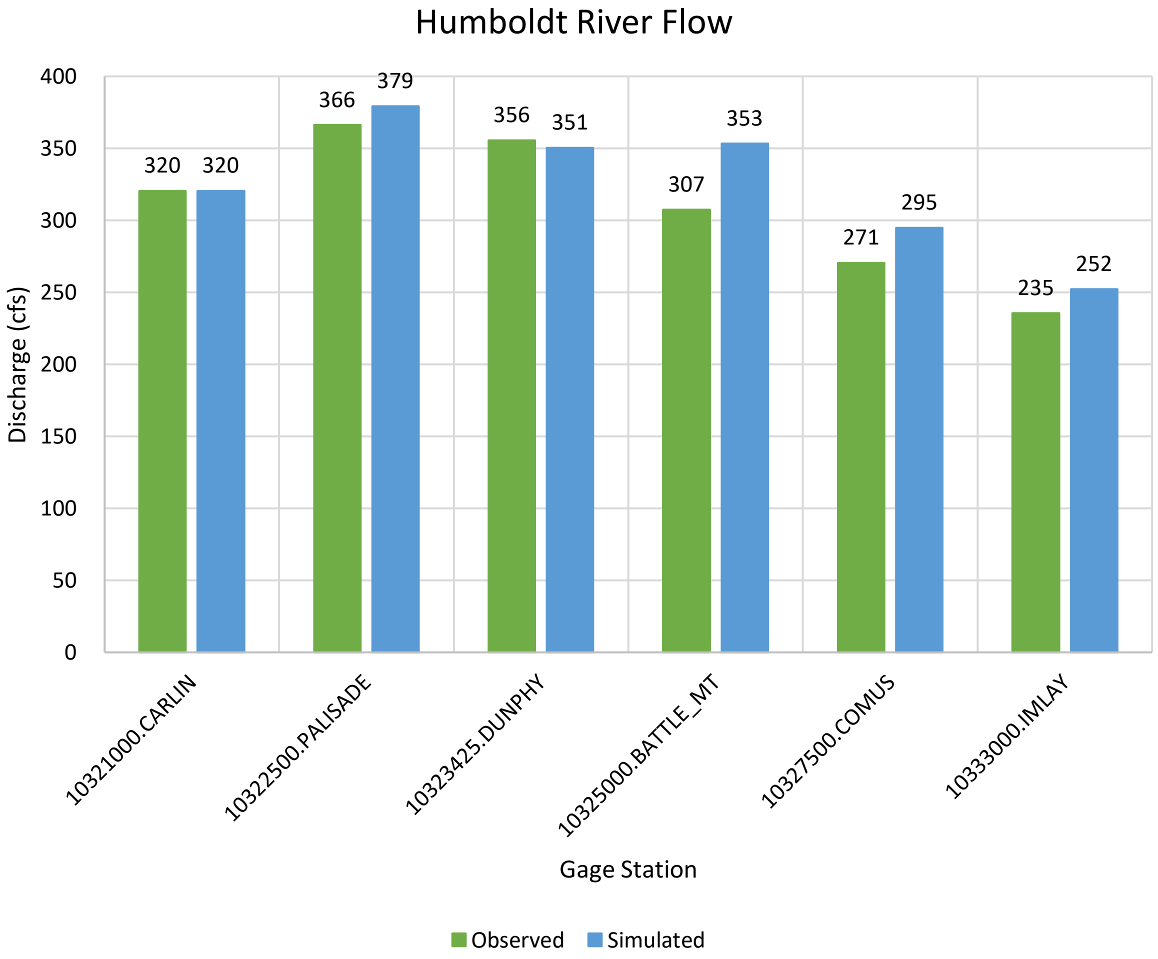


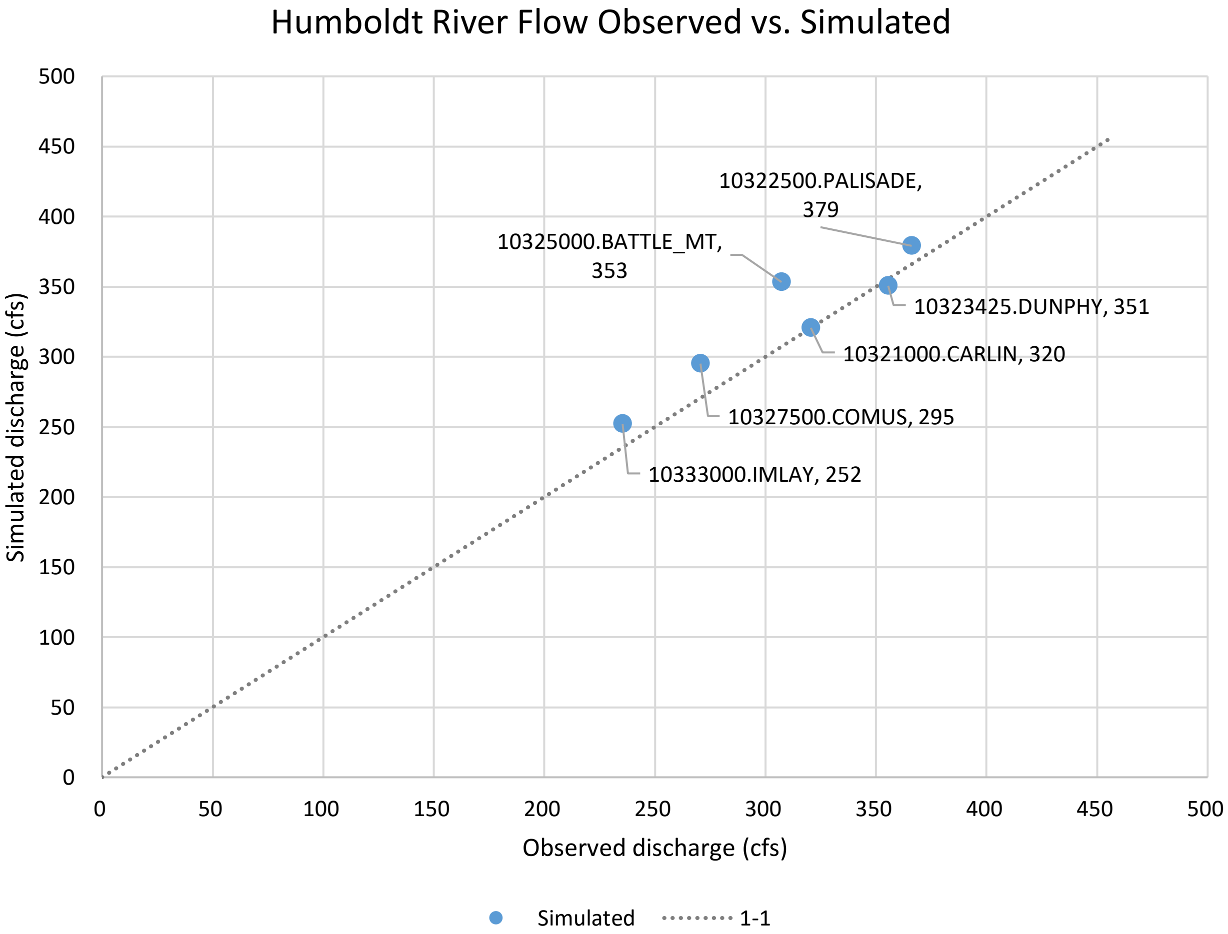
Evapotranspiration distribution and results by HA



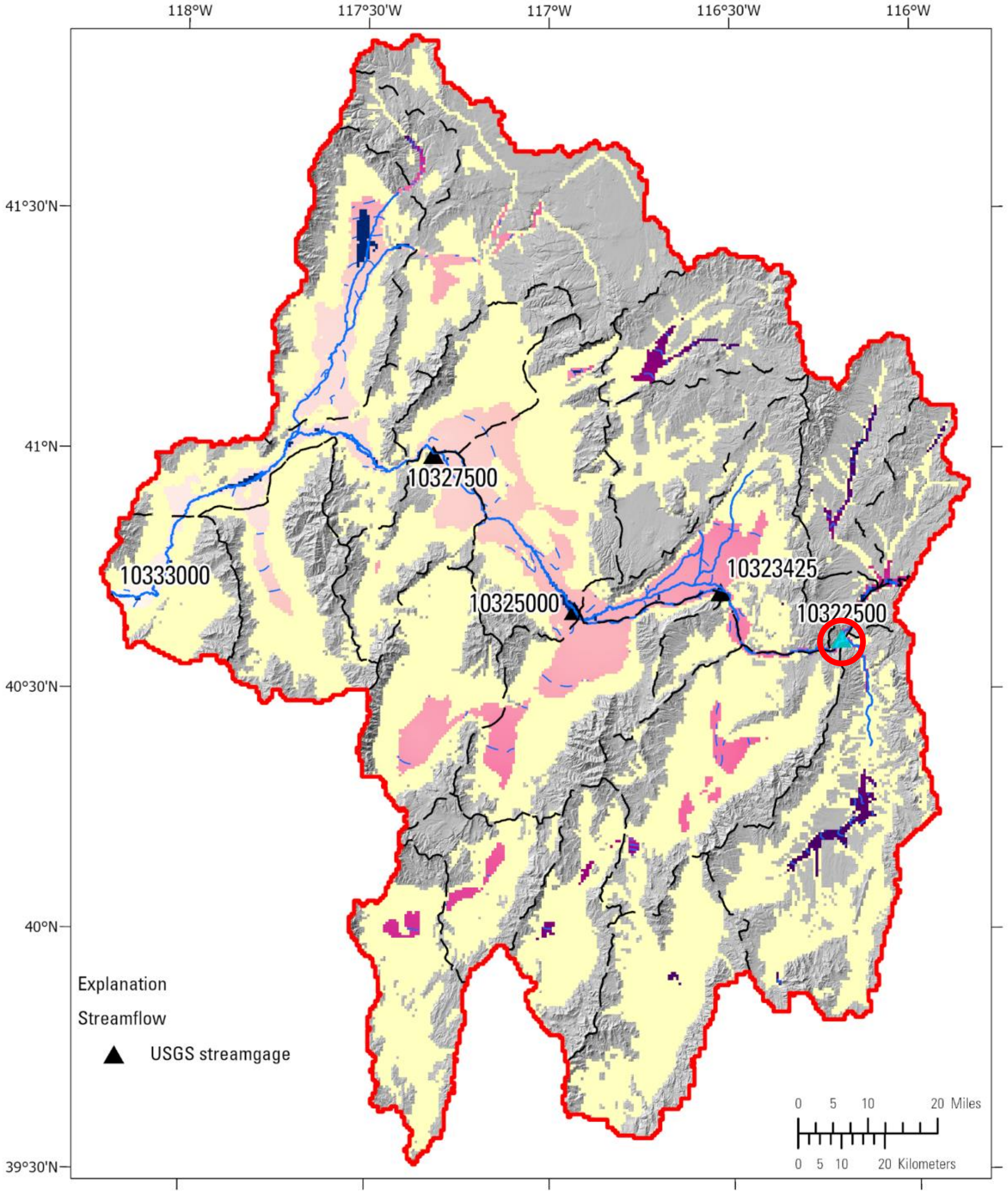


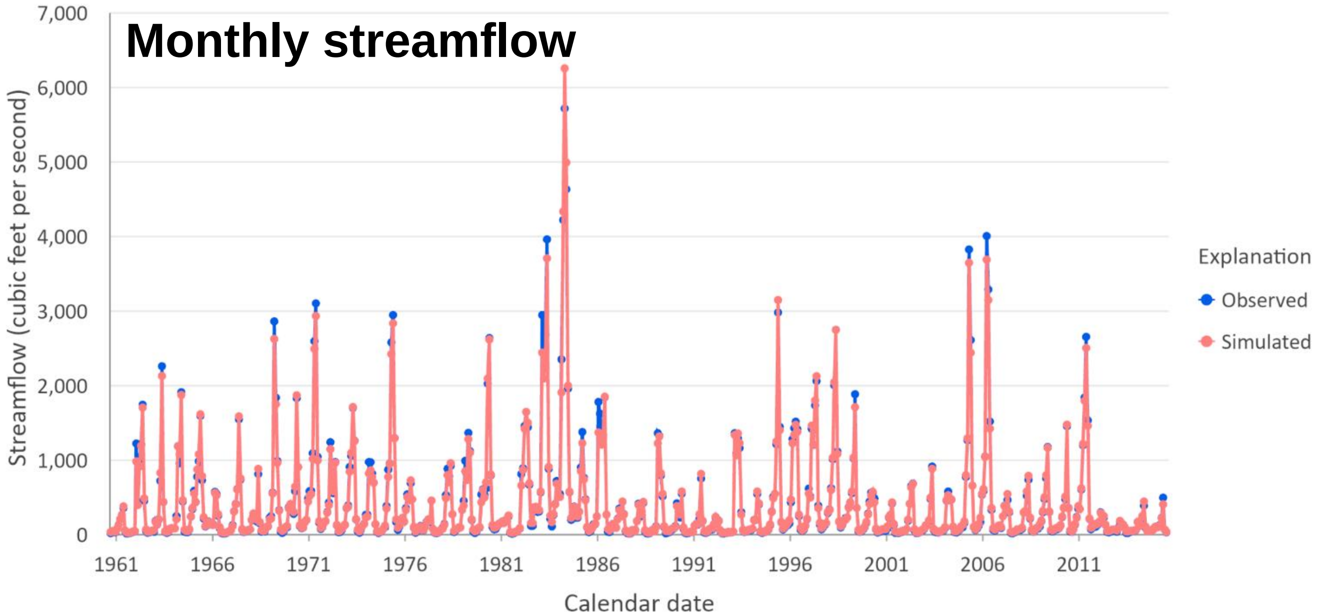
Average streamflow 1945 -1958 for each gage

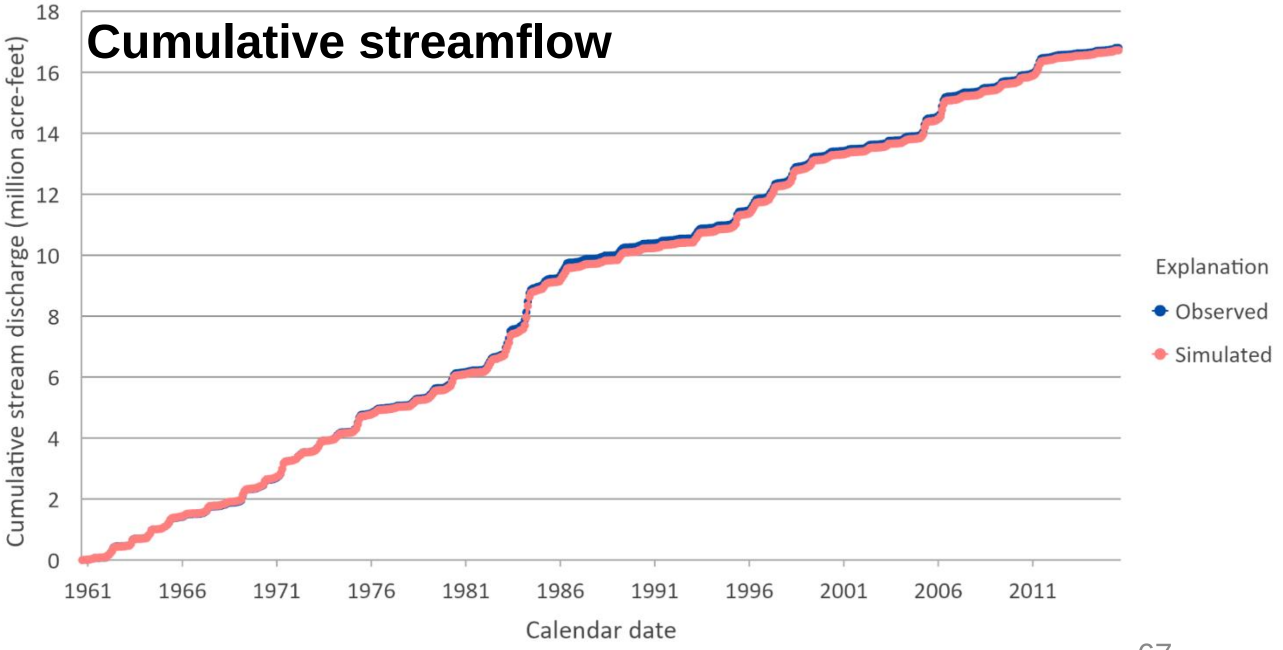




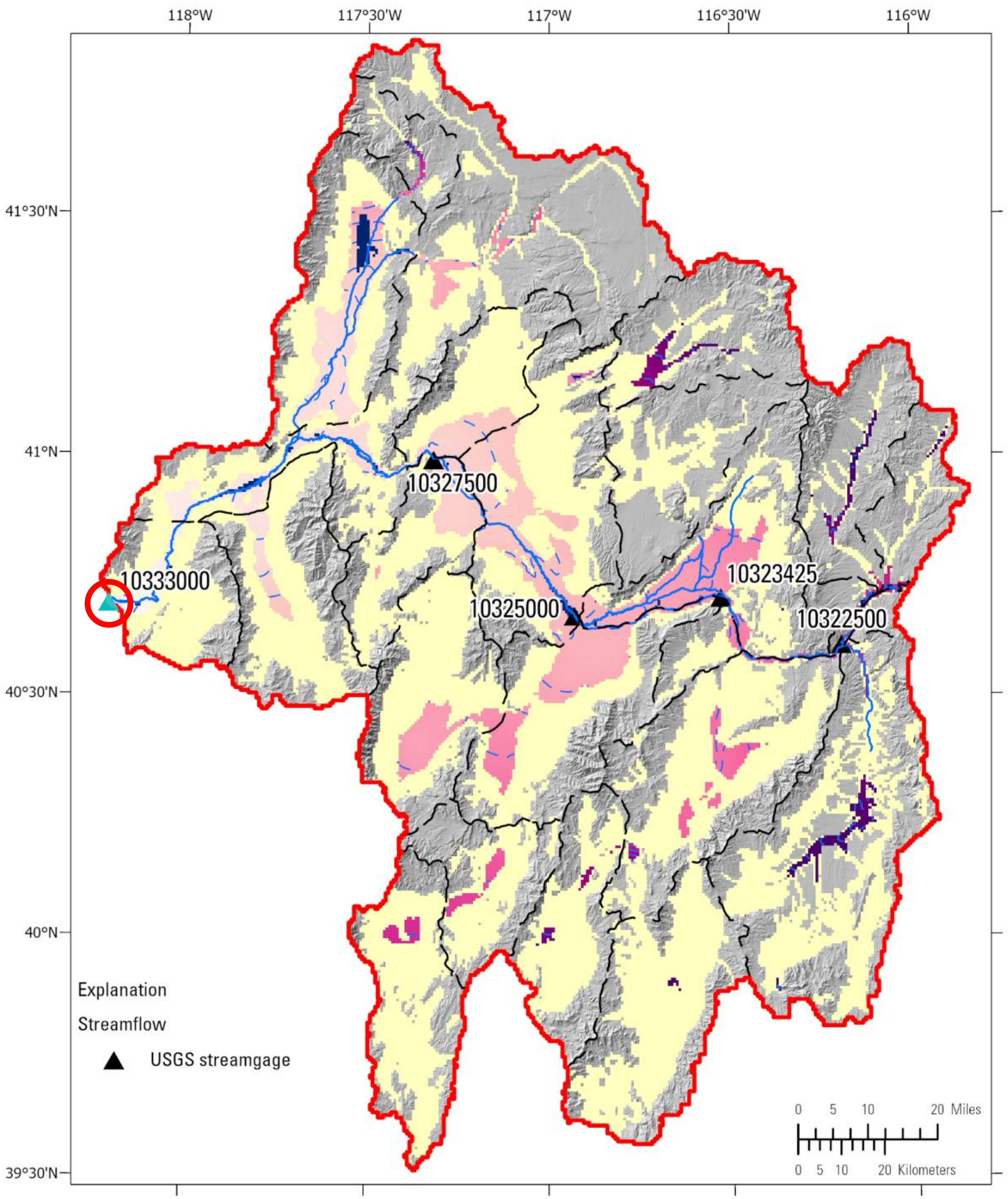
Streamflow and cumulative streamflow Humboldt River at Palisade: USGS-10322500

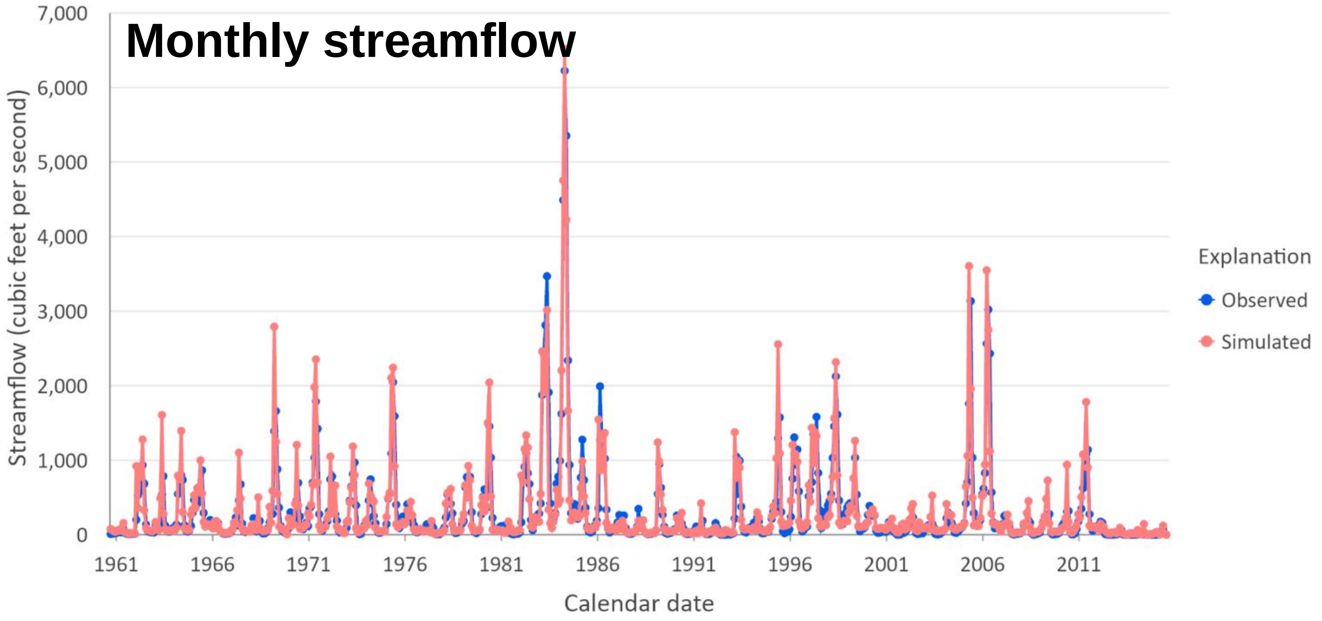


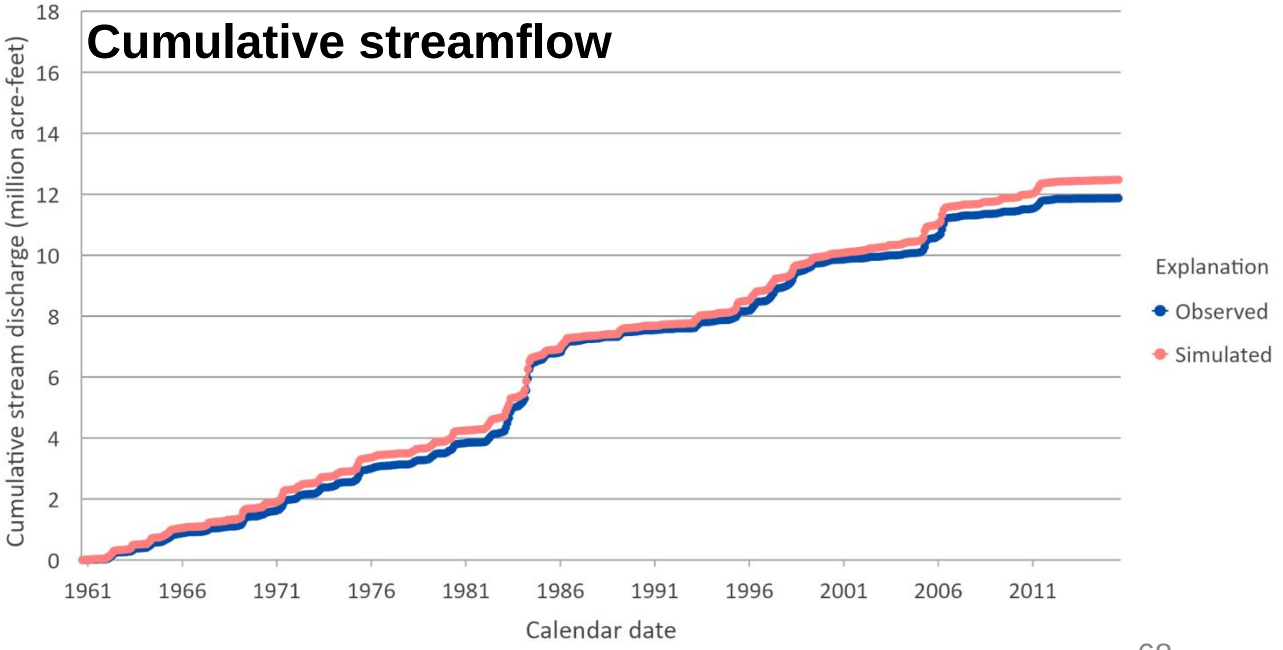




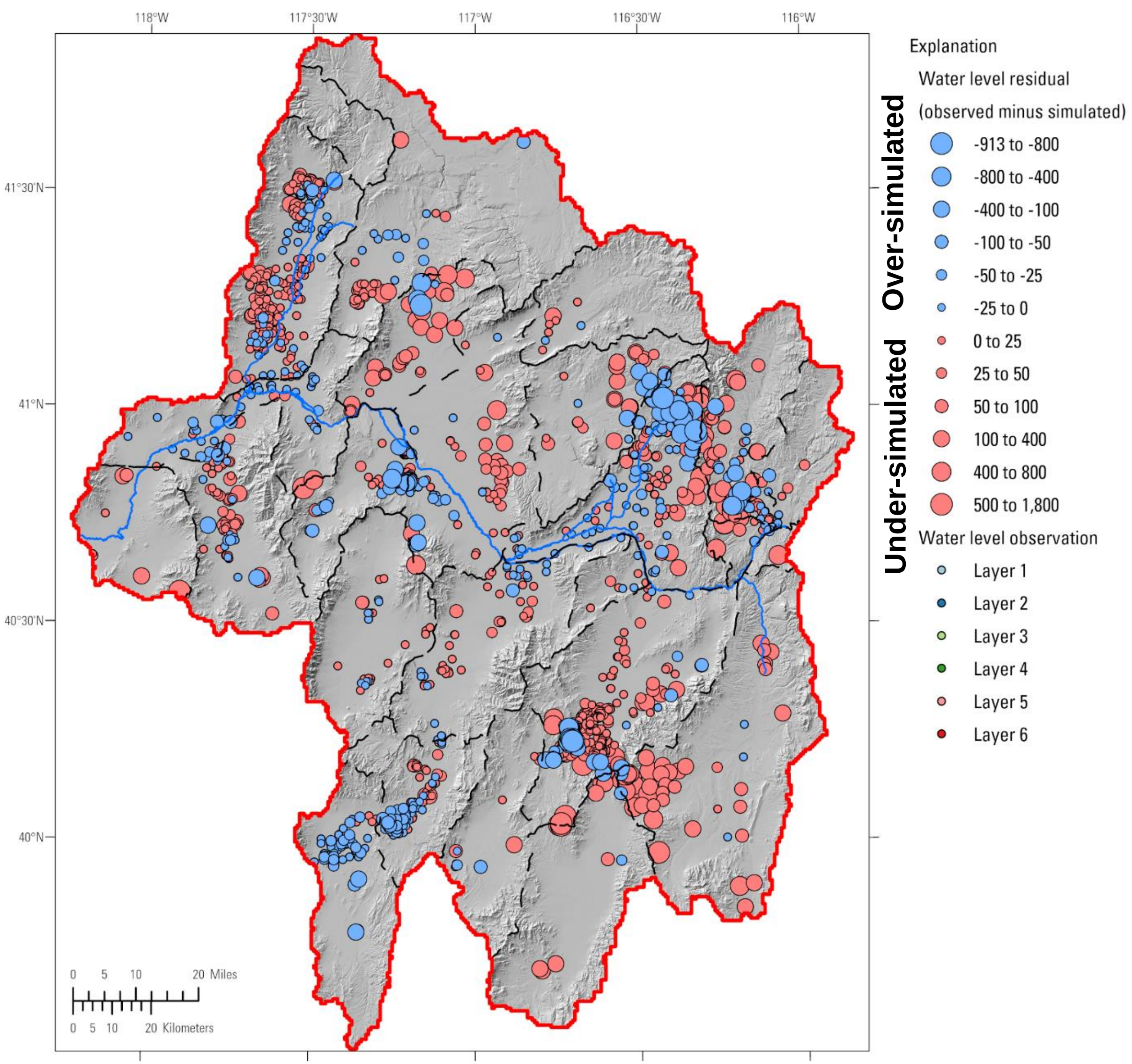
Streamflow and cumulative streamflow
Humboldt River at Imlay: USGS-10333000

