

The Pacific Northwest Streamflow Data Landscape

Kendra E. Kaiser¹, Kyle Blasch², Steven Schmidt¹, Jennifer Villa³

¹ Department of Geosciences, Boise State University

² Associate Director Northwest - Pacific Islands Region & USGS Wildfire Response Coordinator

³ USGS, Integrated Hydrology & Data Science OK-TX Water Science Center

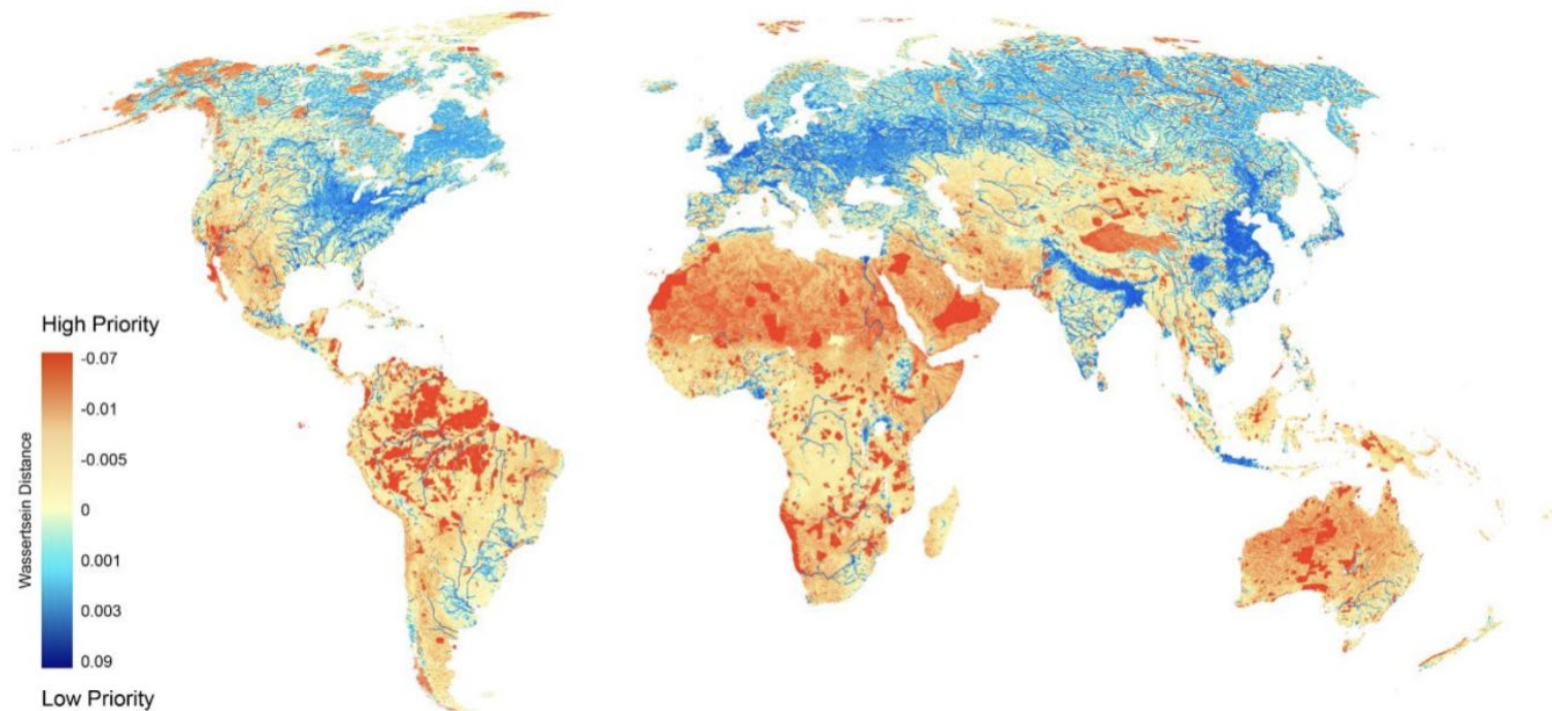


NORTHWEST
Climate Adaptation
Science Center



Global Streamflow Data are Biased

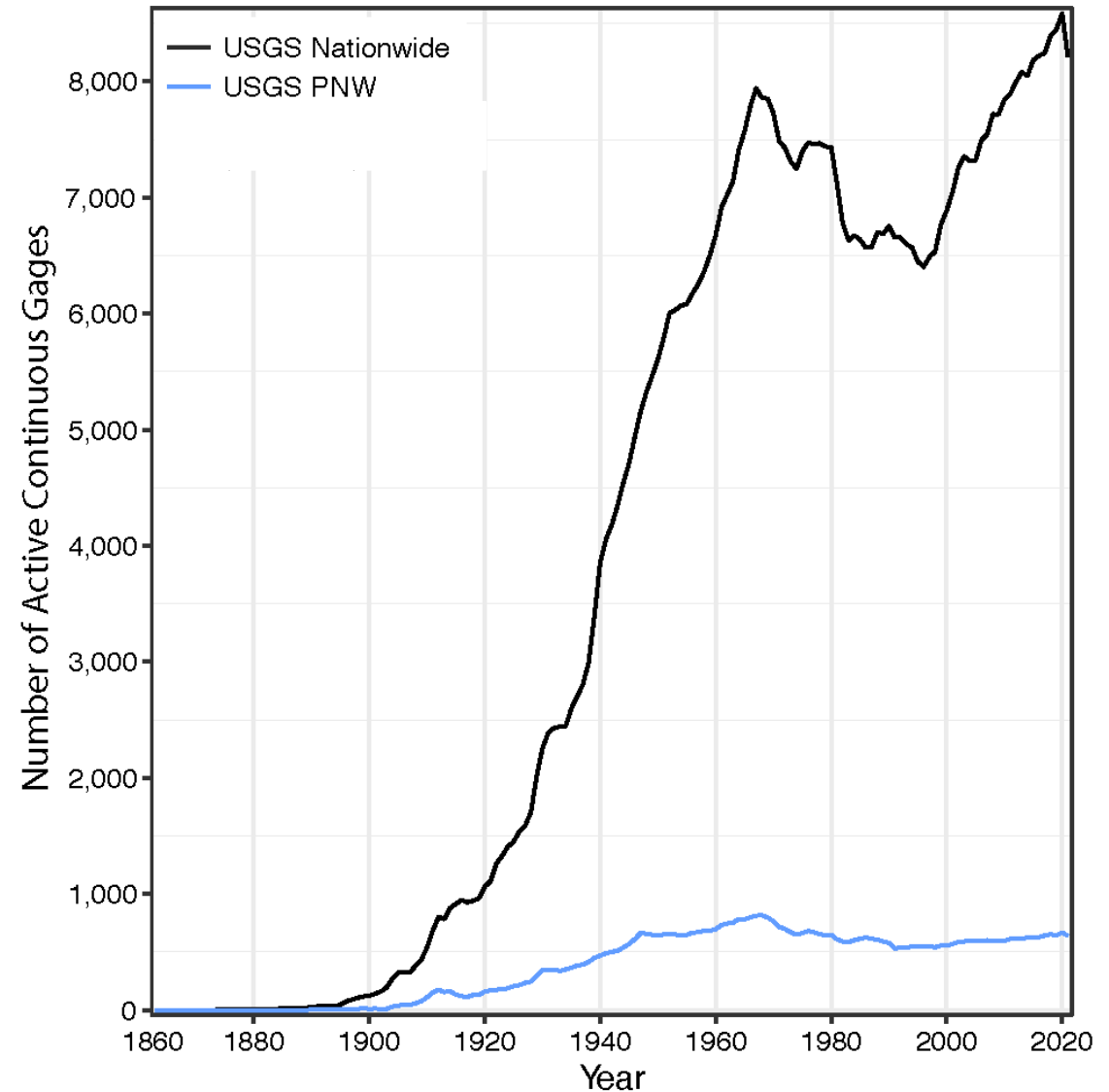
- High order streams
- Highly regulated rivers
- High population density
- Large human imprints
- Disproportionately favors mid-latitudes



