Protecting Drinking Water Sources from Cyano-HAB Impacts in the Willamette Basin

Workshop Notes

Welcome

Welcome and Overview, Ashley Arayas (Cadmus Group)

- Introduction and Overview
- Agenda Review:
  - Morning sessions will include presentations.
  - Afternoon session will have a few more presentations and breakout sessions.
  - By the end of the workshop, we will have a list of critical actions we can take to reduce the impact of HABs on drinking water in the Willamette Basin.
- Attendees will learn about:
  - Cyano-HABs impact on drinking water.
  - Causes, trends, and the current state of Cyano-HABs in Oregon.
  - Actions to reduce Cyano-HABs.
  - Risk communication, health effects, and communication strategies for stakeholders.
  - Where to go for consistent network-wide information and effective communication pathways.
  - Tools for predicting and responding to blooms, especially basin-wide monitoring and communicating as partners.
- Ground rules: This is a collaborative environment. Please be respectful of others' thoughts and perspectives.
- All presentations will be made available after the workshop.

Opening Remarks, Heather Dimke (City of Salem)

- Heather is excited to be here and learn about new information available.
- She is a Public Information Officer for the City of Salem.
- Cyanotoxins are difficult to explain.
- In 2018, the City of Salem issued a warning, which was the first advisory of this kind in this region.
  - Looking back at the 2018 event there is much to learn from the new experience. It took many people by surprise but a lot was learned from the experience.
  - At the same time, the website crashed and an accidental emergency announcement went out.
  - From a communication perspective, they learned how quickly misinformation can spread and how critical it is to quickly get information out there.
- Now in 2021, a lot has changed with response to HABs.
  - Fires may stimulate algal blooms but we need to learn more from today’s workshop.

    - We are learning a lot and quickly. Salem has increased monitoring and testing since 2018. They also have crisis communication training. Additionally, ozone treatment has been added to the treatment facility.
    - She closed noting that it is impressive to see everyone come together to work and learn. Together we will get stronger.

Keynote Address, Representative Ken Helm

- With valuable information this group has it is important to make the knowledge relevant to state policy makers. Other topics such as mental health issues, health care, and public health take up a lot of the bandwidth.
- Additionally the fight for racial justice and environmental justice are important topics.
- Scientists do not get enough funding or enough legislative attention.
- Scientists need to be louder and make more noise to the legislature. Call the legislatures and explain the message.
- They have had recent successes to provide funding for ELISA machines for ODEQ (3093 House Bill). It was a recommendation from a 2019 workgroup.
- They are using workgroups now to get informed.

Background

Statewide Perspectives, Strategies, and Actions - Rebecca Hillwig (OHA)

- Several human and natural causes for Cyano-HABS including, low flow and non-mixing waters, nutrient loading, global warming.
- Sources are varied - septic and ag runoff, naturally occurring organic matter.
- Some OHA perspectives about data and trends - difficult to draw conclusions given varied levels of testing and sampling efforts.
    - 2021 - Toxin based monitoring advised by OHA - better than cell count data from a health based perspective.
    - 2017 - Wettest spring to-date with high level of toxin advisories.
    - 2019 - OHA removed cell counts as the driver for advisories.
    - 2021 - Driest spring on record so far and impacts from wildfires may be felt this year.
- OHA strategies are communications and public outreach (e.g., website content, agency coordination, issuing advisories when needed).
- Oregon was one of the first states to develop advisory levels in advance of WHO guidance.
- Q: How does OHA use satellite data? A: To help inform where blooms are forming.
- Q: How do cyanobacteria use sunlight? A: Photosynthesis.

HAB Monitoring Efforts in the McKenzie Sub Basin - David Donahue (EWEB)

- Potential impacts form HABs include toxins, DOC impacting DBP formation, T&O issues
- EWEB’s HAB monitoring program - sampling from the shore every other week, monthly profile sampling in the reservoir.
- Analytical parameters included cyanobacteria, algae, diatoms, ELISA method in house, TOC, qPCR, etc.
- Utilize real-time monitoring with multi parameter sondes - various locations in the sub-basin. This is a joint effort with USGS and USACE.