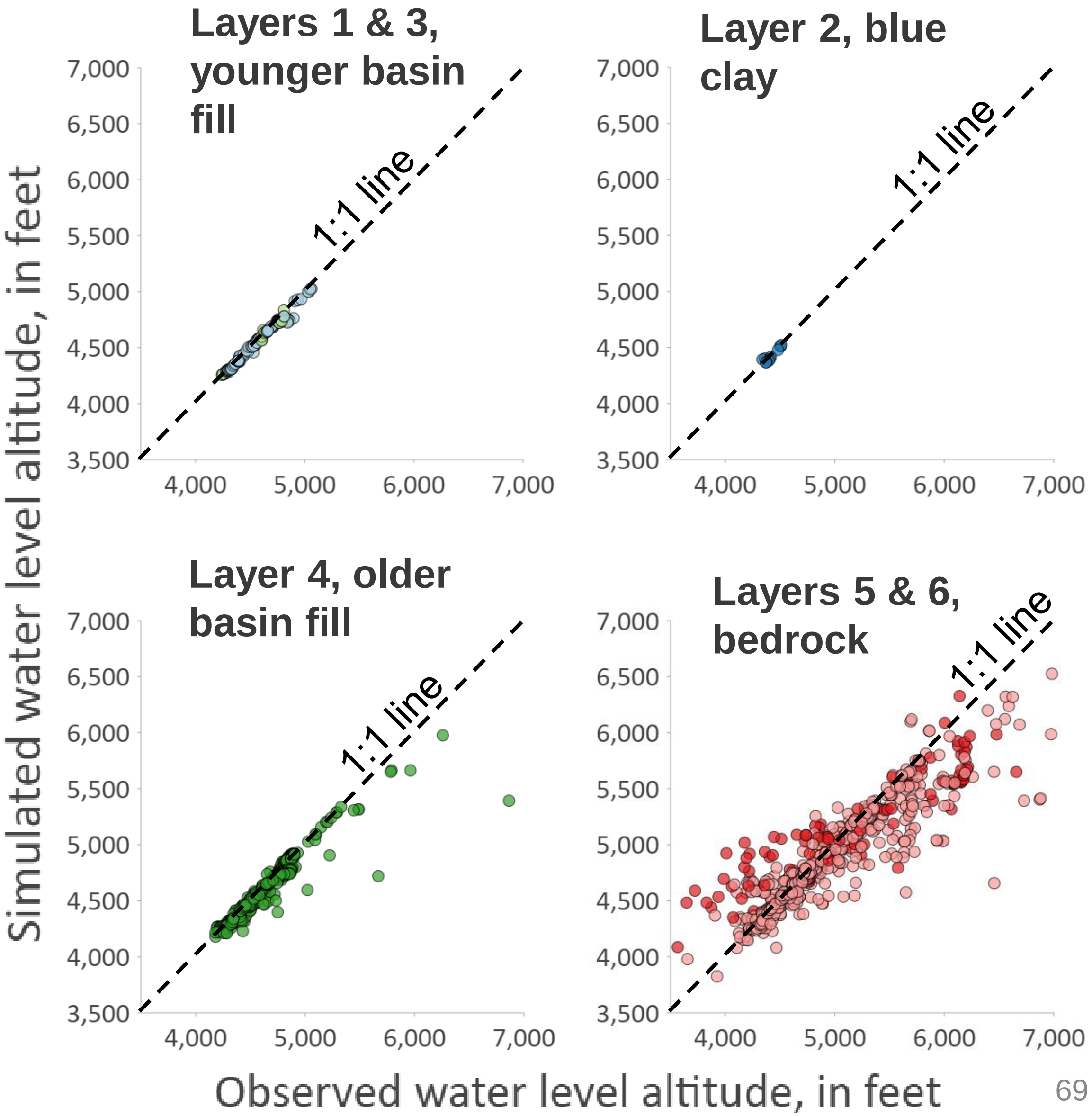




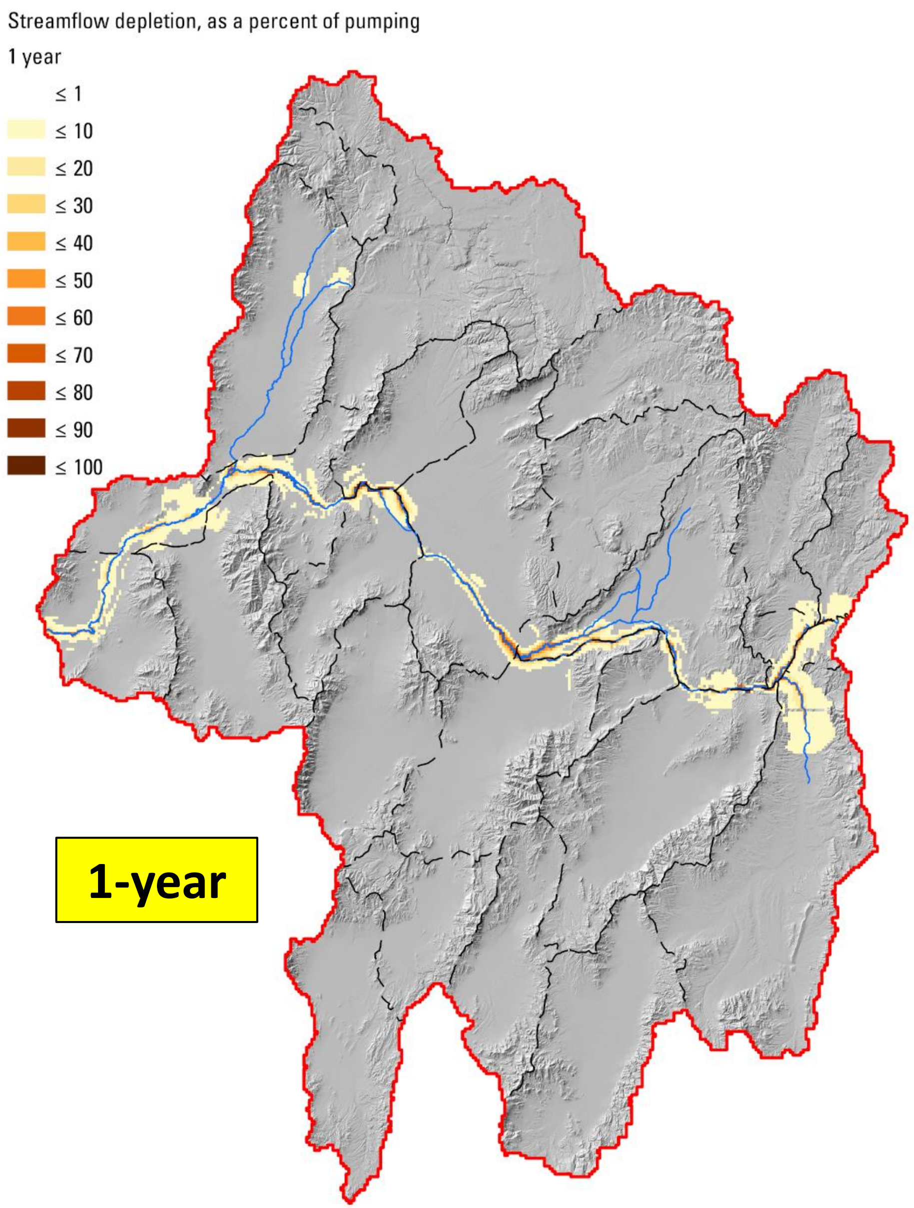


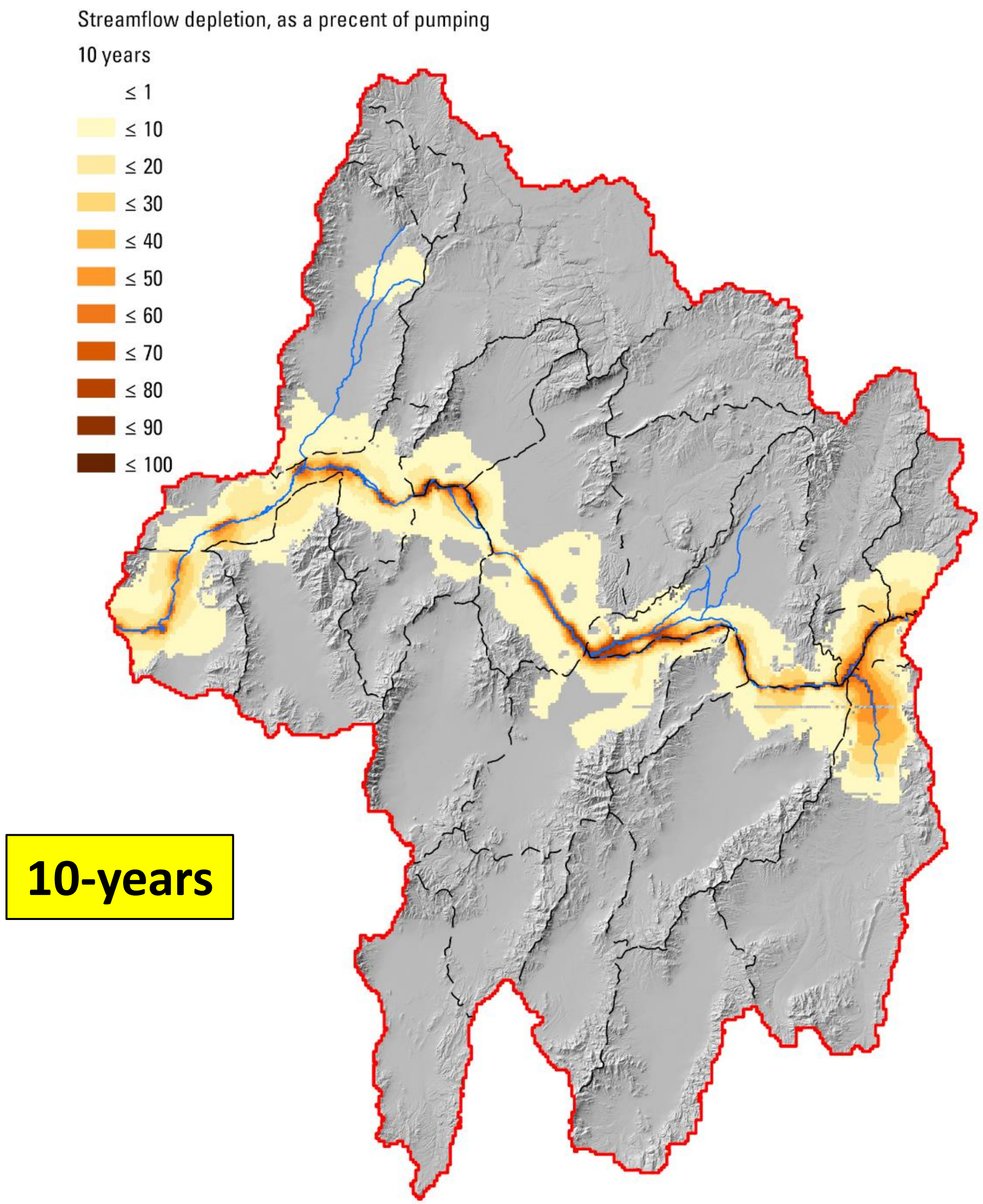
Simulated water level comparisons



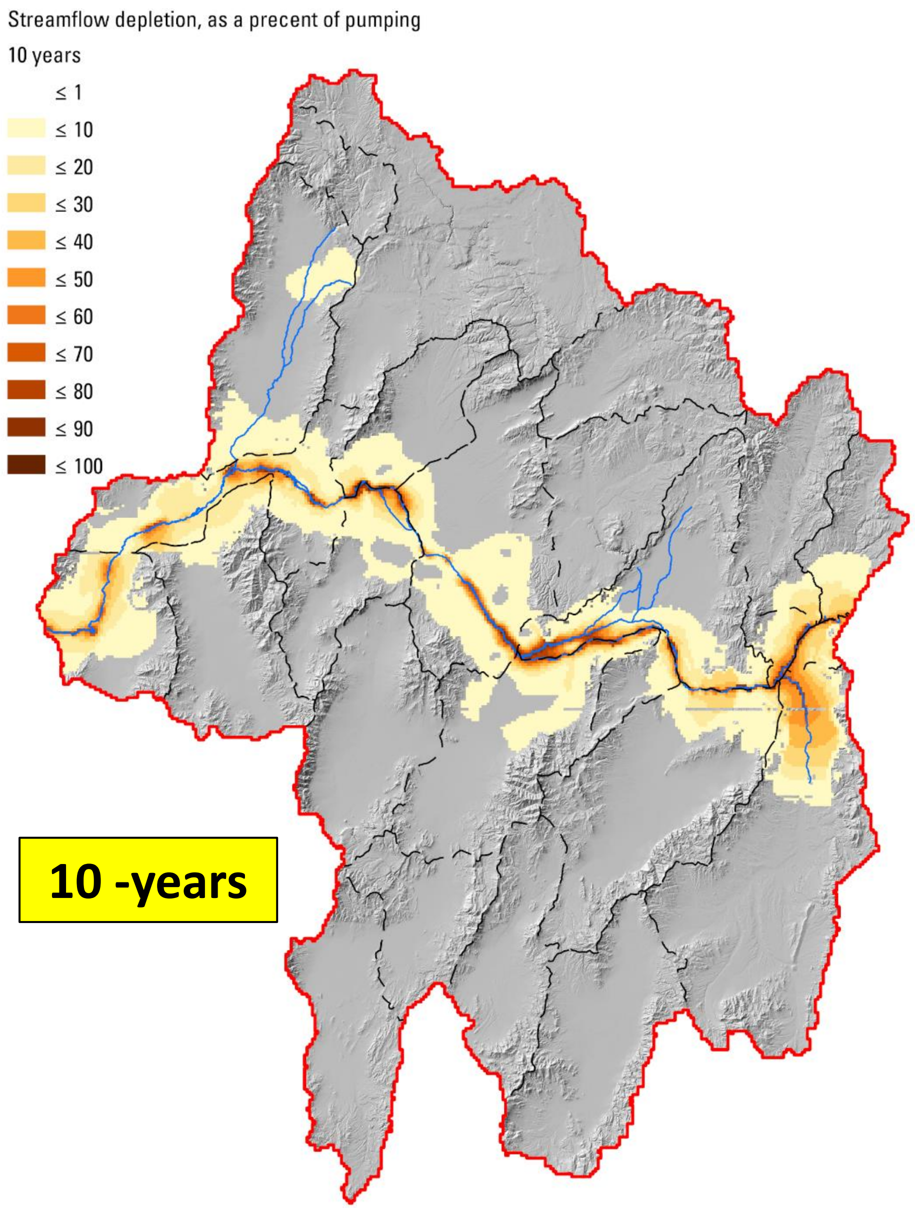


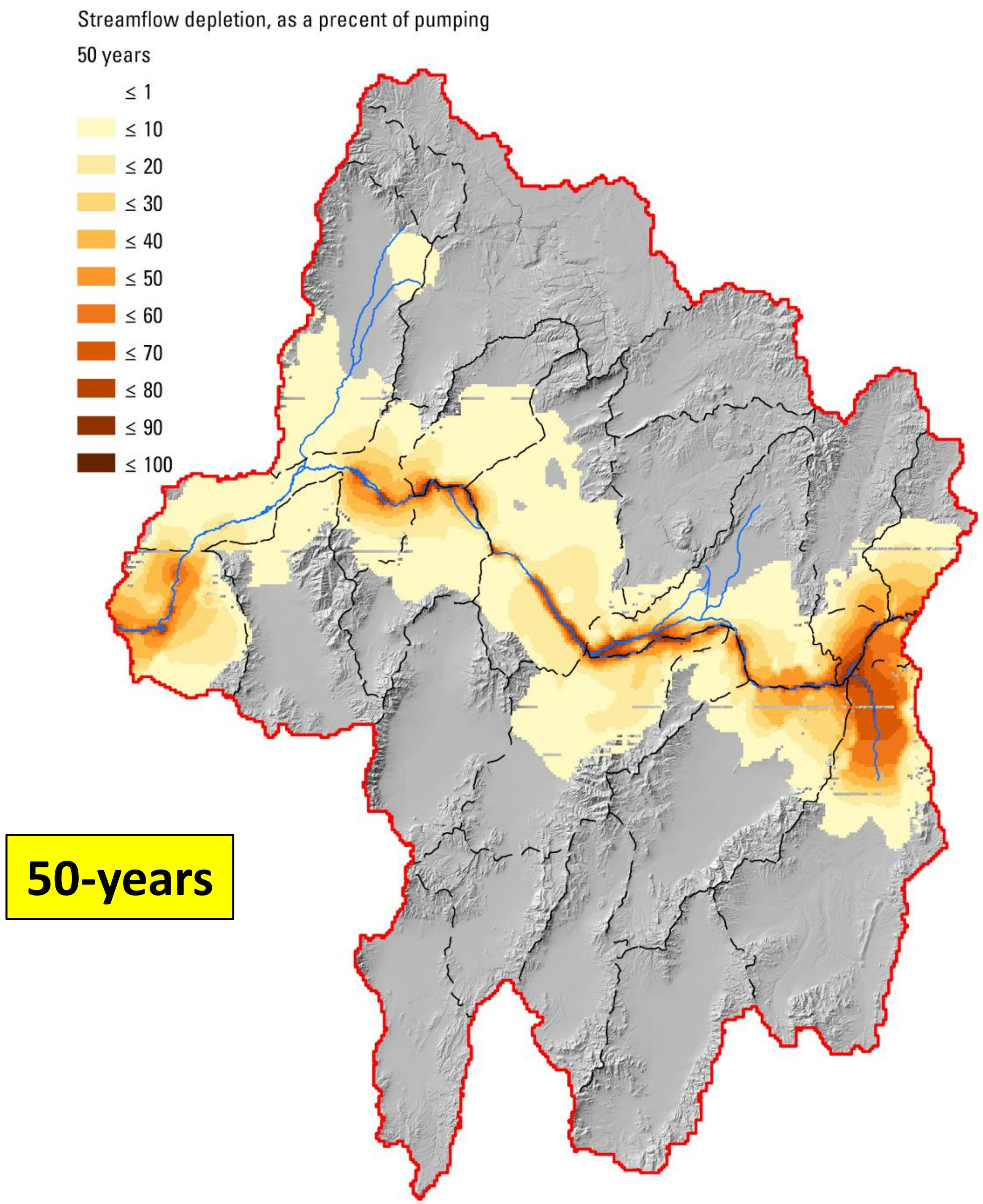
Capture Map – Imlay Depletion: 1-yr and 10-yr



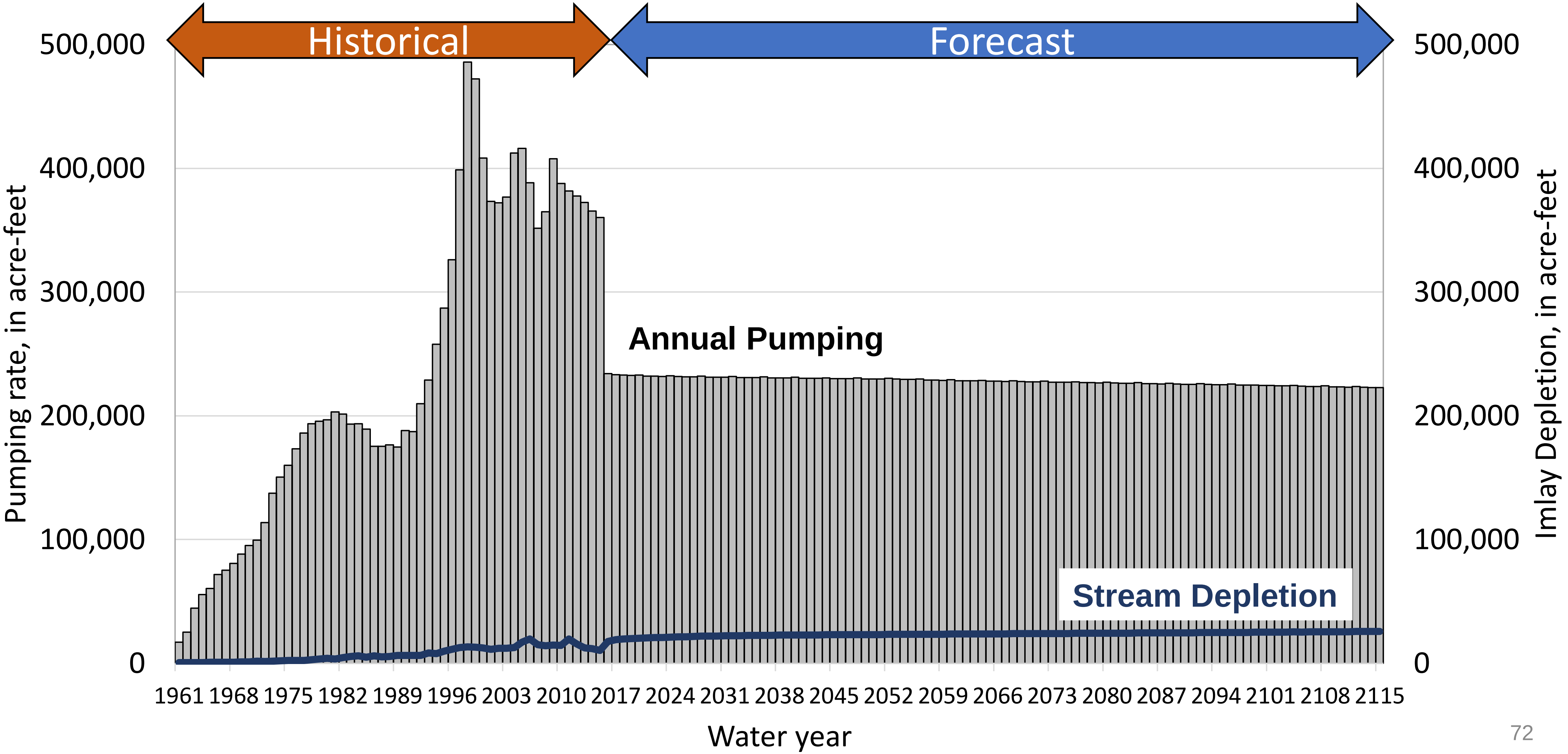


Capture Map – Imlay Depletion: 10-yr and 50-yr

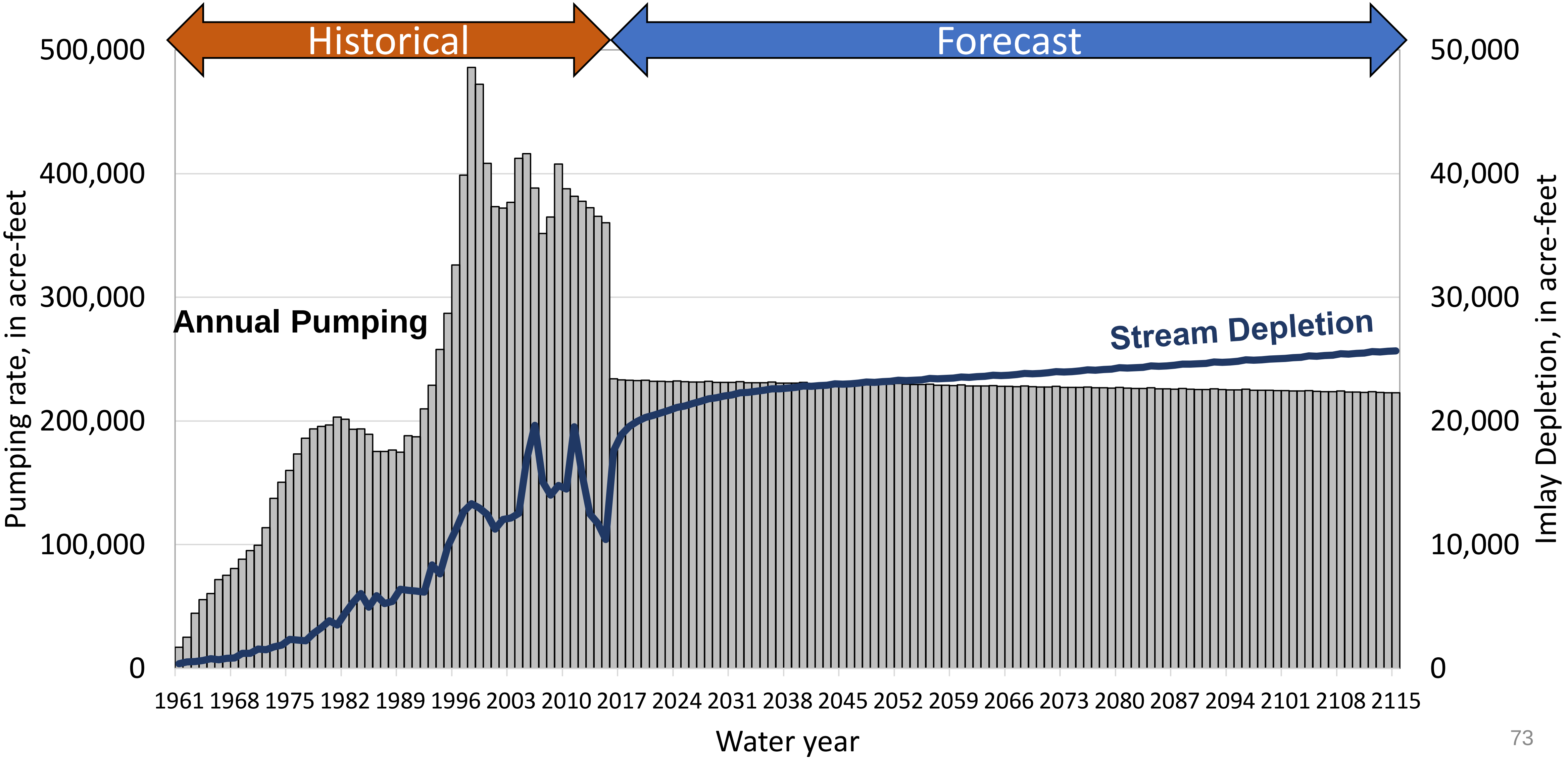




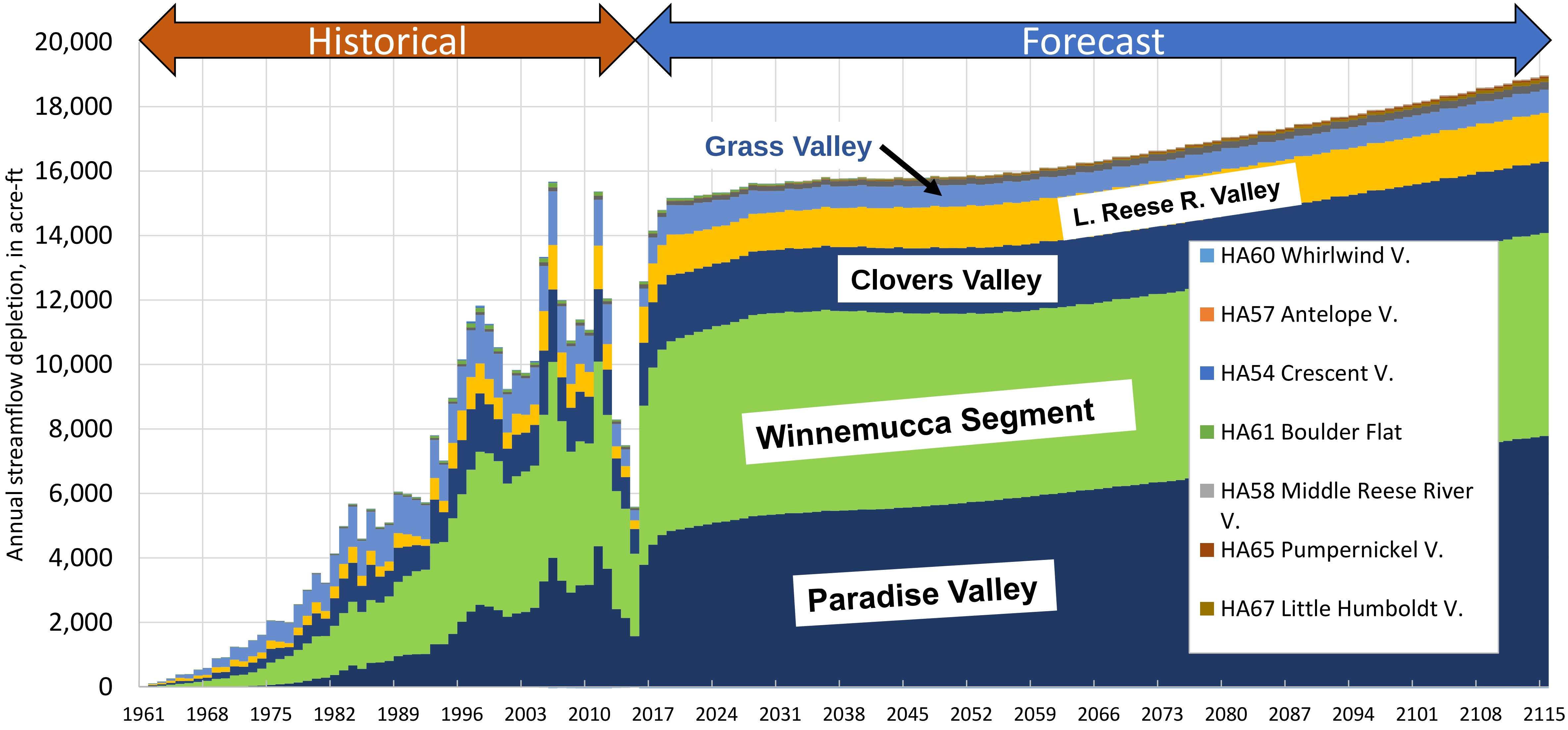
Pumping and Imlay Depletion – All pumping – Same scale



