Data Visualization Resources. Dear Everyone, Please contribute, share! last update: 2019-11-24

Sponsored by PNAMP. Curator: sherynolson@usgs.gov

pacific northwest aquatic monitoring partnership

Contents

Presentations to our Workgroup

~~~~~~

Presentations to our Workgroup

Presentation slide decks are posted on pnamp.org, Data Visualization Project under documents. Video of the presentations are here: Data Visualization google drive folder and on YouTube PNAMP channel, Data Viz playlist. Running workgroup meeting NOTES are posted here.

November 21, 2019: ***NOTE*** - most of these presentations were a live demonstration of the websites.

1. Neil Ward, QW Consultants, presenting with Nancy Leonard, PhD and Mark Fritsch for Northwest Power and Conservation Council: Fisheries and Wildlife; Neil will present the *Program Performance & Progress* tool the Council just released and showcase components of the Program Tracker tool that we will refine over the next few years-the hatchery Ops Dashboard and the Pike Ops Dashboard components. neil.ward@qwconsult.com
2. Benjamin Letcher, PhD, Research Ecologist of the USGS Conte Anadromous Fish Lab presenting the Spatial Hydro-Ecological Decision System (SHEDS) and parts of SHEDS such as the Interactive Catchment Explorer; a focus on cross-filters. U.S. Geological Survey, Leetown Science Center, Silvio O. Conte Anadromous Fish Research Center, One Migratory Way, Turners Falls, MA and UMass Amherst Dept. of Environmental Conservation. ben_letcher@usgs.gov bletcher@eco.umass.edu

September 19 2019 **Colleen Roe** (roec@critfc.org), Solutions Architect/Team Lead ITMD Project and **Denise Kelsey** (keld@critfc.org), Fishery Scientist/IT Program Manager (GIS/Data Management & Applications) of Columbia River Inter-Tribal Fish Commission (CRITFC) presented Tableau: a workshop to develop your data visualizations. **David Graves** presented for Denise.

Colleen notes, "This presentation is going to explore the use and power of data visualizations as a communication mechanism. We
~~~~~~

will build effective visualizations using Tableau, a market leading data visualization tool. Attendees will learn how to use this intuitive tool and be capable of building their own visualizations afterwards. Denise Kelsey will then explain the capabilities built into Tableau to use geospatial information to create geovisualizations. Attendees do not need any preparation for this event."
Getting Started with Tableau.

July 18 2019 ***NOTE*** - there is no slide deck powerpoint available. The entire presentation was a live demonstration.

1. **Steve Rubin**, Fishery Biologist, Western Fisheries Research Center, Seattle srubin@usgs.gov, and **Sachin D. Shah**, Hydrologist, Geospatial Science and Cyber Innovation Branch, Seattle, sdshah@usgs.gov. Both of USGS.

Visualizing spatiotemporal variations of juvenile Chinook Salmon use of eelgrass in Puget Sound

The degree to which eelgrass on river deltas provides critical habitat for estuarine fishes, especially out migrating juvenile salmon, is an important scientific and management issue in the Puget Sound. USGS scientists studied the spatiotemporal variation in abundance and body size of juvenile Chinook Salmon in relation to eelgrass in Puget Sound. In conjunction with the study, a data visualization tool was developed to allow users to interactively explore fish abundance and body size including selecting any desired combination of location and time period. The tool takes into account environmental effects on the distribution and abundance of these species, the application also includes temperature, salinity, depth and supporting data layers that allow end-users to consider how diking and river channelization potentially influenced eelgrass use by these fish.
Data visualization website: Eelgrass Habitat for Chinook in Puget Sound

2. *Part Two*: Sachin Shah.

The path forward for Data Visualizations in Science. Products from the Texas Water Science Center

May 16 2019 Two presentations. A redux - where are they now? Chantell Krider (formerly NOAA contractor developing Puget Sound Partnership's data visualizations) and Michelle Steg-Geltner (Yakama Nation) presented last year in April 2018. Members asked for updates to some of our partners' work and today, Michelle and Chantell presented their new upgrades.

