

The background image shows a river with a large, dense cyanobacteria bloom. The water is a milky, light blue-green color, and the bloom is visible as a thick layer on the surface. The riverbank on the right is covered in dry, brownish vegetation. The overall scene is a natural, outdoor setting.

Nutrient Criteria and Resources to Support Development

Rochelle Labiosa, R10 Nutrients Coordinator and HABs Lead for Ambient
Waters

Outline

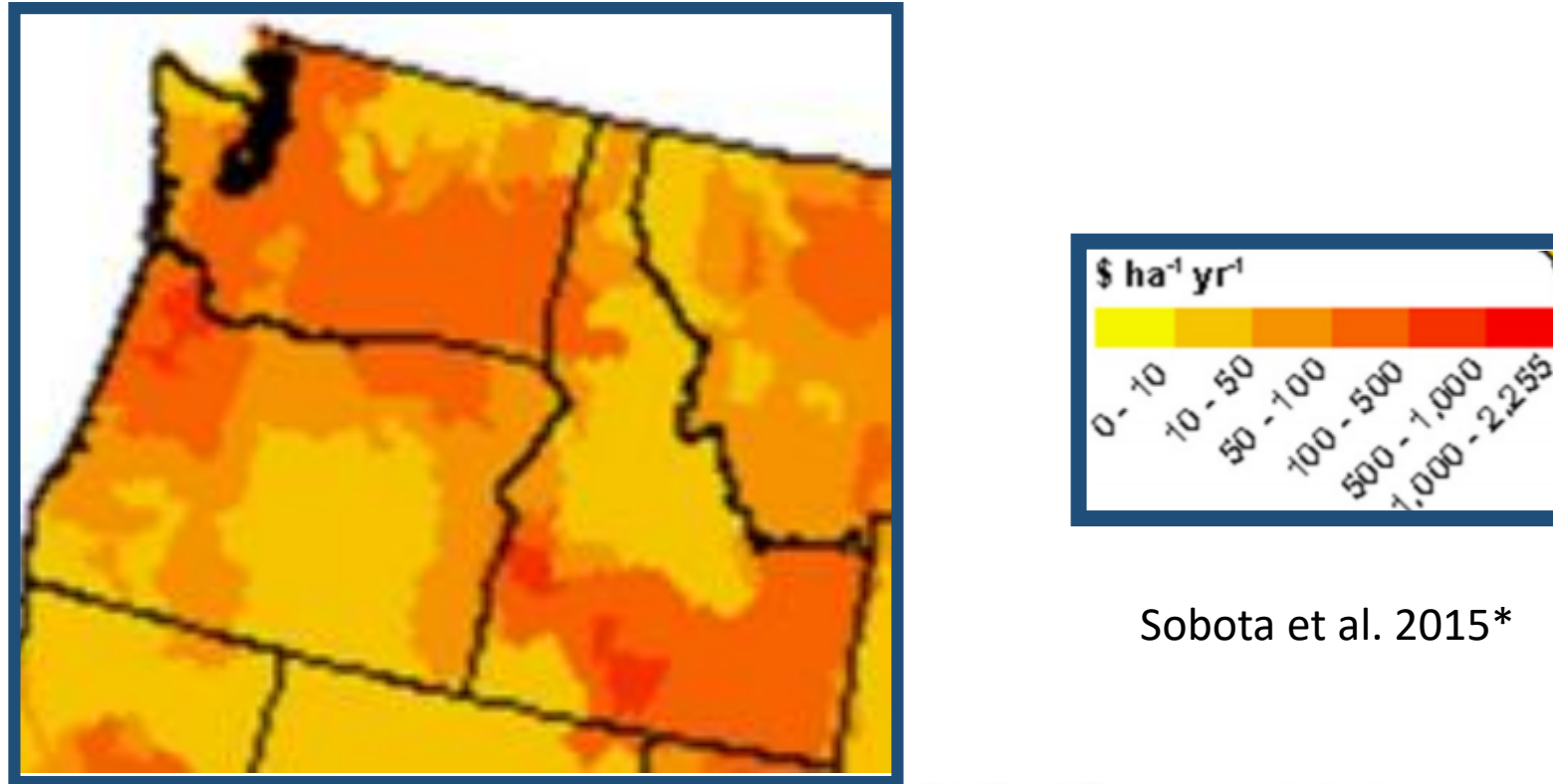
- Nutrient Impacts in Region 10
- National and Regional Nutrient Criteria Status
- Available Tools and Resources
- NSTEPS Support for Nutrient Criteria Development
- Published 304(a) Recommendations and Draft 304(a) for Lakes (under development)
- Interim Approaches and Potential Resources to Support Nutrient Work

The views expressed here are those of the speaker and are not necessarily those of US EPA

The Goal of NNC

To reduce the anthropogenic component of nutrient overenrichment to levels that restore beneficial uses (i.e. described as designated uses by the CWA), or to prevent nutrient pollution in the first place.

Impacts of excess nutrients – example costs



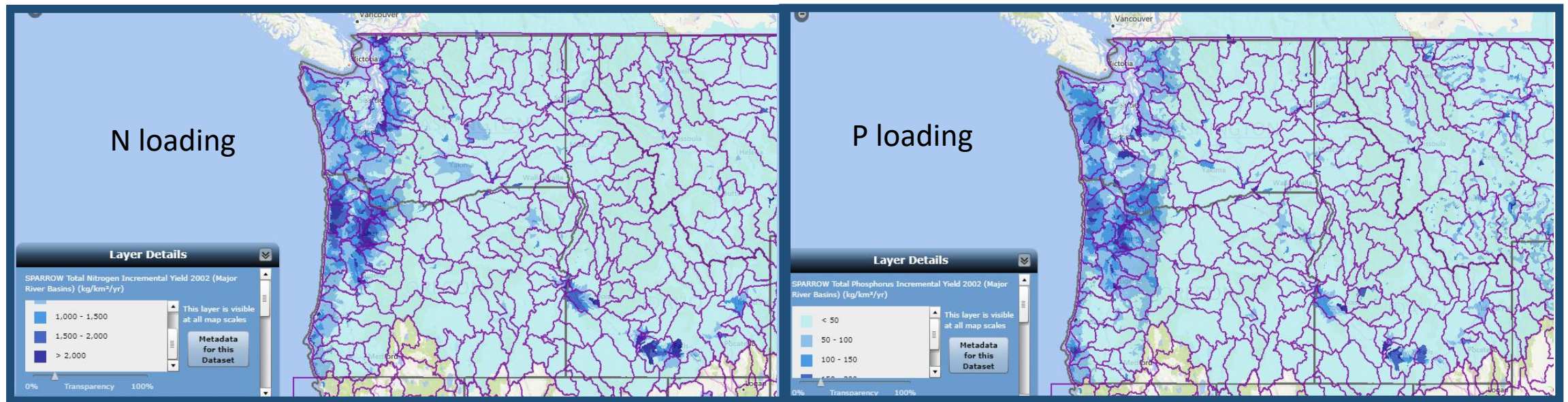
Sobota et al. 2015*

Figure 5. Distribution of total potential damage costs caused by anthropogenic N leaked to the environment by HUC8 watersheds of the conterminous United States in the early 2000s. Potential damage costs were calculated by multiplying specific new and recycled anthropogenic N inputs by source with the central damage cost estimate of US dollars (2008 or as reported) per kg of N leaked to the environment.

<https://iopscience.iop.org/article/10.1088/1748-9326/10/2/025006>

*Based on 2000 estimates and does not include certain costs, including harmful algal bloom costs

N and P loading: USGS SPARROW 2002

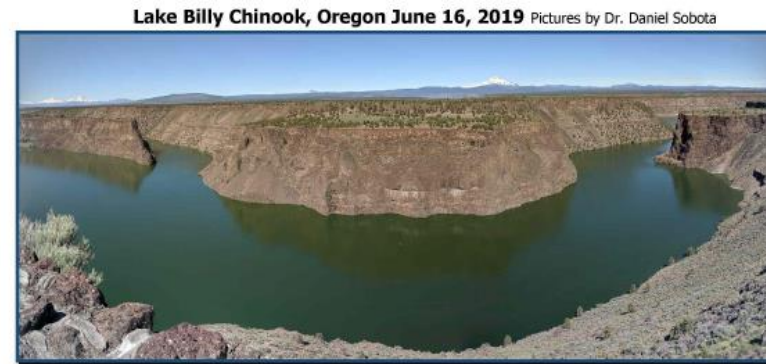


<https://gispub2.epa.gov/npmat/>

HABs Issues –Oregon examples



Upper Klamath Lake, OR
Sentinel satellite image



Overlook where Deschutes and Crooked River arms join in Lake Billy Chinook.



"Break" line where Metolius River joins Lake Billy Chinook.
Dolichospermum (Anabaena) in Lake Billy Chinook.



Odell Lake – August 2019, courtesy Dan Sobota, ODEQ



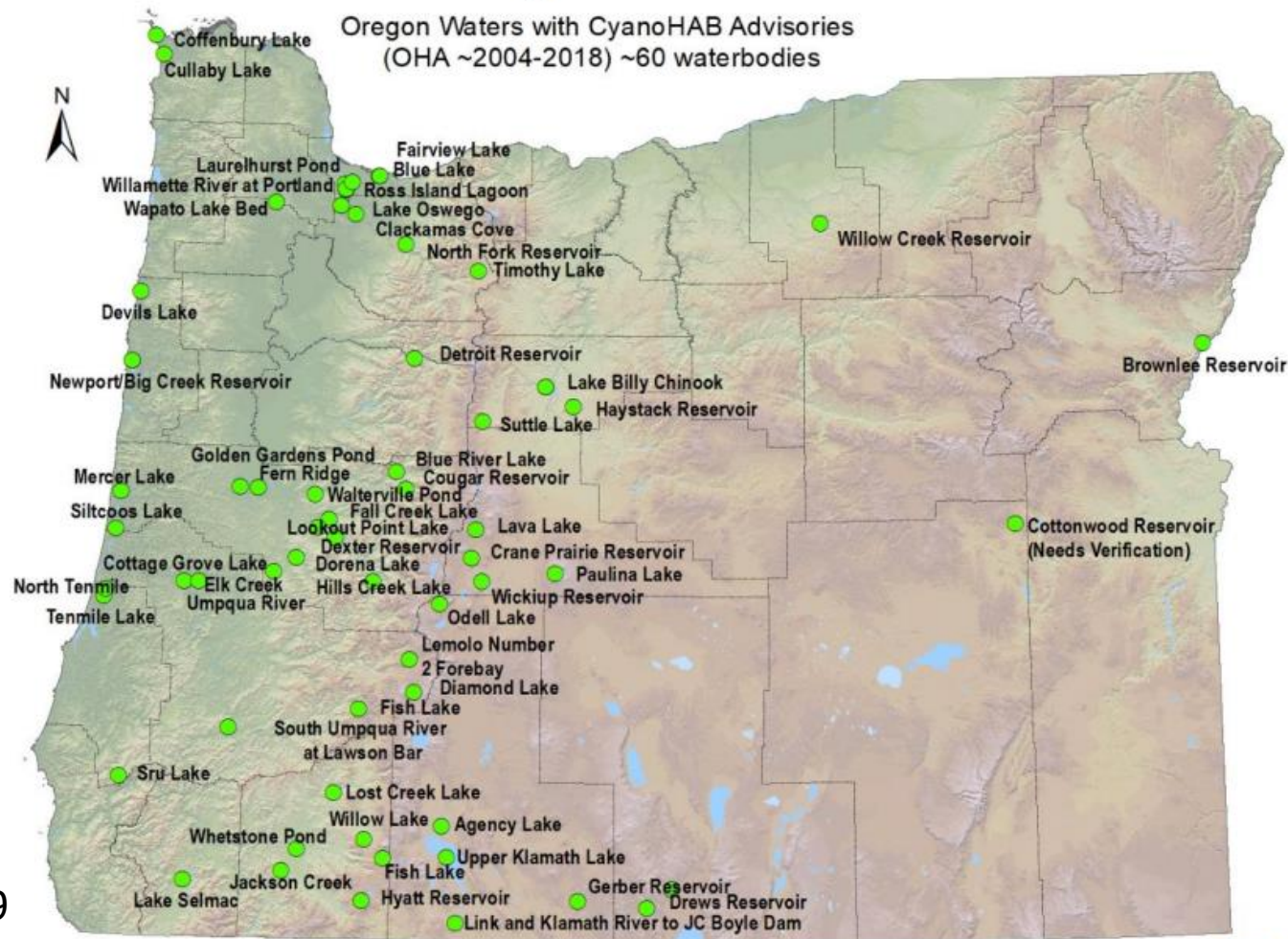
Ross Island Lagoon,
Willamette River, OR
kptv

- Salem, OR Drinking Water Emergency



HABs in Oregon

Where have CyanoHABs occurred?



