A GUIDE TO DATA VISUALIZATION TOOLS FOR WATER QUALITY MONITORING

river NETWORK
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DATA ANALYSIS

Data visualization is an important tool for communicating science to a broader audience. Whether you are a volunteer, community scientist, or professional aquatic ecologist, there are many free tools and low-cost programs that you can use to link the scientific data to actions that can improve water quality.

MICROSOFT EXCEL

This spreadsheet program allows for data organization and visualization using graphs and charts. Types of visuals that may be helpful when showcasing water quality data include bar graphs, line charts, and pie charts. A Microsoft Suite subscription can be obtained for a small fee which includes Microsoft Excel. If you are a student and educator, you may be eligible to downland Office 365 Education for free too. This program may also be available for use on public computers such as those found in a library.

GOOGLE SHEETS

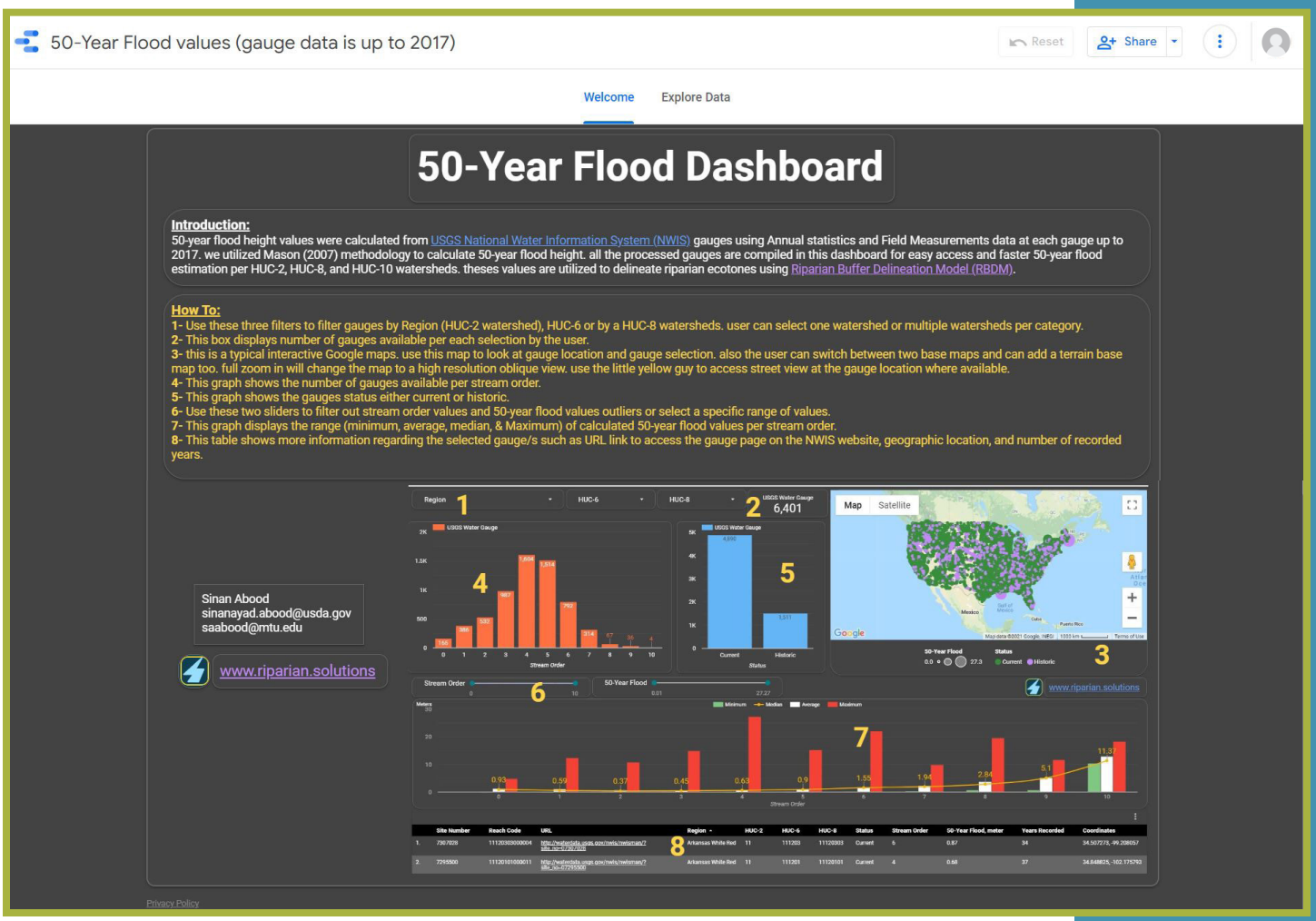
This free spreadsheet program is user-friendly with easy sharing and real-time editing. While the functionality is not as complex as Microsoft Excel, it is a great option for basic water quality data organization and visualization. Data and editing history is also backed up in the cloud, so if there is an issue, it can be retrieved. All you need to get started is a google account.