1. **Chantell Krider**, WA Recreation and Conservation Office, chantell.krider@rco.wa.gov: Tour of the **State of the Salmon websites** and the **Salmon Open Data Portal**. Quick update on **Effectiveness and Evaluation Tools (EET**) that uses data from many different agencies to communicate what's working to restore water quality, salmon, and shellfish beds, but it is not a database. It is a set of query tools to gather information about recovery actions and outcomes to evaluate which actions are effective. Audiences are: Project sponsors – to share local project outcomes; Project managers – to apply local results to a regional scale; Project funders – to demonstrate accountability. EET is an interactive website, with ESRI Story Maps, Tableau - Factsheets, Source data downloadable, with a back end engine using R with package shiny, and others.

2. **Michelle Steg-Geltner**, Yakama Nation Fisheries, stem@yakamafish-nsn.gov: Update on **Status and Trends Annual Reporting Project**

We use Infographics, Story maps for non-technical audiences; Online Data Query and Summary Reports for technical audiences; and Comprehensive Annual Reports, Interactive Websites for both audiences. We use guiding questions as we develop: Who is the audience? What is the message? What data should be displayed or summarized? Can it be understood within 30 seconds-Is it intuitive? The audience informs how the data is presented; one visual doesn't work for all. There are 11 different audiences divided into Technical vs. non-Technical. The Dashboard is in development: http://dashboard.yakamafish-star.net/ Email Michelle for pwd: stem@yakamafish-nsn.gov. PDFs of STAR reports also available at: http://yakamafish-nsn.gov/restore/projects/star

March 21 2019 **David S. Pilliod, Justin Welty presenting (jwelty@usgs.gov)** , with **Michelle I. Jeffries*, Forest and Rangeland Ecosystem Science Center (FRESC)***, U.S. Geological Survey, Snake River Field Station. ***Collecting, Managing, Displaying, and Summarizing Data with the Land Treatment Digital Library and Land Treatment Exploration Tool,***

Data collection and analysis are fundamental to adaptive management of natural resources, but managing and accessing datasets over time has been a perennial challenge for agencies. Until recently, legacy datasets were often collected and stored locally and thus have been largely inaccessible to other resource managers and scientists. This can result in the loss of valuable information and a waste of public resources. Here we will focus on data associated with vegetation manipulations known as land treatments. Legacy treatment datasets have the potential to provide a wealth of information for current resource managers and researchers who want

to design more effective rehabilitation, reclamation, and restoration treatments. In 2008, the U.S. Geological Survey (USGS) partnered with the Bureau of Land Management (BLM) to design the Land Treatment Digital Library (LTDL). The LTDL currently houses >46,000 land treatments and captures tabular data, spatial locations, and documentation in a consistent format. These data are available via our interactive website (https://ltdl.wr.usgs.gov/). The BLM and USGS then partnered to create the Land Treatment Exploration Tool (https://chsapps.usgs.gov/apps/land-treatment-exploration-tool/), an web-application designed (1) to provide a spatial overview of the environmental and landscape characteristics of a planned treatment area and (2) allow users to easily compare a proposed treatment to similar past land treatments. By leveraging the power of standardized, archived data, we hope to improve communication and information about past land treatments to improve future land treatments in the spirit of adaptive management.

November 15, 2018 meeting, three presentations

1. **Kristopher Krowley**, Burns-Paiute Tribe Kristopher.Crowley@burnspaiute-nsn.gov (541) 573-8083: Using Interactive Maps to Strike the Balance Between Technical Rigor and Story-Telling.

As many entities can relate, the Burns Paiute Tribe has a need for a way to keep data protected, accessible, and useful in a variety of circumstances. The use of web-based interactive mapping tools provides us the ability to present and interact with data in a way that is secure, accessible, and meaningful for a broad range of audiences and situations.

2. **Erin Butts**, USFWS (erin_butts@fws.gov): Telling the Pacific Lamprey Story: Using Story Maps for Data Visualization.
   Connecting with a broad audience has its challenges which we addressed by creating an interactive story map allowing users to curate their experience to fit their needs. Web-based mapping tools allow us to tell a story, engage the public and to collaborate more efficiently with partners. https://fws.maps.arcgis.com/apps/MapJournal/index.html?appid=34d16fcc9e5...

3. **Evan Brown**, Idaho Dept of Fish and Game (evan.brown@idfg.idaho.gov): Fishing for Big Data: Follow Idaho Salmon Home (FISH) Website Update
   IDFG and FPC plans to update an older website to accommodate ever increasing data and new data visualization tools. Presented here is an Overview of the existing website and goals for the future.

October 18, 2018. Presentations of data visualization projects.

Data Visualization tools and dashboards for fish and wildlife data.