“Estimated amount of global mean bias change resulting from a gauge being installed on each river segment.” (Krabbenhoft et al., 2022)

USGS Streamflow Networks

- USGS streamflow gaging location bias similar to global bias
- Variable annual number of USGS streamflow gaging stations
 - costs, requirements, objectives
 - other organizations operating streamflow networks



Why Additional Streamflow Measurements?

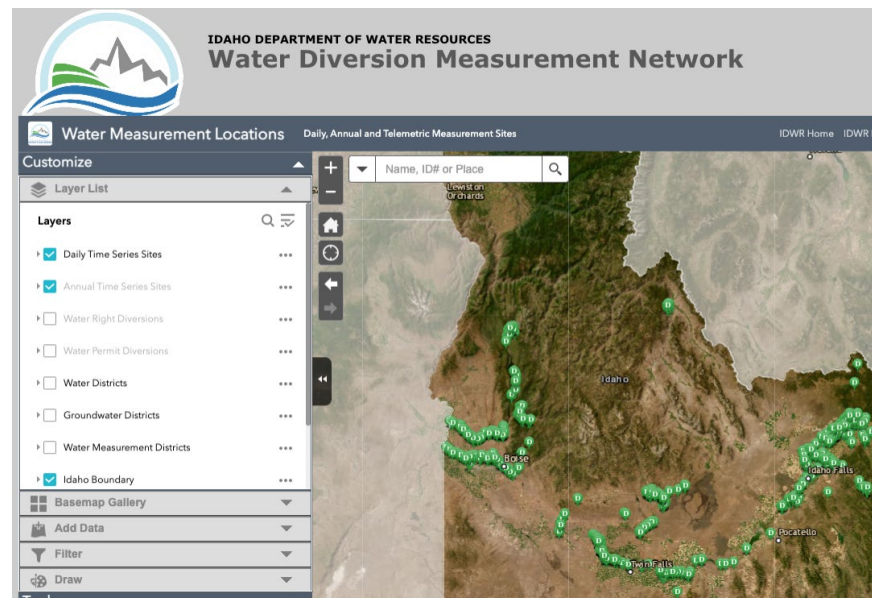
- Resource managers require observational data
 - Mid order streams and headwater streams (e.g., culvert sizing, mining permits, forest practices, ecosystem protection, etc.)
- Improved calibration and validation of predictive models
- Diverse organizations collecting streamflow provides resilience
 - Volatile funding
 - Equipment failure
 - Potential cost-effective gains

Additional Streamflow Data Exist

- Working toward making streamflow data “FAIR”
 - Findable
 - Accessible
 - Interoperable
 - Reusable