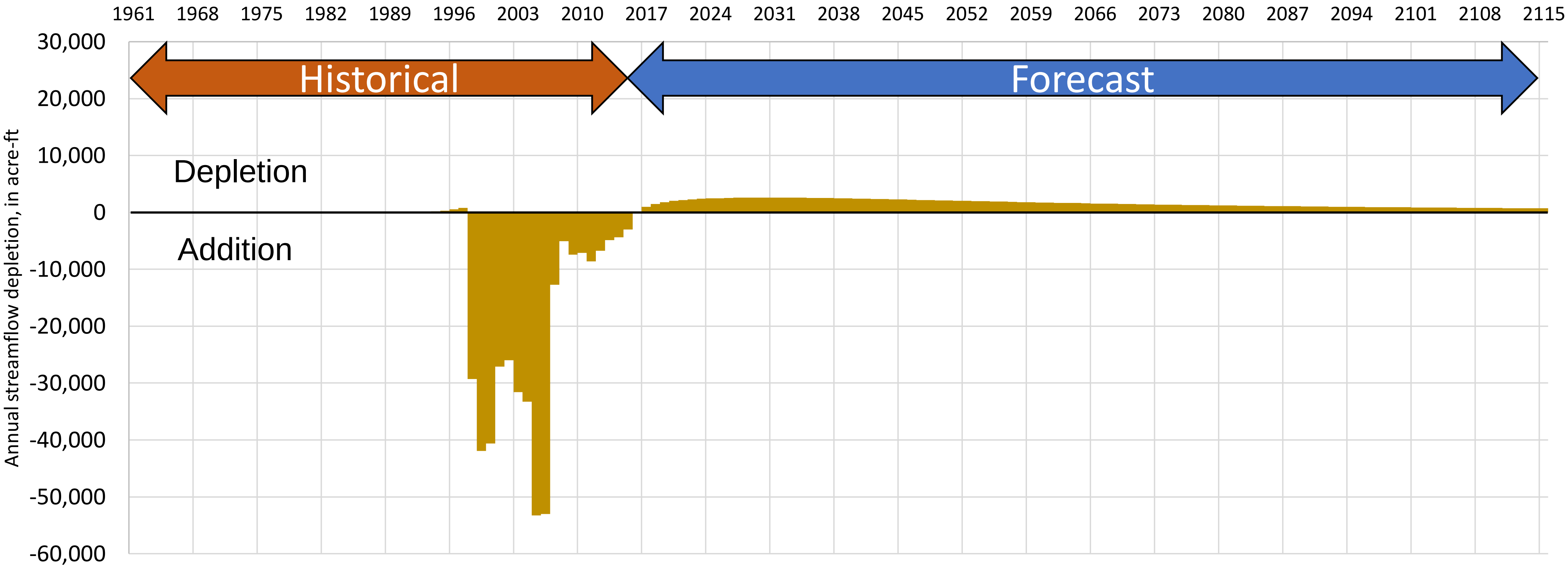
Pumping and Imlay Depletion – All Pumping – Separate scales



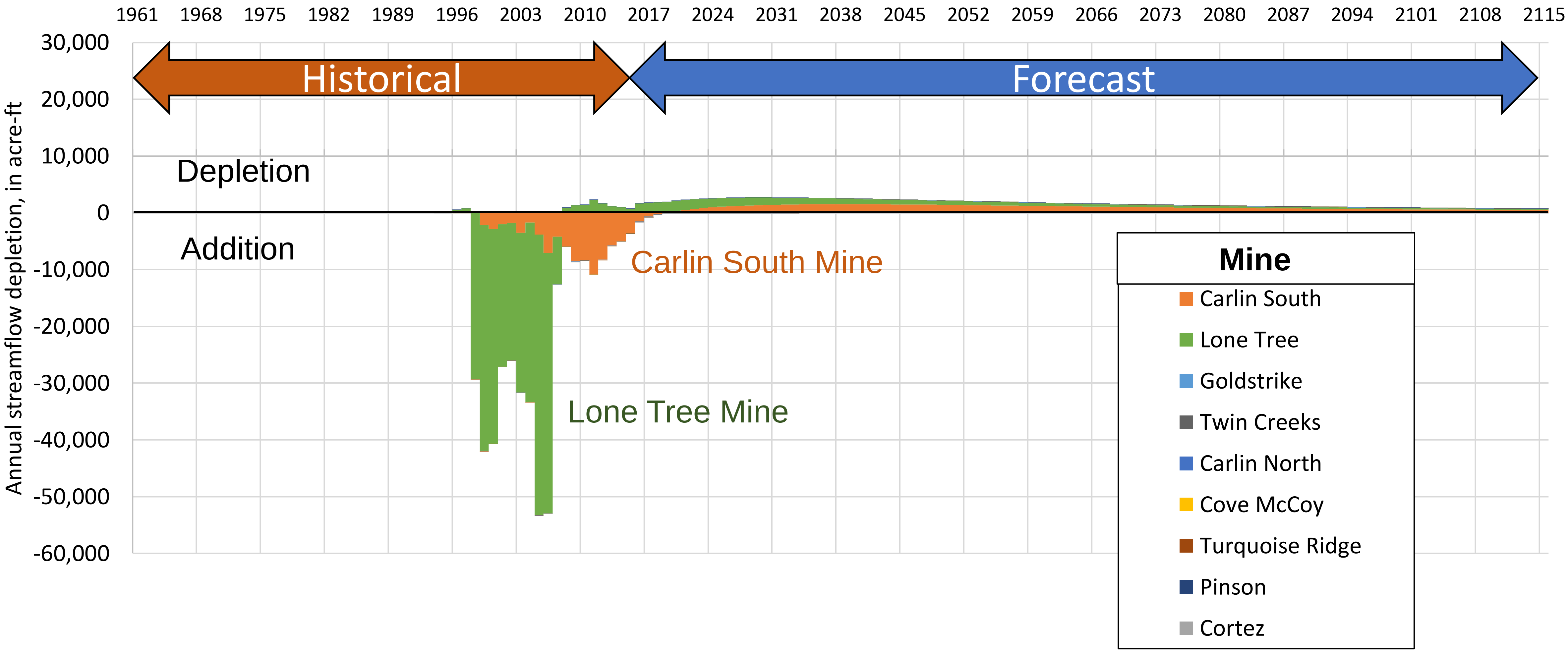
Imlay Depletion by HA – Without Mine Pumping



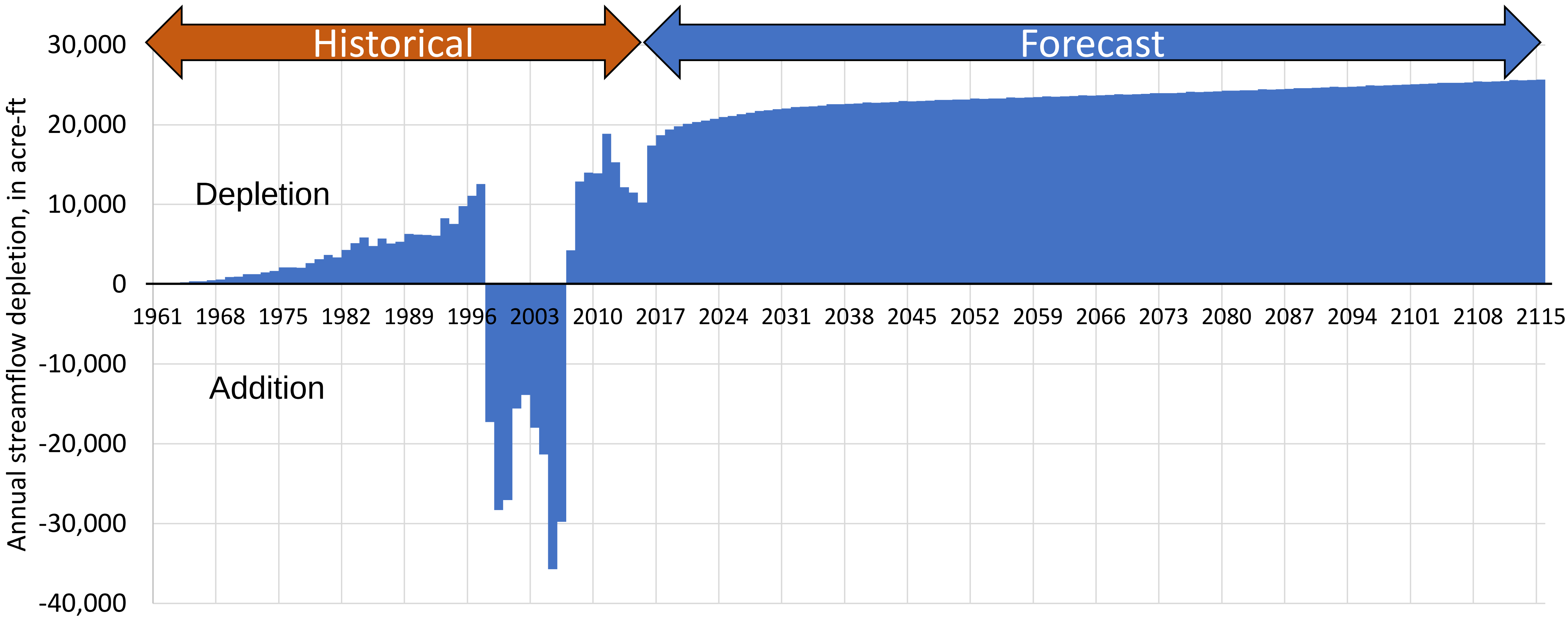
Imlay Depletion from Mine Dewatering (net)



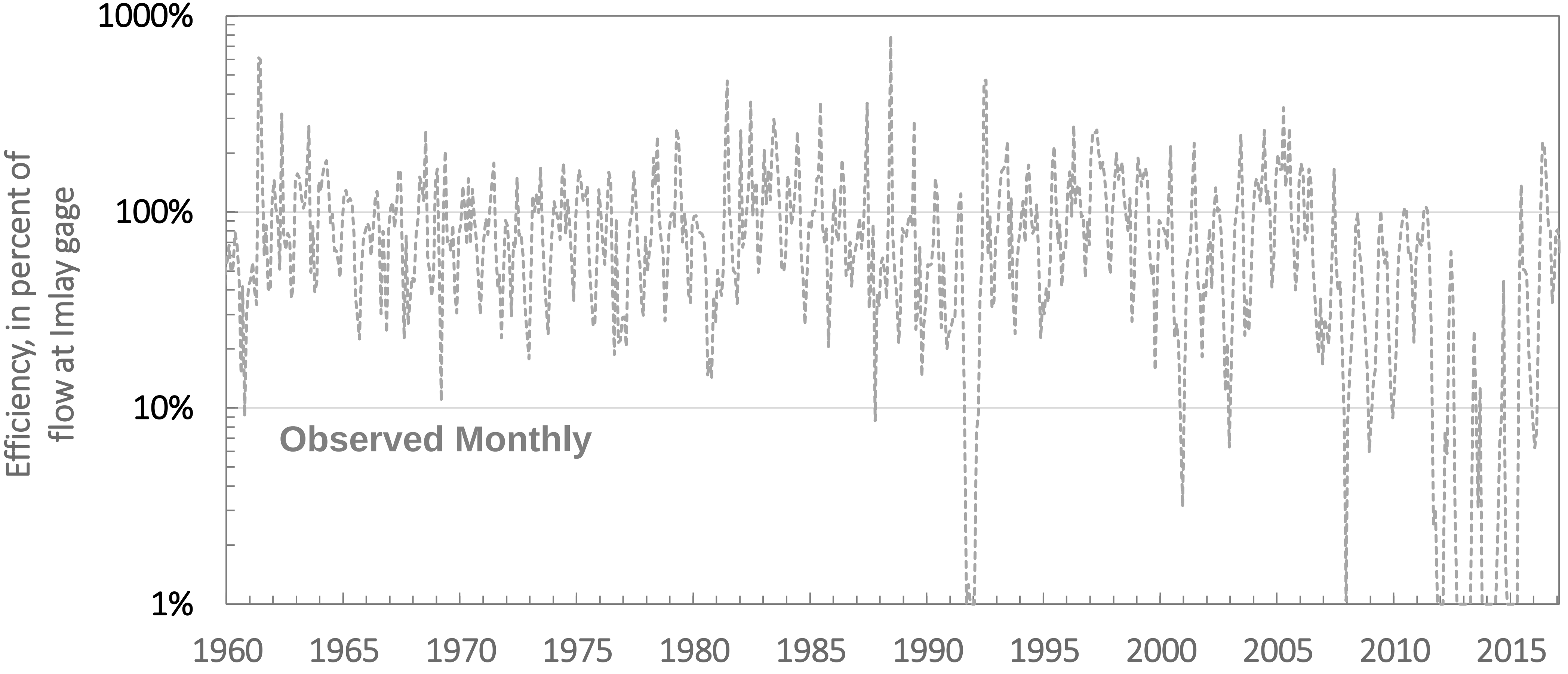
Imlay Depletion by Individual Mines



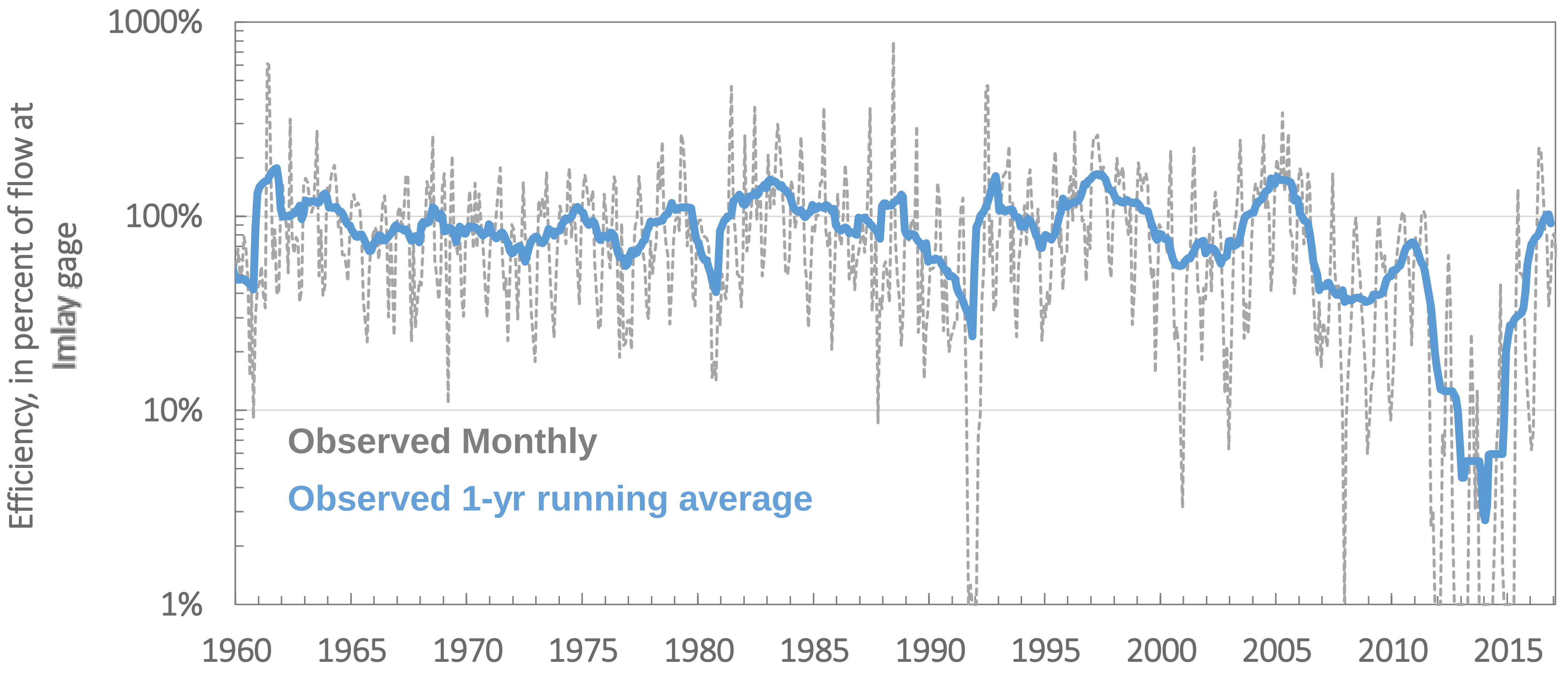
Total Imlay Depletion – All pumping and mine discharge



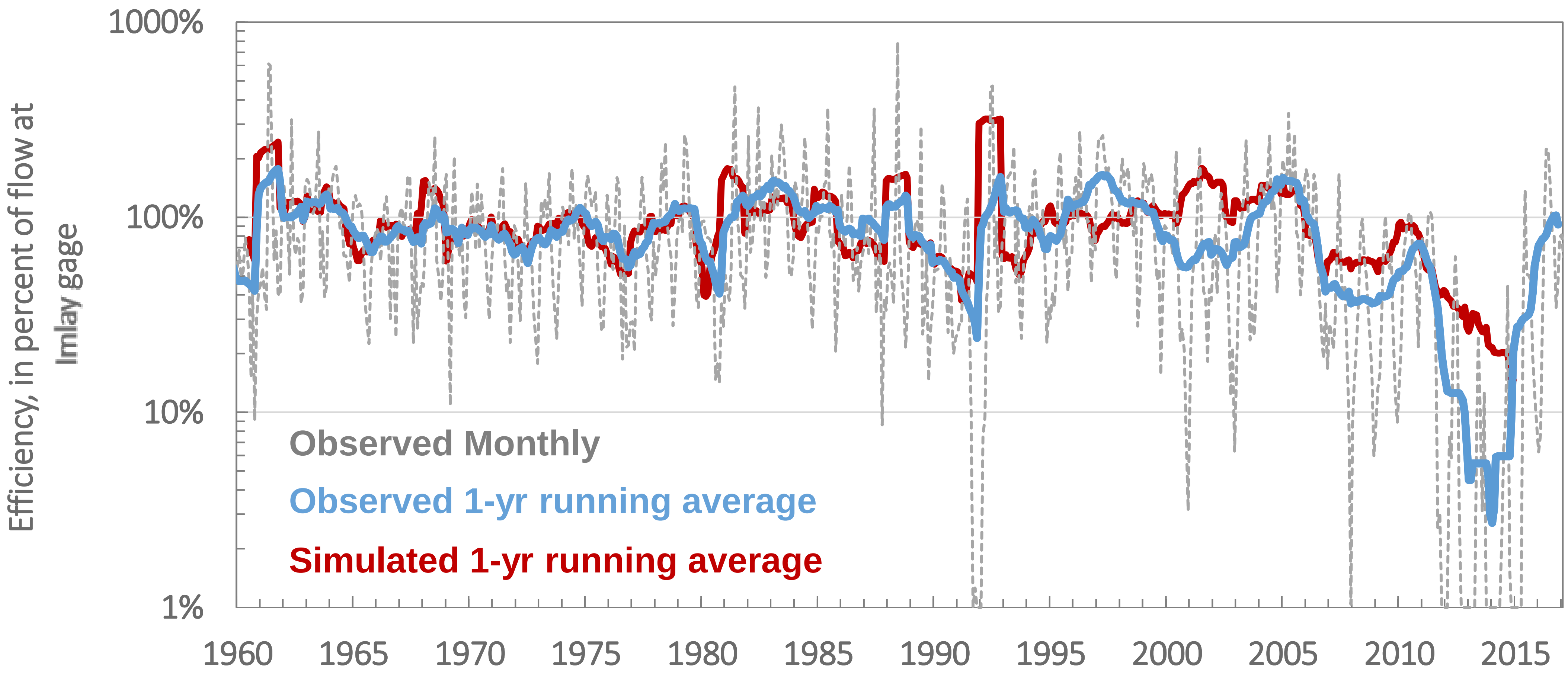
Stream efficiency is defined as percentage of flow at Imlay gage that passed Palisade gage – Observed monthly



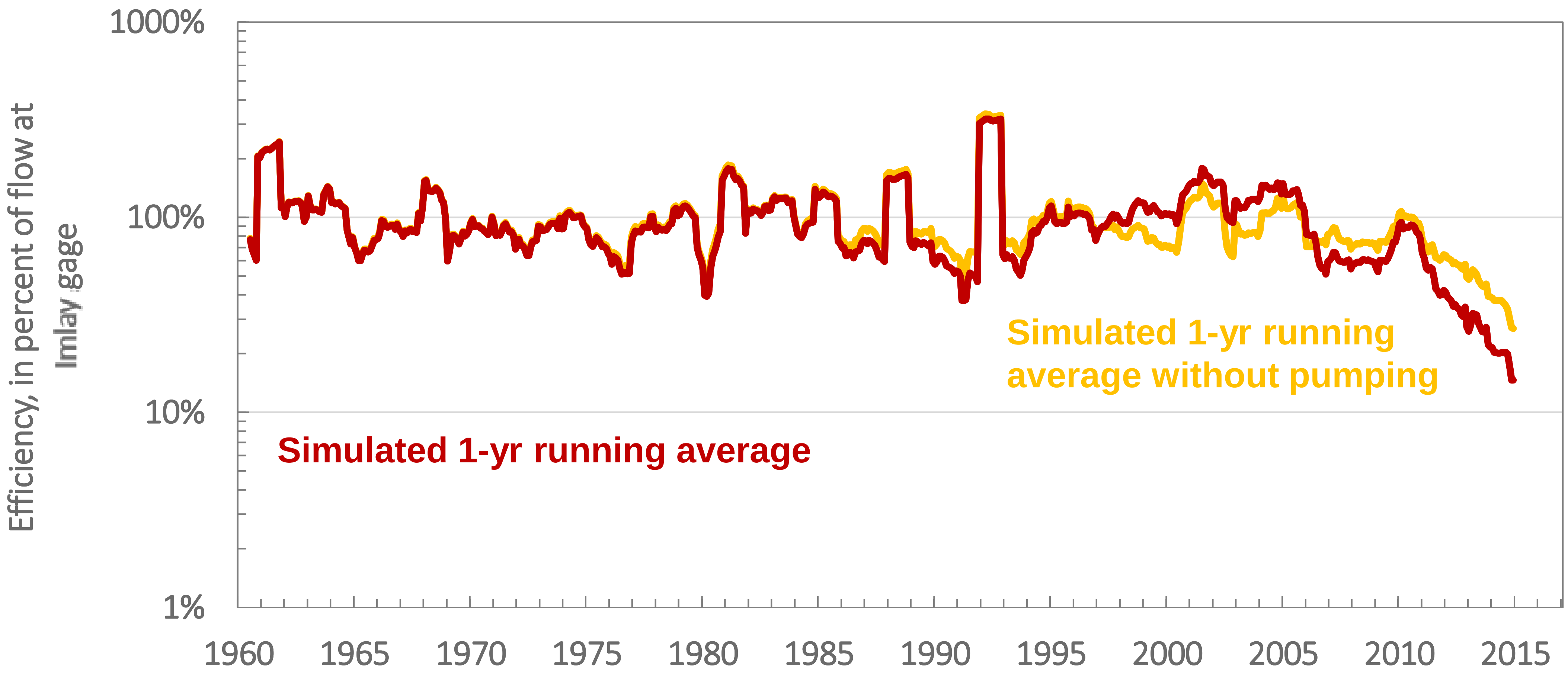
Stream efficiency – Observed monthly with 1-yr running average



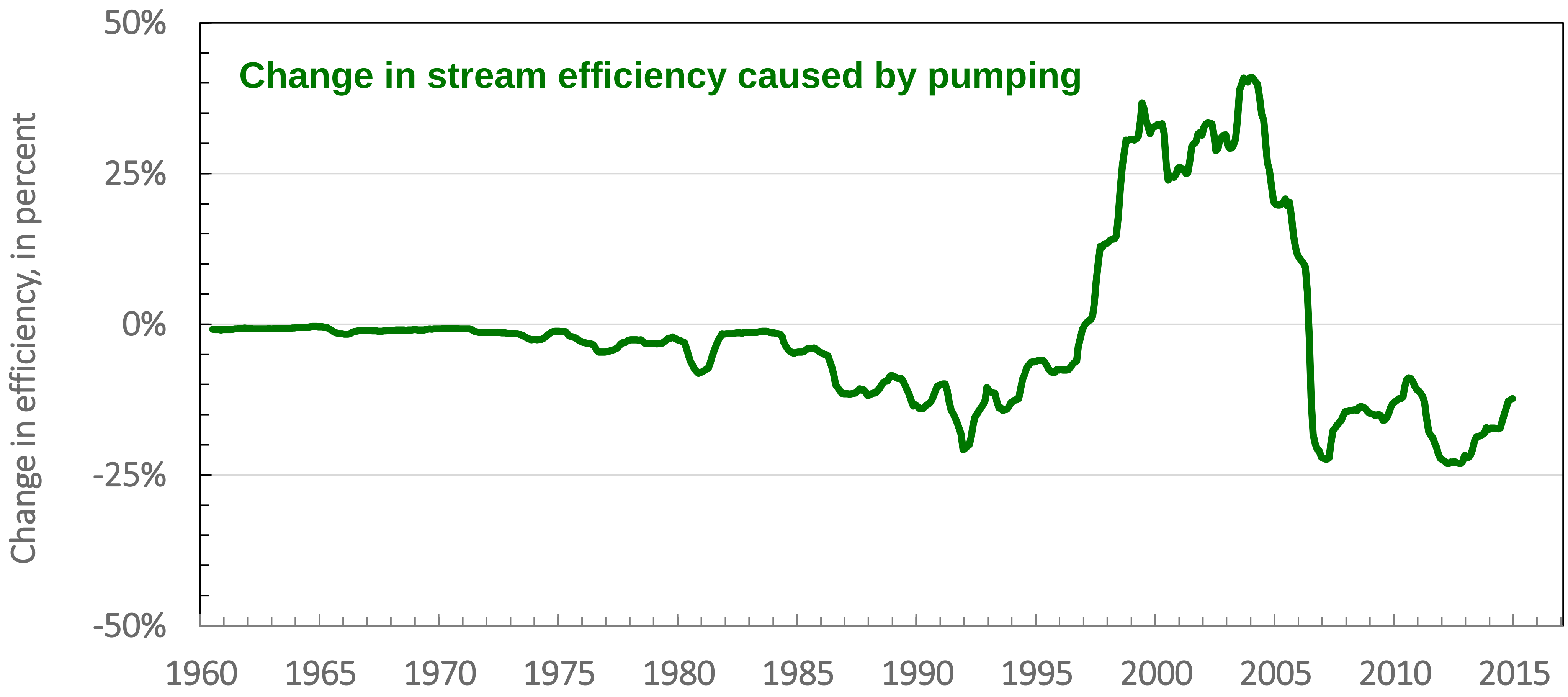
Stream efficiency – Comparing simulated running average with observed running average