- Utilizes a GIS based dashboard that notifies staff when parameters exceed set values - wide variety of taxa identified in McKenzie Sub-basin.
- Max observed cell counts found in Blue River Reservoir for dolichospermum.
- Holiday Fire Farm impacts - Gate Creek nitrate and phosphorus were above 1 mg/L at times (1400 ug/L), which is high for the watershed.
- Benthic monitoring is also ongoing.
- Q: Has EWEB ever detected cyanotoxins in finished water? A: No, due to treatment.

State of Technology and Research Updates

Benthic Periphyton as a Source of Cyanotoxins in Three Oregon Rivers Used for Municipal Drinking Water Supply - Kurt Carpenter, Research Hydrologist (USGS)

- Kurt shared information on research into benthic sources of cyanotoxins conducted from 2016 to 2020 focusing on the Clackamas, McKenzie, and North Santiam Rivers. The research involved collaborations with EWEB, Clackamas River Water Providers, and the City of Salem.
- 64 sampling sites, predominantly in flowing waterways, were studied to document the occurrence of cyanobacteria on rocks and benthic locations and to determine whether cyanotoxins were being generated. While most sampling occurred on mainstem rivers, a limited number of tributaries and reservoirs were included, as well as spring sites where one wouldn't expect anthropogenic influences, and untreated water near drinking water intakes.
- The sampling approach included visual surveys for cyanobacteria colonies and mats, plankton net tows to collect and identify species of cyanobacteria, and Solid Phase Adsorption Toxin Tracking (SPATTs). Researchers used Enzyme-Linked Immunosorbent Assay (ELISA) for cyanotoxin analysis. Positive detections were only recorded when the extract concentration exceeded the lowest standard (i.e. a conservative approach was used). Kurt expressed high confidence in the ELISA analytics.
- Study results showed that 91% of 81 samples tested positive for one or more cyanotoxins. Only seven samples were free of toxins and seven benthic samples in the Clackamas contained all four cyanotoxins.
- Kurt showed photos and shared information about the various species of cyanobacteria found and associated cyanotoxins. Species included Nostoc parmeloides ("ears"), Microcoleus and Oscillatoria mats, and Wollea. He noted that though the water appeared clear, it was transporting quite a bit of material. For example, cyanobacteria was found in the plankton net tows, especially Nostoc (found moving downstream towards drinking water intakes).
- During concluding remarks, Kurt noted that the frequent detection of cyanotoxins in SPATTs is an indication that they dissolve in water. In addition, there is a risk that toxins could be transported downstream in sediment or organic carbon.
- Q: Where can we learn more? A: Recommends the ITRC website: https://hcb-1.itrcweb.org/
- Q: How might land-use play into formation of cyanotoxin-forming cyanobacteria?

  A: Young volcanic rock can provide a continuous source of leaching of phosphorus. In addition, there is a strong correlation between erosion of sediments from certain parts of watersheds (e.g. from upper parts of watersheds that are geologically younger with less time for minerals to wash out, as well as from highly managed timber production areas). Recommends more sampling of nutrients that may be fueling blooms. Other questions to pursue: how much does mobilization of sediment into reservoirs from recent landslides contribute to blooms versus existing sediment?

Application of satellite imagery to detect, quantify, and inform management of cyanotoxins - Dan Sobota, Water Quality Analyst (DEQ)

- Overview of the use of satellite imagery to identify, monitor, and serve as an early-warning system for cyanobacteria blooms. Also shared results of work comparing satellite imagery findings with on-the-ground conditions and monitoring data, confirming its usefulness for cyanotoxin detection and management. Satellite imagery can provide a fast and low-cost method for screening for cyanotoxins in comparison to the costly and time-consuming nature of field sampling and installing/maintaining instruments.
- Imagery used by US EPA for the multi-agency Cyanobacteria Assessment Network (CyAN) is from newer satellites such as Sentinel-3 with Ocean Land Color Instrument (OCLI). This imagery is coarse in scale but provides cyanobacteria abundance in cells/ml and the data can be plugged into algorithms. Thus far, high correlation shown between imagery and bloom advisories (for blooms with greater than 100k cells/ml).
- Current needs for updating and disseminating cyanobacteria data include access to near real-time imagery, methods for converting raw imagery to cyanobacteria counts, and a platform for data distribution. EPA is working on this at the national level with a CyAN mobile application; the agency is also developing a web-based app. DEQ is developing an application (R Shiny) to use the same dataset within Oregon to summarize and share the data with managers and other interested parties.
- The R Shiny app provides access to satellite data (processed identically to EPA CyAN except without some filters) and is regularly updated for “resolvable” waterbodies (i.e. those that are large enough for the satellite imagery to generate cell abundance estimates). Shiny apps could serve as an early warning system by providing info on frequency, timing, and severity of blooms.
- Next steps include continuing work to compare satellite imagery with on-the-ground conditions (focusing now on Deschutes and Willamette) as well as other relevant data, and making the Shiny app available to a wider audience.
- Comment from Rebecca Hillwig with OHA: Aphanizomenon flos-aquae (AFA) was added back to OHA’s potentially toxic algae list due to continuing concerns.
- Q: how do you use satellite imagery quantitatively?