Source: ODEQ 2019

HABs Issues – WA Examples



Hicklin Lake, WA

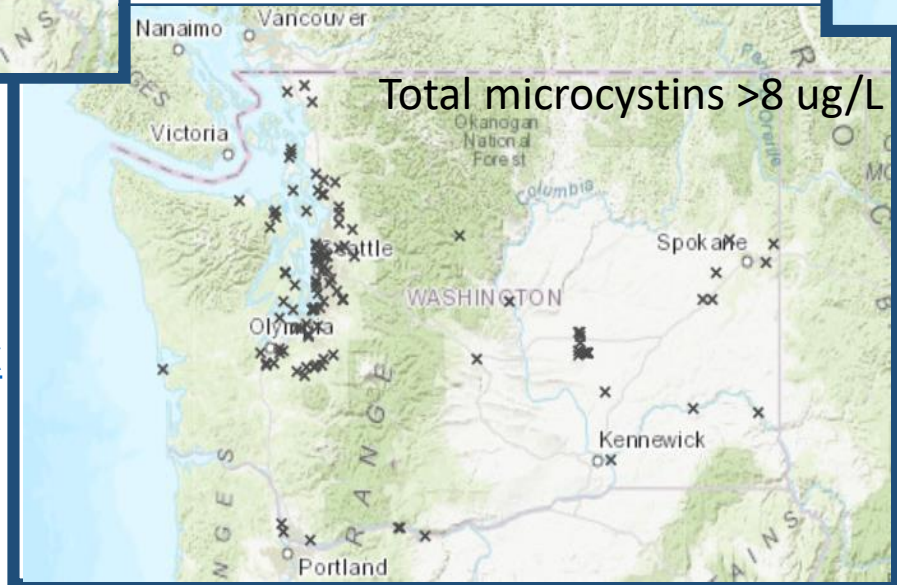
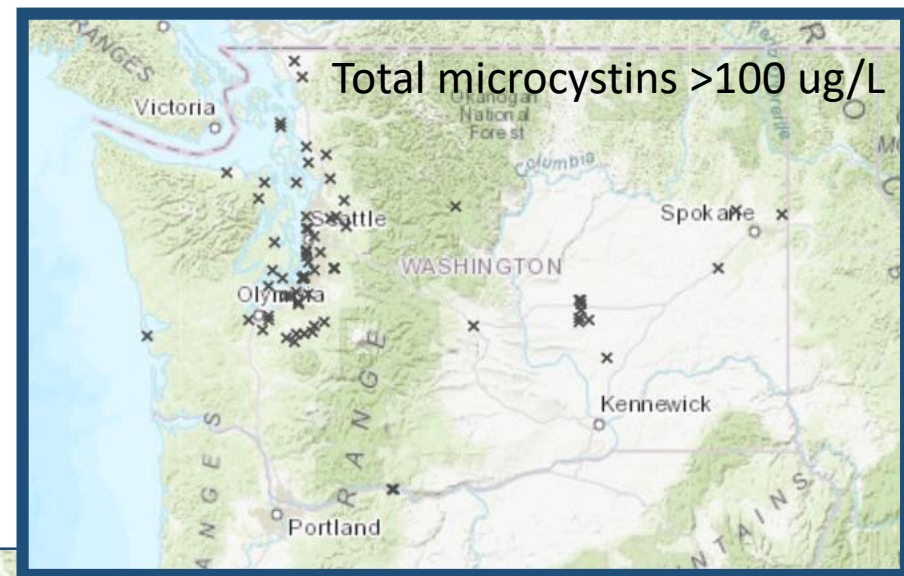
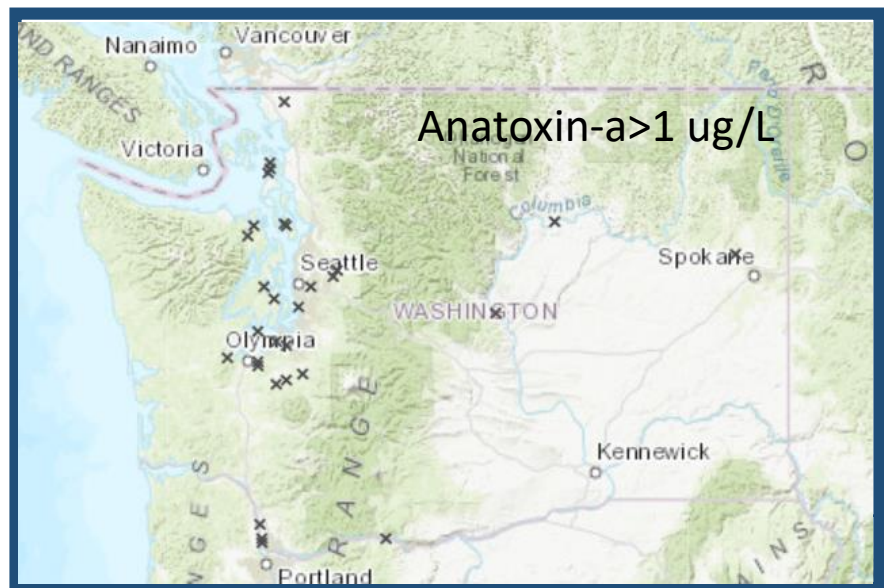


Green Lake, Seattle, WA



Moses Lake, WA (courtesy, WALPA)