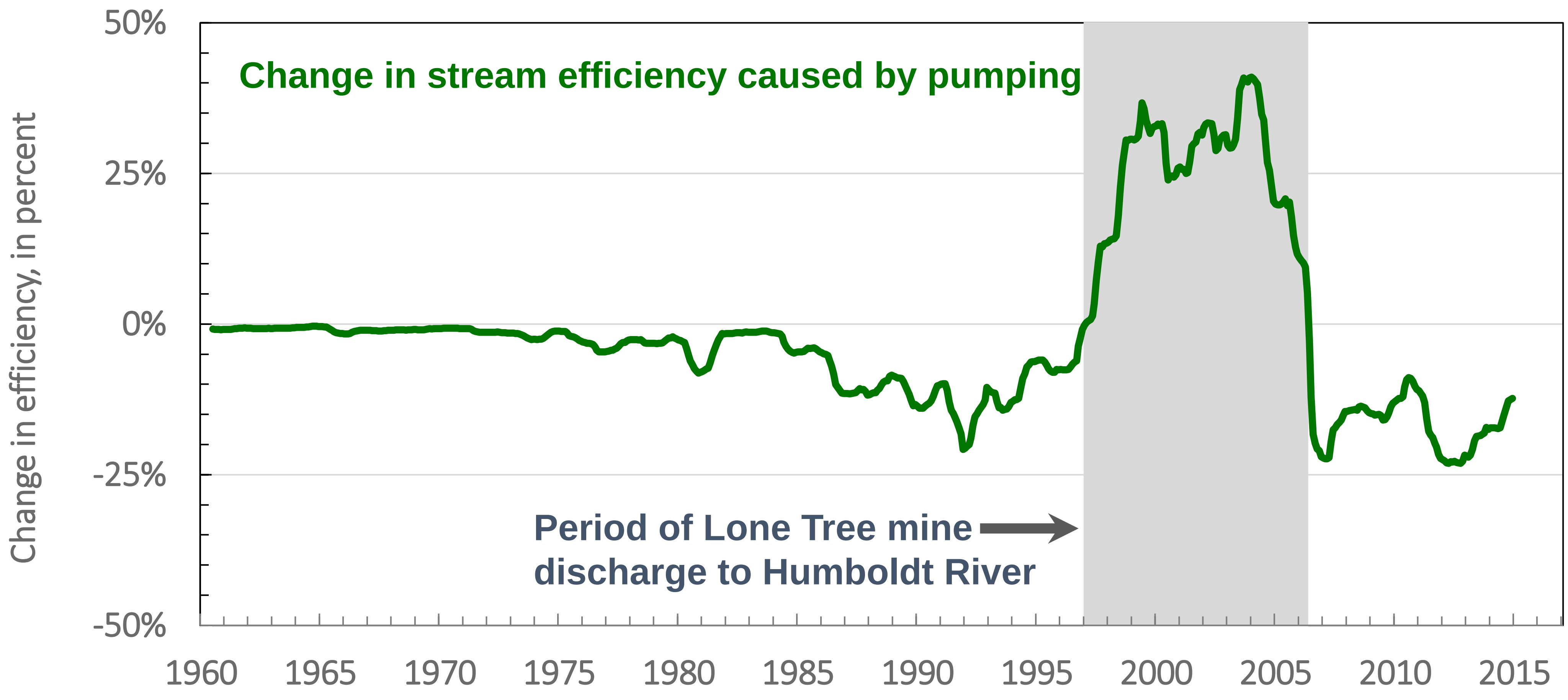
Stream efficiency – Simulated effect of pumping



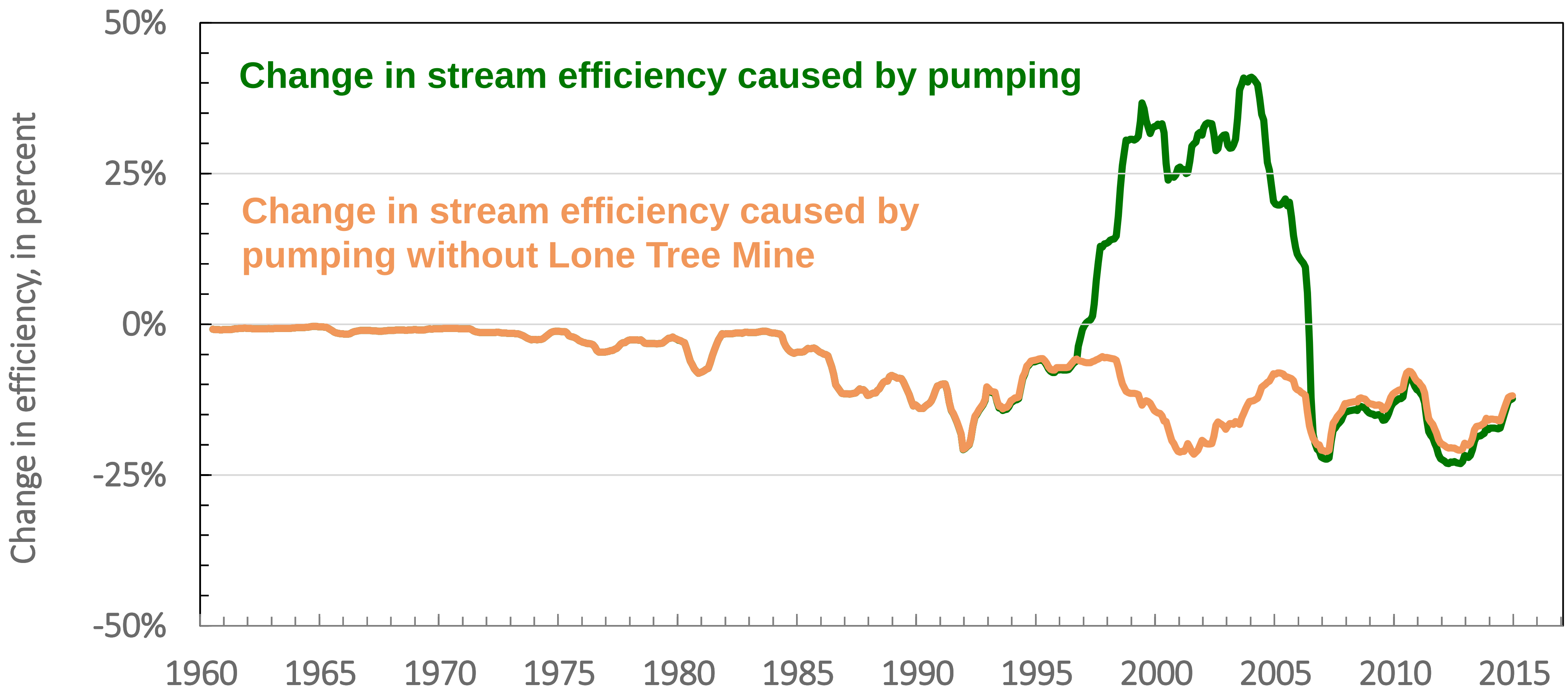
Change in stream efficiency caused by pumping



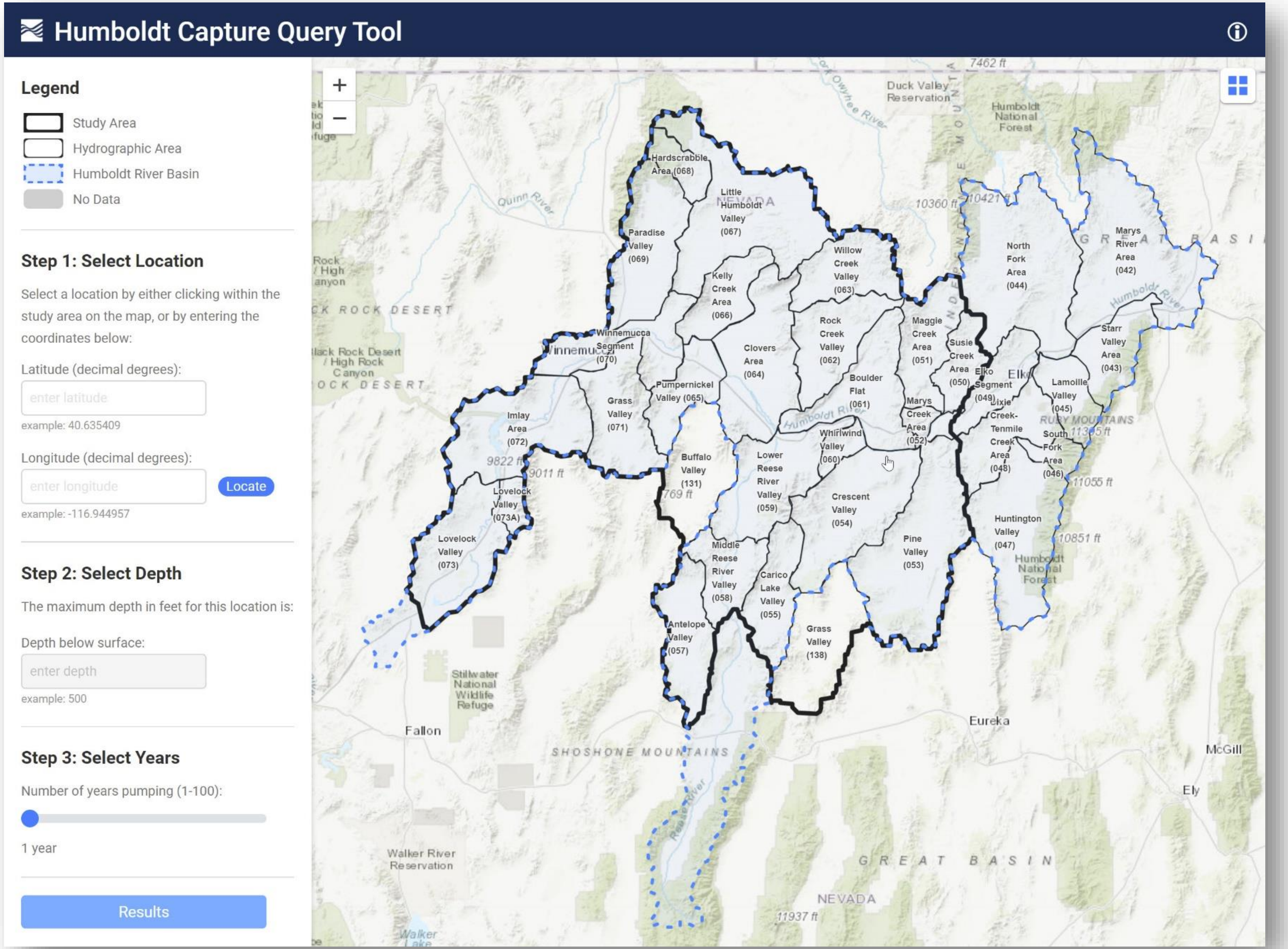
Large increase in stream efficiency in late 1990's and early 2000's was from discharge of Lone Tree Mine into Humboldt River



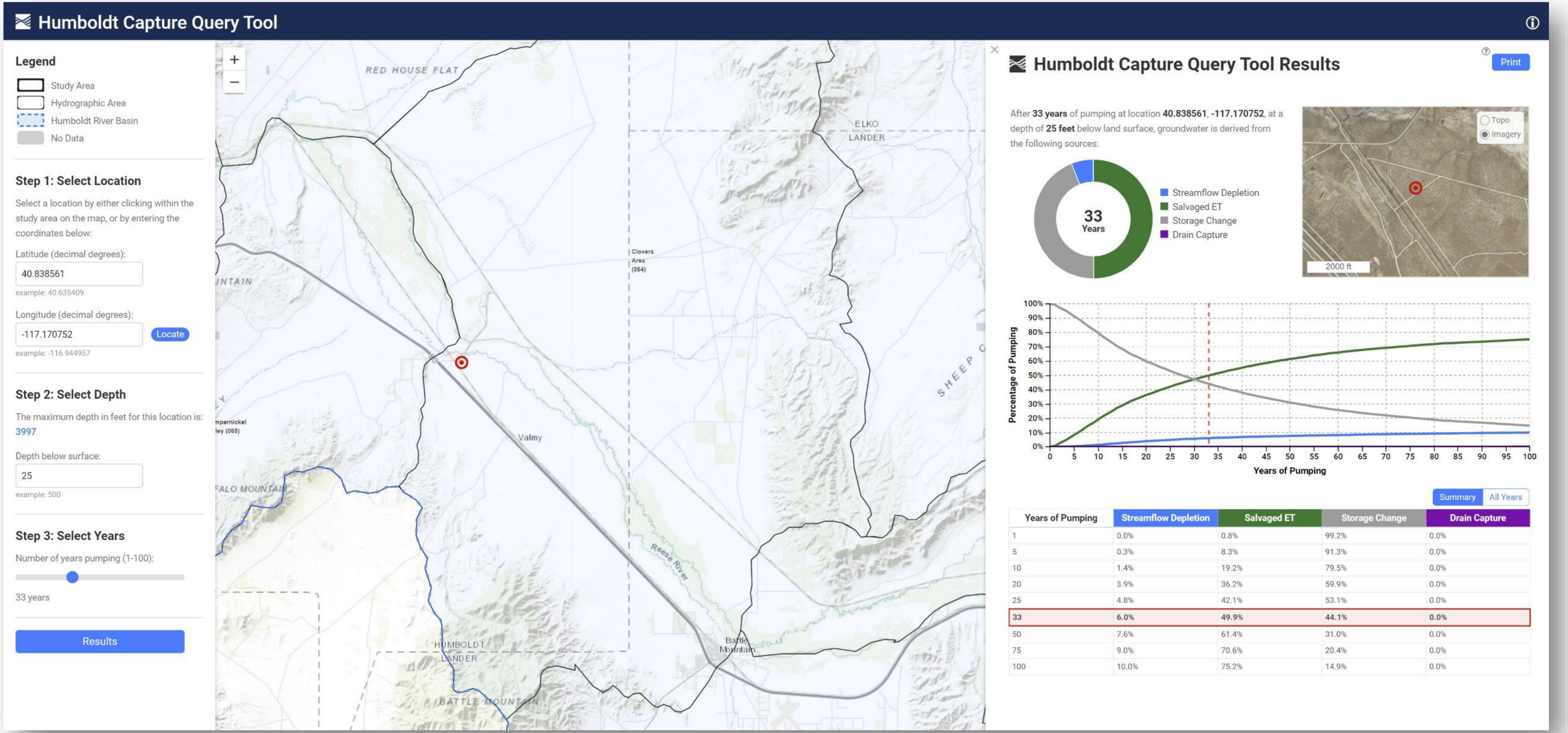
Change in stream efficiency with and without the influence of Lone Tree Mine



Humboldt Capture Query Tool – Query page



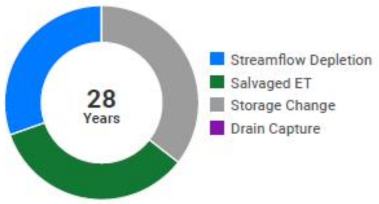
Humboldt Capture Query Tool – Results page

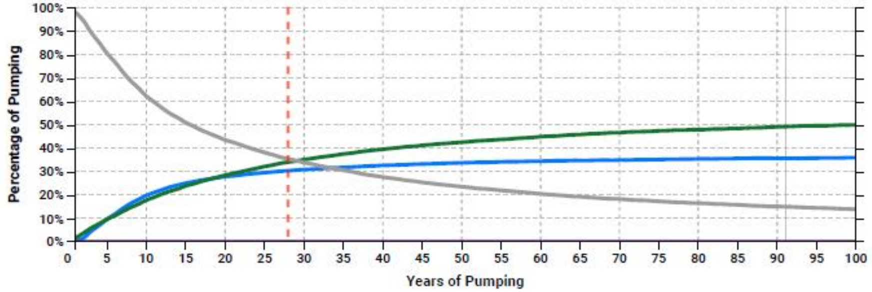


Humboldt Capture Query Tool – Exported results

Humboldt Capture Query Tool Results

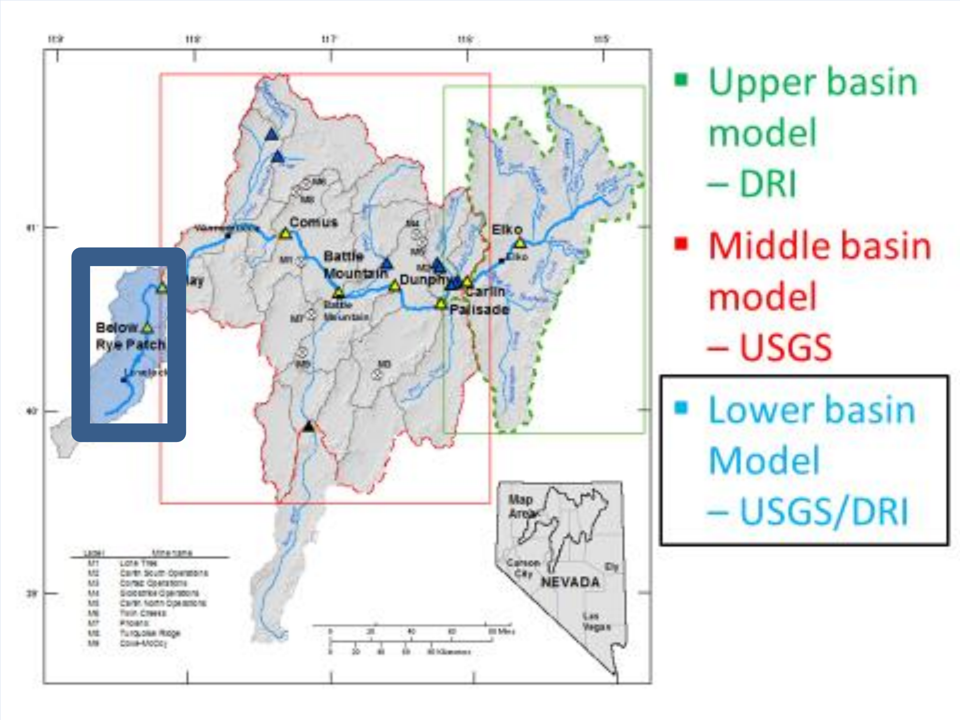
After **28 years** of pumping at location **40.718702, -117.004395**, at a depth of **10 feet** below land surface, groundwater is derived from the following sources:





Years of Pumping	Streamflow Depletion	Salvaged ET	Storage Change	Drain Capture
1	0.1%	1.4%	98.5%	0.0%
5	9.6%	9.6%	80.8%	0.0%
10	19.8%	17.8%	62.4%	0.0%
20	27.9%	28.5%	43.6%	0.0%
25	29.6%	32.2%	38.2%	0.0%
28	30.4%	34.1%	35.5%	0.0%
50	33.8%	42.6%	23.6%	0.0%
75	35.2%	47.5%	17.3%	0.0%
100	36.0%	50.1%	13.9%	0.0%

Lower Humboldt River Basin Model



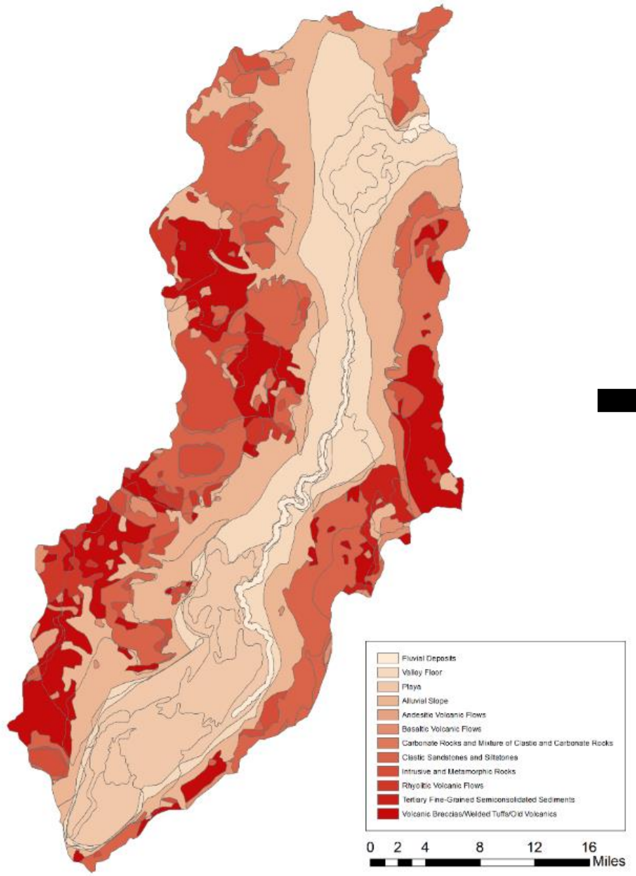
DRI/USGS

Lower Humboldt River Basin Model Update

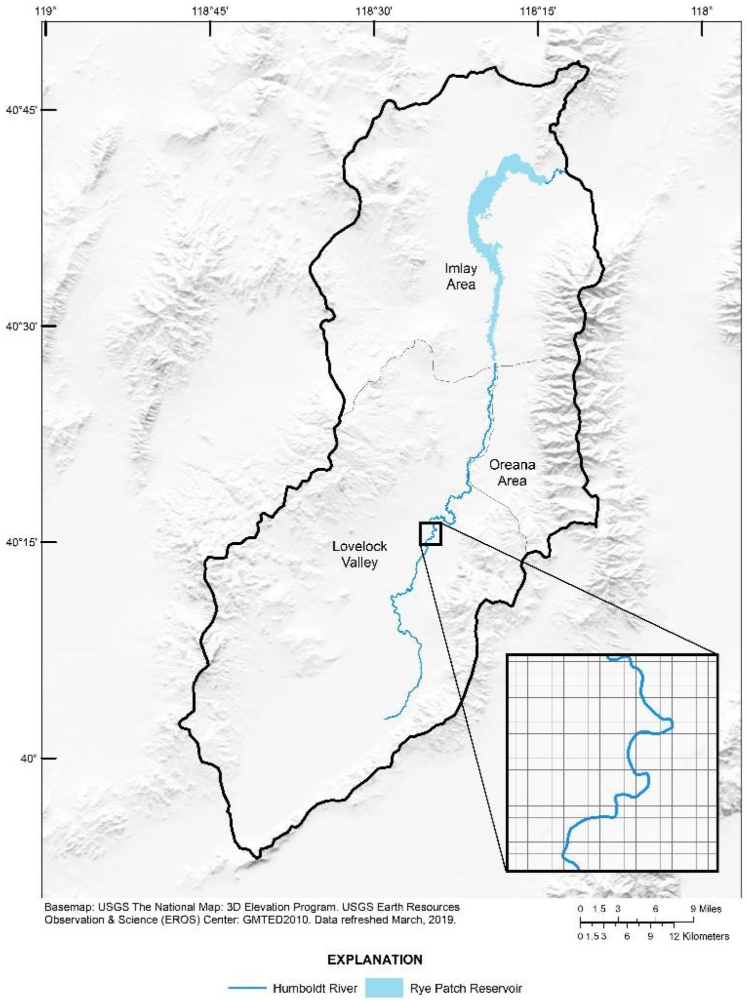
Susie Rybarski/Cara Nadler
February 4, 2021
DRI/USGS

*** Model results are provisional and subject to change***

Model Domain



Modified from Maurer and others (2004)



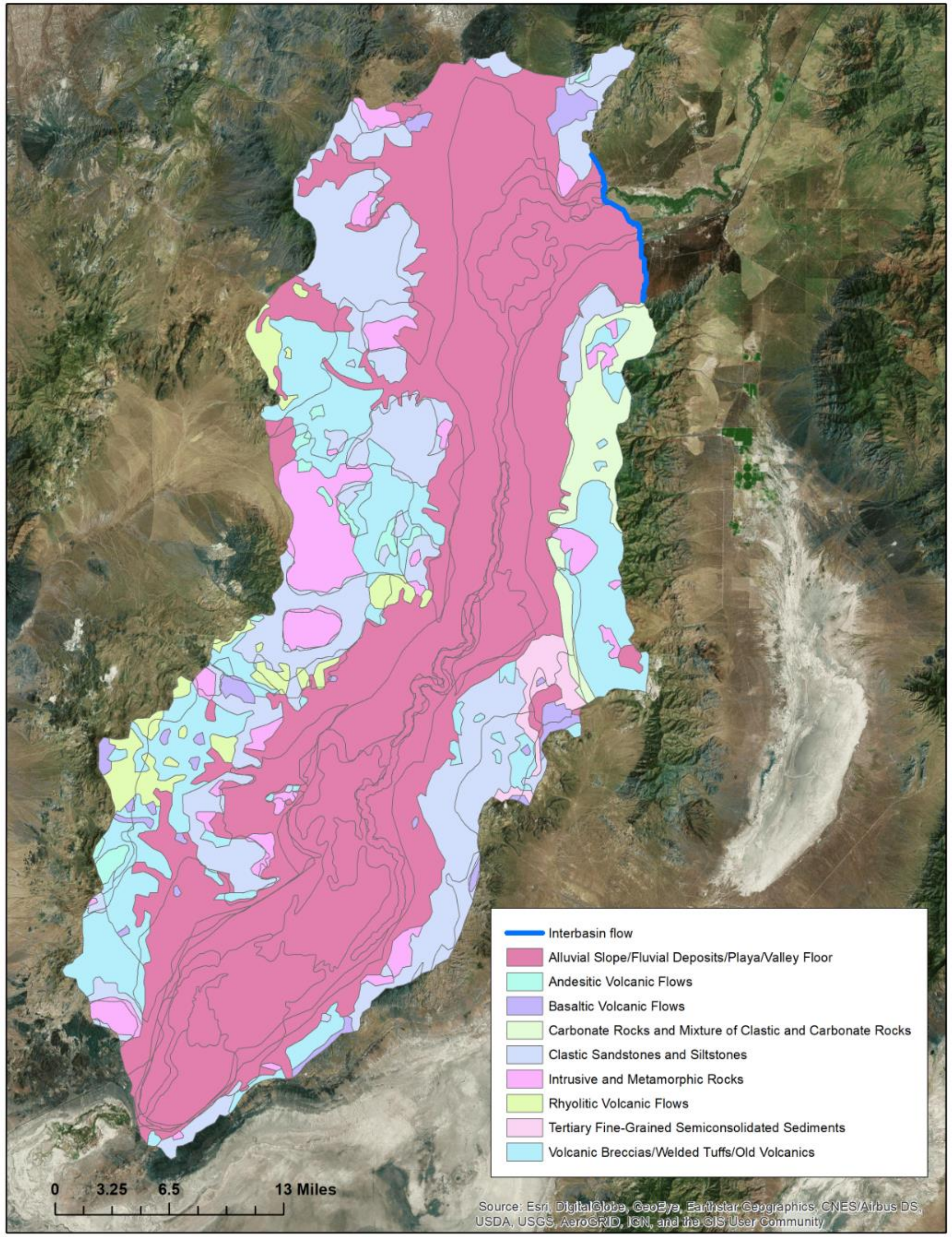
- 500 ft grid cell resolution
- Includes mountain block/bedrock
- 3 layers, generally representing clay (layer 1), alluvium/valley fill (layer 2), bedrock (layer 3)
- Thickness of clay layer set to 50 feet
- Depth to basement based on Ponce and Damar (2017) and used to define elevation of top of layer 3, with a minimum depth of 20 feet bls.

Lakes and River

- Humboldt River simulated using River package (RIV)
- Rye Patch Reservoir simulated as a constant head boundary (CHD), using mean stage for steady state (SS) model.
- Pitt-Taylor Reservoirs, Toulon Lake, and Humboldt Lake not simulated as they are frequently dry and heads are unknown.
- Mean annual stages applied to transient model.
- River conductance calibrated to estimated steady-state river loss of 9,900 acre-feet/year (AFA)
- 6,000-14,000 AF mean annual reservoir loss to bank storage; loss to aquifer unknown (Eakin, 1962; Fereday and Nash, 2017). Simulated loss of 100 AFA determined by model given calibration to ET in Imlay area and local heads.