  A: We can currently use the imagery to identify high/moderate/low cell abundance, but not actual cell counts yet.

Remote Sensing of Cyanobacteria in Lakes: The CyAN Web App and National Modeling - Amalia Handler, Postdoctoral Researcher (EPA)

- Shared information about two projects: the CyAN application and also EPA’s current efforts to use the satellite data to assess on-the-ground risks of cyanobacteria blooms.
- The CyAN app (currently available as an Android app) is an interagency collaboration (https://www.epa.gov/water-research/cyanobacteria-assessment-network-cyan) to provide cyanobacteria abundance in cells per mL for resolvable lakes by relating the satellite imagery

to chlorophyll a production. Currently, this can only capture larger lakes across the U.S. that can be reliably resolved (approximately 2,200).

- EPA's web-based app provides access to the latest CyAN data. This will include lakes across Oregon for which there is ample resolution. The app has a user-friendly interface with an estimate of the most recent cell abundance for a given site and date, along with recent values and whether there is a rising or falling trend in abundance. The app allows the user to compare conditions in different locations within the same waterbody, or between different water bodies.
- Another research area is on using CyAN and national field surveys to assess microcystin risks. Researchers are now connecting CyAN with actual microcystin field survey concentrations to generate a summertime bloom magnitude prediction tool. The bloom magnitude is based on a microcystin threshold of 0.2 µg/L that is a commonly reported detection threshold. A color-coded map can show whether microcystin at a given site is above or below this threshold.
- Statistical analysis of available data can help determine a waterbody's likelihood of exceeding the 0.2 µg/L microcystin threshold. Mapping available to show waterbody monitoring points colored to indicate the likelihood for a specific magnitude bloom. This analysis offers a visually effective way to relate the satellite imagery data to what is actually happening on the ground.
- Q: How much of the water column is visible with CyAN?

  A: Satellites can only pick up info for the largest lakes and to a depth of 1 to 2 meters below the surface, so only the uppermost part of the water column.
- Q: What are the uncertainties in the modeled estimates? Are there ways to reduce this uncertainty?

  A: Inherent uncertainty due to the relationship between data sets and the fact that every lake is distinct. Satellites can detect *chlorophyll a* and how it responds to changes due to phycocyanin, but the relationship changes due to many factors. Work has been validated for a number of different cell densities. To reduce uncertainty, more on-the-ground data is needed.

Predicting Harmful Algal Blooms - James Watson, Manager and CEO (The Prediction Lab)

- Shared information on how models can be developed and used effectively as a reliable predictive tool for cyanobacteria blooms. By collecting a wealth of relevant data and using it in models, we can be more prepared for cyanobacteria blooms, and possibly even reduce their occurrence.
- Important to focus on how best to maximize the usefulness of models and make available data "actionable". Algorithms are used to forecast cyanobacteria blooms. However, challenges include uniqueness of ecosystems, variability in sampling, connectivity between ecosystems, and array of timescales to consider.
- The Prediction Lab has been working with the City of Salem and other municipalities to develop a range of data modeling tools. Examples include a water quality prediction tool to generate daily, one-week, and two-week operational forecasts using Bayesian model averaging; longer-term forecasting using weather/climate data from OSU's PRISM; and machine learning modeling. In addition, he discussed NextGen Analytics which includes hybrid machine learning models and Interpretable AI.
- With artificial intelligence, the "hybrid" machine learning model can be taught to follow the laws of biology and physics (something regular machine models cannot do). Interpretable AI

models can produce “glass box decision trees” where one can see the main drivers and inner-workings of the model, making the model and its outputs more understandable. In addition, with NextGen “Transfer Learning”, one can “train” a model to expand its ability to make predictions (e.g. for an area with no historical data).