HABs in Washington 2007-2019



Source – WA Ecology and King County
<https://www.nwtoxicalgae.org/Data.aspx>

HABs Issues- Idaho examples



Fernan Lake



Round Lake, courtesy B. Scofield



Brownlee Reservoir

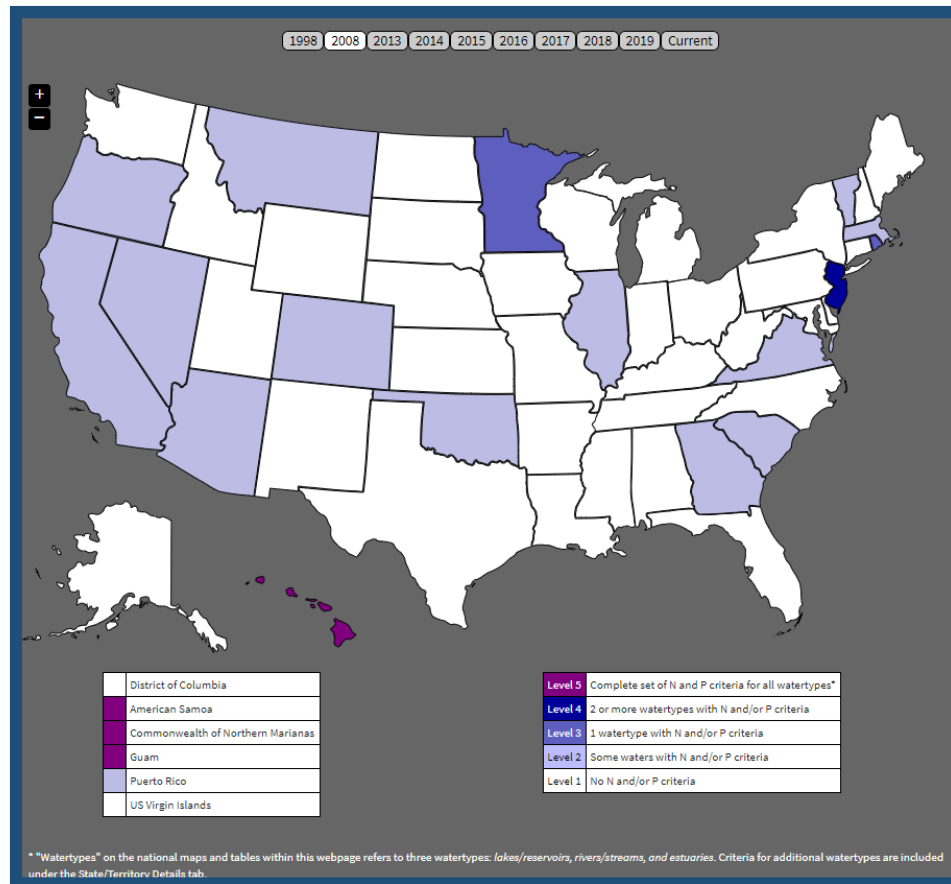
HABS in Idaho 2019-2020



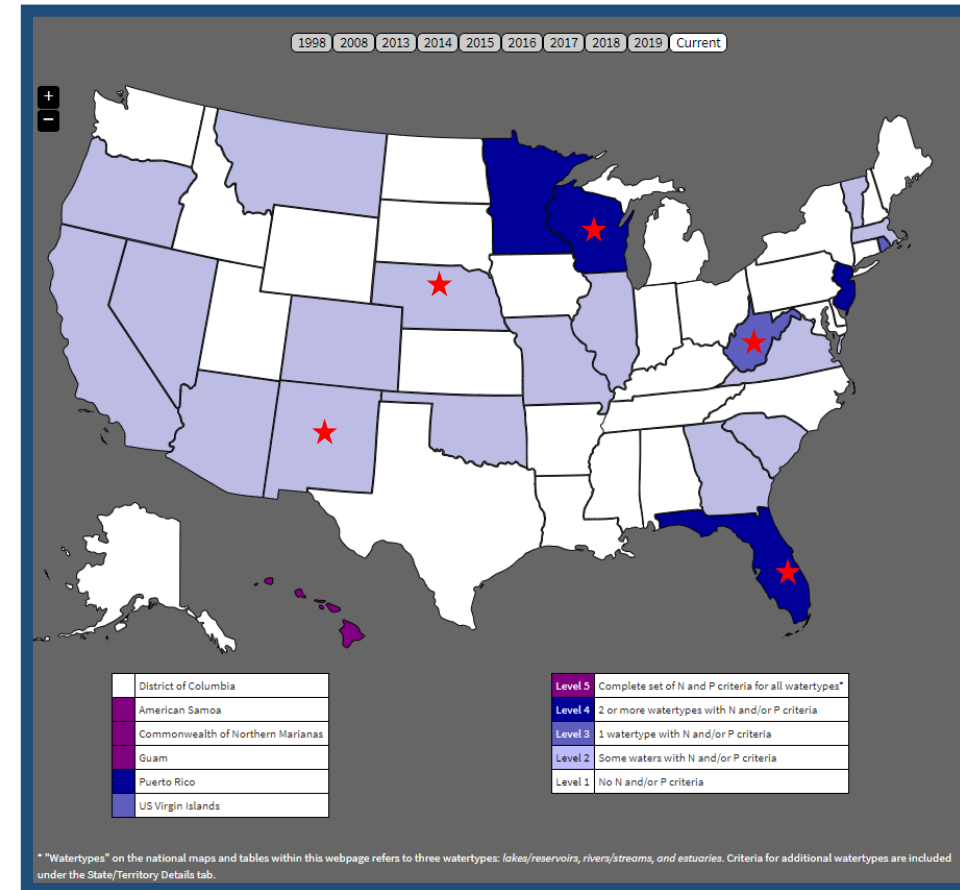
Source: IDEQ

NNC National Status

2008

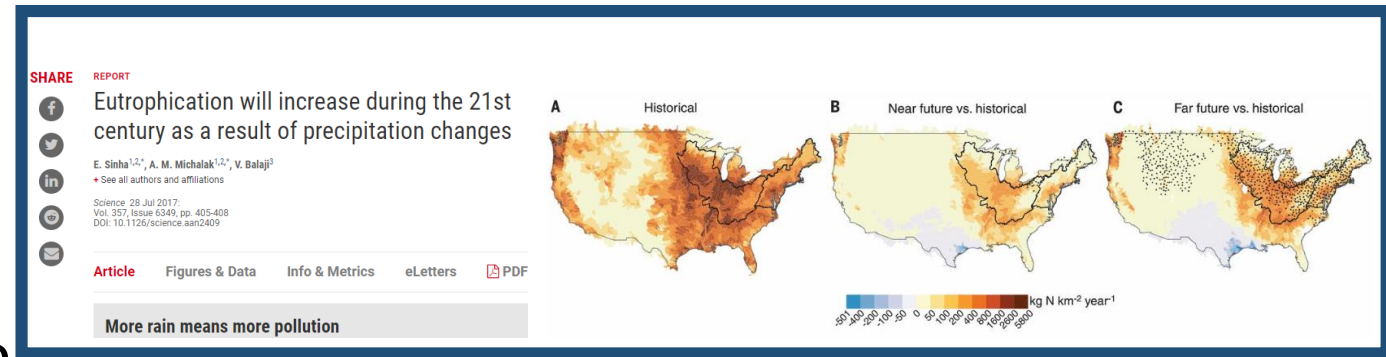


2020



Status of Numeric Nutrient Criteria (NNC) Development

- Technical support is available for identifying suitable endpoints
- Nationally, progress is being made
 - Regionally, incremental progress toward narrative translation; some projects on NNC
- R10 highly recommends prioritization of NNC adoption for waterbodies vulnerable to or impacted by eutrophication and to prevent further eutrophication



<https://science.sciencemag.org/content/357/6349/405>

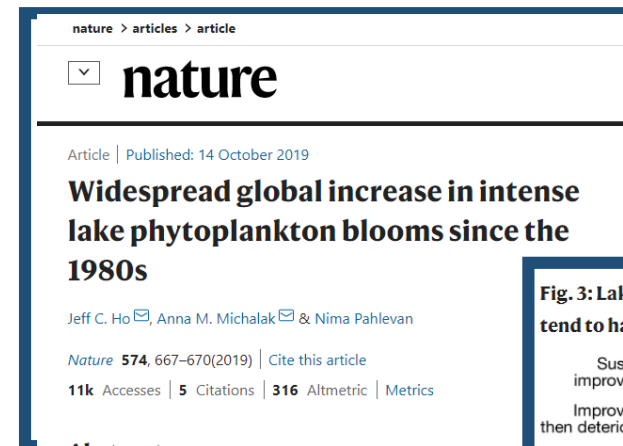
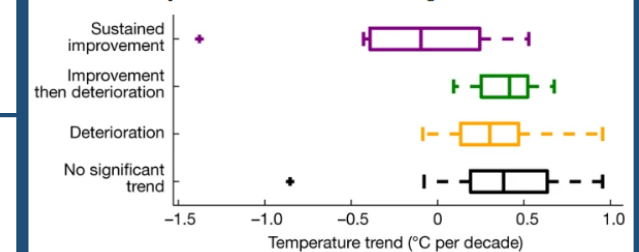


Fig. 3: Lakes that experienced improvements in bloom conditions tend to have experienced little to no warming.



*and recommends identifying targets for pristine waterbodies to ensure further degradation does not occur

Resources for Establishing NNC or Translating Narrative Criteria

Tools to assist states and tribes:

<https://www.epa.gov/nutrient-policy-data/tools-assist-states-and-tribes-reduce-nutrient-pollution>

The Toolkit

<https://www.epa.gov/nutrient-policy-data/toolkit-resources-assist-states-adopting-and-implementing-numeric-nutrient>

Includes:

- Criteria Documents
- Implementation documents
- Economics/Financing
- Communications materials



The screenshot displays the EPA website's page for the 'Toolkit of Resources to Assist States with Adopting and Implementing Numeric Nutrient Criteria'. The page features the EPA logo and navigation links for 'Environmental Topics', 'Laws & Regulations', and 'About EPA'. A search bar is located in the top right corner. The main heading is 'Toolkit of Resources to Assist States with Adopting and Implementing Numeric Nutrient Criteria'. Below the heading, a paragraph states: 'This toolkit compiles available Agency resources to facilitate state adoption of numeric nutrient criteria. It includes information on: criteria and standards development; water quality monitoring, assessment, reporting, and planning; permitting, WQBELs, and trading; economics and financing; and communications materials. This dynamic toolkit will be updated as new Agency materials are developed.' To the right of this paragraph, a note says: 'You may need a PDF reader to view some of the files on this page. See [EPA's About PDF page](#) to learn more.' Below the main paragraph, another paragraph mentions: 'The Association of Clean Water Administrators (ACWA) has developed a companion Nutrient Toolkit page, where state materials—similar in content to the Federal materials on this EPA toolkit—will be housed. [ACWA's preliminary state toolkit](#) was developed in partnership with EPA.' At the bottom, a paragraph provides further information: 'For further information on states' and territories' progress in adopting numeric nutrient criteria see our [State Development of Numeric Criteria for Nitrogen and Phosphorus Pollution website](#), and for information on state nutrient data, see the [Nutrient Indicators Dataset](#).' To the right of this paragraph, a note says: 'The following links exit the site' with an 'EXIT' button.

Toolkit, ctd.

Nutrient Indicators Dataset

| Specific Indicators | | |
|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Documented Nutrient Pollution Nutrient loads and yields Fertilizer Manure | Documented Impacts Hypoxia Harmful algal toxins Groundwater nitrate Assessed and impaired waters | State Actions Underway Limiting loads (Status of Nutrient Requirements for NPDES-Permitted Facilities) Adoption of standards |

Introduction

Water pollution from excess nitrogen and phosphorus (nutrients) is harming the environmental and economic viability of our nation's waters. Human activities have led to a significant increase in nitrogen and phosphorus in the biosphere, altering biological communities in aquatic ecosystems, impairing drinking water, and threatening the growth of businesses and economic sectors that rely on high-quality and sustainable sources of water such as tourism, farming, fishing, manufacturing, and transportation. Recent estimates suggest that nitrogen

Expert Workshop: Nutrient Enrichment Indicators in Streams

For the past 15 years, EPA has encouraged states and tribes to adopt numeric criteria into water quality standards to protect waters from the widespread and growing problem of nutrient pollution. Excess nutrients (nitrogen and phosphorus) cause algal growth that degrades aquatic communities and cause fish kills, degrades beaches and shorelines with nuisance algae, and adversely affect human health from algal toxins and trihalomethane formation in drinking water. State progress toward adopting numeric nutrient criteria has been limited in flowing waters in part because of the technical challenge of developing numeric nutrient criteria when multiple factors (e.g., light, flow) can influence responses (e.g., algal biomass) and confound nutrient response models. Such conditions can make it difficult to predict nitrogen and phosphorus concentrations that adversely affect aquatic life. One approach to overcome such challenges and to reduce uncertainty



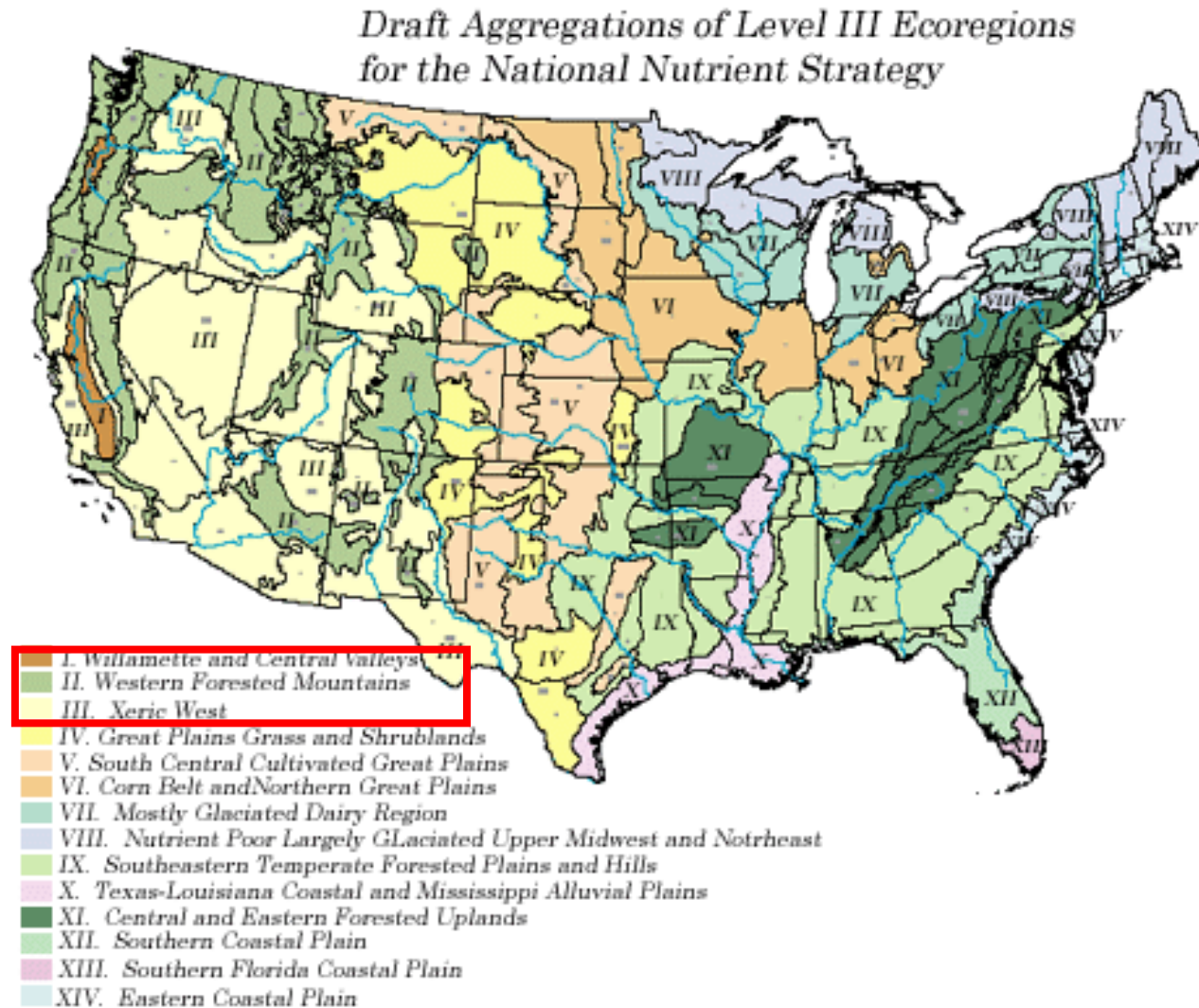
Case Studies on Implementing Low-Cost Modifications to Improve Nutrient Reduction at Wastewater Treatment Plants