 U.S. DEPARTMENT OF AGRICULTURE

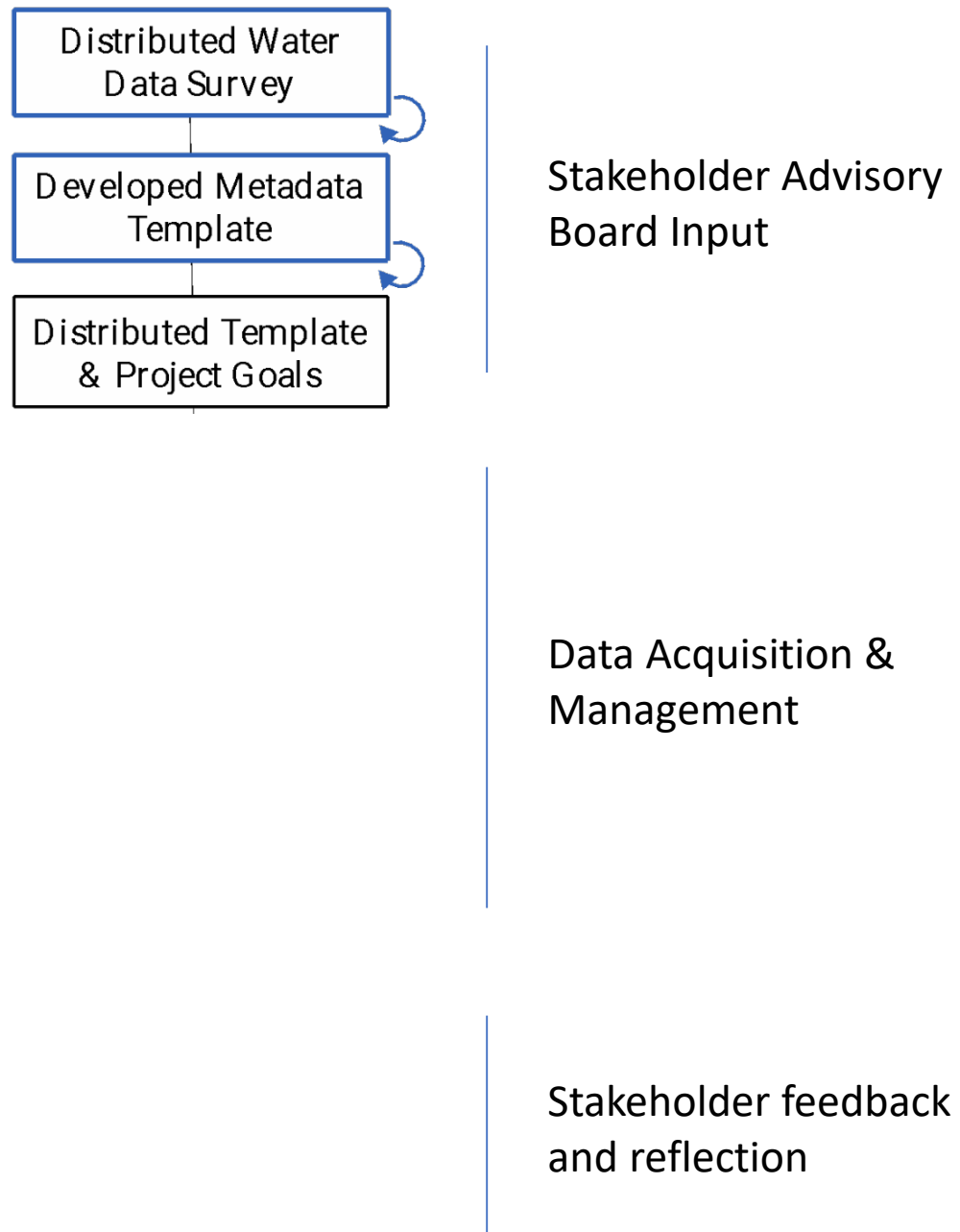
Research Data Archive
Roots of our Research



Objectives

- Catalog non-USGS streamflow monitoring locations in the Pacific Northwest (Idaho, Oregon, Washington)
 - Continuous and miscellaneous locations
- Engage with individuals and organizations that collect streamflow data to identify challenges to streamflow monitoring and implementing FAIR data practices
- Co-develop a data visualization of current and historic non-USGS streamflow gaging stations and miscellaneous measurements

