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September 6, 2023

### **MEMORANDUM**

**TO: Fish and Wildlife Committee**

**FROM: Kris Homel**

**SUBJECT: Update on the Intermountain Province Subbasin Data Management Project**

#### **BACKGROUND:**

**Presenter:** Dan McMeekan, Water Resources Specialist with the Intermountain Province Subbasin Data Management Project, Kalispel Tribe

**Summary:** The Fish and Wildlife Committee will hear a presentation on the resources available to the region through the Intermountain Province Subbasin Data Management Project, a project implemented by the Kalispel Tribe. The presentation will include information on how the project's resources relate to the Council's Fish and Wildlife Program and how they are accessed and shared, along with a discussion of emerging tools or innovations.

**Relevance:** Regional data and information-management projects are critical to supporting the Program's data management, analysis, access, and communication functions. As part of the Mainstem and Program Support Project Review in 2019, the Council formulated a programmatic issue to address the importance of these projects. The programmatic issue emphasized the need to identify which resources house information derived from Program funded projects and how those resources can be accessed by the public. Over the course of this year, the staff will invite all seven of the data management projects included in the Mainstem and Program Support Review to share similar presentations. The Committee has heard from four projects so far- the Columbia Basin Fish and Wildlife Library, the Inter-tribal Monitoring Data project, Data Access in Real Time, and StreamNet. In September, the committee will hear from the fifth

project- the Intermountain Province Subbasin Data Management Project, which is administered by the Kalispel Tribe under Project # 2011-020-00.

Background: A large amount of data is collected throughout the basin by many different projects and having access to that information is critical. This is the role filled by data management projects- they support the Program's data management, analysis, access, and communication functions. Each project is a little different and each fits different needs for their organizations.

The seven data management projects were reviewed in the 2019 Mainstem and Program Support Project Review. In this review, the ISRP highlighted, and the Council agreed with, the importance of supporting regional and sub-regional data management, storage, and dissemination of information necessary for Program implementation and assessment (please see [Programmatic Issue #2](#), pages 8 and 9). In particular, intentional planning for, and dedication of funding is necessary for (1) sharing information that informs decisions and (2) keeping pace with new technologies and knowledge through workshops and other learning experiences. This requires balancing investments in data collection with investments for data processing (data management, analysis, data steward expertise/support) and communication of information.

In an effort to address the Council recommendation and to advance the Council's efforts in the assessment of program performance, there is a need to better understand the information and data sharing resources in the basin, which provide the Council and region with critical Program data and information. In the decision document from the 2019 review, the Council recommended that a subcommittee of the Regional Coordination Forum be convened. The tasks of this subcommittee would be to (1) communicate the role of the regional and sub-regional databases/repositories in providing public access to information derived from Program funded projects, (2) identify the primary regional databases/repositories that house information supporting the Program, and (3) address efficient flow of information between regional and subregional databases/repositories, and projects collecting and analyzing data.

Toward this end, the Council has organized a series of presentations on data and information management projects for this and upcoming Fish and Wildlife Committee meetings. The Council developed a set of questions to better understand the specific work each data management project is doing, how they relate to each other, and how they relate to the Council's Program. Some of these questions are asked of every project during their presentation, and others are specific to individual projects. The presentation on the Intermountain Province Subbasin Data Management Project will provide answers to questions 1-3, 6, and 7.

The required questions are:

1. Describe the data and resources that you provide to the region.
2. How do these data and resources relate to the Council's Fish and Wildlife Program?
3. How are these resources accessed and/ or shared among organizations?

The additional questions are:

4. What kind of collaborations or relationships exist between your data/repositories/organization, and other data management projects/organizations in the basin (not just within the Program)?
5. As the basin and program continue changing and other information needs arise or change, what opportunities do you have to adapt to these different needs?
6. What do we need to be aware of in the future to continue providing data management for the full suite of work implemented under the program?
7. Are there emerging tools or technologies we should be aware of? New data management needs? Innovations to share?

Through these presentations, we hope to highlight the resources that are available from these projects as they relate to the Program both to better understand the accomplishments of the Program, and to inform the region. Following the series of presentations, the Council will develop a summary of the answers each project provided to their specific questions.

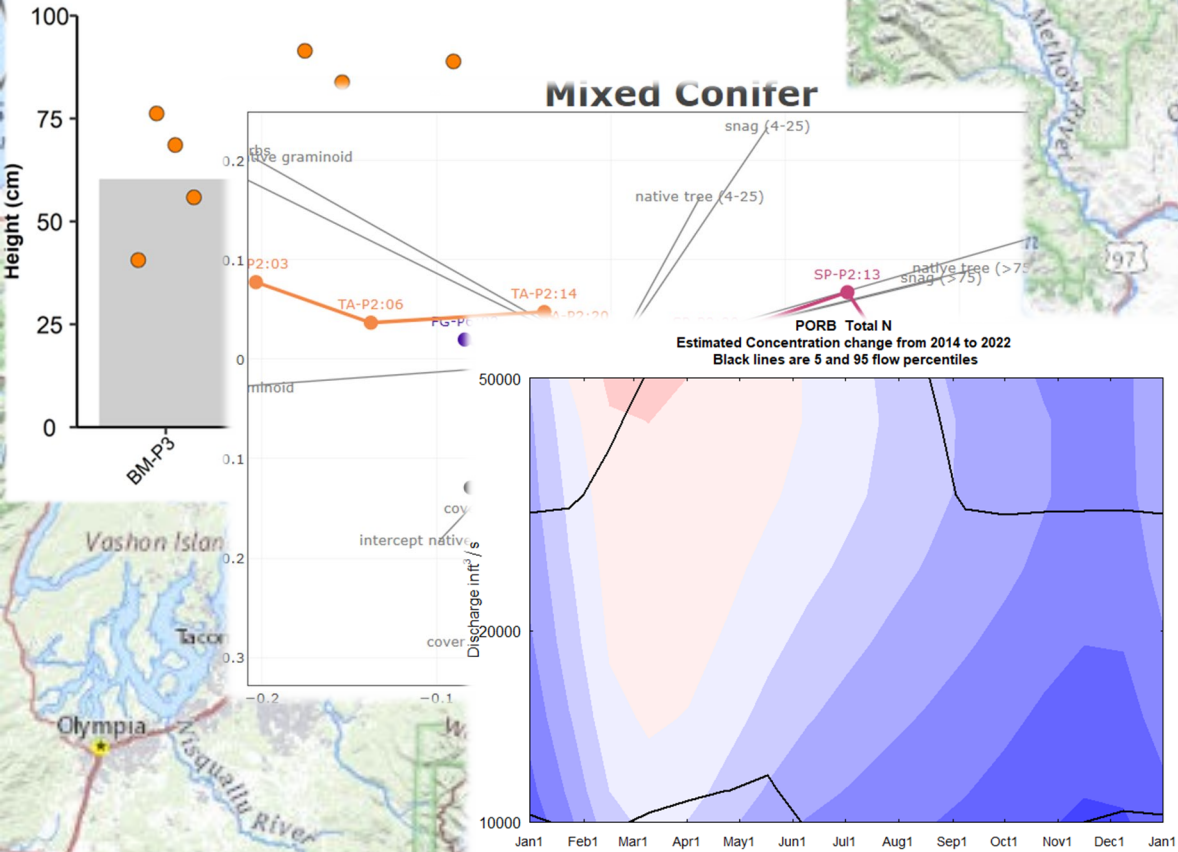
More Info: <https://knrd.org/land/>  
<https://gisdata.knrd.org/knrdgisviewer>