Interbasin Flow

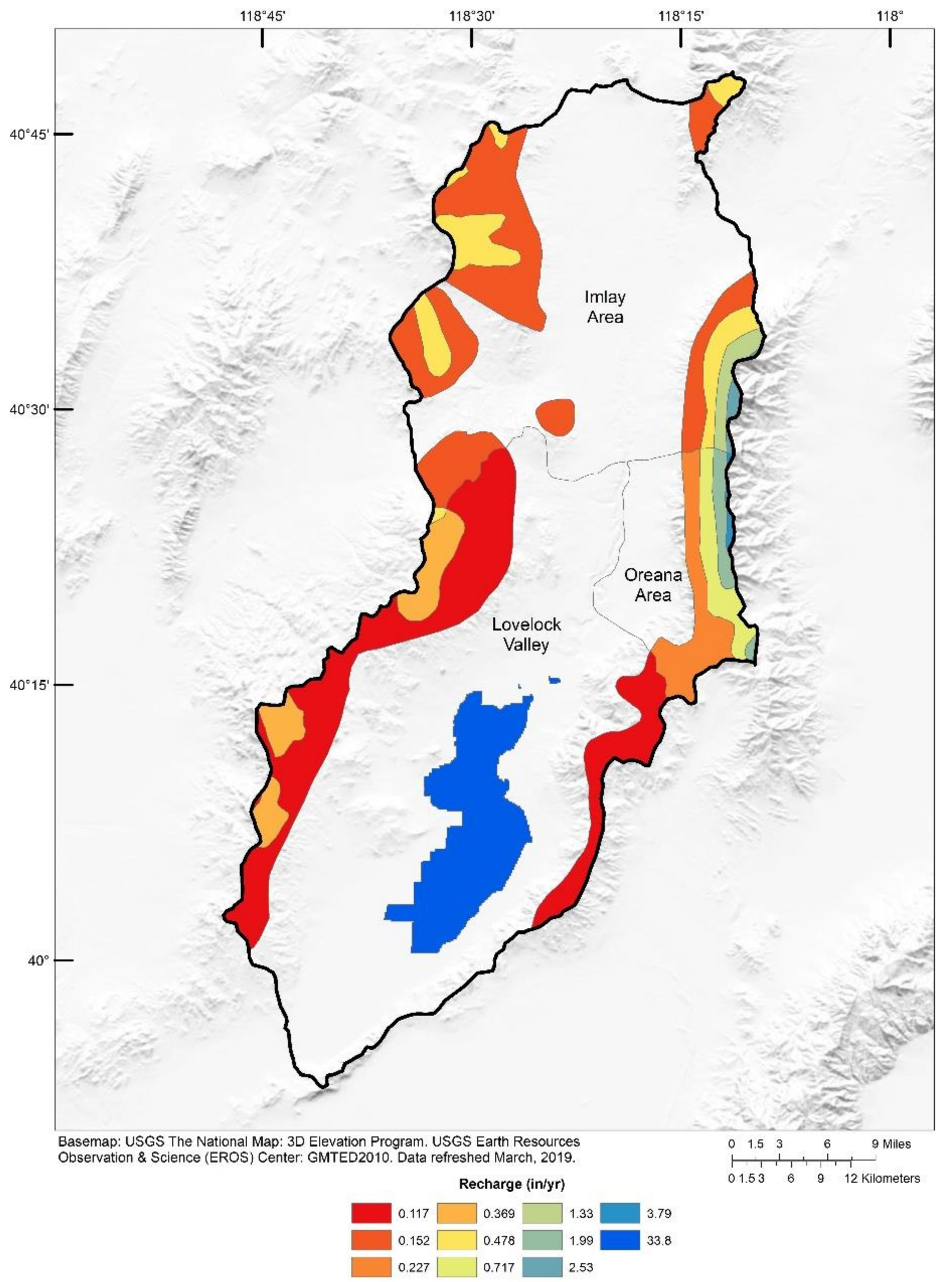
- Specified flux boundary applied along shared boundary with Middle Humboldt model
- Limited to extent of alluvial slope/fluvial deposits/playa/valley floor
- SS flux of 771 AFA based on current outflow from Middle Humboldt model



Steady State Recharge

	Mountain Block Recharge (afy)				
Reference	Lovelock	Oreana	Imlay	Model Domain	Methodology
Everett and Rush, 1965	1,200	2,000	--	--	Maxey-Eakin, 1949
Eakin, 1962	--	--	4,000	--	Maxey-Eakin, 1949

- Mountain block recharge estimates from Recon Reports distributed proportionally over Hardman map intervals
- Ag recharge rate applied as median of 1960-1990 regression (127,800 AFA)
- Simulated mountain block recharge = 5,700 AFA

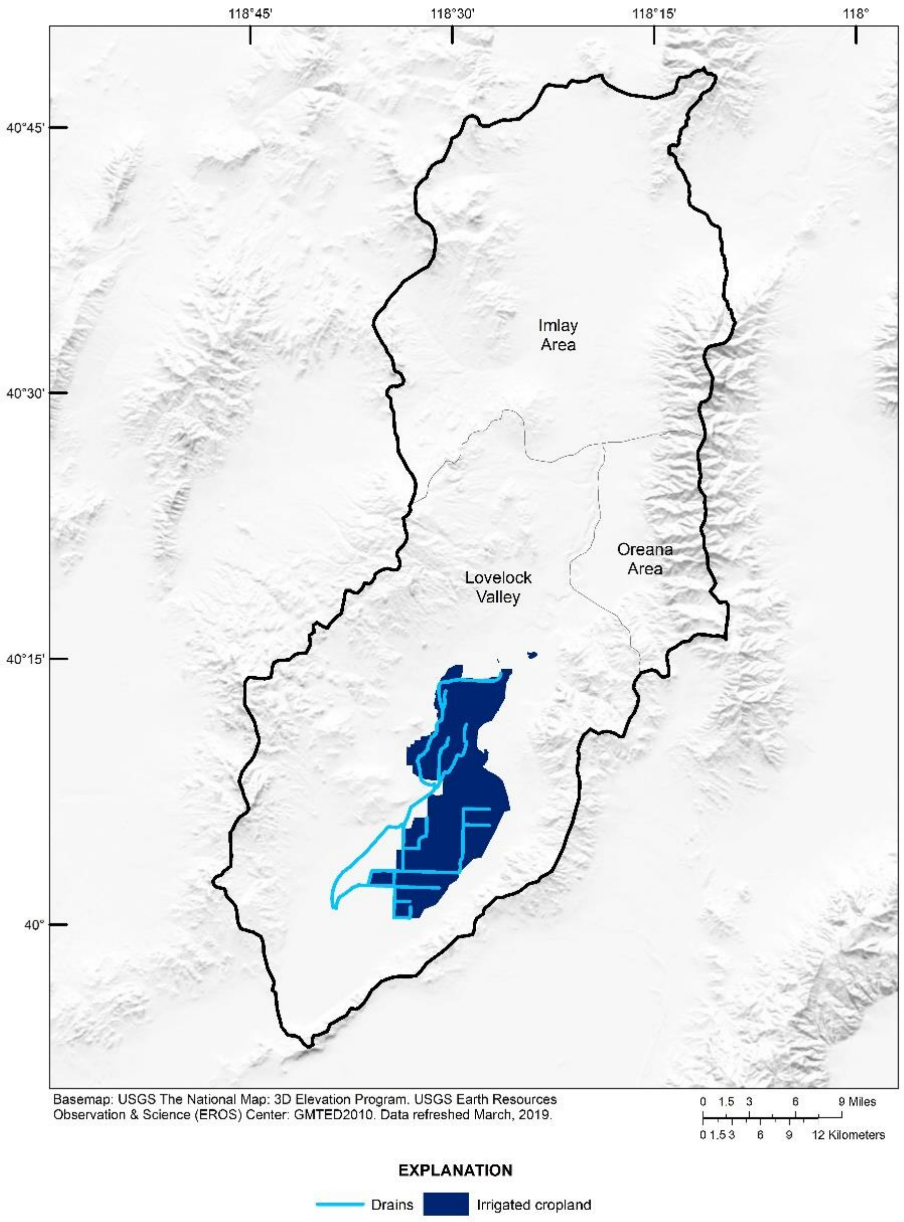


Drains

- Represents ag runoff/recharge lost to sink; simulated using Drain (DRN) package

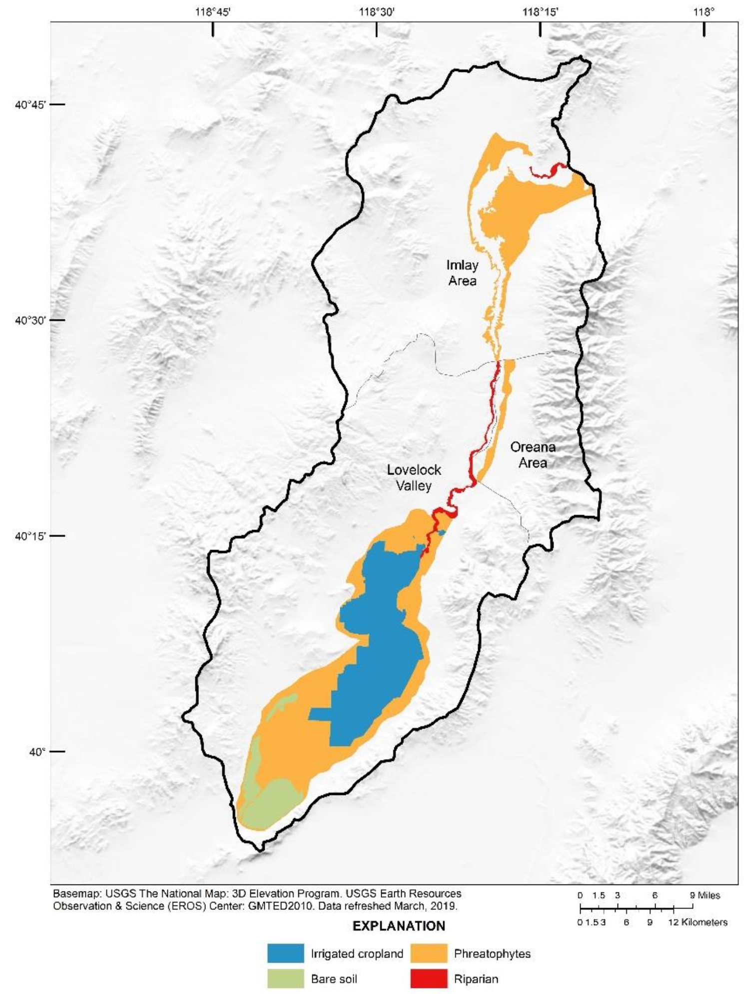
- Drain bottoms set to 9 ft bls

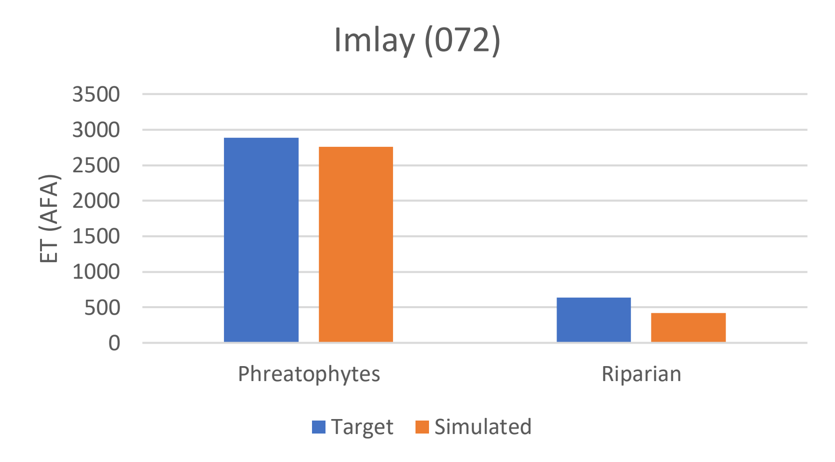
- Drain outflow estimated to be ~18,000 AFA

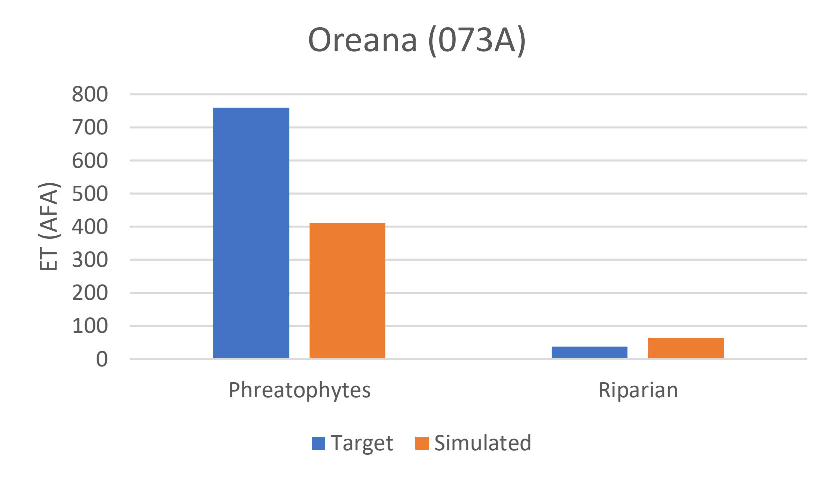


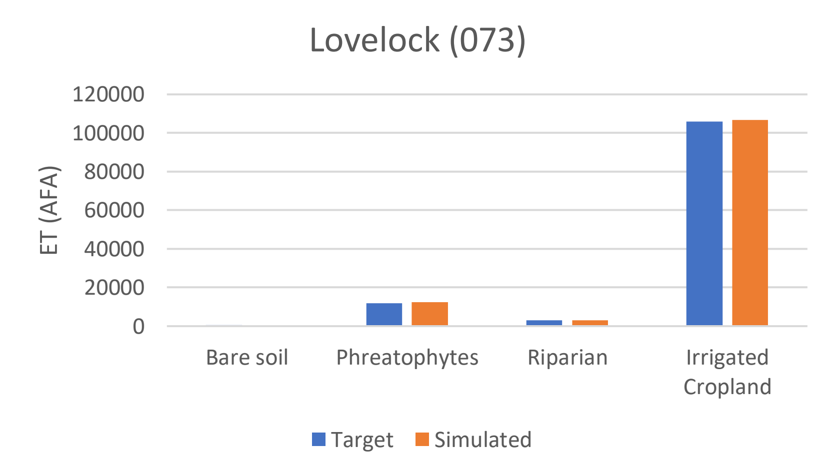
Evapotranspiration

- ET zones applied over DRI polygons, estimated at 126,000 AFA.

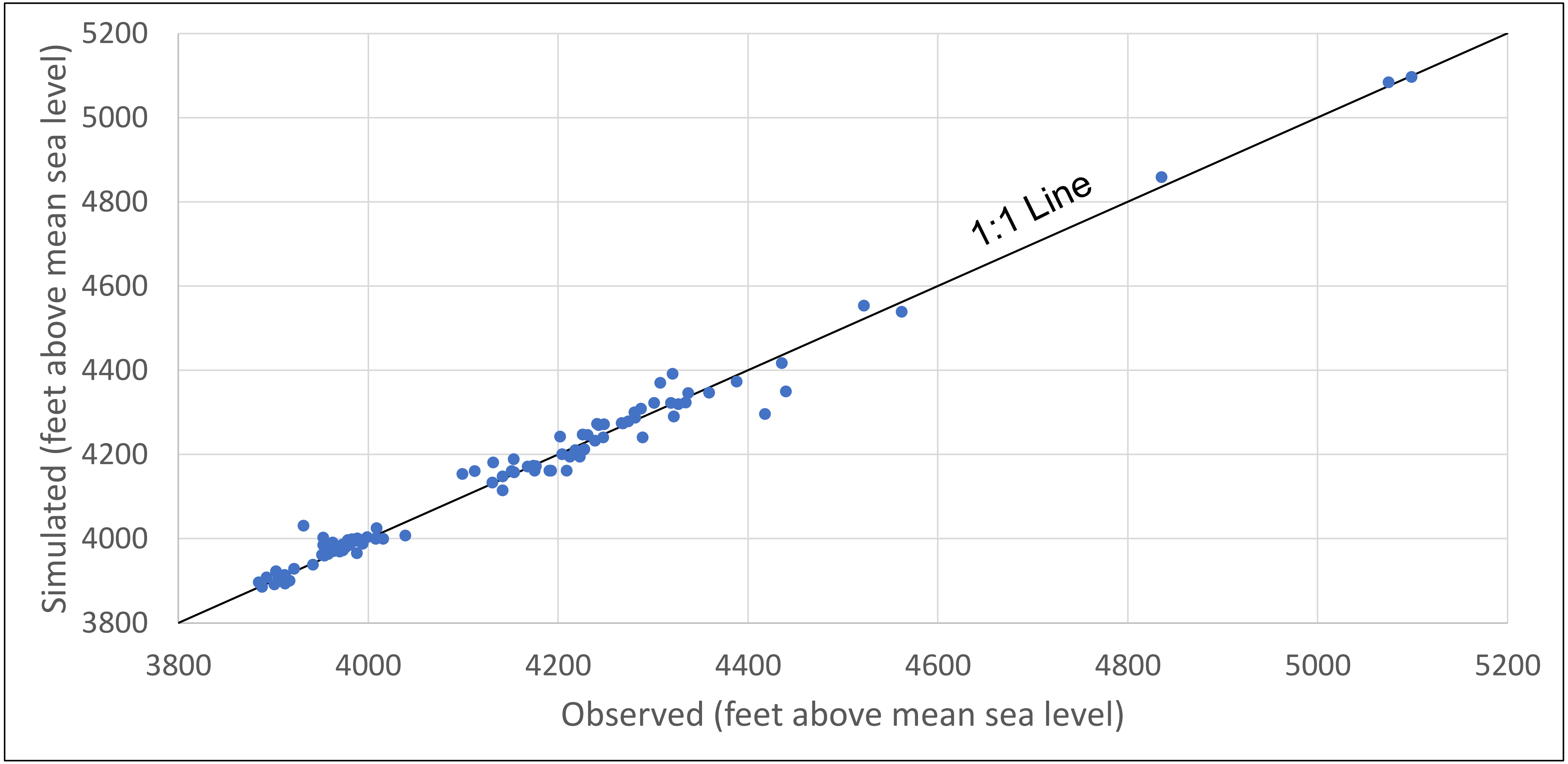






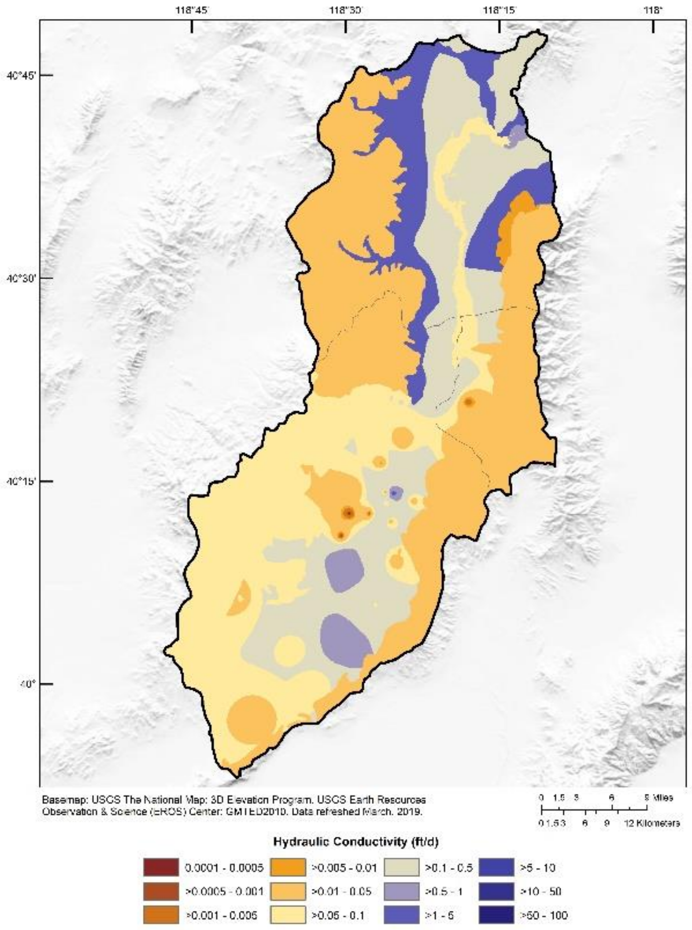


SS Model Calibration

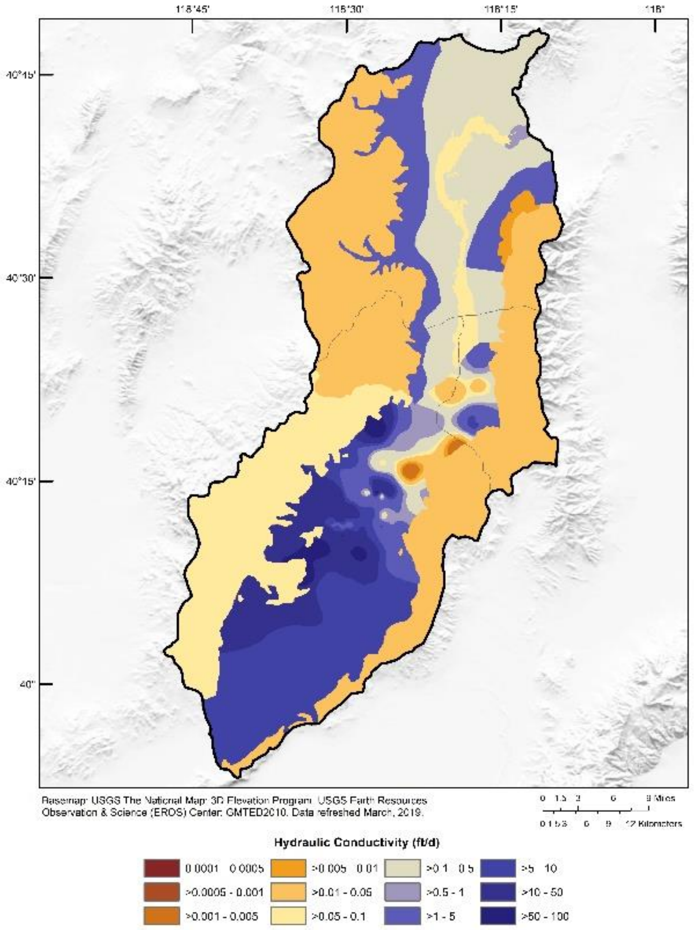


Hydraulic Conductivity

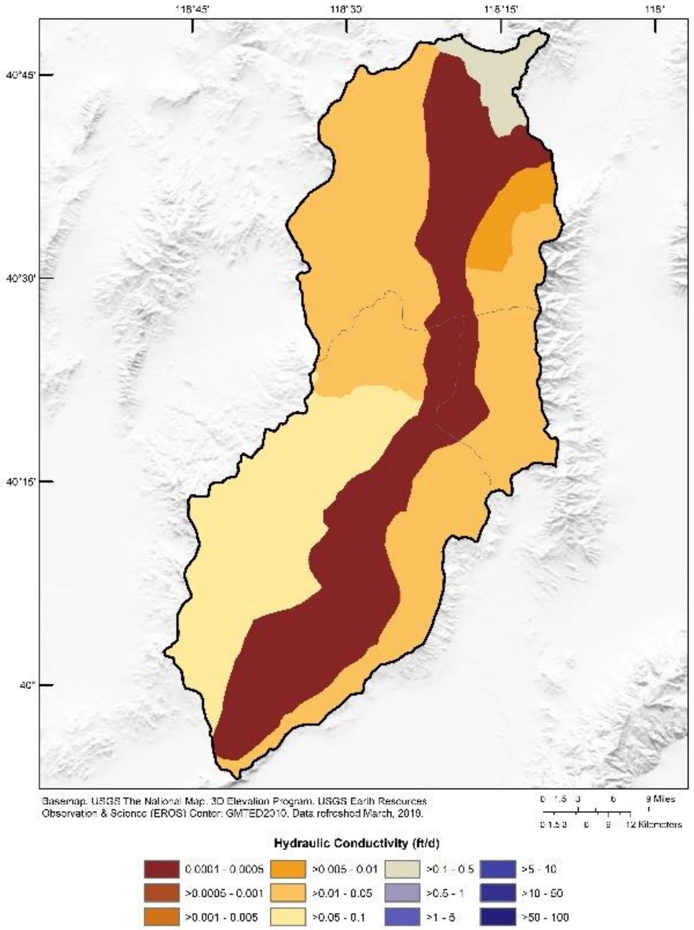
Layer 1



Layer 2



Layer 3



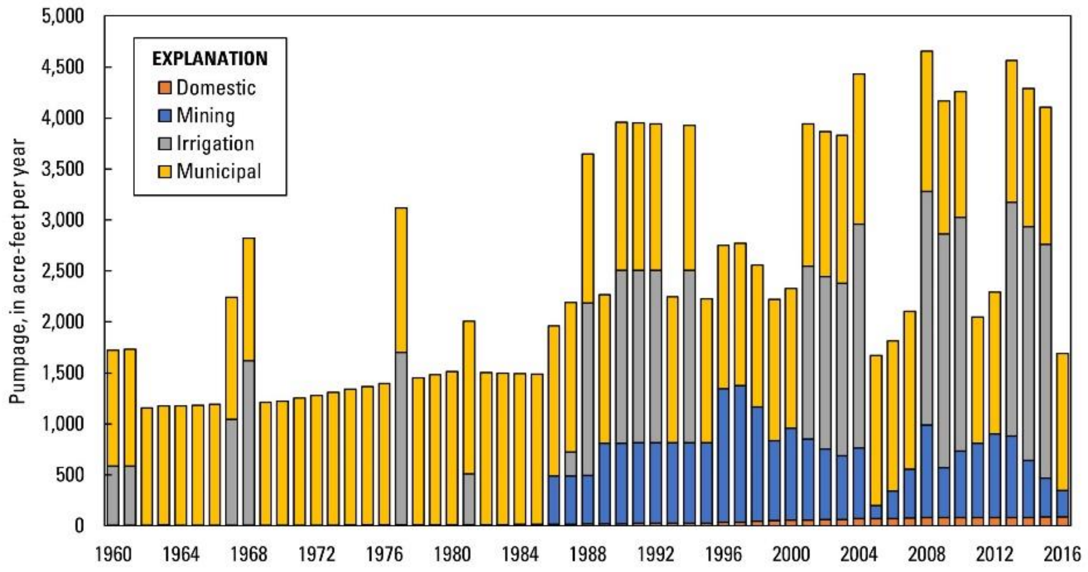
Steady State Flow Budget

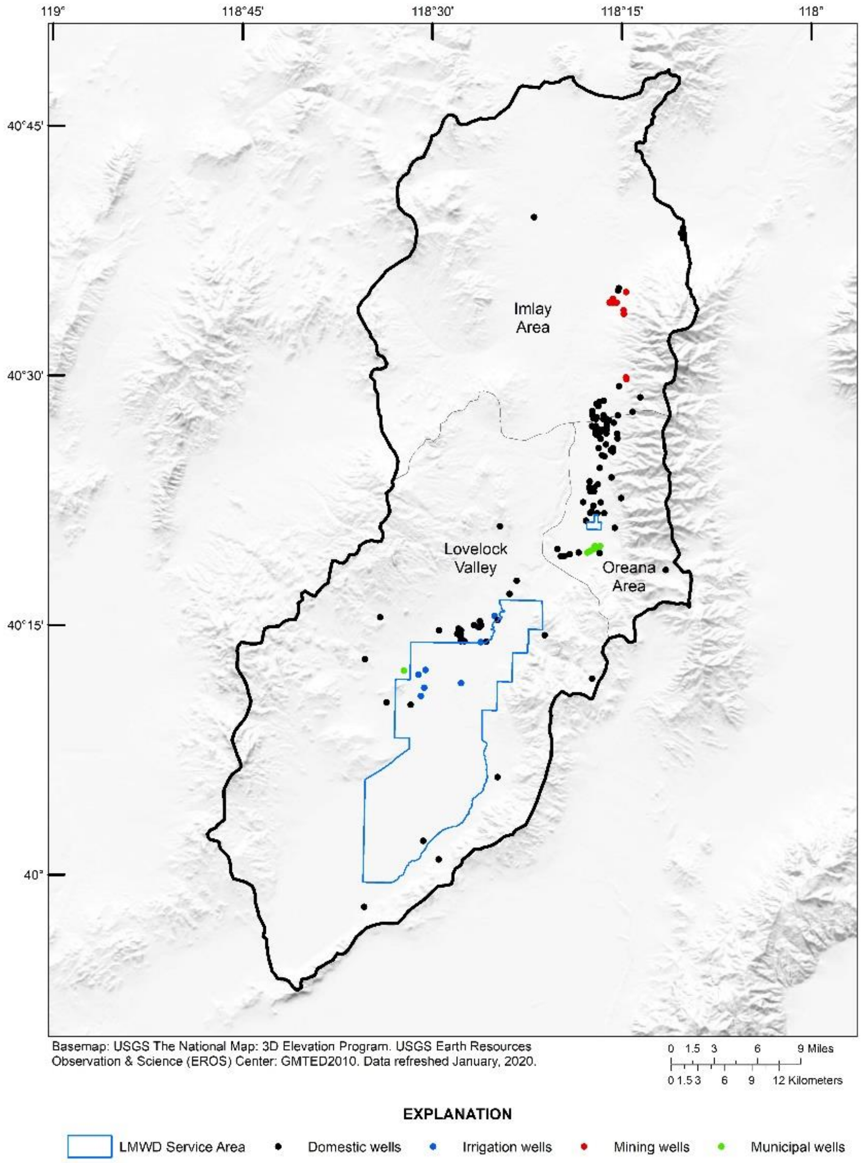
Inflows	Target (AFA)	Simulated (AFA)
Recharge (Mountain block + Total Ag)	133,500	133,500
Reservoir Loss	<14,000	100
River Loss	9,900	9,900
Interbasin Flow	800	800
Total	144,200 + reservoir loss	144,300