Process





Washington Department of **FISH and WILDLIFE**



DESCHUTES RIVER CONSERVANCY



OREGON WATERSHED ENHANCEMENT BOARD



OREGON WATER RESOURCES DEPARTMENT



IDAHO DEPARTMENT OF WATER RESOURCES



MALHEUR WATERSHED COUNCIL EST. 1994



DEPARTMENT OF ECOLOGY State of Washington



BUREAU OF RECLAMATION



Columbia Soil & Water Conservation District



Agricultural Research Service



BOISE STATE UNIVERSITY



University of Idaho



Oregon State University



Soil & Water Conservation District Pendleton, OR

CITY OF Salem AT YOUR SERVICE



An IDACORP Company



TROUT UNLIMITED

The Nature Conservancy



Ecosystem Sciences Foundation

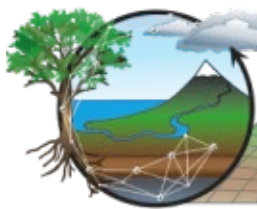


COOS Watershed Association

Improving the Health of Our Watershed



LTER NETWORK

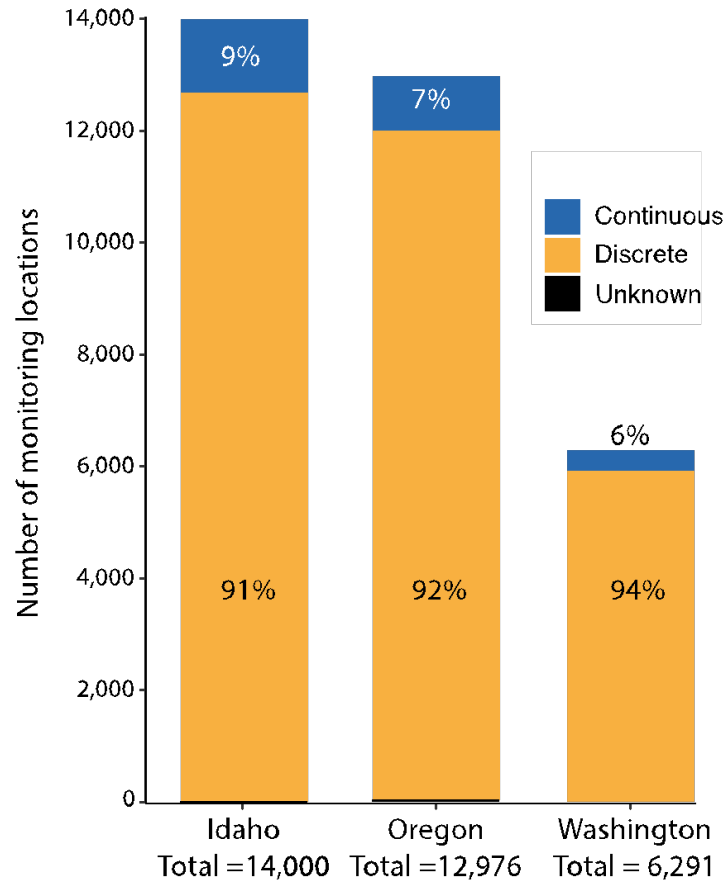


CZNet Critical Zone Network



THE UNDERSTORY INITIATIVE

Non-USGS streamflow monitoring in the PNW



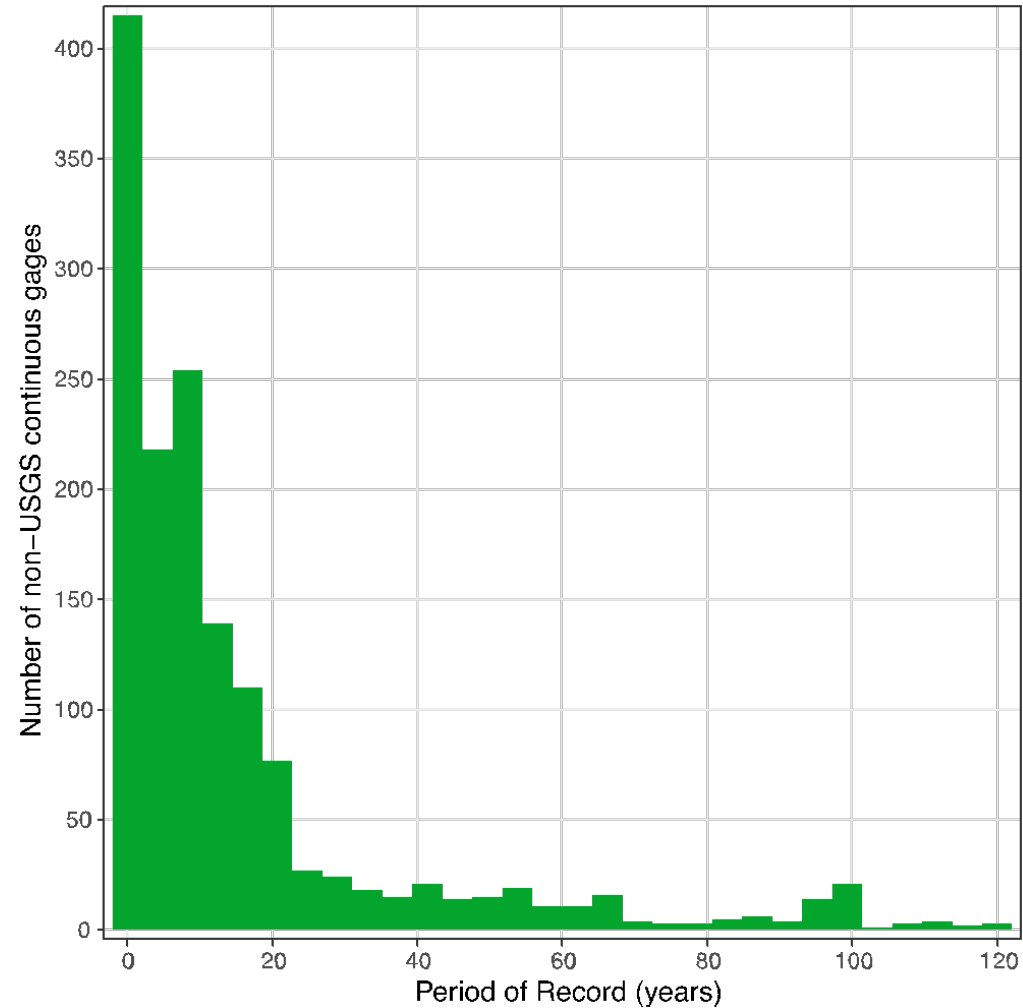
Continuous Gages:
2,661



538: Active
819: Inactive
1,254: Unknown

Discrete
Measurements:
30,557

Duration of record of non-USGS continuous gages in the PNW

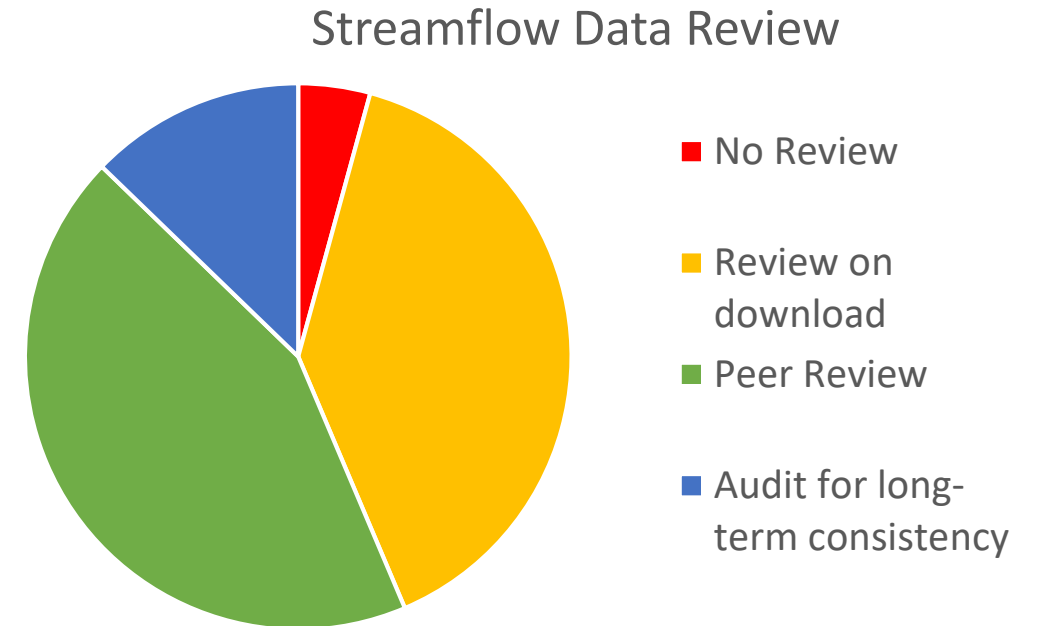


Survey Results – 29+ Organizations

Network Size in # gages	# Networks (Total gages)	Purpose of Networks (multiple purposes allowed; Top three reasons)	Period of record
>40	9 (1,640)	Long-term monitoring Water management Statutory requirements	10-30+ (100%)
11-40	11 (222)	Long-term monitoring Habitat/ecological Water management	<1 (0%) 1-5 (29%) 6-10 (38%) 10-30 (19%) >30 (14%)
<11	29 (157)	Long-term monitoring Habitat/ecological Water management	<1 (11%) 1-5 (43%) 6-10 (17%) 11-30 (0%) >30 (14%)