TIP

Google Sheets has a cool feature where you can "publish chart" to the web. Simply copy the embed code or hyperlink into the back end of your webpage. This will display a live clickable graph or chart.

GOOGLE DATA STUDIO

While many tools can help you visualize data, one of the best out there is Google Data Studio, which is entirely free and accessible to all. The program allows you to turn your data into compelling stories of data visualization art. In addition to creating charts and graphs, you can build interactive reports and dashboards (see example below) that can be shared in real-time. While this program may take some time to master, it can serve as a valuable tool for communicating results and trends. Reports, charts, and graphs can be embedded onto any webpage too. To log in to Data Studio, you'll need a Google account. So if you're part of a larger organization, it might be best to setup a general email account that multiple people might access rather than using your personal email.



GRAPHIC DESIGN

Transforming data into a graph format really allows you to see trends and draw conclusions about what might be happening in your waterway. However, these graphics are not always the ideal graphics to use to communicate to a broader audience. Even if you're presenting to a room of scientists or mathematicians, presenting the data in a clean, readable way is important to help communicate your results. Now that you've identified your trends, determined your audience, and have a good grasp on the stories you want to communicate, it's time to make your graphics!

CANVA

Canva is a free-to-use online graphic design tool. Use it to create social media posts, presentations, posters, videos, logos and more. You don't need to download or install any software: every feature is available from your browser. It has tons of free templates, pre-sized to whatever graphic you might need. Bonus: It has a neat data infographic section that allows for re-creation of basic graphs and charts in a way that is visually appealing. This program is highly recommended for all user types as it is easy to use with endless design options.

GIMP

GNU Image Manipulation Program (GIMP) is the open-source version of Adobe Photoshop. So, if you're up for learning a new graphic design program, this could be a fun one to try out for free. However, it is not user-friendly for beginners. Whether you are a graphic designer, photographer, illustrator, or scientist, GIMP provides you with sophisticated tools to get your job done. It can be used for producing icons, graphical design elements, and art for user interface components and mockups.

ADOBE CREATIVE CLOUD

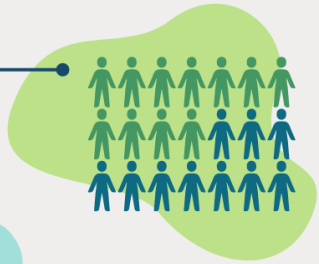
This professional graphic design subscription program offers Adobe Photoshop, InDesign, Illustrator, Premiere, After Effects, and much more. While it is costly, they do offer discounts for students, teachers, and schools. InDesign is helpful for creating polished fliers, booklets, brochures, and reports. Premiere and After Effects are great for producing short videos and animations for digital media sharing. Illustrator is the best tool for creating custom logos or art to include in your outreach efforts.

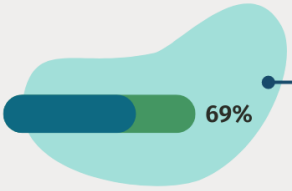
It's all about the **Data Infographic**

Infographic makes it easier for readers to absorb chunks of information. Shortly explain here what will this infographic cover.