DRAFT – Version 1.0
August 2015



https://www.epa.gov/sites/production/files/2015-08/documents/case_studies_on_implementing_low-cost_modification_to_improve_potw_nutrient_reduction-combined_508_-_august.pdf

Ecoregional Criteria



<https://www.epa.gov/nutrient-policy-data/ecoregional-criteria>

Ecoregional Criteria Recommendations and Guidance for Developing NNC- Lakes and reservoirs

Note – no Agg Ecoregion I
(Willamette Valley)

Guidance:

<https://www.epa.gov/sites/production/files/2018-10/documents/nutrient-criteria-manual-lakes-reservoirs.pdf>

Criteria Documents:

<https://www.epa.gov/nutrient-policy-data/ecoregional-nutrient-criteria-lakes-and-reservoirs>

Aggregate Ecoregions Lakes and Reservoirs

| Parameter | Agg Ecor II | Agg Ecor III | Agg Ecor V | Agg Ecor V | Agg Ecor VI | Agg Ecor VII | Agg Ecor VIII | Agg Ecor IX | Agg Ecor XI | Agg Ecor XII | Agg Ecor XIII | Agg Ecor XIV |
|-------------------|-------------------|--------------------|------------------|------------------|-------------------|--------------------|---------------------|-------------------|-------------------|--------------------|---------------------|--------------------|
| TP µg/L | 8.75 | 17.00 | 20.00 | 33.00 | 37.5 | 14.75 | 8.00 | 20.00 | 8.00 | 10.00 | 17.50 | 8.00 |
| TN mg/L | 0.10 | 0.40 | 0.44 | 0.56 | 0.78 | 0.66 | 0.24 | 0.36 | 0.46 | 0.52 | 1.27 | 0.32 |
| Chl <i>a</i> µg/L | 1.90 | 3.40 | 2.00 S | 2.30 S | 8.59 S | 2.63 | 2.43 | 4.93 | 2.79 S | 2.60 | 12.35 T | 2.90 |
| Secchi (m) | 4.50 | 2.70 | 2.00 | 1.30 | 1.36 | 3.33 | 4.93 | 1.53 | 2.86 | 2.10 | 0.79 | 4.50 |

Summary Table for Aggregate Ecoregions

Ecoregional Criteria Recommendations and Guidance for Developing NNC- Rivers and Streams

- Nitrogen fixing (red) Alder can be a challenge along the coast
- Diversity of streams

Aggregate Ecoregions for Rivers and Streams

| Parameter | Agg Ecor I | Agg Ecor II | Agg Ecor III | Agg Ecor V | Agg Ecor V | Agg Ecor VI | Agg Ecor VII | Agg Ecor VIII | Agg Ecor IX | Agg Ecor X | Agg Ecor XI | Agg Ecor XII | Agg Ecor XIV |
|-------------------|------------|-------------|--------------|------------|------------|-------------|--------------|---------------|-------------|------------|-------------|--------------|--------------|
| TP µg/L | 47.00 | 10.00 | 21.88 | 23.00 | 67.00 | 76.25 | 33.00 | 10.00 | 36.56 | 128* | 10.00 | 40.00 | 31.25 |
| TN mg/L | 0.31 | 0.12 | 0.38 | 0.56 | 0.88 | 2.18 | 0.54 | 0.38 | 0.69 | 0.76 | 0.31 | 0.90 | 0.71 |
| Chl <i>a</i> µg/L | 1.80 | 1.08 | 1.78 | 2.40 | 3.00 | 2.70 | 1.50 | 0.63 | 0.93 | 2.10 | 1.61 | 0.40 | 3.75 |
| Turb FTU/NTU | 4.25 | 1.30 | 2.34 | 4.21 | 7.83 | 6.36 | 1.70 | 1.30 | 5.70 | 17.50 | 2.30 | 1.90 | 3.04 |
| | | N | | | | | N | | | | N | N | |

*This value appears inordinately high and may either be a statistical anomaly or reflects a unique condition. In any case, further regional investigation is indicated to determine the sources, i.e., measurement error, notational error, statistical anomaly, natural enriched conditions, or cultural impacts.

Turb - Turbidity

Chl *a* - Chlorophyll *a* measured by Fluorometric method, unless specified. S is for Spectrophotometric and T is for Trichromatic method.

N for NTU. Unit of measurement for Turbidity.

EPA Guidance:

<https://www.epa.gov/sites/production/files/2018-10/documents/nutrient-criteria-manual-rivers-streams.pdf>

304(a) Criteria Documents:

<https://www.epa.gov/nutrient-policy-data/ecoregional-nutrient-criteria-rivers-and-streams>

Summary Table for Aggregate Ecoregions

Criteria Recommendations and Guidance for Developing NNC- Marine Waters

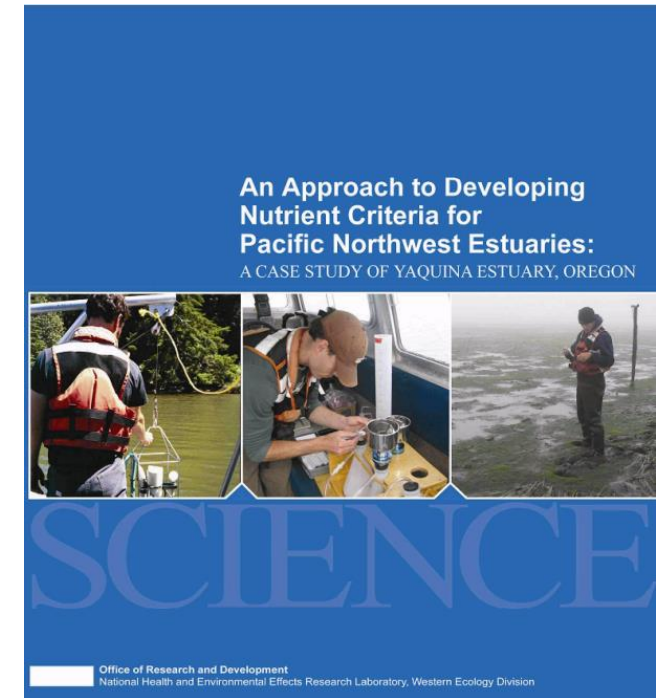
- Upwelling complicates west coast development of NNC
- Can be evaluated with reference-based (mixing models or statistical analyses) or numerical modeling approaches

| Potential dry season criteria for the Yaquina Estuary based on median values for all parameters except for DO. | | |
|----------------------------------------------------------------------------------------------------------------|--------|--------|
| Parameter (units) | Zone 1 | Zone 2 |
| DIN (μM) | 14 | 14 |
| Phosphate (μM) | 1.3 | 0.6 |
| Chlorophyll <i>a</i> ($\mu\text{g l}^{-1}$) | 3 | 5 |
| Water Clarity (m^{-1}) | 0.8 | 1.5 |
| Dissolved Oxygen (mg l^{-1}) | 6.5 | |

EPA Guidance:

<https://www.epa.gov/sites/production/files/2018-10/documents/nutrient-criteria-manual-estuarine-coastal.pdf>

Dry season medians in Zone 1 (lower estuary) and Zone 2 (upper estuary) based on EPA recommendations for high quality estuaries; note DO instantaneous min



<https://www.epa.gov/sites/production/files/2019-02/documents/an-approach-pacific-nw-estuaries-oregon.pdf>

2019 Recreational Water Quality Criteria or Swimming Advisories for Two Cyanotoxins

- Swimming advisories –one day duration; magnitudes are never to be exceeded
- Note for recreational water quality criteria, the 10-day periods **are not** rolling

From the draft implementation materials - duration and frequency interpretation:

- If toxin concentrations are higher than the criterion magnitude **in a sample** collected during a ten-day assessment period, then that period should be considered an excursion from the recreational criteria.
- Do not transform (e.g., average) sampling data.
- The recommended frequency *within a single recreational season* is no more than three excursions. The number of years that a pattern of more than three excursions can *occur across* recreational seasons is to be identified by a state or authorized tribe in its WQS.

Table 6-1. Recreational Criteria or Swimming Advisory Recommendations for Microcystins and Cylindrospermopsin^a

| Application of Recommended Values | Microcystins | | | Cylindrospermopsin | | |
|-------------------------------------|------------------|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|--------------------|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| | Magnitude (µg/L) | Duration | Frequency | Magnitude (µg/L) | Duration | Frequency |
| Recreational Water Quality Criteria | 8 | 1 in 10-day assessment period across a recreational season | More than 3 excursions in a recreational season, not to be exceeded in more than one year ^b | 15 | 1 in 10-day assessment period across a recreational season | More than 3 excursions in a recreational season, not to be exceeded in more than one year ^b |
| Swimming Advisory | | One day | Not to be exceeded | | One day | Not to be exceeded |

^a These recommendations can apply independently within an advisory program or in WQS. States can choose to apply either or both toxin recommendations when evaluating excursions within and across recreational seasons.

^b An excursion is defined as a 10-day assessment period with any toxin concentration higher than the criteria magnitude. When more than three excursions occur within a recreational season and that pattern reoccurs in more than one year, it is an indication the water quality has been or is becoming degraded and is not supporting its recreational use. **As a risk-management decision, states should include in their WQS an upper-bound frequency stating the number of years that pattern can reoccur and still support its recreational use.**

New Draft 304(a) for Lakes (to be released soon for public comment)

- Uses National Lakes Assessment Data (2007 and 2012)
- Comprises a series of models – first to identify chlorophyll *a* targets, and then ultimately derive TN and TP numeric values.
- Models are Bayesian (probabilistic)
- No Alaska

Contact: Lester Yuan,
yuan.lester@epa.gov

New Draft 304(a) for Lakes: Demo 1 – Identifying Human Health Targets Associated with Chlorophyll *a* Targets

- Total microcystins
 - 304(a) magnitudes
 - Drinking water advisory magnitudes

Image removed

All slides on draft 304(a) are examples subject to change

New Draft 304(a) for Lakes: Demo 2 – Identifying Ecological Chlorophyll *a* Targets (Example)

- Hypoxia model
- Zooplankton

Image removed

New draft 304(a) – after deriving Chlorophyll *a* targets, deriving TN and TP targets

- Separate models for TN and TP

Image removed

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Lakes and Reservoirs – Applying draft lake nutrient models with additional state data

- Bayesian model allows us to specify elements of state data and national data that are similar and different.