PNW Streamflow Data Survey Results

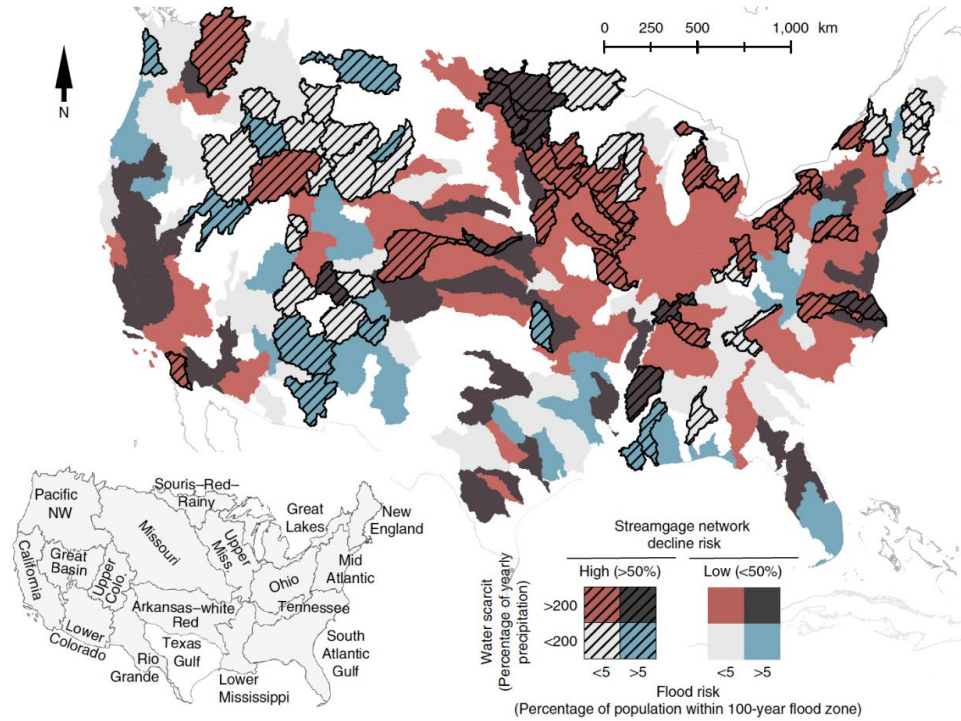
- 56 complete responses
- Streamflow data are collected primarily for organizational needs followed by local community needs
 - National-scale activities ranked lowest for collection purposes
- Quality Assurance & Quality Control (QA/QC) protocols are highly variable across organizations