Data 1

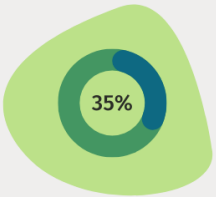
Jumpstart with numbers! Place here data such as number of persons surveyed, total cost of an item, or an important date to remember.





Data 2

Include data like percentages and average. It helps the reader get insight about the topic.



Pie charts help presenting proportions

Briefly describe the content of the graph. What do the numbers mean?

Bar graphs aid in comparing data of different categories

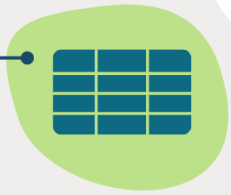
Use this space to highlight essential data that readers need to take note.

Supporting details

Build up the reader's knowledge by placing additional details here.

Data 3

Got more information? Make it more organized by placing it on a table.



Related Illustrations

Spice up your infographic with relevant illustrations or photos.

References

Add credibility to your infographic by pasting here the link of your sources.

Resource Page

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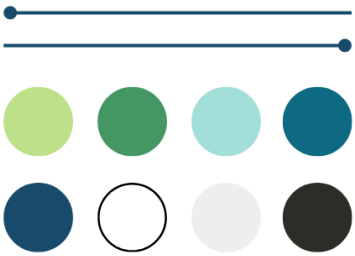
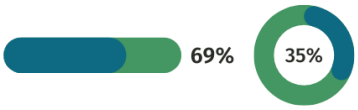




TIP Using templates provided in Canva can make data visualization easy. See the example above. The program allows you to set a color palette, fonts & headings, and insert ready-to-go charts.

COLOR MEANINGS AND SYMBOLISM

Perhaps the most important element! Color can influence and drive engagement, and repetition of the same color can strengthen brand awareness or a message throughout your document. Psychologists have also developed an extensive list of colors and the related feelings they produce.

IMAGE CREDIT: Usertesting.com

TIP

Check out Canva's interactive tool on color meanings and symbolism: https://www.canva.com/colors/color-meanings/

STORYTELLING

A narrative is a story people tell about their lives or experiences. Narratives frame the way that people talk about the issues that are important to them, and how people articulate how they fit into complex systems.

WRITING NARRATIVES

Effectively engaging with people often requires using narratives to tell people stories that describe reality in a relatable and familiar way. Many people have narratives that –for a number of reasons– they are most familiar with, or care most about. Constructing one of these familiar narrative frameworks around an issue will make people more likely to engage with it in a meaningful way.

Before you begin constructing a narrative, the first step is to learn to remove your personal bias. Not everyone feels the same way or comes from the same background as you. And that means they might not feel the same way as you about why an action needs to be taken. However, this does not mean that you can't engage using narratives they care about.

TYPES OF NARRATIVES

- Anthropogenic
- Scientific
- Advocacy
- Ethics
- Sustainability
- Religious
- Environmental
- Social Justice
- Conservative
- Business
- Economic
- Resilience

LANGUAGE DETERMINANTS

Language determinants are used to appeal to stakeholders on the basis of familiar language and receptiveness to certain types of reasoning. Determining whether stakeholders might be most receptive to one type of narrative will help you formulate an story that resonates with them. For example, policymakers might respond well to a scientist highlighting risk, while business people would likely be more receptive to a message that highlights economic opportunity.

SCIENCE	MEDIA	POLICY	BUSINESS	COMMUNITY
Accurate	Dramatic	Realistic	Actionable	Archetypal
Qualifying	Engaging	Speaks to Need	Speaks to Revenue	Circumscribing
Highlight Uncertainty	Highlight Certainty	Highlight Risk	Highlight Benefit	Highlight Certainty
Cautious	Certain	Careful	Candid	Anthemic
Build Case for Further Research	Build Audience and Interest	Build Constituency	Build Business Case	Build Following
Objective	Persuasive	Popular	Visionary	Persuasive
Generate Understanding	Generate Ratings	Generate Momentum	Generate Shareholder Interest	Generate Action
Steer Clear of Policy	Commit to a Conclusion	Commit to Policy Recommendations	Build Science-Based Business Scenarios	Community Ethos

IMAGE CREDIT: Paul Lussier, Yale University

TIP

Think about who is reading the information: Why is this important? What is the big picture? Any historical information? How will it make their lives better? How is it relevant to the community? How will it relate to what people value?