Image removed

See:

<https://www.sciencedirect.com/science/article/pii/S1568988319300265?via%3Dihub>

Rivers and Streams- resources used in other states

Periphyton indicators – sensitive response to eutrophication; Algal indicators in streams compilation- an overview

<https://www.epa.gov/sites/production/files/2017-06/documents/algal-indicators-whitepaper.pdf>

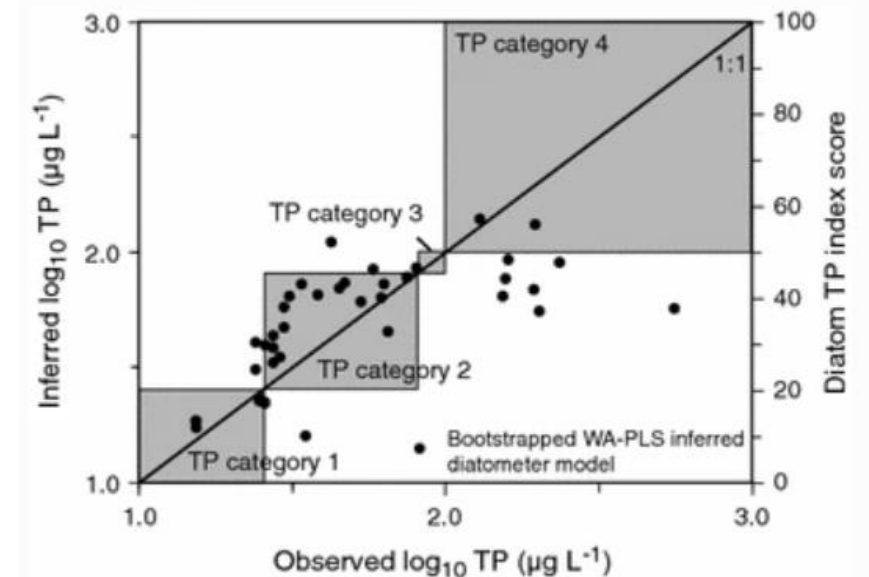
- New Jersey- based on Ponader et al. 2008

<https://link.springer.com/article/10.1007/s10750-008-9429-6>

- Macroinvertebrates- Vermont (also for lakes):

<https://www.tandfonline.com/doi/full/10.1080/10402381.2016.1149257?src=recsys> Smeltzer et al. 2016

Fig. 3



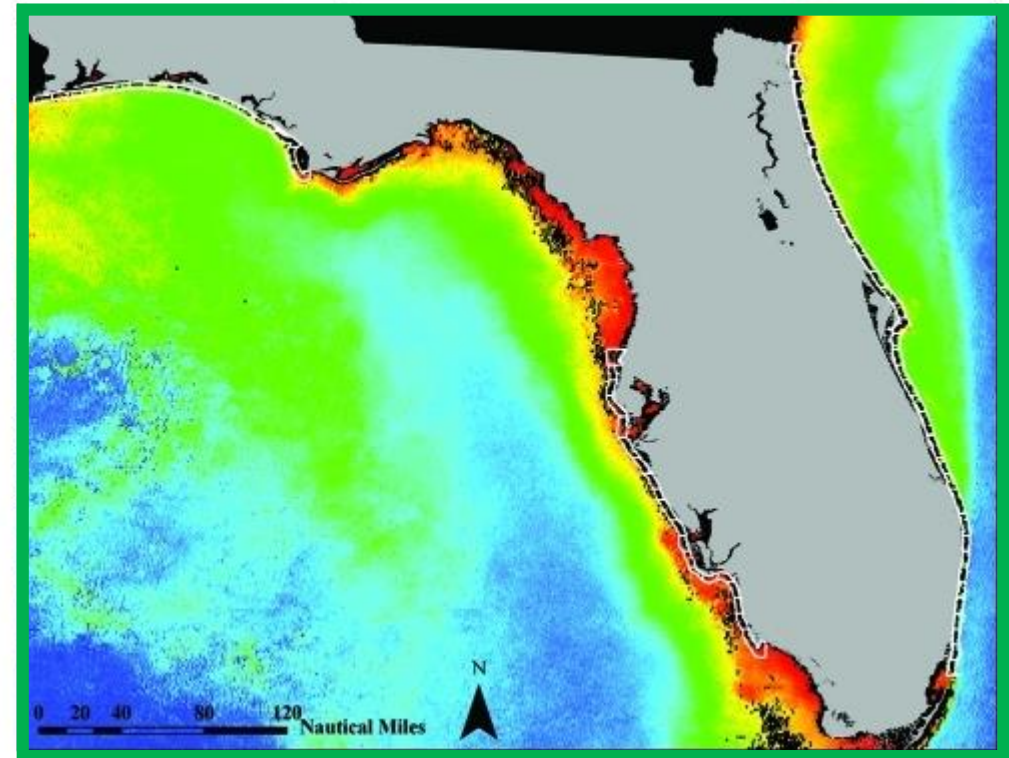
Marine waters

Case studies: Nutrients in Estuaries,
EPA 2010

<https://www.epa.gov/sites/production/files/documents/nutrients-in-estuaries-november-2010.pdf>

- Florida approach – using remotely sensed data to generate a baseline - Schaeffer et al. 2012

https://europepmc.org/articles/pmc3287117/bin/es2014105_si_003.pdf



Nutrient Model Derivation

<https://www.epa.gov/tmdl/tmdl-modeling>

See e.g.,

About the Water Quality Modeling Basics and Beyond Webinar Series

EPA formed the Water Quality Modeling Workgroup in 2013 to facilitate collaboration among EPA and state employees who are using water quality models for CWA regulatory purposes, primarily in the Total Maximum Daily Load (TMDL) and Water Quality Standards programs. The group is hosting a series of six 2-hour Webinars in 2015 to help water quality professionals better understand modeling and how models can be used to solve the problems facing water quality regulators. The first three webinars covered modeling basics, such as selecting, developing, and running hydrology and water quality models. The last three webinars will be focused on modeling specific pollutants (e.g., nutrients, sediment, metals) and other emerging issues.

Modeling Nutrients: Nutrient Cycles, Potential Impacts on Water Quality, and Developing Nutrient Endpoints

This webinar will present information related to nutrient modeling and will include topics such as nutrient cycling, common nutrient related problems (e.g, eutrophication, low D.O., fish kills, and algae blooms), and critical parameters and driving processes. Speakers will also discuss developing nutrient-sensitive endpoints for nutrient modeling.

Speakers: *Tim Wool (EPA Region 4), Steve Whitlock (EPA Headquarters), and Lester Yuan (EPA Headquarters)*

A Note About the Need for Dual Control of N and P



United States
Environmental Protection
Agency

Office of Water EPA - 820-S-15-001

MC 4304T

February 2015

Preventing Eutrophication: Scientific Support for Dual Nutrient Criteria

Summary

Nutrient pollution resulting from excess nitrogen (N) and phosphorus (P) is a leading cause of degradation of U.S. water quality. The scientific literature provides many examples that illustrate the effects of both N and P on instream and downstream water quality in streams, lakes, estuaries, and coastal systems. Development of numeric nutrient criteria for both N and P can be an effective tool to protect designated uses in the nation's waters. The purpose of this fact sheet is

water quality standards and are an effective tool for preventing nutrient pollution, for example, in helping to derive numeric limits in discharge permits. Development of numeric nutrient criteria is one aspect of a coordinated and comprehensive approach to nutrient management [7]. EPA has published several guidance documents to assist states and authorized tribes in deriving numeric nutrient criteria for both N and P to protect aquatic systems [8, 9, 10, 11, 12].

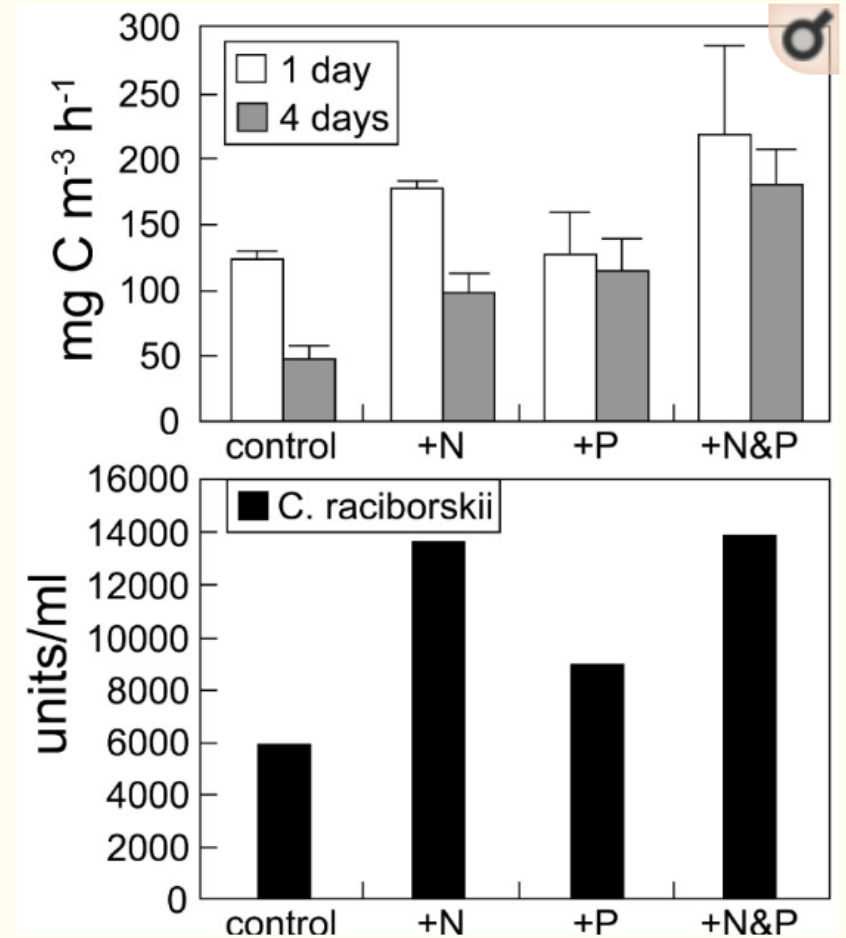
https://www.epa.gov/sites/production/files/documents/nandp_factsheet.pdf

Main points

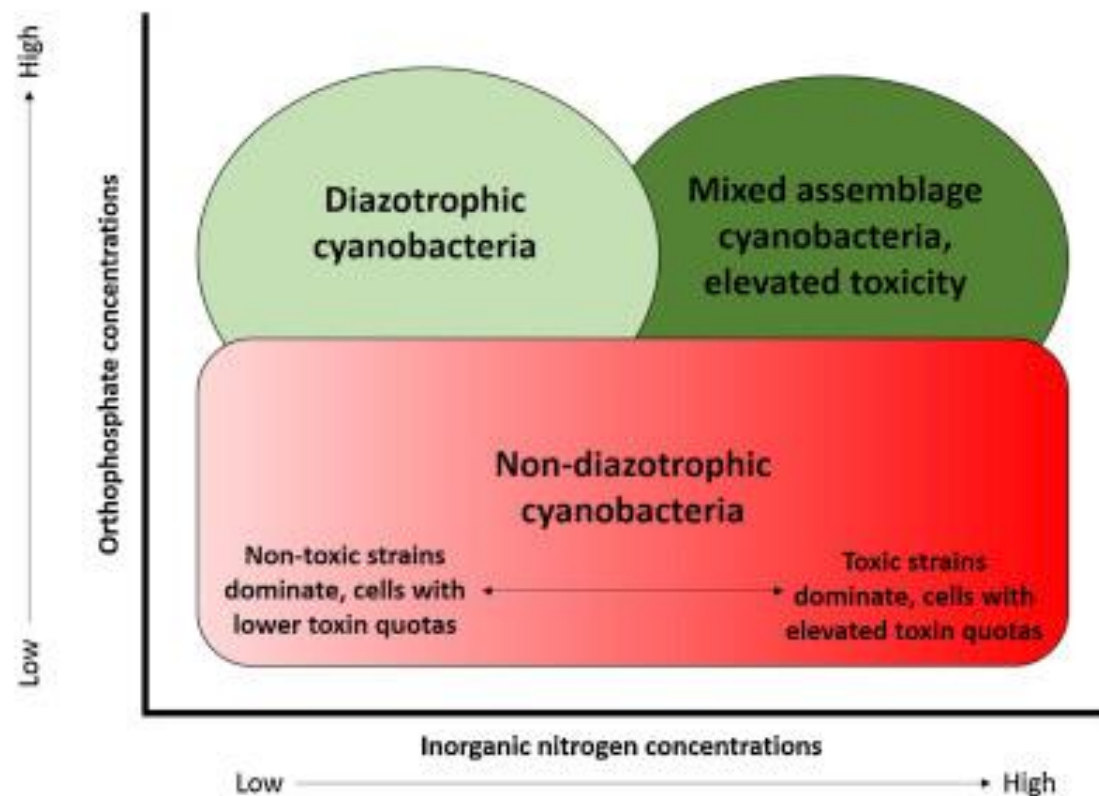
- Trophic status can vary in space and time
- N and P in excess typically result in the highest rates of primary production
- Cyanobacteria dominance can be supported by N and/or P in excess
- DS protection typically requires control of both N and P