Outflows	Target (AFA)	Simulated (AFA)
Evapotranspiration	126,000	125,900
Drains	18,200 + reservoir loss	18,400
Total	144,200 + reservoir loss	144,300

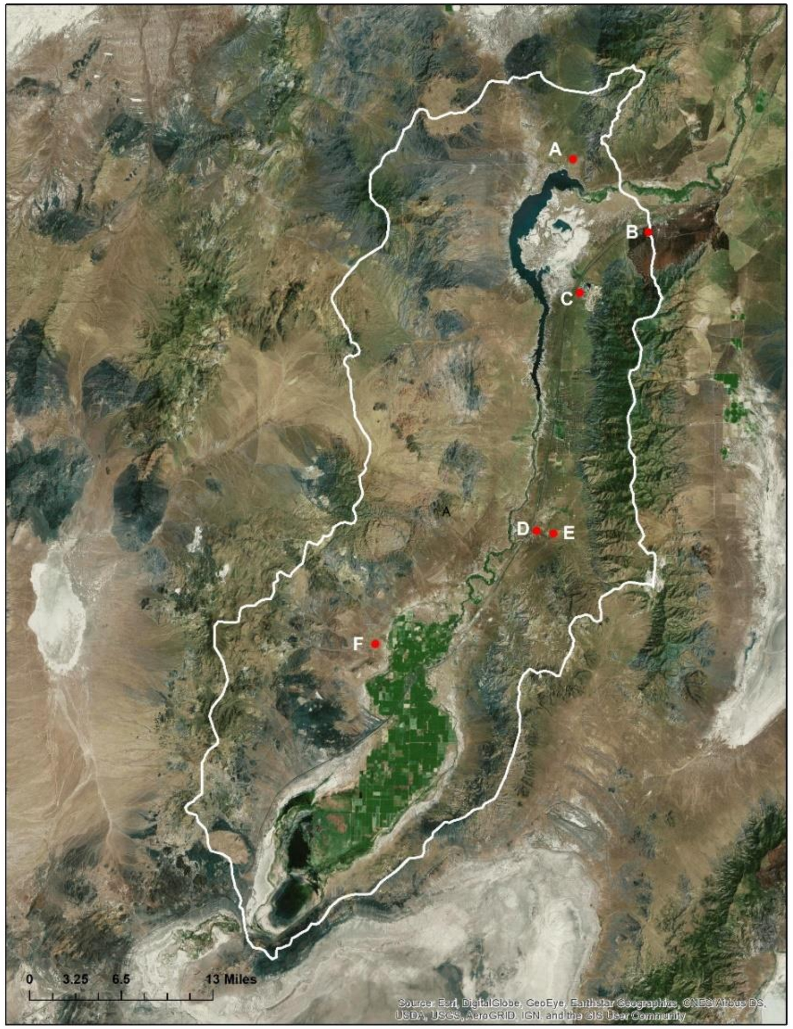
Transient Pumping

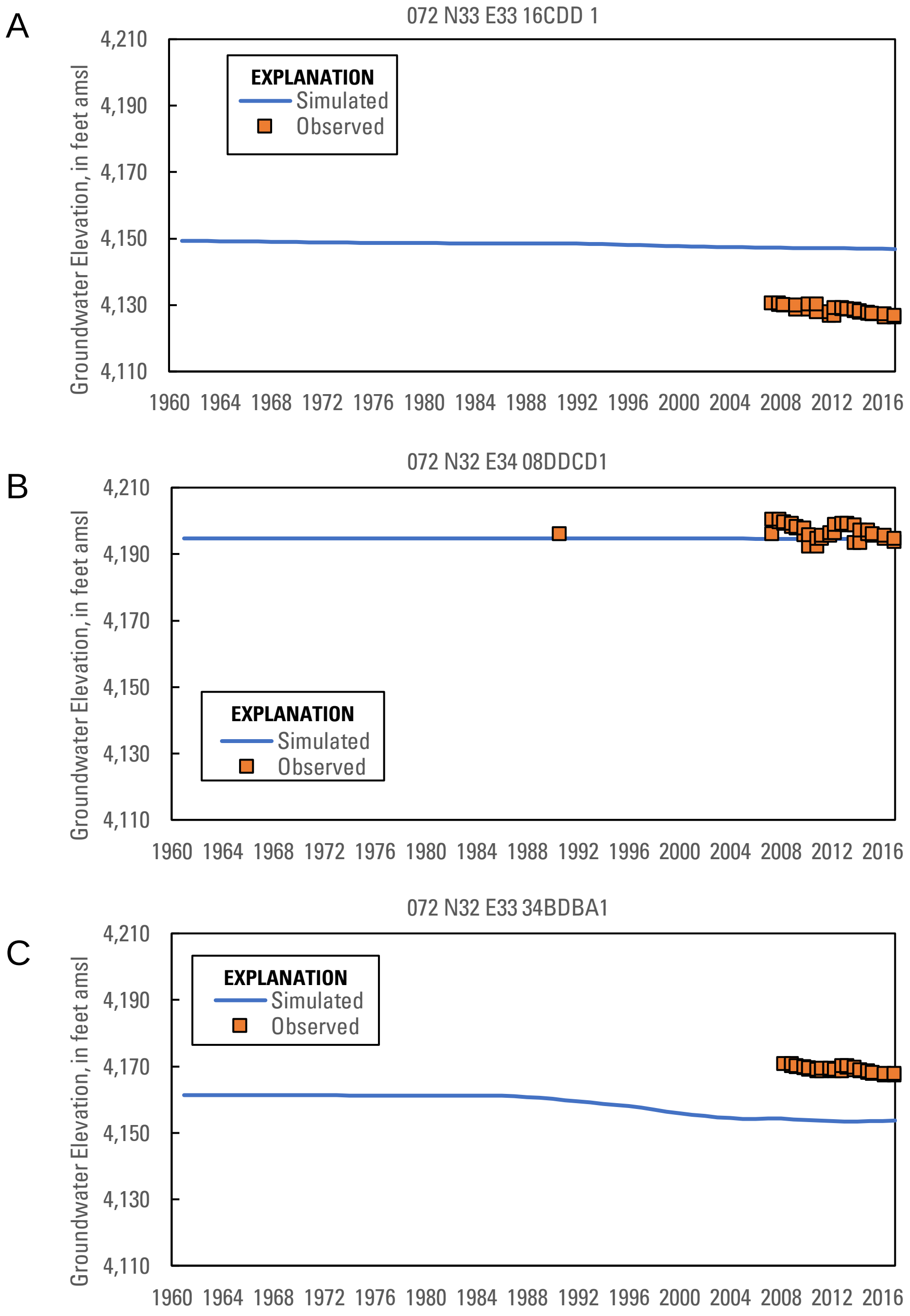
- Domestic wells pumping outside of Lovelock Meadows service area at 0.7 AFA.
- Public supply wells pumped at rates extrapolated backwards to 1960 based on population.
- Mining wells pumpage extrapolated earliest known rates backwards to 1986.
- Irrigation wells pumpage inversely proportional to the ratio of estimated ag recharge relative to the mean ag recharge 1960-1990.