1. Presenter: **Jon Walker**, Jon.Walker@icf.com, GIS specialist, ICF

   Abstract: Fish and wildlife data present unique visualization challenges due to the complex physical and temporal landscapes on which species coexist. A single "snapshot" of conditions is often inadequate, with many environmental variables, species, scenarios, and metrics available for evaluation. We use open source libraries to develop a suite of user friendly tools to assist with aquatic habitat evaluation, stakeholder engagement, and the visualization of species recovery priorities from empirical and modeled ecosystem data. These tools allow us to share information in effective ways that can help guide watershed restoration planning. Resource managers can visualize complex quantitative information to assist with making critical restoration funding decisions for future species recovery. This talk will explore use cases of how these tools are currently applied throughout the Pacific Northwest, and examine lessons learned along the way.

Data Driven Decision Making with Visualization

2. Presenter: **Joe Kirby**, Joe.Kirby@mdc.mo.gov, IT – Enterprise Information Architect, Missouri Department of Conservation
   Abstract: With today's technology, collecting data is easier than ever. Often, we struggle to effectively display our data in meaningful ways. Business Intelligence tools offer organizations the ability to display data in a way that can easily tell a story for a wide audience. This session discusses how the Missouri Department of Conservation is using Tableau to expose our data to more people as well as allow all levels of the organization to better understand trends and patterns in data. With this information, our goal is to enable employees to make quality decisions on the direction of conservation initiatives. Here is a link to two dashboards I have on Tableau Public. https://public.tableau.com/profile/joe.kirby#!/

August 16, 2018. **Alison Appling**, Alison Appling, aappling@usgs.gov; with Co-Authors Jordan Read, jread@usgs.gov; and Lindsay Carr, lcarr@usgs.gov of the Water Mission Area's Data Science Branch, USGS. Amplifying USGS science with timely and

digestible data visualizations. USGS VizLab: https://owi.usgs.gov/vizlab/, with one example: Shifts in Wisconsin fish habitat due to climate change

July 19, 2018. **John Arterburn**, the Confederated Tribes of the Colville Reservation, John.Arterburn@colvilletribes.com. Habitat status and trend results for the Methow:Report Card and Fish data results on the Okanogan Monitoring. The Methow report card for Chinook and Steelhead and their habitats has many ways to visualize, compare and assess trend data, and John gave us live demonstration walk-through the site. With the presentation are these considerations about data gaps, here: https://www.okanoganmonitoring.org/Reports/ViewReportsForType/8

June 22, 2018. **Nancy Leonard**, Northwest Power and Conservation Council, nleonard@nwcouncil.org, Presented Columbia River Basin Fish and Wildlife Program's Visual Information Tools Download the presentation here on pnamp.org

May 16, 2018. **Russell Scranton**, BPA, rwscranton@bpa.gov with co-author **Brian Maschhoff**, brianm@exelearn.com. BPA Conceptual Data Visualizations on Fish Status and Trends, and Related Actions: Presentation to the Data Visualization Working Group May 16, 2018. Slide presentation. and see March 13, 2018. Russell Scranton thoughts for data visualization and data visualization workgroup: https://drive.google.com/drive/u/0/folders/1MLFdZeCQo2xtDWfhJWce-CjQ_SoZkLcf

April 20, 2018.

1. **Michelle Steg-Geltner**, Yakama Nation Fisheries. Presenting overview of YN data visualization. Sources: Dashboard is still in development: http://dashboard.yakamafish-star.net/, Email Michelle for pwd: stem@yakamafish-nsn.gov. PDFs of STAR reports also available at: http://yakamafish-nsn.gov/restore/projects/star

2. **Chantell Krider**, South Sound Spatial presented the Effectiveness and Evaluation Tool (EET) being developed to visualize watershed restoration data in collaboration with the Washington State Governor's Salmon Recovery Office, Washington State Dept of Ecology, and the Puget Sound Partnership

Tools and Guidance to produce Data Visualizations

21 Nov 2019. : Ben Letcher, Contributor. Avoid cognitive overload!

Shneiderman, B. 1996. The eyes have it: a task by data type taxonomy for information visualizations. Proceedings 1996 IEEE Symposium on Visual Languages:336-343.