# 2011-020-00 Intermountain/Province Database

## Management System (GEDMS) Project

● Forb ● Graminoid ● None ● Shrub

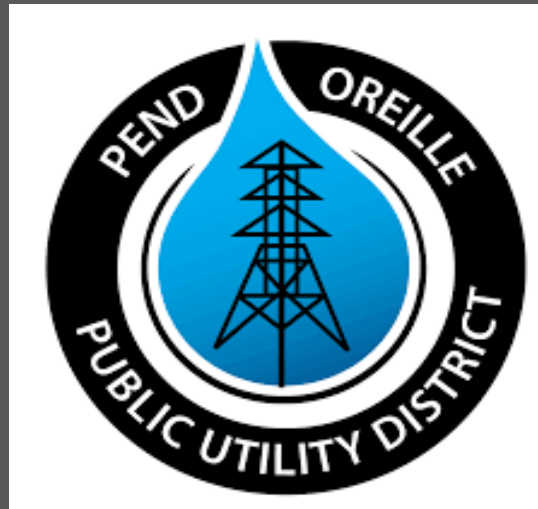


Dan McMeekan [dmcmeekan@knrd.org](mailto:dmcmeekan@knrd.org)



# Project cooperators and data availability

- Repository for terrestrial and aquatic data in eastern Washington and North Idaho
- 69 primary datasets / 5 additions current FY
- 5 Tribes, 1 university, 1 state agency, and 1 utility district
- Recent collaboration – Pend Oreille PUD to UWMEP Terrestrial Monitoring Program (2020)



# Data Sources & ArcGIS Infrastructure

## Layers & Project Counts

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- Aquatic Habitat - 10 Projects
- Cultural - 2 Projects
- Fisheries - 23 Projects
- Forestry - 17 Projects
- Water Resources - 7 Projects
- Wildlife - 10 Projects

## ArcGIS Spatial Components

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- Points, lines, or polygons, depending on the project
- Navigable through layer selection and spatial search tool
- Can also be queried by layer/project and drop-down lists
- Standardized symbology and common base map choices

# Intermountain Area

## Regional Stakeholder Projects

- Upper Columbia Wildlife Monitoring and Evaluation Project (UWMEP) – Upper Columbia United Tribes, EWU, and Pend Oreille PUD
- Joint Stock Assessment Project (JSAP) – CCT, Kalispel, Spokane, and WDFW
- Spring Pike Index Netting – (SPIN) Kalispel and WDFW
- Pend Oreille River & Lake Roosevelt Pike Suppression Project – Confederated Colville Tribes, Kalispel, and WDFW
- Mill Creek Watershed Assessment – Kalispel, POPUD, and USFS (newest collaboration) – Recreational Trails Project







## Terrestrial Resource Data

Upper Columbia Wildlife  
Monitoring & Evaluation Project  
(UWMEP) – Collaborative  
Monitoring Effort

- Coeur d'Alene Tribe
- Confederated Tribes of the Colville Reservation
- Eastern Washington University
- Kalispel Tribe
- Kootenai Tribe
- Pend Oreille PUD
- Spokane Tribe of Indians



# UWMEP Study Sites 2002 - 2023

 **Query Data** 

Please select a date range

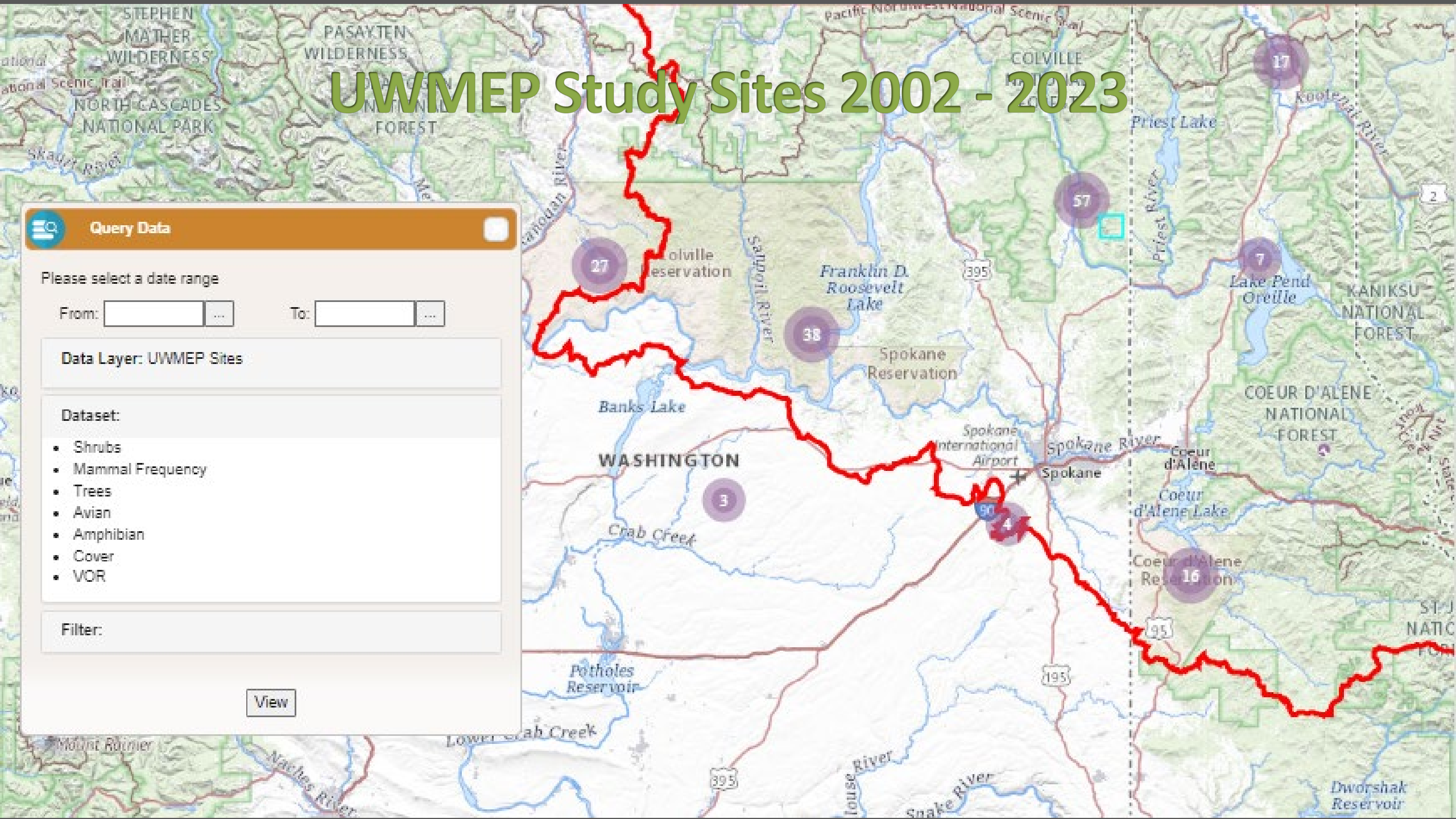
From:  To:

Data Layer: UWMEP Sites

Dataset:

- Shrubs
- Mammal Frequency
- Trees
- Avian
- Amphibian
- Cover
- VOR

Filter:



# UWMEP Monitoring Details

## Strategy

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- Independent monitoring by centralized UCUT staff and field crews
  - Stratified random sampling design for mitigation lands
  - Field Methods – standardized monitoring and equipment
  - Monitoring rotates annually by land ownership
  - 53 mitigation stations sampled in 2020