- Two important needs: 1) a standardized database that holds all data and can be accessed by all, and 2) metrics to measure the impact of monitoring and modeling.
- Related resources for more information: 2016 research article entitled “Measuring the Value of Groundwater and Other Forms of Natural Capital” by Fenichel, et. al. https://www.pnas.org/content/pnas/113/9/2382.full.pdf and work from University of Michigan using multi-scaled geospatial and temporal lake data.
- Q: How do you calculate and represent uncertainty in the models?

  A: Standard approaches from machine learning can help “cross-validate” by looking at a portion of data and evaluating results. This can provide indication of certainty/uncertainty.

State of the Basin

HABs Monitoring and Other Post Wildfire Considerations - Aaron Borisenko, Water Quality Monitoring Manager (DEQ)

- Aaron talked about a short-term focus on public health and safety post-fire and a more medium-term focus on Cyano-HABs in the watersheds.
- It is also important to consider the different beneficial uses of the waterbody, whether it’s drinking water, recreational use, salmon habitat, etc. and what the impacts might be to those specific uses.
- Important to learn from what others have learned about the fires and impacts on water quality (ex. CA fires).
- Make sure to think about who needs the information collected from monitoring and other work. Who needs this info to make decisions on the ground?
- Governor Brown formed a Wildfire Science Team.
- Need to catalog who is monitoring where and then identify gaps.
- Creating 2020 Wildfire Monitoring Maps.
  - April 2021 might be the driest month on record.
  - Elevate pH may also be a concern.
- In 2020 - 58 public water systems sampled for cyanotoxins from May - October, every other week -> over 300 cyanotoxin samples.
- What will the 2021 HAB season look like between wildfire impacts and dry conditions?
- EPA grant funded some qPCR work, how can it be used as an early warning system.
  - qPCR Innovation project with Salem and Clackamas.
- 28 drinking water facilities were in fire-affected areas.
- DEQ Toxics Monitoring Program - added 7 news locations (400 indicators); 3 sampling events/year.
- DEQ and OHA are looking at VOC’s in burned structures and connections.
- Hoping to get funding to acquire a new cyanotoxin analyzer, analytical staff, and field staff.

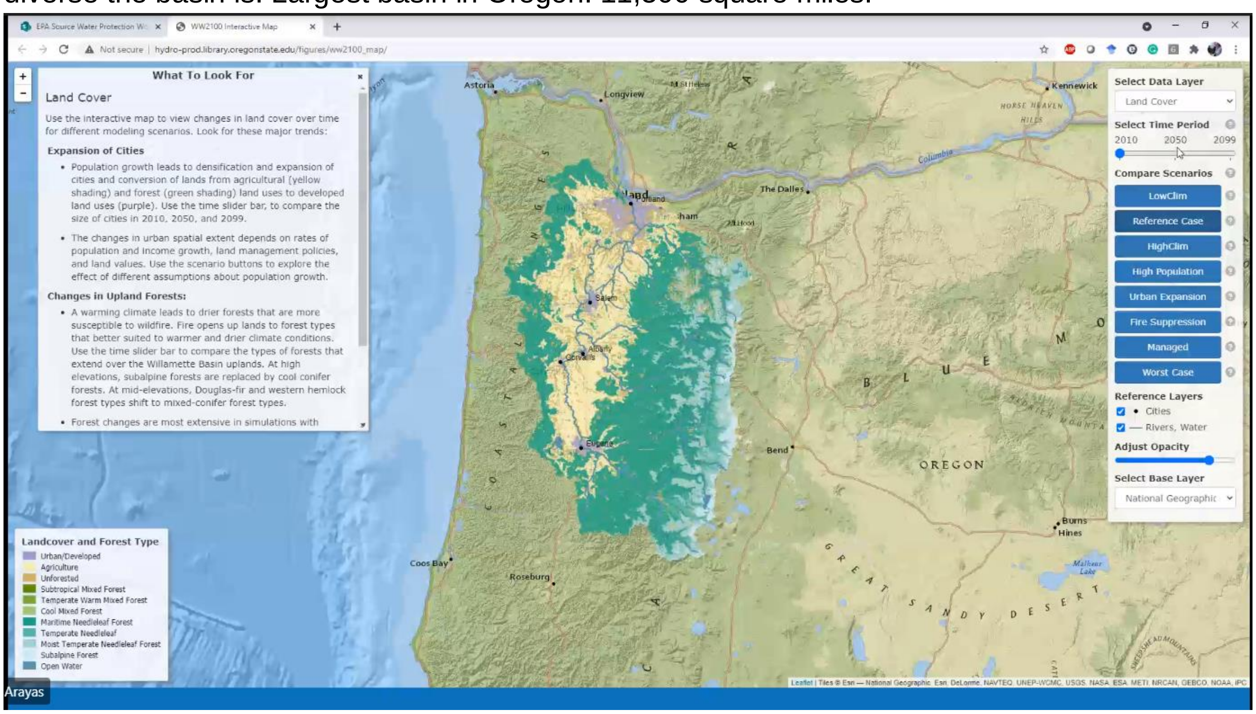
Willamette Basin Strategic Planning for Ecological Restoration - Kathleen Guillozet, Program Director (Bonneville Environmental Foundation)