The takeaway: Overview first, zoom and filter, then details-on-demand

19 Sept 2019. Colleen Roe, Denise Kelsey, Contributors: Tableau Download Tableau Public from the webpage: https://public.tableau.com/en-us/s/. Book: Murray, Daniel G., with InterWorks team. 2016 Tableau Your Data! Fast and Easy Visual Analysis with Tableau Software. Wiley. and

Effective Visualizations: Visual Analysis Best Practices: Simple techniques for Making Every Data Visualization Useful and Beautiful

Tableau's Ten Commandments of Visualization

I. **KNOW THY AUDIENCE**
II. **THOU SHALT UNDERSTAND AND USE PREATTENTIVE ATTRIBUTES WISELY**
III. **THOU SHALT PROVIDE INSTRUCTIONS TO THY END USER**
IV. **THOU SHALT NOT ABUSE COLORS**
V. **THOU SHALT NOT LEAVE TOOLTIPS AT DEFAULT**
VI. **THOU SHALT NOT STUFF THY DASHBOARD**
VII. **THOU SHALT USE VISUALIZATION TYPES THAT BEST FIT THY NEED**
VIII. **THOU SHALT REDUCE CHART JUNK**
IX. **THOU SHALT BATTLE CHANGE BLINDNESS**
X. **THOU SHALT NOT DOUBLE ENCODE**

WEBINAR: **Collecting, Mapping, Analyzing, and Communicating Location-based Data and Story Maps. Thursday, Sept 26, 2019, 3:00 pm ET.** Use modern web-based geotechnologies to collect, map, spatially analyze, and explain the results of your work to others. These tools include Survey123, ArcGIS Online, Operations Dashboards, and story maps. Join geographer and educator Joseph Kerski for an exploration and demonstration of the ways you can be empowered to analyze your data with today's powerful web maps and apps. Register Explore ESA's past series here! See Sharing Science Clearly: Communicating Science through Data Visualization, July 9, 2019

August 2019. Sheryn Olson contributor. I attended the ESIP summer meeting in July. The Earth Science Information Partners is an international organization created in 1998 by NASA and is the trusted community authority that supports the integration of science and data into mainstream use. Now sponsored by NASA, NOAA and USGS it is composed of 110+ partner organizations. A webinar of the meeting's highlights is available on YouTube at https://youtu.be/vbA8CuQz9Rk. The plenary and individual session recordings can be accessed through the Sched site via the session descriptions. For further information, see "Making Data Matter with Ken Kasey", an interview with Arika Virapongse about 20+ years of ESIP.

Casey, Ken (2019): "Making data matter with Ken Casey" [edited interview transcript—blog post]. In Virapongse, A. (ed.), Making Data Matter (blog series). ESIP. Online resource.

May 22, 2019. Sheryn Olson contributor. Elizabeth Wallace. April 2019. Good Pie Bad Pie. Three things your boss won't care about in your data visualization. Open Data Science (ODSC).

March 2019. Jen Bayer, contributor: **Presenting Data and Information:** A One-day course taught by Edward Tufte.

October 18, 2018. Jon Walker (ICF) Uses open source tools, e.g. Javascript D3 (courses for D3 on Linked In here)https://www.linkedin.com/learning/learning-data-visualization-with-d3-js/welcome

Daniel Gutierrez October 29, 2018. **Insights Through Geospatial Data Visualization.** Open data Science. Accessed online 2018-11-16 at https://opendatascience.com/ (see content map at bottom of any page). sjo

May 16, 2018. Courtesy of Denise Kelsey: I just finished this excellent article on data visualization and designing for your audience. http://style.org/ku/. Complete with ppt slide illustrations - sjo

Evans, Frank. 2018. "How to go Beyond Data Visualization" TED talk Oklahoma, USA. recommended by Open Data Science (ODSC)

Data Visualization Beginner's Toolkit #1: Books and Other Resources

Imnoff, Claudia. September 10, 2015. Best Practices in Visual Data Discovery and Analytical Storytelling. Data Management Association International – Rocky Mountain Chapter (DAMA-RMC) Presentation at annual meeting. Available: http://www.dama-rockymountainchapter.org/wp-content/uploads/2015/09/Sep-10-2015-Best-Practices-in-Visual-Data-Discovery-Imhoff.pdf

Strecker, J 2013. Data Visualization in Review: Summary. International Development Research Center/Centre de recherches pour le développement International IDRC/CRDI. 16 pages. Available online: https://www.idrc.ca/sites/default/files/sp/Documents%20EN/data-visualization-in-review-summary-report.pdf