## Goals

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- To meet the monitoring and evaluation requirements of BPA's mitigation agreements
- Support data-driven management of mitigation properties
- Be able to track changes on mitigation lands through time

# Methods

- R Package VEGAN\* Community Ecology diversity analysis for community and vegetation ecology
  - Non-metric Multidimensional Scaling Analysis (NMS) – for vegetation and birding surveys
  - $\beta$  Diversity/Dissimilarity Index(s) – for vegetation
  - Restoration Success Scorecards – for veg, avians, and amphibians
  - Visual Obstruction Readings (VOR) – vegetation functional group and heights

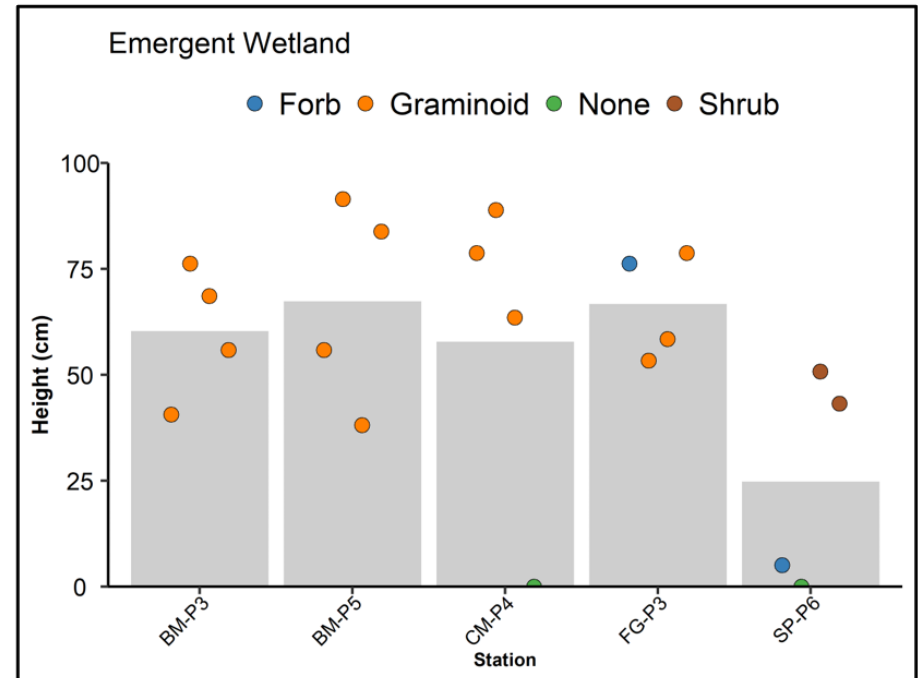
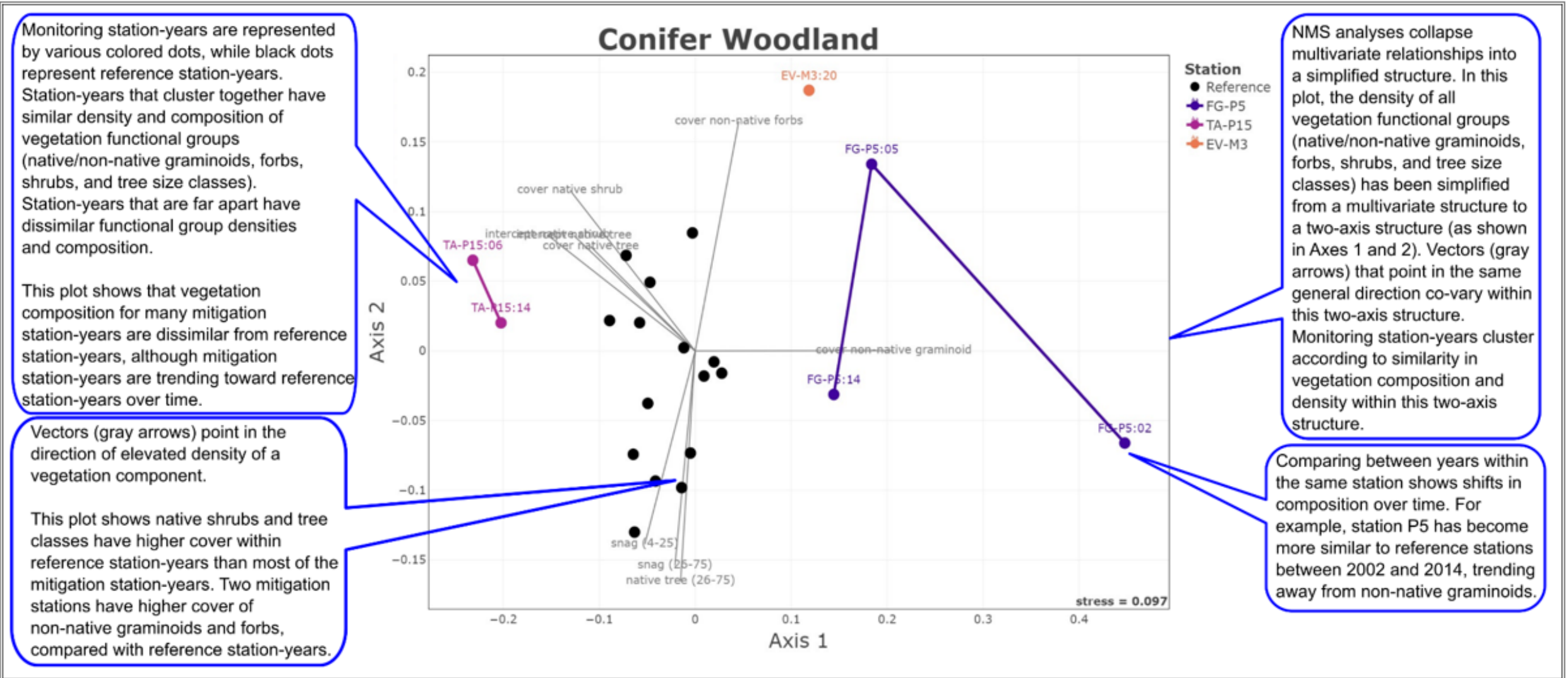


Figure 6. Example VOR plot for the Emergent Wetland Kalispel mitigation stations.

Note: Gray bars represent the mean VOR height measurement; dots represent individual measurements. None indicates a measurement direction which was open water or some other non-vegetative substance.