COMMUNICATING RESULTS

It's time to tell the world the results! And, honestly, it's just perfectly fine if the results are not groundbreaking. Consistency and replication in science are very important. If the result is that the water is squeaky clean, then that is just awesome. If the result is that the water is not safe for swimming, well that is important to report and perhaps drive some action.

DIGITAL MEDIA

Utilizing digital tools such as blogs, website pages, social media platforms, etc. are great ways to get your message out there. Just keep in mind that each platform might have a different audience, and therefore a different narrative!

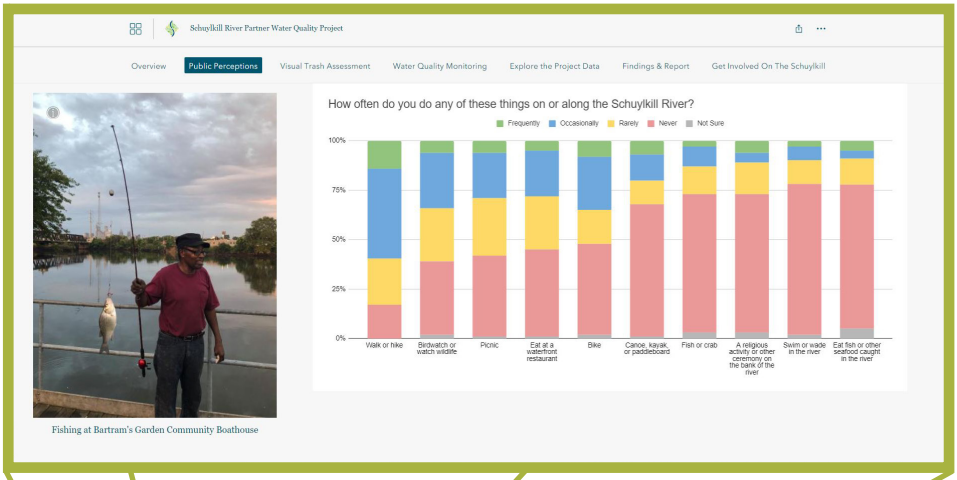
Another good way to communicate information is through a press release or discussion with a local reporter. Getting your data published in the media is a quick way to reach large audiences. By consistently providing high quality, valuable data to a reporter, you become a go-to resource for information. And, they will likely start calling you more often for information to use on future stories.