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

What are the best books on data visualisation? Enrico Bertini, Visualization Researcher/Assistant Professor at NYU. Updated Jul 2, 2016 Originally Answered: There are three books that have been written recently I suggest everyone to add to the data visualization library:

- The TruthFul Art by Alberto Cairo - Why? Because it's the first visualization book that discusses in much more detail how to extract information out of data and how to do it carefully before you decide to present it. It teaches you to be very very careful, and that's a good thing.
- Design for Information by Isabel Meirelles - Why? Because it organizes theoretical knowledge **while** showing you a large section of the visualization design space. It has a very interesting/useful pedagogical style.
- Visualization Analysis and Design by Tamara Munzner - Why? Because it's the first book to cover the whole data visualization pipeline, with a stronger focus on interaction and application development (as opposed to presentation centered visualization). Tamara offers also a very unique taxonomic style for each the topics covered in the book.

Enjoy! Source: Quora https://www.quora.com/What-are-the-best-data-visualization-books

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Examples and Resources

Sept 13, 2019. Sheryn Olson contributor. https://www.esa.org/membership/esa-webinars/, including Sharing Science Clearly: Communicating Science through Data Visualization, July 9, 2019 webinar by Anna K. Monfils, Central Michigan University.

Sept 13, 2019. Sheryn Olson contributor. Six-part blog series sponsored by Tableau, beginning with "Effective data visualizations share this magical hidden structure" by LILACH MANHEIM and MIKE CISNEROS, May 2019.

May 22, 2019. Sheryn Olson contributor. When Data Visualizations go viral: Why This Climate Change Data is on **Flip-Flops, Leggings and Cars** (Vox). Thanks to *Ed Hawkins' Visualizations*, Climate scientist in the National Centre for Atmospheric Science (NCAS) at the University of Reading. Want to learn how to Visualize Data with D3? A climate stripes mug comes with the course!

April 30, 2019. Chris Wheaton (PSMFC) contributor: U.S. Census Bureau Interactive Data visualizations. Don't miss!

March 21, 2019. Justin Welty. ***Land Treatment Digital Library* and *Land Treatment Exploration Tool***.). The LTDL currently houses >46,000 land treatments and captures tabular data, spatial locations, and documentation in a consistent format. The BLM and USGS partnered to create the Land Treatment Exploration Tool a web-application designed (1) to provide a spatial overview of the environmental and landscape characteristics of a planned treatment area and (2) allow users to easily compare a proposed treatment to similar past land treatments

December 19, 2018. Sheryn Olson, contributor: About the Community for Data Integration (CDI). Search for data visualization to find many presentations and examples. ***Anyone can join and participate***. Collaboration areas are the lifeblood of the Community for Data Integration. The whole CDI is considered a community of practice, and there continues to be value in getting the entire group together every month and once a year for a larger workshop.

December 19, 2018. Sheryn Olson, contributor: Open Data Science group's many articles and resources for data visualization: https://opendatascience.com/tag/data-visualization/

October 2, 2018. Becca Scully, contributor: This could be a good data vis presentation. http://www.wafwachat.org/map. I like how they explain the how of it here: http://www.wafwachat.org/data/webservices (s olson). Contacts for WAFWA mike.houts@wafwa.org eric.sproles@wafwa.org
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

September 17, 2018. Mike Banach, contributor: https://www.gapminder.org/ has several well done data visualizations. Just one example for CO2 emissions - press play under the X-axis.

September 12, 2018. Sheryn Olson, contributor. **Motus Wildlife Tracking System** A network of stationary antennas to map migratory animal movement. They are tracking many bird species, a few bat species and at least two insect species (Monarchs and Common Green Darners). Here you can discover, then visualize wildlife tracks by project, by species, sorted by dates. My favorite is migration of Red Knots from 2014-2016.

August 29, 2018. Sheryn Olson, contributor: Dave Merrill and Lauren Leatherby. July 31, 2018. Here's How America Uses Its Land. source: Bloomberg.com. Reporting on how the Forest Service characterizes land use. Accessed 2018-08-29.

August 16, 2018. Alison Appling, Lindsay Carr, Jordan Read of the Water Mission Area's Data Science Branch, USGS. USGS VizLab: https://owi.usgs.gov/vizlab/, with one example: Shifts in Wisconsin fish habitat due to climate change

July 19, 2018. Nancy Leonard, Northwest Power and Conservation Council: Columbia River Basin Fish and Wildlife Program's Visual Information Tools

June 8, 2018. Contributor: Russell Scranton. http://www.r2d3.us/visual-intro-to-machine-learning-part-1/ A great use of a story map to illustrate how statistical machine learning techniques can be used to display data in different ways.