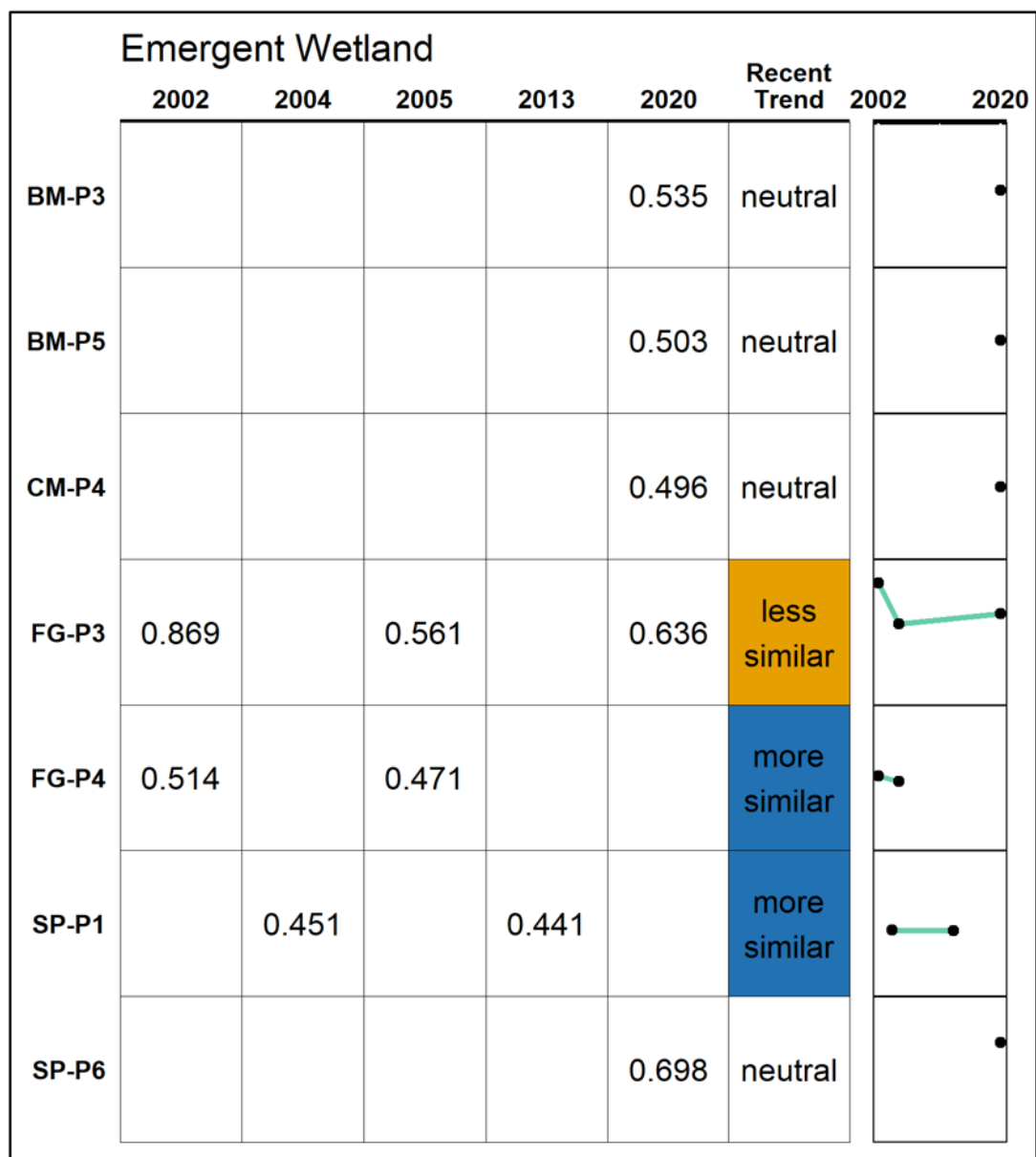
\*Oksanen J, Blanchet FG, Friendly M, Kindt R, Legendre P, McGlinn D, Minchin PR, O'Hara RB, Simpson GL, Solymos P, Stevens MHH, Szoecs E, Wagner H (2018) vegan: Community Ecology Package. R package version 2.5-2.





**Figure 4. Example of a vegetation NMS plot of conifer woodland data.**

Note: Circles represent individual station-years, with increasing distance between station-years reflecting increasing dissimilarity in functional group composition. Black circles represent all reference station-years. Unique colors represent each station (as shown in the legend). Lines of the same color as each station connect station-years through time. Gray vectors (arrows) illustrate elevated cover or counts of individual functional groups. All reference stations are located within Turnbull National Wildlife Refuge (three stations surveyed four years and one station surveyed three years).



## $\beta$ Diversity/Dissimilarity Index(s)

- $\beta$  diversities comparing veg data from mitigation station years to aggregate reference data
- Tables provided for each individual site across all habitat types
- Values closer to zero are becoming more similar to reference site stations, while values closer to 1 are becoming less similar to reference site stations

**Figure 5. Emergent wetland  $\beta$  diversity values for Kalispel (comparing individual mitigation station-years to aggregate reference data) calculated at the genus level using Euclidean distance; recent trends and sparklines compare station-year results for each mitigation station.**

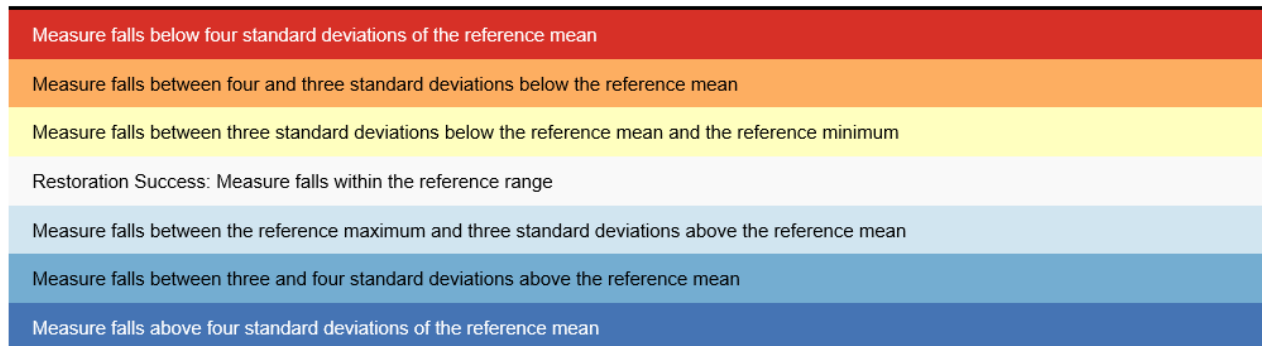
Note: Values closer to 0 have more similar community composition to aggregated reference station-years (two stations surveyed three years) than numbers closer to 1. Although only Kalispel stations are shown here, all emergent wetland stations across all ownerships surveyed in 2020 were included in the analysis.

# Vegetation Scorecards

- Tracks trends in habitat conditions within mitigation stations as they transition towards or away from desired future conditions
- Identify the need for adaptive management intervention
- Values are color-coded according to how close they are to the full range of reference station values for the same habitat type

Table D-1. Kalispel (Flying Goose) Mixed Conifer Vegetation Scorecard.

Structure; Function	Data Collection Method	Metric	Reference Mean (Range)	FG-P6	
				2002	2005
Ground cover; forage and cover	% Cover (Daubenmire)	native graminoid	9 (3–13)	4	0
		non-native graminoid	<1 (0–<1)	6	0
		native forbs	24 (16–32)	26	26
		non-native forbs	<1 (0–2)	10	<1
		native shrubs (small)	49 (34–80)	20	26
		native trees (small)	7 (0–16)	11	4
Shrub cover; forage and cover	Shrub Intercept (m)	native forbs (large)	5 (0–14)	4	5
		non-native forbs (large)	0 (0–0)	0	0
		native shrubs	172 (0–331)	68	111
		native trees (small)	17 (0–33)	48	15
		non-native trees (small)	0 (0–0)	0	0
Tree/canopy cover; cover/shading	Stem Counts by species	native tree 4-25 cm	495 (27–881)	85	66
		native tree 26-75 cm	115 (24–181)	7	22
		native tree >75 cm	<1 (0–5)	0	0
		non-native tree 4-25 cm	0 (0–0)	0	0
		non-native tree 26-75 cm	0 (0–0)	0	0
		non-native tree >75 cm	0 (0–0)	0	0
		snag 4-25 cm	43 (2–110)	15	5
		snag 26-75 cm	5 (0–15)	0	2
snag >75 cm	0 (0–0)	0	0		
Species Richness	Species List	Proportion of number of species present in mitigation compared to reference (%)		85	79