- Kathleen noted that it is hard to link restoration projects to specific outcomes, HAB levels, etc.
- Importance of collaboration: Trying to move from conventional collaboration to more 'stretch' or dynamic collaboration, which may bring together more diverse partners and aims to be more flexible.
- For many projects, think about co-benefits as well. Initial driver might have been fish, but there may also be other benefits to water quality, drinking water, etc. Add partners as needed.
- Start with a pilot and then move to scale
- Anchor habitat projects up and down the Willamette have made a lot of headway in the last several years.
- There are many very complex environmental issues that need to be addressed. These are not always easy to do head on.
- More examples of co-benefits with reconnecting floodplains, controlling aquatic invasive, etc.

Panel Discussion

- Panelists:
  - Nancy Gramlich, Department of Environmental Quality
  - Susan Fricke, Eugene Water & Electric Board
  - Chauncey Anderson, U.S. Geological Survey
  - Al Johnson, U.S. Forest Service
  - James Watson, Oregon State University Prediction Lab

Ashley shared a map of the basin, and said the planning team would like to emphasize how large and diverse the basin is. Largest basin in Oregon. 11,500 square miles.



What has been the most effective for your work?

- JW: It’s us. It’s the community that we have. To be placed into such an actively collaborative community has been amazing. Getting data - models have been so welcome to most of you. Kudos to you guys for creating community, that’s how we’re going to solve this problem.
- CA: The advent of real-time data, especially real kudos to the various partner agencies in the basin for helping to support the installation and operation of real-time monitors within the basin that we can see from our desks. Also, the advent of the ELIZA rapid-test bioassay tests. Also remote imagery will allow us to go to the next step to get the real-time information from a broad perspective where we may not have eyes on the ground.
- SF: Amazing people out there collecting the data. They work collaboratively with other agencies as well. Lab capability for EWEB. We can do our own ELIZA and analysis for microcystin, etc. We don’t have to ship them to Florida. I look forward to people having more of that capacity. We can run the analyses in-house.
- AJ: In the Forest Service, sharing information among various stakeholders. The focus for cyano-HABs for the Forest Service has largely been recreational, where the public is more likely to be exposed. So having partner agencies involved is very helpful.
- NG: I am a Regional person. I provide a support role, with concerned citizens, partners, labs. At DEQ Regional office, Kudos to the existing tools that are online from DEQ’s list of waterbodies. OHA tools online - when a citizen calls me, I can guide them to that website to give them some good guidance. Discussions today will be really valuable for real-time data - not waiting until the end of the season to see what it looks like.

How much time from receiving satellite motivation/detection to boots on the ground to samples in the lab and results? Best and worst case scenario?

- CA: It depends on how serious/urgent it is. If you have ongoing monitoring programs, - real time data give us a better sense of the urgency. If urgent, it will be a couple of days. Ross Island has potential impacts on recreation in the Willamette Harbor. It’s not necessarily anybody’s routine monitoring process.
- AB: The early warning prediction tools help us. There is a risk-assessment portion that happens directly with OHA. I’m hopeful that we’ll get the resources for another field staff person and more analytical capabilities to do a better job of this in the future.
- CA: Limiting factor is the ability to get someone out there to get a good sample for what we need.