Dual N and P Control

- cyanobacteria (as well as algae/net primary production) thrive with abundant excess reactive N and P together



Paerl 2018



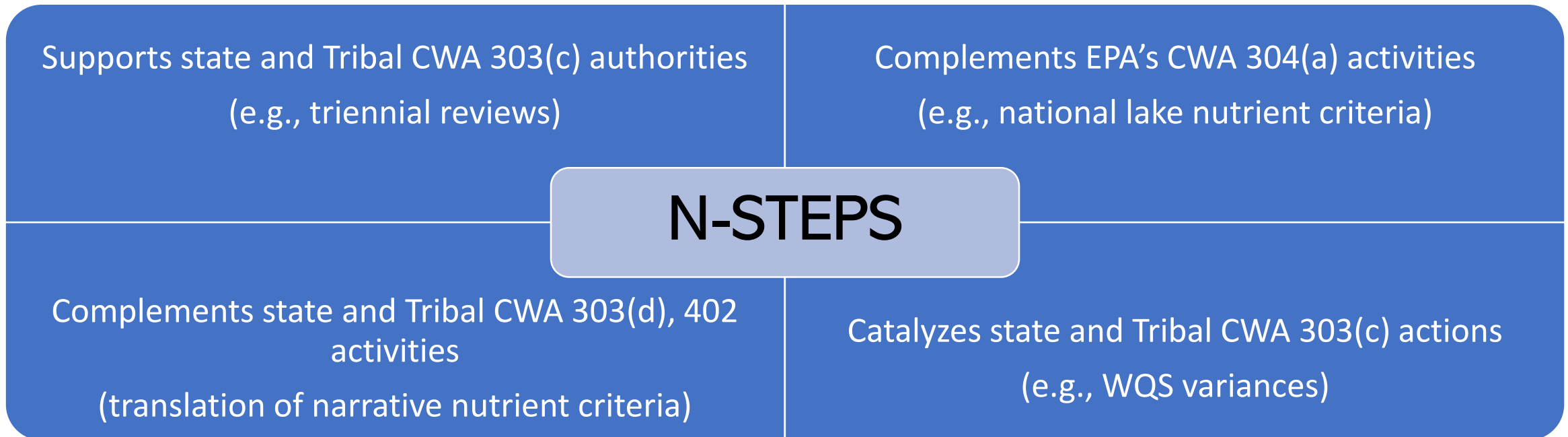
Gobler et al. 2016

[Download](#) : [Download high-res image \(292KB\)](#)

[Download](#) : [Download full-size image](#)

N-STEPS¹ (b. 2005): Scope and Role

- Broad geographic scope – all surface water types, state-wide, site-specific
- Broad technical scope – data acquisition, analysis, model development, technical writing
- Collaborative partnerships – EPA Regions, state and Tribal agencies, other federal partners



N-STEPS


<https://www.epa.gov/nutrient-policy-data/n-steps>

← → ↻

epa.gov/nutrient-policy-data/request-n-steps-support

Apps One EPA Workplace InfoPage: R10's Intr... mat

An official website of the United States government.
We've made some changes to EPA.gov. If the information you are looking for is not here, you may be able to find it on the EPA Web Archive or the January 19, 2017 Web Snapshot. Close X

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Request for N-STEPS Support

Information related to Request for N-STEPS Support.

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- Request for N-STEPS Support (PDF) (4 pp, 206 K)

[Contact Us](#) to ask a question, provide feedback, or report a problem.

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epa.gov/nutrient-policy-data/n-steps

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N-STEPS

The Nutrient Scientific Technical Exchange Partnership & Support (N-STEPS) program was created by U.S. EPA in 2005 to serve as a technical and scientific resource for numeric nutrient criteria development efforts for states, territories and authorized tribes. The program is intended to provide technical assistance to water quality scientists who are working to develop numeric nutrient criteria to protect the designated uses of their state, territorial or tribal surface waters. N-STEPS has developed materials, tools, and offered technical assistance for all stages of numeric nutrient criteria development –i.e. planning, data preparation and management, data exploration, analysis and model development, scientific literature review, and peer review.

You may need a PDF reader to view some of the files on this page. See [EPA's About PDF page](#) to learn more.

Materials and Technical Tools

As part of the materials and technical tools associated with numeric nutrient criteria derivation, N-STEPS has developed an overview of nutrient and response variables, factsheets on available statistical tools, compiled and described models commonly used in nutrient water quality modeling, and provided access to nutrient relevant literature.

Nutrient and Response Variable OverviewsStatistical ToolsModel DescriptionsNutrient Relevant Literature

Nutrient and Response Variable Overviews

Descriptions of common nutrient (e.g., nitrogen) and response variables (e.g., phytoplankton) and sampling methods for these variables. Click on a variable below for more information. Additional resources for variables and sampling methods are included.

| | |
|------------------------|---|
| Clarity | + |
| Dissolved Oxygen | + |
| Nitrogen | + |
| Periphyton | + |
| Phosphorus | + |
| Phytoplankton | + |
| Additional Information | + |

Technical Assistance

Technical assistance for numeric nutrient criteria derivation is available to state, territory, and tribal water quality agencies. These entities

Previous N-STEPS work

WA NSTEPS for Streams – Example Results

periphyton diatom assemblage sensitive indicator to nutrient pollution

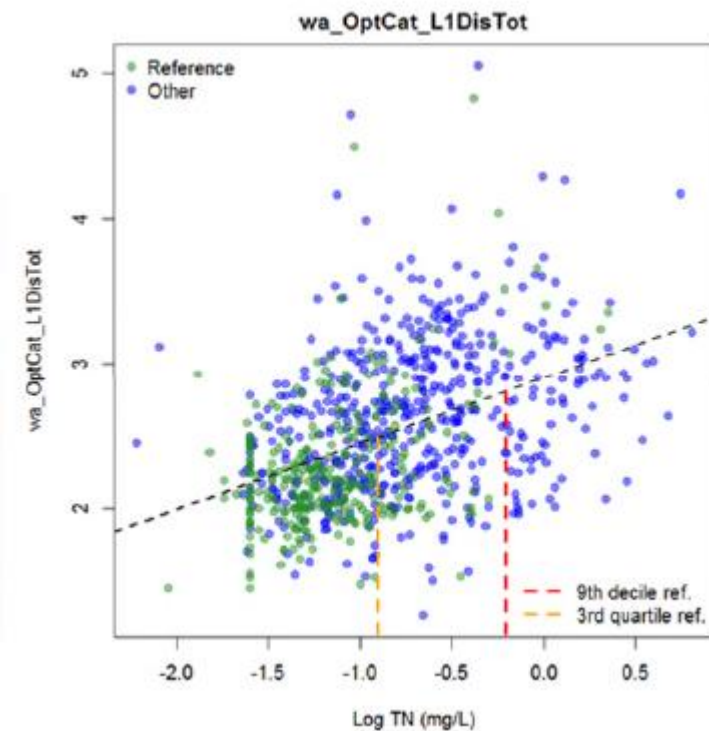


Table 3 – TN endpoints interpolated from periphyton metric regression models as responses to TN for all reference sites. All linear regressions presented were statistically significant ($p < 0.001$) in the proper response direction (ecologically sound). Rho = spearman's correlation coefficient, b = regression intercept, m = regression slope, r^2 = variance explained by regression, q = percentile of deciles (90th) and quartiles (75th), TN90 and TN75 are the interpolated log-base TN values (first value) and back-transformed values (second value) associated with the reference percentile of each metric. Metrics and metric sources are explained in the Methods and in Appendix 3. Results for other metrics are shown in Appendix 5.

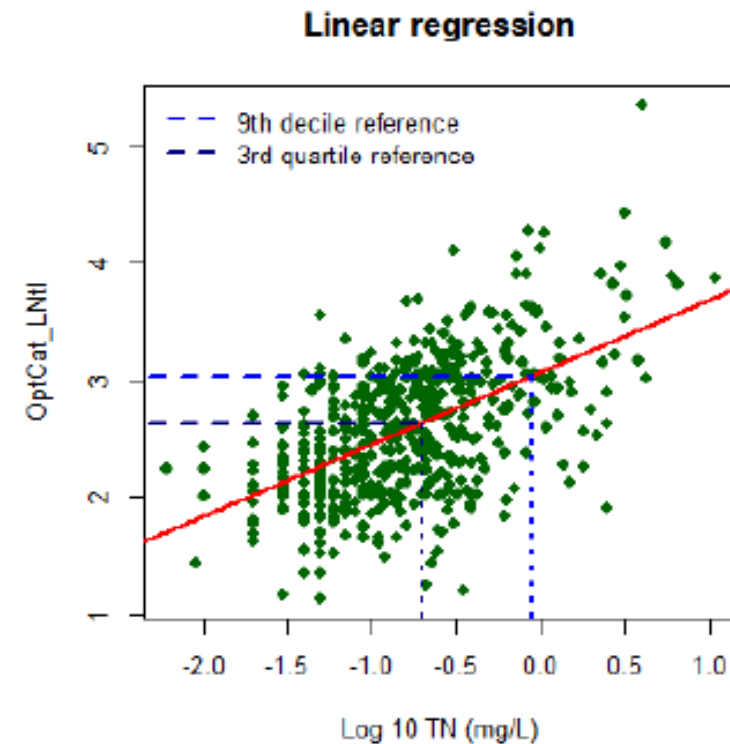
| Metric | Abbreviation | rho | intercept | slope | r2 | q90 | TN90 | q75 | TN75 | | |
|-----------------------------------|---------------------|------|-----------|-------|------|------|-------|-------------|------|-------|-------------|
| TN Optima Index | wa_OptCat_LNtl | 0.46 | 2.73 | 0.45 | 0.21 | 2.68 | -0.11 | 0.78 | 2.28 | -1.01 | 0.10 |
| % Disturbed Land Index | wa_OptCat_L1DisTot | 0.45 | 2.90 | 0.45 | 0.19 | 2.81 | -0.21 | 0.62 | 2.49 | -0.91 | 0.12 |
| Multivariate Disturbed Land Index | wa_OptCat_DisTotMMI | 0.38 | 2.52 | 0.48 | 0.14 | 2.57 | 0.10 | 1.26 | 2.15 | -0.77 | 0.17 |
| TN and TP Index | wa_OptCat_NutMMI | 0.37 | 2.49 | 0.46 | 0.14 | 2.56 | 0.16 | 1.45 | 2.16 | -0.71 | 0.19 |
| Embeddedness Index | wa_OptCat_XEMBED | 0.36 | 2.24 | 0.42 | 0.15 | 2.15 | -0.22 | 0.60 | 1.84 | -0.94 | 0.11 |

Table 4 – TP endpoints interpolated from periphyton metric regression models as responses to TP. All other details as in Table 3.