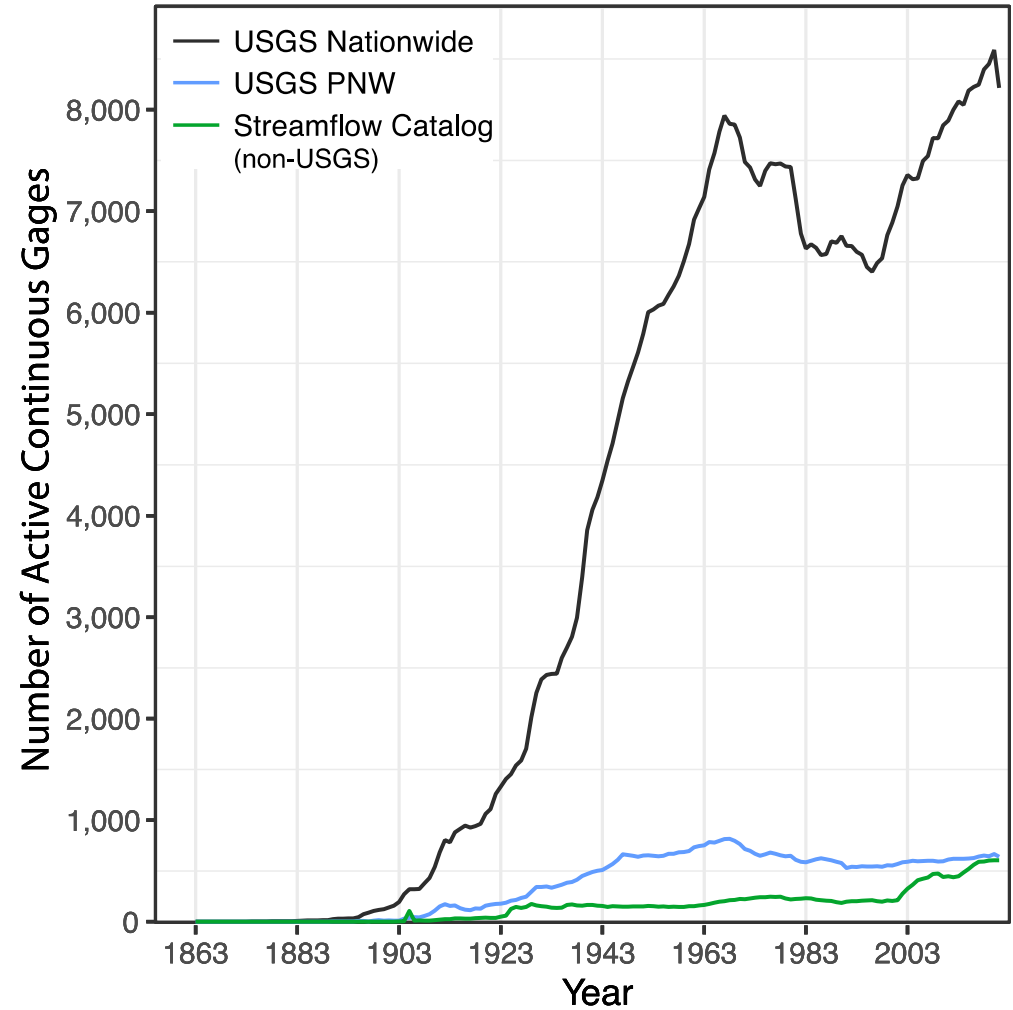
National Context

NATURE SUSTAINABILITY

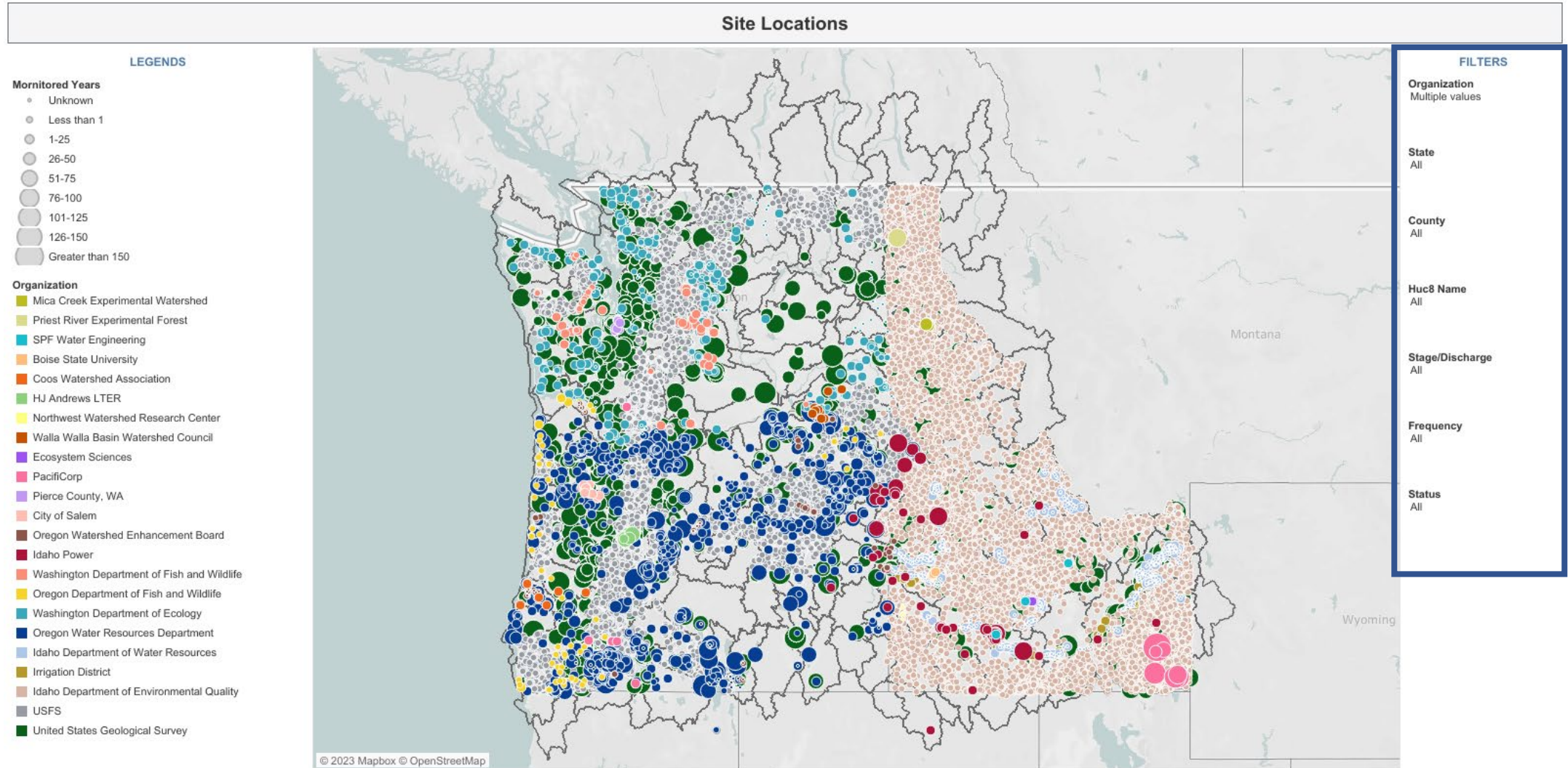
ANALYSIS



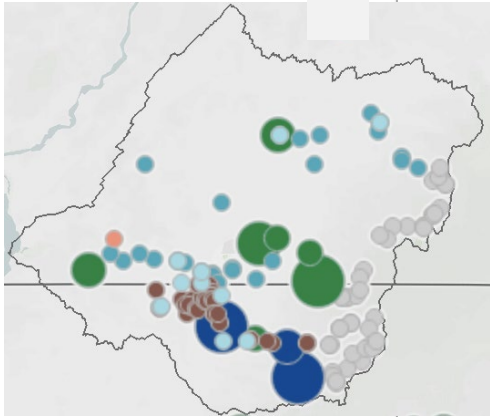
Ruhi, et al., 2018



Streamflow Data Catalog



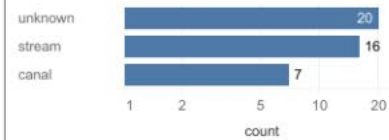
Data Exploration



Additional Site Information

State	Organization	Organization Dataset	Org. Site Name	Site No.	Huc8 Name	Huc8 No.
Oregon	Oregon Water Resources Department	OWRD	COUSE CR NR MILTON-FREEWATER, OR	14011800	Walla Walla	17070102
			DRY CR AB LITTLE DRY CR NR WESTON, OR	14016300	Walla Walla	17070102
			EASTSIDE D AT MILTON-FREEWATER, OR	14012398	Walla Walla	17070102
			HUDSON BAY-TUMALUM CN NR FREEWATER, OR	14012400	Walla Walla	17070102
			LEEHMANN-BISHOP D NR LAKEVIEW, OR	11341160	Walla Walla	17070102
			LITTLE WALLA WALLA R NR MILTON, OR	14012100	Walla Walla	17070102
			MILTON-FREEWATER HUDSON BAY D NR FREEWATER, OR	14012300	Walla Walla	17070102
			PINE CR NR WESTON, OR	14016200	Walla Walla	17070102
			PLEASANT VIEW CN NR FREEWATER, OR	14012200	Walla Walla	17070102
			SWARTZ CR NR UMAPINE, OR	14016350	Walla Walla	17070102
			N FK WALLA WALLA R NR MILTON FREEWATER, OR	14010800	Walla Walla	17070102
			S FK WALLA WALLA R NR MILTON, OR	14010000	Walla Walla	17070102
			WALLA WALLA RIVER AT MILTON-FREEWATER, OR	14012000	Walla Walla	17070102
	Oregon Watershed Enhancement Board	WWBWC	Walla Walla River, North Fork near mouth (River Mile 0.4)	9021	Walla Walla	17070102
	Walla Walla Basin Watershed Council		Course Creek at River Mile 1.1	S-142	Walla Walla	17070102