**Table 8. Kalispel Emergent Wetland Avian Scorecard**

Guild Type	Guild	Reference	Species Richness Value											
			BM-P3	BM-P5	CM-P4	FG-P3			FG-P4			SP-P1		SP-P6
			2020	2020	2020	2002	2005	2020	2002	2005	2014	2004	2013	2020
Nesting Structure	burrow	0.0	1	1	0	0	0	1	0	0	0	0	0	0
	cavity	2.3	0	2	0	3	2	1	3	5	2	3	4	4
	cavity, secondary	1.4	4	2	1	4	1	1	2	3	0	2	0	3
	cliff	2.0	1	1	1	1	0	0	1	0	1	3	1	1
	floating	2.2	0	0	1	3	1	1	1	1	1	1	0	0
	ground	4.3	7	6	5	10	7	3	8	6	5	4	1	4
	herbaceous vegetation	4.0	2	3	3	5	5	3	4	5	2	3	2	3
	parasitic	1.0	0	1	0	1	0	1	0	0	1	1	1	1
	shrub	3.4	4	6	1	2	1	2	5	3	6	4	5	4
	tree	6.2	5	6	1	4	3	5	6	4	14	11	11	9
Disturbance Response	beneficial	2.5	2	4	1	4	1	1	3	1	3	3	4	2
	neutral	14.7	16	21	6	22	15	13	18	18	20	19	13	20
	sensitive	7.5	6	3	6	7	4	4	9	8	9	10	8	7
Diet	aquatic generalist	1.5	0	1	1	3	2	2	2	2	0	1	0	1
	aquatic herbivore	1.7	0	0	0	3	2	0	1	1	0	0	1	1
	aquatic invertebrates	2.8	4	4	1	7	3	2	4	2	2	3	0	1
	generalist	3.3	3	5	0	5	4	2	5	3	7	4	6	5
	granivore	2.8	0	1	1	1	0	1	0	0	1	1	1	2
	herbivore	1.2	0	1	0	1	0	0	2	1	1	1	0	0
	insectivore	12.2	15	16	9	11	7	10	13	17	19	19	16	16
	piscivore	1.6	2	0	1	2	2	1	3	1	1	1	0	3
	raptor	0.0	0	0	0	0	0	0	0	0	1	1	1	0
scavenger	1.0	0	0	0	0	0	0	0	0	0	1	0	0	
<b>Overall Species Richness</b>	<b>25.0</b>	<b>24</b>	<b>28</b>	<b>13</b>	<b>33</b>	<b>21</b>	<b>18</b>	<b>30</b>	<b>27</b>	<b>32</b>	<b>33</b>	<b>26</b>	<b>29</b>	

Note: Values listed are the number of species detected during the three selected and combined surveys within each station-year. Number of species in each station year is compared to the mean reference values for that guild. The color fill indicates the difference in the number of species: yellow indicates station-years with >1.5 species fewer than the mean reference value, light green indicates station-years with 1.5 to 0.1 species fewer than the mean, dark green indicates station-years with 0 to 1.5 species greater than the mean, and blue cells have >1.5 species greater than the mean.

## Avian Scorecards

- Breeding bird surveys that assess species abundance, community diversity, and tracks their trends
- Data provides info on the avian response to changes in habitat structure and function
- Indicates progress toward restoration success

# Amphibian Scorecards

- Contain mean count per trap night from all mitigation and reference station years
- Counts used to compare species lists and relative abundance between species within each station-year

		Riparian Shrub					
		Mitigation		Mitigation	Mitigation	Reference	
		KTOI-P7		KTOI-P9	KTOI-P15	FG-R10	
		2013 (3)	2020 (4)	2020 (2)	2020 (2)	2003 (10)	2004 (5)
Invasive	American Bullfrog	0	0	0	0	15.6	2.6
	Ambystoma species	0	0	0	0	0	0
Native	Columbia Spotted Frog	1	0	0	0.5	0	0
	Long-toed Salamander	0	0.25	0	0	0.2	0
	Oregon Spotted Frog	0	0	0	0	0	0
	Pacific Treefrog	0	0	0	0	0	0
	Tiger Salamander	0	0	0	0	0	0
	Western Toad	0	0	0	0	0	0

**Figure 7. Example Amphibian Scorecard for Kootenai Riparian Shrub habitat type.**

Note: Values within the cells represent counts per trap-night. Trap nights are given in parentheses under the year of the survey. For years prior to 2019 trap-nights are a minimum only as historical data only included nights where there was at least one capture. Therefore, the number of trap-nights (and calculated counts per trap-night) may be inaccurate for surveys completed before 2019.



# Joint Stock Assessment (JSAP) / Resident Fish Projects

**Query Data**

Please select a date range

From:  To:

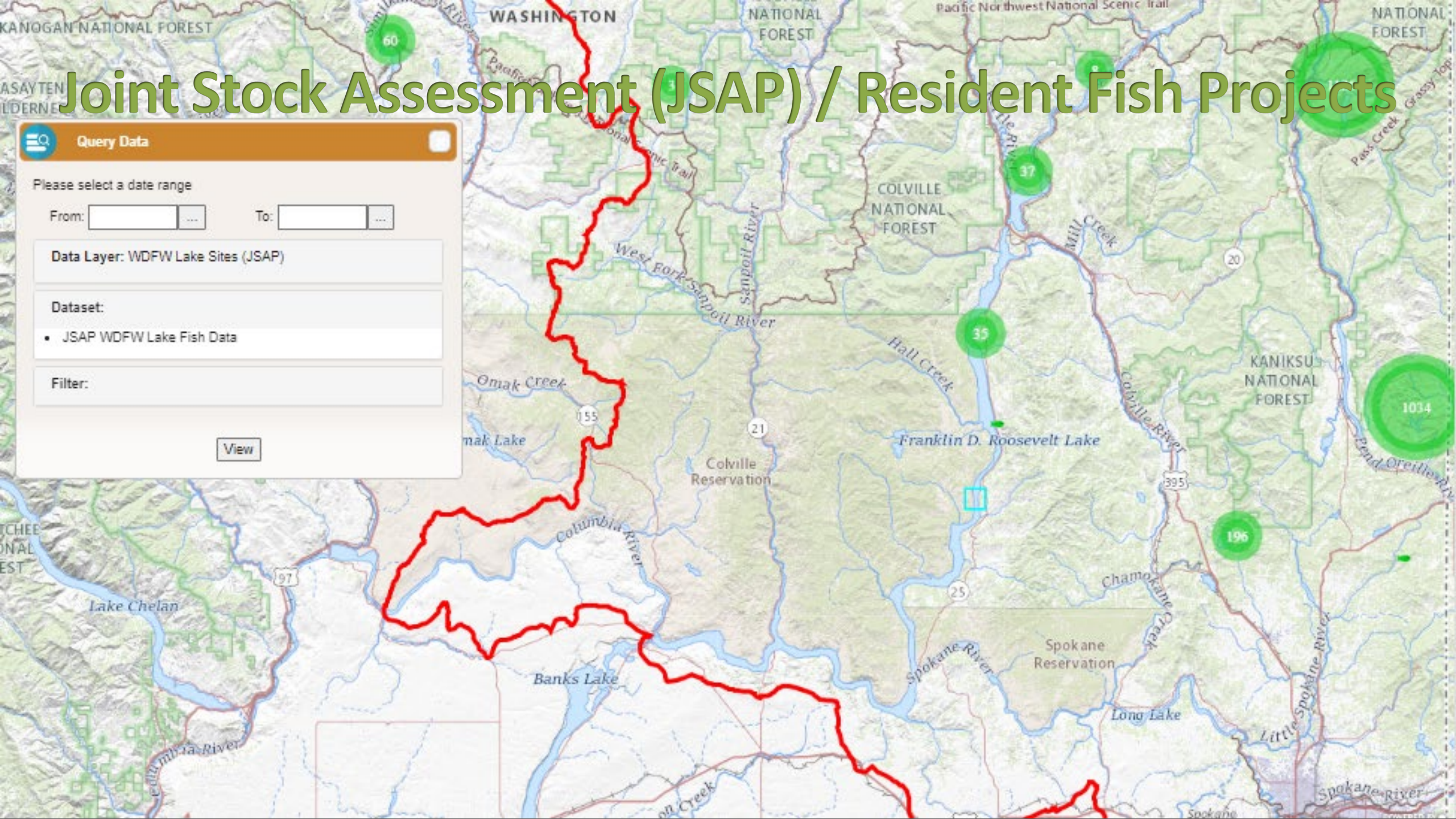
Data Layer: WDFW Lake Sites (JSAP)