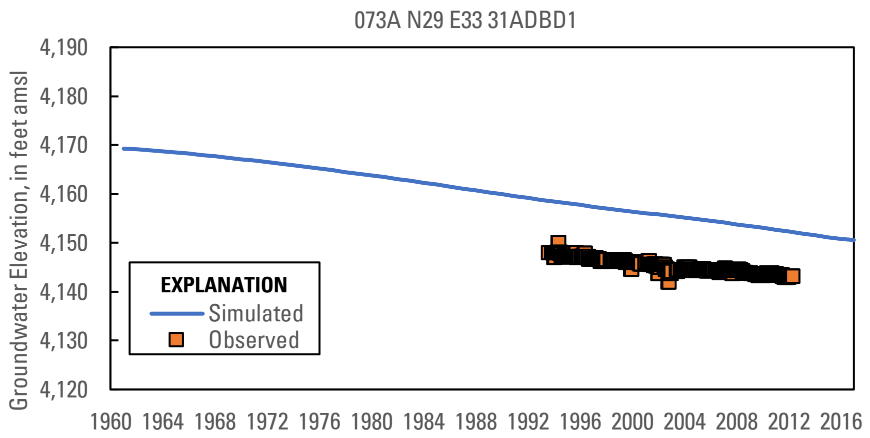
Transient Results



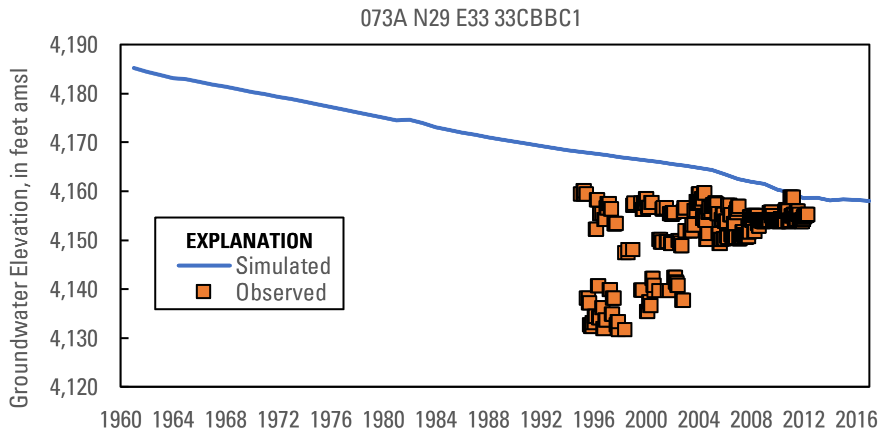


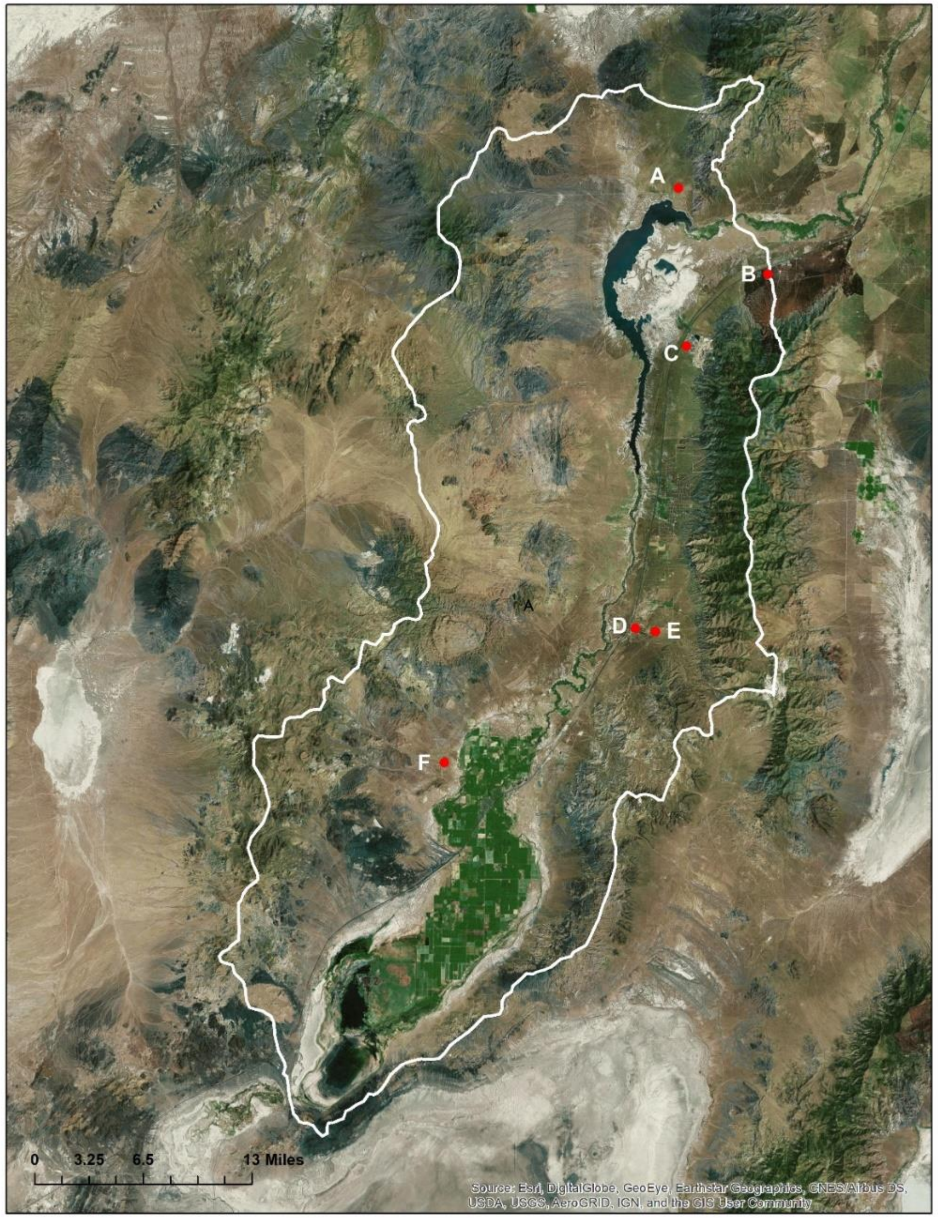
Transient Results

D



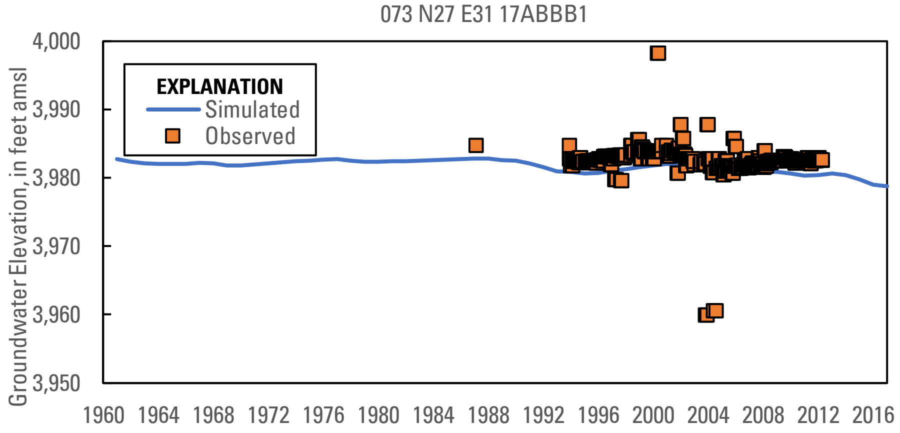
E

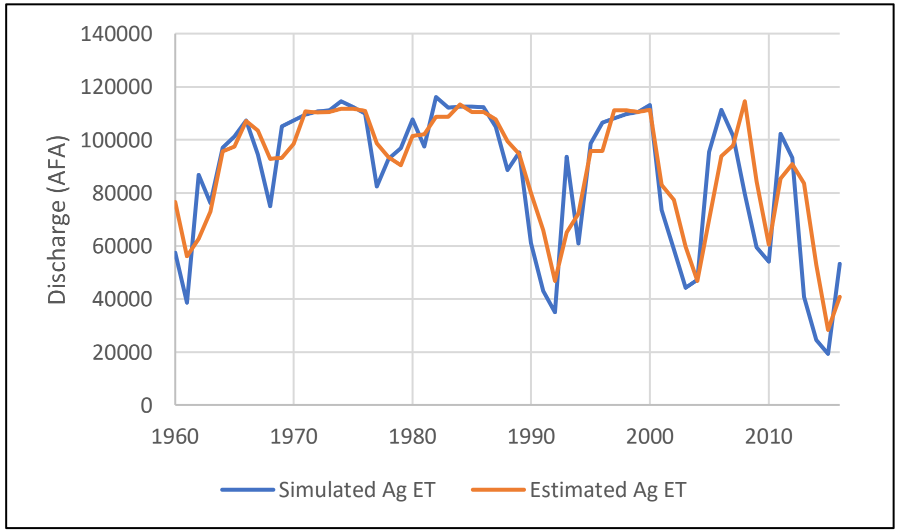


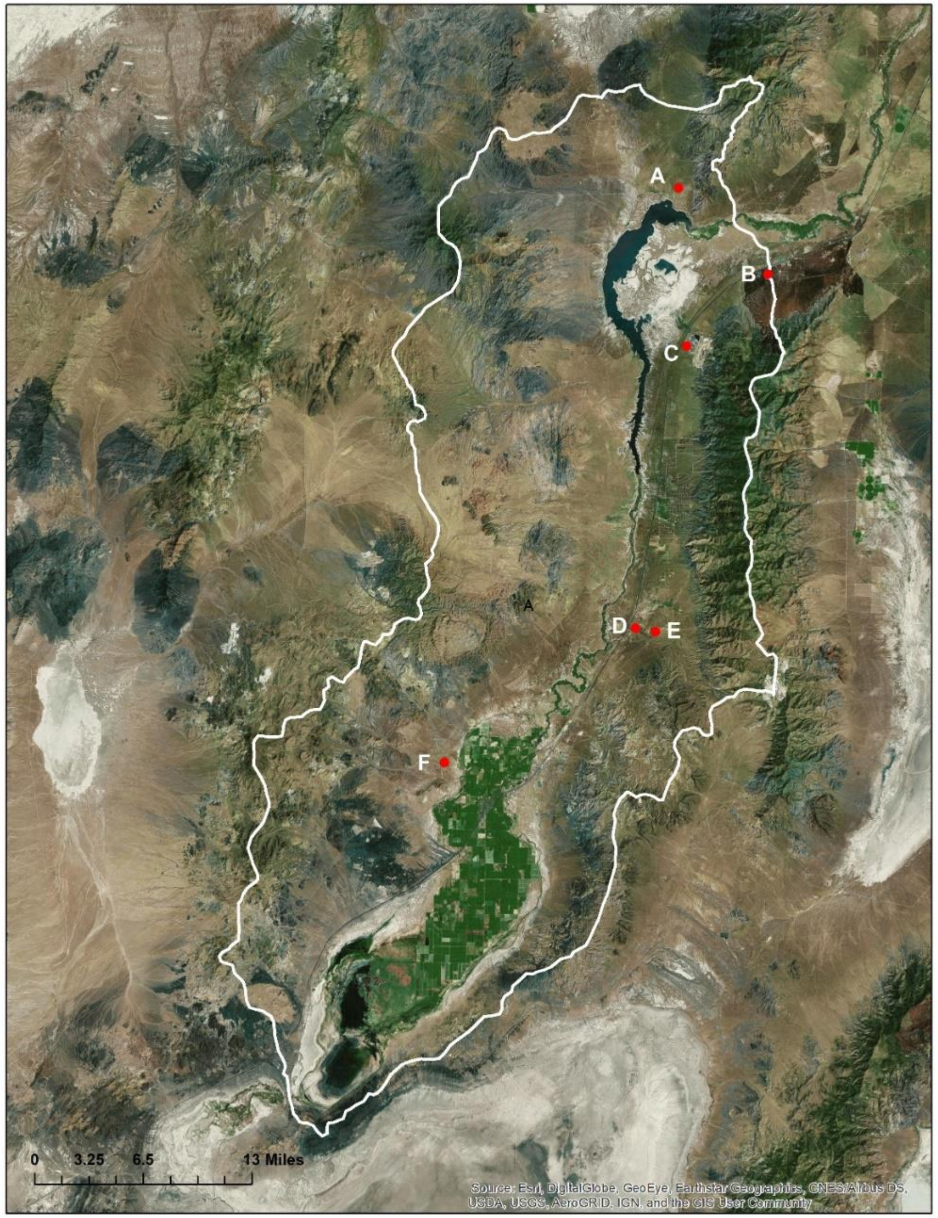


Transient Results

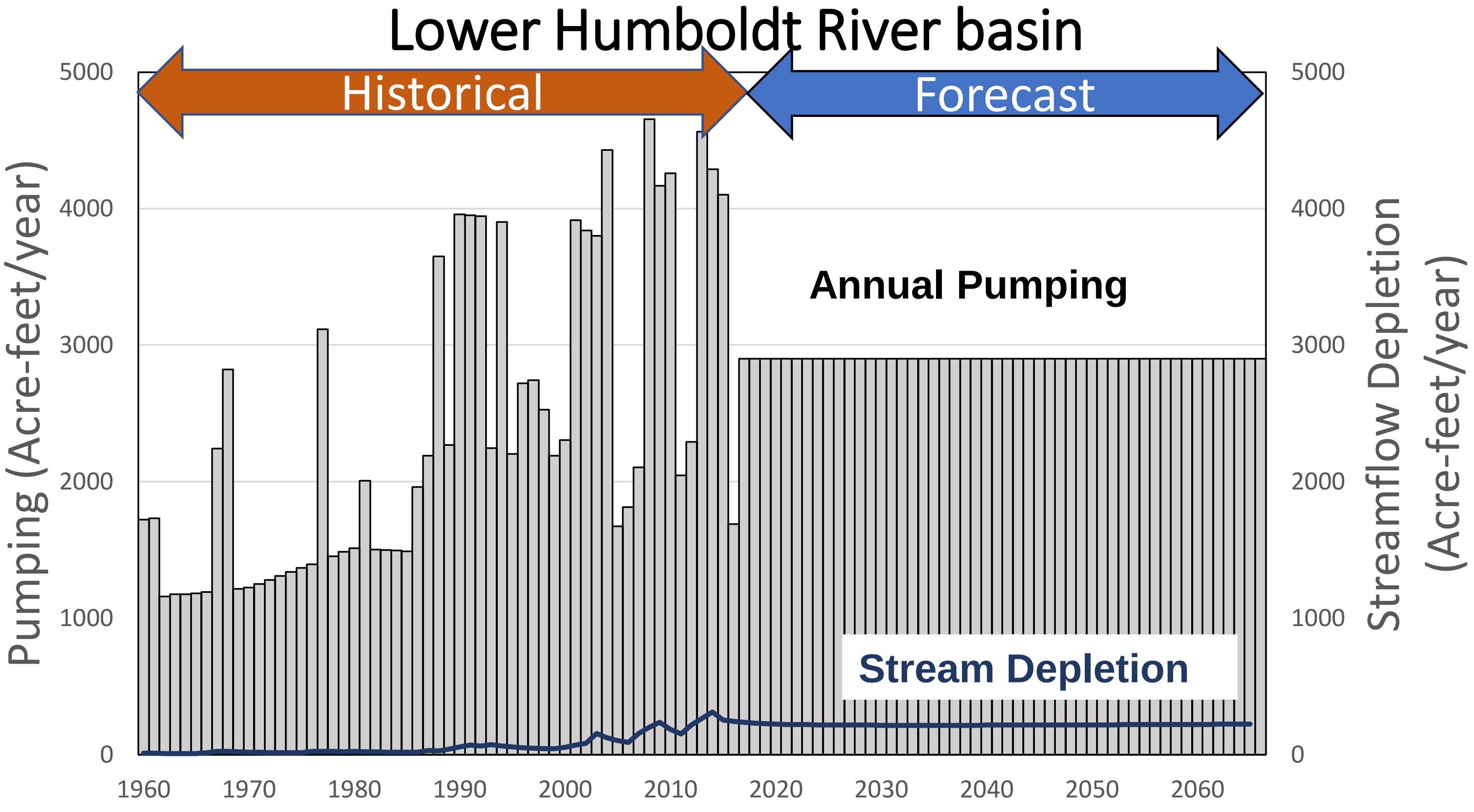
F



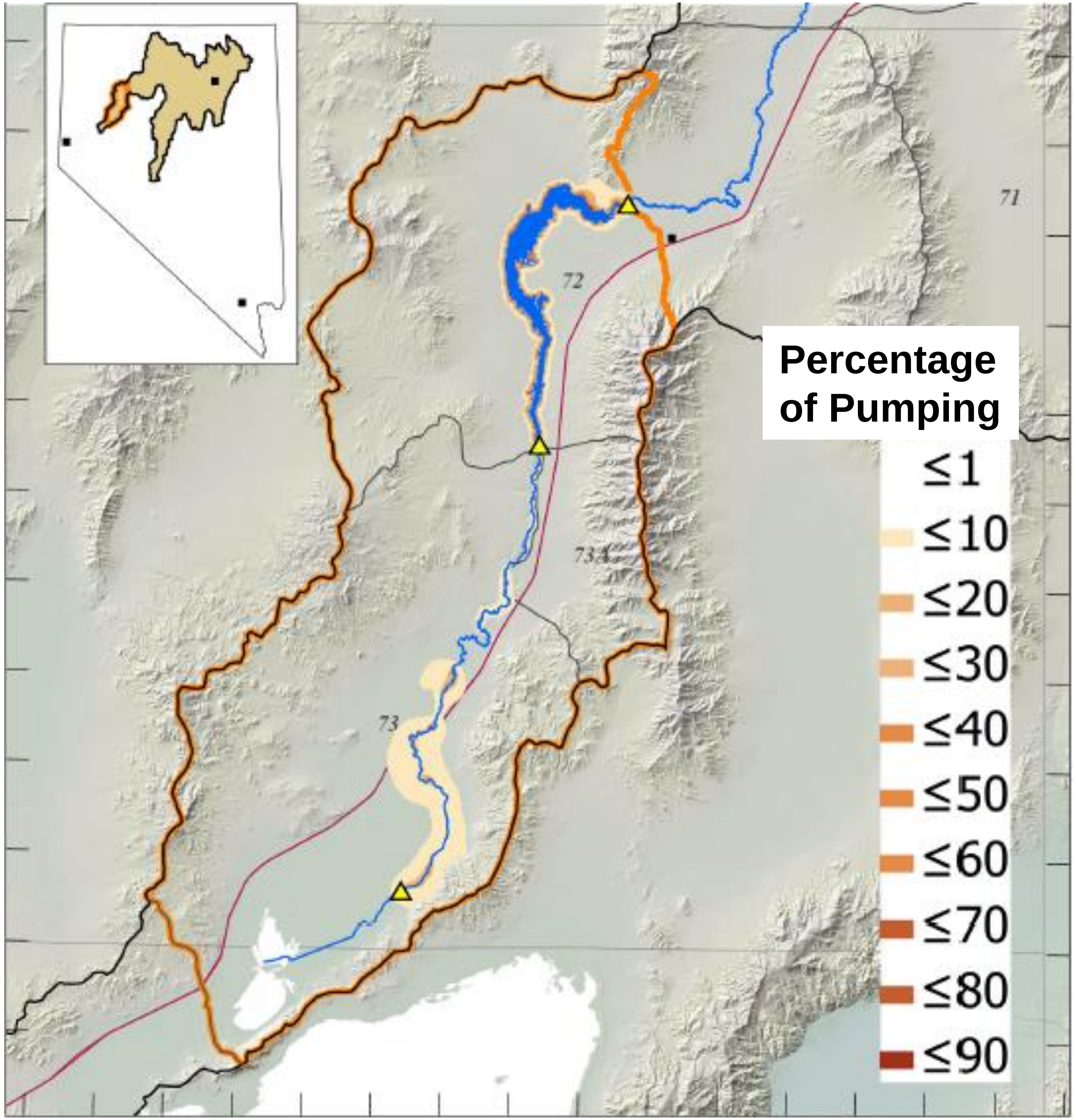




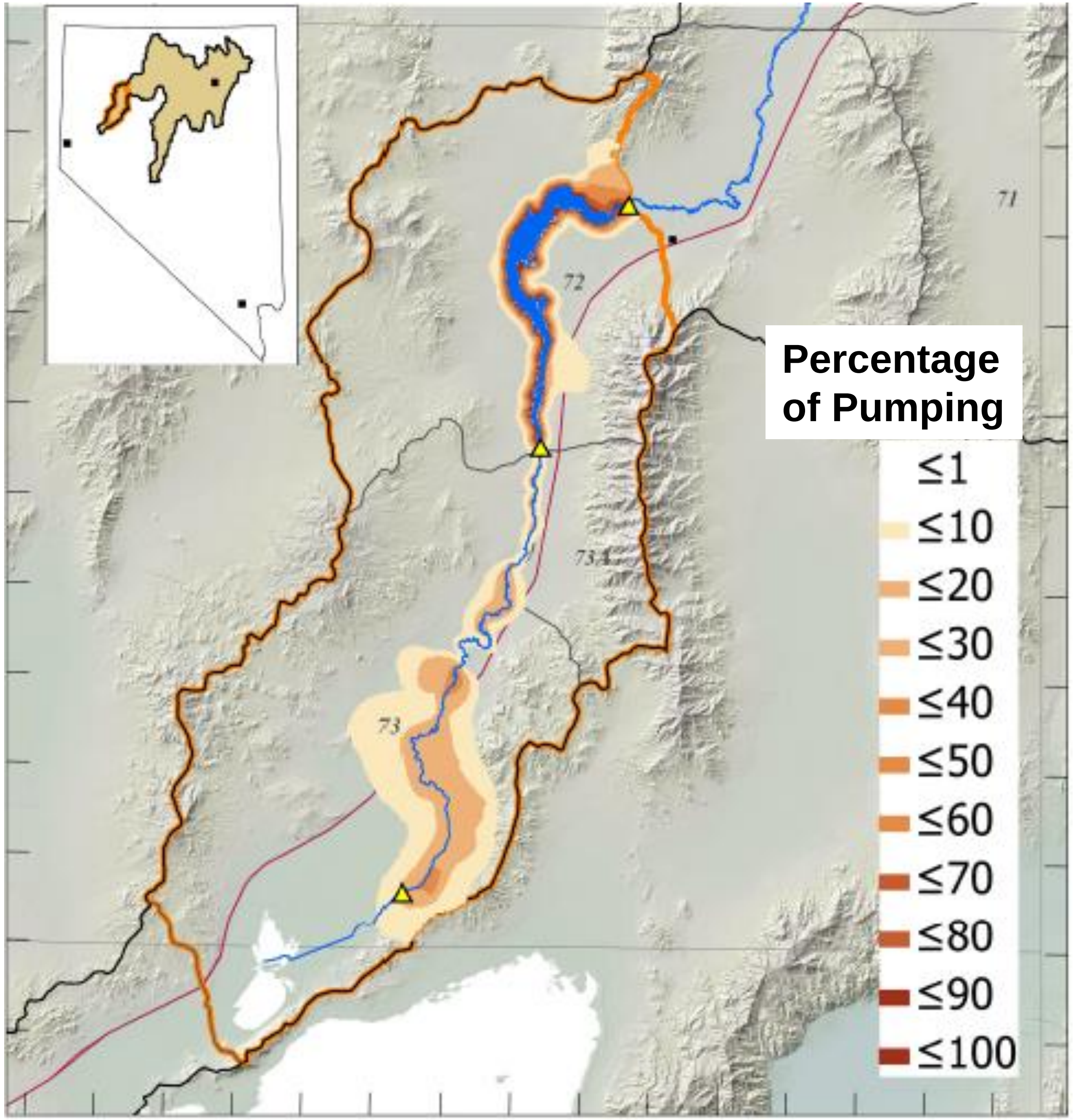
Estimated Humboldt River Depletion



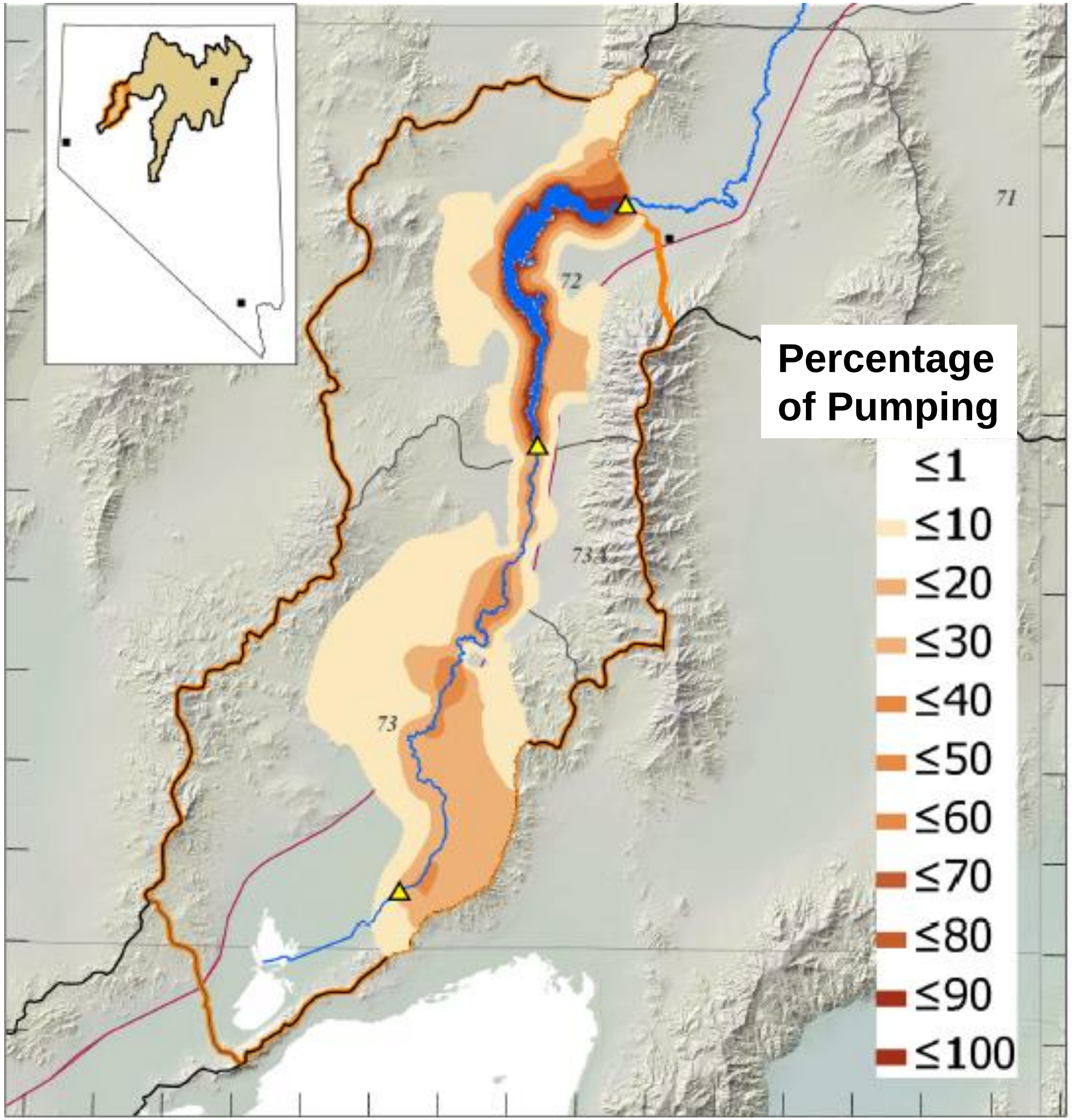
Streamflow Capture Map – Lower Humboldt after 1 year of pumping



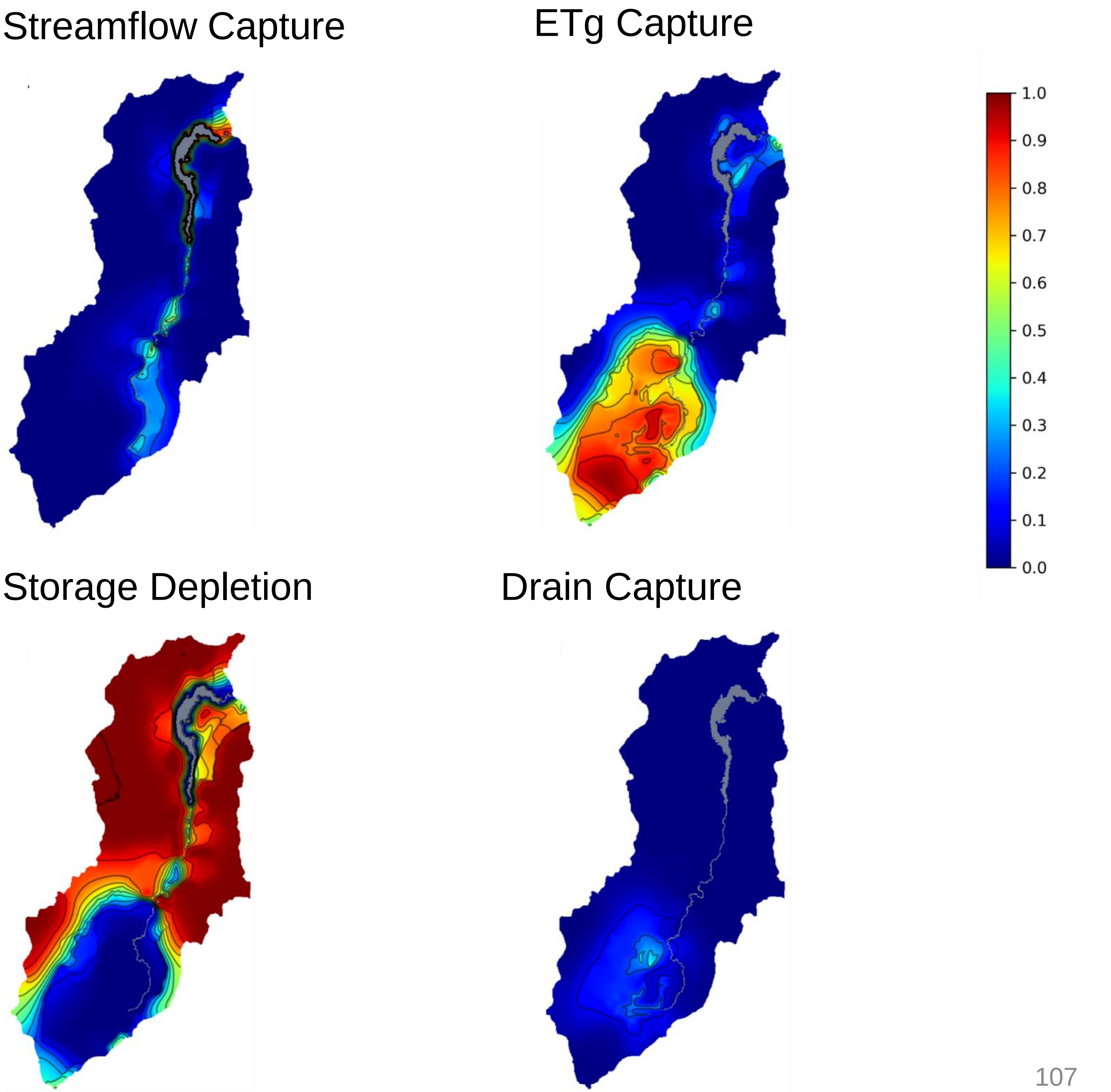
Streamflow Capture Map – Lower Humboldt after 10 years of pumping



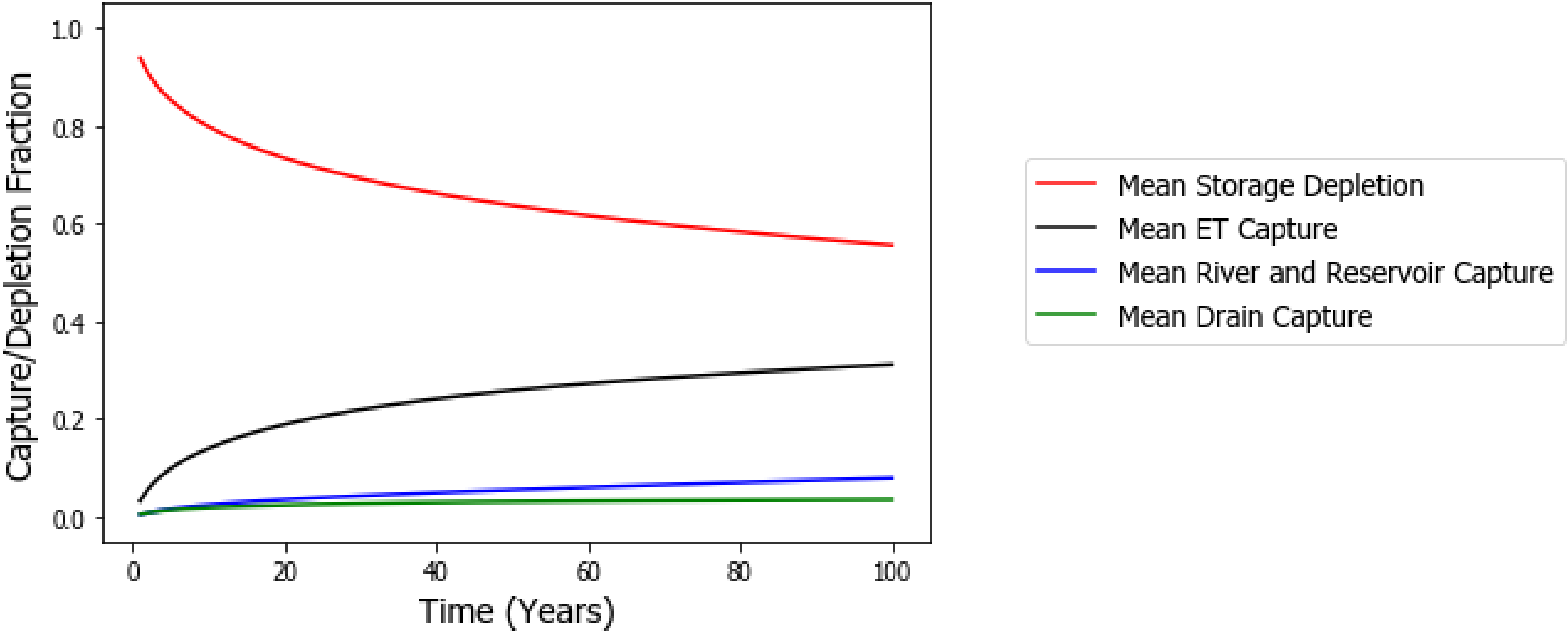
Streamflow Capture Map – Lower Humboldt after 50 years of pumping



Capture Maps – Lower Humboldt after 10 years of pumping



Average Capture and Depletion Curves



End of Technical Presentations

10 Minute Break

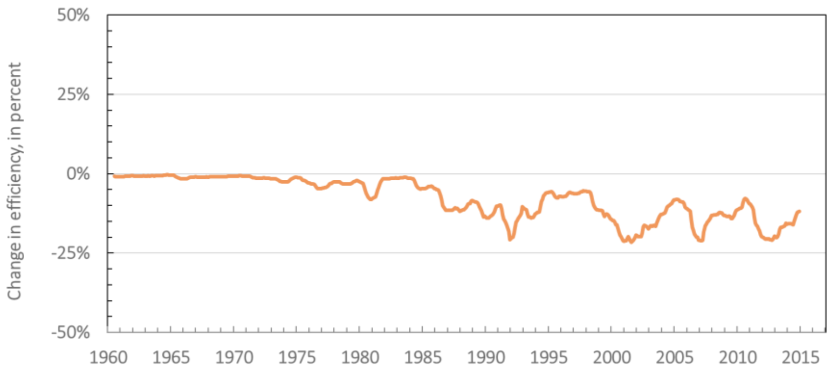
Link to Management Approach: Draft Order

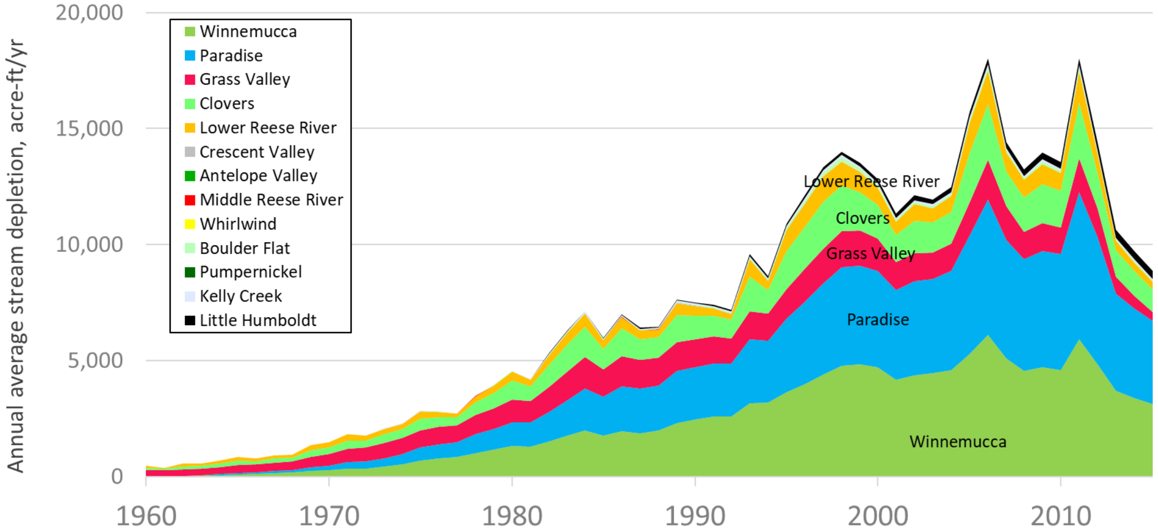
NDWR

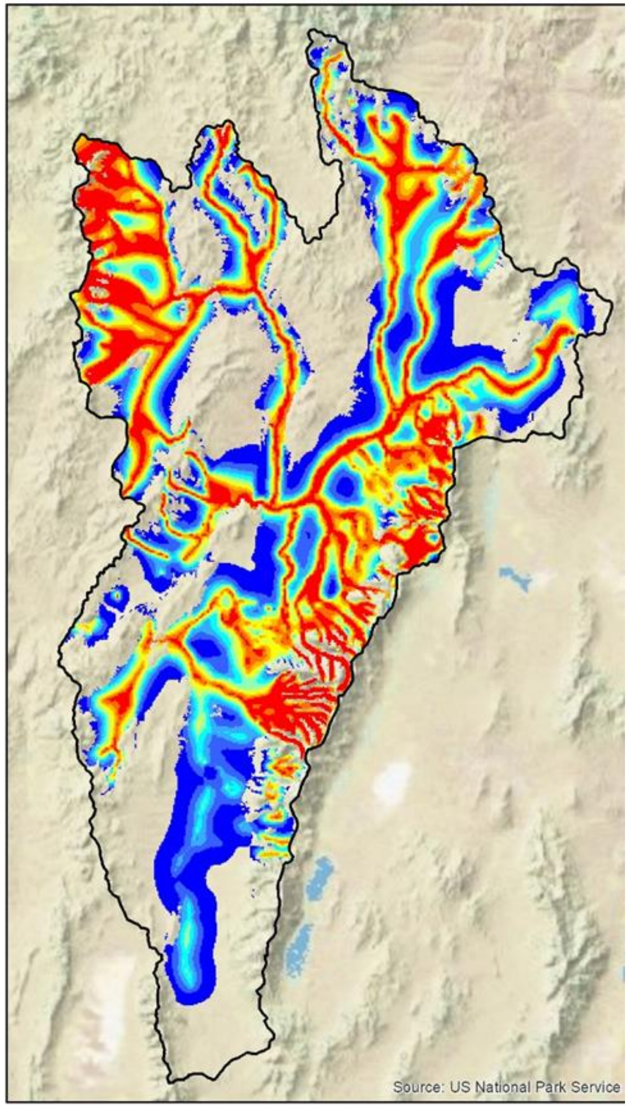
Capture Study Goal

Goal:

- Characterize amount and distribution of **capture**
- Help understand capture dynamics that may affect amount and distribution of **conflict**





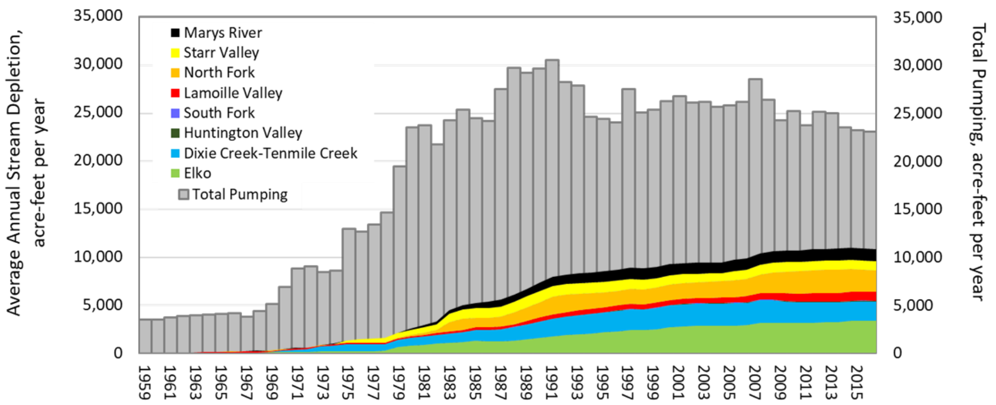


Capture Study Results

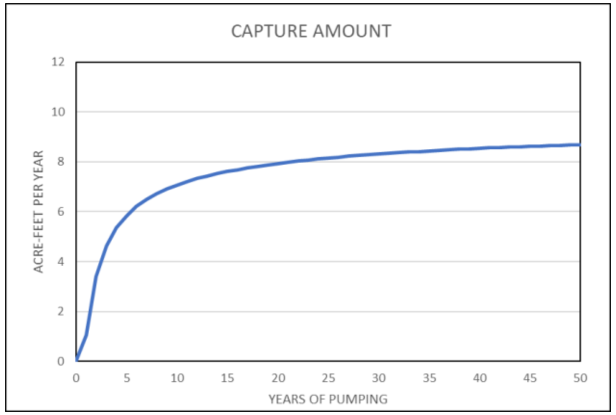
Capture:

- ✓ Estimate/Predict legacy, ongoing, future capture from existing permits
- ✓ Predict capture from new appropriations
- ✓ Predict increased capture from change applications

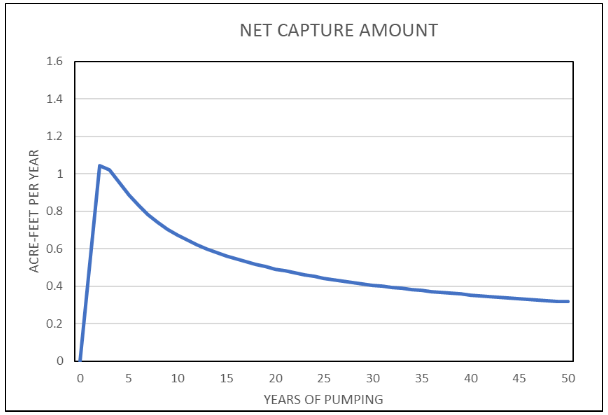
Upper Humboldt Capture relative to Pumping



New Appropriation Capture



Change App Capture

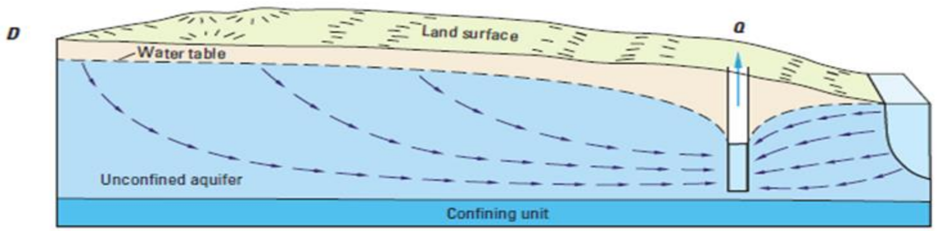


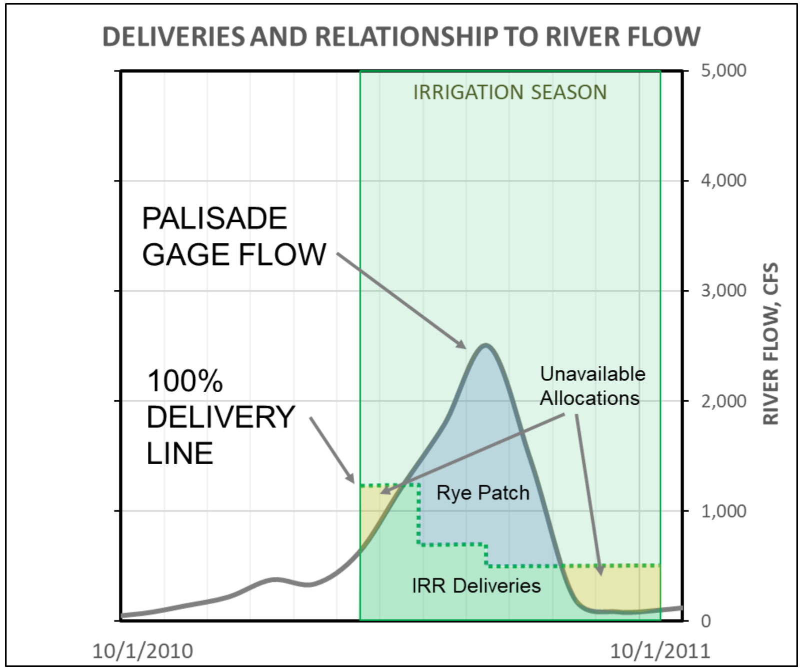
Management Goal

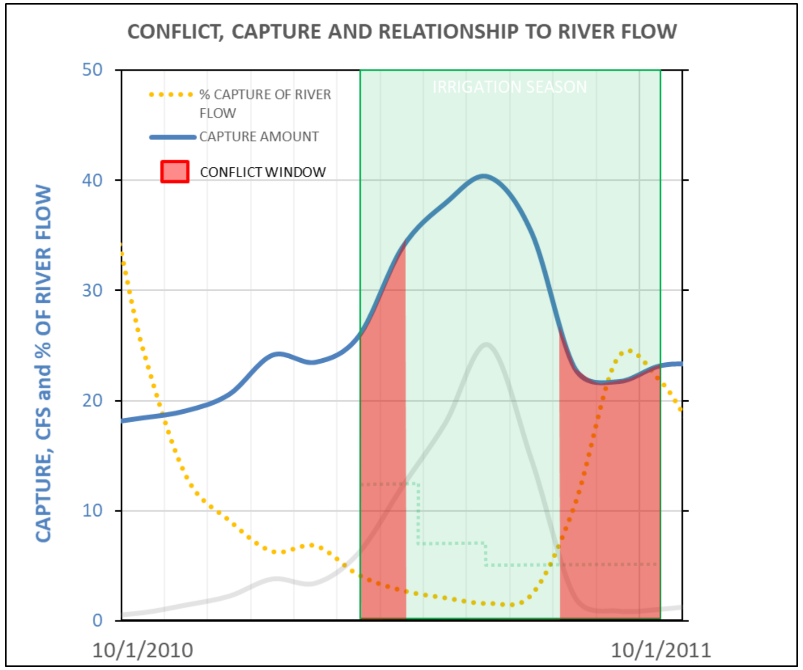
Goal:

- Prevent
- Avoid
- Reduce
- Mitigate

Conflict due to **Capture**







NEED TO UNDERSTAND CAPTURE ***AND CONFLICT***

Science to Management

- What can we do now?
  - ✓ Administer new appropriations to prevent additional capture
  - ✓ Administer change applications to prevent increased capture
  - ✓ Build framework for enacting statutory available tools (curtailment)
  - ✓ Facilitate community-supported solutions to prevent, avoid, reduce, mitigate ongoing and legacy capture
  - ✓ Improve capabilities to appropriately deliver SW by priority and to measure conflict with assistance of model
  - ✓ Consider adaptive, regional-scale solutions that improve the situation

Settlement Agreement

PCWCD:

✓ Dismiss Writ Petition

SE:

✓ Develop draft order

✓ Issue by 1/19/21

PERSHING COUNTY WATER CONSERVATION DISTRICT,

Petitioner,

vs.