What are the most significant gaps/issues/challenges that you see when dealing with Cyano-HABs?

- SF: How we’re going to deal with benthic HABs. Harder to identify, so many varieties. Not as well studied. Also post-fire impacts.
- JW: Broader challenge: where do we draw the boundaries around the systems that we study? I’m a modeler. So I do this all the time. What happens upstream is very important, but our attention has been drawn to fire because last year’s were very severe. There may be other impacts that we need to get a handle on. Does it stop with the Willamette? At what scale do we want our models to be? Do we want longer time scales? I’ve been thinking for months, years, decades? El Niño, La Niña? Also climate change. There is no such thing as normal. There is no average anymore, so what does that mean for our future modeling efforts?
- AJ: A lack of resources to monitor multiple locations is really difficult. It involves personnel time to sample, surveillance monitoring on our priority sites. We like to do this weekly, but people

are overloaded with other projects, fire recovery projects - it's hard to find people who can devote time to cyano-HABs monitoring.

- CA: We have biases/skew in the data that's collected, and that becomes important when someone tries to model it. Public health sampling vs. representative sampling. Public health sampling is targeted toward the worst-case scenario, but doesn't represent what's happening in the body of water as a whole. There's a lack of clear responsibility for who should be sampling given water bodies over a given time. It's spotty across a landscape. We need that long-term data, not just sampling from when there's a bloom.
- NG: Calls come in from private areas. Monitoring takes place mostly on public water bodies. Would be good to have tools for monitoring on smaller scales. I work with folks on non-point source improvement plans. Would like to combine that with source water assessment. Look at upstream/collaborate more. Looking more focused within their jurisdictions to make improvements.

What is one thing you think is feasible to take on as a next step, to implement, to impact how we prepare, respond to, or communicate within the Willamette Basin or more broadly?

- NG: Based on these presentations, a centralized database for us and for the public. More real-time to anticipate what's happening and get the info to people who are in more remote areas would be a great thing to do.
- AJ: The Forest Service decided to focus on social media to a greater extent to communicate with the public about cyano-HABs, to notify people about known hazardous blooms.
- SF: More consistent communication to the public about health risk so they can make their own decisions. Social media messaging and press releases need to be consistent. When people go to a water body, people should be able to see messaging based on monitoring so that they can make public health decisions for their family.
- CA: Communication and education, in particular, to make sure the public can understand the information they are receiving. They need the opportunity to get more information. We're struggling with a more formalized or more complete lines of who's got responsibility for what kind of monitoring in various locations, because that's not always clear. A site with a bloom may not be in anybody's particular monitoring program or have routine data collection going on.
- JW: As a member of the public, I'd like something like a weather report. Like air quality reports. The CYAN app from EPA is pretty cool, but still only shows data from one satellite. As a next step in terms of an app or vehicle for public engagement on all the data we've been collecting, and not just satellite monitoring. A place for all of us to compare notes in a collective way.

Communications and Management

Effective Cyanotoxin Risk Communication Preparation - Tarrah Henrie, Senior Water Process Scientist (Corona Environmental Consulting)

- Step 1: Understand Cyanotoxin Communication Practices.
- Step 2: Address Internal Management Questions.
- Step 3: Communicate Proactively with the Community.
- Step 4: Select, Modify, and Deliver Effective Message Products.

These three aspects of EPA health advisories make messaging very complex and difficult:

1. EPA decided to go with two different populations: young children & vulnerable and general.
2. A 10-day exposure period.
3. Health Advisory is not a Maximum Contaminant Level.

Layer information:

- Use the lowest number in a health advisory (most protective for sensitive subpopulations) to simplify the message. Many who are sensitive don't identify as sensitive.
- Lots of factors to consider/ internal discussions needed before issuing a health advisory
- Develop an external communications plan: Include communications objectives, collaborators, audiences, content needed by audience over time, delivery modes.

Communication best practices: identify your role/organization and the date, specify what action is needed along with potential consequences and examples, let people know where to find more information.