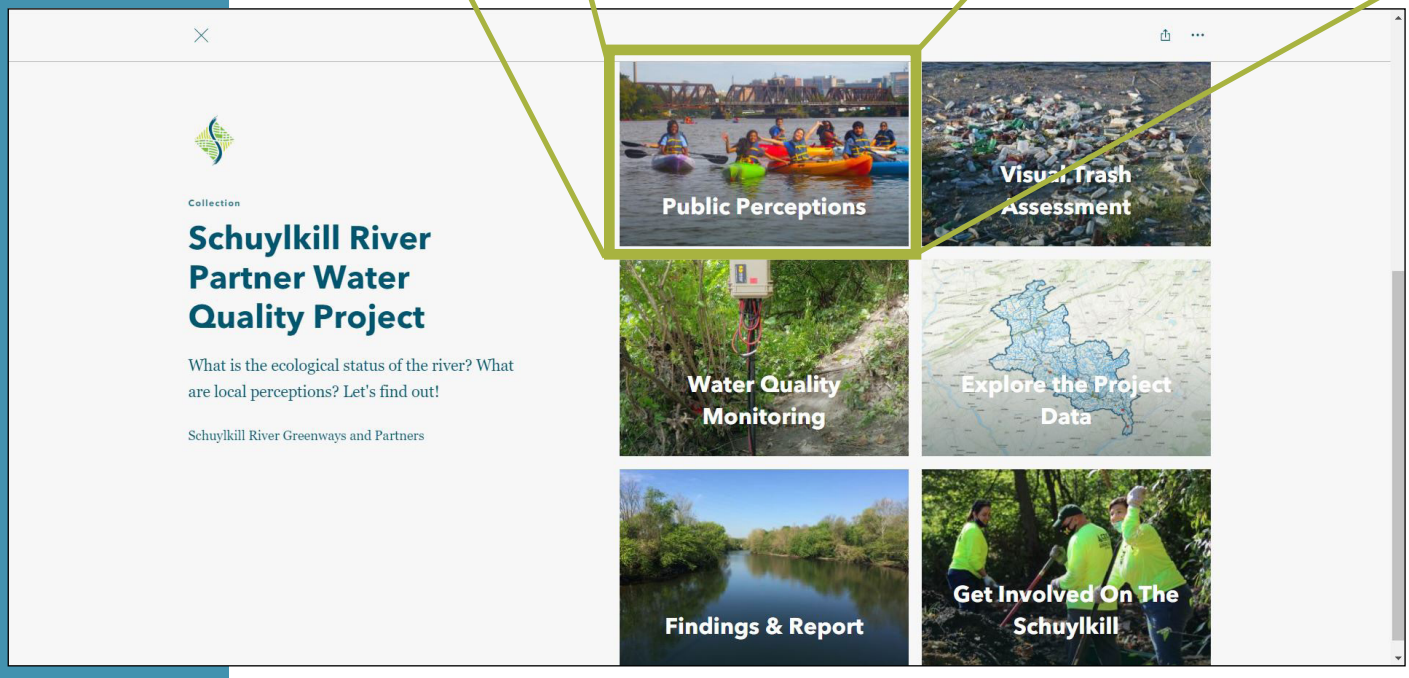
One of our favorite ways to share data is through an ArcGIS StoryMap. We have found the combination of embedded maps, text, and photos is a great way to visual results in a way that is digestible to the public. Check out the next page for more details.

Science communication is a critical part of being a scientist, whether a volunteer or professional. There are many different ways to do it. So if one way doesn't work, try something new. We encourage you to keep telling your stories using the principles presented above to communicate the results to whatever audience is important to you!

ArcGIS STORYMAP

Create inspiring, immersive stories by combining text, interactive maps, and other multimedia content with ArcGIS StoryMap. With this, you can publish and share your story with your organization or everyone around the world. The tool requires an ESRI online annual subscription and nonprofits are eligible for a discounted rate.





RESOURCES

WATER QUALITY PORTAL

waterqualitydata.us

Run by the National Water Quality Monitoring Council, the Water Quality Portal is the premiere source of discrete water quality data in the United States. It integrates publicly available data from USGS, USEPA, and 400+ state, federal, tribal, and local agencies.

MONITOR MY WATERSHED

monitormywatershed.org

Monitor My Watershed is an online data portal run by Stroud Water Research Center that lets you discover and map monitoring data and share and compare your monitoring data with the world. It hosts real-time sensor data from EnviroDIY™, macroinvertebrate data from the Leaf Pack Network®, and monitoring data from WikiWatershed.

WATER DATA COLLECTIVE

waterdatacollaborative.org

The Water Data Collaborative provides a place for all monitoring participants to communicate, collaborate, and learn from each other via The Mainstem Network. It is the only centralized hub of its kind built exclusively to amplify the voices and impacts of community scientists.

CLEAN WATER HUB

cleanwaterhub.org

The Clean Water Hub is collaborative tool to help people track water quality in local creeks and streams. It's a place to share local data results so that we can make an impact. It enables volunteers and community members to play an active role in the act of conserving, monitoring, and restoring the quality of our nations streams and rivers.

PENNSYLVANIA WATER QUALITY NETWORK

bit.ly/pawaterquality

The Pennsylvania Water Quality Network is a statewide, fixed station water quality sampling system operated by the PADEP's Bureau of Clean Water. It is designed to assess both the quality of Pennsylvania's surface waters and the effectiveness of the water quality management program.

WIKIWATERSHED

wikiwatershed.org

WikiWatershed™ is a web toolkit to support citizens, conservation practitioners, municipal decision-makers, researchers, educators, and students to collaboratively advance knowledge and stewardship of freshwater. It offers rapid visualization of watershed data and advanced geospatial analysis capabilities.

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