| Metric | Abbreviation | rho | intercept | slope | r2 | q90 | TP90 | q75 | TP75 | | |
|-----------------------------------|---------------------|------|-----------|-------|------|------|-------|--------------|------|-------|--------------|
| TP Optima Index | wa_OptCat_L1Ptl | 0.67 | 3.31 | 0.72 | 0.41 | 2.52 | -1.10 | 0.080 | 2.07 | -1.72 | 0.019 |
| TN and TP Index | wa_OptCat_NutMMI | 0.65 | 3.36 | 0.71 | 0.38 | 2.57 | -1.11 | 0.078 | 2.18 | -1.66 | 0.022 |
| Multivariate Disturbed Land Index | wa_OptCat_DisTotMMI | 0.63 | 3.34 | 0.69 | 0.34 | 2.61 | -1.05 | 0.089 | 2.16 | -1.71 | 0.020 |
| Embeddedness Index | wa_OptCat_XEMBED | 0.58 | 2.86 | 0.56 | 0.30 | 2.15 | -1.28 | 0.052 | 1.85 | -1.81 | 0.015 |
| Conductivity Index | wa_OptCat_LCond | 0.57 | 3.18 | 0.61 | 0.27 | 2.58 | -0.98 | 0.106 | 2.11 | -1.74 | 0.018 |

OR NSTEPS for Streams – Example Results

- Large variety of endpoints provided over the wide range of possible MMI identified
- Focus on most significant MMI, and threshold of median reference response



ID NSTEPS for Streams- Example Results; includes aesthetic ratings

Table ES-1. Nutrient threshold values (mg/L) based on reference distributions, modeled reference, and stressor-response analysis for TP and TN in nutrient site classes.

| TP | MF_N | MF_S | P_high | P_low |
|-----------------------------------------|--------------|--------------|--------------|--------------|
| Reference Distribution 75 th | 0.011 | 0.019 | 0.025 | 0.046 |
| Reference Distribution 90 th | 0.015 | 0.035 | 0.033 | 0.082 |
| Median CPA | 0.013 | 0.017 | 0.043 | 0.049 |
| Median Reference Regr. Interp. | 0.004 | 0.018 | 0.017 | 0.131 |
| Median non-reference Regr. Interp. | 0.017 | 0.028 | 0.061 | 0.076 |
| Potential Threshold Range | 0.011-0.013 | 0.017-0.019 | 0.025 | 0.046-0.049 |
| TN | North | S_hi_E | S_hi_W | S_low |
| Reference Distribution 75 th | 0.15 | 0.38 | 0.22 | 0.58 |
| Reference Distribution 90 th | 0.26 | 0.45 | 0.24 | 0.81 |
| Median CPA | 0.76 | 0.31 | 0.13 | 1.29 |
| Median Reference Regr. Interp. | 0.14 | 0.30 | 0.14 | na |
| Median non-reference Regr. Interp. | 1.04 | 1.55 | 0.44 | na |
| Potential Threshold Range | 0.14 - 0.15 | 0.30 – 0.38 | 0.13 - 0.24 | 0.58 - 0.81 |

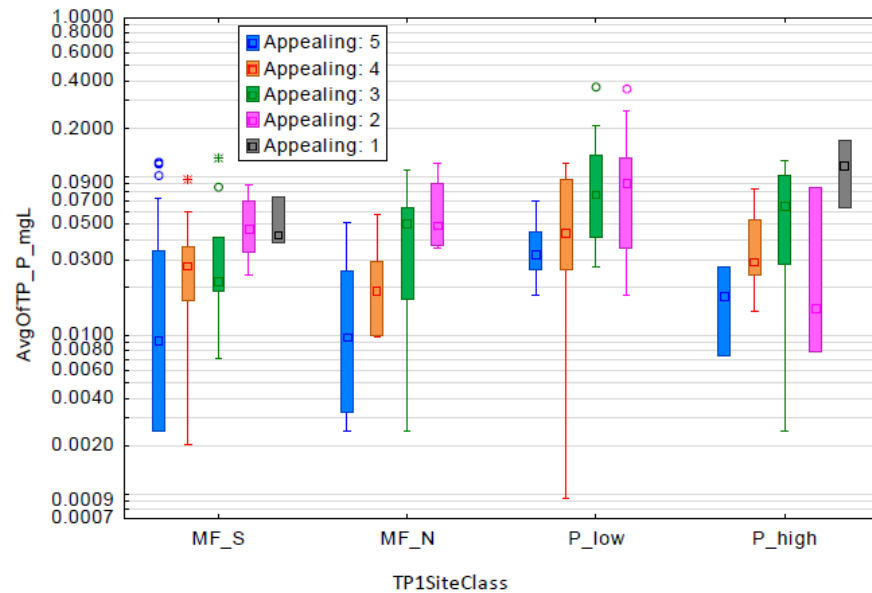
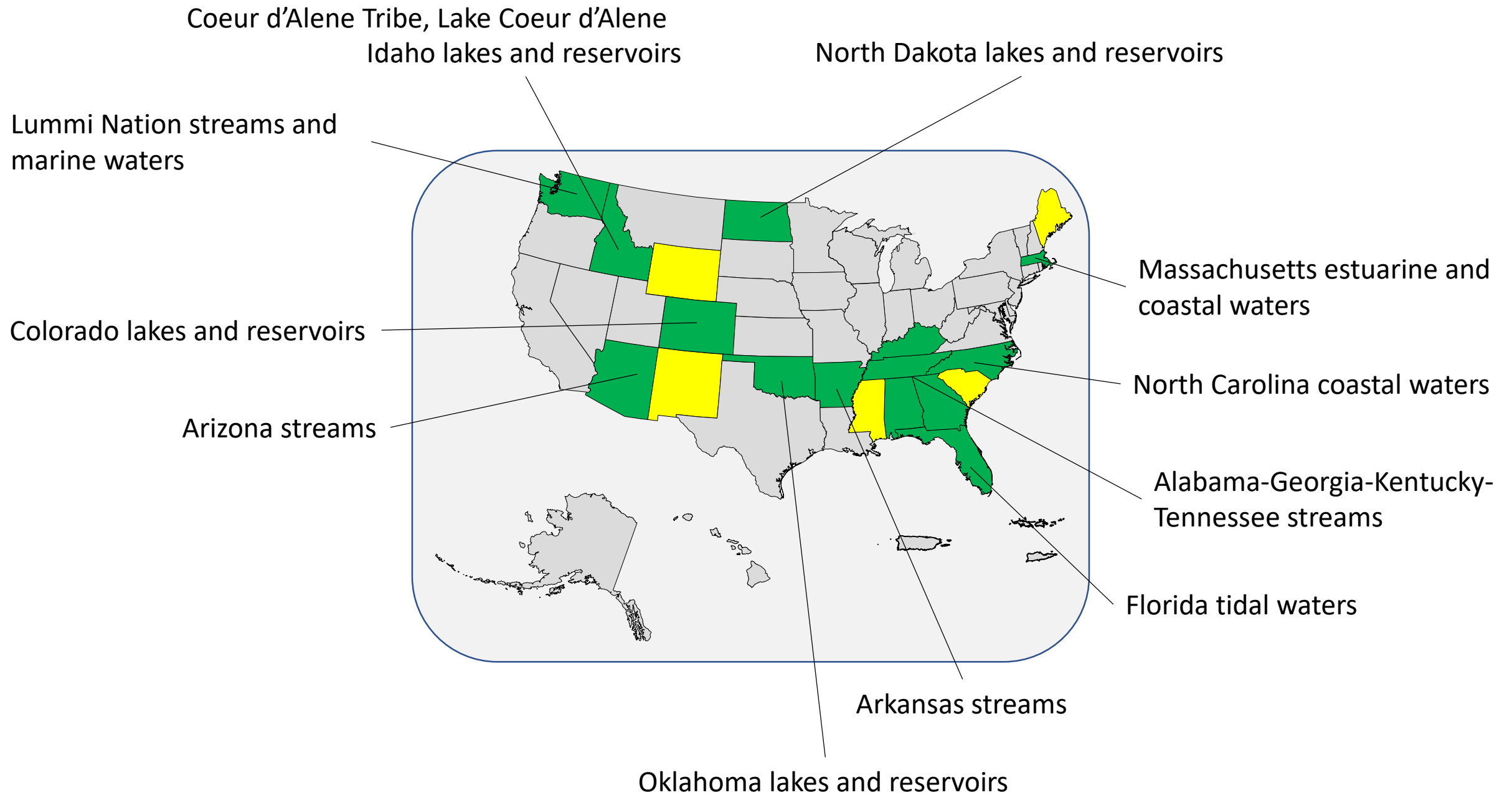


Figure 16. TP concentrations in aesthetic rating categories, by site class.

Current N-STEPS work

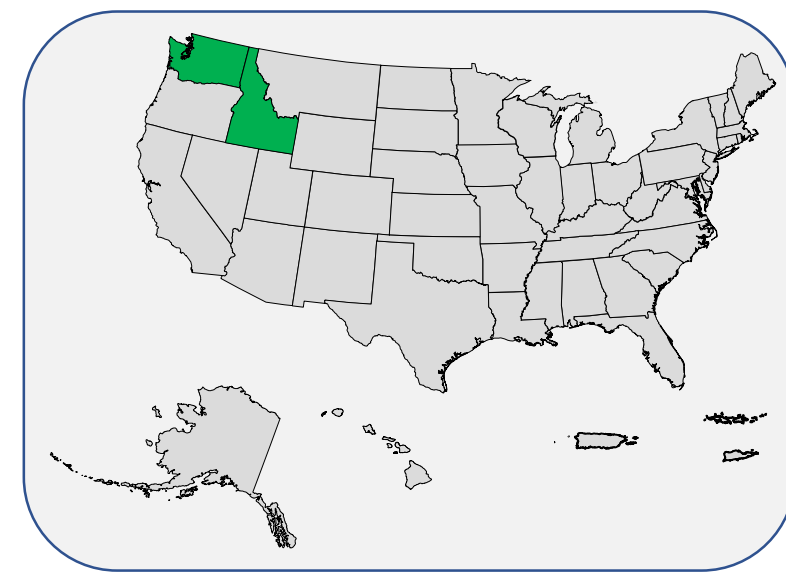


Lummi Nation (Washington), streams and marine waters

- Nutrient criteria to protect aquatic life
- FY18/19 N-STEPS
 - Estimated least-disturbed nutrient conditions
 - Conducted stressor-response modeling
 - Completed report
- R10 exploring local 3-D models in marine waters

Coeur d'Alene Tribe (Idaho), Lake Coeur d'Alene

- Nutrient criteria to protect aquatic life
- FY18/19 N-STEPS
 - Lake data analyses for local conditions
- Stressor-response modeling with CyAN data (collaboration with EPA ORD's CyAN project)