Review of important aspects of communication products (health advisory, alert, action): proactive, multilanguage, and multipurpose messaging, ensure variety of modes (reverse 911, texts, press releases, print and web versions); reach at-risk groups

- Share what people need to know about Cyanobacteria in drinking water.
- Provide basic information and where to find more details.
- Talk about PETS. Very important consideration. Dogs go into water, then come out and lick the cyanobacteria off their fur.

Safe message: Note that the science is still developing, they'll keep up with info from EPA and DOH.

- Recommend two kinds of sampling. Raw and treated water. Focus the sampling seasonably. Proactive monitoring in reservoirs to prevent blooms.

Algae Response and Communications Plan - Jessica Dorsey, Senior Program Manager (City of Hillsboro & Joint Water Commission)

- Review of Joint Water Commission response and communications plan:
  - Originally developed in 2016 when there were already known blooms in watershed
  - Included federal advisory guidelines; provided guidance for monitoring efforts
  - Major updates based on OHA's cyanotoxins rule included more details e.g. speciation, lessons learned from blooms in Salem

The algal response plan:

- Specific continuation of general, routine watershed monitoring program.
- Segmented by location type: reservoirs, streams, water treatment plant, distribution systems (partners).
- Stepwise approach includes triggers for moving up and down levels.
- Communications plan:

    - Outlines JWC staff's responsibilities for providing information to staff/partners, regulators, elected officials and public.
    - Lists actions based on algal response level.
    - Guiding principle: maintain trust.
    - Includes guidelines for communicating to various target audiences.

2019 AFA bloom at Hagg Lake:

- Described actions between Feb. 28 when a HAB Level 1 was triggered through May 6, returning to routine monitoring (HAB Level 2), including staff observation and monitoring according to their plan.
- Described communications process and contacts

Key takeaways:

1. Establish clear/meaningful triggers for moving up and down through the plan.
2. Early/consistent communication is important for keeping the message clear if/when it reaches external audiences.
3. Be prepared but flexible as needed (i.e., sampling locations, labs, etc.).

Breakout Group Report Outs: Critical Actions

The workshop facilitator divided participants into virtual breakout rooms to focus on key questions in four specific areas of Cyano-HABs work using "jamboards" to brainstorm responses. At the end of the group discussions, participants in each breakout group were asked to identify what they considered to be the most important "critical actions". Results are summarized below:

- Prevention and Mitigation:
    - Identify and understand root causes and drivers.
    - Ensure adequate local analytic capability.
    - Ensure adequate and timely information management.
    - Include Cyano-HABs information, including preventative measures and tools, in outreach plans, training, and landowner communication

- Prediction and Monitoring:
    - Need a centralized regional HABs Database that provides real-time and historic data; limnology data; HABs species information; and has ArcGIS capacity.
    - Focus on enhancing partnerships, especially with agricultural and forestry groups.
    - Find better ways to understand when blooms become toxic
    - Find more ways to relate satellite imagery to on-the-ground conditions

- Response:
    - Larger systems can help! Don't reinvent the wheel.
    - Share information in advance to allow time for developing actions; have a HABs Response Plan/standard operating procedure in place that covers important details
- Communications:
    - Use available tools and resources (outreach, access, and communication).
    - Use appropriate mechanisms and methods to reach all audiences

    - Help vulnerable communities.
    - Develop a comprehensive database to share data (federal, state, or public) and ensure it is accessible.

Funding

Funding Opportunities with Drinking Water Providers - Julie Harvey, Drinking Water Protection Program Coordinator (ODEQ)