Dataset:

- JSAP WDFW Lake Fish Data

Filter:

[View](#)





# Joint Stock Assessment (JSAP) / Resident Fish Projects

## JSAP – Origin for Priority Stream Projects

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- Eastern Brook Trout Rotenone treatments
- Western Cutthroat Trout reintroductions
- Redband Trout Mark-Recapture Projects
- Sterile YY Eastern Brook Trout outplant Projects

## JSAP – Origin for Priority Lakes Projects

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- SPIN – Spring Pike Index Netting
- Sullivan Lake Kokanee Weir Trapping
- Pike Suppression Project(s)
- Burbot Assessments / Genetics
- Redband Trout Baseline Assessments – Upper Columbia River
- Redband Trout Genetics Project

# Innovation and Flexibility is the future

## ➤ Open-Source Programs

- (R, Python, Juno, Julia, Apache Zeppelin, etc.)
- Extensions and integration between programs are becoming the new standard
- Example: R package rio <https://cran.r-project.org/web/packages/rio/vignettes/rio.html>

## ➤ ArcGIS Portal (Group sharing and user-defined editing capabilities)

## ➤ Wildcard

- Big data, i.e., Large Language Models (AI) – likely to be monetized through enterprise development and software rollouts
- Uncertainties about how this will influence database development

# Innovation and Flexibility is the future cont.

- Prepare to Pivot – Expect rapid change in data collection techniques, summary outputs, and storage needs
- Increase in remote sensing (Unmanned Aerial Vehicles) and imaging that generate lots of data
  - Lidar models for water and terrain are commonplace
  - Expect widespread adoption
  - Costly – UAVs can be expensive; the software is normally proprietary and licensed



# Watershed Trends - (EGRET) USGS R Stats package

- EGRET (Exploration and Graphics for RivEr Trends)\* Weighted Regression on Time, Discharge, and Season (WRTDS)
- Program pulls data directly from the USGS gaging network (daily average discharge)
- Simultaneously pulls water quality data from 1 of 3 sources
  - USGS or other agency sampling station
  - National Water Quality Portal
  - User-supplied flat file, properly formatted
  - Merge Data → Run WRTDS Model → Output → Analysis
- Went live February 2023

\*Hirsch, R.M., De Cicco, L.A., Murphy, J., 2023, Exploration and Graphics for RivEr Trends (EGRET), version 3.0.8, doi:10.5066/P9CC9JEX

## Appendix 4. Sample Workflow\*

These workflows illustrate a simplified workflow used in interactive processing. They can serve as a handy reference to remind the analyst of the order of processing and the names of the most common functions and their commonly used arguments.

Load data from web services:

```
library(EGRET)
Daily <- readNWISDaily("06934500","00060","1979-10-01","2010-09-30")
Sample <-readNWISSample("06934500","00631","1970-10-01","2011-09-30")
INFO <-readNWISInfo("06934500","00631")
eList <-mergeReport(INFO, Daily, Sample)
```