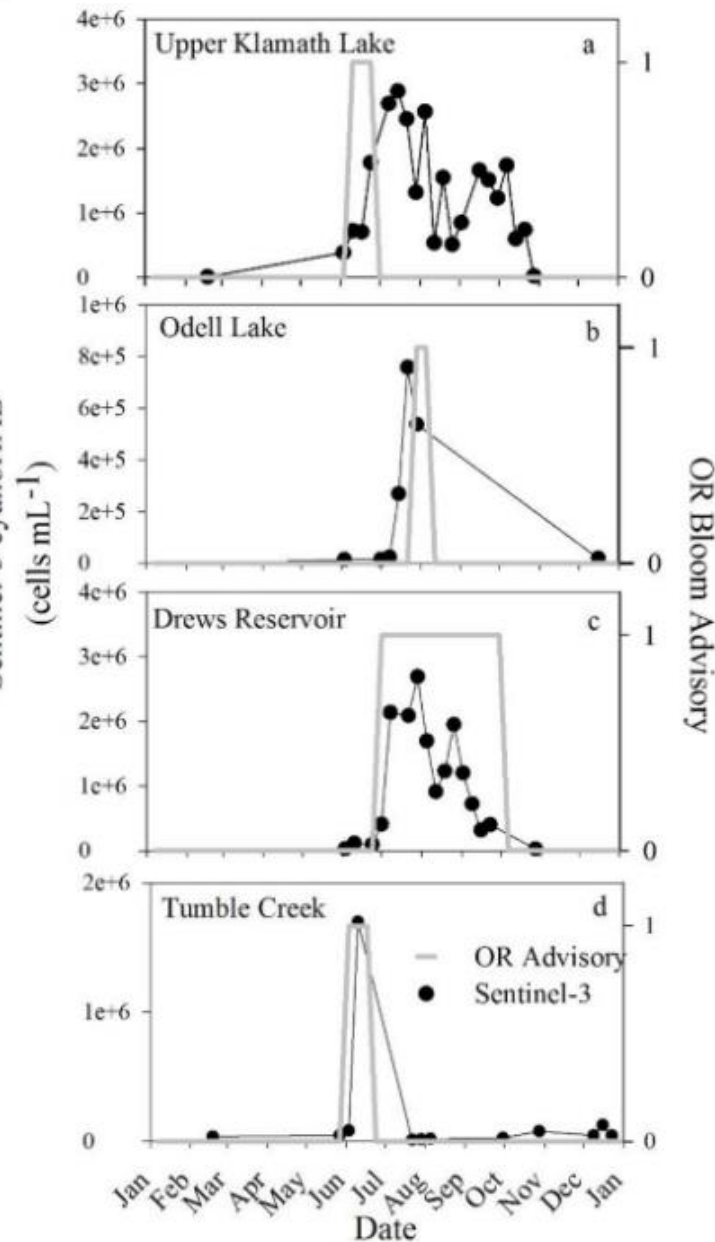
Region 10

Idaho lakes and reservoirs

- Nutrient criteria translation to protect HABs-impacted waterbodies (human health and ecological endpoints)
- FY18/19 N-STEPS
 - Data acquisition and analyses
- Exploring watershed predictors of harmful algal bloom risk in downstream lakes and reservoirs (collaboration with EPA ORD's CyAN project)



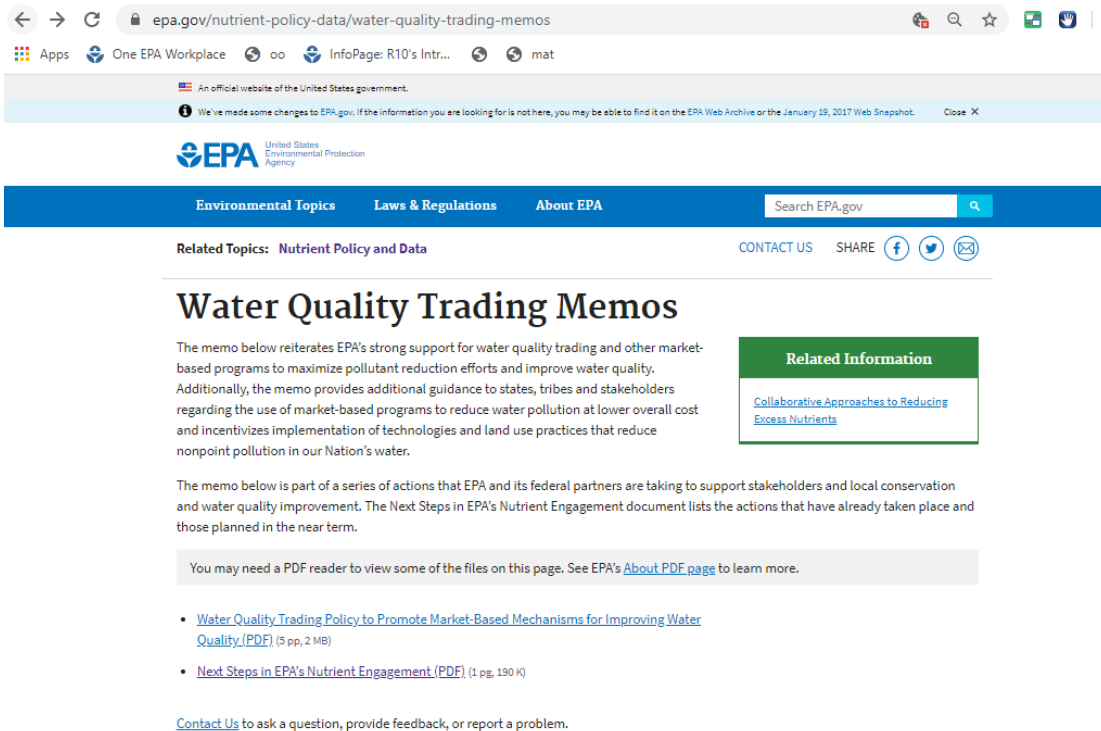
Sentinel-3 cyanoHAB



App at google play store for android devices. Desktop tool under development

<https://www.epa.gov/water-research/cyanobacteria-assessment-network-mobile-application-cyan-app>

Challenges - Implementation



The screenshot shows the EPA website's 'Water Quality Trading Memos' page. The header includes the EPA logo and navigation links for 'Environmental Topics', 'Laws & Regulations', and 'About EPA'. A search bar is present. The main content area features the title 'Water Quality Trading Memos' and a paragraph explaining EPA's support for water quality trading. A 'Related Information' box contains a link to 'Collaborative Approaches to Reducing Excess Nutrients'. Below the main text, there are links to two PDF documents: 'Water Quality Trading Policy to Promote Market-Based Mechanisms for Improving Water Quality (PDF)' and 'Next Steps in EPA's Nutrient Engagement (PDF)'. A 'Contact Us' link is at the bottom.

epa.gov/nutrient-policy-data/water-quality-trading-memos

Environmental Topics Laws & Regulations About EPA Search EPA.gov

Related Topics: Nutrient Policy and Data CONTACT US SHARE

Water Quality Trading Memos

The memo below reiterates EPA's strong support for water quality trading and other market-based programs to maximize pollutant reduction efforts and improve water quality. Additionally, the memo provides additional guidance to states, tribes and stakeholders regarding the use of market-based programs to reduce water pollution at lower overall cost and incentivizes implementation of technologies and land use practices that reduce nonpoint pollution in our Nation's water.

The memo below is part of a series of actions that EPA and its federal partners are taking to support stakeholders and local conservation and water quality improvement. The Next Steps in EPA's Nutrient Engagement document lists the actions that have already taken place and those planned in the near term.

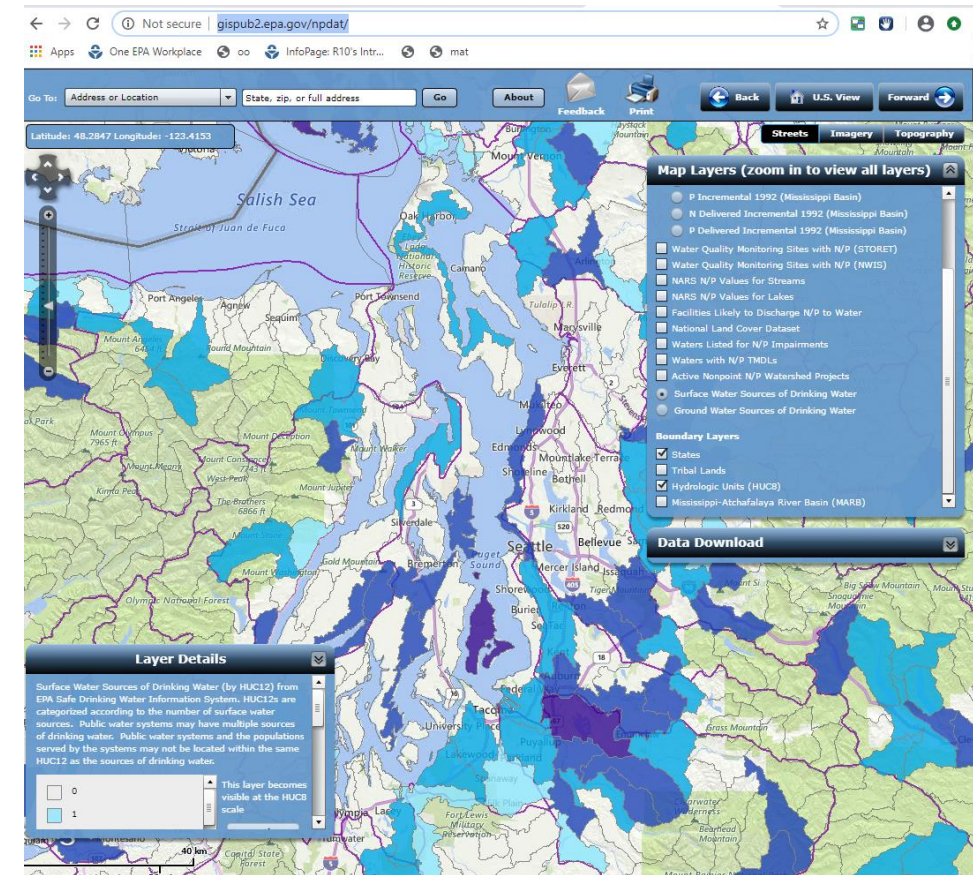
You may need a PDF reader to view some of the files on this page. See EPA's [About PDF page](#) to learn more.

- [Water Quality Trading Policy to Promote Market-Based Mechanisms for Improving Water Quality \(PDF\)](#) (5 pp, 2 MB)
- [Next Steps in EPA's Nutrient Engagement \(PDF\)](#) (1 pg, 190 K)

[Contact Us](#) to ask a question, provide feedback, or report a problem.

Trading Policy – R10 contact is Claire Schary:
schary.Claire@epa.gov

<https://www.epa.gov/nutrient-policy-data/water-quality-trading-memos>



NP Dat: <https://gispub2.epa.gov/npdat/>

Frequent Questions: Nutrient Criteria Implementation

Here are common questions and their answers about nutrient criteria implementation that we have received from states. We will periodically update this list with additional questions and answers.

| | |
|----------------------------------------------|---|
| Standards | + |
| Permits | + |
| Monitoring, Impairment, Assessment and TMDLs | + |
| Criteria | + |
| References | + |

<https://www.epa.gov/nutrient-policy-data/frequent-questions-nutrient-criteria-implementation>

Regional examples of creative implementation

Dixie Drain, Boise River, Idaho

Improved management throughout the lower Boise basin

Non-point

Point

No-till drill



Permeable pavers



Cover crops



Drip irrigation



West Boise



Meridian



Dixie Drain



USGS

**Photos courtesy of Lower Boise Watershed Council members*

Additional Sources of Technical Assistance or Other Support

- RTAG for Nutrients: planning for 2021 meeting
- Contractor technical support (as resources allow) for nutrient management planning projects- ask Rochelle
- R10 Laboratory – accredited laboratory for LC MS MS and ELISA methods for certain cyanotoxins

EPA Nutrients Research Page
<https://www.epa.gov/water-research/nutrients-research>

Contact

- Rochelle Labiosa –R10 Nutrients Coordinator and HABs Lead for Ambient Waters Labiosa.Rochelle@epa.gov 206-553-1172