- Main sources in Oregon for drinking water protection:
    1. Drinking Water Source Protection Funding from Oregon Health Authority (about 200k annually, no match required) to work on reducing risk to intake or wells. Fund also has loans that can only go to Public Water System with completed Updated Source Water Assessment. Funds can also be used for emergencies such as wildfire impacts. Examples of specific projects include sediment reduction in Lincoln City's source area and watershed restoration in the City of Dallas' source area. Proposals usually due in March.
    2. Drinking Water Providers Partnership - group of funders from national and state government agencies and nonprofits. Idea is to strengthen partnerships between upstream landowners and restoration practitioners. Must be a drinking water source area with a federal nexus. Funding is 400-600k annually with each project up to $50,000. Can be done in partnership with other funding. Proposals are usually due in January. Example project is the City of Dallas' Upper Rickreall Habitat Enhancement.
    3. Clean Water State Revolving Fund - low interest loan fund; good fit for nonpoint source pollution prevention work. Also a "sponsorship option" to reduce interest rate.
    4. DEQ 319 grants - Federal matching funds to address nonpoint source pollution. Awards can range from about $30,000 to $75,000. Deadline in April. Match required.
    5. Supplemental Environmental Projects - funding comes from respondents to DEQ compliance and enforcement orders. Applicants submit scopes of work for potential funding.
    6. Water System match contribution
    7. Partnerships with NRCS - National Water Quality Initiative: funding for detailed watershed assessment and an outreach strategy.
    8. Post wildfire resources: https://wildfire.oregon.gov//

Leveraging funding sources for restoration - Lizzie Marsters, Environmental Finance Manager (World Resources Institute)

- Encouraged attendees to think about the business plan for funding HABs work and how to unlock funding sources.
- Oregon has many infrastructure needs. Green infrastructure can help lower these costs and needs - nature has multiple benefits. What does this mean for funding options?
    - Current Public Funding Options.
    - Redirecting Public Funding.
- Financing sources and sequencing:
    - Private Capital - green bonds.

        - Example: Central Arkansas Water (CAW) example of issuing green bonds to protect watershed. 33% for forest protection, 66% for gray infrastructure, true interest cost = 2.136%. Morgan Stanley paid a premium. CAW used a dedicated watershed protection fee from ratepayers.
            - How to replicate: Need project champions, Funding to add capacity, Public buy-in of strategy, Credit-worthiness of issuing entity, and Anchor funding (green bond) leverages federal funds.
        - Example: Raleigh's Leveraging Capacity = $0.50/month on rate payers over several years yielded millions to use as leverage capacity.
- Key takeaways: Watershed champion at the utility and dedicated annual funding stream for conservation yields big impact.
- Conditions for success: Building momentum, Designing the program, Implementing the action plan.

NRCS Technical Assistance and Financial Assistance Resources - Amanda Moore, State Resource Conservationist (NRCS)

- Natural Resource Conservation Service (NRCS) - Works with all types of landowners to conserve landscapes on a voluntary basis. They offer landowners Technical Assistance (TA) and Financial Assistance (FA).
    - TA - includes planning and assistance identifying and mitigating conservation issues.
    - FA - offered to eligible landowners.
- NRCS Oregon Service Centers - Lots of basin team leaders who supervise staff who work directly with landowners. Look at the website for local district conservationists.
    - Oregon has a strategic approach to conservation. The goal is to enhance capacity. This is meant to be a locally led process.
- Environmental Quality Incentives Program (EQIP) - provides FA and TA to landowners. Continuous sign-up program. See website for funding cycle periods and eligibility criteria. Contact the local NRCS office and start working on a conservation plan. Any new applications (from today) will be deferred to next fiscal year.
- The National Water Quality Initiative (NWQI) (under EQIP) targets funding toward small watersheds.
    - Two types: Planning phase and implementation phase.
        - Source Water Protection is eligible as of 2018.
        - Priority and eligible watersheds are identified in coordination with DEQ's Drinking Water Program.
- PL-566 Watershed Protection and Flood Prevention - provides TA and FA. For example, work with irrigation districts to reduce water loss.

Moving Forward/Closing

Closing Remarks - Joel Cary, Water Resources Division Manager (Tualatin Valley Water District)

- Prioritized Actions:
    - Create and use a centralized predictive database and reporting tool.
    - Expand partnerships with the agriculture and forestry sectors and target education and outreach to specific audiences.

- Improve public education and communications around Cyano-toxins (e.g., when does a bloom turn toxic? What drives Cyano-HABs? Connect individual behavior to water quality).
- Conduct research to better understand the drivers and the root causes of Cyano-HABs.
- Use existing communication tools and best practices, expand guidance on mechanisms and methods for communicating, and develop a database with communications tools.
- Have a focus at the state-level to provide resources and funding and treat HABs as a statewide issue.
- Increase how quickly and effectively we can share accurate and informative information and move from satellite data to on-the-ground steps.
- Learn from one another and lean on other systems that already have plans, have already faced these challenges, and can help.