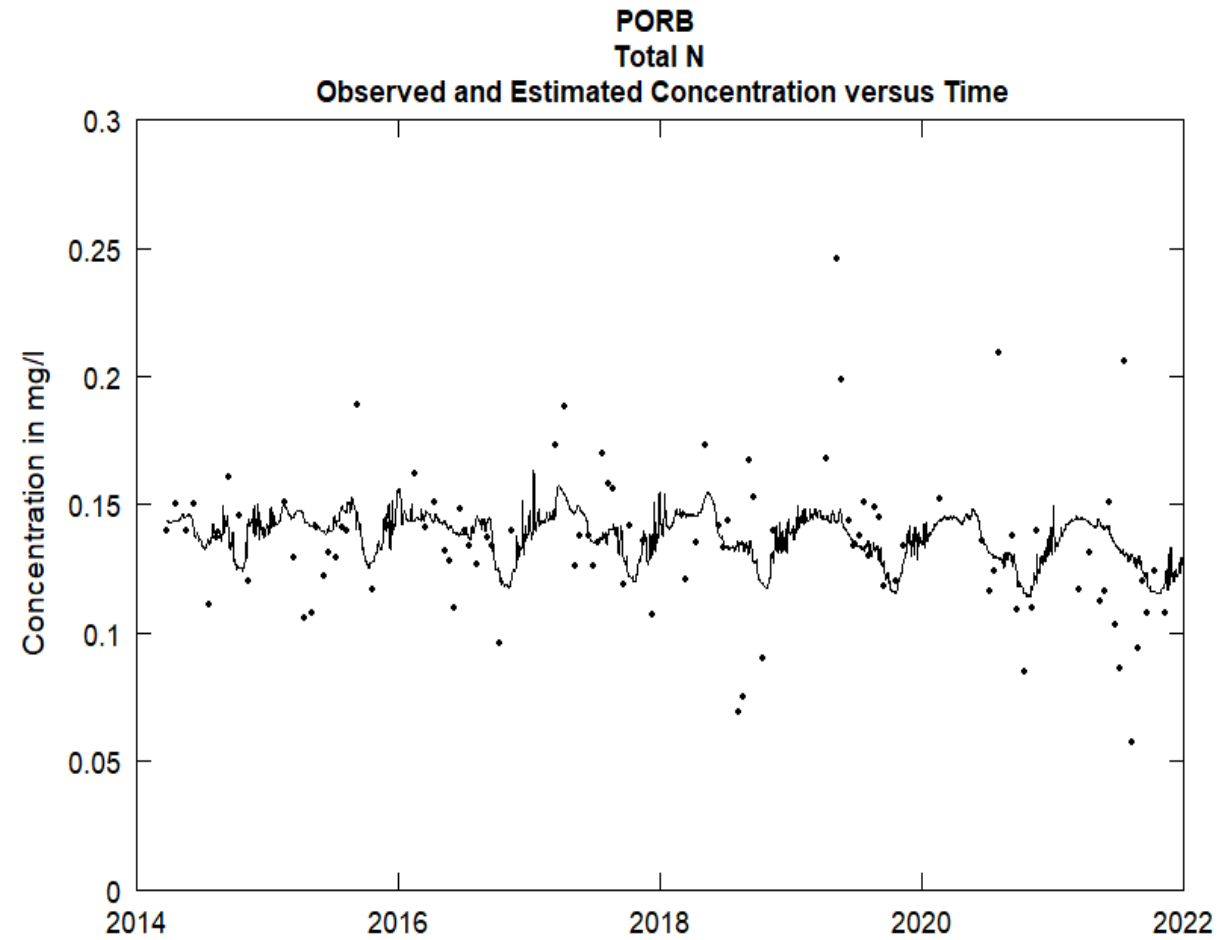
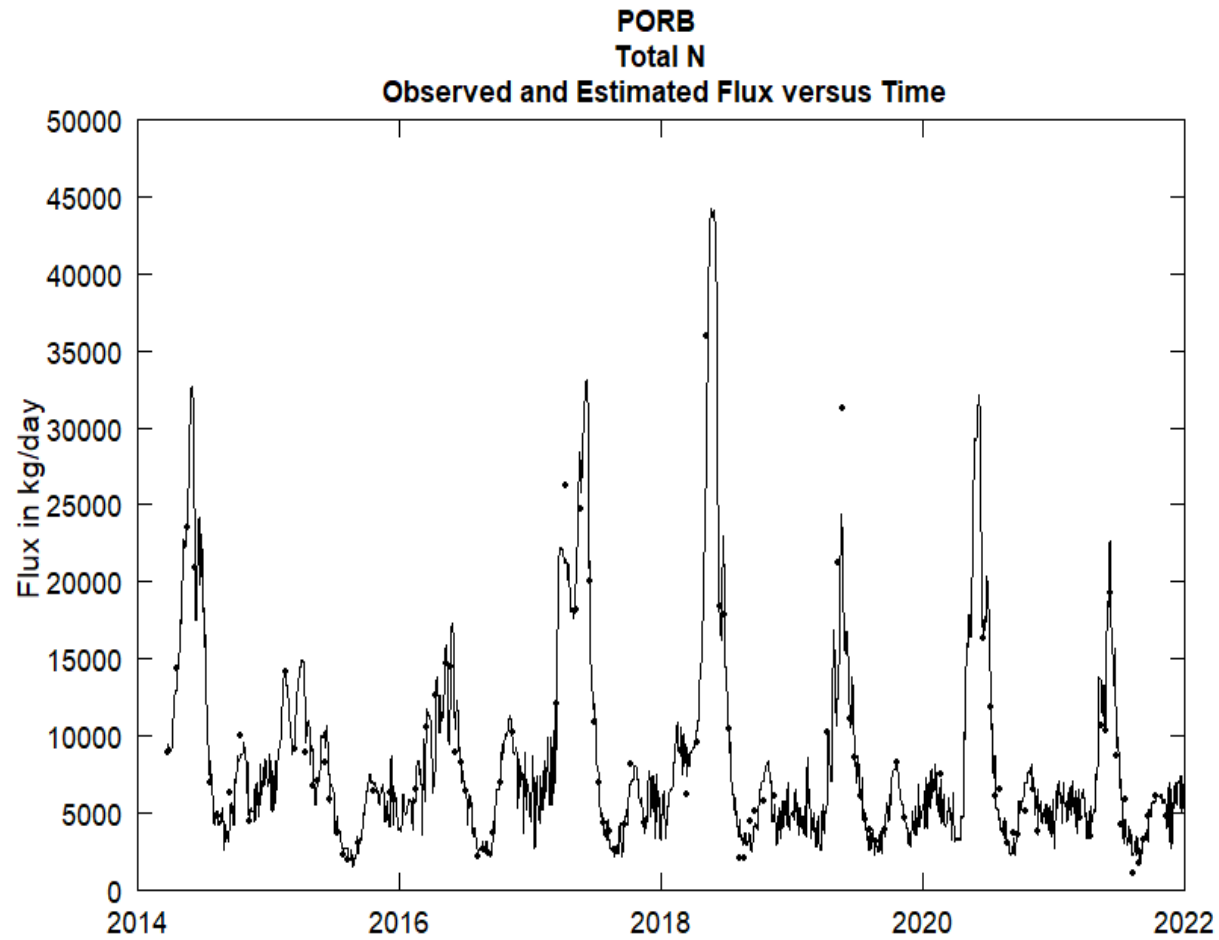
- A few interactive prompts, then
- Hit the run button
- Start analyzing

\*Hirsch, R.M., De Cicco, L.A., Murphy, J., 2023, Exploration and Graphics for RivEr Trends (EGRET), version 3.0.8, doi:10.5066/P9CC9JEX

# EGRET Watershed Analysis / Trends

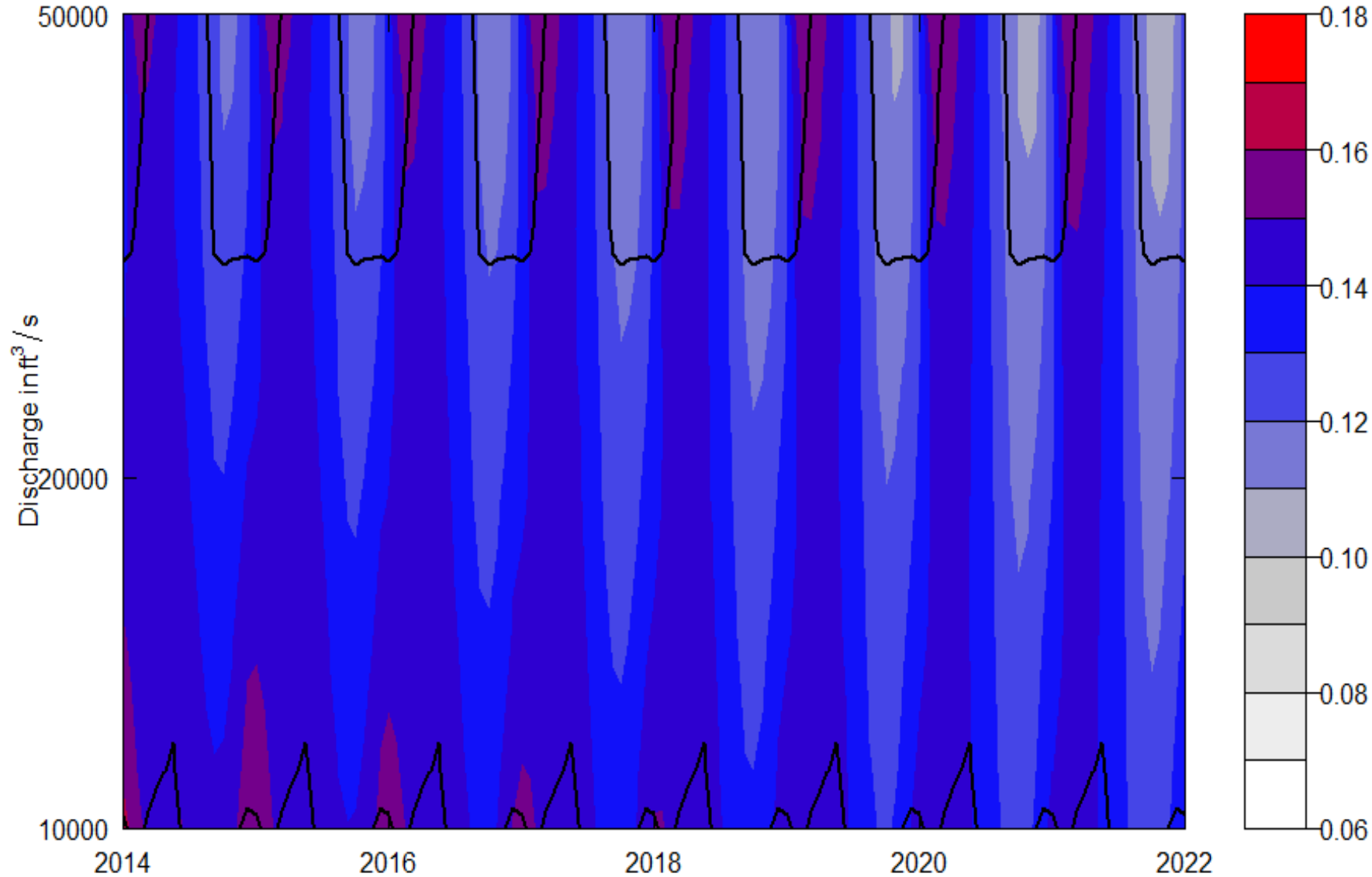
- Properly formatted data stored for modeling provides seamless integration
- Shows the utility of primary data storage for rapid and powerful analysis with less effort – click the run button
- Multiple (batched) water chemistry analyses can be run
- Companion module EGRET Ci available April 2023