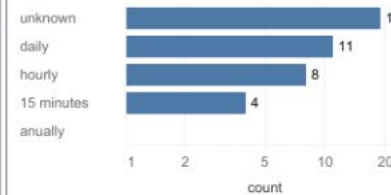
Stream Type



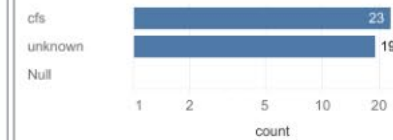
Purpose



Interval



Unit



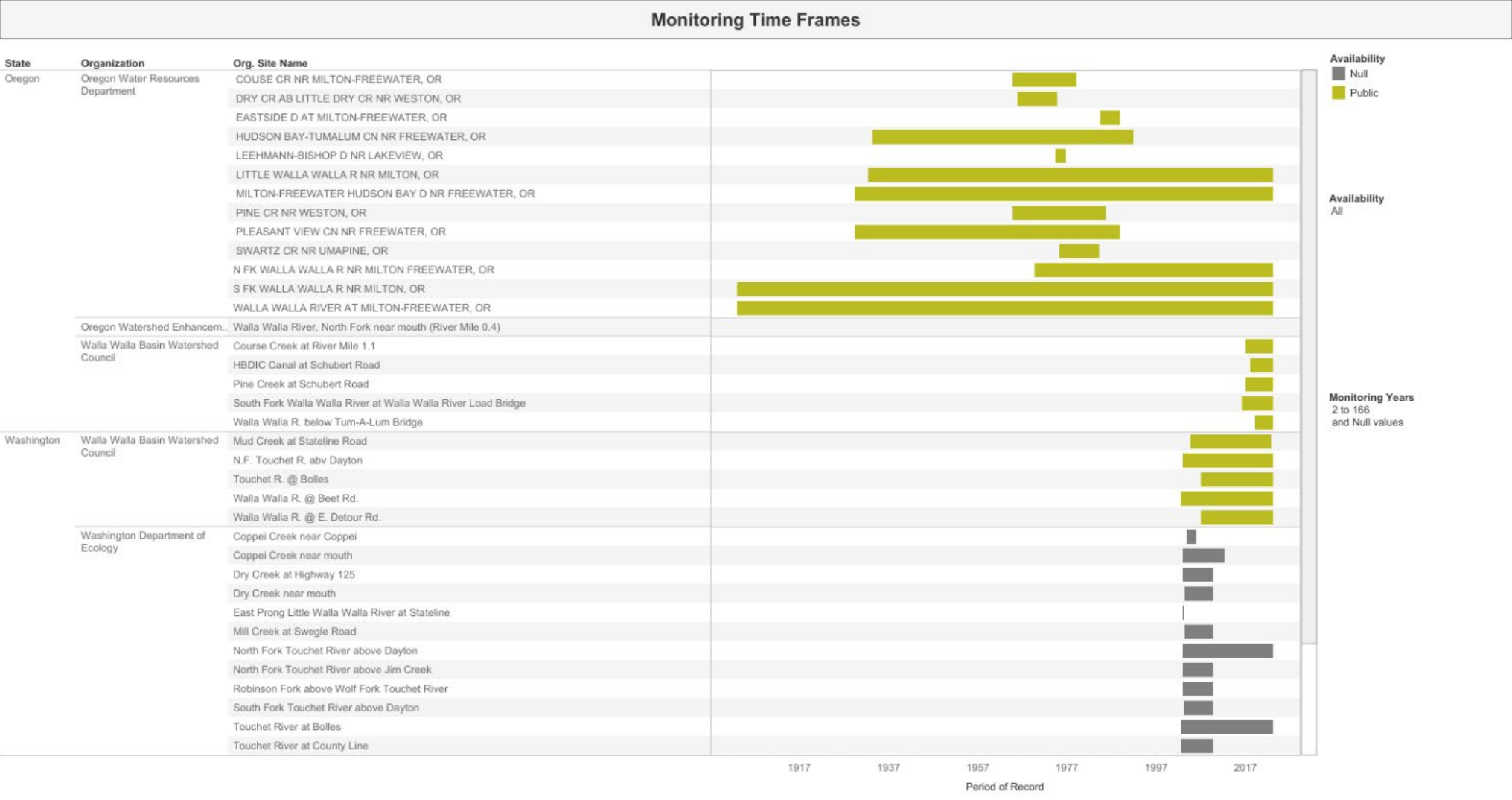
Frequency



Instructions for Use

This dashboard interacts with the **Map** and the **Monitoring Time Frames** dashboards. You can make a selection directly from the table. Use Ctrl+select to select more than one. To reset them, click on the selection [again] to deselect.

Data Exploration



Instructions for Use
 This dashboard interacts with the **Map** and the **Additional Information** dashboards. You can make a selection directly from the table or from the filters above. To reset them, click on the selection [again] to deselect and/or select the "Show All Values" option on the filter.

Challenges Identified

- Volatile funding sources are particularly challenging for small organizations
- Few organizations able to match USGS data quality standards
 - The USGS is the leader in monitoring techniques and QA/QC, yet limited capacity to implement
- Not all organizations have an *accessible* streamflow database

Water Resources Community Solutions

- All organizations have communicated fiscal needs for data management, not just physical monitoring
- Prioritize simplifying and centralizing operating procedures and metadata standards
- Create automated & open-source QA/QC workflows
- Internet of Water, **Geoconnex**: registry system that creates a unique identifier that links to a URL where the original data is hosted
- USGS Water Mission Area – **Network Linked Data Index**: indexes data to the National Hydrography Dataset