TIM WILSON, P.E., State Engineer of the State of Nevada, DIVISION OF WATER RESOURCES, DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES,

Respondent

STIPULATION AND ORDER FOR DISMISSAL WITH PREJUDICE

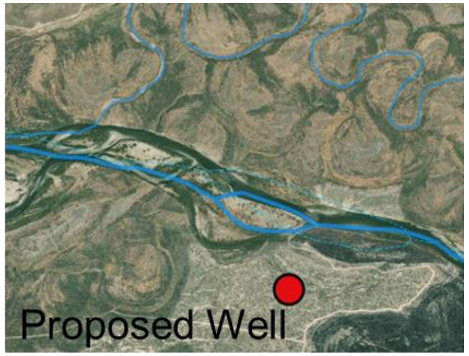
DRAFT INTERIM ORDER

ESTABLISHING PROCEDURES FOR REVIEW OF APPLICATIONS TO APPROPRIATE GROUNDWATER IN THE HUMBOLDT RIVER REGION WITH REGARD TO THE POTENTIAL FOR CAPTURE OF AND CONFLICT WITH DECREED RIGHTS TO THE WATERS OF THE HUMBOLDT RIVER AND TRIBUTARIES

Draft Interim Order

- Addresses:

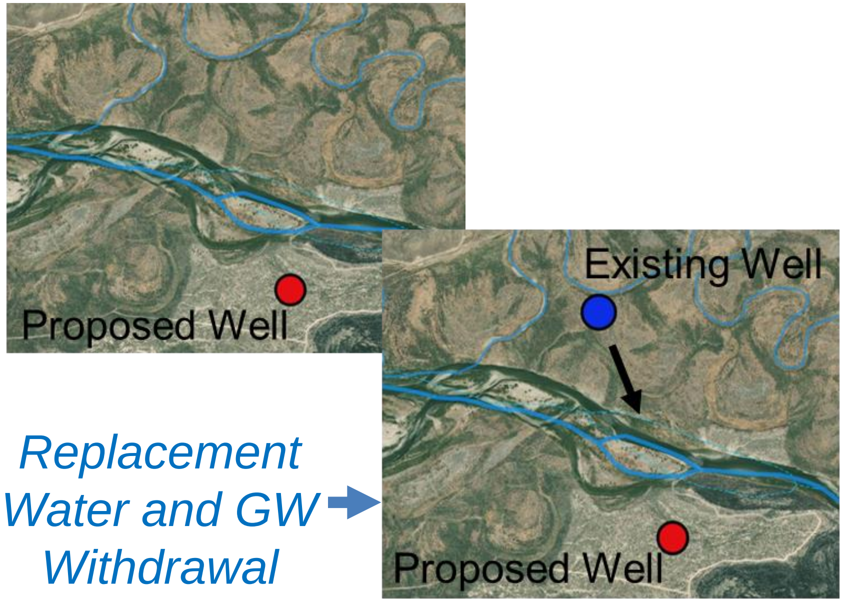
  1) New Appropriations



Replacement Water and GW Withdrawal

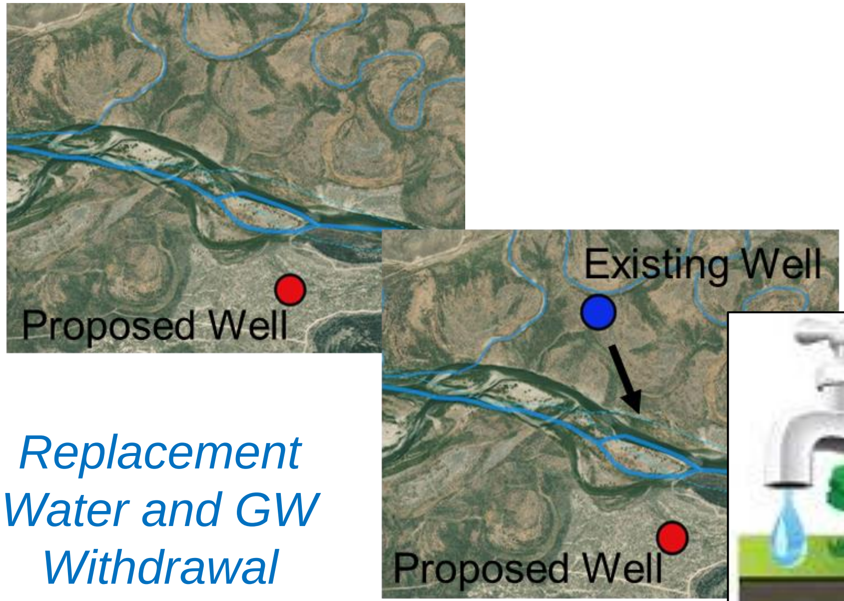
Draft Interim Order

- Addresses:
  1) New Appropriations
  2) Change Applications



Draft Interim Order

- Addresses:
  1) New Appropriations
  2) Change Applications
  3) **Curtailment Process**



Replacement Water and GW Withdrawal

Focused Curtailment

Does not address alternative or long-term management remedies

New Appropriations

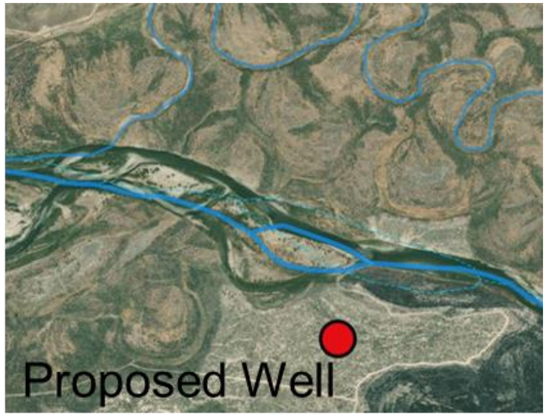
- **Replacement Water Proposal**

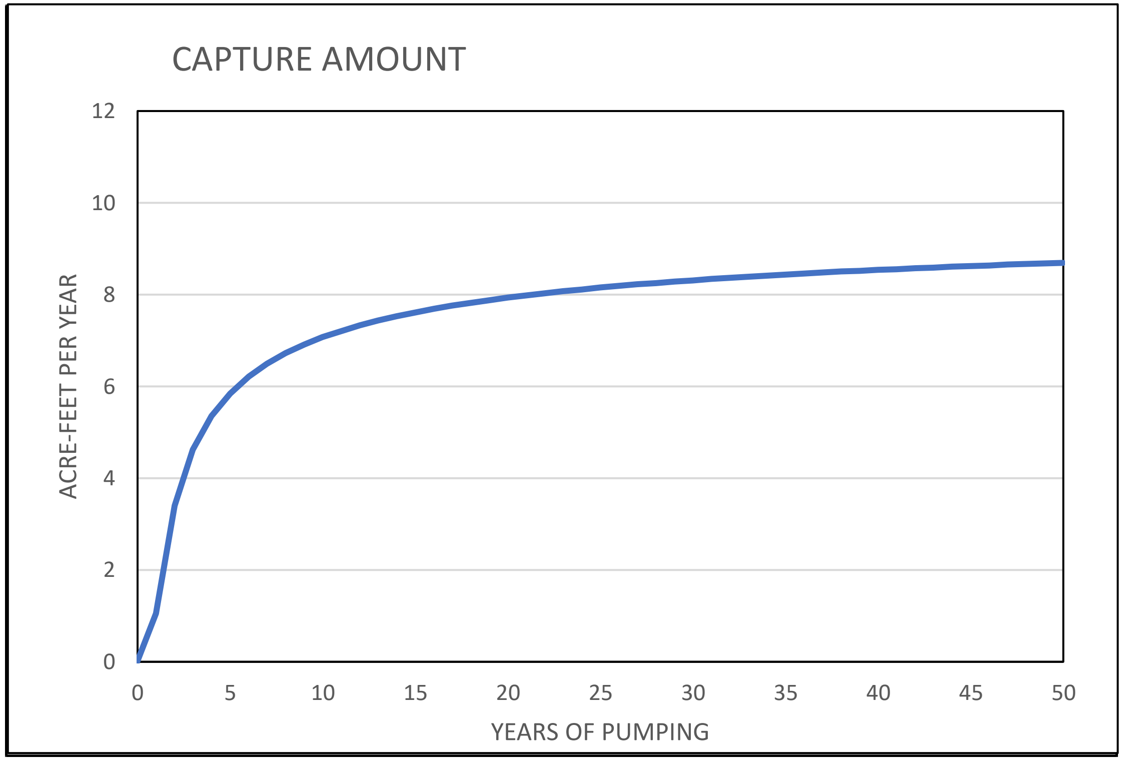
GROUNDWATER RIGHT APPLICATION:

lication:

Information on New or Change Application

Application #:	89110	
Duty Applied-for:	10	acre-feet
Distance to river:	3,130	ft
Transmissivity:	500	ft2/day
Storage Coeff:	0.05	unitless



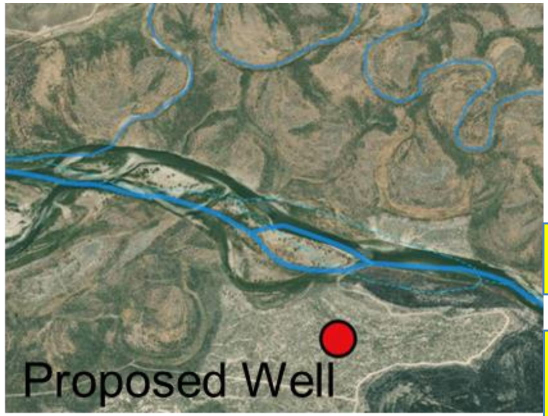


∑ 50-YR CAPTURE AMOUNT:	**382.15**	af

New Appropriations

- **Replacement Water Proposal**

2A: UPPER RIGHTS				
PRIORITY DATE		HARVEST cfs	MEADOW cfs	DIVERSIFIED cfs
1870		0.045	0	0
TOTAL:		0.045	0	0



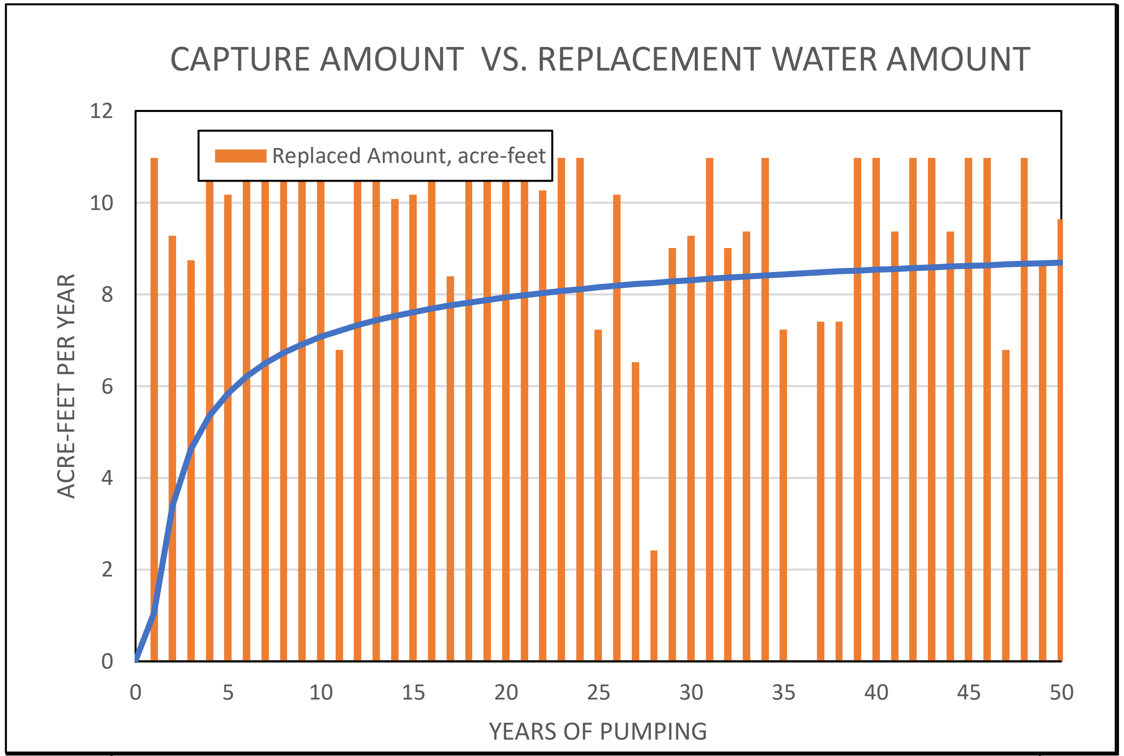


CHART NOTE: WHEN ORANGE BAR IS BELOW BLUE LINE, REPLACEMENT WATER IS INSUFFICIENT TO OFFSET DEPLETION

- ✓ Replaced > Capture
- ✓ Annual Capture Offset in >= 80% of Years

∑ 50-YR CAPTURE AMOUNT:	382.15	af
∑ 50-YR REPLACED AMOUNT:	477.25	af
AVERAGE DELIVERED FOR SCENARIO:	9.545	afs
% YEARS CAPTURE NOT REPLACED:	20.0%	
% YEARS DUTY NOT REPLACED:	**40.0%**	

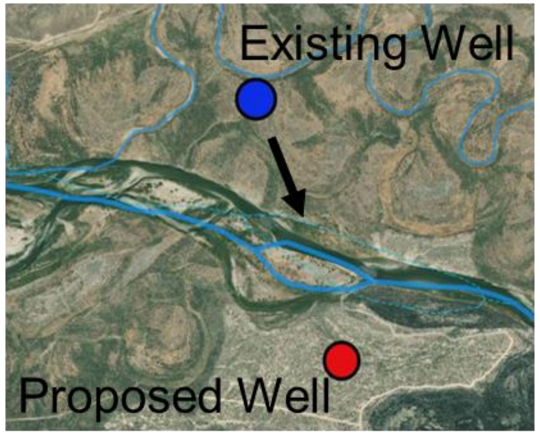
Applications to Change POD

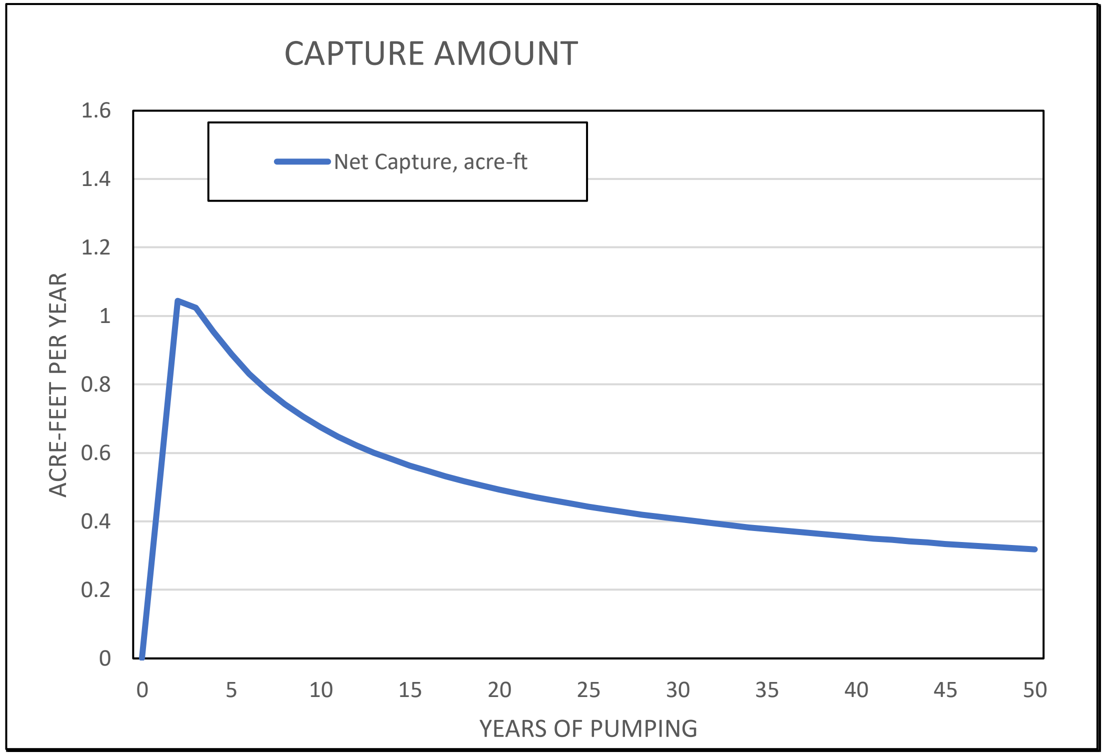
- **Withdrawal Proposal**

GROUNDWATER RIGHT APPLICATION:

Type of Application: **Change**

Information on New or Change Application			Enter Information on Base Right to be changed		
Application #:	89110		Permit #:	72080	
Duty Applied-for:	10	acre-feet	Duty Changed:	10	acre-feet
Distance to river:	3,130	ft	Distance to river:	3,900	ft
Transmissivity:	500	ft2/day	Transmissivity:	500	ft2/day
Storage Coeff:	0.05	unitless	Storage Coeff:	0.05	unitless
Diffusivity:	10000		Diffusivity:	10000	





50-YEAR SCENARIO STATISTICS	
∑ 50-YR CAPTURE AMOUNT:	25.28 af

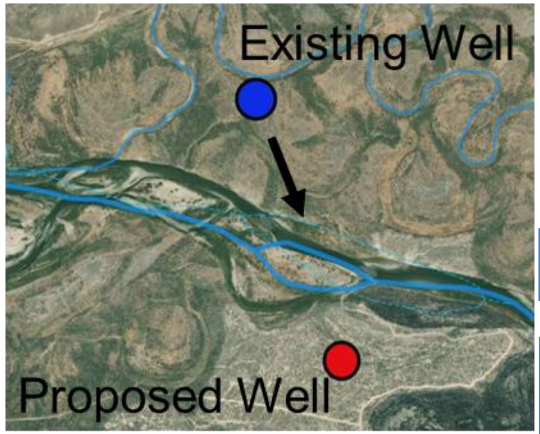
Applications to Change POD

- **Withdrawal Proposal**

WITHDRAWAL OPTION:

Enter Information on Withdrawal Right to be changed

Permit #:	72080	
Duty:	1.6	acre-feet
Distance to river:	3,900	ft
Transmissivity:	500	ft2/day
Storage Coeff:	0.05	unitless



✓ Replaced > Capture

✓ Annual Capture Offset in >= 90% of Years

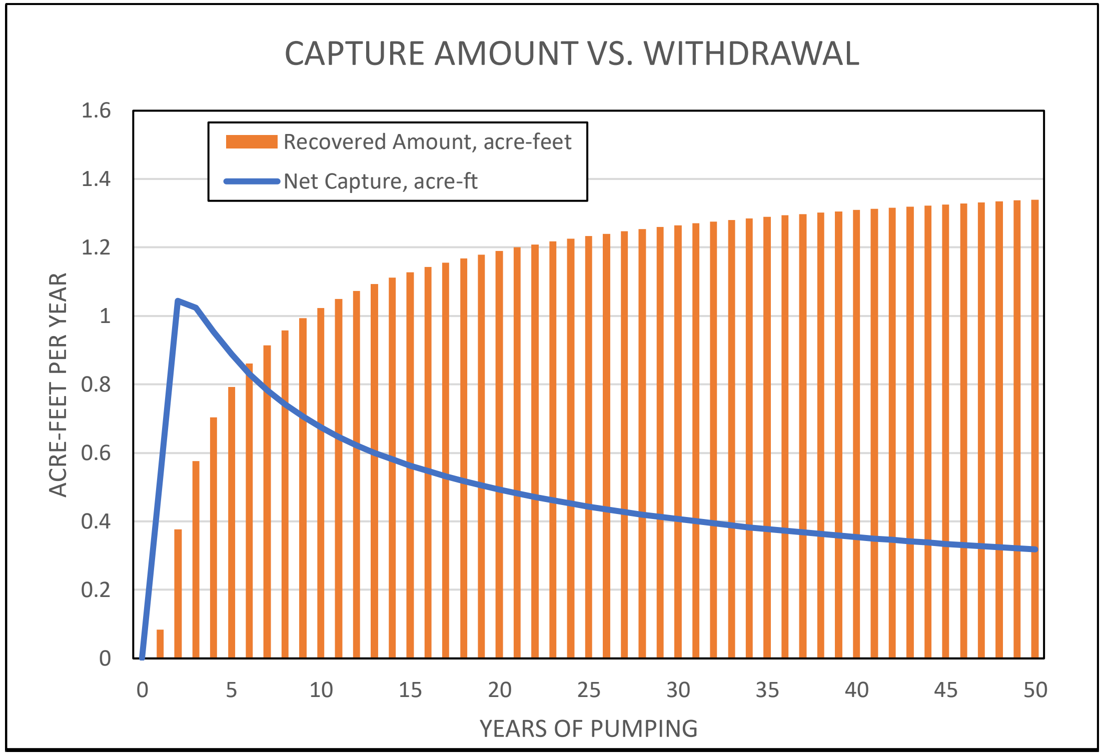


CHART NOTE: WHEN ORANGE BAR IS BELOW BLUE LINE, REPLACEMENT WATER IS INSUFFICIENT TO OFFSET DEPLETION

50-YEAR SCENARIO STATISTICS		
∑ 50-YR CAPTURE AMOUNT:	25.28	af
∑ 50-YR RECOVERED AMOUNT:	57.10	af
% YEARS CAPTURE NOT REPLACED:	10.0%	

Draft Interim Order

Curtailment

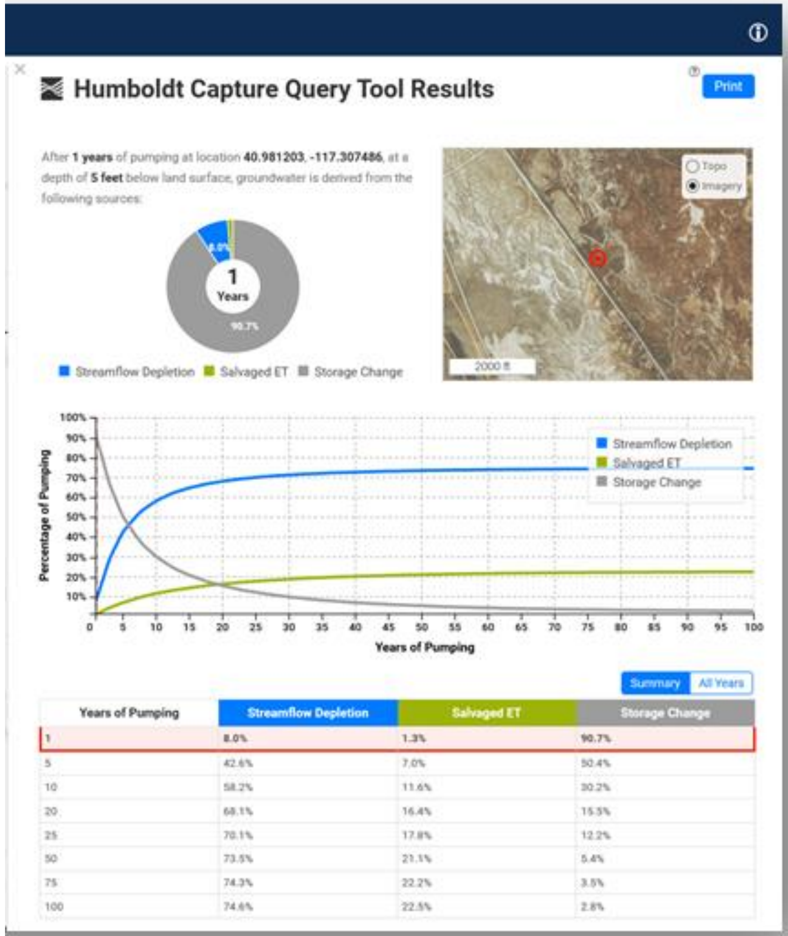
http://water.nv.gov/documents/Notice%20and%20Proposed%20Order%20Humboldt%20River%20Region.pdf

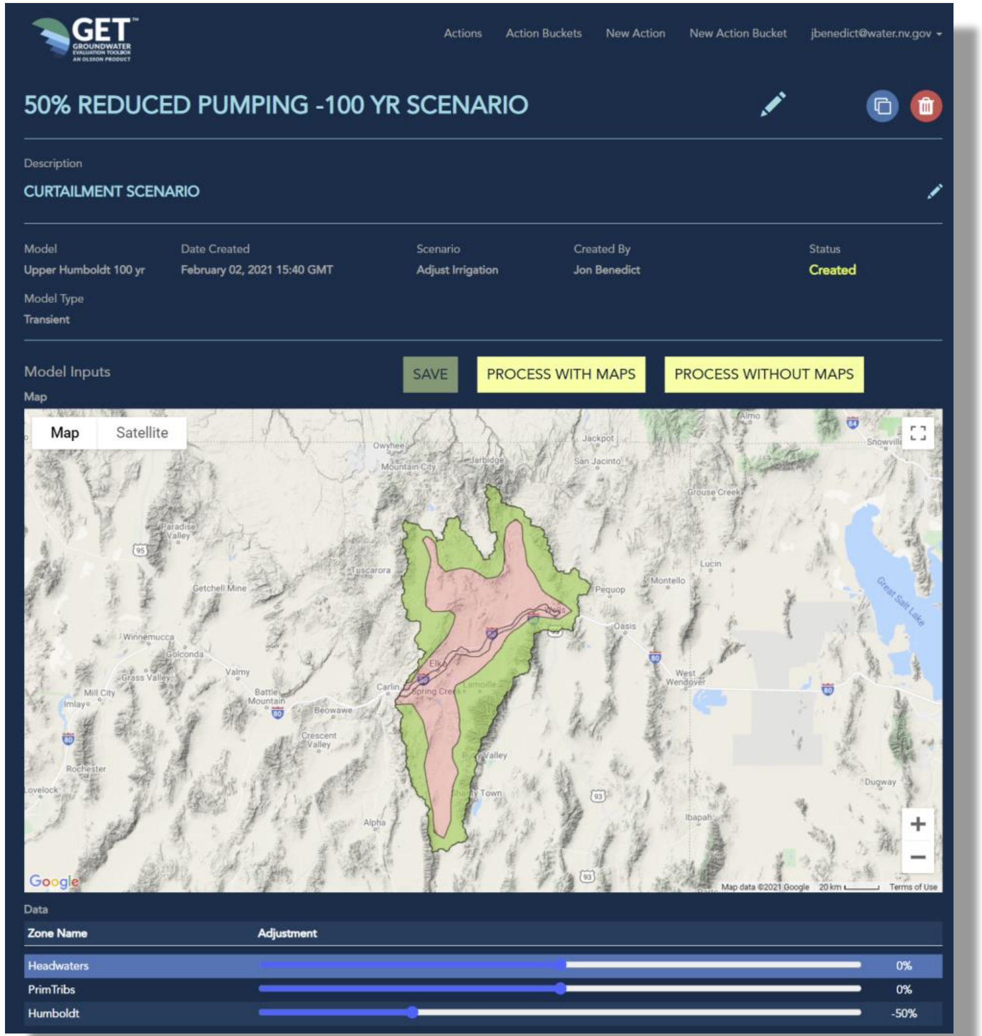
B. Hydrologic conditions:
   i. Effectiveness of any curtailment to increase actual flow in the decreed source and thereby avoid conflict caused by non-delivery of senior rights.
   ii. Drought conditions as measured by available snowpack data, runoff forecast for the season, prior years' condition and cumulative water deficit.
   iii. Well location and potential for capture as demonstrated by USGS and DRI models

FOCUSED CURTAILMENT BASED ON:

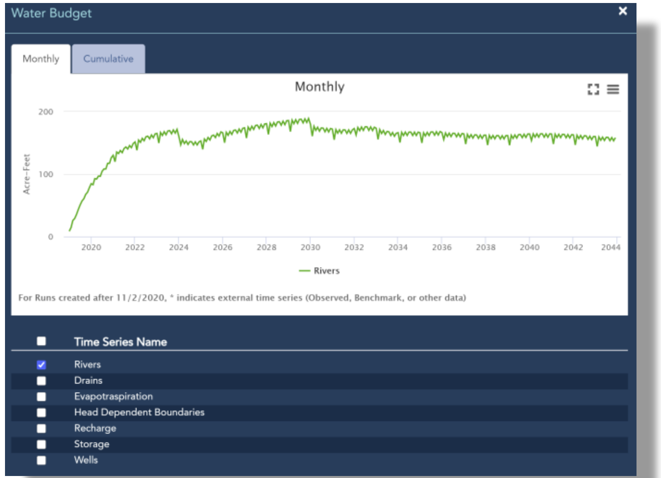
✓*Drought conditions*
✓*Short-term benefit*
✓*Capture liability*

What's Next for Linking Science to Management?





GET™
GROUNDWATER EVALUATION TOOLBOX
AN OLSSON PRODUCT



Next Steps

NDWR

Next Steps

- Final model results for management analysis and decisions
- Appropriate level of precision in relying on model results
- Public awareness and transparency
- Hearing on draft order: Friday April 2, 2021
- Final order to be issued following review of public comment

Division of WATER RESOURCES

DEPARTMENT OF CONSERVATION & NATURAL RESOURCES


Questions