# EGRET Watershed Analysis / Trends





PORB Total N  
Estimated Concentration Surface in Color  
Black lines are 5 and 95 flow percentiles

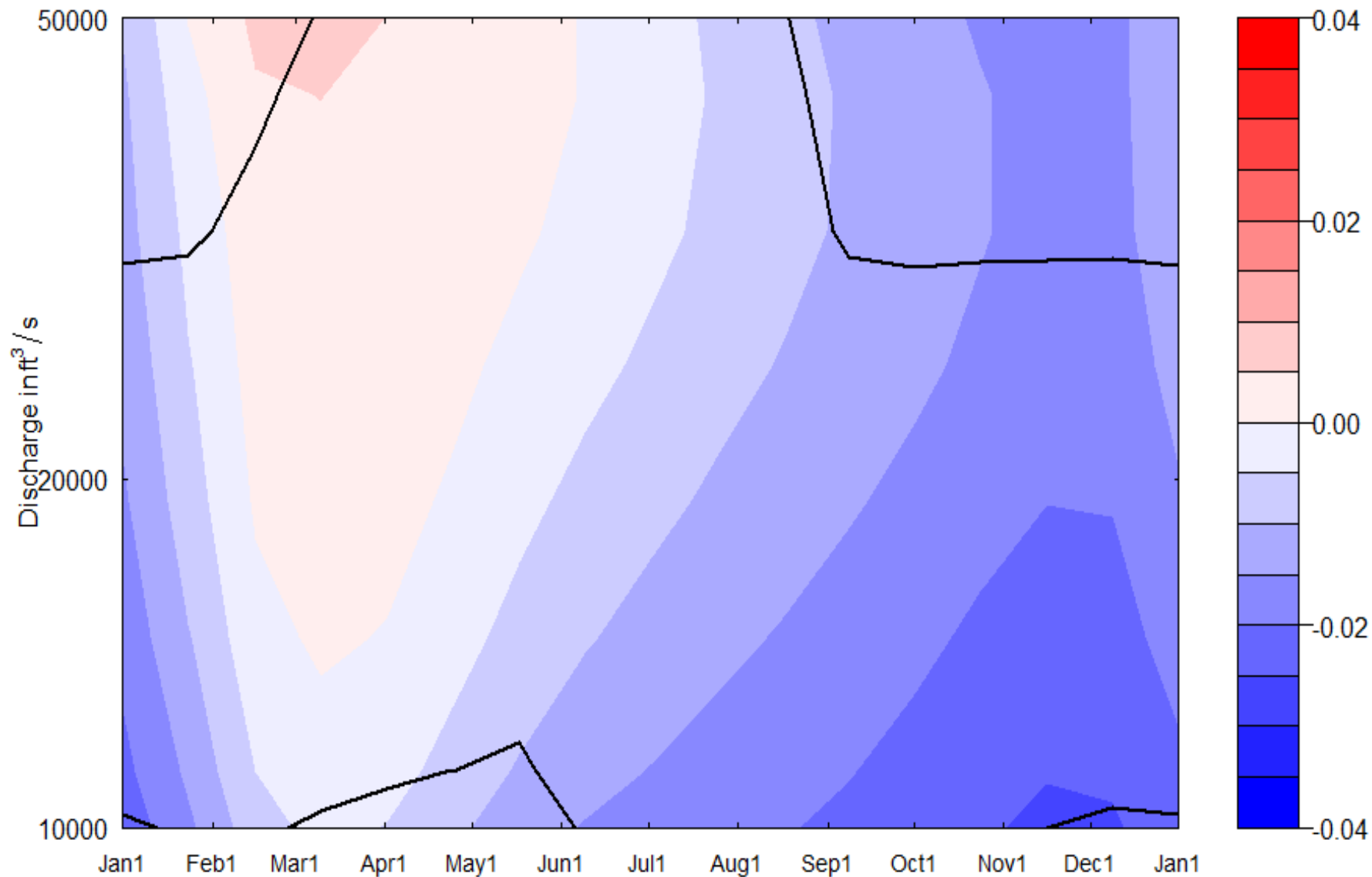


# EGRET

## Watershed Analysis / Trends

- Shows a steady decline in concentration by year and intra-seasonally
- Decline during the winter period, although there is a slight increase during spring runoff.
- We can ask what are the changes in TN concentrations for the period

PORB Total N  
Estimated Concentration change from 2014 to 2022  
Black lines are 5 and 95 flow percentiles



# EGRET

## Watershed

### Analysis / Trends

- Improvement for much of the year, particularly from summer through winter
- Land use practices or something else (waste treatment effluent release)?
- Possible to capture new permit end of pipe discharge activities

# Support of the Council's Fish and Wildlife Program

- A GIS-driven database on watershed monitoring data should be established. Ideally...coordinated with terrestrial monitoring-mitigation data also being collected.\*
- Standardization of data collection efforts across projects\*
- Terrestrial and aquatic primary data repository\*
- Eliminate redundancy and provide access to primary data\*
- Multiple agency efforts for a regional database repository\*
- Extraction of data, reports, and providing access to metadata\*
- QA/QC utilities, data validation provided in Data Management System (DMS)

# What does BPA need to know – future implementation

- Increased funding for the maintenance of databases because IT infrastructure is changing rapidly
- Transitioning from on-site physical data servers to Cloud storage centers:
  - Pros:
    - Provides an ala cart experience for current and future storage needs
    - Security upgrades (in real-time)
    - IT focus on services/troubleshooting, *not* hardware maintenance or security threats
  - Cons:
    - Costs are prohibitive for many. Set up for base network exceeding 20k
    - Monthly Fees 2k+, and requires experts to set up
- Wage inflation is occurring, and subcontract work costs are rising



# What's next - New additions to GEDMS

- Wildlife Carnivore Survey – KNRD & F&WS
- Trails Project (Mill Creek Watershed Assessment) – KNRD, USFS, PUD
- Peregrine Falcon Surveys – KNRD
- Fisheries eDNA Brook Trout Suppression Project
- Cutthroat Trout DNA Project



# Thank you!

## Citations

Coutant, C.C., et al., Council Document ISRP 2000-3, Review of Databases Funded through the Columbia River Basin Fish and Wildlife Program

Hirsch, R.M., De Cicco, L.A., Murphy, J., 2023, Exploration and Graphics for River Trends (EGRET), version 3.0.8, doi:10.5066/P9CC9JEX

Oksanen J, Blanchet FG, Friendly M, Kindt R, Legendre P, McGlinn D, Minchin PR, O'Hara RB, Simpson GL, Solymos P, Stevens MHH, Szoecs E, Wagner H (2018) vegan: Community Ecology Package. R package version 2.5-2.