May 29, 2018. John Arterburn via Nancy Leonard and Tom Iverson: new habitat status and adaptive management reporting tool for the Methow River Subbasin. This is an electronic reporting tool that compiled all existing habitat data through 2014 and ran it through the EDT model. Results were compiled and reported at the web address below. Future EDT modeling efforts will be returned in this format from the Okanogan next year and possibly the Entiat and Wenatchee in the next few years if current funding proposals are successful. Follow the web link below. We would love your comments and feedback. Feel free to contact either Eric or I if you have any questions, John ARTERBURN, Principal biologist, Colville Tribes, 509-631-2134, https://ecosystems.azurewebsites.net/hstr-methow/

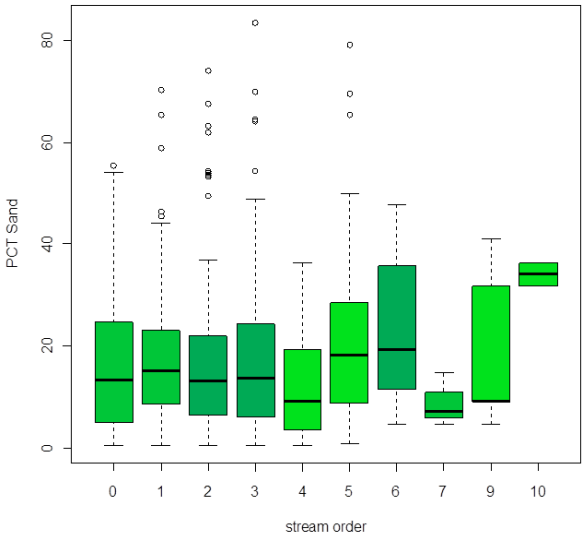
Mar 21, 2018. Contributed by Mike Banach. Univ. MI voter mapping: Visualization by proportions of voters, electoral college. http://www-personal.umich.edu/~mejn/election/2016/

May 18, 2018. Courtesy of Jack Janisch, WA Department of Ecology. Here is a data source for cleaned metric data that can be easily visualized as graphs with a bit of R code: This URL is the starting point https://fortress.wa.gov/ecy/eimreporting/WHM/WHMSearch.aspx?State=newsearch&Section=all Then,

1. type WHM_ in the uppermost box labeled Study ID. Click the blue Search button
2. on the next screen click Download All, at the top
3. on the third screen check the Metrics box and the Physical Field Data box
4. enter the verification code to queue the download.

Jack Janisch (ECY) JAJA461@ecy.wa.gov Contributor. 2018

Stream order is in the Data Collection Event table so you'll just need to join (R command) that to the metrics table.



With these data and the default R package, command: boxplot(), you can produce box-and-whiskers plot of the data showing default medians, with default 25%,75% quartiles, and outliers.Note - When displaying such a figure, including more info in a caption about the percent sand metric would be helpful-sjo, after conferring, Jack sent more info: Shown in the figure is the Percent Sand metric, statewide, plotted against stream order for the combined years 2009-2012.

I'd call the data certified rather than raw, but instead I'd direct them to the metrics. We've done much of the summary work already for legislators, the public, PNAMP members, or others who might want to use the data system by calculating around 250 habitat metrics at each site. Currently data are stored for around 1500 site visits statewide. What the boxplot showed was the condition of Washington state for a particular metric--that's the message I think. That's what Washington state looks like by our sampling approach, which is pretty interesting--it's rare to see that sort of consistent statewide data set. Much of the sampling implements probabilistic methods, so inference is possible. Each box is essentially a distribution for the metric. In this case the grouping variable is stream order.

FYI, Jack sent me the boxplot, then we conferred several times to be sure what we were posting here was clear, which emphasizes the need for metadata--Sheryn; Jack's comment: I think your questions are at the core of data visualization--what does it mean, how does it help, why should we care? I had sent a very simple graphic, just a boxplot, but even the meaning of that I've needed to clarify. So, I look forward to more PNAMP discussion. I suspect data visualization is much more than making a pretty map or UI.

Questions? contact Jack Janisch (ECY) <JAJA461@ecy.wa.gov>