Internet
of Water

COALITION

PNW Streamflow Data SWOT Analysis

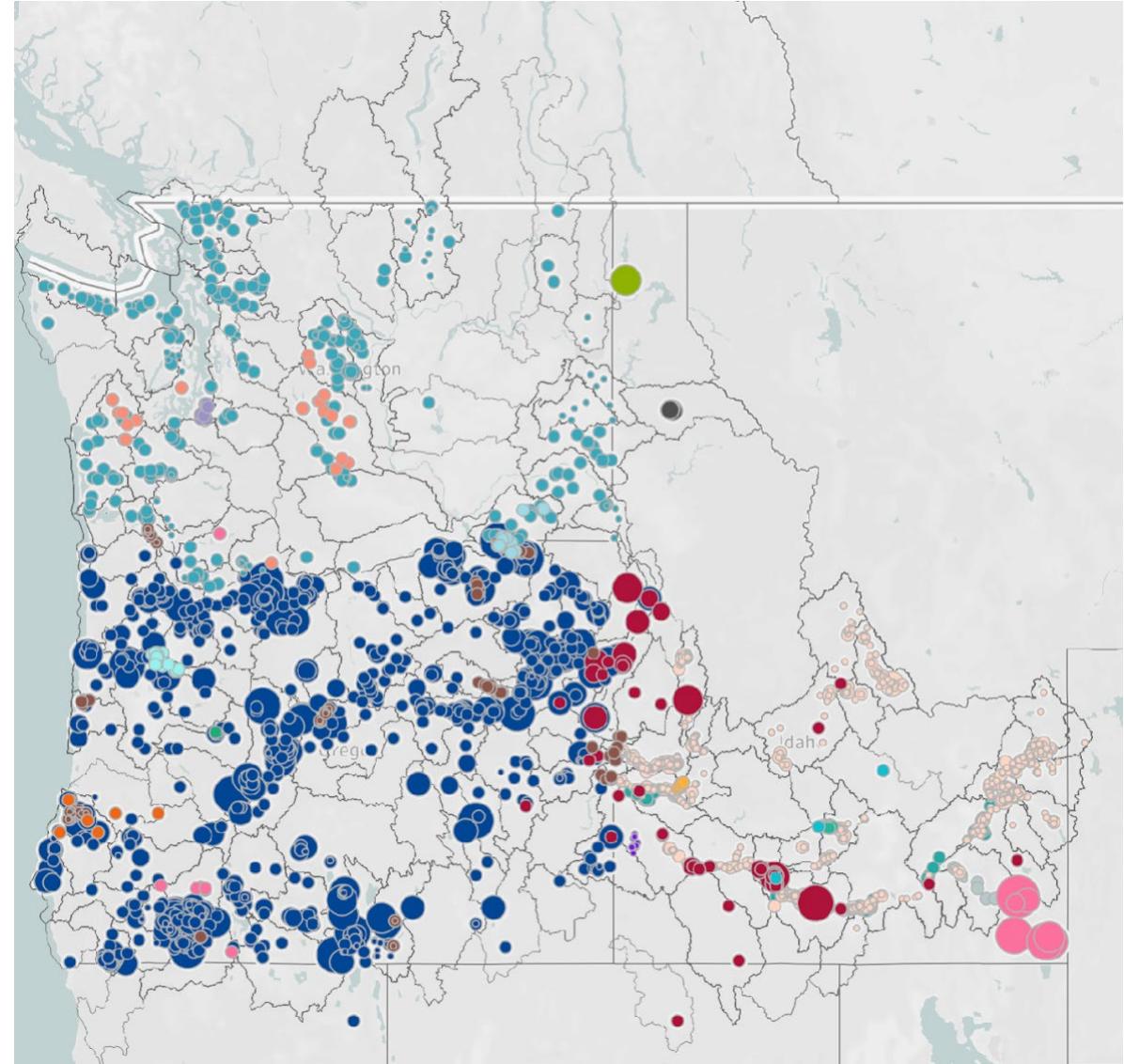
Internal	Strengths <ul style="list-style-type: none">• Created community around PNW streamflow data• Identified common challenges and needs• Developed the Streamflow Data Catalog	Weaknesses <ul style="list-style-type: none">• Engaged individuals are volunteering their time, this is not a funded priority• Existing work is piecemeal by state or organization, so there is limited coordination
	External	Opportunities <ul style="list-style-type: none">• The Water Mission Area is exploring Tiered Gaging• There are examples of funded USGS training opportunities for tribes (e.g. TESNAR) which could be expanded• The Internet of Water is facilitating these efforts
	Valuable	Challenges

USGS Leadership Opportunities

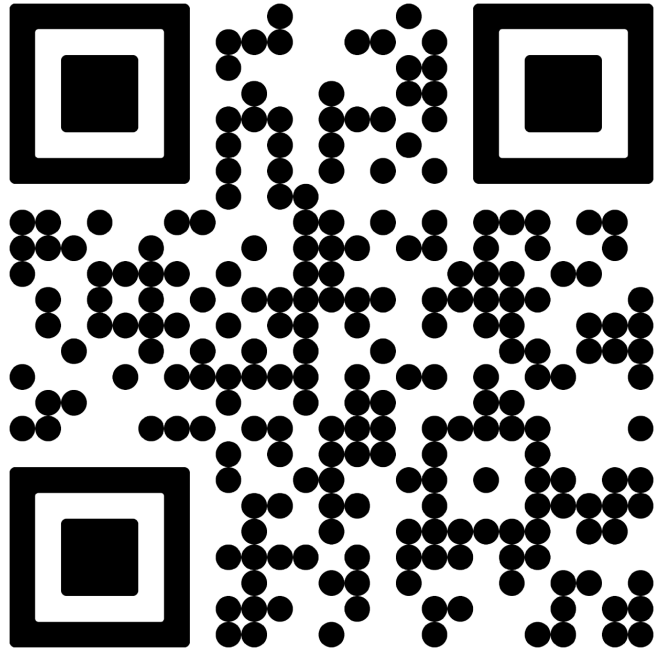
- Advancement of tiered gaging concept
- USGS provides the science and descriptions behind methods
- Advancing FAIR practices for the benefit of all organizations

Take-homes

- There is a ton of data out there
- Integrating data is a BIG task
 - We need to know where the data are located
 - Metadata needs to be complete
 - Resources need to be allocated
- Efforts like this increase the visibility & utility of ongoing streamflow data collection



Fill out this form if you have Streamflow Data!



Streamflow Data Catalog:

tableau.usgs.gov/views/Streamflow_Catalog/Introduction